

*The Feasibility Assessment of Afforestation for  
Carbon Sequestration (FAACS)*

*Incentives to Expand Forest Cover:  
A Framework for Canada  
Phase 1*

An Overview of Global Incentives for Afforestation

by  
Rory Gilson

JUNE 30, 2003

<b>A. INTRODUCTION</b> .....	<b>8</b>
1. PREFACE.....	8
2. CURRENT GLOBAL SITUATION .....	9
3. CARBON SEQUESTRATION .....	9
4. AFFORESTATION PROGRAMS .....	9
5. MOTIVATIONS FOR THE ESTABLISHMENT OF AFFORESTATION PROGRAMS .....	11
<b>B. NORTH AMERICA</b> .....	<b>12</b>
1. INTRODUCTION.....	12
<i>Agricultural Land Availability</i> .....	12
<i>Forestry</i> .....	12
2. CANADA.....	13
FEDERAL PROGRAMS .....	15
<i>Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS)</i> .....	15
<i>The Permanent Cover Program (PCP)</i> .....	15
<i>The Canadian Model Forest Program</i> .....	16
<i>The Prairie Farm Rehabilitation Administration (PFRA)</i> .....	18
<i>The PFRA Shelterbelt Program</i> .....	18
<i>The PFRA Shelterbelt Enhancement Program (SEP)</i> .....	19
3. ALBERTA.....	20
<i>Woodlot Pilot Extension Program</i> .....	20
<i>Alberta-Pacific Poplar Farm Program</i> .....	21
4. BRITISH COLUMBIA .....	21
<i>Forest Renewal BC</i> .....	21
<i>Small Woodlands Program of BC (SWP of BC)</i> .....	22
<i>Industry-sponsored Poplar Planting Programs</i> .....	22
5. MANITOBA .....	23
<i>Manitoba Agro Woodlot Program</i> .....	23
<i>Woodlot Extension Program</i> .....	24
<i>Woodlot Field Days and Tours Program</i> .....	25
<i>Woodlot Management Plans in the Manitoba Model Forest</i> .....	26
<i>Woodlot Seedling Program</i> .....	26
6. ONTARIO .....	27
<i>Early Afforestation Initiatives in Ontario</i> .....	27
<i>Agreement Forests: 1921 -1998</i> .....	28
<i>Woodlands Improvement Act: 1966 - 1993</i> .....	30
<i>Project Tree Cover: 1992 - 1997</i> .....	31
<i>Ontario Soil &amp; Crop Improvement Association</i> .....	32
<i>Permanent Cover Programs (PCP) I &amp; II: 1990 - 1993</i> .....	33
<i>Ontario Environmental Farm (EFP) Incentive Program: 1993-present</i> .....	33
<i>Restoration of the American Chestnut - Response to a Species at Risk: 1998 - 1999</i> .....	34
<i>Ontario Maple Syrup Producers' Association (OMSPA)</i> .....	34
<i>Wetland Habitat Fund: 1997 - present</i> .....	35
<i>Stewardship Councils: 1996 - present</i> .....	35
<i>Over-The-Counter Nursery Stock Program</i> .....	36
<i>Hybrid Poplar Development Program</i> .....	37
<i>Domtar Woodlot Management Services</i> .....	37
<i>Ducks Unlimited Wetlands Protection, Restoration and Enhancement Program</i> .....	38
7. QUÉBEC.....	38
<i>Changes to the forest system since 1986</i> .....	40
<i>Financial support program for development of private woodlots</i> .....	40
<i>Private Lands Initiative Property tax rebate program</i> .....	41
<i>Forestry financing program</i> .....	41
<i>Forest Tenant Farming</i> .....	42
8. SASKATCHEWAN .....	42

<i>The Conservation Cover Program (CPC)</i> .....	42
<i>SaskPower Carbon Offset Agreements</i> .....	43
9. THE UNITED STATES .....	43
<i>Planting Programs</i> .....	44
<i>Agricultural Land</i> .....	45
<i>Forestry</i> .....	45
<i>National Fire Plan</i> .....	46
<i>Minnesota's Hybrid Poplar Program</i> .....	46
<i>Biomass Power for Rural Development Initiative</i> .....	47
<i>Hybrid Poplars in the Pacific Northwest</i> .....	48
<i>The Forestry Incentives Program (FIP)</i> .....	49
<i>1990 Farm Bill</i> .....	50
<b>C. EUROPE .....</b>	<b>51</b>
1. INTRODUCTION .....	51
<i>Agriculture</i> .....	51
<i>Forestry</i> .....	51
<i>Directive 2080/92</i> .....	53
COUNTRY EXPERIENCE .....	55
2. AUSTRIA .....	56
<i>BIOSA-Biosphere Austria</i> .....	57
<i>The Permanent Austrian Forest Inventory</i> .....	57
3. BELGIUM .....	58
<i>Flemish Region</i> .....	58
<i>Reconversion of lands (reforestation)</i> .....	58
<i>Prohibition on deforestation</i> .....	59
<i>Walloon Region</i> .....	59
<i>Preservation of the ecological stability of forests</i> .....	59
<i>The Wood Energy Plan</i> .....	59
<i>The potential of forest ecosystems to sequester carbon (1999-2001)</i> .....	59
4. DENMARK .....	59
<i>The Forest Act</i> .....	60
<i>Forestry Extension</i> .....	61
<i>Nature restoration and re-establishment</i> .....	62
5. FINLAND .....	62
6. FRANCE .....	65
<i>Tree grants in France</i> .....	66
<i>Forest Fire Reduction</i> .....	67
7. GERMANY .....	67
8. IRELAND .....	69
9. NETHERLANDS .....	72
10. NORWAY .....	73
<i>Forest Trust Fund</i> .....	74
<i>Income tax</i> .....	75
<i>Property tax</i> .....	75
<i>Inheritance tax</i> .....	75
11. SWEDEN .....	75
12. UNITED KINGDOM .....	79
<i>Forest Policy</i> .....	79
<i>Planting Programs</i> .....	80
<i>The Woodland Grant Scheme (WGS)</i> .....	81
<i>The Farm Woodland Premium Scheme (FWPS)</i> .....	81
<i>Evaluation of the Schemes</i> .....	82
<i>The Scottish Forestry Grants Scheme (SFGS)</i> .....	83
<i>The Scottish Experience</i> .....	84
<i>Wales</i> .....	85

Private Initiatives for Afforestation .....	86
<b>D. AUSTRALASIA .....</b>	<b>87</b>
1. AUSTRALIA .....	87
Government Structure.....	88
History of Plantation Establishment.....	89
Phase 1 from 1900 to 1960.....	89
Phase 2 from 1960 to 1980.....	89
Commonwealth Softwood Forestry Agreements Acts .....	89
Phase 3 – “Transition from government softwood to private hardwood” Plantations 1980 to 1990..	90
National Afforestation Programme and associated programs .....	91
Joint Venture arrangements .....	91
Phase 4 – “Private plantation boom” From 1990 to present.....	92
Farm Forestry Programme .....	93
Plantation for Australia: the 2020 Vision.....	93
Incentive Mechanisms.....	94
Tax Policy.....	94
Immediate deductibility of non-capital expenditure .....	94
Landcare deduction .....	94
Landcare offset .....	94
Diesel and Alternative Fuels Grants Scheme .....	95
Current Situation .....	95
2. NEW ZEALAND .....	95
History.....	96
Forestry Encouragement Loans .....	98
Forestry Encouragement Grants 1969.....	99
Forestry Encouragement Grants 1982.....	99
Achievements of the Loans and Grants Schemes .....	100
Māori Leased Land.....	100
The Forestry Rights Registration Act 1983 .....	100
Deregulation.....	101
Erosion Control.....	102
Current Situation.....	102
<b>E. LATIN AMERICA .....</b>	<b>103</b>
COUNTRY EXPERIENCE .....	105
3. ARGENTINA.....	105
Model Forests in Argentina.....	107
Model Forest Sites.....	107
4. BELIZE .....	108
5. CHILE .....	110
Incentive Programs.....	111
Chile's Model Forest Program .....	114
Model Forest Sites.....	114
6. COSTA RICA .....	115
Tax Exemption.....	117
Bank lending.....	117
Certificado de Abonos Forestales (CAF) .....	117
Fund for Municipalities and Organizations .....	118
Forestry loan certificate (CAFA).....	118
Fondo de Desarrollo Forestal (FDF).....	118
Forest Management Bond Certificate (CAFMA).....	118
Carbon Fixing (CARFIX) .....	118
Incentive System Reform.....	119
Certifiable Tradable Offsets (CTOs) .....	121
Costa Rica Certified Tradeable Offsets (1997) .....	121

7.	GUATEMALA .....	122
	Forestry Policy .....	123
	Communal forestry concessions .....	124
	Programa Incentivos Forestales or PINFOR (Program for forestry incentives) .....	124
	Protected Areas .....	125
<b>F.</b>	<b>ASIA .....</b>	<b>126</b>
1.	CHINA .....	126
	History .....	127
	National Compulsory Tree Planting Campaign .....	128
	International Aid .....	129
	Shelterbelt Development Programme along the Upper and Middle Reaches of the Yangtze River ...	129
	The Coastal Shelterbelt Development Programme.....	129
	Plain Afforestation Programme.....	130
	Taihang Mountains Afforestation Programme .....	130
	The Three-North Shelterbelt Development Programme .....	130
	Joint Ventures .....	131
	Forestry loans from State banks .....	131
	Collection of refundable levies for regeneration funds. ....	131
	Investment by timber demanding sectors.....	132
	Forest Tenure Contracts.....	132
2.	INDIA .....	132
	History .....	133
	Joint Forest Management (JFM) .....	133
	Other Programs .....	134
3.	INDONESIA .....	135
	Logging Concession Rights (HPHs) and Timber Utilization Permits (TUPs).....	136
	Development Plans (Repelitas).....	137
	Plantation History .....	138
	The Reforestation Fund .....	138
	Hutan Tanaman Industri (HTI) .....	139
<b>G.</b>	<b>AFRICA .....</b>	<b>141</b>
1.	GAMBIA .....	141
2.	GHANA .....	143
	Private/Public Partnerships .....	144
3.	SOUTH AFRICA .....	145
	Outgrower schemes .....	146
<b>H.</b>	<b>INCENTIVES FOR AFFORESTATION.....</b>	<b>148</b>
1.	INTRODUCTION.....	148
2.	DIRECT GOVERNMENT ASSISTANCE / PROGRAM INCENTIVES .....	150
3.	PREFERENTIAL TAX TREATMENT .....	159
4.	INDUSTRY PARTNERSHIPS AND THIRD-PARTY LEASING ARRANGEMENTS .....	160
5.	MARKET-BASED CARBON TRADING .....	163
6.	NON-TRADITIONAL INCENTIVE MECHANISMS .....	165
7.	CONCLUSIONS .....	166
<b>I.</b>	<b>BIBLIOGRAPHY.....</b>	<b>167</b>

## **Executive Summary**

### **Introduction**

This study was conducted under the Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) initiative for the Canadian Forest Service (CFS) of Natural Resources Canada (NRC). The CFS and its partners are exploring the potential for a large-scale afforestation effort in Canada on privately owned land as an efficient mechanism to contribute to Canada's Kyoto commitments.

Efforts are underway to fill key information needs on afforestation in Canada, as well as build the capacity to meet Kyoto Protocol reporting requirements for afforestation. Current work efforts include: collecting information on past afforestation activities and their future potential; assessing policy issues including design, mechanics and potential incentive structures; establishing a network of afforestation pilots to test private landowner's interest and participation in afforestation; and, developing afforestation carbon accounting tools.

One of the key information gaps that the FAACS initiative intends to fill is a thorough assessment of the various types of incentives that are available to expand forest cover (i.e., afforestation and reforestation) in Canada to achieve a range of environmental and economic objectives. To assist in this assessment, a descriptive framework on the range of available afforestation incentives is required that draws on the past, current and proposed mechanisms in a Canadian and international context. This framework will also help scope out the practical set of incentive opportunities that Canada should consider, and help identify important considerations such as implementation barriers, partnership involvement and responsibilities, infrastructure requirements, and regional implications.

In this context, the purpose of this study is to identify and discuss the range of available incentive mechanisms and partnership arrangements to expand productive tree cover in Canada. This is done through an examination of past and present afforestation programs both in Canada and in other countries.

In addition, new and creative non-traditional incentive mechanisms to encourage afforestation / reforestation for timber supply, conservation and carbon sequestration purposes are also identified and described. A summary of incentive mechanisms found, including a sub-grouping of incentives into different categories and initial observations on the effectiveness of these approaches, are provided at the end of the document.

### **Approach**

The rationale and mechanisms for the implementation of planting programs are illustrated through a series of case studies of afforestation programs on an international, continental, national, state, community and individual scale. Industry partnerships in the context of afforestation are also examined, both within and between countries.

In total, 27 countries over six continents were examined, with an emphasis put on cases involving developed countries, as it was felt that incentive mechanisms used in these countries will eventually prove to be more applicable to the Canadian context. Some less-developed countries were looked at as well, however, and some interesting and innovative incentive mechanisms were found.

For each continent, country, province or region contained in the study, a summary of the geographic and geo-political environment is also given, along with a description of the area's

history in terms of forestry management and experience with afforestation, particularly in terms of agricultural land conversion. In many cases, the evolution of a country's Forest Act is looked at, in order to examine the motivations driving afforestation programs during a nation's history. With this background, the reader is provided with the context in which afforestation incentive programs were developed, so that they may draw parallels, or contrasts, with regional conditions in Canada.

In North America, planting programs in both Canada and the United States are examined, using programs implemented on federal, provincial/state, and local levels. Canada is further divided into the provincial groupings of BC, Alberta, Saskatchewan, Manitoba, Ontario and Québec, in order to examine regional approaches to afforestation efforts. A lot of emphasis is placed on smaller, region-specific programs, as it is felt that many of these hold the keys to creating successful and sustainable programs in Canada.

European countries are given a lot of attention in the study, due to the many economic and geographic similarities with Canada that are found there. In this context, afforestation programs in Austria, Belgium, Denmark, Finland, France, Germany, the Republic of Ireland, the Netherlands, Norway, Sweden, and the UK were examined. Many of these countries, such as Ireland, were deforested long ago, and have undertaken massive reforestation/afforestation programs in recent years.

The two countries of Australia and New Zealand are covered under the section on "Australasia". These two countries have a lot of parallels with the Canadian situation, largely due to their lower population densities and modern economies. Both countries also have sizeable indigenous populations that have been targets of some afforestation programs. The case of New Zealand is of particular interest, due to recent large structural changes to the forest industry.

In Latin America the countries of Argentina, Belize, Chile, Costa Rica, and Guatemala were looked at. Costa Rica, in particular, has been the home of many innovative programs, and is, in many ways, at the forefront of global afforestation and environmental efforts.

The Asian countries of China, India, and Indonesia were also looked at, largely due to their sizeable forestry industries. China, in particular, has implemented a massive afforestation campaign, utilizing a variety of innovative and interesting afforestation programs. Perhaps the most interesting (and most effective) of these is the National Compulsory Tree Planting Campaign, where every person in China, excluding the young and the elderly, was required to plant three to five trees a year.

Very few countries are presented in Africa, due to the large socio-economic differences with Canada. For illustrative purposes, however, the countries of Gambia, Ghana, and South Africa were examined, and some interesting approaches were found. In Gambia, for example, the law states that a person who plants a tree then owns that tree, regardless of whether or not it is planted on their property.

## **Preliminary Findings**

Preliminary findings are given in the last section of the document, which contains a summary of the incentive mechanisms found. Although more analysis is needed, certain trends can already be seen, and some preliminary observations are given. Incentives are broken down into the following categories: (i) Direct Government Assistance / Program, (ii) Preferential Tax Treatment, (iii) Industry Partnerships and Third-Party Leasing Arrangements, (iv) Market-based Trading and (v) Non-traditional Incentive Mechanisms. A small description of each incentive, as well as each incentive category, is included. Initial observations on the effectiveness of various incentive mechanisms are also given, along with some findings based on a review of literature on the subject.

Early observations conclude that the vast majority of the afforestation programs undertaken in the studies utilized direct government assistance or programs (mostly grants, loans, subsidies and/or tax breaks) to motivate landowners to plant trees. Often, these programs turned out to be unsustainable, as when the incentives were taken away afforestation efforts dropped off, and afforested land was often returned to its previous usage. It was also found that these direct incentives sometimes resulted in plantings on unsuitable land, and that competing incentives such as those for agriculture often create offsetting disincentives for landowners.

Indirect government incentives were used less often, but tended to attract more serious growers, and thus tended to achieve better results. Indirect incentives, for example, generally required less direct government involvement, and tended to attract planters who were more interested in pursuing sustainable forest practices.

The study also found that recent trends in afforestation involve the establishment of third-party leasing arrangements and other private partnerships. These arrangements help with start-up costs, and provide landowners with a ready market for timber.

Market-based carbon trading is also attracting a lot of interest, although questions concerning the rules that will govern them are so far proving to be a disincentive to involvement in such schemes.

### **The Next Phase**

The second phase of this study will examine these mechanisms in more detail. The main tasks set out for the second phase of the study will be to:

Evaluate and critically review the past and current incentive mechanisms to expand productive tree cover in Canada and in other countries (as identified in Phase 1) for the purposes of enhancing timber supply, expanding conservation cover and enhancing carbon sequestration activities that are eligible under the Kyoto Protocol.

Where possible, quantify the landowner / partner participation rates of the past and current incentive mechanisms in Canada and in other countries and discuss the relationship between the various incentives mechanisms and landowner / partner participation.

Evaluate and rank the potential application of the available incentive mechanisms and the likelihood for success in Canada. This should also involve the identification of a practical set of incentive mechanisms that Canada should further investigate.

Identify and discuss important considerations that must be addressed (e.g., barriers, landowner / partner involvement and responsibilities, administrative requirements, infrastructure requirements, regional implications, etc.) that may impact Canada's ability to advance the implementation of practical incentive mechanisms in Canada.

The document, or documents, resulting from the phase 2 works will also integrate feedback from various forestry specialists across Canada, drawing on their expertise, so that the conclusions reached will be applicable to the Canadian context. This document, or documents, is expected to provide valuable input into the development of a viable, sustainable, and effective afforestation policy that will help Canada to meet its Kyoto commitments.



## **A. Introduction**

### **Preface**

The Canadian Forest Service (CFS) of Natural Resources Canada (NRC) and its partners are exploring the potential for a large-scale afforestation effort in Canada on privately owned land as an efficient mechanism to contribute to Canada's Kyoto commitments. Through the Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) initiative, efforts are underway to fill key information needs on afforestation in Canada as well as build the capacity to meet our Kyoto Protocol reporting requirements for afforestation. Current work efforts include: collecting information on past afforestation activities and their future potential; assessing policy issues including design, mechanics and potential incentive structures; establishing a network of afforestation pilots to test private landowner's interest and participation in afforestation; and, developing afforestation carbon accounting tools.

One of the key information gaps that the FAACS initiative intends to fill is a thorough assessment of the various types of incentives that are available to expand forest cover (i.e., afforestation and reforestation) in Canada to achieve a range of environmental and economic objectives. To assist in this assessment, a descriptive framework on the range of available afforestation incentives is required that draws on the past, current and proposed mechanisms in a Canadian and international context. This framework will also help scope out the practical set of incentive opportunities that Canada should consider, and help identify important considerations such as implementation barriers, partnership involvement and responsibilities, infrastructure requirements, and regional implications.

In this context, this study provides the following research objectives:

To develop a framework that outlines and describes the various incentive mechanisms that could be used to encourage afforestation on private-owned land to contribute to Canada's Kyoto commitments and other economic and environmental objectives.

To determine a practical set of incentive mechanisms that Canada should continue to investigate, and address important considerations that may impact future implementation efforts in Canada.

This paper comprises the first of two phases in this study. This first phase aims to identify and discuss a range of available incentive mechanisms and partnership arrangements to expand productive tree cover through an examination of past and present afforestation programs both in Canada and in other countries.

In this context, research work for this analysis relied heavily on existing literature, as well as experts in Canada and elsewhere. The rationale and mechanisms for the implementation of planting programs is illustrated through a series of case studies of programs on an international, continental, national, state, community and individual scale.

In total, 27 countries were examined, with an emphasis put on cases involving developed countries. It was felt that incentive mechanisms used in those countries would prove to be more applicable to the Canadian context. Some very poor countries were looked at as well, however, and some interesting and innovative incentive mechanisms were found.

A summary of incentive mechanisms found, including a sub-grouping of incentives into different categories and initial observations on the effectiveness of these approaches, are provided in the last section of the document.

## **Current Global Situation**

According to the Global Forest Resources Assessment 2000 (FAO, 2001a), the area of global plantation forests had risen to 187 million hectares by the turn of the century, a significant increase over the 1995 estimate of 124 million hectares. Asia accounted for 62%. The largest plantation forest resources were found in China (24%) and India (18%). Annual new planting was 4.5 million hectares globally, with Asia and South America accounting for 91%. The predominant genera were *Pinus* (20%) and *Eucalyptus* (10%); however, the species groups varied markedly among geographic regions. Globally, 48% of the plantation forest estate was for industrial (or production) use, 26% for non-industrial (or protection) use (fuelwood, soil and water protection other environmental values) and 26% was not specified.

Reported plantation forests accounted for less than 5% of global forest cover, of which, those planted for industrial purposes made up around 3% of global forest cover. However, industrial plantation forests have been variously estimated to account for from 22% of global roundwood supplies to industry (FAO, 2000a) up to 35% in 2000, 44% in 2020 and 46% in 2040 (FAO, 1999); (ABARE et al, 1999); (Carle et al, 2002).

It is expected that plantation forests will have an increasing role as a sustainable, energy efficient and environmentally and socially friendly source of world roundwood, fibre, fuelwood, non-wood forest products and other social and environmental values. This is particularly so as natural forest areas decrease owing to deforestation (largely in developing countries in the tropics and subtropics) or are designated as protected areas (largely in developed, temperate countries).

### **1. Carbon Sequestration**

Research has shown that conversion of farmland to forest plantations results in a net increase in carbon sequestration rates, even compensating for a decline in soil carbon (Scott et al., 1999). This is of particular interest in Canada due to the large landmass and the potential for substantial land use change. Suggestions have been made that there exists a large potential for GHG emissions reduction and carbon sequestration by allowing and encouraging marginal farm operations to convert to tree production.

The potential for increasing carbon stocks in the terrestrial biosphere might be limited compared to total greenhouse gas emissions, but their impact could be considerable in relation to the reductions necessary for compliance in the first commitment period (2008-2012). Land-use change and forestry projects, then, are considered a low-cost option for addressing climate change mitigation (van Kooten et al., 2002). In Canada, afforestation is being considered, to sequester enough carbon to meet one-fifth of its international obligations, and at lower cost than emissions reduction.

### **2. Afforestation Programs**

Afforestation has been promoted, both in Canada and elsewhere, for many years in advance of concerns over climate change. Trees have long been used for construction purposes and for firewood, and many nations initiated afforestation programs centuries ago for the purpose of increasing domestic supply or for creating export markets.

Trees have also been long recognized for their values as wind breaks or for erosion control, and for quite some time have been recognized as being beneficial for the environment. Industry has acknowledged the value of supplementing its fibre supply in certain regions through the promotion of private woodlot or plantation development, and governments have seen the wisdom

of supporting this in order to reap the social and fiscal benefits generated by an active forestry industry.

As noted by Williams and Griss (1999), the benefits of afforestation tend to be a function of the types of trees planted, where they are planted and how they are managed. These functions can include:

- carbon sequestration;
- shelterbelt or windbreak;
- wildlife habitat and biodiversity conservation;
- soil and water protection (e.g. erosion control and flood management);
- aesthetics;
- biodiversity;
- wood supply;
- bioenergy;
- employment; and
- rural diversification.

All afforestation projects, of course, do not provide all of these benefits. Indeed, in a given project some gains may be offset with losses in other areas. And some projects may end up doing more harm than good. A policy goal of increasing wood supply, for example, may be in direct conflict with one of maintaining or increasing biodiversity, or even landscape aesthetics.

In essence, the goals of governments can be broadly classified into three broad domains (Buck 1995; Ruitenbeek and Cartier, 1998):

- the economic,
- the social, and
- the environmental,

These broadly relate to policy instruments of market modifiers, institutions and laws (Buck, 1995). These goals are linked such that a policy pertaining to, say, social equity may affect sustainability of economic efficiency either positively or adversely (Ruitenbeek and Cartier, 1998).

For the afforestation policy environment, additional complications are that:

- forests provide interrelated, multiple outputs within these three domains;
- there are different agents through whom forested areas can be established and managed, i.e.: government, corporate, community or individual.

In short, forests have multiple uses and multiple users (D'Silva et al., 1994). The interrelated environmental, social and economic domains also highlight the need to consider policies in parallel (Klooster, 1999), with some understanding of the linkages and potential distortions that can result policies that are not well thought out.

Identical policy incentives and legislative frameworks in countries with different economic, social and environmental advantages may achieve very different results. In this way, policies in some countries may not achieve similar successes here in Canada. Government policies affecting forestry plantations, for example, may directly, or indirectly from outside the forestry sector (Ruitenbeek & Cartier, 1998), affect the forestry sector in unintended, or even undesirable, ways.

The measure of how successful government policies and legislation concerning afforestation programs are, then, will depend heavily on how well the linkages of these policies are examined prior to implementing policy. It is hoped that this study, and its subsequent analysis, will aid in the examination of these linkages, so that sound policy decisions can be made.

### **3. Motivations for the Establishment of Afforestation Programs**

In general terms, governments implement incentives in order to achieve some level of equitable return in terms of the three goals mentioned earlier (i.e. economic, social or environmental). Historically, in the case of plantations, the returns have usually been economic, as illustrated in most of the case studies in this paper. In more recent years, as with the case of Finland, these goals have increasingly been driven by environmental (such as biodiversity and climate change) and direct-use social factors (such as parkland and existence valuations).

Although the FAACS's primary objective is to plant trees for the purpose of carbon sequestration, historically there have been many policy motivations for wanting to expand productive tree cover. While the traditional reason for plantation establishment has been to provide fibre and other products, as well as in site rehabilitation, any analysis of incentives for afforestation needs to also include both competing and complementary reasons for planting trees.

Most of the government-sponsored afforestation programs contained in the case studies are motivated by a desire on the part of government to increase national or regional timber supplies. Many countries strive to be self-sufficient in terms of their lumber supply, while others seek to capitalize on foreign demand by planting for export markets.

Conversely, some of the most effective and sustainable planting programs have taken place when the government isn't much more than a bystander in the process. Examples of this kind of program occur when forest companies lease land directly from farmers for the purpose of increasing their timber supply. A good example of this is Alpac's poplar farm program in Alberta.

Moreover, while most such programs usually involve timber supply issues (i.e. programs with little, or no, government involvement), these are not the only reasons for companies or foreign governments to want to contract directly with landholders. Carbon Credit Trading is certainly another area of growing interest, and countries like Costa Rica have paved the way for others in this area.

With this in mind, the case studies covered also look at the reasons why afforestation programs have been entered into in the first place. Each case study contains background information on the country, including some history of the forestry industry and the evolution of each country's forestry policy. Statistical data on land-use and land-use change are included, as well as geographical data, political data, and information on the agricultural sector. In this way, a complete picture of the country is given, in order to illustrate some of the similarities to, and differences with, the Canadian experience.

In Phase 2 of this study many of these case studies will be elaborated upon, and some new studies will be added. Success rates will be analyzed and compared. The process of compiling these studies has initiated many collaborative efforts, and these, along with the results of similar studies currently underway around the globe, will hopefully make for an interesting and useful analysis.

## **B. North America**

### **1. Introduction**

#### **Agricultural Land Availability**

About 11% of the world's agricultural croplands are in North America, producing food, fibre and other products both for the region's own needs and for export. Almost 20% of the United States is covered by arable and permanent cropland and 26% by permanent grassland or pastures (OECD, 1999). Although only 7% of Canada's land is devoted to agriculture, this represents virtually all the undeveloped land that is amenable to cultivation (Environment Canada, 1996). It is estimated that between 1,123,000 and 1,402,000 ha of land is realistically available for afforestation across Canada (Williams & Griss, 1999).

#### **Forestry**

Canada is the world's second largest country in terms of total land area (behind the Russian Federation), and the United States follows close behind, ranking third in land area and fourth in forest area. According to TBFRA-2000<sup>1</sup>, the forest cover in the two countries is 96.5% natural forest. After the Russian Federation and Brazil, Canada has more forest than any other country, with 244.6 million ha. The United States is the fourth most forested country, with 226 million ha (FAO, 2001). While Canada's forest area remained static during the past decade, in the United States it has increased by almost 3.9 million ha, approximately 1.7%.

The forests of Canada and the United States are among the largest, most diverse and most intensively utilized in the world. Forests cover about 26% of North America's land, slightly below the global average of 30%. It is estimated that North America contains between 12-14% of the global forest area (FAO, UNEP estimates) and 28% of the world's temperate and boreal forests (TBFRA-2000). An additional 11% of the region is "other wooded land" (between 5% and 10% canopy cover). In Canada, forest and other wooded land together comprise 45% of the land area. When inland water areas are not considered in the United States, the respective figure is 31%.

The two North American countries differ significantly in the ownership of their forest resources. This has a major influence on approaches to forest management and political positions on international forest policy issues, seen most notably in their opposite positions on the merits of a global forest convention.

In Canada, 94% of forests are publicly owned, with the provinces having jurisdiction over 71% of forest land, and 23% is under federal and territorial government jurisdiction (NRC, 2000). Although privately owned forests constitute less than 7% of the forest area, there are more than 425,000 private landowners.

In contrast, some 60% of forests in the United States are privately owned, with over 10 million private forest owners. Around 35% are publicly owned and managed by the federal government, and the 50 states own and manage 5% (FAO, 2001). Public forest ownership is concentrated in the west, while most private forests are in the east, with the result that forest politics tend to be influenced by geography. Vast tracts of private forests are owned by large companies, amounting to about 10% of the total forest area and the greatest part of the forest plantations. Historically, much of the timber production in the United States came from public lands, but in the past decade

---

<sup>1</sup> The report "Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand (industrialised temperate/boreal countries)", or "TBFRA-2000", is the UN-ECE/FAO contribution to the FAO Global Forest Resources Assessment 2000.

this was reduced to less than 10%. A major shift in public policy has greatly reduced timber harvesting in National Forests, which are increasingly used for recreation and environmental conservation. National Forests account for 17% of forest land and 19% of theoretically available timber supply. In 1996, however, only 5% of the United States timber harvest came from National Forests.

Estimates show that North America now grows 255.5 million m<sup>3</sup> more timber annually than is harvested (UNECE and FAO, 2000). The region accounts for about 40% of the world's production and consumption of industrial wood products (Mathews and Hammond, 1999).

It is estimated that the land area under plantation is increasing in both countries. In Canada, the area regenerated by planting increased from a little less than 100,000 ha in 1975 to nearly 400,000 ha in 1997 (REGEN, 2002), while the United States has about 21 million ha of plantations or some 4.5% of its forest land base (UNECE and FAO, 2000). Natural forests showed a net increase of 0.1% during the period 1990-2000.

There are an estimated 425,000 woodlot owners in Canada who collectively own more than 18 million hectares of commercial productive forest land, which represents more than 12% of Canada's total (National Forest Strategy, 1998-2003). Woodlots are an important source of commercial timber providing an annual harvest of 39.6 million cubic metres, or 21% of the national harvest. Equally, if not more important to woodlot owners, woodlots provide habitat, biodiversity, clean water, and spiritual and recreational opportunities.

The following section contains a selected sampling of the many federal, provincial, co-operative, community and private incentive schemes in Canada and the United States. This selection is by no means comprehensive, but does serve to illustrate the range of programs, past and present, available in North America.

## **2. Canada**

Canada is the second largest country in the world and extends across the continent of North America from Newfoundland on the Atlantic coast to British Columbia on the Pacific coast. Canada is slightly larger than the United States, its southern neighbour, but has only about a tenth as many people. Much of Canada is uninhabited or thinly populated due to rugged terrain and a severe climate.

Canada has the world's third largest forest resource after the Russian Federation and Brazil. Forest and other wooded land account for well over two-fifths of its land area, and the area of forest and other wooded land per inhabitant is one of the highest in the world (FRA, 2000). There is a broad belt of coniferous forest, essentially boreal, across the country, with tundra to the north. To the south and east of this (Ontario, Québec and the maritime provinces), forests have a larger broadleaved component. British Columbia has specific forest types determined by the montane and coastal nature of the province. Coniferous species make up the major part of the growing stock, the main species being spruces, pines, firs and larches. Along the west coast of British Columbia other species, which grow to very large sizes, are Douglas fir, western hemlock and western red cedar. Broadleaved species, which predominate in the south-eastern parts of the country, include maples and oaks, while species of birch, alder and willow occur widely throughout the country.

All in all, there are about 180 species of forest trees in Canada (NRC, 2002) and a very wide range of forest types. Nearly two thirds of the forest and other wooded land are comprised of forest, of which one half is classified as available for wood supply. About one third of other wooded land, which is mostly in the harsher climatic conditions, is available for wood supply. Most of the forest not available for wood supply is classified as such because of its remoteness and the lack of infrastructure makes commercial harvesting economically non-viable. A large part

of the forest and other wooded land is boreal in nature, about half of the forest and virtually all of the other wooded land is still undisturbed by man. More than nine tenths of forest and other wooded land are publicly owned, mostly by the provincial governments (71%).

Six percent of Canada's forest land is owned by an estimated 425,000 individuals, families, communities and forest companies. These privately owned forests, of which 80% are located east of Manitoba and mostly in the Atlantic provinces, are generally productive and of high quality. They are the source of 19% of Canada's industrial roundwood production (logs, bolts and pulpwood), 77% of maple products, 79 % of fuelwood and firewood, as well as virtually all of the nation's Christmas trees.

The Provinces are responsible for forest management legislation, setting up their own forestry authorities, setting and collecting forestry charges and determining the provincial government's responsibilities vis-à-vis the private sector. Since 1982, with an amendment to the Constitution Act, the provinces have had the power to levy indirect taxation on natural resource revenues and control inter-provincial exports of resources and energy. Revenues collected tend to go to provincial treasuries, and are not necessarily re-invested in forestry.

There has been a federal presence in forestry for over 100 years. A Federal Department of Forestry was established in the 1989 Forestry Act and in 1993 it was restructured as the Canadian Forest Service (CFS) to form part of a broader natural resources department, known as Natural Resources Canada (NRC).

Although 80% of Aboriginal communities live in the forest belt of Canada, until recently their rights have not always been acknowledged. Today, there is a movement for the restitution of areas to indigenous peoples. New federal and provincial legislations aim to ensure Aboriginal participation in forest management, rights to forest resources and equity in employment. For example, the Government of Québec and the Grand Council of Crees signed an historic agreement, the Braves' Peace, on February 7, 2002. The forestry component of the agreement is aimed at greater participation of Cree communities and more consideration of the Cree way of life in the management of forest resources.

The revised tax bulletin IT373R2 clarified many issues that were identified in the 1992 and 1998 reviews of the effect of tax legislation on sustainable forestry practices. Woodlot owners can be considered farmers for the purposes of capital gains deduction rules for intergenerational transfers and deductions of silviculture expenses, both of which encourage the use of sustainable forest practices.

Roughly 0.4%, or about one million hectares, of Canada's commercial forests are harvested yearly (CFS, 2002). Each province or territory establishing Annual Allowable Cuts, which are based on the average volume of wood that may be harvested under sustained yield management. More than half the harvested area is left to regenerate naturally, usually after some form of preparatory site treatment. The remaining areas are seeded or replanted.

Most of Canada's forest stands are even-aged due to such cyclical and widespread disturbances as fire and insect infestations. Roughly 1.6% of Canada's forests are affected by fire, insects and disease each year, and they are also left to regenerate naturally.

With some two-thirds of Canada's estimated wildlife species live in forests, an estimated 50 million hectares (12%) are forest areas protected from harvesting by legislation or policy. Some 117 species are listed as threatened or endangered, including 41 forest-dwelling species.

Canada's forests are the engine behind a \$74-billion industry. They help drive the Canadian economy by generating more than \$34 billion toward the trade surplus, by creating direct employment for close to 353,000 Canadians, and by acting as backdrop for a tourism industry worth several billion dollars. Canada is the world's largest exporter of forest products, producing

large quantities of all forest products, and is particularly important as a producer of sawn timber and wood pulp.

Important non-wood forest products in Canada include nuts, wild fruits, maple syrup, berries, mushrooms, other edible plant products (e.g. wild rice, ginseng, ginger), medicinal plants, game, floral greenery and Christmas trees.

## **Federal Programs**

### **Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS)**

Action Plan 2000 provides \$500 million over five years for various measures in key sectors, including the forest sector (other sectors include energy, transportation, industry, agriculture, waste management and technology). Once implemented, the federal government estimates the measures will reduce Canada's greenhouse gas emissions by an estimated 65 megatonnes annually during the 2008-2012 commitment period, or one-third of its Kyoto Protocol objective. This federal contribution to the federal-provincial First National Business Climate Change Plan is in addition to the previous federal investment outlined in the February 2000 Budget, in which \$600 million was committed over five years toward increased action on climate change.

The forest component of Action Plan 2000 includes a three-year preparatory measure: the Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS), under which this study is done. FAACS focuses on assessing, planning, designing and evaluating the feasibility of a large-scale afforestation program in Canada. As a means to assess the design, mechanics, and feasibility of developing a large-scale program, afforestation pilots, or trials, are being identified across the range of suitable lands in Canada. The primary target group for the afforestation pilots is private landowners with marginal agricultural land.

One of the key information gaps that the FAACS initiative intends to fill is a thorough assessment of the various types of incentives that are available to expand forest cover (i.e., afforestation and reforestation) in Canada to achieve a range of environmental and economic objectives. To assist in this assessment, a descriptive framework on the range of available afforestation incentives is required that draws on the past, current and proposed mechanisms in a Canadian and international context. This framework will also help scope out the practical set of incentive opportunities that Canada should consider, and help identify important considerations such as implementation barriers, partnership involvement and responsibilities, infrastructure requirements, and regional implications.

### **The Permanent Cover Program (PCP)**

The PCP is an off-shoot of the federal-provincial National Agricultural Strategy (NAS) of 1986. Run under the auspices of the National Soil Conservation Agreements, the PCP provides funds for converting lands at risk of soil damage by planting perennial forages for hay or pasture, or planting trees for recreation or wildlife.

The Permanent Cover Program is an example of a program implemented primarily for soil conservation reasons, which also has significant benefits for other environmental issues. It was delivered by the Government of Canada, through the federal Prairie Farm Rehabilitation Administration (PFRA), within four provinces - Manitoba, Saskatchewan, Alberta and British Columbia.

The PCP was first introduced in 1989 as a three-year program in Manitoba, Saskatchewan and part of Alberta, and it was later expanded to also cover the rest of Alberta, Ontario and British Columbia. It has been estimated that some C\$2-5 million of soil productivity has been saved by



the establishment of permanent cover on some 320,000 ha of land (Tyrchniewicz and Wilson, 1994; Vaisey, Weins and Wettlaufer, 1996).

Applicants enter into long-term contracts for 15 or 21 years to ensure that the conversion is long-lasting. Eligible components can include: buffer strips of grass along watercourses and wetlands, with or without trees or shrubs; the retirement of flood plain land from agricultural production; block plantings of trees on highly erodible uplands; and tree windbreaks. The PCP was extended for three years with \$50 million earmarked for PCP 2 under the Farm Support Adjustment Measures Program of April 1991.

Payments per acre varied between PCP 1 and PCP 2 and between the provinces. Ontario, and to some extent also British Columbia and Alberta, tend to have higher rates than Saskatchewan and Manitoba. The Prairie Farm Rehabilitation Administration (see below), which administers the program in the western provinces, began offering fixed sums under PCP 2 in an attempt to simplify procedures and minimize the potential for treating similar cases differently.

In Manitoba and Saskatchewan, the program now offers \$40/acre per year for 10-year, and \$70/acre for 21-year, agreements. In Alberta and British Columbia, however, the program offers \$50/acre for 10-year, and \$85/acre, for 21-year agreements to reflect higher land values. Ontario has a different, more complicated system, in which the rates depend on local land rental values and the time and materials required to plant the land into permanent cover and maintain it. Ontario program costs for a 15-year contract have ranged from \$500 to \$3,000/acre, in any case many times higher than in the Prairies. Though the social value of caring for fragile land out of production is probably higher in densely populated Ontario than in the spacious Prairies, it is not clear that the program allocations between provinces reflect any such appraisal of the relative social value of environmental improvements.

According to a 1997 report of the Auditor General of Canada, the Permanent Cover Program took approximately 520,000 hectares of marginal land out of crop production through the PFRA, at a cost of some \$74 million over an eight year period (for an average of \$142/ha). It was considered a success, based on the results of a client survey and interviews with provincial agencies. The report noted, however, that many of the Permanent Cover Program agreements with farmers fell outside the concentration of marginal land identified during the program design stage.

## **The Canadian Model Forest Program**

The Government of Canada, through the Canadian Forest Service, launched Canada's Model Forest Program to address the challenge of balancing the extensive range of demands placed on Canadian forests today. The principle behind the program is simple. A model forest is an example of leading edge forest management practices and research.

By developing partnerships, each model forest is working towards achieving Sustainable Forest Management (SFM) in their area. Moreover, each model forest serves as a demonstration of partners representing a diversity of forest values.

Model forests undertake projects that will help them to meet their goal of achieving sustainable forest management. These projects may include research, the development of alternative forest management tools and techniques, education and communication. Through their outreach programs, model forests put landowners and those interested in forestry, in closer contact with researchers and forest experts.

Canada's Model Forest Program has always recognized the importance of private woodlots in the quest for SFM. Four out of the 12 model forest sites throughout the network have very significant private ownership (Fundy, Nova Forest Alliance, Bas-Saint-Laurent and Eastern Ontario). These model forest sites have undertaken comprehensive projects and programs, which integrate and accentuate SFM initiatives on private lands.

To address many of the SFM challenges and opportunities that exist in the private woodlot sector, the Canadian Model Forest Network (CMFN) has developed a strategic initiative, which focuses on issues specific to private woodlots.

The Canadian Forest Service is the program's primary financial sponsor, although financial support may also be provided by partners within each model forest. Funding can also be in the form of in-kind sponsorship, such as the donation of time, expertise, materials and equipment.

Each Model Forest, through their partners, must provide a minimum of \$250K in cash or in-kind contributions annually.

The creation of model forests was a direct result of public feedback. A nation-wide public consultation, conducted in 1990 by the federal government, revealed public concerns about forestry practices and preservation of the natural environment.

Groups from across the country were invited to submit proposals for a model forest in their regions. Fifty proposals were assessed according to their ability to match four predetermined categories:

- The objectives and management philosophy, and how they supported the concept of sustainable management and integrated resource management (40%)
- The activities and results proposed using "best forestry practices" (25%)
- The use of the most advanced technology and the demonstration of techniques and results (25%)
- The communication of the results to the public and the general financial and administrative management of the proposal (10%)

On June 25, 1992, a network of 10 proposed model forest sites, representing six of the main forest regions of Canada, was announced.

- Western Newfoundland Model Forest
- Fundy Model Forest in New Brunswick
- Bas-Saint-Laurent Model Forest in Québec
- Eastern Ontario Model Forest
- Lake Abitibi Model Forest in Ontario
- Manitoba Model Forest
- Prince Albert Model Forest in Saskatchewan
- Foothills Forest in Alberta
- McGregor Model Forest in British Columbia
- Long Beach Model Forest in British Columbia

An independent evaluation recommended that during Phase II, the program should attempt to build on the experiences and knowledge that had been achieved during Phase I. In general, it was recommended that the model forests: now begin to apply, "on-the-ground," the sustainable forest management systems and techniques that they had developed during Phase I; establish acceptable indicators, measurement and monitoring systems, and reporting mechanisms that they could use to accurately assess their performance in relation to their individual goals and objectives; disseminate results and knowledge gained at local, national, and international levels; attempt to work together more as a network, and participate in activities and share more knowledge at the network level; encourage the participation of a broad range of forest values.

Although research and innovation is taking place in each model forest, some activities are pursued at the national level. This allows model forests to come together and share their unique perspectives as they work toward sustainable forest management on a national scale.

## **The Prairie Farm Rehabilitation Administration (PFRA)**

The Prairie Farm Rehabilitation Administration (PFRA) has been working with people on the Canadian Prairie for more than six decades, to develop a viable agricultural industry and sustainable rural economy in Manitoba, Saskatchewan, Alberta and the Peace River region of British Columbia. The PFRA was established by an Act of Parliament in 1935 in response to the widespread drought, farm abandonment and land degradation of the 1930s. Its original role was to:

"... secure the rehabilitation of the drought and soil drifting areas in the Provinces of Manitoba, Saskatchewan and Alberta, and to develop and promote within those areas, systems of farm practice, tree culture, water supply, land utilization and land settlement that will afford greater economic security..."

In partnership with other levels of government, farm groups, producers and industry, PFRA develops and conserves the area's soil and water resources and encourages diversification into new crops, value-added processing and other wealth-creating opportunities.

Eligibility varies according to the program, and programs and agreements administered by PFRA are targeted to the following five regions that reflect the differing landscapes across the Prairies:

Northern Alberta and the Peace River region of British Columbia;  
Southern Alberta;  
Northern Saskatchewan;  
Southern Saskatchewan;  
Manitoba.

PFRA offers technical assistance and in some cases financial assistance in a wide range of areas including soil and water conservation, water supply development and wastewater treatment, irrigation, rangelands management, community pastures, shelterbelts, engineering, surveying and drafting, project management, economic planning and rural development, integrated resource management, environmental analysis, sustainable agriculture, and wildlife and waterfowl habitat.

The PFRA currently serves over 30,000 clients annually, through ongoing programs and short-term initiatives offered from a network of district and regional offices and special Centres in the three Prairie provinces, and the Peace River region of British Columbia.

The PFRA has two major afforestation programs, The PFRA Shelterbelt Program and The PFRA Shelterbelt Enhancement Program. These are described separately below.

### **The PFRA Shelterbelt Program**

In 1963, the Shelterbelt Centre at Indian Head Saskatchewan became part of PFRA. This program provides seedlings for shelterbelt, conservation and reclamation planting in Manitoba, Saskatchewan, Alberta and the Peace River region of British Columbia. Technical assistance is also available free of charge.

To be eligible for the program applicants must be from one of the following groups:

bona fide farmers and producers of primary agricultural products;  
federal and provincial departments;  
villages, towns and cities;  
charitable organizations;  
Indian band councils and individuals for plantings on reserves.

The Shelterbelt Centre in Indian Head, Saskatchewan, produces and provides tree and shrub seedlings to farmers and conservation groups for farmstead, field, wildlife habitat, and agroforestry plantings. Major emphasis is placed upon field shelterbelt plantings for soil conservation, snow management and crop stabilization.

Trees are supplied free of charge, but transportation costs must be paid by the applicant. Seedlings are shipped to the closest Agricultural Representative office or Rural Service Centre in the spring (usually late April to mid-May).

For the purposes of wildlife habitat, during the summer staff make on-site inspections and assist landowners with species recommendations and design of the planting based on site characteristics, species of wildlife present and/or desired, and landowner objectives. Diagrams of the planting design along with information on spacing, species totals and planting instructions are also provided.

### **The PFRA Shelterbelt Enhancement Program (SEP)**

The SEP is a \$4-million, five-year initiative designed to reduce greenhouse gases through increased shelterbelt plantings on agricultural lands across the Prairies.

Under this program, the federal government is enhancing its existing Shelterbelt Program in Manitoba, Saskatchewan, Alberta and the Peace River Region of British Columbia.

The program is administered through Agriculture and Agri-Food Canada's (AAFC) Shelterbelt Centre in Indian Head, Saskatchewan. Through the SEP, the Centre's services are expanded to improve shelterbelt planting success, while reducing costs to landowners. As part of the program, clients are supplied with weed-controlling materials and specialized mulch application equipment.

Under the program, AAFC, through the Prairie Farm Rehabilitation Administration (PFRA), is working in partnership with farmers, livestock producers and rural organizations to:

- reduce GHGs by 0.3 megatonnes by 2010,
- plant some 8,000 kms of shelterbelts by 2006 in addition to the Centre's annual planting commitments, and
- fulfill Canada's commitment to the Kyoto Protocol.

To be eligible for the Shelterbelt Enhancement Program, applicants must apply for, and receive, seedlings through the PFRA Shelterbelt Program. The following groups are eligible under SEP:

- Bona fide producers of primary agriculture products;
- Federal and provincial departments for conservation plantings, reclamation or research purposes;
- Owners of rural holdings greater than 39 acres (15.8 ha);
- Rural holdings of 39 acres or less, commercial enterprises, golf courses, resort areas or private holdings in urban areas are NOT eligible.

The following plantings are eligible under SEP:

- Farmyard shelterbelts must be established around farmyards, livestock facilities or other farm buildings; must be a minimum 800 metres in total length;
- Field and roadside shelterbelts, and riparian buffer strips must be a minimum 800 metres in length, and composed of tree and/or shrub species that will succeed under local conditions;
- Wildlife tree plantings must encompass a minimum one hectare of land and not be established adjacent to inhabited farmyard sites.

### **3. Alberta**

Alberta is covered by about 38 million hectares of forest. The province's forests play an important role in supporting Alberta's economy, generating revenue of over \$8 billion annually, and providing about 52,000 jobs for Albertans. More than 1.5 million hectares of forested land lie in Alberta's agricultural zone, according to Dave Burdek, Regional Conservation Co-ordinator with Alberta Agriculture, Food and Rural Development. With 10% to 20% of the annual allowable cut in Alberta coming off of private land, or approximately \$500 to \$700 million dollars of value-added product, these are significant forestry resources.

#### **Woodlot Pilot Extension Program**

The increased demand for fibre and trees and the pressure for sustainable long-term supplies have helped bring together a broad-based group to form the Woodlot Pilot Extension Program. The partners in the Program consist of:

1. Alberta Agriculture Food and Rural Development (AAFRD)
2. Prairie Farm Rehabilitation Administration (PFRA)
3. Ducks Unlimited Canada (DU)
4. Alberta Pacific Forest Industries Inc. (ALPAC)
5. Alberta Conservation Association
6. Ainsworth Lumber Company Ltd.
7. Weyerhaeuser Canada Ltd.
8. Daishowa-Marubeni International Ltd.
9. Vanderwell Contractors Ltd.
10. Millar Western Forest Products Ltd.
11. Weldwood of Canada Ltd.
12. Woodlot Association of Alberta

Only a small portion of the agriculture area in Alberta is being managed as sustainable woodlots. The Program feels that landowners not only need to be aware of the economic and social benefits of sustainable woodlot management, but must actively manage these areas in a sustainable fashion to protect the resource and achieve land use goals. The development of woodlot or resource management plans and sharing information on the opportunities related to sustainable woodlot management will help promote agroforestry as a land use option.

The main goals of the partnership are:

- to increase awareness of economic and environmental implications of agricultural area forest management;
- to increase landowner participation in sustainable woodlot management; and
- to encourage integrated community land use planning.

One of the goals of the program is that increased awareness of the range of values and opportunities associated with sustained forest management will lead to balanced decision making by landowners and policy makers.

In this context, the objectives of the partnership are to:

- Provide, develop, source, and disseminate information on woodlot management.
- Promote sustainable woodlot management as a component of individual business plans.
- Provide information on agro-forestry and forest related value added opportunities.
- Promote sustainable woodlot management as a component of integrated land-use plans.
- Expand the impact of the pilot program beyond the AAFRD northern region.

- Promote sustainable woodlot management as a viable land-use opportunity.
- Increased development of woodlot/resource management plans by landowners.
- Increase plantings, i.e.: shelter belts, block planting, forest belts, hybrid trees, conservation planting.
- Promote sharing of information related to sustainable woodlot management at a local level by bringing land owners together and providing resources to individuals and key leaders.

### **Alberta-Pacific Poplar Farm Program**

The most rapidly developing hybrid poplar program in Canada takes place in Alberta. The Poplar Farm Program, led by Alberta-Pacific Forest Industries Inc. (ALPAC) first established 200 ha of operational and research trials in 1993. The company currently forecasts to plant 20,000-25,000 ha to supply 15%-25% of the 2.5 million m<sup>3</sup> annual supply required for its large single line pulp and paper mill in Boyle. Of this land, approximately 3,000 ha are to be leased.

In total, Alpac is seeking to lease some 60,000 acres of private land within 200 kilometres of their mill (located approximately 50 kilometres northeast of Athabasca, Alta.) over the next 20 years, in order to grow poplar trees for use in the mill.

The major incentive for the development of the ALPAC program stemmed from the concern about fibre supply. The company believes that plantations can help them control fibre costs for their mills in the future. Alpac forecasts a 25% loss of its land base during the next rotation due to oil and gas claims, land claims and fire. The company expects to average field growth of 12 m<sup>3</sup> ha<sup>-1</sup>yr<sup>-1</sup> (4 Mg ha<sup>-1</sup>yr<sup>-1</sup>) over a 20-30 year life-span. The yield estimates are somewhat speculative, as very limited field experience with hybrid poplars has occurred in this short growing season area with moderate rainfall. Plantings are planned to take place in a 200-250 km radius of the Boyle pulp mill, and contracts will be carried out on lease arrangements with local landowners or potential joint-venture agreements.

Other forest product industries are also beginning trials. A Western Boreal Aspen co-operative has been formed which includes ALPAC, Weyerhaeuser, Ainsworth Lumber, Daishowa-Marabini America, Slave Lake, Miller Western and Slocan. Research on genetic improvement of hybrid poplars is also being co-ordinated by the University of Alberta. Currently, the program is importing improved clone material and examining the possibility of establishing a breeding co-operative. The co-operative plans to evaluate both hybrid poplar and aspen.

## **4. British Columbia**

### **Forest Renewal BC**

The province of British Columbia's Forest Renewal Act 1994 created a quasi-public corporation called Forest Renewal BC. In 1993 the province increased the stumpage royalty on Crown timber by 30%, and that increase goes to fund the corporation. It spends the money on environmental, economic, and social projects related to forests. About 70% of its money goes towards reforestation of degraded lands, along with stream and habitat restoration. About 30% goes towards economic and social projects intended to make the forest sector more sustainable, profitable, and stable. Some of its activities, such as making loans and grants, require specific approval from the Lieutenant Governor in Council. Forest Renewal BC is governed by a board of directors appointed by the Lieutenant Governor and has several additional advisory committees, which provide opportunities for stakeholders to participate in the management of the corporation. The Act puts in place several planning and record-keeping requirements to promote transparency.

## Small Woodlands Program of BC (SWP of BC)

The SWP was a Forest Renewal BC initiative with an afforestation component. Program development and services were funded by Forest Renewal BC until March 31, 2002. Now that this funding is no longer available, the program is presently under transition. The Forest Research Extension Partnership (cc) is maintaining ties with regional SWP partners as well as partners throughout the province, though the level of extension available is now limited due to funding constraints.

The SWP was essentially an initiative to increase wood supply, create forest jobs, and stimulate traditional sources of rural income. The program focused on non-industrial private forest land that was not currently committed to sustainable forestry (lands outside the Provincial Forest and Forest Land Reserve). These included:

- residential class land,
- farm land,
- unmanaged private forest land,
- First Nations reserves, and
- agricultural leases.

Non-industrial landowners were considered those who did not have an interest in a large processing facility but did have sufficient land to practice sustainable forest management. It was estimated that there are some 20,000 such land owners across the province.

A fundamental goal of the program was to encourage sustainable forest practices on private land by helping landowners to acquire the necessary skills, knowledge, and financial resources needed to do this. The delivery of the program was facilitated through Regional Delivery Agencies. The goal of these agencies was to educate, support and facilitate collaboration amongst landowners. It was hoped that this would lead to a self-sustaining organizational network with the interest, authority, and ability to represent landowners.

The program focused on non-industrial private *Program Goals*, which:

- Expand BC's productive forest landbase by encouraging small-scale forestry on private lands, in a manner that increases rural income and local jobs.
- Support the integration of forestry with other values and uses of private land by assisting landowners to make informed land and resource decisions.
- Promote the development of a stewardship ethic amongst landowners, which is based on sound forestry, agricultural, and environmental principles.
- Increase public awareness of the importance of private forest land and its importance to rural economic development.

FORREX also provides resource materials through The Small Woodlands Collection that is, or will be, accessible through the regional public library systems.

## Industry-sponsored Poplar Planting Programs

The earliest program with fast-growing trees to evolve in Canada was in southern British Columbia in the late 1950's by the Scott Paper company. The southern mainland of British Columbia is home to Canada's fastest growing poplar trees, and the company currently has 2,000 ha of plantings mainly on provincial crown land and company owned land. On agricultural sites, densities of 800-900 stems per hectare are planted and harvested on 15-year rotations. The low density is used to facilitate the production of larger sized trees for ease of handling at their pulp facility.

The major scale up of the crop, however, was then subsequently performed by MacMillan Bloedel. Research plantings were initiated by the company in the early 1980's with approximately 80% of the upscaling conducted over the past 4-5 years. The poplar planting program in British Columbia also received some technical support from the British Columbia Ministry of Agriculture. A total of 1,600 ha of plantings have been undertaken by Macmillan Bloedel's subsidiary, Poplar Farms Inc., in British Columbia and a further 2,300 ha on the coastal side of the Cascade Mountains of Washington State. In the U.S., the plantations are managed on a 9-year rotation and in Canada the rotation length is approximately 12 years, due to the shorter growing season and less fertile soils. Rotations of 12 years or less qualify for a lowering of the tax status on the land for agricultural purposes. The primary commercial market for the material is a "high brights" paper chip product from MacMillan Bloedel's pulp and paper mills. The afforestation program is currently in a state of flux as Macmillan Bloedel has recently divested from the pulp and paper industry, and Poplar Farms Inc. was sold along with the paper division to the paper company Pacifica. Poplar Farms Inc. is currently for sale by the new owners.

The major problem with the British Columbia afforestation program is the limited land base available in Southern British Columbia. For example, no more than 10,000 ha of additional land is foreseen to be available for poplar plantings (Stenersen, 1999; Van Oosten, 1999).

## **5. Manitoba**

### **Manitoba Agro Woodlot Program**

Manitoba Habitat Heritage Corporation (MHHC) partnered with Conservation Districts on a number of tree planting initiatives and realized how difficult it was to establish trees on farmland in Manitoba. MHHC found that when farm producers think of planting trees they encountered three major problems:

- They think of single row shelterbelts.

- Due to weeds and competition for moisture, tree planting on agricultural land is extremely difficult.

- Because producers don't have the time to be actively involved in tree planting and maintenance, it is critical to have access to a local organized and experienced tree planting service

They therefore realized the need to promote agroforestry tree planting. Trees had to be integrated into farming systems, to solve problems or contribute to farm production.

MHHC developed its woodlot program strategy in south-western Manitoba within the following context:

- Landowners, primarily farmers, believed that trees had no economic value. They cleared land for agricultural production.

- While clearing land for agriculture was acceptable, forest harvesting had a bad reputation among farmers.

- The small and scattered stands were a great distance to conventional industrial markets. There was a lack of skilled forestry workers within the area.

- Stands had been unmanaged and had problems ranging from decadence to insects and diseases.

- MHHC had to develop a strategy that supported the development of woodlot management and harvesting within the context of its mandate of conserving, restoring, and enhancing fish and wildlife habitat.

- The farm community was in crisis, due to the elimination of agricultural supports, globalization, and reduced commodity prices.



The major objectives of the initiative were essentially to:

- Increase producer awareness of the potential for trees to contribute to farm productivity and profit.
- Promote trees as a secondary crop to produce on-farm lumber.
- Increase biodiversity and enhance habitat.
- Provide options to conventional weed maintenance that increase survival and performance.

From 1992 to 1995, MHHC secured external partnership funding for a number of large-scale planting initiatives, to restore and enhance habitat – e.g. Wildlife Corridors. As external funding dried up, MHHC shifted its emphasis to small-scale agroforestry projects. They now attempt to design multi-purpose planting projects that exceed the basic goals of landowners by partnering with C.D's or contractors to do the planting. One of MHHC's innovations was to promote the use of fabric and plastic mulch as well as use of native grass seed. This not only minimized the need for herbicide, but also allowed landowners to plant and walk away.

MHHC has planted 1,000,000+ trees and shrubs, including the only silvacycling project in Canada. Silvacycling is an alley crop system designed to enhance hog manure nutrient management. Their site has detailed soils analysis and is set up for long-term research. The future of MHHC is subject to funding.

A survey of landowners showed that 94% rate the technical support of MHHC as being very good to excellent. Some 86% of respondents rate the service received as very good to excellent, and 53% believed the information from the Agro Woodlot Program more than met or exceeded their expectations.

### **Woodlot Extension Program**

The Woodlot Extension Program was formed in the early 1990s by the Manitoba Forestry Association (MFA) to assist Manitoba landowners interested in woodlot management. The Woodlot Association of Manitoba, The Manitoba Christmas Tree Growers Association and the Manitoba Forestry Association MFA were involved in developing program criteria and implementing the program. The primary objectives of the Woodlot Program are to promote land stewardship, and to help landowners realize the potential of their wooded property in meeting their personal goals.

The WEP achieves its objectives through:

- arranging onsite "walk'n talk" sessions with landowners and preparation of management plans;
- providing an information service by phone, mail, email, and through the MFA office;
- participating in the preparation and delivery of field days and seminars;
- facilitating the distribution of trees and materials; and
- assisting with the sale of products.

The primary service offered to the landowner is an initial "onsite" visit and the preparation of a Woodlot Management Plan. The MFA Extension Officer meets with the landowner and, during their "walk'n talk" visit, discusses various possibilities available for the development and maintenance of the property. Some landowners may be averse to removing trees, but, upon receipt of information on insect and disease damage and decadence, they realize this may be an option. Planting of trees is often recommended in the plan to reforest an area that may have been cleared, or may have died from natural causes, or that is on marginal land better suited to trees than crops. Many other woodlot opportunities such as traditional and non-timber forest products, wildlife enhancement, recreation, and eco-tourism that are available to landowners are also

discussed at this time. This initial meeting is deemed invaluable as many landowners appreciate the opportunity to exchange ideas and goals with the MFA Extension Officer.

Following the initial visit, the Extension Officer prepares a detailed management plan based on the specific topics and objectives discussed during the “walk’n talk”. This plan, along with additional information required to carry out the recommendations in the plan, is mailed to the landowner as a complete package, which includes a folder that holds the management plan and detailed information tailored to the landowner's specific needs.

The second component of the Woodlot Program is the return visit. A return visit, after the initial “walk’n talk”, is a valuable complement to the written plan provided to the landowner.

Return visits offer assistance to the woodlot owner who wishes to proceed with timber harvesting (Operational Return Visit), or who has completed initial recommendations contained in their other management plan and may want to carry out additional work in the woodlot (Technical Return Visit).

The MFA staff have completed 662 management plans on 62,692 forested acres since the beginning of the MFA Woodlot Program in 1992, throughout 54 municipalities across Manitoba. A Joint Advisory Committee continues to meet quarterly. Representatives from Manitoba Conservation, Manitoba Forestry Association, Manitoba Habitat Heritage Corporation, Manitoba Christmas Tree Growers Association and the Woodlot Association of Manitoba meet to discuss the Manitoba Woodlot Program and share information. The meetings are a forum for these groups to present pertinent program information, upcoming meeting and conference schedules, and also to allow the participating agencies to brainstorm on new program ideas.

Nearly 700 woodlot owners are actively involved in ongoing woodlot management activities. The program will continue to provide landowners with information enabling them to make informed decisions with respect to woodlot management. The MFA Woodlot Program maintains an actively rotating waiting list of approximately 30 landowners at any given time. There are 682 landowners with management plans in place, and approximately 10% of these are requesting additional advice as they work towards their land management objectives. The program hopes to complete 100 new plans and 30 return visits annually.

### **Woodlot Field Days and Tours Program**

The Woodlot Association of Manitoba (WAM) exists largely to provide information and education for its members. Given a limited budget available to carry out all its functions, WAM needed to find a way of offering a varied program of woodlot experiences to its members and the interested public in a cost-efficient manner. Their tours and field days allow participants to meet other woodlot owners and wood product users and to observe the methods and equipment being used by those owners, including those related to afforestation.

The field days and tours program evolved out of the initiatives of the WAM board of directors. At each meeting the directors discuss what events can be done over the next year and draw on their own contacts and resources to find events or demonstrations which would be of interest and use to the members.

The associated education program depends heavily on links with other producers or organizations. They have collaborated with organizations such as the Interlake School Division, Ducks Unlimited, Manitoba Forestry Association, Pineland Nursery, and many individuals who are producing forest or agricultural products from private lands. When seeking out these partners, they strive to tailor their programs to provide mutual benefits to their partners and co-operators. The co-operators may provide information, such as describing their methods and facilities, or may provide infrastructure, such as providing vehicles for tours or doing some of the administration of the program (collecting fees, registering participants, distributing brochures, etc).

WAM field days and tours have routinely drawn attendance of 40-50 participants, which is about 20% of their membership at any given time. In general, there are good numbers of both new attendees and people who have been to past events. There appears to be no trouble finding landowners to host portions of the events, or in finding organizations to participate. Both landowners and organizations donate their time and effort or supply help at cost, so WAM saves money and can provide good educational opportunities to their membership. In addition, the variety of people and organizations participating gives the event credibility and helps maintain the interest of the audience.

This kind of initiative is particularly helpful for landowners with little knowledge of silviculture, or for those who are unsure of the benefits of planting trees on their land. Such programs provide important synergies to government programs, by helping landowners to see the value of planting trees on their land.

### **Woodlot Management Plans in the Manitoba Model Forest**

The Woodlot Management Plans program provides an important lesson in problems that have been encountered in government-funded programs for First Nations forest reserves. Similar problems in forest management may be encountered in the implementation of afforestation programs in First Nations reserves.

The initiative was started when individuals from two separate First Nations (FNs) approached the Manitoba Model Forest (MBMF) for help in deciding what to do with reserve forested lands. The FNs were concerned that while woodlot management and improvement plans have been prepared from time to time for First Nation (FN) reserve forests, they were often ignored due to staff changeovers and/or lack of funding. The lands and concerns were initially scoped out by the MBMF General Manager who worked with the FN individuals to identify their needs and the expertise required.

Two projects with different objectives were undertaken. In both cases, however, the forested lands had been neglected with indiscriminate harvesting and repeated fires. In one case the objective was to enhance the forested land around an ecotourism development, and in the other case, to re-initiate planned forest management actions for forest improvement. Both initiatives had an underlying objective of creating employment opportunities for the marketing of both timber and non-timber forest products.

In both cases, experts identified by the MBMF were brought in to assess the situation on the ground with community members. Working with community members, development plans were prepared. These plans were then used by the communities to submit proposals to other funding agents for implementation. Both were successful in acquiring needed financial resources to begin implementing their plans. Both projects received funding from the MBMF but were carried out by consultants who worked with community members and the MBMF General Manager.

The program found that while the lack of plans for reserve lands is a problem, it can usually be overcome with outside support; however, the resources and resolve to carry out the plans over the long term are often non-existent. This results in discontinuous projects as resources are found, lack of continuity in staff and priorities, and wasted and duplicated efforts.

### **Woodlot Seedling Program**

The Woodlot Seedling Program is a small initiative run by the Manitoba Forestry Association (MFA), which helps local landowners to acquire seedlings for afforestation purposes. The program was implemented in 2000 when a local nursery (Pineland Forest Nursery) was considering discontinuing taking smaller tree seedling orders for local private landowners. The

nursery was finding it too time consuming for their staff to deal with smaller tree seedling orders, so they approached the MFA to determine if the Association would take over this part of their distribution. Landowners were experiencing some difficulty in gaining access to the tree seedlings they wished to plant, and in purchasing healthy and appropriate stock at a reasonable price.

The MFA agreed to purchase the seedlings from the Pineland Forest Nursery at a reasonable price and sell them to landowners. Order forms are prepared by the MFA and distributed to potential purchasers who place their orders by a designated time. All orders must be prepaid. The major objective for the MFA is to continue to provide tree seedlings for landowners as a complementary component of the woodlot program, which the Association delivers.

This has been successful because of the service extended to landowners and the financial gains by the MFA to assist with their ongoing education programs. Response to the seedling program has been exceptional, indicating interest and willingness on the part of landowners to plant trees. In the first year alone close to 100,000 seedlings were distributed.

## **6. Ontario**

### **Early Afforestation Initiatives in Ontario**

Ontario has a long history of tree planting on private lands dating back to the late 1800's. The millions of hectares of plantations that are on the southern and central Ontario landscape were largely established through the visionary efforts of individual landowners and also through various provincial and other tree planting programs.

Afforestation programs have included Agreement Forests, Woodlands Improvement Agreements, and tree-planting programs operated by many of Ontario's Conservation Authorities and several other smaller-scale programs, and are responsible for the planting of over 1 billion trees on private lands across the province. The lessons learned from these programs include afforestation techniques, tending and harvesting techniques, greater awareness of the ecological role of plantation forests, as well as an understanding of what motivates private landowners to undertake afforestation (OMNR, 2001).

Most potential land available for afforestation is owned by private landowners. In southern Ontario, these private holdings usually consist of relatively small parcels scattered across the landscape (Cherry, 2001), while lot sizes generally tend to be larger in northern Ontario. Thus the main challenge is to get landowners participating in making available these parcels of land. In addition to private landowners, some potential future land options may include hydro/gas line corridors, discontinued landfills, and abandoned mines (Cherry, 2001).

Some 750 ha of marginal and sub-marginal land in Ontario, for example, were planted in 1998 (DeMarsh, 1999). Factors such as land ownership, land parcel size, program incentives, and crop profitability are recognized as contributing to the feasibility of converting land to forest (ArborVitae et al., 1999). Current agricultural policy, however, somewhat limits land availability for forest use by requiring only a gross annual income of \$7,000 for farm status, which acts as a disincentive for tree planting (E. Boysen, pers. comm., 2001).

There are some 60.9 million hectares of forested land in the province, representing approximately 57% of the 106.8 million hectare provincial land base (including water) (MNR, 1996). Private forests account for approximately 5.6 million hectares or 8.2% of forested land and 5.2% of the total provincial land base. About two-thirds of the private forests are located in the Southcentral Administrative Region of the Ministry of Natural Resources (MNR), where they occupy approximately 38% of the land base.

Many of the earlier afforestation programs concentrated on the afforestation of abandoned or marginal farmlands. Many of these sites had experienced severe soil erosion accompanied by significant reductions in site productivity. The afforestation and restoration of the ecological functions of these sites was considered to be of paramount public importance.

As noted by the Puttock (2001), the early history of afforestation in Ontario has been well documented by Coons (1981, 1988) and others. The tree planting movement in Ontario had its roots in the agricultural sector. Well before the provincial government was actively involved in forest management and afforestation, farmers and farm organizations such as the Ontario Fruit Growers Association, recognized the importance of restoring tree cover to the landscape. Extensive clearing of the forest during the mid-1800's resulted in serious problems for agriculture and settlement. Forests were driven back, fuelwood became scarce, and the incidence and damage by flooding increased. Soil erosion, soil infertility, and wind presented serious problems to the late 19th century farmer (Coons, 1981). By the late 1870's eminent horticulturists such as William Saunders (who in 1886 became the first director of the Agricultural Experimental Farm in Ottawa) began to promote afforestation as one means of preventing further degradation of agricultural lands.

The Ontario Legislature in 1871 passed "An Act to encourage the planting of trees upon the highways in this Province, and to give a right of property in such trees to the owners of the soil adjacent to such highways" (White, 1899). Puttock (2001) notes that this appears to be the first time that legislation was enacted to encourage tree planting in Ontario. The Act was subsequently superseded by The Ontario Tree Planting Act 1883.

Following a recommendation of a committee appointed to attend the 1882 American Forestry Congress in Cincinnati and Montreal, The Ontario Tree Planting Act 1883, was passed to encourage planting and care of trees along public highways and along the boundary lines of adjoining farms. The act provided for payment to landowners of up to \$0.25 per tree with the costs shared equally by the municipality and the province. Landowners were paid three years after planting if the trees were healthy. The main source for stock were wild seedlings and saplings dug from surrounding woodlots. Thomas Southworth, Clerk of Forestry for Ontario reported in 1896 that some 75,000 trees had been planted during the nine years that the Act had been in effect (Southworth, 1896).

Large-scale afforestation of private lands gained momentum in 1905 with the free distribution of trees from provincial nurseries to landowners. From 1905 to 1919, some 3.4 million trees had been distributed to private landowners (Coons, 1981).

The following sections describe afforestation-related programs in Ontario from 1921 until the turn of the century. Information in these sections is largely taken from Puttock's (2001) excellent review of tree planting programs in Ontario.

### **Agreement Forests: 1921 -1998**

The Counties Reforestation Act 1911 provided that a county could pass by-laws for purchasing or leasing lands suitable for afforestation purposes. In 1921, The Reforestation Act was passed enabling the province to enter into agreement for reforesting, developing, and managing lands held by counties. The Agreement Forests Program was put in place to allow the Ontario Ministry of Natural Resources (OMNR) to manage forests on behalf of municipalities, conservation authorities, and townships, with the first agreement signed in 1922.

Legislative changes in 1945 and again in 1960 also made it possible for townships and municipalities respectively to become involved in Agreement forestry. Finally in 1975, Domtar Inc. became the first corporation to participate in the program. Over a 76-year period (1922- 1998), that the program was in effect, the number of Agreement holders varied as new owners entered

into agreements while others decided to leave the program. By 1982, the program grew to include 59 agreements with 106,596 hectares of land (OMNR, 2001).

The Provision of Planting Stock Program was started to allow landowners to purchase planting stock below cost. The Advisory Services Program provided extension services from the OMNR to private landowners.

In 1994, the Ministry of Natural Resources began to negotiate the termination of the formal agreements with the owners, thereby transferring all management responsibilities. Due to the unique accounting system of the agreement forest program (all costs and revenues were recorded in a ledger book), some forests were "in the black" and transition of responsibility was not an issue. Many others were "in the red", meaning that revenues had not caught up to the expenditures at that time. Owners were reluctant to assume both management responsibilities and the outstanding net management costs at the same time. Accordingly, the provincial government agreed to finally ignore these outstanding costs, and view them as an investment in a healthy natural environment instead. This cleared the way for final negotiations with the remaining owners.

These programs were discontinued in 1998. At the time when the program was discontinued there were 56 agreements with 128,853 hectares of land.

In the mid-1990s, the OMNR transferred management responsibilities to owners of the Agreement Forests, terminating formal agreements. Since this period, many agreement forests have continued to thrive - generating income, providing employment for local workers, and providing key wildlife habitat and recreational areas for the local populations.

The Agreement Forests program consisted of a partnership between the Agreement holder (e.g., a county) and the Government (Ministry of Natural Resources). Features of an agreement were outlined in a Department of Lands and Forests publication entitled *Municipal Forests* (Circular No. 14, February 1927, 19p.), as follows:

- An Agreement holder purchased the land in blocks of not less than 400 ha. (1,000 ac.) in area.
- Funds for the purchase were supplied entirely by the county (Conservation Authorities received a government grant equal to 50% of the value of the land).
- Land was deeded in the name of the Agreement holder and leased to the province for a specific period of time - initially 30 years.
- The province assumed all responsibility for establishing the forest and maintaining it over the term of the agreement. This included supplying and planting the trees, infrastructure and facilities, and any labour required.
- The province collected any revenues from the sale of forest products. Revenues were entered as credits to the forest account.

#### Accomplishments

- Approximately 147.5 million trees planted. Long term planning for seed and stock needs and seed source and stock deployment control provided by MNR nursery system
- The Agreement Forests program satisfied the need to reforest the "wastelands" identified by Zavitz in 1909. This provided a good example of how to reforest and restore critical areas. Some forests are in blocks as large as 27,000 acres.
- The province made substantial contributions to the purchase of those lands, enabling the Agreement holders to acquire the lands.
- Elected officials and the public (through the Conservation Authorities) were involved in the program. In essence, the Agreement Forests were the first community forests in Ontario.
- The program left a legacy of well-managed forests throughout Ontario and strengthened the concept of public ownership of natural areas in the province.

As the forests matured, they have provided significant areas of wildlife habitat; have provided employment and income for their owners; have stabilized strategic watersheds; and have served as a demonstration of large-scale afforestation efforts.

The agreement was registered against the title of the property, thereby ensuring long-term stability and protection of the investment.

### **Woodlands Improvement Act: 1966 - 1993**

In 1962 the Minister of Lands & Forests proposed policies and programs that would assist landowners in reforesting and otherwise managing idle lands. Following the success of provincially-assisted afforestation trials on private lands in south-western Ontario in 1964 and 1965, the Woodlands Improvement Act 1966 came into being. The legislation allowed the Department of Lands & Forests to enter into agreements with individual landowners to provide assistance with afforestation and stand improvement. It was used to encourage afforestation on abandoned, usually marginal, agricultural land from Sudbury southwards.

The program was exceedingly popular with landowners. From rather modest beginnings, the number of properties under agreement peaked at over 10,000 in the early 1980's although the total area under agreement continued to increase through the 1980's. However, as a result of provincial government restructuring and spending cutbacks, the MNR began to phase out the program in 1993, such that the program became oversubscribed as MNR did not then have the capacity to answer all the requests for participation. The Woodlands Improvement Act was rescinded in 1998, but the essential provisions of providing for agreements with landowners were incorporated into the revised Forestry Act in 1998.

The agreement was not registered to title, allowing the landowner to sell the property freely. An added incentive for most lands managed under the Woodlands Improvement Act was a tax rebate for the managed lands in the form of the Managed Forest Tax Rebate Program (Cherry, 2001). This program is still in place today for properties enrolled as managed forests.

Features of an agreement were outlined in *Private land forests: A public resource* (MNR, 1982). These included:

- A minimum of five acres was required to qualify for the program.
- Under a Woodlands Improvement Agreement, provincial forestry staff prepared a work plan and either provided or paid for the work to be undertaken.
- The landowner committed the land to forestry for 15 years, agreed to give adequate protection, and purchased the trees for planting. The trees were provided by provincial nurseries at a subsidized rate. This is a good example of a cost-shared planting program. Upon expiry, the original agreement could be replaced by an Advisory Services Agreement, whereby the MNR provided the necessary management advice at no cost to the landowner.
- Agreements were not registered against title to the property.
- The area under the agreement qualified for the managed forest property tax reduction program that was in effect from 1975 to 1993, and re-initiated in 1996 to present.
- Agreements were with the original landowner. If a property was sold, the new landowner could agree to assume the responsibilities of the vendor under an Assumption Agreement. However, if the original owner wished, they could simply pay back all management costs borne by the MNR, and exit the agreement in that manner as well.
- The program operated across the province, and many areas in northern Ontario were also reforested as a result.
- Long term planning for seed and stock needs and seed source and stock deployment control provided by MNR nursery system

- Landowners were invited to participate in annual WIA field days, where organized tours of different properties demonstrated alternative management concepts and techniques. Landowner education and awareness was a key objective of the program.

#### Accomplishments

- Approximately 213 million trees planted on at least 52,000 ha private land.
- The W.I.A. program provided strong co-ordinated support and technical expertise to landowners for all management activities from seed and stock production to site assessment and preparation to planting, maintenance, and thinning.
- The program contributed to afforestation on private lands on a larger scale than was possible before the program.
- Landowners had increased potential to earn future income from their lands through the sale of wood products.
- The program provided the province with an opportunity to invest in its own future through economic activity generated by the sale of wood products.
- Consistency fostered awareness and trust of landowners.

#### **Project Tree Cover: 1992 - 1997**

A more recent initiative to afforestation is Project Tree Cover (PTC), launched in the fall of 1992. This program was a partnership under Tree Plan Canada between the National Community Tree Foundation (NCTF), Forestry Canada, the Ministry of Natural Resources, and Trees Ontario. Tree Plan Canada (TPC), a national tree planting and care program was established under the Green Plan to offset the global warming problem. Funding and technical assistance was provided by Forestry Canada, and the program was managed by NCTF (a non-profit charitable foundation). Trees Ontario was a program of the Ontario Forestry Association (OFA) that was established with MNR assistance in 1990. The above parties signed a memorandum of agreement in December 1992. Trees Ontario would co-ordinate the planting of trees supplied from MNR nurseries, and later private nurseries, using funding from Tree Plan Canada. MNR agreed to supply technical support.

The overall objective of PTC was to establish trees in areas currently lacking forest cover. The program target was the creation of approximately 10,000 ha of woodland cover (over 16 million trees) at a projected total expenditure of \$15 million over 5 years. The plan called for up to 3.7 million trees to be planted annually, following the start-up year (1992/93) in which 2 million trees would be planted. The program was in effect for 5 years and was discontinued in 1997 for several reasons including NCTF funding constraints, MNR staff reductions and nursery closures, and an apparent lack of co-ordination between the OFA and its partners in program delivery. Afforestation is still carried out by the Tree Canada Foundation and the Boy Scouts on a volunteer basis. The Scouts Canada program is also used as a fund-raising activity. The program planted some 4 million trees in 1998 and claims a 75% survival rate (Williams & Griss, 1999).

PTC was designed for rural landowners having relatively small properties, although this was in direct competition for the same pool of landowners routinely targeted by the Conservation Authorities. Funding was restricted to private land sites 2 - 4 ha. in size (equivalent to 3,500 - 8,500 trees). The following criteria were established:

- Trees could not be established primarily for the purpose of commercial production (i.e. timber, Christmas trees, or landscape trees).
- Landowners had to sign a 5-year commitment to maintain the trees.
- Landowners had to contribute \$0.20 per tree in cash or contribute work of equal value prior to commencement of planting.
- A tree establishment plan had to be prepared and signed by MNR technical staff.



Planting and tending contracts were awarded through competitive tender process and a "Contractor Performance Report" was used as the basis for payment for work performed. The OFA conducted a follow-up survey of participants (survey responses are on file at OFA).

The program was administered through the Ontario Forestry Association's Trees Ontario program, including:

Handling and approval of applications.  
Arranging planting operations through silvicultural contractors, Conservation Authorities, or the MNR.  
Financial accounting and record keeping.  
Promotion of the program.

The MNR agreed to:

- Provide tree seedlings from provincial nurseries under a cost sharing arrangement with the landowner. MNR contribution was \$0.40 per tree (in kind). The landowner was responsible for maintenance of trees planted and for contributing \$0.20 per tree (cash or in-kind).
- Contact landowners and groups interested in participating, inspect the land, prepare detailed planting plans,
- Monitor the field work including site preparation, planting, and tending.

#### Accomplishments

Over the five-year period 1992-1997 that the program was in effect, approximately 6.4 million trees were planted (as opposed to the 16 million tree target).

Over 700 landowners participated in the program.

Although the Forestry Act required that trees provided to any program that were grown on provincial nurseries had to go to landowners with more than 5 acres, many MNR districts agreed to provide stock to smaller properties. When the WIA and the National Soil and Water Conservation - Permanent Cover programs were discontinued, the OFA responded by removing the restriction on maximum size of area to be planted.

As of November 1998, 1,021 ha. (2,080,000 trees) had received tending under the program.

This represents approximately one-third of the trees planted.

### **Ontario Soil & Crop Improvement Association**

The Ontario Soil and Crop Improvement Association (OSCIA), founded in 1939, is a non-profit farm organization that promotes the communication and facilitation of responsible economic management of soil, water, crops, and air. The OSCIA membership represents virtually all commodity groups across the province and is a credible, active, grassroots voice on agricultural issues. The OSCIA has 55 local county/district branches across the province and is a significant presence in all the major agricultural areas of Ontario.

The OSCIA is committed to four strategic directions: producer education, development and delivery of stewardship programs, development of local associations, and addressing consumer concerns on agricultural environmental issues. Tree planting and afforestation have been important components of several of the OSCIA stewardship programs, including the Permanent Cover Programs I & II (1990-1993), Ontario Environmental Farm Plan (EFP) Incentive Program (1993-present), and the Restoration of the American Chestnut - Farm Response to a Species at Risk (1998-1999).

## **Permanent Cover Programs (PCP) I & II: 1990 - 1993**

The PCP I & II programs promoted on-farm conservation by providing financial incentives for farmers to retire fragile agricultural land. Farmers were invited to submit 'bids' to secure up to \$10,000 in federal contribution. Local OSCIA committees reviewed the bids and funding was awarded on the basis of local priorities. Bids were considered for different permanent cover projects including:

- Grass buffer strips
- Tree and grass buffer strips (8-20 feet wide with up to 3 rows of trees)
- Enhanced buffers
- Highly erodible, fragile land retirement (20 acres maximum, trees mandatory)
- Flood plain (trees optional)
- Wetland buffers
- Tree windbreaks.

### **Program Features**

- OSCIA assisted in program development and was responsible for program delivery.
- Contribution and Land Use Agreements were signed between the landowner and Agriculture Canada. Terms varied from 5, 10, and 15 year agreements (vast majority were 15 years).
- Budgets were made available to all agricultural counties and districts, with amounts based on row crop acres.
- For tree planting projects, the planting was typically done by the landowner or by a 'planting agent' (Conservation Authorities or MNR) under separate contract.
- Most of the trees originated at provincial nurseries.
- Program allowed for tending of new plantations (usually involved a second herbicide treatment to control competing vegetation).

### **Accomplishments**

- About 1,800 farmers participated in the program, averaging 4.4 acres per project.
- Approximately 2.5 million trees were planted on fragile farmland across Ontario.
- Bid process allowed farmers to decide reasonable compensation (including opportunities for compensation for taking land out of annual crop production or pasture).
- Local farm committees awarded bids based on true value.
- Sites are casually policed by the local farm community to ensure compliance.
- Fair compensation through the tree planting contracts with planting agents.
- Farmers were responsible for their own project design and function.
- Long term agreements with Agriculture Canada formalized commitment.

## **Ontario Environmental Farm (EFP) Incentive Program: 1993-present**

The EFP provides up to \$1500 per farm business to help farmers implement new management practices that effectively address a 'poor' or 'fair' rating in their EFP. Expected benefits include erosion control; stream, ditch, and flood plain management; woodlands and wildlife. To date, about \$10.3 million has been claimed through incentives. Records indicate that every federal dollar paid out in grant stimulates a \$3 expenditure towards the same project by the farmer.

### **Program Features**

- The program is delivered through the OSCIA for the Ontario Farm Environmental Coalition.
- Of the 22 project worksheets, tree planting typically appears as an action item in three areas: soil management (planting tree windbreaks); stream, ditch, and flood plain management

(planting tree buffer strips along watercourses); woodlands and wildlife (wildlife corridors, plantings for wildlife).

No contribution or maintenance agreements are signed with these tree-planting projects. The \$1,500 grant can be claimed for paid invoices for material and/or contractor costs. There is no requirement for farmers to show matching funds. The farmer's labour or materials are not eligible as paid work.

The tree stock is obtained from several sources (e.g. private nurseries, Conservation Authorities).

#### Accomplishments

Eligibility tied directly to having an appropriate peer reviewed Environmental Farm Plan. A high 'return' for every federal grant dollar spent - 3:1.

### **Restoration of the American Chestnut - Response to a Species at Risk: 1998 - 1999**

The objectives of the program were to use the American chestnut, a threatened species, as a focal point and springboard to draw the attention of the agricultural community towards the plight of wildlife species at risk on and around farm land. The program also strived to demonstrate a different approach to working with landowners towards restoring a species at risk.

The program was co-ordinated by the OSCIA and funded through:

Agriculture and Agri-Food Canada through the National Soil & Water Conservation Program administered by the Agricultural Adaptation Council.

Wildlife Habitat Canada.

Natural Resources Canada - Canadian Forest Service.

Ontario Ministry of Natural Resources.

#### Program Features

The program cost-shared on establishment and maintenance costs on up to one acre of retired crop or pasture lands.

Fifteen year conservation Agreements were signed between the farming landowner and the OSCIA.

The planting was typically conducted by either the local Conservation Authority or Stewardship Council. The landowner was actively involved in site preparation, planting and/or maintenance.

The American chestnuts (1,250) were obtained through the Grand River Conservation Authority nursery near Burford. The other hardwoods and conifers came from a variety of sources, primarily nurseries formerly operated by the province.

#### Accomplishments

11,550 trees planted (including 1,250 American chestnut) on 24 farms in 1999 only.

Planting sites were designed to satisfy the needs and interests of the farmers (i.e. erosion control, wildlife, biodiversity, and future timber products).

Engaged many interests from farm and wildlife organizations, and provincial and federal government agencies.

### **Ontario Maple Syrup Producers' Association (OMSPA)**

There are about 1,200,000 commercial taps placed on 2,000 farms annually in Ontario. The maple syrup industry in Ontario generated an estimated \$17.7 million dollars from the sale of maple products in 2000. At present, about two-thirds of the syrup consumed in Ontario is

imported. Therefore, the industry in Ontario is seen as a growth industry. Modest growth of the industry has occurred over the past decade, tempered by high establishment costs facing prospective producers. OMSPA is actively supporting applied research and extension initiatives supportive of the maple industry, including the establishment of maple orchards.

About 30,000 trees have been provided from private and provincial nurseries to support maple orchard establishment in the past 10 years, including about 20,000 trees from the Kemptville nursery in the 1990's.

### **Wetland Habitat Fund: 1997 - present**

The Wetland Habitat Fund (WHF), initiated in 1997, provides landowners with financial assistance for projects that improve the ecological integrity of wetlands. The objectives of the WHF are:

- To promote ecologically sound landscape uses that meet the needs of waterfowl, wetland wildlife, and people.
- To increase the abundance of wetland wildlife and to improve the quality and quantity of wetland habitats.
- To encourage landowners to participate in wetland habitat improvement, maintenance, and monitoring.
- To have a positive effect on wetland habitat diversity to benefit waterfowl.

The fund is supported by:

Wildlife Habitat Canada  
Ontario Ministry of Natural Resources  
Internationally by the North American Waterfowl Management Plan partners

### **Program Features**

A wetland conservation plan is required.

The WHF favours project submissions with conservation plans that:

contribute to the restoration and improvement of local wildlife habitat,  
lead to benefits that can be enjoyed either directly or indirectly by the general public, and  
encourage partnerships and foster co-operation among landowners, interest groups and  
conservation agencies.

Eligible habitat projects may receive up to a maximum of 50% of project cost or \$5000 (whichever is less). The landowner's contribution to the project cost can include in-kind support.

Tree planting is often delivered through the Conservation Authorities and/or private consultants.

Habitat inventories, wildlife population studies and capital costs (e.g. buildings, computers, vehicles, etc.) are not funded.

### **Stewardship Councils: 1996 - present**

The stewardship program is guided by the principle of "influencing" voluntary land management decisions, rather than enacting laws or other restrictions. The Stewardship Councils are composed of members of the community representing a broad spectrum of landowners and land interests. Stewardship Councils are encouraged to:

Work on the principle that progressive and co-operative work can only be done if it jointly involves landowners and land interests to attain private land stewardship;  
Find partners and local funding in order to carry out projects in their areas;  
Provide a forum to recognize and influence community involvement and interest in private land stewardship; and,  
Provide a focus and direction at the local level to develop entrepreneurial programs that provide opportunities for revenue generation.  
A small amount of seed money is available from the Province to the Council for these projects.

Several Stewardship Councils have established modest tree planting programs. The objectives of these programs vary with local needs such establishing farm windbreaks, re-vegetating stream banks, addressing the issues of habitat fragmentation and loss of bio-diversity, and providing landowners with access to reasonably priced planting stock through bulk purchasing.

Landowners or community groups do most of the planting and there are no minimum area requirements. Stock is purchased from private nurseries. The cost of nursery stock is generally shared between the landowner and the Stewardship Council. In an innovative approach to stock acquisition, the Northumberland Stewardship Council has been active in bulk ordering on behalf of landowners and partner organizations for four years. The Peterborough and Victoria Stewardship Councils have joined the program to take advantage of bulk pricing and operational logistics. In the future, these Councils will have to consider securing long term access to tree seedlings, due to the lack of producers and limited supply of southern Ontario planting stock (reasonably priced and correct seed source).

#### Accomplishments

Approximately 218,000 trees planted between 1996 and 2001.  
Reduced cost of nursery stock to landowners.  
Excellent educational value in schools and the farm community.  
High landowner interest and involvement.  
Brings the landowner, Stewardship Council, and other community groups together for a common goal.

### **Over-The-Counter Nursery Stock Program**

With the creation of the first provincial nursery at the Ontario Agricultural College in 1905, landowners were able to acquire tree seedlings at no charge. This policy was eventually enshrined in the Forestry Act 1960 and continued throughout the ninety-year period that provincial nurseries were in operation although subsequently landowners were required to pay a nominal amount for seedlings. For example, the Forestry Act, 1980 authorized provincial nurseries to furnish nursery stock to landowners and public organizations at greatly reduced prices. These sales of nursery stock, termed Over-The-Counter (OTC) sales were extremely popular with landowners, service organizations, and Conservation Authorities, and provincial afforestation programs excluding the Agreement Forest and W.I.A. programs. OTC sales account for some 792 million seedlings (approximately 69%) distributed from provincial nurseries to private land between 1905 and 1996.

#### Program Features 1980-1996

Minimum order of 100 trees, increasing in multiples of 50 trees. Landowner paid \$10 + \$.025 per tree (Forestry Act, 1980). A 1991 study of order size for OTC sales from the four southern Ontario provincial nurseries (St. Williams, Midhurst, Orono, and Kemptonville), indicated that 60% of the 1,257 clients who obtained seedlings through the OTC program that year purchased less than 2000 trees. However, this accounted for only 4% of the

trees sold. The remaining 40% of the clients who purchased more than 2000 trees accounted for 96% of the trees sold.  
Minimum area 2 ha.  
Supplied stock to Conservation Authority afforestation programs and provincial afforestation programs (excluding Agreement Forests and W.I.A. agreements for which nursery stock was allocated separately).  
The 4 provincial nurseries in southern Ontario supplied most of the stock for private lands.

#### Program Accomplishments

Approximately 792 million trees supplied for afforestation of private land.  
A low cost source of seedlings for private landowners.  
Continuity of supply allowed Conservation Authorities and provincial programs to schedule planting in 2-3 years in advance. This facilitated long-term planning and

According to Marilyn Cherry (2001), afforestation rates through many of the programs listed above managed by the Ontario Ministry of Natural Resources (OMNR) were much lower than expected for a number of reasons, the primary factor being insufficient resources (mainly OMNR staff time and availability of planting stock) to meet demand. Some properties were ineligible for the programs because they were too small, and areas north and west of Sudbury did not promote the Woodlands Improvement Program. During the 1970s and 1980s, landowners were unwilling to pay for afforestation due to the low short-term returns available. Afforestation efforts have also been countered to some degree by initiatives that encouraged landowners to revert marginal farmland back into agricultural use (Patterson, 1995). These subsidies had the unintentional effect of causing land degradation because it became profitable to farm beyond the sustainable capacity of the land. In addition, in southern Ontario there continues to be pressure to convert forest and agricultural lands to urban uses.

#### **Hybrid Poplar Development Program**

The government of Ontario funded a large research and development program for hybrid poplars in eastern Ontario from the early-1970's to the mid-1990's. The focus of the afforestation program was to establish abandoned and low quality farmland with poplar to supply Domtar's Cornwall pulp and paper mill. Currently the program consists of 1,000 ha of privately-leased lands and 1,200-1,500 ha of Domtar-owned lands, managed by the Ontario Ministry of Natural Resources. This arrangement is under review where control of all lands will likely be reverted to Domtar.

The program peaked in the 1980's, and was one of the leading programs in North America that focussed on the development of fast-growing hybrid poplars. Much effort was placed into improving poplar silviculture techniques and improving poplar germplasm. The afforestation program experienced mixed success. Some of the problems encountered included sites with poorly drained soils that proved unsuitable for poplar cultivation, and septoria canker caused mortality on a high number of clones particularly on the drier sites. Plantations tended to be small as abandoned fields in eastern Ontario are typically 1-3 ha in size, with natural hedgerows between fields, therefore plantation sizes varied between 0.5 ha - 12 ha. The land was leased at \$27-30 ha-1yr-1 with an option to renew or opt out after the 12-13 year life-span of the stand.

#### **Domtar Woodlot Management Services**

Domtar provides landowners with woodlot management services from the mills in Cornwall and Trenton. These programs provide full service forest management to landowners, including management planning for all values, tree marking, product marketing, and harvest control. Domtar commits to managing the woodlots according to good forestry practices while optimizing the return to the landowner. All pulpwood is delivered to Domtar at a fair market price. Sawlogs and veneer are sold on the open market.

Domtar in Cornwall also provides landowners, who have available, arable land, with a program for intensive management of hybrid poplar. Domtar arranges for site preparation, tree planting, tending, and thinning and also arranges the final harvest. Landowners are paid lease payments for their land and stumpage for the poplar that is sent to Cornwall.

Cornwall has agreements with some 311 landowners covering 4,000 hectares. Trenton has 125 landowners covering 4,000 hectares.

Cornwall and Trenton each have two full time staff dedicated to the programs, a part-time commitment of a forester, and various contract and student staff for assistance.

The programs were developed, in part, to increase the availability of low cost wood, including certified wood, close to the mills by appealing to landowners interested in sustainable forest management.

### **Ducks Unlimited Wetlands Protection, Restoration and Enhancement Program**

In southern Ontario the agricultural landscape faces many pressures that reduce the area and productivity of wetlands. In this area most of the land is privately owned and has been cleared for agriculture. Ducks Unlimited recognizes that there should be a minimum forest cover of five per cent and they promote the importance of riparian forests.

The major objective of this program is to maintain the quality and quantity of wetland habitats by communicating the value of wetland systems and by promoting land use policies and programs that will minimize losses to wetland habitat. In Ontario, strategic landscape visions have been developed for the Great Lakes-St. Lawrence and Boreal Plain Regions. These visions form the basis for program implementation and development. In the future, landscape visions will be developed for the Boreal Forest and the Hudson Bay Lowlands, regions with predominately Crown lands.

To accomplish this, Ducks Unlimited offers a variety of programs for private woodlot owners. These include provision of information and knowledge, financial incentives, and the undertaking of specific activities on behalf of landowners.

The organization also acts as an advocate and catalyst in promoting its wetlands agenda. It fosters discussion and dialogue with federal, provincial, and municipal governments and conservation authorities to promote its vision and strategy.

Success for this program will be measured by monitoring changes in the wetland land base over a 20-year time frame, through such means as remote sensing and field examinations.

## **7. Québec**

Forests account for nearly 750,300 km<sup>2</sup> of Québec's total area of 1.7 million km<sup>2</sup>. Moreover, approximately 92% of all land in Québec is under public ownership, with more than half covered by commercial forests. Québec's private forests cover an area of 70,400 km<sup>2</sup>, accounting for nearly 8% of all its southern forests, and are owned by 130,000 private woodlot owners. Composed mainly of hardwood species, they are generally located close to urban centres, and hence to major roads, labour sources, and wood processing mills.

Overall, woodlands account for a little under half the total area of agro-ecosystems in Southern Québec (Environment Canada, 2003). Twenty-four percent of them are hardwood forest, 17%,

softwood forest and 17% mixed forest; regenerating forests, meanwhile, account for fewer than 2% of the total area of Québec's agro-ecosystems.

Although woodlot owners have a wide range of interests, most of them produce timber for the wood-processing mills. Some, however, have developed their forests for leisure and vacation use, generating significant seasonal revenues as well as some important spin-offs for their municipalities.

The private forests produce considerable quantities of firewood, Christmas trees and maple syrup. Hunting and fishing are also important, and 50% of all person days for these two sports are spent on private land. Thousands of owners develop their woodlots for timber harvesting. Forestry activities, generating annual revenues of some \$600 million, have spawned many small and medium-sized businesses, and nearly 400 municipalities derive direct benefits from this development. The Ministère des Ressources Naturelles (MRN) contributes approximately \$90 million per year to the private sector.

Until 1996, private woodlot management was underwritten by the Ministère des Ressources Naturelles du Québec (MRNQ) [Québec Department of Natural Resources] through the Programme d'aide aux propriétaires de boisés privés [private woodlot owners' assistance program]. In addition to providing private woodlot owners with trees for replanting, free of charge, the MRNQ program also subsidized up to 80% of the cost of forestry work (Guy Larochelle, pers. comm., 2003). Woodlot owners assumed the remaining costs.

An initial Summit on Private Forests was organized in 1995 for woodlot owners and their principal partners, and a second summit was held in 1998. These two events led to a major restructuring of private woodlot development management and the creation of 17 regional agencies in 1996 for private forest development, and to the formation of a watchdog committee responsible for overseeing the application of Summit decisions.

Each agency has since drawn up a protection and development plan describing the private forest development potential within its territory, explaining any obstacles to development, and recommending specific measures aimed at achieving sustainable forest management. The 17 regional agencies allow hitherto unprecedented co-operation between the MRN, the municipal community, forest producers' organizations and associations of wood-processing plant-operating permit holders.

The agencies contribute to the funding of forest management plans, private woodlot development work, and training and information activities for forestry producers. They have also implemented programs that present prizes and recognition awards for private woodlot protection and development.

Private forest timber harvests increased during the period 1995-99, with a total softwood cut of 23.3 Mm<sup>3</sup> and a total hardwood cut of 26.2 Mm<sup>3</sup> (90% and 67% of the allowable cut respectively). Thanks to the various assistance programs available to woodlot owners, more than 24,500 management plans were produced and silvicultural work was carried out over a total area of 320,000 ha.

Regional actors and local communities are playing an increasingly important role in forest management. In the five-year period covered by the Summary Report on the State of Québec's Forests 1995-1999, the MRN's shift towards regionalization and joint action led to the signature of thirteen special agreements with different regional authorities, eight territorial management contracts with regional county municipalities (RCMs), and 95 forest management contracts with Native communities, RCMs, joint management boards and other organizations. Fifteen inhabited forest pilot projects were also launched, with a goal of creating new business partnerships between forest users, with greater participation by local populations in resource management decisions.



In addition to promoting partnerships, the Forest Resource Development Program generated major investments in all regions of Québec, and led to the completion of numerous silvicultural, wildlife, environmental, recreational and educational projects.

Over the years, forestry producers have also come on board, and have started to change the way they carry out their work by adopting forestry practices that increasingly respect the principles of sustainable development. Various tools have been made available to allow them to produce wood, while at the same time protecting the resources of the forest environment.

In addition, forestry producers have access to programs that provide financial and technical support for forestry activities. The goal of these activities is to protect and develop all registered forest areas as defined in the Québec Forest Act. Land owners are also entitled to funding in the form of forestry loans or a partial refund of their property taxes.

### **Changes to the forest system since 1986**

The Forest Act and its regulations have been amended several times since they were first adopted. Among other things, the amendments were intended to:

- make it possible to use a portion of the dues payable on timber harvested from the public forests to fund certain resource protection and development activities in public and private forests (the Forest Resource Development Program was introduced following this particular change);
- allow for the creation of regional agencies for private forest development and to require every agency to prepare a protection and development plan that is consistent with the objectives of the development plans proposed by the regional county municipalities and that stipulates the methods to be used to guarantee the sustainability of timber supplies;
- authorize the agencies to provide financial or technical support for the protection or development of private forests in their respective areas; and
- create a fund jointly fed by the State and timber supply and forest management agreement holders to finance forestry research, forest surveys and the production of seedlings for reforestation.

### **Financial support program for development of private woodlots**

The financial support program for development of private woodlots was set up by the MRN following the summit on private forests (May 1995) as a means to provide financial support to private woodlot owners, in order to manage and improve their registered properties.

Wood producers must use an accredited forestry adviser for the professional and technical services required to carry out the work subsidized under this program. A forest adviser is a forestry engineer or a company that employs a forestry engineer who has been accredited by the regional private forest development agency. Wood producers interested in taking advantage of the program may apply to the regional agency or the department office closest to the registered land to obtain the names of accredited forest advisers.

Financial assistance is generally provided for the following (may differ among regional agencies):

- silvicultural work
- technical assistance
- preparing a forest management plan
- seedlings for reforestation

However, the financial assistance that a producer receives only covers up to 80% of the cost of work, up to an annual maximum per producer, as set by the agency. The wood producer must pay the difference. The program's annual budget is slightly over \$50M, with the MRN providing \$34.5M, and forest industries and woodlot owners providing some \$8M each.

The private forest development agencies are responsible for implementing the program. The partners included in this arrangement are:

- Québec Forest Industries Association (QFIA)
- Québec Lumber Manufacturers Association (QLMA)
- La Fédération des producteurs de bois du Québec (FPBQ)
- La Fédération Québécoise des Municipalités (FQM)
- Le Service de mise en valeur des forêts privées (SMVFP)
- Le Regroupement des sociétés d'aménagement du Québec (RESAM)

### **Private Lands Initiative Property tax rebate program**

This program was set up by the Department of Natural Resources (MRN) to offer recognized forest producers (who apply) a tax credit equivalent to 85% of property taxes (municipal and education) paid on assessed units registered as being used for forestry activity only. The program is part of an MRN scheme to protect and develop Québec's private forests.

To be eligible for the rebate, the wood producer must carry out, or have carried out, development work of a value equal to or higher than the amount of income taxes paid. Since 1997, this work must be accounted for in a report from a forestry engineer. The owner must also agree to protect the work for a period of five years if the work performed is totally or partially destroyed.

### **Forestry financing program**

This program was created in April 1997 in conjunction with the Ministère des Ressources Naturelles and is administered by the La Financière Agricole du Québec. It was established as a result of the private forests summit (May 1995), where the major players in the private forest sector, the representatives of private woodlot owners, the wood products manufacturing industry and municipal authorities, met to implement a plan for protection and development of Québec's private forests and to create regional development agencies. The program had previously existed for some time, under the name "Crédit Forestier", but ceased its activities in the beginning of the 1990s, and was reactivated as a result of the Summit.

The program's goal is to offer the most advantageous financial products on the market. The program provides financial support for wood producers to foster creation, maintenance or development of forest production units of at least 80ha, as well as implementation or development of forestry businesses providing services to woodlot owners. Links with other programs: This program is part of the MRN scheme for protection and development of Québec's private forests.

The program offers a guaranteed loan to recognized wood producers at a guaranteed farm loan interest rate equivalent to a first mortgage on a single family residence. The amount of the loan varies on average from \$10,000, and up to \$500,000 in some cases. The maximum loan period is 30 years.

Examples of items for which a loan may be granted include:

- purchase of woodlots or forestry businesses;
- purchase of machinery and equipment for forest management;
- construction or renovation of buildings;

- forest management work;
- purchase or redemption of interest (shares, partnership shares);
- refinancing of loans taken for wood production purposes.

The loans do not finance activities related the production of seedlings and the processing of firewood.

### **Forest Tenant Farming**

The Lower Saint Lawrence Model Forest Project has developed a partnership system known as "forest tenant farming". Under this system, Abitibi-Consolidated Inc. (ACI), a large newsprint company, entrusted the management of two large holdings (approximately 45,000 ha) to the model forest corporation to allow the settlement of forest tenant farmers. The forest farmers individually manage timber resources in their section of the holding and collectively manage the territory's non-wood forest products (hunting, fishing and recreation). While they may sell their wood on the free market, ACI reserves the right to choose the destination of sawlogs. In return, the forest farmers pay a stumpage fee, which is administered by the model forest. Landowners must also adhere to sustainable forest management practices through five-year plans, annual operational plans and financial forecasts.

As of 2000, some 26 farms had been established, averaging about 1,000 ha. After five seasons of operation, the farmers' average gross annual income was around US\$34,000, which was well above the regional average of US\$19,000 and even above the provincial average of US\$28,000 (Mayers, 2000). Abitibi-Consolidated is benefiting from the farmers' forest tending as well as an improved corporate image. The model's success has attracted attention and it is currently being considered for extension to public land surrounding rural communities. (Some 90% of the province's commercial forest is under public tenure.)

## **8. Saskatchewan**

### **The Conservation Cover Program (CPC)**

The Conservation Cover Program is a four-year, \$26-million initiative of the Government of Saskatchewan that will contribute to the cost of converting crop land to perennial cover. The Program will provide financial and technical assistance to Saskatchewan farm operators (including Crown land lessees) who wish to convert areas of annual crop land to perennial cover. The Conservation Cover Program is a "green program" that will result in environmental benefits including soil conservation, water quality protection, greenhouse gas emissions reductions and the enhancement of wildlife habitat. Most farmers will select marginal crop land areas for conversion, including sensitive lands with environmental risks such as erosion or flooding.

The government is providing the province's producers with some \$3.9 million under the 2002 Conservation Cover Program to convert up to a maximum of 50 acres to perennial cover. All soil classes are eligible, but the crop land being converted must have been in annual cropping or summer fallow in 2001. There is no restriction on the perennial species established or future land use. Although it is expected that most lands will remain in perennial cover for several years; however, there is no set minimum.

The Program will provide producers with an acreage payment of up to \$15 per acre to seed land in annual crop production to perennial cover. An initial acreage payment of \$7.50 per acre (maximum 50 acres) or \$375 will be paid to eligible applicants. Depending on program uptake, a second and final acreage payment of up to \$7.50 per acre will be prorated amongst all eligible applicants who received the initial acreage payment. Agriculture officials will also provide the necessary help to set up perennial cover.

The program funding will leave a significant portion of the conversion costs to be borne by the applicant. As such, it is expected that the program will not distort markets for forage seed or forage supplies and will be at best a minor factor in any decisions to increase livestock production or change land use.

Farm operators will be eligible to apply for additional acreage conversion in subsequent years of the program. The program is expected to be in place for a four-year term, allowing farmers the time to implement long-term strategies for land improvement.

In 2001, approximately 11,000 farm operators participated in the program, converting over 500,000 acres to perennial cover. Additional information from applicants indicates producers planted approximately 150,000 acres over and above those eligible to receive a payment.

### **SaskPower Carbon Offset Agreements**

On the prairies, corporations and organizations have initiated tree-planting projects outside of those aided by the Tree Canada Foundation. In Saskatchewan, SaskPower operates a greenhouse, heated by wasted heat generated at its Shand Power Station, which produces about 300,000 seedlings each year for reforestation or afforestation projects.

November 1999 marked the beginning of a new agreement between SaskPower and Saskatchewan Environment that will result in emission reduction credits and environmental benefits by protecting existing carbon reserves and restocking an area classified as "Not-Sufficiently Restocked". This land was harvested several decades ago but has not successfully regenerated. The original Agreement has two components. One involves planting 5 million seedlings on about 3,300 ha of land over 1999–2002. The second component is the establishment of approximately 225,000 ha of forest carbon reserves in 1999–2000, removing these areas of provincial forest from harvesting.

As part of this agreement, between four and five million seedlings are currently being planted. As well, the project protected existing forested areas through the creation of forest carbon reserves. These reserves will sequester carbon from the atmosphere, allowing SaskPower to receive carbon offset credits from the agreement. The details of this project are currently undergoing third party verification (SaskPower, 2001). Once verification is completed, SaskPower will be entitled to 22 million tonnes of CO<sub>2</sub> offsets.

## **9. The United States**

The United States (hereafter referred to as the US or USA) consists of 48 contiguous states in North America and the non-contiguous states of Alaska in the northwest corner of North America and Hawaii in the Pacific Ocean. The lower 48 states are bounded on the north by Canada, on the east by the Atlantic Ocean, on the south by the Gulf of Mexico and Mexico, and on the west by the Pacific Ocean. The total land area of the country is 9,809,630 km<sup>2</sup>. There is a huge range of climatic conditions from boreal to sub-tropical, and of topography from mountain ranges in the west to the central plains and the hills inland from the Atlantic Ocean to the east.

Forest and other wooded land accounts for some one-third of the land area, and is located mainly to the east and west of the central plain. According to the FAO (2003), around 90% of the forest is available for wood supply; the remainder is not available for conservation and protection reasons. The major part of the forest is classed as semi-natural, with less than a tenth, mainly in Alaska and the west, remaining undisturbed by man, and a smaller proportion of plantations. Coniferous species, which are primarily found in Alaska, the west and south, make up over half the growing stock, consisting mainly of a rich array of species in the west, including ponderosa and lodgepole

pine, Douglas fir, western hemlock, Engelmann and Sitka spruce, redwoods, subalpine fir, etc. Other species occur in the boreal conditions of Alaska. In the south, where many forests are on former agricultural land or cut over forestland, the main species are various pines. The eastern forests, largely reforested naturally on abandoned farming land, are rich in broadleaved species, oaks, maples, hickory, ash, beech, birch, alder, poplars, and others.

Net increment of broadleaved species is appreciably higher than fellings, leading to a long-term rise in growing stock, but net increment and fellings of coniferous species are more nearly in balance. Some 40% of forest and other wooded land is owned by the State (much of this in the west and mountainous regions, along with Alaska) and other public institutions; most of the remainder is owned by private individuals and forest industries, with some owned by private institutions and by indigenous peoples. Apart from wood production, recreation, hunting, biodiversity and wilderness are of major importance.

The United States is the world's largest producer, and consumer, of wood products. The US produces around 30% of global industrial roundwood, and its share of global production and consumption of sawn timber, wood-based panels, pulp, and paper is of a similar magnitude. The US is also the largest importer, and the second-largest exporter, of forest products.

## **Planting Programs**

There are a variety of national and state incentive programs that encourage reforestation, afforestation and active forest management on private lands. Most programs offer technical and/or financial assistance to landowners who manage their properties to produce public (e.g. carbon sequestration), as well as private benefits. Some states offer real property tax deductions and/or deferrals to landowners who replace or maintain forest cover. The 2002 Farm Bill provides a substantial increase in funding, primarily through the USDA Natural Resources Conservation Service, for programs that assist private landowners with the installation and maintenance of conservation and forestry practices.

As in Canada, many of the federal programs addressing afforestation in the USA are targeted at achieving conservation objectives on agricultural land and at taking marginal agricultural lands out of production. The 1996 Farm Bill provides for several programs that provide incentives to landowners to afforest lands or to better manage forested lands. Under the Forestry Incentives Program (FIP, see below), the federal government pays some 65% of the costs of tree planting and stand improvement to a maximum of \$10,000 per year, provided the landowner agrees to maintain practices for at least 10 years. The Stewardship Incentives Program provides funds and technical assistance to landowners who develop Forest Stewardship Plans (including afforestation) with the federal government covering 75% of the costs up to \$10,000 per year and again the landowner must agree to maintain the planned practices for 10 years.

The US Conservation Reserve Program (CRP) was enacted in 1985 and expanded in 1990 to help farmers retire cropland that was environmentally sensitive or susceptible to erosion for 10 years in return for rental and cost-sharing payments and technical assistance. The CRP endeavours to convert highly erodible cropland or other sensitive areas to vegetative cover with the federal government providing up to 50% of the costs of a cover crop to a maximum of \$10,000 per year. Finally, as a result of the Reforestation Tax Credit funds received under these programs are partially tax-deductible. As of October 1999, some 12.5 million ha of cropland were enrolled in the CRP (Zinn, 1994; H. John Heinz III Center, 1999).

Roughly half of the South's forested wetlands were lost between colonial times (i.e. circa 1780) and the 1990s, primarily through clearing for agriculture (Wear et al., 2002). In the last decade, attention has begun to focus on restoring these areas, primarily in the Lower Mississippi Alluvial Valley where the most extensive loss of forested wetlands has occurred. Much of the restoration activity has been funded through the Wetland Reserve Program, which encourages afforestation of agricultural areas and supports conservation easements of up to 30 years or into perpetuity.

Through the Wetland Reserve Program and several other restoration programs, about 195,000 acres in the Lower Mississippi Alluvial Valley have been replanted. However, the full restoration of wetland functions requires much more than tree cover. The effects of massive deforestation, extensive drainage systems, and channelization of streams and rivers make restoration of geomorphic, hydrologic, and ecological processes extremely difficult. Wetland restoration activities will require long-term efforts extending far beyond initial tree planting.

## **Agricultural Land**

The United States enjoys a natural abundance of productive agricultural lands and a favourable climate for producing food crops, feed grains, and other agricultural commodities, such as oil seed crops. The area of U.S. cropland used for crop production declined by 10% during the 16-year period between 1981 and 1997, from nearly 160 million hectares (nearly 390 million acres) to about 140 million hectares (nearly 350 million acres). During this same period, conservation programs for the most environmentally sensitive and highly erodible lands have removed nearly 15 million hectares (35 million acres) from cropping systems.

Although the United States harvests about the same area as it did in 1910, it now feeds a population that has grown two and one-half times since then (U.S. Department of State, 2002), and its food exports have also expanded considerably. Agricultural productivity increases are due primarily to technological change in the food and agricultural sectors. In the absence of these improvements in productivity, substantially more land would need to be cultivated to achieve today's level of productivity.

The increase in no-till, low-till, and other erosion control practices reduced erosion on cropland and grazing land by 40% between 1982 and 1997 (U.S. Department of State, 2002). These practices also have helped to conserve carbon associated with those soils, protect soil productivity, and reduce other environmental impacts, such as pesticide and nutrient loadings in water bodies.

U.S. agricultural productivity has improved by over 1% a year since 1950, resulting in a decline in both production costs and commodity prices, limiting the net conversion of natural habitat to cropland, and freeing up land for the Conservation Reserve Program.

## **Forestry**

Forested areas in the United States have expanded in the past 20 years, but the amount of old-growth continues to decline. Today, U.S. forests vary from complex juniper forests of the arid interior, to the humid and highly productive forests of the coastal Pacific Northwest and Southeast. In 1997, forests covered about one-third (nearly 300 million hectares, or nearly 750 million acres) of the total U.S. land area (U.S. Department of State, 2002). This includes both the forest-use lands and a portion of the special-use lands. The forests are immensely variable, ranging.

Excluding Alaska, U.S. forestland covers about 250 million hectares (620 million acres). Of this, nearly 200 million hectares are timberland, most of which is privately owned. However, much of the forested land is dedicated to special uses (i.e., parks, wilderness areas, and wildlife areas), which prohibits using the land for such activities as timber production. These areas increased from about 9 million hectares (over 20 million acres) in 1945 to nearly 45 million hectares (about 100 million acres) in 1997. As a result, land defined as "forest use land" declined consistently from the 1960s to 1997, while land defined as "special uses" increased.

Management inputs over the past several decades have been gradually increasing the production of marketable wood in U.S. forests. The United States currently grows more wood than it

harvests, with a growth-to-harvest ratio of nearly 1.5. This ratio reflects substantial new forest growth; however, old-growth forests have continued to decline over the same period.

The U.S. government supports efforts to sequester carbon in both forests and harvested wood products to minimize unintended carbon emissions from forests by reducing the catastrophic risk of wildfires.

## **National Fire Plan**

The recently completed National Fire Plan will improve fire management on forested lands, especially in the western parts of the United States. The effort is designed to foster a proactive, collaborative, and community-based approach to reducing risks from wild-land fires, using hazardous fuels reduction, integrated vegetation management, and traditional fire-fighting strategies. While the initiative recognizes that fire is part of natural ecosystems, it is expected to have long-term benefits in reducing greenhouse gas emissions because the risks of catastrophic forest fires will be lower. In addition, the initiative is also expected to generate a great volume of small-diameter, woody materials as part of hazardous fuel-reduction activities. Some of these materials have the potential to be used for biomass electric power and composite structural building products.

It is recognized that climate change will present great challenges, involving shifts in the optimum growing conditions for some North American forest species by more than 300 miles to the north, thereby exceeding the rates at which the less actively managed forest could migrate.

The United States has an active policy to promote and protect carbon sequestration in forests. The Action Plan includes several programs to maintain carbon sequestered in forest ecosystems that provide about 9% of the emission reductions needed to reach the greenhouse gas target in 2000. The emphasis is not on afforestation or reforestation, unlike some countries, but on better management of existing forests. Tree planting, however, will be assisted on poorly stocked and non-stocked, non-industrial private forest land by 233,000 acres in 5 years through the Stewardship Incentive Programme.

## **Minnesota's Hybrid Poplar Program**

Minnesota has had a strong hybrid poplar research effort with thirty years of research on poplar production, physiology, and breeding, performed by the University of Minnesota and the U.S. Forest Service. The main reason being the strong support it has received from the U.S. Department of Energy. The scale up program consisting of two projects was established primarily in the mid-1990s. One project, funded by the U.S. Department of Energy, involved a scale up of an 800 ha area of Alexandria, Minnesota. The second project was the Oklee Tree Project established in Northwestern Minnesota. The latter project provides a good example of how to initiate tree planting in a region.

The project involved a co-operative effort between the Agricultural Utilization Research Institute (AURI), University of Minnesota-Crookston, Natural Resources Research Institute (NRRRI), Minnesota Power (MP) and local, state, and federal agencies. The goal was to plant 1,200 ha of poplars within a 50-km radius of Oklee, Minnesota, initiated in the spring of 1995. The project determined the economic feasibility of planting hybrid poplars as an alternative cash crop, and to provide an opportunity for the future development of a biomass energy facility. Trees that were planted on Conservation Reserve Program (CRP) land were eligible to receive: 5-year contract extensions, cost sharing for establishment from an Agricultural Stabilization and Conservation Service (ASCS), US\$ 85 acre<sup>-1</sup> (around CAN\$ 315 ha<sup>-1</sup>) for establishment from a grant from the Legislative Commission of Minnesota Resources to AURI, and 30-year contracts from MP (which include guaranteed purchase contracts for wood and yearly payments to growers).

Planting areas were selected based on number of available acres, suitable soil types and growing conditions, proximity of wood markets, high pressure gas and electric transmission lines, co-operation of local, state and federal agencies, and willingness of growers to consider hybrid poplars as an alternative crop. Each site was rated for suitability of hybrid poplar growth, plantation size, and distance from Oklee. Growers determined when to plant poplars, grown at densities of 1,200-1,700 trees ha<sup>-1</sup> and on rotations of 10-15 years, using similar cultural practices as in other regions.

## **Biomass Power for Rural Development Initiative**

Years of research on short-rotation woody crops in New York, combined with growing concern about environmental issues, prompted the formation of the Salix Consortium in 1994. Over 20 organizations have collaborated to facilitate the development of willow biomass crops. This crop will provide a renewable feedstock for bioenergy and bioproducts that produces multiple rural development and environmental benefits.

Midway through the Biomass Power for Rural Development project over 242 ha (600 acres) of willow biomass crops have been planted in New York State. The goals of the Biomass Power for Rural Development initiative include increased production of renewable energy using biomass resources to generate power; creation of new jobs and markets, especially in rural areas; and a net reduction in greenhouse gas emissions. The program is proceeding in three phases:

PHASE I-Engineering Design: Integrated biomass power system development, engineering, and environmental permitting and licensing.

PHASE II-Demonstration: Construction, demonstration, and testing of biomass energy crop feedstock supply systems and conversion facilities.

PHASE III-Commercialization: Integrated biomass feedstock supply systems and conversion facilities function as commercial enterprises without federal funding assistance.

Regional trials have been established in nine states and Canada. The near term use for willow biomass crops is co-firing with coal. The Greenidge power plant has demonstrated continuous co-firing for several years. A successful test firing of willow biomass has been performed, and co-firing retrofits at the Dunkirk power plant have been completed. Research is underway on the fabrication of materials and chemicals from willow biomass that are currently derived from non-renewable fossil fuels.

Planting stock production for willow biomass crops currently occurs at two facilities in New York state - the New York State Department of Environmental Conservation's Saratoga Tree Nursery (STN) and the SUNY - ESF's research station in Tully, NY. Cutting orchards, irrigation systems, and cold storage facilities have been developed at both locations to support these operations. In the winter of 1998/99 almost 1.5 million cuttings (records are kept on the number of 25 cm (10 inch) long cuttings or the equivalent in rods or whips) were produced at the two. This represents an increase of 85% from 1997/98. Cuttings made from first-year coppice material in central and western New York added another 110,000 cuttings to the supply. Planting stock production was down slightly to 1.41 million cuttings in 1999/2000 due to the severe drought and restrictions imposed on irrigation systems at both locations.

Since 1998 the Salix Consortium planted over 242 ha (600 acres) of willow biomass crops in western New York within a 60 km radius of the Dunkirk power plant. All of the sites were in a hay crop the previous year or had been fallow for one to five years. These types of field conditions are common across New York because the agriculture industry, and in particular the dairy industry, has been in decline over the past decade. The 242 ha (600 acres) are spread over 14 landowners, with field sizes ranging from 2 ha to 40 ha (5 to 100 acres). Smaller fields were immediately adjacent to one another so that no collection of fields was smaller than 8 ha (20 acres) in size. Farmers are being paid a 5-year land rent similar to existing commercial rents in



the region, which range from US\$ 25-40 acre<sup>-1</sup> (CAN\$ 93-148 ha<sup>-1</sup>) Custom operators have been hired to perform the field work.

Interest in willow biomass crops continues to grow across the Northeast and North-Central regions of the United States. Over the past seven years clone-site and genetic selection trials have been established in nine states, and the province of Québec in Canada. Trials were conducted previously in southern Ontario by the University of Toronto (Kenney et al., 1996). The current clone-site trials range in size from 0.5 to 1.0 ha (1.2 to 2.5 acres) in size. At each site between six and 40 different clones of willow and poplar are being screened for their suitability to different soils and climate conditions.

Estimated yield ranges in Canada vary by region, with the southern mainland of British Columbia having the highest potential productivity, followed by Ontario and Québec, the Atlantic provinces and the Prairies (Samson et al., 1999). Short-rotation willow is grown at 12,000-15,000 cuttings ha<sup>-1</sup>, is harvested on a 3-4 year cycle, and can have a plantation life of 20-25 years.

### **Hybrid Poplars in the Pacific Northwest**

The largest afforestation program using fast growing poplar or willow occurring to date is the hybrid poplar program of the Pacific Northwest. In 1996, there were 26,900 ha of hybrid poplar in this region (Wright and Tuskan, 1997). Currently, there are nearly 100,000 acres of hybrid poplars growing in the Pacific Northwest, from southern Oregon into British Columbia, due primarily to the efforts of the WSU-UW poplar program. The project addresses the issue of increasing plant and soil carbon sequestration by altering existing ecosystems through the conversion from low productive, unimproved pasturelands to fast growing hybrid poplar plantations in the Pacific Northwest.

The WSU Poplar Research Program has been in existence for nearly 30 years. The early success of the program was based on creating hybrid trees by breeding native black cottonwood (*Populus trichocarpa*) with eastern cottonwood (*P. deltoides*). The better hybrids out grew their parents by 40 to 50%, capturing the trait for rapid height growth from black cottonwood and the trait for rapid diameter growth from eastern cottonwood. Since the start of the hybrid breeding program, over 10,000 individual offspring have been tested for growth.

Most of these plantations are owned or are under lease to paper companies that are growing the trees primarily for fibre, and are approximately equally split between the fertigated east, and the non-irrigated sites west of the Cascade Mountains. By applying agricultural methods to growing these trees, the plantations are extremely productive, producing 70 to 80 foot trees with 8 to 10 inch diameters in 6 to 8 years. More recently, the hybrid poplar wood has been used to make solid wood (molding, furniture core stock, and structural lumber) and engineered wood products (plywood, oriented strand board and fiberboard) that have excellent characteristics, comparable to or better than industry standards.

The program has been successful due to various factors. The region has relatively high fibre prices since much of the fibre is imported into pulp mills within the region (in part due to new environmental restrictions on logging). Moreover, the west side of the mountain range receives abundant rainfall, furthermore, due to a favourable growing season, rotation cycles are relatively rapid compared with other regions. In addition, a research and development consortium was established between industry and university scientists to develop improved plant materials. Breeding programs are now led by individual companies. Drawbacks to the plantation program in the Pacific Northwest are the limited land base and high demand and costs of water for the irrigation on the east side. The program has achieved much success largely due to a strong emphasis placed on tree improvement through germplasm collection and evaluation, as well as plant breeding. Approximately 20-30 operational clones exist in the region, which is 3 to 4 times higher than the average for other regions.

## **The Forestry Incentives Program (FIP)**

The Forestry Incentives Program was enacted in 1973 to increase the timber supply in the United States by increasing tree planting and timber stand improvement on non-industrial private forest lands. Timber harvest reductions on public lands in the West, environmental constraints on private lands throughout the U.S., and increased demands for wood fibre continue to prompt concerns about the nation's timber supply.

In the 1990 farm bill, sunset provisions were added that would replace FIP with the broader-purpose Stewardship Incentive Program (SIP) by December 31, 1995. FIP was scheduled to terminate on December 31, 1995, under provisions of the 1990 Farm Bill. Originally, Congress had intended that SIP would replace FIP after its sunset date, but the 1996 Farm Bill extended FIP to the year 2002.

From its inception in 1974 through 1994, FIP cost-shares of more than \$200 million funded approximately 3.32 million acres of tree planting, 1.45 million acres of timber stand improvement, and 0.27 million acres of site preparation for natural regeneration on the nation's non-industrial private forest lands. As of 1992, about 73% of the total area of FIP accomplishments occurred in the South, 22% in the Northeast and North Central region, 3% in the Pacific Northwest, and the balance was distributed throughout the country (Graddis et al., 1995).

The South accounted for 90% of the program's tree planting activity, with 10 southern states each planting more than 178,000 acres of trees since 1974. In addition, Oregon and Washington combined planted about 90,000 acres of trees under the program. Timber stand improvement (tsi) practices were distributed throughout most forested states, with 55% in the Northeast and North Central states, and 38% in the South. Arkansas led the nation in tsi, followed by the Midwest states of West Virginia, Missouri, Ohio, and Indiana.

Tree planting cost share expenditures and area treated were greatest in the early 1980s, with more than 200,000 acres planted per year. Later years have had planting rates of 150,000 to 175,000 acres annually. Tsi cost-share finding and acres treated were greatest in the initial years of the program, and range from about 30,000 to 40,000 acres annually in the last decade.

Average government payments per acre for FIP activities increased throughout the 1970s when 75% cost-share rates prevailed. They decreased markedly in the early 1980s as most states changed to a 50% cost-share payment rate. Payments later increased, as inflation has increased treatment costs, decreasing the real FIP appropriations.

Secondary impacts of the program have included development of private contracting vendors, increased softwood shares of regional timber supply, and sustaining forest products manufacturing firms.

Evaluations of the program (Gaddis et al., 1995) indicate that it has been successful and efficient in meeting this objective. Ninety percent of the funds allocated to FIP actually go toward performing practices in the field because the federal and state agencies administer the program as part of their overall responsibility. Timber supply was projected to increase by more than 1 billion cubic feet each year due to the program. Public and private rates of return averaged about 10% for the various public and private accounting criteria, and program benefit-cost ratios consistently exceeded 1.0 by a substantial margin and federal income taxes on the timber harvests stemming from FIP plantings would eventually be more than double the annual federal FIP expenditures.

Retention rates for FIP have exceeded 92% for the duration of the program. Overall, the accomplishments of the program and the economic evaluations of its activity indicate that it has been successful at increasing forest planting and improvement practices and is economically

efficient. It has increased timber supplies and has provided acceptable financial returns for both the public and for private forest landowners who participate in the program.

## **1990 Farm Bill**

The Forestry Title of the 1990 Farm Bill, signed into law on November 28, 1990, provided a comprehensive national policy for the management, protection, and enhancement of the nation's 353 million acres of privately owned non-industrial forest land. Two new USDA Forest Service programs were authorized under the legislation, the Forest Stewardship Program (FSP) and the Stewardship Incentive Program (SIP). The USDA Forest Service operates the FSP in co-operation with State Forestry agencies and newly created State Forest Stewardship Coordinating Committees to deliver management planning assistance to landowners who have an interest in enhancing and protecting multiple forest values on their land.

The FSP and SIP programs provide technical and financial assistance to non-industrial, private forest owners. The Forest Stewardship Program helps such owners prepare integrated management plans and, in many cases, by teams of natural resource specialists. The Stewardship Incentives Program cost-shares up to 75% of approved management practices, such as afforestation and reforestation. An approved Forest Stewardship management plan is a prerequisite to gaining cost-share assistance under SIP.

USDA's Forest Service manages both programs, in co-operation with state forestry agencies, and plans are tailored to meet the specific objectives of each landowner and specifically address environmental, economic, and social values. A recent survey of landowners with Forest Stewardship Plans found that they were three times as likely to implement these plans if they received financial and technical assistance.

There are even funds under SIP to help landowners with the cost of hiring private consultants to develop the stewardship plan. While all federal forestry cost-share programs provide technical assistance for practice design and installation, along with standards for compliance before payments are made to landowners, SIP goes a step further because of its direct link to comprehensive whole property planning provided by the FSP.

The programs' intent is to improve conservation of our lands through enhanced planning and management. An original goal of the Stewardship Incentive Program was to increase tree planting in the United States by over 94,000 hectares (232,180 acres) a year within five years and to maintain this expanded level of planting for another five years (U.S. Climate Action Report, 2002).

During fiscal years 1991–99, 150,964 hectares (372,881 acres) of trees were planted. The cost of the program during this same period was about \$23.5 million. The program was not funded for fiscal years 1999 through 2001.

## **C. Europe**

### **1. Introduction**

Steady population expansion, economic changes and economic growth over the past 30 years have led to competing demands on land for agriculture, forestry, environmental protection and recreation, and for urban and infrastructure development. The average annual rate of land cover change in Western Europe is quite small but at the local level changes can be significant, especially in densely populated areas. It is estimated that 74% of the population of Europe is concentrated in only 15% of its land surface (EEA, 1999). At the same time, these areas experience high levels of activity in industry, transport, services and other economic sectors, with concomitant environmental problems.

On average, in the EU 42% of the surface area consist of forests and other wooded land, 39% is utilized agricultural area, and 15% is classified as other land area. Sweden and Finland account for 43% of the forest or wooded land in the EU. The UK, Ireland and Denmark are the Member States with the highest proportion of utilized agricultural area.

### **Agriculture**

In terms of the composition of agricultural areas there are considerable differences between the Member States. In Finland, Denmark and Sweden, the majority of agricultural land is used for crop farming/tillage. In Ireland, on the other hand, nearly 80% is used for pasture or as fields. Permanent cultures (e.g. vineyards) cover considerable areas especially in the Mediterranean countries Greece, Spain, Italy, Portugal, and France.

Despite being a minority activity in terms of income and employment, agriculture continues to be the dominant land use in Europe. However, agricultural land use area is continuously decreasing in the EU. Reasons for this development include the increasing use of land for settlement and/or leisure areas. Since the 1950s, Europe has experienced a continuing trend towards urbanization at the expense of natural, semi-natural and agricultural land. The area under productive agriculture in Western Europe has fallen over the past 30 years, by 6.5% for arable and permanent crops and by 10.9% for permanent pasture (FAOSTAT, 2000).

This decrease, however, has been accompanied by more intensive production methods. This intensification trend seems set to continue, and better integrated spatial and land use planning and management are required to tackle the problems associated with land cover and land use change. During the 1990s, in many parts of Central and Eastern Europe, pressure on land resources began to decrease, due to the collapse of centrally planned economies, the ending of state subsidies to large collective farms and depopulation of rural areas. The economic collapse also led to a sharp decrease in the use of agricultural chemicals, abandonment of huge irrigation projects and agricultural land, and a decrease in numbers of livestock with a generally beneficial effect on the environment. A substantial land area is being reforested, and this trend may accelerate with climate change.

### **Forestry**

At the turn of the century Europe contained about 1 billion hectares of forests (FAO, 2000), which corresponded to 27% of the world total. The Russian Federation alone accounted for 851 million hectares and Sweden and Finland for another 49 million hectares. The remaining 38 countries had together less than 15% of the forests in the region. Europe's forests amount to 1.4 ha per capita, which is considerably above the world average; however, the area per capita in Central and Southern Europe is much lower. Almost all forests are located in the boreal ecological

domain and Europe has almost 80% of all boreal coniferous forest. The net change of forest area is positive at 881,000 ha per year, corresponding to 1% annually.

For the region of the European Union, and as a result of sustainable forest management, forests are on the increase. When mature trees are felled, at least the equivalent surfaces are replanted and the biodiversity of the area preserved. Concerted efforts are also made to ensure that they can be used for recreational purposes. The EU has a total forest area of 130 million hectares, accounting for about 36% of its total land area (EU, 2003). In comparison with the other regions of the world, the EU's forest resources are modest and represent only 4% of the world's forest resources. Only 70% of the annual growth of EU wood resources are used, as the remaining 30% of forest is unsuitable for or unavailable to industry.

There are a wide variety of forest types defined by their bio-climatic and soil conditions. Their ecological characteristics can be divided into numerous vegetation zones, ranging from the sub-Mediterranean zone to the Arctic belt, and from coastal plains to the Alpine zone. Forestland in the EU is 65% privately owned (EU, 2003). As there are about 12 million private forest owners in the EU, privately owned forests tend to be highly fragmented into small plots, with most holdings smaller than five hectares. Ownership also varies widely within the Community. In Greece and Ireland, the State owns about two thirds of forestland, while in Belgium, Spain, Italy, Luxembourg, France and Germany, local communities play an important role as forest owners.

In the European forest sector, with the exception of the years immediately following the Second World War, fellings have stayed well below increment and forest area has expanded steadily. There have been few major changes in silvicultural theory and practice: the trend towards intensive monocultures favoured in the 1950s and 1960s has been reversed in response to criticism from an increasingly well informed and environmentally sensitive public. Silviculture has returned to earlier principles, which are more cautious and less economic (C. Prins, *Unasyva* Vol. 52, No. 1 (No. 204), 2001).

Since 1950, forest area has increased particularly in Ireland (more than six-fold), UK (two-fold), Italy (approx. 75%) and Greece (approx. 60%). In the other countries, the forest area has risen slightly or remained constant. Forest area has not declined in any of the Member States.

The average ratio of fellings to increment for EU-15<sup>2</sup> is about 65%. No member state exceeds 90% and for 11 states it is below 70%. Based on this indicator, EU-15 forests are managed in a sustainable way. In quantitative figures for the EU as a total, in the nineties the actual net annual wood increment (i.e., subtracting removals from forest) was 191 million m<sup>3</sup>, which resulted from a net annual increment of 487 million m<sup>3</sup> and removals of 298 million m<sup>3</sup>. Actual net carbon increment (subtracting removals) was 63.21 million tons per year, or 0.46 tons per hectare per year, which resulted from net annual increment of 164.15 million tons and harvest of 103.47 million tons (FAO, 2000).

There is no common EU policy concerning forestry, which means that practically all forestry activities are carried out within the agricultural programs of EU. This includes afforestation, which has been quite important in some member countries (like Ireland and Spain). Afforestation of non-forest land is only a small part of the total picture of forestry incentive programs, and the majority of them are national, not EU-based. This is particularly true in countries where forestry has at least some role in the economy.

With respect to reforestation programs, the general difference between Europe and North America may be that in Europe reforestation is normally an obligatory process after final harvest, and is therefore written into forest laws. However, reforestation is supported financially in some cases for industrial private forest owners (NIPF).

---

<sup>2</sup> Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

## **Directive 2080/92**

The most extensive program for afforestation funding within EU-countries in the 1990s was known as "Directive 2080/92" (named after the EU-directive, which was the legal basis for those payments). As forestry is not a matter regulated by EU-treaties, this directive was based on an agricultural program (and funds from the CAP (Common Agricultural Policy)). The main objective of the program was to "reduce agricultural production area" while "providing income opportunities in rural areas".

In 1992, measures accompanying the common agricultural policy were adopted primarily to benefit the environment, early retirement and silviculture. These measures aimed to support the expected processes of change, and to mitigate some of the effects deemed to be disadvantageous for farmers.

The scheme is mandatory at member state level, but optional for land-owners. The European Agricultural Guidance and Guarantee Fund co-finances 50% of the costs or 75% in specially designated areas. The CAP reform has provided measures for the afforestation of agricultural land and the improvement of forests within agricultural holdings, and 1,340 million ECU were granted for new forests and rehabilitation of existing farm woodlands for the period 1993 to 1997. Structural funds for economic development are to some extent used for forestry-related activities; for the period 1994-1999, 416 million ECU were budgeted to stimulate development in the least developed areas and 545 million ECU to support restructuring of agriculture.

Member States presented 43 programs in 1993 (some national, others regional), most of which were approved in the spring of 1994. The implementation of the measure lagged behind expectations in 1993 and 1994, but the afforestation rate improved in 1995 and 1996. Up to the end of April 1996, 550,000 ha were afforested and the Member States have committed a much larger area to afforestation under this Regulation. The expenditure by the end of 1996 was ECU 500 million.

In July 1997, the European Commission published the "Agenda 2000" document, which included proposals for the reform of the Common Agricultural Policy (CAP), and after wide discussion a further package of CAP reforms was adopted in 1999. The new CAP is a further step towards supporting the broader rural economy rather than only agricultural production.

The new measures improve forest resources while helping to control agricultural production and improving countryside management. The regulation also explicitly aims at carbon absorption. It contributes directly to carbon sequestration by participating in the costs of afforestation of agricultural land. It also contributes to the silvicultural improvement of certain existing forests and enhancing their CO<sub>2</sub> absorption capacity.

Afforestation of agricultural land is among the accompanying measures of the original 1992 CAP reform, and was continued as core elements of rural development programs for the period 2000-2006. Support may be granted for the afforestation of agricultural land, provided that the plantation is adapted to local conditions and compatible with the environment.

The four main objectives for the regulation were:

- To accompany the changes planned in the context of the common market organizations,
- To contribute to a long-term improvement in forestry resources,
- To help to manage the countryside in a way which is more compatible with the balance of the environment, and
- To fight against the greenhouse effect and absorb carbon dioxide.

To meet these four objectives, the instruments already in place were reinforced (in order to be more effective), and the following were introduced:

- Aid for afforestation, intended to promote an alternative use of the agricultural land,
- Aid for investment, in order to create plantations,
- Premium for maintaining the new planting,
- Premium for compensation for loss of income Aid for improving existing afforestation (enabling farmers to develop their forestry activities).

As the reform of the CAP modified the provisions for financial support to farmers, it appeared necessary to improve the earlier aid schemes and make them more dynamic.

Regulation 2080/92 introduced a few innovations along the following lines:

- The part-financing of the operations cost by the "guarantee" section of the EAGGF, making it possible to cover as much as 75% of these costs in Objective 1 regions and 50% in other areas,
- Opening aid for afforestation up to a much wider range of beneficiaries, (including local authorities), and opening up the compensatory premium for loss of income to non-farmers,
- The introduction of a maintenance premium over the first 5 years, set up according to the types of planting and the period (the first two years and the following three years) ,
- A significant increase in the maximum amount eligible for aid, particularly in the compensatory premium for loss of income, and
- The modulation of the maximum amount of aid per type of afforestation, distinguishing between broadleaved trees, conifers and short-rotation species.

Regulation 2080 offered the Member States a compulsory framework within which each had the freedom to show preference for certain objectives and certain beneficiaries, and to adjust the aid according to its strategy and financial means. This adjustment according to national contexts and priorities was all the more important because Regulation 2080 has sometimes been seen as an "all-purpose" regulation, listing many objectives at different and sometimes even contradictory levels. One million hectares of agricultural land were afforested between 1994 and 1999 owing to Regulation 2080. The contribution in terms of volume of wood is 2.7% of the wood produced in Europe, and here too the national disparities are large.

In all countries the plantings under 2080 are irreversible because of permanent protection of the forests against land clearance, and felling is subject to administrative authorization as soon as the land achieves the status of a forest.

Noting that "fast growing species cultivated on the basis of a short felling cycle is generally profitable", 2080/92 went on to specifically forbid the grant aiding of these species unless planted by farmers themselves. Grant aid for the planting of hardwoods was encouraged for both private persons and public authorities. But the fast growing species, the conifers, specifically sitka spruce and lodgepole pine, were only to be funded for farmers practicing farming as their main occupation. They must draw more than 25% of their income from farming (or farm based tourism or craft activities) and spend more than 50% of their time on farming and farm based activities.

A quite extensive evaluation of the effectiveness of this policy was co-ordinated by IDF (Institut pour le développement forestière) and released by the EU Commission March 2001. This study was effectively an ex-post evaluation of the accompanying measure (1992-99) on afforestation of agricultural land and investments in woodlands. It assesses the impacts of the measures on rural development, forest resources, agricultural production and environment, and looks at how the implementing arrangements have influenced these impacts.

While the report is formulated rather "cautiously", due to the problems associated with analyzing an industry with long rotations, one can nevertheless read some rather "striking" results from it. The main result is that while the program DID result in substantial afforestation, mainly in Southern EU-member countries (and regions), it did NOT really contribute substantially to reducing agricultural production area, as most of the afforestation happened on relatively low productivity lands.

It is also noted that this period is not long enough to ensure the continuity of the newly forested areas, and their growth in the long term. It also does not guarantee the ability of some countries financially to continue afforestation at a comparable rate over the period 2000-2006.

It should be noted that in most EU-member countries (with the notable exception of the UK and Ireland, where property rights are a bit "stronger") forest owners are obliged by national forest laws to reforest after (clear-) cutting (i.e. there is a principle of "forest has to remain forest"). For that reason there is no real need for specific "reforestation"-funding, but in some countries incentives exist for reforestation with "more close to nature" species-mixes. Usually these policies are aimed at increasing the share of broadleaves, especially in lower elevations (i.e. below 500m sea level).

In most of the countries which have "reforestation-requirements" there is now some discussion on easing up on these requirements, as they are actually seen as a potential disincentive for afforestation of agricultural land (as the decision for FOREST is irreversible). For farmers a conversion of agricultural land to forest land also involves another problem: The land-value for forest land is often only a fraction (i.e. 1/2 or less) of that of agricultural land. Consequently, if land is converted "legally" to forest land, the result is often that the value of the land is reduced.

According to the Temperate and Boreal Forest Resources Assessment (TBFRA-2000) there was in aggregate an average annual increase in the area of forest of approximately 500,000 ha and a decrease in that of other wooded land of about 200,000 ha for the European countries. The countries reporting the largest increases in forest area were Spain, France, Portugal, Turkey, Greece and Italy, all Mediterranean countries with active programs of afforestation or conversion of other wooded land to forest<sup>3</sup>. Other countries with active planting programs included Bulgaria, Ireland and the United Kingdom. Only a few countries reported a declining trend in the area of forest, including Albania, Belgium, Finland and Yugoslavia, although the decreases in area have generally been small.

## **Country Experience**

The following provides a selected list of individual European country's experiences in afforestation and reforestation, both inside and outside the scope of EU Regulations and funding. While this is by no means an exhaustive summary of afforestation in Europe, it does provide a broad overview of the kinds of government policies and incentive programs implemented for the purposes of afforestation and reforestation in Europe.

---

<sup>3</sup> Note: According to the Report to Parliament and the Council on the application of Regulation (EEC) no 2080/92, p.5 the forest increase of UK and Ireland is higher than that of Portugal, Italy and France. A possible explanation for this discrepancy is that the report refers also to spontaneous revegetation included in the TBFRA data, whereas the Regulation 2080/92 is focussing on intentional afforestation only.



## **Austria**

Austria is situated in southern central Europe, covering part of the eastern Alps and the Danube region and, although land-locked, it borders on the Mediterranean area. The country has a wide variety of landscape, vegetation and climate, and situated as it is at the heart of a continent, it has always been a junction for communication links between the trade and cultural centres of Europe.

Austria is a federal state with a total area of 32,368 sq. miles (83,858 sq. km) and consists of nine provinces. Austria has common borders with no fewer than eight other countries. The variety of Austria's geography and climate has resulted in a wide diversity of vegetation, in which the main groups largely coincide with the different climatic regions. Austria is characterized by the oak and beech forests that predominate in central Europe, while above 1600 ft. these give way to a mixture of beech and fir. At altitudes higher than 4000 ft., fir predominates and in turn gives way to larch and stone-pine.

Of the total territory of Austria that is used for economic purposes, some 18% is arable land and 27% meadowland and pastures. In 1997 the total number of farms and forestry operations was approximately 252,000. Of these, 77,000 farms (30%) were operated as sole source of income and the rest were run by part-time farmers. In 1997, the number of persons gainfully active in agriculture and forestry was some 159,000 or 5% of the working population. The final production of Austria's agriculture and forestry amounted to ATS 63 billion, its contribution to national income was ATS 33.2 billion, and to GDP 1.4%. Some 66% of the agricultural final production (ATS 49.5 billion) arises from animal production, and 34% from plant production.

Around 41% (about 3.4 million hectares) of Austria's total territory is used for agricultural purposes; meadowland and pastures make up some 2 million hectares. Austria's agriculture mainly features small and medium-scale farm units, with 51% being accounted for by small-scale farms (less than 10 hectares of arable land) and 2.6% by large-scale units (more than 100 hectares). Farms are almost exclusively family-run. Only the large-scale forestry enterprises are to a significant extent the property of the state or federal provinces, local communities, the churches or co-operatives.

At present Austria's forests and woods cover approximately 3.9 million ha, this corresponds to around 47% of the country's total area. Consequently, timber plays a very important role as a raw material in the domestic economy. In the Alpine regions of the country the forests are to a great extent replaced by arable land, especially on the northern edge of the Alps, where above an altitude of 2000 ft grassland prevails. Characteristic of the Pannonian region are scrub, mixed deciduous wood and heathland. To the east of Lake Neusiedl (Burgenland) one can find typical salzsteppe flora.

As almost half of Austria is already covered with forest, it is not expected that additional afforestation will lead to much further carbon sequestration. Especially in the mountainous areas, the potential for new plantations is low, and only a very slow shift in species towards more mixed stands that could potentially store more carbon is foreseen. Almost 20% of the forested area is protection forest. The forests are under stress from pollution and pests, including browsing animals, and that efforts to mitigate these problems are also contributing to maintaining the carbon reservoirs (national communication of Austria to the FCCC, 1996).

Forest management practices, including afforestation over the last decades, has a situation in which net sequestration is equivalent to around 15 Mt CO<sub>2</sub> annually. The growth in newly forested land slowed from an annual 10,000 hectares in the 1970s to 2,000 in the 1990s. Since approximately 46% of the country is covered with forest, major additional afforestation is not expected, particularly in mountainous areas where the potential for new plantations is low. Only a slow shift towards broadleaved species is foreseen where pine and spruce are used at the margins of or outside their natural habitat. Mixed forest (coniferous and broadleaved species) is

expected to dominate for natural reasons. The tendency towards mixed forests is promoted by subsidies.

The increase in carbon accumulation by managed forests between 1985 and 1995 was approximately 60%. This was attained primarily by the afforestation of regions previously used for agriculture, better forest management and innovative forest engineering practices. The 1997 forest inventory showed an increase of 7,000 ha per year, compared to the earlier inventory figure of 2,000 ha per year.

This increase has also been supplemented in the framework of the protection against dangers caused by torrents, avalanches and erosion dangers; particular attention is paid to functional forest improvement. The mountain forest belt is crucial for the prevention of the natural dangers cited above. Permanent settlement in mountain valleys without protective mountain forests would not be possible.

Enormous efforts to protect critical areas against lying fallow are made by the mainly agricultural landowners during their land and forestry management. In addition, nearly 550 redevelopment projects on an area of approximately 110,000 ha are currently supported by public funds. The priority ranking takes place on the basis of concepts of forest protection of the countries. Besides the functional improvement of the mountain forest belt, the redevelopment projects also include afforestation above the current timberline as well as the improvement of agriculturally used areas of Alpine pastures with respect to its protective function. The implementation of measures is mostly done by the forest owners, due to the property structure, especially by mountain farmers.

Financial means for the described technical and biological precaution measures are provided by the federal government (61%) and the Lander (20%). At the federal government level, measures are proportionally financed by the Austrian Funds for the Protection of Natural Disasters and the 'Green Plan' (support in accordance with forest-law of 1975) (Knieling, 2001).

### **BIOSA-Biosphere Austria**

BIOSA is a society dedicated to dynamic environmental protection, and is a voluntary initiative of farm and forestry enterprises. In this program, a total surface area of more than 1,700 ha has been made available by businesses which commit themselves - on a voluntary, commercial basis - to nature conservation management in the sense of biotope and species conservation. Twenty-year leases and scientific biotope management concepts were developed for these nature conservation contract areas. BIOSA obtains its funds from ecosponsoring projects in a partnership with industry and commerce. This is an active step toward a demand-oriented product management of nature conservation services (nature trails along rivers and lakes, moor projects, arid biotope conservation programs, etc.)

### **The Permanent Austrian Forest Inventory**

The permanent Austrian forest inventory, carried out by the Forestry Research Centre, plays a major role in determining and monitoring the biodiversity of woody plants in Austria's forests. Beyond merely collecting basic data on Austria's forests, this program examines biodiversity-related indicators such as the distribution and composition of tree species. Forest condition is further documented by a forest damage surveillance system linked with a European network. Forest soil condition was documented in the course of a special, nation-wide survey by the Forest Soil Condition Inventory; this included studies on vegetation ecology. A two-pronged effort is being made to implement Strasburg Resolution S-2 (Conservation of Forest Genetic Resources) of the First Conference of Ministers for the Protection of Forests in Europe. The first involves a national concept to preserve genetic diversity (implemented as of 1986) at the Forestry Research Centre in close co-operation with the Provinces and the Federal Forestry Agencies. The second involves Austria's formative participation in the European Forest Genetic Resources Programme.

This program is undertaking a Europe-wide effort to co-ordinate the conservation of genetic resources for various tree species. In addition, the conservation of biological diversity is promoted in the framework of implementing Helsinki Resolutions H-2 (Protection of Biodiversity in European Forests) and H-4 (Adaptation of Forests to Climate Change).

Prompted by the forest dieback issue, the Forestry Research Centre in 1986 developed the project "Conservation of Genetic Diversity", which is a co-operative effort pooling a number of different disciplines. Since then, a series of co-ordinated in-situ and ex-situ conservation measures have been implemented in this framework. Nation-wide, this has led to the establishment of 242 conservation units (gene conservation reserves > 30 ha and gene conservation cells < 30 ha) with a total surface area of more than 8200 ha.

As of 1995, the project "Natural Forest Reserves" has provided a vehicle to establish a representative network of such reserves for all types of tree communities known in Austria.

## **2. Belgium**

Belgium is located on the southeast coast of the North Sea. Its territory covers 30,750 km<sup>2</sup>, of which 21% or around 6,460 km<sup>2</sup> was forest in 1997 (FCCC, 2000). The forest inventory is carried out once every 10 years, the most recent one dating from 1990. Around a fifth of the total area of Belgium is covered by forest but the coverage is unevenly distributed. It makes up 21%, 20% and 8% of the areas of the Walloon, Brussels and Flemish regions, respectively, and around 80% of the productive forest is in the Walloon Region. Coniferous species dominate forest cultivation in the Walloon Region, while deciduous trees predominate in the Flemish Region.

At the federal level, in 1995, a ministerial decree based on an EC directive (2080/92) provided for subsidies to farmers for conversion of agricultural land to forest in order to compensate for loss of revenue. Subsidies for production of biofuels were also available. The federal Government provided 50% co-financing to EC subsidies for the acquisition of new sites for nature development, afforestation and reforestation, which amounted to BEF 190 million between 1991 and 1998. Total expenditure by the three regional governments on nature conservation and forestry was about BEF 3,800 million in 1996, representing 5% of overall public expenditure on the environment.

The Federal Government has implemented a measure for overseeing actions undertaken at the regional level to encourage reforestation; financial assistance was available, compensating farmers for the loss of revenue associated with reconversion (reforestation of agricultural or other plots of land); this governmental aid, rarely requested, was phased out in 2000.

### **Flemish Region**

In the Flemish Region, both the Environmental Policy Plan (MINA2) and the Structure Plan for Forest envisaged creating 10,000 ha of new forest and converting another 10,000 ha of agricultural land into forest by 2007, pursuant to the same EC regulation. To achieve the first objective, the Flemish government spent BEF 2,269 million between 1991 and 1998 in establishing 3,830 ha of new forest. Multifunctionality and sustainability are two priority themes of forest management, as well as safeguarding the forest ecosystem.

### **Reconversion of lands (reforestation)**

The authorities of the Flemish Region have set up, under the town and country planning act ("Flanders Structural Town and Country Plan"), measures aiming to extend the amount of woodland. The Flemish Region policy of reforestation is based on two strategies: firstly the authorities are pursuing a purchasing policy aiming to create new areas of woodland; secondly

they are pursuing a policy of financial support aiming to initiate reforestation initiatives by local authorities or individuals.

### **Prohibition on deforestation**

New regulations regarding deforestation came into force in February 2001. The objective of these regulations is to preserve wooded areas in the Flemish Region; the deforestation of ground outside residential and industrial areas is no longer allowed unless special exemption is obtained from the general prohibition of deforestation. Furthermore, if any trees are felled from a plot of land compensation is required; this may be made in kind (by planting trees elsewhere), or by a payment. The compensation factor depends on the ecological value of the wood concerned and varies from a factor of 1 to 2; the basic figure for the compensation is BEF 80/m<sup>2</sup>, multiplied by the compensation factor.

### **Walloon Region**

In the Walloon Region, specialization in forest management is leading to the conversion almost everywhere of small groups of trees into timber plantations. Coniferous plantations are generally single species standard timber plantations. Standard timber plantations are also the rule in the Flemish Region for both coniferous plantations and deciduous trees. The annual afforestation/reforestation campaign has grown in size considerably over recent years. In the Walloon Region, the areas planted with deciduous trees are increasing, as well as their ratio in the annual afforestation/reforestation effort. The regeneration of clumps of trees has, more than in the past, had the objective of diversification of the species according to the local ecology so that the tree chosen is best suited to the position that it occupies.

### **Preservation of the ecological stability of forests**

The Rural Development Plan 2000-2006 provides compensation for the lack of income for proprietors who practice forest conservation, by a policy of awarding allowances to private proprietors for setting up, managing and conservation of private forest reserves.

### **The Wood Energy Plan**

A Wood Energy Plan was set up in March 2001. It is targeted at initiating and conducting a dozen projects for automatic wood heating, gas generation or other technologies using wood designed to recover energy from wood in Wallonia. This plan essentially concerns municipalities and communities, whether or not connected to district heating. By this plan, actions will be taken to give out information and make people aware of the issues, feasibility pre-studies will be performed (evaluation of the available resources, evaluation of energy needs, and evaluation of the potential RUE) and assistance will be furnished with setting up projects.

### **The potential of forest ecosystems to sequester carbon (1999-2001)**

This study is targeted at continuing the work begun in 1997 by the Agricultural University of Gembloux on the impact of forest ecosystems on climate change. The purpose of this extension of the study is to deepen the understanding of the sequestration of carbon by root biomass and to improve the experimental devices and the system for using the data from the Vielsam site. The cost of operations for 1999- 2001 reached BEF 20 million.

## **3. Denmark**

In 1805 the forest of Denmark covered only 2-4% of the total area (Jensen, 1993). Since the beginning of the last century afforestation has more or less continuously been carried out by the

state or by private owners or companies subsidized by the state. By 1990, some 12% of the Danish territory was covered by forests, or 417,000 ha (Denmark's second national communication on climate change, submitted to UNFCCC on 5 December 1997). It is assumed that the annual average afforestation in the mid-1990s was about 1,900 ha and the rate of afforestation at the moment is around 2,500 ha/yr. Almost the whole present forest area is therefore first, second or in some cases third generation after afforestation of non-wooded land.

This massive afforestation of the Danish countryside was motivated by the threatening prospects of an acute shortage of timber and fuelwood. The state began by fencing in the remaining forests and then by prompting new afforestation, particularly on the low productive heathland on the Jutland peninsula. This growth has mainly taken place by planting non-indigenous conifer species on former heathland, shifting sand and dune areas.

In 1992 the total arable area of Denmark was 27,600 km<sup>2</sup>, which is about 65% of the total area of the country. Since the 1930s the arable area has decreased by about 10%. Part of this land has been used for infrastructure and municipal development, but more recently the area of agricultural land has also decreased due to afforestation and environmental measures. Permanent grassland also decreased by about 10% during this period, whereas annual crops have increased. Due to the EU Agricultural Policy reform, 2,000 km<sup>2</sup> of arable land has been set aside every year in order to reduce food production. This land may be used for non-food production.

It is estimated that approximately 70% of the forest area is privately owned while the remaining 30% is owned publicly. Most private forests are owned and managed by farmers. The structure of Danish forests is largely characterized by a large number of small forests taking up a very small proportion of the forest area. Forests smaller than two hectares, for example, make up 35% of the amount of Danish forest estates, yet they only make up 2% of the forest area.

Denmark was among the countries that included climate change in their policy agendas in the late eighties. Since then, climate change policy has been target-oriented. The national target adopted by the parliament in 1990 called for a 20% reduction in energy-related CO<sub>2</sub> emissions in 2005, compared to their 1988 level.

## **The Forest Act**

A new Forest Act was enacted in 1989, based on the principle of integrating production and conservation in all forest areas. It is an objective of the parliamentary decision, taken in 1989 and reiterated in 1996, to set a forest policy objective to double the forest area, corresponding approximately to obtaining a 20- 25% forest cover after one tree-generation (80-100 years). This would require an afforestation rate of 5,000 ha/yr. While this objective was originally triggered by agricultural over-production, the focus is now on nature values and opportunities for outdoor recreation. Action proposal 129a from IFF deals with encouragement of co-operation and co-ordination of activities with regard to forests and trees in environmentally critical areas. This is well integrated into the Danish afforestation efforts.

The Act defines good and multiple-use forest management as management with due regard to increasing and improving wood production, as well as nature conservation, landscape, historical values, environmental protection and recreational interests. Subsidies are given in private forests for nature conservation. Funds are allocated for afforestation, particularly for urban, recreation forests with broad-leaved trees. Funds are also allocated for forest improvement and afforestation on private land.

The subsidy schemes make it possible to grant subsidies for promoting the cultivation of deciduous trees with their native deciduous tree and bush species, and the preservation of old trees. It is also possible for the Government to support the management of private forests of particular nature value. This scheme is aimed primarily at promoting the setting aside of

untouched and coppice forests, which private forest owners would perhaps not otherwise maintain for economic reasons.

Although the 1989 parliamentary decision stated that this afforestation should be undertaken by the state and private land-owners half and half, thus far, the majority of afforestation has taken place on state-owned land, with a smaller part on marginal farmland. To promote afforestation on private land, the Government offers a subsidy for a 20-year period but landowners have been reluctant to use this option, as inflation was not considered when disbursing subsidies. Additional funds of DKr 120 million annually were made available for afforestation in 1998 and it was expected that this supplementary action would also help reduce the impact of nitrogen leakage into groundwater.

In order to promote planting within the desired afforestation zones, the subsidy amount was highest when planting within designated afforestation zones (75% of the direct costs for planting broadleaf trees and 60% for conifers), and lowest when planting outside of these zones (50% of direct costs for broadleaf trees and 40% for conifers). Subsidies were, furthermore, only granted for afforestation exceeding 2 ha.

In 2000 the previous 10 years of the Danish afforestation efforts were evaluated. It was concluded that while the overall quality was rather good, more emphasis should be put on nature considerations. Furthermore, the afforestation efforts are running behind schedule. If the forest area is to be doubled within a tree generation, 40,000 – 50,000 ha should be afforested over a period of 10 years, but afforestation has only reached 30-35% of this target. This is mainly due to the high cost level associated with afforestation activities in publicly owned as well as private forests, and competition with other land-uses, mostly agriculture, which eventually constrain afforestation efforts.

The present afforestation policy implies a considerable trade-off between agricultural and forest land, with agricultural land decreasing from 65% to 55% of the total area of Denmark. Full implementation of the parliamentary decision was quite uncertain, given that farmers face a choice between EC subsidies or afforestation grants.

Although the thrust of the policy is to afforest the increasing amount of farmland that will be put out of production, the government has also decided that some amount of the new afforestation should be placed close to urban areas. This will be done in order to provide people in the cities with recreation facilities. It is expected that around 25% of the Danish State afforestation, therefore, will be considered urban forest.

## **Forestry Extension**

Besides the public and the public-funded private subsidized afforestation, non-public-funded private afforestation also takes place. This private afforestation has partly been encouraged by various alterations to the legislation on agriculture, cadastral conditions and tax-systems. Forestry extension provides farmers and landowners with access to organizations or individuals with knowledge of laws and programs that can help with afforestation projects.

Forest extension in Denmark is concentrated in two large private organizations, the "Danish Forestry Extension" (see below) and the "Danish Land Development Service". In addition to these companies there are some smaller private associations, a number of private individuals and local national forest districts. Extension officers or managers of large forest districts they are mainly advised by The Royal Veterinary and Agricultural University, DFLRI, along with two private organizations, The Decoration Greenery Section and the Danish Forestry Society. The latter two organizations also advise larger forest owners and large producers of Christmas trees and greenery.

These private organizations also offer services that entail the handling of forest products sales of logs, timber, decoration greenery, and Christmas trees, often on a commission basis. Their services can also include assistance with logging or planting operations. Sale of plants or materials like fencing material and fertilisers are also typical services of the private forest advisors.

The Danish Forestry Extension consists of 15 local units called "Forest Owners Association". These units offer consulting services to forest owners and are owned by the forest owners themselves via their membership of the unit. Each unit is typically headed by a board of five to nine members that are chosen by the membership. The Danish Forestry Extension currently represents approximately 7,000 forest owners with a total of 70,000 ha of forest land equivalent to 25% of private Danish forest.

### **Nature restoration and re-establishment**

In 1989 a more proactive element of protection of biodiversity was introduced in Danish nature protection. As a result of a Marginal Land Strategy in 1987, economic means were reserved to ensure nature restoration, to improve public outdoor facilities in nature and to increase state afforestation at a larger scale.

During the period 1989 to 1996, more than DKK 1.1 billion was used for nature restoration, public management, and afforestation. In total, about 5,550 ha of nature have been restored and 4,000 ha of state forest have been planted. The goal for afforestation is to double the forest area from app. 12% to app. 25% of the country's area.

Most of the large nature restoration projects have been carried out on land purchased by the Government. The means available have ensured full compensation to the landowners involved, long-term security for the implementation of projects and a fixed framework for the future management of these areas.

## **4. Finland**

A total of 262,300 km<sup>2</sup> or 86.1% of Finland's land area is classified as forestry land. As compared to the area of forest and other wooded land, this also includes 31,200 km<sup>2</sup> of treeless wasteland. Some 200,000 km<sup>2</sup> of forests have an annual growth of at least 1.0 m<sup>3</sup> per hectare. Thanks to the influence of the Gulf Stream, there are forests even in the northernmost parts of Finland.

Various kinds of peatlands are a fundamental element of the Finnish landscape. In fact, the Finnish name of the country, Suomi, might have originated from the word "suo", i.e. mire. In the cool and humid climate the soil becomes waterlogged, which creates the right conditions for peatland vegetation and the formation of peat. Originally, about one-third of Finland was covered by peatlands. Half of this area has been drained for farming, forestry and peat extraction purposes, while the other half has been preserved in its natural state.

There are about twenty indigenous tree species growing in Finland, the most common ones being pine, spruce and birch. Usually two or three tree species dominate a forest. Naturally pure pine stands are found in rocky terrain, on top of arid eskers and in pine swamps. Natural spruce stands are found on richer soil. Birch is commonly found as an admixture, but it can occasionally form pure birch stands.

A good half of the forest land area consists of mixed stands. Rarer species are found mostly as solitary trees. The south-western corner and the south coast of Finland have a narrow zone where oak, maple, ash and elm grow.

Measures to set aside and afforest agricultural land were introduced in Finland during the late 1960s, primarily in response to agricultural over-production. Due primarily to a marketing surplus of agricultural products resulting from agricultural expansion and intensification programs, a number of Acts were introduced by the Finnish government in the late 60s and early 70s, which permitted forest improvement funds to be used for field afforestation. This provided a great incentive for Finnish farmers, who have traditionally been the owners of Finnish non-industrial private forests, to afforest portions of their land.

The main features of the legislative changes involved were:

The Farm Income Tax Act (1967) specifically exempted afforested fields from the normal forest taxation scheme, which is based on the average growth potential of forest land by site-types;

The Field Reservation Act (1969) allowed for subsidies to be paid for the suspension of agricultural production for periods of three to nine years. Afforested fields received the reservation subsidy for 15 years. A revision of the Act in 1977 substantially increased this subsidy;

The Forest Improvement Act (1969) enabled state funds to subsidize the practical aspects of afforestation, e.g. planning, materials, labour, and re-planting in case of seedling failure. The amendment also allows for a 100% subsidy for the afforestation of fields considered to be unsuitable for agriculture.

The Farm Closure Act (1974) encouraged the enlargement of farms through the consolidation of arable land. The act enables poorly productive fields to be afforested under the terms of the Forest Improvement Act.

The Farm Act (1977), which forms the basis of Finnish agricultural policy for the 1980s, enables the Board of Agriculture to purchase and afforest fields.

Act Concerning Agricultural Production Regulation and Balancing (1977) follows from the Field Reservation Act and is more flexible. Under the terms of the Act, a payment is provided to farm owners who agree to afforest fields that were in agricultural production the year prior to the afforestation agreement. The practical aspects of the afforestation may be partly or wholly covered under a subsidy from the Forest Improvement Act.

Act Concerning Agricultural and Forestry Land Procurement Rights (1978) allows farmers to receive prior information on the sale of neighbouring farmland or forests, as well as granting them priority purchasing rights. The aim of the Act is to assist in the rationalization of farm and forest holdings.

The Rural Livelihood Act (1990) replaces the Farm Act from the beginning of 1991, and enables funds to be made available for diversifying rural occupational possibilities. It is designed to support small-scale forestry and farming enterprises.

Although these Acts have been continuously modified since their inception, there were no fundamental changes in them since the 1970s. If anything, support for afforestation strengthened until membership with the EU in 1995.

Historically, peatland drainage programs and the conversion of unproductive forest stands to productive stands have been important measures in afforesting land that is marginally productive, yet suitable for forestry. The peatland programs are now over, and the conversion is still going to some extent, particularly in Lapland. However, this conversion measure can't be seen in statistical profiles of afforestation efforts, as unproductive forest stands are already considered to be forest land.

In the past, annual field afforestation figures have been strongly correlated with public sector grants and premiums. The peak for afforestation under these schemes was in 1972, when extension services and nurseries had caught up with the afforestation applications such that over 12,000 ha were converted to forestry. From this peak, there was a steady decline in afforestation activities, particularly after the set-aside program ceased in 1974. From 1982 until 1986 afforestation levels held at around 2,500 ha, until substantial increases in the afforestation premiums led to a resurgence of afforestation activities.



A temporary increase in the afforestation premium at the beginning of the 1900s gave rise to a peak of activity that reached some 17,000 ha in 1992. This rate of afforestation fell to between 5,000 ha and 9,000 ha (according to different sources) in 1994 due to a suspension of the premium in anticipation of EU membership in 1995. Membership led to a new field afforestation program aimed at achieving between 10,000 and 20,000 ha/yr for five years.

Afforestation programs in Finland (as elsewhere in the EU) have not been considered sustainable (Selby, personal communication). Usually the first year of a program sees active participation, but thereafter participation falls dramatically. Actual afforestation levels in Finland under the EU scheme only achieved a 42% success rate over the five year period they were in place, ending with a low of around 30% in 1999 (estimate, Selby, 2000).

Today in Finland, the afforestation of agricultural lands amounts to some 6,000 ha/yr in a country of around 30 million hectares (excluding lakes and rivers). This is not a very significant measure compared to the 2 million hectares of agricultural field, over 20 million hectares of productive forest, and 6 million hectares of scrub and waste land in the country.

Finland has currently abandoned its afforestation programme under the EU financing scheme, preferring to use the same funding for improvements in agricultural environmental protection schemes. This is politically more acceptable in a country where the farming lobby still carries some clout. This grant also helps soften the burden to existing farms of a radical reduction in farm incomes following reforms to the EU's Common Agricultural Policy and the national policy of supporting only (potentially) economically viable farms.

However, the field afforestation programme continues to run, and this option is supported if an estate owner chooses to participate. Most farmers prefer to rent any unused fields to other farmers (J. Leppänen, personal communication), and in Finland the landscape is already so forested that afforestation of more fields is not considered to be a priority.

Re-forestation in Finland is secured under the Forest Law, according to which a forest owner has to reforest a clearcut area within a given period using silviculturally appropriate methods (seeding, planting or natural regeneration on suitably prepared sites). Shelterbelt planting is not considered to be an issue in Finland.

Today, about one-third of Finnish forests are regenerated naturally and two-thirds artificially. Natural regeneration is based on seeding from trees already growing on the site, usually by leaving a number of seeding trees standing at felling. Artificial regeneration requires the removal of almost all mature trees from the site. A new stand is established on the clear-felled area, either through direct seeding or planting.

The total volume of stock in Finnish forests amounts to about two billion cubic metres. For over thirty years, the increment of stock has exceeded harvesting volumes and natural drain. Today, the annual increment is about 75 million cubic metres, whereas less than 70 million cubic metres are harvested or die of natural causes. Of the total logged area, regeneration felling accounts for roughly one-third and thinnings two-thirds.

Thanks to increasing increment, it has been possible to continuously increase the harvesting. This is a result of improved forest management practices and forest improvement measures, for instance, drainage ditching. The annual increment of stock has been increased by about 15 million cubic metres. Today, natural peatlands are no longer subjected to drainage ditching; the activities are now concentrated on maintaining previously drained areas and forests established there.

In the 1990s, the area of forests strictly protected from fellings totalled 1.5 million ha. These forests correspond closely with IUCN categories I and II. Otherwise, protected forests and forests

in restricted forestry use together totalled just under one million hectares. A good one-half of all protected forests are productive, while the rest is scrub land of low productivity.

Approximately 6.5% of the productive forest land and close to 40% of the scrub land is protected in Finland. Most of the protected forests are located in northern Finland.

Finnish forest owners have easy access to expert advice related to the management of their forests. There are about 200 forest management associations that provide the forest owners with advisory services relating to forest management and felling as well as other types of related services. The associations' task, stipulated by law, is to promote private forestry while securing its economic, ecological and social sustainability.

In addition to logging, forestry includes forest management and improvement work. About EUR 200 million are invested every year in forest regeneration, young stand management, fertilizing, improvement ditching and constructing forest roads. About three-quarters of this is financed by the forest owners themselves and the rest is covered by State subsidies.

## **France**

France is located in the west of Europe and is situated between the Atlantic and the Mediterranean Sea. It is the largest country in the European Community (EC), with an area of 550,000 square kilometres, and has varied geographic characteristics. Farmland and forests cover 80% of the land area. Over the period 1970 to 1995, the area of land devoted to agriculture decreased by 7%; the area of permanent grassland has declined as cereal, oilseed and protein crops have grown in importance.

Extension of wooded areas in France began at the beginning of last century. The rate of progress was initially fairly modest: from about 7 million hectares in 1830, the area of woodland rose to 11 million hectares over a century later (1945), with stages of expansion followed by periods of consolidation (particularly between the two wars). Since the establishment of the National Forestry Fund (FFN) in 1947, natural extension and afforestation has averaged around 63,000 ha annually.

On the average FFN assisted in the afforestation of 21,000 ha a year, declining from a high rate of 30,000 ha a year during the 1950s, to about 10,000 ha a year during the 1980s. By 1990 the establishment of FFN increased the coverage of woodland to nearly 15 million hectares, giving an overall proportion of woodland of about 27% of the land area (TBFRA, 2000). Semi-natural forest has long accounted for the bulk of wooded land.

Prior to 1993, the Common Agricultural Policy (CAP), notably through a mechanism of price support for farmers, strongly encouraged the intensification of agricultural production in France, as well as the conversion of pasture (permanent and temporary grasslands) to arable land and, to a lesser extent, of wooded areas. The depletion of wooded areas continued until recently in certain regions, even though there has been a substantial net increase in wooded areas in the country as a whole.

A change in the price support mechanism should have reversed this trend so conversion of pastures and forest to farmland should have ceased; yet the economic advantage associated with intensified farming is such that this has not occurred.

In 1993, however, the Government made a decision to raise the afforestation rate to 30,000 ha by 1998. In 1994, public assistance was made available for both reforestation of forest land and expansion of the forest cover. The subsidy scheme has related to revenue forgone if the land has not been used for agricultural purposes, half of which has been provided by the EC in the context of CAP reforms. The scheme was complemented with various tax breaks for farmers converting

agricultural land to forest. The system also involves a number of fiscal advantages (partial exoneration from the tax on unbuilt land and the inheritance tax).

In 1994 and 1995, respectively 12,000 ha and 11,000 ha were subsidized but, as a result of budget constraints, the objective was abandoned such that a similar planting rate would be maintained until 2000.

Finally, in parallel with the enhancement of forestry resources, it was decided to promote applications of wood in the construction sector and in the energy sector. The idea being that private investment in forestry developments will naturally be facilitated if there is a prospect of a good return; this return will be the higher once markets for forestry products can be assured.

In France, most of the plantings under Directive 2080 took place in the western half of the country, where 76% of the area afforested was in only seven regions. The impact on the resource is measurable in the Pays de la Loire, the region which planted the most with 7240 ha: in ten years, the level of afforestation rose by 9 to 10%. The area afforested due to the aid represents almost 6% of the forested area in the region and 2.5% of the private forest.

A survey conducted by CEMAGREF on plantings prior to 2080 shows that only a small portion of the agricultural land that was afforested (natural + artificial afforestation) will remain afforested in the long term. For the period from 1992 to 1996, it was estimated that 60% to 80% of the planted areas would remain forested.

However, the National Plan for French Forests (NPFF), which was issued following the damage caused by the two storms in December 1999, and unveiled on 12 January 2000, calls for the redeployment of financial and human resources. This will initially lead to a fall in the level of afforestation of agricultural lands, of probably less than 10,000 hectares per year, in favour of forest re-planting.

Subsequently, the annual afforestation level is expected to increase to 20,000 hectares per year in 2006. After that time, increases in initiatives to timber agricultural land will depend on the situation of the forests, and in particular the extent of natural regeneration that may occur and that cannot yet be assessed. The human, technical and financial resources required to advance to an annual agricultural land afforestation rate of 30,000 ha, after 2006, will be reassessed in 2005, but the intention is that the initial objective will be maintained in the longer term.

### **Tree grants in France**

Land consolidation, which is often imposed upon farmers, often means the disappearance of the hedges and trees in a landscape. In order to maintain this tree capital, the French Institute for Forestry Development (IFD, 1995), set up tree grants paralleling the exchange of parcels. The principle is to guarantee that owners will get back an equivalent land and tree capital after the exchange, with full ownership, usufruct, or ownership without usufruct. There is, in fact, a great temptation for owners to fell standing timber prior to consolidation. These incentive procedures assume ownership adherence to and respect of the rules. Each single tree or row of trees is accounted for and assigned a value. The species and volume of exploitable logs are assessed for specific timber species. Some owners receive a wood value exceeding the one they abandoned, and for this case there are equivalency procedures. In the reverse case, they receive a premium in cash (or in kind in the form of fuelwood).

Orchards are also the targets of specific action. The Rénova Federation established a programme in 1995 in Ariège and in Haute-Garonne to restore and enhance old-fashioned fruit varieties. The rural social fabric of these regions was under threat following the widespread abandonment of agricultural lands, and local authorities and farmers were looking for ways to preserve the local fruit-tree legacy. An awareness-building campaign was followed by rejuvenation pruning in over 300 orchards in the region. More than 50 farmers are now

responsible for a high-quality cottage industry which has sparked such enthusiasm that farmers belonging to the Rénova network are now building a plant to process fruit into cider and juice. The target is 80,000 bottles by 2004. An experimental orchard programme to enhance never-before-studied local varieties is now in the planning stages.

## **Forest Fire Reduction**

Forests, particularly in southern France, are vulnerable to forest fires. Policies, including raising public awareness of how to reduce the risk of fire, the establishment of observation posts and firebreaks and the provision of firefighting teams, limit annual damage to about 0.3% of forest subject to risk, compared to an EC average of over 1%.

## **5. Germany**

Germany is located in northern Europe and has a temperate climate. The average temperature is about 9° C annually and from 17° to 20° C in the hottest summer months, depending on the region. Of Germany's 35,696 million hectares around 55% was devoted to agriculture and 29% to forest in 1993 when the last land survey was performed.

Germany's forest area is around 10.7 million ha and the annual average timber growth is about 8 m<sup>3</sup>/ha. Geobotanically, Germany's forests are located in the temperate zone, and in their natural make-up they consist primarily of mixed deciduous-tree populations. However, as a result of human impacts, the conifers spruce, fir and Douglas fir predominate.

Around 30% of Germany is covered with forests. Despite conversions for construction and settlement, for example, the forest area has been expanding since 1960 by around 500,000 ha to 10.7 million ha today. Since virtually the whole of Germany, except for high mountain regions, sea coasts and special sites, used to be covered with forests, forests have always been an important part of the German landscape. There are no longer completely untouched forest ecosystems in Germany. Particularly on the more favourable sites, deciduous trees were largely cleared for agricultural and other purposes. Today, coniferous trees prevail on around 70% of the remaining forest area, partly mixed with deciduous trees, and frequently in regions where they did not exist before systematic forestry began. The main tree species today are spruce, pine, beech and oak.

Around 46% of German forests, mainly small forests, are privately owned by 1.3 million forest owners. As self-helping organizations, forestry co-operatives are to improve the economic situation of these enterprises. 31% of the forest area is owned by the Laender, 20% by public-law corporations and 3% by the Federal Government.

With an average of 270 solid cubic metres/ha, Germany takes a leading place in Europe with respect to its growing stock. Whereas current annual fellings in Germany account for only 3.7 cubic metres/ha, the potential and sustainably usable roundwood availability is 5.7 cubic metres/ha. Therefore, only about 70% of the felling potential is exhausted.

The Federal Forest Act is designed to conserve forests due to their economic benefits (productive function) and their importance for the environment and the recreation of the population (protective and recreational functions), to expand them, wherever possible, and to ensure their proper management on a sustainable basis, whilst promoting the forestry sector and reconciling public interests and the concerns of forest owners.

For years, new afforestation has been promoted in Germany by means of investment subsidies within the framework of the Joint Scheme for the "Improvement of Agricultural Structure and Coastal Protection". Under this scheme the Federal Government pays some 60% of the costs,

and the States pay the remaining 40%. The scheme is used to promote silviculture measures like afforestation, transformation from monocultures into mixed stands, etc.

Problematic has been the lack of uniform conditions for afforestation. Prior to integration into the EC, considerable differences were observed within the country, not only between the Federal Republic of Germany (FRG) and the former German Democratic Republic (GDR), but also within the FRG. Due to the manifold claims on land for other purposes, historically little attention was given to the conversion of land to forest activities (Weber, 1993).

During the 1960s up to 10,000 ha of land was being afforested annual in the FRG. This rate of afforestation decreased drastically into the 80s, as the vast majority of available marginal land had already been afforested. Between 1979 and 1988, an average of 8.3 million DM (4 million ECU) per year was spent on afforestation in the FRG. Over this period just over 36,000 ha of land was afforested, for an average of less than 4,000 ha/yr.

In 1991, incentives for new afforestation of agricultural land were considerably enhanced through the introduction of an additional 20-year new-afforestation bonus for farmers and forest owners. The effects of this bonus on the rate of new afforestation resulted in a doubling of the annual afforestation rates to between 6,000 and 7,000 ha. The largest part of the subsidies has benefited privately owned forests, with subsidy amounts per unit (ha) continuously increasing.

Comparing the afforestation support in the individual German states, it is apparent that different support processes are available in different areas of the country. Some States chose fixed amount financing, for example, while other states opt for share financing, sometimes with maximum support amounts. The maximum support amounts per tree vary widely between States, and sometimes within individual States. With the coming into force of the support schemes in 1991, many of the State subsidy amounts clearly increased.

In Bavaria, for example, the maximum afforestation amount totalled around 5,700 DM/ha, but increased to a maximum of 11,500 DM/ha after the support schemes were put into place (Weber, 1993). This increase in subsidies had a predictably significant impact on afforestation rates in Bavaria, increasing from less than 1,000 ha in 1988 up to about 2,500 ha in 1993 (Ammer, 2000).

New afforestation has been supported for many years within the "joint-task" framework. This support consists of two components:

Subsidies to help defray initial investment costs. Particular emphasis is placed on planting of near-natural deciduous and mixed-species forests. Up to 85% of eligible costs are reimbursed for planting of deciduous stands; up to 75% of eligible costs are reimbursed for planting of mixed-species stands.

Since 1991, a new-afforestation bonus has also been paid: farmers and forest owners receive, for up to 20 years, a bonus as compensation for losses of income due to set-asides of agricultural land.

The subsidies were further modified by the "Council Ordinance of 30 June 1992 for the introduction of Community assistance regulations for afforestation measures in agriculture", which provided for area-oriented assistance for:

- Care for areas on which agricultural use has been discontinued,
- Long-term set-asides of cultivated land (up to 20 years), for effective environmental protection and nature conservation measures, and
- Afforestation of land previously used for agriculture.

In 1993, this support was improved still further, as the amount of an additional bonus, depending on the soil quality of the newly afforested farmland or grassland, and on the tree species selected, was increased up to 1,400 DM per year and hectare.

Forestry associations and measures against new forest damages are also promoted. If there is a natural disaster that causes much damage, forest owners get tax relief. There is also additional funding from the European Union for the eastern part of Germany (up to 75% of afforestation costs). Sustainable forest management is hampered to some extent by unfavourable ownership patterns, small sizes of forests and fragmentation of forest ownership. Ways of solving these problems arise from co-operation between forest management units, in particular with the help of forestry co-operatives.

## **6. Ireland**

Ireland is located on the northwest coast of Europe. Its climate is predominately influenced by the relatively warm waters of the Gulf Stream, making it milder than other parts of the world at the same latitude. During the coldest winter months the temperature falls to between 4°C and 7°C on average, and in the warmest summer months the temperature averages between 14°C and 16°C. Rainfall is common throughout the year, averaging from 800 to 1,200 millimetres in low-lying areas.

In 1995, agriculture, mainly based on livestock rather than tillage farming, accounted for around 7% of GDP and was the primary land use, accounting for 4.9 million hectares out of a total area of 6.9 million hectares. Wetlands and bogs accounted for about 14% of land cover. Throughout the 20th century, the promotion of agricultural production and development had been emphasized by successive governments, which was further promoted when Ireland joined the Common Market on the 1st of January 1973. The Common Agricultural Policy promoted agricultural production across Europe, whilst not catering for a specific forest policy.

Forest cover in the Republic of Ireland extends to some 660,000 ha, or almost 9.5% of the land surface. Plantations comprise by far the largest part of the forest area (more than 95%). These have been established over the past century, with the majority being planted in the past half decade. Forestry is therefore a relatively recent land-use in Ireland. Some 42% of this area is privately owned, with the remaining 58% owned by Coillte and Duchas. It has been estimated that there are approximately 11 thousand private woodlands owners.

The majority of the forest stands occur on marginal agricultural lands and are composed of coniferous species, typically Sitka spruce and lodgepole pine. Although in recent years many farm foresters have planted high quality land with a range of suitable broadleaved species, which has enhanced species diversity. The average size of the holdings is eight hectares and they rarely have adequate road infrastructure.

At the start of the 20th century only 1% of Ireland was under forest. Recent afforestation policies have significantly increased the land area under forestry and forest cover is now 9.7% of national territory. While Ireland has one of the lowest levels of forest cover in the EU, where the average is 30%, the recent planting rate is among the highest in Europe. National planting targets of 20,000 hectares per annum currently aim at doubling forest cover to 17% by 2030, with timber production also set to expand.

The majority of the forests established during the first half of the 20th century were State planted. Interest in forestry from the private sector remained low during this period, despite the availability of financial incentives for afforestation from the Government since 1931. The situation significantly changed during the 1980s with the introduction of the Western Package Scheme of Grants by the European Economic Commission. This scheme specifically targeted farmers in disadvantaged areas of rural Ireland and provided financial assistance to cover 80% of the cost of forest establishment. However the scheme proved to be largely unsuccessful due to the lack of tradition of farm forestry in Ireland as well as the long delay in receiving any economic returns from the crop.

During the early 1980s state planting in Ireland far exceeded private planting. As a result of the Single European Act in 1987, aid transfers to poor Member States were approved. Ireland was eligible for this support and consequently a Forestry Operational Programme was implemented benefiting all Irish landowners. Interest in forestry grew substantially among the farming community with the introduction of the Scheme of Compensatory Payments in 1987 and the Forest Premiums in 1989. These schemes provided an annual premium to compensate for the loss of income from land removed from agricultural production.

An exponential increase in forestry plantings occurred after the introduction of this “compensatory allowance” or annuity, which was designed to overcome the long payback period (Gairdner, 1993). However, this sometimes had negative effects, such as the planting of ecologically significant bog land. It has been estimated that perhaps 20% of the coniferous plantations were carried out on land that has proved unsuitable. Not only were ecological values threatened, but also the plantations were in areas with no natural, commercial advantage for industrial forestry.

Still, as a result of these schemes, the private planting began to increase from 1989 onwards, such that most of the private planting in Ireland have been grant-driven. From 1990 to 1997, 143,090 ha were afforested (17,886 ha/yr), 71,880 ha by farmers (8,985 ha/yr).

Over the period 1990-1995, 95,000 ha were afforested and the total forest area was expanded by 20%. The highest level of afforestation during this period was achieved in 1995, when close to 24,000 ha were afforested. The total forest area in Ireland at the end of 1995 was 570,000 ha, which represents 8% of the total land area of the country. While conifers, mainly Sitka Spruce, represent around 84% of the forest estate and 80% of the planting, an increase in diversity and in the planting of broadleaves was encouraged. Broadleaf planting increased from 3% of all planting in 1990 to 20% in 1995.

In 1996 the Irish government issued *Growing for the Future, A Strategic Plan for the Development of the Forestry Sector in Ireland*. It set a target of achieving a productive forest area of 1.2 million ha by 2030, or 17% of the land area of the country. The basis for the target level was twofold:

to increase annual roundwood production to 10 million cubic meters by 2030 to improve economies of scale and overall competitiveness, and  
to increase the level of farmer planting in the interests of rural development.

Planned afforestation levels were set at 25,000 ha up to 2000 and 20,000 ha per year from 2000 to 2030. The Forestry Sub-Programme of the Operational Programme for Agriculture, Rural Development and Forestry was expected to result in 695,000 ha, or 10% of the total national land area being afforested by the year 2000.

A substantial drop in private afforestation was seen from 1997 onwards. This drop can be largely attributed to schemes introduced by the reforms of the CAP in 1992. These reforms addressed issues concerning rural-exodus, over-production of food at the European scale and the rural environment. However the role of forestry was emphasized by the specific objectives of Council Regulation 2080/92.

Directive 2080/92 enabled the afforestation of around 121,000 ha, which represented 50% of the current area of productive forest of private individuals (200,000 ha in 1996, source: Forestry statistics, 1995-1998 data (2000)). This was a considerable impact, all the more so as the afforestation of private forest is a new phenomenon. Indeed, 70% of the area of private forest was less than 4 years old.

Farmers were the main group targeted with the achievement of the government's afforestation policy. Attractive grants and premiums were put in place to encourage participation in forestry. An

added attraction is that returns from forestry are tax-free. Despite these excellent incentives farmers did not respond in sufficient numbers and the afforestation program ran below target.

The change in the granting mechanism delayed planting decisions and increased competition from other land uses. Grants for afforestation ranged from £1,540-£4,000 per hectare (C\$ 3,155-8,200 per hectare, based on the exchange rate at the time of writing). 75% of the grant was paid upon the establishment of the plantation and the balance four years later on evidence of satisfactory maintenance. In addition, landowners received annual premiums of £90-135 (C\$185 – 275) per hectare per year for 15 years for non-farmers and £145-340 (C\$300 – 700) per hectare per year for 20 years for farmers. In 1997, 11,403 ha were planted by 1,352 applicants (8.43 ha per applicant) at a cost of £14.4 million (C\$29.5 million). A further £13.2 million (C\$27 million) in premiums was paid to 9,207 applicants in that year for a total cost of £27.6 million (C\$56.5 million).

A number of agri-environmental schemes were also introduced by these reforms, providing disincentives to afforestation. These included the REPS, farm extensification & early retirement. Therefore forestry development began to compete with a number of agricultural land-use options, which can in many cases generate the same or higher rates of income.

It is these concerns that led the National Council for Forest Research and Development (COFORD), working with the Forestry Forum, to commission a study on farmers' attitudes to forestry. The aim of this study was to find out the reasons why farmers were not taking up forestry in sufficient numbers and to make recommendations to address these reasons.

The results of the study are set out in the COFORD report (1997), which utilized a farmer survey to assess the government's program. This work identified a specific land-base that was available for afforestation. It shows that if this land-base were planted it would achieve the government targets for afforestation levels set out in *Growing for the Future*. A set of actions to make this happen was proposed as specific recommendations for government and for state agencies.

As an alternative to purchasing land for afforestation, Coillte, Ireland's autonomous self-financing state forestry corporation, implemented a form of joint venture similar to those seen in regions of Canada, in which farmers provide land to Coillte to plant. In return Coillte shares both the income from the afforestation grants and the revenue from timber sales with the landowner. The scheme has allowed Coillte to increase production and offers farmers a form of tax-free income. In the period running up to 1999 there were 216 such schemes involving 4,481 ha (Landell-Mills and Ford, 1999).

A long-term forestry strategic plan created in 1999 provided for 20,000 ha of new afforestation per annum for 2000-2030. These proposals expected to increase forest area to 895,000 ha by 2010 and to 1.2 million ha by 2030, doubling the area under forest in the State from approximately 8% to 17%.

The new Irish forestry regulatory regime, as introduced in December 2001 by the European Communities Regulations, 2001, removed initial afforestation from the planning acts, and initial afforestation is now 'exempt' from planning permission requirements. A new forestry consent procedure, governed by the Minister for Communications, Marine and Natural Resources, allows for public participation in the consent process through a system of public notification via local newspapers, with a period for comment. Provision has also been made for consultation with specific bodies including Dúchas, The Heritage Service and An Taisce - the National Trust for Ireland. The new regulations lower the thresholds for mandatory Environmental Impact Assessment from 70 to 50 ha. Provision for requiring an EIA below the threshold has also been included where there may be significant environmental impacts.

Currently, most afforestation is being carried out by Coillte Teoranta and by private management companies on behalf of private individuals (Maguire, 2001). Such arrangements do not require



any legal framework for acquisition of land as no change in land ownership occurs. Furthermore, although national planting targets outlined in current forest policy (Department of Agriculture, Food and Forestry, 1996) are quite ambitious, an accelerated level of private planting is very likely due to the recent change in Rural Environmental Protection Scheme (REPS) policy. Until 2000, farmers were not permitted to plant land that was to be included in the land designated for their REPS schemes. This discouraged farm forestry. Now farmers who are participating in REPS may also receive forestry grants and premiums (although they may not receive both types of payments in respect of the same land).

## **Netherlands**

The Netherlands is a small, low-lying and densely populated country. It has a land area of 34,000 km<sup>2</sup> with about 24% of the land lying below sea level. About 27% of the land is devoted to urban, infrastructure and other uses, 10% to forest and 59% to agriculture, the remaining 5% being natural land. The Netherlands has a coastal climate strongly influenced by the oceanic effect, making its climate much milder on average than that of other countries at the same latitude.

The Netherlands has a very limited forest area, which provides only 10% of the country's demand for forest products. Efforts have been underway since the nineteenth century to increase afforestation initially in poor land, with more recent efforts aimed at the improvement of ecological values of these areas. Approximately 20% of the forest area is exclusively reserved for ecological functions. Only about 20% of the forest is formed by mixed stands, and the biodiversity of these young forests is increasing as a result of reducing clear-cut areas or adopting shelterbelt systems, increasing rotation periods, promoting indigenous tree species (including local provenances) and mixed stands, increased natural regeneration and conservation of dead wood. Forest condition and biodiversity are affected by high levels of nitrogen deposition.

At the beginning of the 19th century, most of the forest land was managed as coppice or coppice with standards. Only a few relicts of undisturbed forest remained in the Netherlands. Tree species used were mostly indigenous species. Exotic species were mostly used as curiosities in forest parks. The forest area was part of the common marches as was also waste land. There was little or no interest in long term investments for production of merchantable timber. Short term use of the forest took place: the forest area was devastated by intensive use of the forest.

Regulations on the common marshes were ended in the period 1800-1810. In the period 1810-1850 former common marshes were divided and sold to institutions and/or private individuals. Large scale plantations started in the period 1850-1900 by forestation of waste land (protection forest against sand drifts, introduction of artificial fertilisers) and establishment of high forest as long term investment. Mostly *Pinus Sylvestris* is used and also a substantial area is afforested with introduced exotic species as *Pseudotsuga menziesii*, *Larix* species, and *Pinus nigra*-species (TBFRA-2001).

In the period 1900-1950 afforestation of waste land continued. During World Wars I and II the forested area diminished. The main part of the forest in this period was managed as high forest. An important product is logs for the mining industry. Nearly all coniferous forests are managed as plantations.

After 1950 the mining industry lost its important role: the last mine was closed around 1968 and so the market for logs was lost. Economically important is roundwood production for paper, fibreboard and sawlogs. The forest area with exotic species has remained fairly constant in the last 40 years. As a result of greater emphasis on recreational, landscape and nature aspects of the forest area the deciduous forest area has rapidly increased in the last 40 years while the coniferous 'production' forest area has remained fairly constant.

Based on existing forest expansion policies under the Regional Scheme for Green Areas (1995), the main principle of Dutch policy is to ensure that the number of trees planted annually exceeds the felling rate, so that in 2020 the forest will be 20 to 25% larger, in terms of hectares covered, than in 1995 (FCCC, 2001).

Current afforestation policy is laid out in the domestic forestry plan. The target of this Plan is to afforest an area of 75,000 ha in 25 years representing an increase of over 20% of existing forested area. Of the total additional area, 30,000 are to be afforested by farmers following European Union proposals. In addition, there is government finance to afforest a further 25,000 ha. The remainder will be achieved through voluntary activities.

In order to speed up the forest expansion, a system of forest certificates is being introduced equivalent to the estimated CO<sub>2</sub> sequestered as an added stimulus for land owners to plant forests. It is envisaged that these certificates will be purchased by target groups needing to lower their own CO<sub>2</sub> emissions. Although Dutch officials have noted that forest expansion is not a low-cost climate mitigation measure, they believe that forests provide other benefits (FCCC, 2001).

An important part of forests in the Netherlands (about 57,000 ha) is also owned by private nature conservation organizations. These organizations are subsidized by the government and have environmental protection as a main goal, although sometimes harvesting is practiced as long as it does not obstruct their primary mandate.

## **Norway**

Norway, which stretches 1,752 kilometres on the east coast of the North Sea, has highly dispersed settlements. Out of a population of around 4.4 million in 1997, about three quarters of a million lived in the capital Oslo and its surrounds, in the south-eastern part of the country. Norway is rich in natural resources, having significant offshore oil and natural gas reserves and also significant hydroelectricity resources. Norway has limited land resources available for farming, with only about 3-4% of Norway's land area of 306,253 km<sup>2</sup> currently under cultivation. The total size of agricultural areas in use has remained stable during the last few decades, but the importance of agriculture to the national economy has been declining.

Since the first forest inventory in 1925, the annual increment of Norway's forests has been larger than the harvest. As a result, the volume of the growing stock has more than doubled since 1925. Forests now cover some 29% of the Norwegian land area (TBFRA, 2000). In 1999, the net increment (annual increment minus roundwood removals and calculated natural losses) in Norwegian forests was 11.6 million m<sup>3</sup>, or 1.7% of the total volume. Most of the plantations are located in the coastal districts of western and northern Norway, the majority of which were established in the 1960s and 1970s.

Guidelines for strategic planning of forestry at the municipality level were introduced in 1993, at which time a wide variety of forestry and environmental aspects were integrated into the planning stage to reflect an increasing environmental consciousness. Forestry activities are generally supported by providing owners with tax advantages, but all financial support schemes were revised in 1994 to improve the preservation of biological diversity. The financial support schemes now favour environmentally sound investments, and all support schemes require that forest owners take environmental value into consideration.

Data from inventories carried out by the Norwegian Institute for Land Inventory show that the total volume of the growing stock, without bark, below the coniferous forest line was on average 648 million m<sup>3</sup>, in the period 1994 - 1997. This consisted of 46% spruce, 33% pine and 21% broadleaved trees. In 1996, the net increment in the growing stock was about 11.6 million m<sup>3</sup> or 1.8% of the total volume.

About 80% of the forest is in private ownership and only around 1% is protected by the State. The economic importance of forestry declined during the 1990s as a result of low timber prices and moderate harvesting. However, in some rural areas, forestry is still important economically, and the export value of timber is considerable, corresponding to 4.3% of total exports in 1999.

The registered level of silviculture activities has been dropping for several years, while other uses of forested areas have become more important. This may be partly explained by the fact that thinning accounts for a rising proportion of roundwood cut, and partly by the fact that clear-cutting and replanting are, to some extent, being replaced by logging techniques that ensure a larger degree of natural regeneration.

Forest policy consists of regulations, including certain requirements for reforestation in particular, economic support schemes, research and information programs. The Forestry and Forest Protection Act, established May 21, 1965 (as amended and with separate regulations), prohibits the cutting of growing forest, and provides for State funding of planting and other silviculture activities. The average support for planting amounts to around 30% of total costs, but support can vary from nothing up to 80% of project costs.

The Forestry and Forest Protection Act is the most important regulation in terms of forest practices in Norway. The overall goal of the Act is to “promote forest production, afforestation and protection of forest land while allowing for the functions of forests as sources of recreation, major landscape features, living environments for plants and animals, and as hunting and fishing grounds” (Royal Norwegian Ministry of Agriculture, 1994).

The Forest Act applies to all categories of owners. It is based on the fundamental principle of freedom with responsibility for the individual owners. The law, however, contains provisions that empower the authorities to take action when necessary, and to prohibit or place conditions on afforestation, introduction of new tree species, and other activities.

Construction of forest roads is regulated by separate regulations, such that all road construction must be reported, and plans as well as finished roads must be officially approved. Forest practices and operations may be subject to special restrictions in areas of particular recreational or environmental value. The Forest Act contains provisions dealing with forest land where location, condition or characteristics are such that it must be managed with particular care. The intention is to maintain the protective or protected function of the forest stands in question, while permitting economically feasible forestry operations. Protection forest may include forested land that protects other forest or farmlands, as well as forests growing at high elevations, along the coasts or in the far north (Royal Norwegian Ministry of Agriculture, 1994).

## **Forest Trust Fund**

The Forest Trust Fund affects how smaller private forest holdings in Norway are managed through tax incentives for private landowners. The influence of the fund is limited to holdings with an average annual harvesting potential below 3,000 m<sup>3</sup> in the most important forest areas. Its tax incentives are perhaps the single most important taxation scheme for non-improved private forest (NIPF) owners in Norway. The history of the Forest Trust Fund dates back to 1932, when the first Forest Protection Act was passed. A mandatory investment system requires funds to be collected from private forest owners and reinvested in forest lands according to rules established by the Ministry of Agriculture, Forest Department. When timber is sold, 5% to 25% of the value is deposited into a trust fund for a given forest property. Each forest owner is free to set the percentage from year to year according to his or her financial situation, investment plans, etc., but permission is required to set it below 8%.

The trust fund is effective because the forest owner does not pay income tax on the amount deposited in the fund. When money is withdrawn from the fund and applied to long-term investments, such as silviculture and road construction, a significant proportion of the money can

still be deducted from annual income taxes. Depending on the owners' marginal tax rate, the tax effect may result in a 50% to 60% reduction of the total cost of the activity (Oistad et al., 1992).

Forest landowners do not receive the interest earned from their trust fund. According to the Forestry and Forest Protection Act, the interest is for the "common benefit of Norwegian forestry." The money is distributed to forest authorities at national and regional levels and to the forest owners' associations where it is used according to guidelines developed by advisory boards at the different levels. The interest is an important source of funding for informational activities, extension services, study tours, and equipment rentals. The Norwegian Forest Society and Women in Forestry are two of the organizations supported by this fund.

### **Income tax**

Forest owners pay income tax on their average net income for the last 5 years. The net annual result is calculated as income minus costs. The most important income is usually from timber sales. Harvesting, hauling, and silvicultural treatments are all costs. Forest roads are treated differently according to their quality and expected durability. A 5-year mean was originally used to reduce the effects of progressive income tax for owners with irregular harvests, a factor that is less significant after the tax reform of 1992. The system results in a delay in tax payments, which lowers the forest owners' actual tax rate. Special regulations apply when buying or selling a forest holding, which can also inflict on the actual tax payments (NLH, 1998).

### **Property tax**

Property tax of a forest holding is paid according to the value of the forest "as a durable source of income if in appropriate use", according to a system defined by tax authorities. The average annual harvesting volume is calculated according to monitored volume stock and age class distribution. This average is then used to calculate net value according to prices and costs, which is then capitalized (NLH, 1998).

### **Inheritance tax**

When somebody is buying a farm from a close relative, he or she has to pay inheritance tax. Special regulations apply to tax rates according to value, but the tax is paid both on the estate and on a gift, which is often a part of the agreement for such transactions. With regards to estate tax, the value is calculated according to a continuing use for agriculture and forestry production.

Harvesting from the forest has a long tradition in Norway, and up to the beginning of this century, the annual harvest was larger than the gross increment. Since then, there has been an increase in the standing volume of Norwegian forests based on annual surveys.

## **7. Sweden**

The Kingdom of Sweden is located on the Scandinavian Peninsula in northern Europe. It is situated in Scandinavia between Norway and Finland, with a long coastline on the Baltic Sea. Apart from mountains in the north west, Sweden is relatively flat.

The warm Atlantic Gulf Stream gives Sweden a milder climate than other parts of the world equally far north. The population of 8.8 million predominantly lives in the south, especially around Stockholm, where in summer the average temperature is about 18° C, while winter temperatures are slightly below freezing and snowfall is moderate. About 15% of the population lives in northern regions of the country, where they experience long cold winters.

About 3% of the labour force works in the agriculture sector and in 1995 it was estimated that less than 10% of land area was devoted to farmland. Special measures are taken to promote agriculture and rural development, particularly in northern Sweden, where natural conditions make agriculture less productive. Compensation aims at preventing transformation of arable land to other land uses, such as forestry.

Forests cover about 27.5 million hectares of Sweden's 45.2 million hectares, but only 22.5 million hectares of managed productive area is covered by the inventories. Sweden has rich natural supplies of coniferous forest, which accounts for more than half of all land area. The forestry industry is important for Sweden with a turnover of about SKr 200 billion per annum and a workforce exceeding 100,000 people.

Since the 1920's the growing stock in Sweden's forests has increased by more than 60%. The annual increment in the forest today is almost 100 million m<sup>3</sup> standing volume. Most of the annual forest increment is due to forest management practices and it is believed that if silviculture were to cease the timber volume would return to a natural, lower level. Thus the potential to increase forest coverage is limited and there are no specific climate change related policies in this sector. About 1,600 to 2,800 ha are lost per annum owing to forest fires and forest inventories include adjustments for this.

The total standing volume today is almost 3 billion m<sup>3</sup>, corresponding to about 320 m<sup>3</sup> per person. More than three quarters of the forest is available for wood supply, the remainder is not available mainly for conservation and protection reasons. As much as one sixth of the forest is classed as undisturbed by man, most of the rest as semi-natural, with small areas of plantations. About 87% of forests are privately owned, and around half of this is owned by private, small-scale forest-owners. The latter is often referred to as family forestry and is more common in the southern parts of the country. Forest companies own almost 40% of the forest land, mostly in the northern parts of Sweden. The state owns the remaining 13%.

The average forest area in family forest is estimated at around 42.4 ha. There are about 350,000 private owners, 70% of which live on their properties. One-third of the private forest-owners are women. There is constant change in ownership, and in recent years the state is increasing its share. In recent years most of the state forests have been reorganized into companies.

Hunting, which is closely regulated, and nature conservation are major forest functions, as is the collection of non-wood forest products, but the supply of wood to the large wood-processing sector remains the most important individual function.

In southern Sweden by the 1600s, large areas of forests had been transformed into grazing lands or agricultural fields. With the beginning of the industrial revolution in the UK, there was an increased demand for timber from Sweden. This, added to timber consumption from a growing Swedish population, led to further deforestation, while livestock grazing in forests contributed to forest degradation in many areas. By the 1850s, the area of forest in southern Sweden had sunk to an all time low since the last ice age. This prompted concerns in the government and administration, which spread to parliament and led to the adoption of the first national Forest Act in 1903. This act sought to promote forest regeneration in harvested areas and established County Forestry Boards, which exist to this day, to encourage this. Since 1850, the area of forest in southern Sweden has recovered to above the level in the 1650s. The forests are different however, with Norway spruce predominating, instead of mixed forests of coniferous and deciduous species.

Many of the forests in south and central Sweden were restored since the mid-19th century on abandoned agricultural land. Coniferous species, of which the most important are Scots pine and Norway spruce, account for more than four fifths of the growing stock volume. Birch is the main broadleaved species, with some aspen, alder, oak, beech and ash. Net increment per hectare, at

about the European average, is higher than fellings, resulting in a steady expansion in growing stock.

Forest policy in Sweden has been expressed in a number of Forestry Acts since the first one in 1903. Among a number of revisions, a commission of inquiry was established in 1973 to work on a new Act. This commission predicted serious overexploitation of Swedish forests in the first part of the 21st century, because in 1970, for the first time since the 1920s, forest fellings exceeded growth (SOS, 1997). In consequence, they recommended a range of measures (including subsidies for silvicultural activities, and the possibility of requiring forest owners to harvest timber on their lands) to increase production. These were largely adopted in the new 1979 Forestry Act. As a result, this Act was very production-orientated.

While the standing volume of trees has been increasing this century, timber felling has been on a slightly upward trend since 1980. Until the late 1980s there was a heavy policy emphasis on increasing wood and fibre production, although Swedish NGOs began expressing concerns about the environmental impacts of forestry in the 1960s (Eckerberg, 1994). It was in the late 1980s and early 1990s that quantitative evidence began to emerge about the impact of forestry practices on forest-dependent species. Awareness of the preservation of biodiversity became important in the public's eye during this period, such that the issue gradually led to a reframing of the Act to focus on biodiversity issues.

Grants for the afforestation of arable land were undertaken starting in 1990 within the framework of the agricultural realignment programme, but actual implementation was considered to be limited. According to the Agricultural Register, more than 14,000 ha of cropland were afforested between 1990 and 1993.

In 1993/4, changes in the Forestry Act, therefore, reflected the increasing importance of biodiversity and the preservation of species as environmental and production goals were given equal priority. Striving towards deregulation and less state intervention, the Act was also reworked so that there is less regulation on forest owners, but greater responsibility to fulfil policy goals and penalties in the event of failure to comply. Consequently, the new policy relied, to a great extent, on the good-will of the forest owners. The role of the forest owner in Sweden was thus changed to that of a "caretaker", who is responsible for determining the future state of the forest. The owners are required to specify the method for regeneration and the environmental measures to be taken in final felling. If the costs are too high, the owner is eligible for subsidies.

As a result of the decision in Parliament in 1993 on Forest Policy, regulations under this policy also required that about 4% of the managed forest is protected by law for conservation or recreational use. In part because of this, state funds for buying forest land for nature reserves, especially in the south and east of Sweden, were increased by 50%. At the same time, EU funds were allocated to help finance training in forestry conservation. As a result of the new parliamentary decisions, the 1994 budget of the Forestry Administration was increased to around US\$ 37 million, one-third of which was state-derived and the remainder from contractual services provided to forest owners and other state authorities.

Legislation under the new Forestry Act required that:

New forest must be planted or naturally generated after felling when the land's capacity to produce timber is not fully exploited. Planting or measures for natural regeneration must have been completed by the end of the third year after felling.

Disused agricultural land must be reforested within three years of the land falling into disuse. This does not, however, apply to land to be protected for its natural characteristics or its cultural heritage.

Reliable methods and suitable species of trees must be used in the forestation work. Natural regeneration can be a good method if the site is suitable. Otherwise, the land must be sown or planted. Soil scarification is often a prerequisite for good results.

If there are insufficient numbers of seedlings, supplementary planting must take place before it is too late. Subsequent weeding and thinning may be necessary.

The Act also eased up on certain regulations in force prior to 1993. Obligations of landowners were considerably eased, such that:

- Minimum rotation ages were shortened. For the poorest Scots pine sites this meant a reduction from 130 years to 110 years, while reduction was from 65 to 45 years for the best Norway spruce sites.
- More species were allowed when measuring the number of seedlings required for acceptable regeneration.
- The allowable cut on forest estates was increased.

In addition, Government Bill 1995/96:76 stated that Sweden, as a member of the EU, must introduce a supportive programme for the afforestation of arable land in keeping with EEC Council Regulation 2080/92. The afforestation programme was allocated approximately US\$24 million annually over the subsequent four-year period.

While the afforestation rate in the 1980s was about 30 square kilometres per year, under the new legislation approximately 100 square kilometres per year were afforested. In 1996, timber stocks grew by about 100 million m<sup>3</sup>, whilst fellings and natural mortality resulted in a 70 million m<sup>3</sup> reduction, and over 90% of fellings went to sawmills or the pulp and paper industry.

In the same year, the forest sector employed around 26,300. This is less than 1% of people employed by all branches of industry that year. The wood processing industry employed 44,400 people (1.1%) and the pulp, paper, and paper goods industry employed 49,200 people (1.2% of all branches of industry) (Skogstyrelsen, 1997).

The National Board of Forestry and local Boards work with a broad representation of stakeholders, and the necessity for participation is stressed. The extension service has also changed its emphasis for increased forest yield and now covers guidance on nature conservation. Since the late 1980's about 100,000 forest owner and forest employees have been involved in a special educational campaign called "Richer Forests". Publicly funded campaigns are run to make foresters more environmentally aware. To promote silviculture, each of the 11 county forestry boards is required to draw up action plans with specific goals involving improvements in forestry practices.

In their 1999 submission to the IFFF, Sweden estimated that Swedish forests would continue growing at the 1999 annual rate of about 100 million m<sup>3</sup>. They theorized that as global demand for paper was expected to grow at about 2.8% per annum until 2010 and as demand for biomass in energy production grows, logging rates are expected to increase. By 2020 annual fellings are expected to exceed 80 million m<sup>3</sup>, compared to current levels of about 66 million m<sup>3</sup>, based on a five-year average.

In this context, the Swedish Parliament recently decided on the following interim targets for Sustainable Forests:

1. A further 900,000 ha of forest land in need of protection will be excluded from forest production by the year 2010.
2. The amount of dead wood, the area of forest with a high proportion of deciduous trees and old-growth forest will be maintained and increased by 2010 by:

increasing the quantity of hard dead wood by at least 40% throughout the country and considerably more in areas where biological diversity is particularly at risk;

- increasing the area of established forest with a high proportion of deciduous trees by at least 10%;
- increasing the area of old-growth forest by at least 5%;
- increasing the area regenerated with deciduous forest.

## **United Kingdom**

The UK covers 24.3 million hectares (ha) of land most of which is in commercial use. Agriculture accounts for about 18.4 million ha; forestry for nearly 3 million ha (includes England, Wales, Scotland and Northern Ireland, NIWT, 2001); and the remaining 3.5 million ha is largely urban (FCCC, 1997). The proportion of land used for agriculture has declined over the past 20 years and that for forest and urban woodland has increased. The UK has a strong system of land use planning and encourages new development to reuse brown-field sites wherever possible.

Around three-quarters of England's woodlands and forests are privately owned and about one-quarter are public forests managed by the Forestry Commission (FC), through its agency Forest Enterprise. There are many thousands of small farm woodlands, but few ownerships with more than 100 ha (250 acres) of woodland. Management of woodlands for sporting activities and amenity is an important objective on many woodland estates and on farms. Timber production is typically important on the larger estates.

England was once largely covered with woodland, but over many centuries this was cleared and used to meet the needs of an increasing population. Around 6,500 years ago most of the country (80%) was covered in forests, but by the time of Roman rule in 43AD there was probably only around 20% of Britain covered in forest. Trees continued to be cut down, such that 1,000 years ago England's woodland cover had declined to around 15% of its land area. By the beginning of the 20th century it had reached a low point of around 4%, and most of the timber used in Britain was imported from other countries.

In 1919 the government decided that more trees had to be grown in Britain to provide the timber products that were needed. To do this the Forestry Commission was set up, as part of the government, and given the job of creating new forests. Fast growing softwood trees like Larch, Sitka Spruce, Norway Spruce, Douglas Fir, and Scots Pine were often chosen as they were the quickest way to produce timber. The Forestry Commission's target was to have 2 million acres (833,000 ha) of forest by the year 2000. This target was reached by 1983. Now the total area of forest in Great Britain has increased to over 11%. Today, Britain imports more than 80% of the wood it needs; four out of every five tonnes. It is Britain's fourth biggest import at an annual cost of £6 billion.

A National Inventory of Woodland and Trees (NIWT) was commissioned in 1994 and the survey fieldwork for Great Britain was completed in July 2000. Survey results concluded that the total area of woodland in England is 1,096,885 ha, which represents 8.4% of the land area. Broadleaved woodland is the dominant forest type representing 52.1% of all woodland. Conifer woodland represents 25.6%, Mixed woodland 12.3% and Open Space within woodlands 6.5%.

The main broadleaved species is oak covering 158,665 ha or 25% of all broadleaved species. The main conifer species are pines covering 129,593 ha or 38% of all conifer species. A total of 222,694 ha or 22% of woodland over 2 ha is owned by or leased to the Forestry Commission, and 799,128 ha or 78% of woodland is in other ownerships.

## **Forest Policy**

United Kingdom forest policy is not determined by its climate protection policy and has been working to different imperatives since it started in 1919. In the last decade afforestation has



aimed at a rate of 20,000 to 30,000 ha/yr, although this target was only achieved during the 1994/95 fiscal year with actual planting rates reaching less than 19,000 ha/yr for the rest of the period (British Forestry Statistics 2002). The rate of carbon fixation is estimated to be broadly static at 2.5MtC/yr, equivalent to 1.5% of the United Kingdom's CO<sub>2</sub> emissions.

In its 1995 White Paper Rural England, the UK Government said it would like to see a doubling of woodland in England over the next half century. To take forward this objective, the Forestry Commission and the Countryside Commission have published a discussion paper to develop the debate about the priorities for woodland creation and stimulate thinking about how the target could be achieved.

There have been a range of other changes to land use that are expected to increase the carbon reservoir, including non-rotational set-aside - part of the reform of the EU Common Agricultural Policy - under which most farmers must set aside (i.e. take out of production) a percentage of their arable land (10% in 1996 reducing to 5% in 1997). Since 1 July 1995, farmers entering eligible land into certain agri-environment and forestry schemes have been able to count this land against their set-aside obligation under the Arable Area Payments Scheme.

In the United Kingdom, 93% of the plantings made under Directive 2080 were in two regions: Scotland with 67% and England with 26%. These plantings represented 8% of the productive forest in Scotland and 4% in England.

In periurban areas, plantations on agricultural land acquire the status of "industrial land", which leaves the owner with the option of clearing the land after the 20 years of aid, subject to administrative authorization. Whereas arable land could not be built on, passing through wooded status makes it possible to obtain permission to build on this land.

The national forest programme for the UK is not contained in a single document, but in a number of key documents. The UK Forestry Standard, published in 1998, sets out how these principles of sustainability will be delivered in practice, bringing together in one document a wide range of detailed guidance. The Standard:

- explains the international and domestic setting in which guidance and regulation of forestry has developed;
- sets out the criteria for sustainability in forestry and the indicators by which they can be assessed, not only at the national level but also locally by forest managers;
- commits the Government to monitoring performance against these criteria.

In 1998 the Government also published a Forestry Strategy for England. The strategy 'A New Focus for England's Woodlands' sets out the Government's strategic priorities and programs for forestry in England. The strategy is founded on four guiding principles of quality, integration, partnership and public support.

## **Planting Programs**

Very few, if any, woodlands in Britain are planted without some form of grant, and there are a range of incentive schemes for new planting. Two main initiatives, however, are responsible for most of the planting. The Forestry Commission offers grants to landowners through the Woodland Grant Scheme (WGS) and operates the Farm Woodland Premium Scheme (FWPS) on behalf of the Agriculture Departments in England and Wales and the Rural Affairs Department in Scotland.

The Farm Woodland Premium Scheme (FWPS), which replaced the pilot Farm Woodland Scheme (FWS), encourages farmers to convert productive agricultural land to woodland and makes annual payments to help offset the agricultural income foregone. Around 46,000 ha of new woodland have been approved in the UK under these two schemes. This amounts to some 50 million trees.

## **The Woodland Grant Scheme (WGS)**

The WGS is operated by the Forestry Commission (FC) and offers establishment grants for new woodland and management grants for existing woodlands. The FC is also responsible for operating felling controls for existing woodland and offering grants to assist and encourage the proper management of mature forests. The scheme provides grants for planting at different rates for conifers and broadleaves, and also includes locational supplements in some areas. The Scheme also offers Challenge Funds in which you can bid for money to carry out work in existing woodlands in specified areas of the country.

The Forestry Commission also issues licenses to fell trees where appropriate, but normally require the owner to replant the area. There is a statutory requirement that the FC consults on certain grant or felling license applications; for some other applications they make arrangements with the stakeholder to undertake local consultation. In both circumstances, they send copies of the applications to the relevant Local Authority and other statutory bodies, who are given 28 days to consider the details of the application and make comments to the FC.

When the FC receives details of an application for new planting and felling, they normally visit the site and check the proposals carefully. Once they are prepared to approve an application, details are entered on the Register of New Planting and Felling, which is maintained to provide information to the public. The Register gives information about the geographical location of the proposals and about the scale of the operations.

Information about a particular case remains on the Register for four weeks. During this time anyone can submit comments to the FC about the proposals or ask to see further details of the application before doing so. The FC then takes account of all the comments they receive and may ask the applicant to modify the proposals if necessary. Once all the requirements are satisfied, the FC approves the application and issues the WGS contract. Details of approved applications are also shown on the Register for four weeks. Details of many applications, particularly those in sensitive areas, are sent to local planning authorities under formal consultation arrangements with the FC.

## **The Farm Woodland Premium Scheme (FWPS)**

The FWPS scheme encourages tree planting on farmland, and provides annual payments to farmers to replace income foregone for approximately either 10 years or 15 years, depending on the trees planted and how they will be managed. The scheme is essentially designed to encourage the creation of new woodlands on farms. FWPS can only be given where WGS is also payable, as the environmental and silvicultural standards of the WGS must be satisfied before an FWPS application can be approved.

The stated objectives of the FWPS are:

‘To enhance the environment through the planting of farm woodlands, in particular to improve the landscape, provide new habitats and increase biodiversity. In doing this, land managers should be encouraged to realize the productive potential of woodland as a sustainable land use.’

The statutory basis for the scheme is contained in EC Regulation 2080/92, the Farm Land and Rural Development Act 1988 and the FWPS Statutory Instrument.

To receive annual payments over 15 years, more than 50% of the area of the wood must be planted with broadleaved trees, and/or native Scots pine. (Native Scots pine will only qualify for

payments for 15 years in the case of a native Scots pinewood within the range of Scots pine in Scotland). The wood must not be felled within the 30 years following the first annual payment. Silvicultural thinning during that time is allowed, so long as the wood remains mainly broadleaved. Nurse trees, which are to be removed from the woodland, are not included when determining the percentage of the area planted with broadleaves.

Other woodlands (i.e. generally those with 50% or more of the area of the wood planted with conifers) will receive annual payments for 10 years, so long as they are not felled within 20 years of the first annual payment. If a grant recipient is planting fast growing broadleaves that will be felled in less than 30 years (e.g. poplars), they will also receive payments over 10 years, so long as the trees are not felled within 20 years of the first annual payment. Woodlands that are to be felled before 20 years are not eligible for FWPS.

Payment rates depend on both the quality of the land used under the scheme and the geographical location of this land. For example, rates of payment range from L60/ha/yr for afforestation on unimproved land in what is considered to be the "less favoured area" (LFA), to L300/ha/yr on arable land located outside of the LFA. Land quality ranges from "Arable Land", to "Other Improved Land", to "Unimproved Land", while the LFA scale ranges between "Outside the LFA", to "LFA Disadvantaged Areas", to "LFA Severely Disadvantaged Areas".

Rates of annual payment are reviewed at least every five years, and the reviews take account of relevant factors including trends in income from comparable agricultural land. The rates of annual payment could, therefore, go down as well as up in certain circumstances. Any changes in rates have to be approved by Parliament.

The WGS is currently being phased out, and will largely be replaced by the Scottish Forestry Grants Scheme (see below). In order to assess the effectiveness of the WGS, a joint Forestry Commission/DEFRA public consultation was carried out between May and August 2002, including a survey of a relatively small sample of stakeholders.

## **Evaluation of the Schemes**

As part of the review process the Forestry Commission and DEFRA commissioned consultants to carry out an evaluation of woodland creation under the WGS and FWPS. A steering Group was set up by the Forestry Commission and DEFRA to oversee the process and worked to terms of reference agreed by the Forestry Minister. The Steering Group was a non-executive Forestry Commissioner, and had a diverse membership with representatives of woodland owners and managers, rural businesses, Government agencies and Wildlife and Countryside Link. It reported to FC and DEFRA officials in November 2002.

In addition to the public consultation and consultants' evaluation the Forestry Commission used two focus groups and an expert consultation to further inform the review.

This study found that over the period of the evaluation (1992/93 to 2000/01) the total area of new woodland created in England, on which grants have been paid, totals approximately 41,925 ha and of this 22,070 ha (52%) were created using the WGS and FWPS and 19,855 ha (48%) using WGS only. This represents an increase of approximately 3.8% in the woodland area in England. The majority of participants in the two schemes have been individuals, estate owners or farmers. The main motivation for involvement in the schemes has been environmental and social rather than economic.

The average area of new woodland planted under WGS was approximately 1 ha and approximately 3 ha under WGS with WGS/FWPS. Under both WGS and FWPS the predominant species planted were broadleaved. The total amount of new planting, and the amount planted under WGS/FWPS, increased from the North to the South of England. Most of the land planted was previously in arable use (58%) with lesser amounts on improved land (37%) and unimproved

land (5%). Approximately 20% of all new woodlands created between 1992/93 and 2000/01 have received grants to provide community benefits through increasing access or recreational opportunities.

Non-participation in the scheme appears to reflect farmers' lack of experience with forestry; tenancy restrictions on planting; perceived loss of agricultural income, and the lower level of forestry incentives compared with agriculture. Overall WGS expenditure on woodland creation alone has risen from £4m in 1992/93 to £10m in 2000/01. Expenditure per year on FWPS has risen from £1.36m in 1994/95 to £4.5m in 2000/01 at current prices.

A survey of a relatively small sample of stakeholders suggests that WGS and FWPS are seen overall as performing relatively well in delivering economic, environmental and social benefits post 1992. The schemes are judged to have done relatively well in generating environmental benefits over the early years of creating woodlands, but stakeholders felt that it was too early to expect economic or social benefits to emerge, especially as the average new planting scheme has been small. The Evaluation concluded that the movement in Government policy to deliver sustainable rural development and the distortions arising from CAP support that tend to discourage tree planting on agricultural land provide a strong case for public sector intervention through grant support for woodland creation.

While the number of landowners consulted was relatively small, the surveyors felt that outputs provided a good deal of detailed information. It was concluded that, in their current forms the Woodland Grants and Farm Woodland Premium schemes only partially satisfy the range of needs expressed by the groups consulted. Primarily the current criteria for grant aid would need to be changed or broadened to include and encourage a wider range of potential projects. With respect to timber production, the grants schemes require a radical overhaul if the commercial timber industry is to have any opportunity of survival in the longer term.

### **The Scottish Forestry Grants Scheme (SFGS)**

The new SFGS will open to new applicants on 16th June 2003. Following publication of the Scottish Executive's Scottish Forestry Strategy 'Forests for Scotland' the opportunity was taken to review the Woodland Grant Scheme and the Farm Woodland Premium Scheme and give them a greater Scottish focus. The resulting new scheme will encourage the creation and management of woods and forests to provide economic, environmental and social benefits now and in the future.

Grants will be made available under three main areas:

- Grants for woodland expansion: creating new woodlands,
- Restocking grants, for replanting following felling, and
- Stewardship grants for a range of activities in existing woodlands.

For planting on agricultural land a landowner may be able to claim annual payments under the Scottish Forestry Grants Scheme: Farmland Premium (SFGS:FP) from the Scottish Executive Environment and Rural Affairs Department (SEERAD).

Under SFGS, grant payments will be based on a contribution of standard costs of forestry operations. Depending upon the level of public benefit, grant payments will either be at 60% or 90% of the standard cost. However, in the case of restocking, standard cost will be set at 75% of the new planting standard costs.

## **The Scottish Experience**

Scotland has nearly two billion trees growing across more than 1.3 million ha, or around 17% of Scotland's total land area. This makes Scotland the most wooded country in Britain, and Scottish trees account for almost half of all Britain's woods and forests. The amount of tree cover in Scotland is still growing as about 10,000 ha of new woodland are planted annually, as well as replanting where trees have been harvested.

About 36% of all of Scotland's woods and forests (around 478,000 ha) are publicly owned, and are looked after by the Forestry Commission on behalf of the people of Scotland. Private landowners (including farmers and crofters), communities, local councils, and voluntary organizations such as the National Trust for Scotland, the Woodland Trust and The Royal Society for the Protection of Birds own the other 64% of Scotland's woods. Of this, up to 20,000 private owners own more than 1 ha, about 5,000 own more than ten hectares; and about 1,000 own more than 100 ha.

Only about 10% of Scottish forests are natural, or 2% of the land area. Most forests have been planted relatively recently and 82% of these are conifers (spruce, pine, larch and fir) that grow fast in Scotland's mild and wet climate.

In the Middle Ages, trees were cut down to make hunting forests in Highland glens and in the Lowland valleys. Flocks of sheep grazed on the Border hills, eating seedlings and preventing regrowth of the woods. There were still large forests in the Highlands, and birch wood was an important part of the economy. By the 1500s Scotland was already importing wood from the Baltic.

In 1503, the Scottish Parliament passed an act to encourage tree planting, saying that the forests of Scotland were 'utterlie destroyit'. Landowners began to plant woods to enhance the grounds around their great homes.

From around the 18th century, landowners began to improve traditional farming practices. They planted trees to create shelterbelts to protect their livestock. They also planted trees to create attractive parkland and 'policy woods' around their homes. Between 1750 and 1850 some 200,000 ha were planted in Scotland.

The Napoleonic Wars (which ended in 1815) restricted wood imports, and demand for home-grown wood reached a peak. By 1900, Scottish tree cover had declined to about 5% of Scotland. Scottish forestry had fallen into decline, due mainly to increased exploitation of timber in other parts of the world, the removal of the timber import duty and the transfer of land to new owners more interested in its 'sporting' qualities.

The pressure on woodlands increased even more when even larger areas of woodland were cleared during the Second World War. After the war, the Forestry Commission bought large areas of land for tree planting and gave grants to private landowners to plant trees to rebuild the forests. Since 1947, Scotland's tree cover has nearly trebled from 513,000 ha, or 6.6% of land area, to 1,318,000 ha, or 16.9% of the land area.

Thus, over the past 80 years, commercial forests, predominantly of Sitka spruce, have been established on a large scale throughout the uplands of Scotland. The techniques used to achieve this have tended to be intensive, often with deep ploughing and network drainage followed by herbicide and/or fertilizer input. Plantations required insecticide application in peat soils, and serious windthrow problems were encountered.

Scotland provides an example of the disadvantages in trying to make too much land available for afforestation. In the late 1980s, government support for private forestry in the Flow Country of Scotland led to tree planting in many areas where it was considered environmentally

inappropriate, especially as plantations were of exotic species. A public outcry led to the zoning of areas for afforestation.

As a result, government policy over the last 10-15 years has shifted away from the planting of new commercial forests, seeking instead to encourage the creation of new native woodlands, often on very wet, exposed and nutrient-poor sites in the Highlands. The intensive establishment methods used successfully with commercial species are not considered to be sustainable forest management for such new native woodlands, and hence 'low input' establishment regimes have been favoured. It has become apparent that many of these 'low input' schemes are having problems in becoming established, with broadleaf species in particular failing or dying back.

Still, Scotland's working forests currently produce nearly five million tonnes of wood a year. Before it leaves the forest, the timber that is harvested is worth around £100 million. Wood production in Scotland is expected to almost double in the next 20 years, as forests planted during the past 30 years mature.

## **Wales**

Forests and woodlands make up more than 14% of the land area in Wales. The majority (almost 70%) of this woodland is conifer. In recent years, the trend has been to diversify and plant more broadleaved and mixed woodlands. In 1999-2000, nearly 25% of all planting was of broadleaved species. Broadleaved woodlands now occupy some 84,000 ha in Wales.

Working forests still form the backbone of Welsh forestry, which contributes some £400 million of gross output per year to the economy in Wales and provides just over 4,000 jobs. However, today the Commission must balance these considerations with other social and environmental factors.

A positive legacy of planting in the 1960s and 1970s is the potential for wood production to increase during the next 15-20 years, providing raw material for the expanding wood processing industries in Wales. The current timber production from the woodlands is around 1.4 million tonnes, which is predicted to rise to some 1.9 million tonnes of timber by 2015.

There are also large numbers of relatively small privately-owned woodlands. About a quarter of Welsh woodlands are found on farms. These are predominantly small broadleaved woodlands of high environmental value.

The forestry commission looks after Wales's public woodlands, which make up over 40% of the total afforested area, on behalf of the Welsh Assembly Government, which took over policy responsibility for the land when it was established in 1999.

The Commission delivers the Assembly's forestry policies through:

- working in partnership with others to promote the interests of forestry;
- encouraging good forest management which maximizes public benefit by providing targeted grant-aid for woodland owners;
- regulating forest practice in both public and private woodlands through consultation, the use of felling controls and environmental impact assessments.

For Wales a new system of grant aid for woodlands will be in place from April 2005. The grants will be based on long term management plans for woodlands. In the meantime, the current Woodland Grant Scheme package will continue. There are targeted new planting grants for the expansion of native woodland and creation of new woodlands for quality timber.

## **Private Initiatives for Afforestation**

An increasing number of woodlands are managed for conservation and recreation by charitable trusts and private owners. There are also a number of partnership initiatives that have undertaken woodland planting, including the 10 Community Forests in England, the Central Scotland Forest, and the National Forest (in England).

There are no incentives paid by the public sector for planting forests for carbon sequestration, however there are private sector companies (e.g. Future Forests), that have become involved in this. Under such schemes private companies pay Future Forests to establish new areas of forest. Future Forests then pays landowners for the tree-planting.

## D. Australasia

Australia and New Zealand are among the world's least densely populated countries and this absence of population pressure is among the defining characteristics of forestry in this subregion. Australia, the world's sixth largest country, has 154.5 million hectares of forests covering 20.1 percent of the country's land area. Forest cover in New Zealand amounts to 7.9 million hectares or 29.7 percent of land area.

Changes in forest area cover in Australia and New Zealand in the period 1990 to 2000 are relatively small in a global context. During this period Australia reported deforestation of 282,000 ha per year, while New Zealand reported an average net gain in forest area of 39,000 ha per year. The net forest loss of 243,000 ha per year in the subregion constitutes only 2.6 percent of global deforestation. Australia's reported decline in forest area is, in part, the result of improved forest assessment methods. Australia's generally dry climate means large areas of the country are susceptible to wildfires, and significant areas of forest and woodland are burnt each year.

The following two case studies relied heavily on two country reports that were prepared for a comprehensive multi-national study on the "Impact of incentives on the development of plantation resources in the Asia-Pacific Region". Namely the:

*Australian Case Study: Report to the 19<sup>th</sup> Session, Asia-Pacific Forestry Commission, Mongolia 26-30 August 2002*

And

*The Impact of Incentives on the Development of Plantation Forest Resources in New Zealand*  
MAF Information Paper No: 45  
August 2002

These reports were considered to be the most up-to-date and comprehensive coverage for these two countries at the time of writing.

### 1. Australia

Australia occupies the island continent of the same name located south-east of Asia. It is bounded on the north by the Timor Sea, the Arafura Sea, and the Torres Strait; on the east by the Coral Sea and the Tasman Sea; on the south by the Bass Strait and the Indian Ocean; and on the west by the Indian Ocean. It is about 4,000 km wide and about 3,700 km from north to south with a total area of 7,682,300 km<sup>2</sup>. Although Australia is the smallest continent, it still comprises five percent of the earth's land area and Australia is the world's sixth largest country.

Australia has a large forest resource despite having a relatively low proportion of forest cover (about 21 percent of land area). At the same time the areas of other wooded lands are the largest among the temperate/boreal industrialized countries (more than 420 million ha, including open woodland and tall shrub lands). The vast majority of the Australian forest resource is natural forest, dominated by eucalyptus species, mixed with a variety of acacia species, cypress pine (*Callitris* spp.) and paper-bark (*Melaleuca* spp.). Australia also has significant areas of plantation forest comprised mainly of radiata pine and eucalyptus (FAO, 2000).

In general, Australia's forests and woodlands form a broad crescent around coastal Australia extending from the Kimberley Plateau in the north, to Perth in the southwest, and as much as 700 km inland. Closed canopy forests mainly occur in relatively narrow coastal zones, primarily in tracts along the eastern and southeastern coasts (including Tasmania), and in the far southwest



of Western Australia. These tracts of closed forest are generally encircled by larger areas of open forests (primarily eucalypt forest). Further inland, where average annual rainfall begins to decline below 900 mm, open forests give way to eucalypt woodlands, which in turn are supplanted by acacia shrubland in areas where annual rainfall is below 400 mm (Bureau of Rural Sciences, 2000).

At 1.57 million hectares, Australia has substantial plantation resources and is increasingly dependent on them as a primary source of wood and forest products, both for export and domestic use. Their evolution largely reflect the timber industry's, and Australia's, transition from the goal of self sufficiency underpinned by commercial development with direct incentives, to ecological sustainable development both supported and driven by broader micro and macro economic reforms. In line with this change, indirect are replacing direct incentives in places, with the private sector progressively replacing government in terms of hands-on management and investment.

Australia's State of the Forests (SoF) Report has identified that approximately 70% of the nation's forest resources are now privately owned or managed (NFI, 1998). This is a significant milestone as State forestry agencies held the majority only 10 years ago. This turnaround is due to the privatization of previous State owned pine plantations in several States and the expansion of private plantings.

The number of large-scale private sector investors is fairly small. Of the plantation estate 95% is considered industrial with only 5% actually held by small-scale landholders and communities (i.e. plantations whose owners' total estate is less than 1,000 hectares).

## **Government Structure**

While the prime responsibility for land use, forestry, and conservation matters rests with the State Governments, each level of government in Australia has specific interests in, and responsibilities for, forest management. The Commonwealth Government retains certain powers and interests, which can have significant implications for land use management practices. It is responsible for coordinating a national approach to both industry development and environmental issues including forest, land and water management.

The States have enacted legislation that allocates forest land tenures and specifies the administrative framework and policies within which public and private forests are managed. All Australian forest services are run by State forestry agencies, reflecting the constitutional demarcation of responsibilities. For this reason there is no national forest agency.

For their part, Local Governments have responsibilities for local land use planning within the limitations set by their respective State Governments, which affect public and private forest management and use. In practice, then, responsibility for policies affecting decisions on land use and the environment is shared between Commonwealth, State and Local Governments.

The principal national policy documents establishing priority actions for the sustainable management and use of Australian forests, relevant to plantations, are:

- National Forest Policy Statement (NFPS) (1992);
- Plantations for Australia – The 2020 Vision (1997); and
- Action Agenda for the Forest and Wood Products Industry (developed in 2000).

In addition, there is a range of initiatives at State and Commonwealth Government levels that further these policies. These include programs promoting farm forestry and revegetation and removal of government impediments to investment in growing and processing forest products.

## **History of Plantation Establishment**

Since European settlement most forest land has been cleared for agriculture. This has been reversed since the 1980s with most plantations now established on previous agricultural land. Encouragingly, planning approval processes in most States now prohibit clearance of native forest for establishing plantations. Four distinct phases characterize this evolution.

### **Phase 1 from 1900 to 1960**

Efforts to establish plantations began with the State forest agencies in the early 1900s. State Governments established most of the initial plantations to offset Australia's limited endowment of native softwoods. The State of South Australia took the lead in the 1870s establishing integrated operations based on *Pinus radiata* plantation. Other States followed by establishing softwood plantations so that by 1940, more than 90% of plantations were State owned.

Government efforts throughout this period concentrated on replacing softwood imports through the establishment of plantations. In the absence of a national forest policy, some State forestry agencies initiated trial plantation areas to assist with species and site selection. Various schemes to encourage smaller scale or woodlot planting on farms and other private lands were also undertaken from the 1920s. The rate of planting on farms increased in the 1930s aided by incentives often associated with achieving broader environmental benefits.

However, their efforts were largely ad-hoc with variable success, and farm forestry incentives made only a small contribution to industrial wood supplies. Direct incentives were minimal and largely focussed on employment as part of the States' response to the depression. Incentives therefore were mainly indirect, consisting of information transfer and lower risk from R&D undertaken by the States. Commonwealth incentives were largely non-existent. By the Phase's end, plantations were generally State owned and relatively small.

It was not until 1950 that any major expansion in private planting occurred, when large industrial companies commenced planting in order to supply pine (*Pinus radiata*) and eucalypt pulpwood to supplement resources from the States. These plantations, established by the larger timber companies, gradually supplied increasing quantities of sawlogs as well as pulpwood.

### **Phase 2 from 1960 to 1980**

The widening gap between forecasts of demand and domestic supply became clear after the Second World War, as the post War building boom led to increased demand and concerns rose over the level of softwood imports and sustainability of native (hardwood). It became clear that native forests could not sustain high harvesting rates in the long term, let alone meet rising demands. Increased plantations were seen as the solution to increasing timber supply and reducing imports. Commonwealth and State Governments jointly advocated a significant increase in pine (*Pinus radiata*) plantations.

The States aimed to increase their planting rate from 16,000 hectares a year to 28,000 hectares a year, so that Australia would be largely self sufficient through a plantation estate of 1.2 million hectares by the year 2000. In 1966 the Commonwealth provided generous, low-interest "Softwood Loans" to the States so their planting could increase by 26,000 hectares a year. In addition, private growers were encouraged to plant 4,000 hectares a year.

### **Commonwealth Softwood Forestry Agreements Acts**

Since most of Australia's timber imports consisted of softwoods in the 1960s, the States and Commonwealth formulated a policy of self-sufficiency in softwoods by 2000. This was formalized in agreements made under the Softwood Forestry Agreements Acts of 1967, 1972 and 1976.

Under these Acts, loans made on annual basis from 1967 to 1982 enabled purchases of land as well as the establishment and tending of an additional 100,000 hectares (approximately) of new softwood plantations. This committed the Commonwealth to provide favourable loans (totalling \$78.1 million) to the States to establish and maintain softwood plantations.

The loans were attractive to the States because of a 10 year interest free period. Made from the Commonwealth's Consolidated Revenue Fund, they were repayable over 20 years with repayments commencing 15 years after the date of each advance. This 'grace' period of 35 years matched the planned harvest time of the trees, assuming sawlog rotations used at the time. The agreement also provided for interest to be either capitalized over the deferment period or paid as it fell due. Interest was paid at the long term bond rates prevailing at the time of payment.

Under the agreements the States undertook to carryout efficient planting and tending and in conformity with sound forestry, financial and environmental practices. The Commonwealth also required the States to keep full accounts, books vouchers, plans, documents and other records relating to planting and tending under the agreements. Planting and tending programs were monitored by the then Australian Forestry Council, which was made up of State Ministers and chaired by the Commonwealth Minister responsible for forestry.

The Softwood Loan Agreements were very successful, expanding the overall plantation estate from around 170,000 hectares to nearly 900,000 hectares. While not initially aimed at the private sector, this initiative was instrumental in enabling the State Governments to dramatically increase plantations during the 1960s and 1970s, and without this incentive, the softwood plantation industry would not have reached its present large scale. These plantations became the basis for the wide range of domestic wood processing facilities developed subsequently (e.g. pulp mills). Victoria and Tasmania are progressively privatizing their softwood plantations, parts of which were established under these initiatives.

Indirectly these incentives were also responsible for a rise in environmental awareness, due to large scale plantation of exotic species and clearance of some native forests for plantations. This period, however, saw few small scale forestry operations established. Companies were still largely Australian owned, as foreign investment in forestry businesses had not yet begun to make its mark.

The creation of industrial state-owned plantations also attracted private investment through the associated creation of markets, logistic infrastructure, research and development and risk reduction. The plantations established have become the basis for the wide range of domestic wood processing facilities developed later in the 1990s.

### **Phase 3 – “Transition from government softwood to private hardwood” Plantations 1980 to 1990**

Phase 3 marked a transition from the dominance of government to private ownership of softwood plantations and the expansion of eucalypt (hardwood) plantations. This was in response to large changes occurring in the forest industry and Australian society, including increasing commercial and budgetary pressures on governments and industry from high interest rates and activism on native forest harvesting.

Reflecting its transitional nature, the growth of plantations slowed during this Phase. Overall, incentives benefited State and large industrial growers only and even then with limited benefit, due to the underlying structural and logistic impediments and smaller, non-industrial growers being outside the scope of incentives. Nevertheless, gains made during the previous Phases were consolidated. Increased investment by States and large plantation owners created a supply driven demand for plantation timber (both softwood and hardwood), which reduced the capital risk and generated an incentive for other investors. Research into growth and management was

undertaken. Importantly, it created the will to resolve the underlying broader structural impediments.

Large scale private sector forestry investment occurred during the 1980s. Exporting woodchips became an important business in most States. This enabled some companies to convert significant areas of land to plantations, although less of it was conversion from native forests. Tibbits (1986) describes the extent of eucalypt plantations in Tasmania up to 1984. He notes the large increases from 20 hectares per year in the 1970s up to an average of 1500 hectares per year for the period 1982 to 1984.

The loan arrangements made during the previous period expired at the end of 1981-82, following a broader review of Commonwealth functions. To stimulate an expansion of the commercial hardwood timber resource during this period, the Commonwealth Government supported research and funded the establishment of the National Afforestation Programme. Importantly, this was the first production forestry initiative that directly sought to engage private landholders. Other incentives included joint ventures between State or private landowners and investors, as outlined below.

### **National Afforestation Programme and associated programs**

Dargavel notes that the National Afforestation Programme (NAP) funded the establishment of 6,000 hectares of hardwood plantations between 1987 and 1992 and supported research on growth. The Commonwealth established the NAP in 1987 to stimulate an expansion of commercial hardwood timber, and assist in land rehabilitation and control degradation through afforestation. Nearly \$15 million over three years was targeted at State and large private industrial growers. The programme was also the first production forestry initiative that directly sought to engage private landholders. However, the programme was not really designed to address the needs of non-industrial forest managers and lacked a supportive policy framework to address underlying social, economic and institutional impediments to plantation development (Donaldson, 1998).

The NAP was later expanded and replaced by the One Billion Trees and Save the Bush programs in 1989, which had a clearer focus on biodiversity conservation and were later supplemented by initiatives like the Corridors of Green Programme and the Wet Tropics Tree Planting Scheme in North Queensland. These were all later incorporated in the Bushcare Programme with advent of the Natural Heritage Trust 1 (NHT 1) in 1997. Over this time, funding for programme delivery increased from about \$3 million over the first five years to over \$350 million over the five years 1997 to 2002.

### **Joint Venture arrangements**

Joint venture arrangements first appeared to any extent in the mid- to late- 1980s, often between State Government forestry agencies and private landowners. With the Commonwealth Softwood Loan Scheme coming to a close, States saw joint ventures as one option to continue the growth in commercial plantations and to promote smaller scale farm plantations. Since then, it has become an important tool in plantation development, especially as a mechanism to attract overseas investment.

Western Australia is a good example, where farmers developed large eucalypt plantations, primarily for pulpwood, in joint venture arrangements with funding from overseas investors. The investors were mainly in the pulp and paper industry and sought to secure reliable high quality supplies from a stable location.

Basically, there are three different types of joint venture arrangements that have contributed to the planting of some 82,900 ha, or 8% of the country's plantation estate, since the mid-1980s (Curtis and Race, 1998):

In lease joint ventures, the farmer signs over the land in a lease to the industry. Such schemes are attractive to commercial farmers and smallholders, as regular payments are made and indexed over an agreed period. With annual lease payments ranging from US\$90 to \$170 per hectare per year, returns are considerably higher than in many neighbouring grazing enterprises.

Cropshare joint ventures are those in which the landholder and industry or government partners contribute inputs and proportionally share returns at harvest, based on the market price. Cropshare schemes are often attractive for underutilized agricultural land often with poor access and low productivity - which does not always suit industry needs.

Market joint ventures guarantee a sale for the grower, usually based on the market price at the time of harvest. The grower is required to offer the industry partner the first option of purchase, but if a better price can be found, the grower may sell to another purchaser.

Under these schemes, Governments attempted to target farmers and smaller landholders (i.e. of less than 1,000 hectares) with incentives rather than large companies, in order to increase investment in forest plantations in this sector. Thus, plantations were increasingly being established on previous farmland rather than native forest. Although this was a relief to the predominantly urban conservationists, it was beginning to raise concerns among the farming community that their traditional livelihoods would be altered.

#### **Phase 4 – “Private plantation boom” From 1990 to present**

The fourth and ongoing Phase began in the 1990s. This Phase is largely the realization of previous work and new incentives to overcome lessons learnt, from the preceding 30 plus years. The focus of plantations and accompanying incentives has grown from self sufficiency to the development of an internationally competitive plantation growing and processing industry, underpinned by a significant, long term and environmentally sustainable plantation resource facilitated through major private sector investment.

Softwood plantings dominated until the 1980s with one species, *Pinus radiata*, contributing over two thirds of the area. Since 1990 the plantation sector has undergone a dramatic shift with plantings changing from softwood to hardwood. In 2001 hardwood plantings, mainly *Eucalyptus globulus*, were 75,100 hectares compared with 10,600 hectares of softwood. Notably, 87% of the total standing hardwood plantation has been planted since 1990.

This phase has led to the highest sustained growth and total area in Australia's plantation development, achieved through various incentives. At the State level, incentives are predominantly direct mechanisms and include those initiated by large private companies targeting smaller private landowners, while the Commonwealth has moved towards indirect enabling mechanisms. Overall though, governments have increasingly distanced themselves from the hands-on participation and instead are focusing on removing impediments and attracting investors (existing and new).

There has been a range of factors driving this growth, largely underpinned by:

- Commonwealth and State recognition for, and agreement on, dedicated strategies and programs to promote Australian forest plantations (including farm forestry) nationally and internationally;
- Opening of the economy and increased foreign investment, through changes to the tax system to remove inequities between plantations and traditional land uses such as agriculture;

- Sustained lower commercial interest rates combined with stable economy and low inflation;
- Elimination of market distortions through the introduction of competitive neutrality principles, leading to progressive privatization / commercialization of State plantations;
- Progressive lifting of export controls on unprocessed wood sourced from plantations;
- Market demand for pulpwood, especially in the Asia-Pacific region where supplies are forecast not to meet demand;
- Integrated land use planning, including farm forestry, to increase available private land for plantations and environmental benefits; and
- Promotion of environmental benefits from plantations e.g. land and water restoration, greenhouse/carbon storage.

The broader farming and city communities have also acknowledged the biodiversity and environmental benefits arising from plantations being incorporated into traditional agricultural areas and, in some instances, even replacing them.

In 1992, the Commonwealth and State Governments developed a common policy position on forests, known as the National Forest Policy Statement (NFPS). The NFPS is the primary means for integrating environmental sustainability and commercial production. The NFPS sets out objectives that include: conservation, wood production and timber industries development, private native forest use, and plantation development.

### **Farm Forestry Programme**

The Commonwealth's National Farm Forestry Programme (NFFP) operated from 1996 to 2001, funded from NHT 1. Its aim was to encourage the incorporation of commercial tree growing and management into farming systems for wood and non-wood production, increasing agricultural productivity and sustainable natural resource management. This was aided at the regional level by establishing Regional Plantation Committees (RPCs), to promote information networks, increase the skill base, initiate demonstration projects and design regional strategies. The adoption of farm forestry was assisted by farmers wanting to diversify and enter a new market as a risk management strategy, investors establishing plantations on farmland through joint ventures or annuity schemes, agricultural gains (e.g. increased agricultural yields) and environmental services (e.g. soil and water conservation).

More than a third of the current total farm forest resource was planted since the formation of the Programme in 1995. This period has seen a major shift from softwood to hardwood establishment, mirroring a national trend in plantations. By the Programme's end, farm forestry had contributed approximately 5% to the total plantation resource and 12% to the total privately owned resource. A further 11% approximately of industrial plantations came from leased or joint venture arrangements of farm land.

### **Plantation for Australia: the 2020 Vision**

Released in 1997, the Plantations for Australia: the 2020 Vision is the most important strategic policy setting the current direction of plantation development in Australia, with many of the present incentives being a direct result of this policy. It is a framework of actions designed to achieve an internationally competitive plantation growing and processing industry that is commercially focused, market driven and market oriented. It aims to develop a significant, long term and environmentally sustainable plantation resource through major private sector investment.

The 2020 Vision is a public/private partnership that details the main actions to encourage plantation establishment to meet the target of trebling the plantation area from 1.1 to 3.3 million hectares by 2020.

## ***Incentive Mechanisms***

Under the NFFP and the 2020 Vision, various direct and indirect incentives have been offered. While many of these have not directly targeted planting activities, a number of them have done so. Following is a summary of some of the more effective or interesting policies that have led to afforestation during this period:

### ***Tax Policy***

The Australian Taxation Office (ATO) is the Commonwealth Government's main revenue collector, responsible for collection of around 96% of revenue. The ATO has implemented a range of direct and indirect incentives to support primary production generally, including plantations. These incentives include tax equity, recognizing the unique challenges of plantation establishment as against other primary production that are annual or have shorter rotations. This aims to directly assist plantations to remain a competitive alternative to other primary production.

The following forestry operations are considered to be primary production for accessing tax benefits specific to primary production:

- Planting or tending trees in a plantation or forest that are intended to be felled;
- Felling trees in a plantation or forest; and
- Transporting trees or parts of trees that have been felled in a plantation or forest to the place where they are first to be milled or processed, or from which they are to be transported to the place where they are first to be milled or processed.

The New Tax System (NTS) was introduced on 1 July 2000. A major change under the new system is the introduction of a broad based 10% Goods and Services Tax (GST) and the abolition of wholesale sales tax and some State taxes. The main benefits for forestry and associated industries such as transport will be through the removal of a number of State taxes, a reduction in the embedded taxes and lower on-road transport costs for wood products. In effect the GST affects plantations all the way from establishment down to processing and marketing.

### ***Immediate deductibility of non-capital expenditure***

Non-capital expenditure on plantations such as plantings, establishment costs and management fees can be claimed as an immediate tax deduction. Expenditure on items of capital nature, such as roads, dams are deductible over a period of time, as specified in the recent tax changes mentioned above.

### ***Landcare deduction***

While introduced prior to 1985 it remains ongoing. Primary producers and users of rural land can claim an immediate deduction for capital expenditure on soil conservation, prevention of land degradation and related measures. Though not a direct incentive for plantation establishment, it boosts land rehabilitation that indirectly aids plantation establishment (especially in the case of farm forestry).

### ***Landcare offset***

This was introduced in 1998. Primary producers and users of rural land, with taxable income of up to \$20,000 a year, can claim a 30 cents in the dollar tax offset for capital expenditure on soil conservation, prevention of land degradation and related measures. This measure can be claimed as an alternative to the Landcare deduction and may provide an incentive for plantation establishment in degraded lands which provide commercial and conservation benefits.

### ***Diesel and Alternative Fuels Grants Scheme***

This Scheme is part of the NTS and assists Australian business through lower transport and production costs for on-road transport. For diesel, the rate is presently 18.51 cents per litre. The concession allows investors to claim an immediate deduction for certain prepaid expenditures invested in a plantation forestry managed agreement. The prepaid activities must be completed within 12 months of the activity commencing and by the end of the following income year. The concession applies to plantation activities such as ripping and mounding the site and planting seedlings.

### **Current Situation**

A diverse range of ownership arrangements exist in the Australian plantation industry, including joint venture and annuity schemes between public and private parties. Of the 2001 standing plantation estate of 1.57 million hectares, it is estimated the majority (54%) are now privately owned. Since the 1990s there has been a dramatic increase in the establishment of private plantations with 89% of new areas planted being on private land in 2001 (Wood et al., 2002).

The end result is the evolution of Australia's forest plantations over four phases, with the standing estate having increased by 1,263,232 hectares (513%) since 1965-66 (when major growth in plantations began). These phases largely reflect the timber industry's, and Australia's, transition from the goal of self sufficiency underpinned by commercial development with direct incentives, to ecological sustainable development both supported and driven by broader micro and macro economic reforms. In line with this change, indirect are replacing direct incentives in places, with the private sector progressively replacing government in terms of hands-on management and investment. These phases are now discussed in detail.

By 2002, many of the impediments to plantation expansion (especially for private investment) had been addressed, either by removing the impediment (e.g. woodchip export restrictions) or improving the commercial operating environment for private investors to establish plantations. The community has also begun to acknowledge the positive biodiversity and environmental benefits arising from plantations being incorporated into traditional agricultural areas, with most plantations now being established on previous agricultural land. Diverse ownership arrangements now exist, including joint venture and annuity schemes between public and private parties. Plantings are changing from softwood to hardwood in response to overseas demand. In 2001 hardwood plantings, mainly *Eucalyptus globulus*, were 75,100 hectares compared with 10,600 hectares of softwood. Notably, 87% of the total standing hardwood plantation has been planted since 1990.

Recent trends indicate that the current expansion in plantations is on track to meet the target of the 2020 Vision. The focus is on boosting the availability of suitable land, getting incentives right, establishing a culture of commercial plantations and improving information flows.

Collectively the incentives have proven highly effective. Combined with an eager pulp market and the loosening of export restrictions and foreign investment, they have produced an explosion in the planting rate.

## **2. New Zealand**

The total land area of New Zealand is 27.1 million hectares, slightly larger than Laos and slightly smaller than Vietnam. It is comprised of two main islands (the North and South Islands) and several small islands, located between latitudes 33° and 47° south. About 25 percent of New Zealand is less than 200 metres above sea level, with steep hills and mountain ranges up to 3754 metres often forming a backdrop to this low lying land.



Natural forests in New Zealand comprise mainly cool temperate rain forests extending along much of the western side of South Island and through the mountainous axes of North Island. In northernmost areas there is a gradual transition to warm temperate rain forests. Plantation forests have been established throughout the country, with the largest concentration (around one-third of the total area) planted on the volcanic plateau of central North Island (FAO, 1997a).

In the year ended March 2002 (provisional figures, Ministry of Natural Resources):

- an estimated 20.9 million cubic metres of wood were harvested from New Zealand's forests (99.7% of which came from the plantation forests);
- the average recovered volume from plantations was 482 cubic metres per hectare harvested, and the average age of the harvested radiata pine was 27 years;
- 13.5 million cubic metres were processed on-shore by New Zealand's industry mix of four pulp and paper companies, eight panelboard companies, more than 350 sawmillers, and approximately 80 remanufacturers;
- the estimated roundwood equivalent of 14.3 million cubic metres was exported, in raw and processed forms, earning NZ\$3.6 billion and ranking forestry third in terms of commodity exports;
- the estimated roundwood equivalent of 1.7 million cubic metres of forest products (December 01) was imported (largely paper and paperboard);
- forestry directly provided jobs for 24,300 people or 1.3% of the total employed (as of February 2001).

A century ago, nearly all the wood used in New Zealand came from natural forests. Today, hardly any of it does. Nearly 90% of New Zealand's natural forests, all owned by the state, are legally protected. Less than one percent of the 17 million m<sup>3</sup> annual wood harvest is now derived from natural forests. Of the total land area of 27.1 million hectares, approximately 16.8 million hectares are in private ownership and 10.3 million hectares are government-owned.

Over 90% of New Zealand's plantations grow radiata pine, a species native to the California coast. New Zealand's mild, wet climate is ideal for this species, which grows faster there than anywhere in the world, usually maturing in 20 to 30 years. Radiata pine is a general-purpose timber particularly desirable for pulping, packaging, clearwood, plywood, and engineered board products. Focusing on one well-suited, fast-growing species has enabled the New Zealand forest sector to concentrate its research on site management and genetic improvements to increase overall yield and quality.

The forest industry now accounts for roughly 76% of New Zealand's GDP and 13% of its overall exports, making it the country's third-largest export earner after meat and dairy products. Forest plantations have diversified the country's land use and its economy, and have increased employment, particularly in rural areas.

## **History**

Prior to initial Māori (Polynesian) settlement in New Zealand about 800 years ago, very few areas below the natural treeline were unforested. Over 100 natural forest types covered around 85% of the country. Now that figure is more like 23%, largely because of extensive clearing, initially by Māori and later by European settlers for grazing, a trend fuelled by New Zealand's historic and almost total dependence on farming.

Between the 14th and the 16th centuries in particular, large areas of forest were burnt as the population expanded. The impact was greatest in the drier eastern regions of both islands and in the central South Island some forest types were nearly eliminated. Deforestation through Māori fires probably ceased around 1600.

In 1840, when the Māori population was about 115,000 and there were some 2,000 European settlers, the Treaty of Waitangi was signed between the British Crown and Māori chiefs. The Treaty was designed to record the consent of Māori to New Zealand becoming a British colony.

European settlement commenced in earnest from this time, when indigenous forests covered about 53 percent of the land area. The European settlers and their descendants saw forests as both an obstacle to agriculture and an inexhaustible source of timber. Pasture increased from less than 70,000 hectares in 1861 to 4.5 million hectares in 1901.

At the same time, beginning about 1871 large grants of government land were made to district councils for afforestation purposes. In return, the councils were expected to provide the seedlings and fund and undertake forest establishment, which were difficult to achieve. It was eventually agreed that planting should be gradual and that the areas where planting was deferred could be leased to provide revenue to defray some of the costs. Provincial governments also sought to increase private planting by the issue of a land order of £4 to anyone who successfully planted one acre with any type of tree. This scheme lasted for 20 years and tree planting subsidy schemes had stopped in the early 1890s.

Comparatively unskilled labour was employed in tree planting. Prison labour comprised the bulk of the labour force used in government afforestation up until 1921. Initially this was supplied free of charge to the Forest Service, but for about 6 years up to 1921 the Forest Service (and its predecessor) was charged the actual cost of maintaining the prisoners (5 shillings to 7 shillings and 6 pence per prisoner per day).

By 1920 most of the current 11.9 million hectares of agricultural land had been cleared. This was the primary cause of the decrease in natural forest cover to the current 6.3 million hectares or 23% of New Zealand's land area (Ministry for the Environment, 1997).

A Royal Commission on Forestry set up in 1913 recognized the limitations of the indigenous forest for future timber supply, the unsatisfactory fragmentation of forestry administration, and a lack of interest in afforestation by the administrators. The first national forest inventory was carried out between 1921 and 1923, which revealed that some 5 million hectares, or around 20% of the country, could be classified as forest land, of which only 45% (2.24 million hectares) was merchantable. Thus, in the 1920s New Zealand began developing forest plantations, mainly to offset the depletion of the natural forest.

Partially in order to facilitate this, from 1921 to the end of 1930 the sale of trees at cost price from government nurseries for private planting was also given considerable emphasis, and resulted in a significant number of trees being planted. In 1927 alone some 4.8 million trees were supplied from government nurseries to individual landowners. Much of this planting was still for shelter and on-farm uses, rather than for commercial returns.

Improvements in afforestation and planting techniques, particularly between 1921 and 1924, resulted in the cost of establishing plantations being reduced from more than £25 per acre in 1918 to less than £2 per acre in 1925. This eliminated one of the principal objections to afforestation – that it was uneconomic. The goal of 120,000 hectares by 1935 became national policy.

An official report calculated that about 238,000 hectares of radiata pine planted over a 34 year period would be needed to supply likely demand, assuming no remaining indigenous forest resources. A new afforestation strategy was announced. This recommended that the 5,200 ha of government plantations that existed in 1925 be increased to 120,000 hectares by 1935, in order to meet New Zealand's timber needs from 1965 onwards.

During the Great Depression, subsidized work relief programs gave considerable stimulus to the afforestation programme of the government. Tree planting under public works relief schemes was widespread during the 1930s and the target of 120,000 hectares by 1935 was exceeded by 25% in 1934.

One of the responses of the government during the depression was to provide a building subsidy that paid 33.3% of the award rate of wages up to a maximum total house building cost. This had obvious backward linkages to the timber industry. Freight rate concessions were also available.

From around 1934 large scale forest planting ceased. This resulted from a new forest policy in that year that de-emphasized the importance of expanding the plantation estate and emphasis was placed on diversifying the planting so that no species would form more than 30% of the total resource. A more limited afforestation programme continued, partly to reduce the proportion of radiata pine from its 40% level in 1934 to the 30% target level, and partly to achieve a fuller age class distribution.

Afforestation, particularly private afforestation, was limited during the 1940s and 1950s. Meat and wool farming in particular were very buoyant during this period and tree plantings on farms were not able to compete with such returns. During the 20 years from 1939 to 1958, the total area planted was just 55,000 hectares. Private planting picked up only during the latter part of this period and accounted for 16,000 hectares (29%) of the total compared to 39,000 hectares planted by the government.

Tax relief was provided from 1949 to farmers who had forest plantations. This allowed expenditure incurred in planting, and protecting and maintaining shelterbelts and woodlots, to be charged against income for tax purposes.

From 1960 onwards the government progressively introduced a range of support measures to accelerate tree planting on private land. As with the first planting boom, this expansion was driven by the government Forest Service. Again, the planting was largely radiata pine. The ever-increasing amount and complexity of the government incentives to forestry characterized this period from the early-1960s through to the mid-1980s. The plantation estate grew from 352,000 hectares in 1960 to over one million hectares by 1984, of which nearly half was in private ownership.

### **Forestry Encouragement Loans**

The government introduced Forestry Encouragement Loans under the Farm Forestry Act 1962. This provided for loans to landowners for terms of up to 20 years at an annual interest rate of five percent (inflation at the time was three percent per year) which included provision for insurance up to the amount of the loan. Loans could be sought for the establishment (£25 per acre or approximately \$1,871 per hectare at December 2001) and tending (£15 per acre or approximately \$1,123 per hectare at December 2001) of areas from 5 to 100 acres (2 to 40 hectares), over a five year period. The amount was intended to cover the full cost of establishing a small forest or farm woodlot. Half of the loan sum and half of the interest were refundable after 20 years if the plan was satisfactorily completed. Priority was given to areas with high timber demand, areas close to population centres, and areas where forest industries were present or expected to develop.

Despite these measures the area planted remained significantly below target and it was clear that the five percent interest rate was not sufficiently attractive.

In 1965 the Farm Forestry Act was amended and renamed the Forestry Encouragement Act. It was also extended to allow local government to take advantage of it for loan periods up to 40 years. The rate of interest payable on new loans was reduced to three percent, with interest only charged on the non-refundable half of the loan. A new option was provided to compound interest

up to the point where the forest began earning income. The limit of 100 acres (40 hectares) as the maximum area able to be planted over a five-year period was removed to enable greater areas to be planted with the approval of the Ministers of Forests and Finance.

## **Forestry Encouragement Grants 1969**

In 1969 the government concluded that the rate of new planting under the loan scheme was unlikely to ever reach the target. Regulations providing for Forestry Encouragement Grants were introduced in 1970 to gradually replace the loan scheme and to serve in lieu of tax deductibility. Almost all of the land chosen by farmers to plant in trees was marginal for agriculture, but unlike the case in some other countries (Ireland, for example), the land chosen tended to be good for forestry growth (often weed-prone gully sites which trees naturally favour).

Under the new scheme annual cash grants equal to 50% of the qualifying costs of establishing and developing new forests were available for approved planting programs for individuals, trusts, partnerships and smaller companies whose annual qualifying expenditure did not exceed \$200,000 (approximately \$2,185,000 at December 2001). A maximum of \$750 per hectare (approximately \$8,194 at December 2001) was payable and the minimum area eligible was two hectares. The scheme was seen as offering similar incentives to the tax exemptions enjoyed by the larger forest companies.

The Forest Encouragement Loan scheme was retained for local authorities only. A maximum loan of \$1,200 per hectare was available for establishment and tending of plantations of a minimum area of two hectares. Interest was charged at 7% per year (the inflation rate in 1970 was 6.6%), of which 0.5% was to provide fire insurance.

Subsequent changes to the loans and grants schemes occurred as follows:

1977:

- A single interest rate of 4.5 percent was introduced for new loans and the 50 percent loan refund provision was cancelled. Farmers with existing loans, where the forest had been brought up to an acceptable standard of tending, were given the option of retaining their loan or having their existing debt fully remitted and claiming a proportion of their future qualifying costs under the grant scheme.
- The maximum grant amount was increased from \$300 to \$450 (approximately \$1,506 to \$2,260 at December 2001) per hectare. The Forest Service reported that the area of new plantings was falling because the grants made up only a third of the cost of growing a forest, rather than the half originally intended.

1980:

- The financial limits on annual expenditure under the grant scheme were removed.

Protection/production grants were introduced, targeted at farmers with areas of land needing stabilization who wished to carry out the work themselves. The scheme provided grants of up to two-thirds of the costs of forest establishment, together with half of all subsequent costs. (Less than three percent of the area approved by the Forest Service for assisted planting in 1982/83 qualified under the protection/production scheme).

## **Forestry Encouragement Grants 1982**

In 1982 the government introduced a revised form of incentive, also known as Forestry Encouragement Grants to try and provide equitable assistance to all landowners. From April 1, 1983 all previous forestry incentives were withdrawn. They were replaced by a flat rate grant of 45 percent of qualifying costs. The new grants were extended for the first time to the larger forestry companies.

At the same time, the right to deduct current forestry expenditure from taxable income, which had been available to the forestry companies since 1965, was removed. The effect was to increase the government's revenue from taxation while at the same time creating a large new expenditure item. In view of the large planting areas involved the grants were to be controlled clerically, by random financial audits of annual claims, rather than by field inspections of forestry operations.

With the introduction of the Forestry Encouragement Grants, the Forestry Encouragement Loan scheme ended in 1983. Loan holders were given the option of retaining their loans or having the loan cancelled and receiving grants payments for further expenditure. Many opted for the grants payments, but, for cash flow reasons, most local authorities continued with their loans.

Among a long list of eligible expenditures, activities qualifying for grants included the clearing and preparing of land, and the cost of trees, planting, blanking and release cutting.

The Forestry Encouragement Grants scheme was ended in the 1984 budget, being replaced by full deduction of forestry establishment costs against current income for tax purposes. Transitional loans, to complete the development of existing forests, were made available to previous grant holders through the Rural Bank. Protection/production grant holders remained eligible for grants of up to 39.4% of qualifying costs until 1990/91.

### **Achievements of the Loans and Grants Schemes**

Nearly 200 Forestry Encouragement Loans were approved over the 20 years of the scheme's operation. The total area planted under the loans scheme was 20,000 hectares. More than 3,000 Forestry Encouragement Grants were made over the 13 years of this scheme's operation. The total area planted under the grants scheme was 100,000 hectares.

### **Māori Leased Land**

Another option the government entered into to facilitate afforestation involved land lease arrangements with Māori. The Forest Service established and managed forests on Māori land, and profits were to be shared between the government and the landowners. From 1967 to 1985 a number of leases were established involving a total of 71,000 hectares of Māori land, with around 51,000 hectares planted in trees. From the government's perspective, the forests were a means of utilizing Māori land that was otherwise unlikely to be in an equally productive use. The initial leases were for 99-year terms, with the landowners receiving a share of stumpage in lieu of rent. The leases provided for consultation with the landowners and safeguards relating to wahi tapu (sacred) areas. Subsequent leases were for shorter terms with annual rental payments in response to Māori wishes for greater control.

Following this lead, the private forest industry also entered into lease arrangements with Māori landowners.

### **The Forestry Rights Registration Act 1983**

In 1983 the Forestry Rights Registration Act was passed to facilitate the use of joint ventures for the development of plantation forestry. This was a very simple piece of legislation to provide for a forestry right to be granted by the owner or lessee of land to another person to establish, maintain and harvest, or just to maintain and harvest, a crop of trees on that land. It also incorporated rights of access and provisions for payments, royalties, or a division of the crop or the proceeds from the crop. The Act provides for the registration of a forestry right against the title of the land to which it relates, but without the high standard of survey normally required for registering instruments against land titles. The Act has had only modest use by companies and private investors.

## **Deregulation**

Until the mid- to late- 1980s, the government had played a direct role in regulating and structuring New Zealand's forest industry, and had also established about half the country's forest plantations and selected end-uses for the wood that would maximize processing in New Zealand.

Deregulation in 1984, however, started a shift in the New Zealand economy from one of the most controlled to perhaps the most open economy in the world. An initial 20% devaluation was followed in 1985 by a float of the New Zealand dollar. Direct incentive schemes were terminated, extension services became cost-recoverable, and significant changes were made to the taxation regime that applied to forestry. Investment and land development concessions were withdrawn and cost recovery for previously free government services was introduced.

The rates of afforestation fell to very low levels in the late 1980s and early 1990s, and then quickly rose to record levels subsequent to privatization, further amendments to the taxation regime, and the influence of an international price spike for wood.

The relevance to plantation development is that these fundamental changes to the economy created an environment that increased the relative attractiveness of forestry, and once embedded were a powerful stimulant to further plantation development. In 1987 the government decided to sell its forests, but not the land upon which they stood, to private industry. The sale process left the government with less than 7% of the national plantation forest estate. Subsequent settlements of claims under the Treaty of Waitangi have seen forest land, and some of the remaining forests and land, pass to Māori ownership so that today the government owns about 3% of the plantation resource.

At first this quasi-privatization, along with the elimination of government subsidies for planting and forest management, provoked a sharp decline in forest planting. But the trend has since reversed itself and new plantings are at record levels, primarily on the basis of market signals (since there are no longer any fiscal incentives).

The government's commercial forestry activities were initially corporatized, then privatized in the early 1990s. This combination of events resulted in a dramatic drop in new planting. By 1992 the bulk of the government's plantation forest assets had been sold. Further changes to the taxation regime were introduced and the government actively promoted forestry investment, mainly through the provision of information. Concurrent and ongoing development in most regions of the supporting infrastructure such as ports, railways and bridges was another key factor facilitating development.

Declining agricultural product prices and land values also had an important influence on the competitiveness and profitability of forestry. Agricultural landowners recognized the value of forestry in diversification and sustainable management. Most importantly, a global price spike for logs in 1993-94 drew unprecedented interest in forestry. These factors buoyed private investment and were important in attracting foreign investors and forest managers, who brought capital, plantation development expertise, technology and, very importantly, access to foreign markets.

Moreover, the gradual removal of agricultural subsidies in New Zealand has removed an incentive to farm marginal land, which has resulted in increased afforestation on agricultural land, both improved and unimproved.

The net result of these influences was a surge in new planting to record levels during the mid 1990s, with plantings increasing by about 60-80,000 hectares a year. By the late 1990s, forest plantations covered some 5% of the country's land area, or 1.76 million ha. The last few years have seen planting decline to a perhaps more sustainable long-term rate as log prices returned to more traditional levels.

## **Erosion Control**

The East Coast region is an area with extreme soil erosion problems, highlighted by the impact of a major cyclone in 1988 called Bola. The East Coast Forestry Project was initiated by government in 1992 with the objective of planting 7,000 hectares of commercially productive forest each year for 28 years on this eroding and erodible land. The objective was subsequently refined to achieving by 2020 sustainable land management on the worst 60,000 hectares of severely eroding land (defined by mapped land use capability units) in the East Coast region by afforestation, reversion to indigenous woody vegetation, gully planting or approved alternative treatments.

The project allows landholders to tender for a grant to support their erosion control programme through plantation forestry or other approved options. In the year 2002 there were 193 grantees with a total approved programme of 35,789 hectares for planting between 1993 and 2004. Of this about 29,100 hectares have been planted. For afforestation and farm gully planting 70% of the grant is paid on establishment and 30% on final thinning. For reversion to indigenous vegetation, where the area must be subject to a covenant or a non-use agreement, 50% is paid in year one and 50% in year five.

Through the East Coast Forestry Project the government is providing a financial incentive to ensure commercial plantation development, primarily for environmental objectives with a public good element, occurs in areas that would otherwise remain unplanted.

## **Current Situation**

The end result is a New Zealand plantation forest estate of 1.8 million hectares that continues to grow at around 30,000 to 40,000 hectares per annum, and is 91% privately owned. Radiata pine accounts for 89% of the plantation area, Douglas-fir another 6%, other softwoods (mainly Pinus species) 2%, and hardwoods (mainly Eucalyptus species) 3%. All of this plantation forest resource is managed primarily for the production of industrial roundwood. In addition, there are some smaller areas of plantation forest managed primarily for soil conservation purposes.

## **E. Latin America**

The Latin America and Caribbean region has the world's largest reserves of arable land with an estimated 576 million ha equal to almost 30% of the total territory (Gómez and Gallopín, 1995). The region also contains 16% of the world total of 1 900 million ha of degraded land, taking third place behind Asia and the Pacific and Africa (UNEP, 2000).

Priority issues in the region include: loss of agricultural area (caused by factors such as erosion, changes in agricultural practices and growing urbanization); land degradation (associated with compaction, leaching of nutrients and pollution); and land tenure (covering inadequate and inequitable distribution of land as well as lack of tenure rights).

Agricultural expansion has intensified the use of natural resources and exacerbated many of the processes of land degradation. Over the past three decades, there has been an increase in arable land and grassland at the expense of forests. During 1972–99, the area of permanent arable land and cropland expanded in South America by 30.2 million ha or 35.1% and in Meso-America by 6.3 million ha or 21.3% (FAOSTAT, 2001).

Nonetheless, South America still contains about 885 million hectares of forests (FAO, 2000), which corresponds to 23% of the world total. South American forests amount to 2.6 ha per capita, which is considerably above the world average. Almost all forests are located in the tropical ecological domain and South America has about 54% of all tropical rain forests and the proportion of forest cover in the tropical rain forest zone is 82%. Forest plantations represent just 1% of the total forest cover. The annual net loss, based on country reports, is high at 3.7 million hectares annually, corresponding to 0.4% annually.

Central America consists of the countries of Belize, Guatemala, Costa Rica, El Salvador, Honduras, Mexico, Nicaragua and Panama. Mexico has the largest land area, with more than 190 million hectares, of which 29% is under forest cover. The remaining countries together have a land area of 51 million hectares, with 34% covered by forest. The countries to the south of Mexico from Guatemala to Panama are recognized as a biological corridor between North and South America.

The region of Central America has one of the highest negative rates of forest area change in the world. In terms of gross area, Mexico and Nicaragua have the highest negative change in the subregion. In relation to the amount of forest cover, however, the highest rates of negative change are found in El Salvador, Nicaragua and Belize, whereas Costa Rica and Honduras have the lowest rates. The countries with the highest proportion of forest cover are Belize and Honduras, with 59% and 48%, respectively. Even though broadleaf forest covers the largest area in the region, coniferous formations are economically more important in some countries; for example, in Honduras *Pinus oocarpa* and *Pinus caribaea* are very important, as are *Pinus montezumae* and *Pinus ayacahuite* in Mexico. It was also noted that in all countries where coniferous formations exist, deforestation rates for these formations are higher than for other forest types.

Three-quarters of South American plantations were planted after countries adopted incentive schemes (Victor, 2003), usually subsidies. Yet today, the private establishment of new plantations is continuing despite the fact that governments are scaling back incentive programs.

Mexico and Costa Rica have the largest area of plantations in Central America, promoted by forest incentive policies in both countries. These plantations are utilized both for industrial purposes and fuelwood production. Belize has the lowest plantation area in Central America. The contribution of the region to the world's plantation area is less than 1%.



In the early twentieth century, even Brazil, currently the region's main producer and exporter of forest products, was a large importer of timber. For many years the United States, Canada, Finland and Sweden exported large volumes of lumber to Brazil. Factors arising from the First and Second World Wars helped reverse this situation, but in Brazil, as well as in other countries of the region, the consolidation of the forest sector did not start until much later.

Land, agricultural and forest policies developed by some countries during the 1960s were perhaps the most important elements leading to changed perspectives related to forests and forestry in the region.

Forestry policies had a substantial impact, particularly in Brazil and Chile. In the 1960s these countries developed a fiscal incentive programme to support the establishment of forest plantations. The plantations, mainly based on pines and eucalyptus, soon made available uniform and low-priced raw material, recognized as an important element in attracting the capital needed to develop the forestry industry.

The largest plantations are in Brazil, with approximately 7 million ha including 4.1 million ha of industrially utilizable planted forests. Chile has 1.6 million ha of reforested area, practically all for industrial purposes, Argentina 0.7 million ha, Venezuela 0.5 million ha, Cuba 0.4 million ha and Peru 0.3 million ha. Colombia, Mexico and Uruguay have about 0.2 million ha each. In each of the other countries of Latin America and the Caribbean region the reforested area is less than 100,000 ha. The estimates of the current yearly reforestation rate vary from 460,000 to 520,000 ha (Haltia, 1995; WRI, 1994).

Practically all the plantations have been established on abandoned agricultural lands that are often in a process of erosion. Only in exceptional cases has prime agricultural soil been used for tree plantations. This has been the case lately in Chile where industrial plantations are highly profitable and encouraged by a system of incentives.

Although the majority of existing plantations are industrial in nature, agroforestry and social forestry are widely practiced in the region. These plantations have yielded important benefits to local communities and improved environmental conditions. For example, in the case of the Inter-American Development Bank (IDB), about half of the targeted 774,600 ha of plantations financed in the past 15 years have been financed for community forestry through 33 loan projects (Keipi, 1995). The primarily industrial plantations have been executed through only three large programs.

Traditional "development" arguments for subsidies have included import substitution or the creation of exportable production. However, the validity of this rationale depends on the competitive advantage of the forest sector with respect to forest production in other countries or relative to activities in other sectors in the corresponding country. On the other hand, a social justification for plantation subsidies on the basis of employment generation and reduction of rural poverty can be made, although this raises obvious questions about the labour intensity of plantations versus alternative investments in rural areas. Therefore, an analysis has to be carried out on the effectiveness of forest investments compared with other sectors.

Sometimes an argument has been presented to consider forest incentives as a self-financing investment in the sense that the income generated over time may greatly exceed the subsidy and, if that income is taxed, the government may at least partly recover its contribution. In the case of Chile, the subsidies have been reported to be profitable to the state (Beattie, 1995).

In contrast with the experience of many European countries (e.g. Ireland), practically all the plantations in South America have been established on abandoned agricultural land (Keipi, 1997).

Latin America is an important region from a forestry point of view, at present as well as in the outlook for the future. Its 776 million ha of forests represent about 22 % of the world's total forest areas and 40% of all tropical forests (Prado, 2000).

Although the deforestation rate of natural forests in the region is declining, it is still running at a rate of 0.5 %, concentrated mostly in tropical forest areas. Some evident reasons are the conversion of land to farming and livestock, wildfires, illegal logging, degradation caused by unsustainable exploitation in some areas, and replacement by industrial plantations. However, many of these obvious reasons are, actually, symptoms reflecting more fundamental underlying causes to be found in the economic signals perceived by those taking part in forestry and whose incentives often conflict with the aims declared by society in favour of retaining large areas of forest. Moreover, in many cases, the aims declared by society are a long way from what it is willing to finance when the benefits and all associated costs are made clear to it.

In the Southern Cone, Argentina is the country which has the biggest area suitable for forestry, estimated at 20 million ha of land. About half of this is located in areas with a suitable climate for fast growth. If afforestation continues at the rate of between 50,000 to 70,000 ha yearly, the plantation area of Argentina could reach over 2 million ha by the year 2020.

Although in the past, public investment in afforestation played a major role, increasingly over the past three decades, afforestation has been financed mainly by private sources. In the countries of the region, the State fostered policies aimed at encouraging afforestation, acting as promoter and controller, but generally keeping away from direct operation. The first program, which proved to be successful on a large scale, was introduced in Chile in 1974 and today, Argentina and Uruguay have similar promotion policies. It is estimated that during the 20 years the forestry promotion law was in force in Chile (D.L 701), the State invested about US\$140 million in subsidies for afforestation and management, something that catalyzed private investment amounting to more than US\$4,000 million in afforestation, management and industry.

It is important to note that subsidies, by themselves, might not to be successful. In the Chilean case, in 1974 when the forest subsidy was set, there was a business environment in which forestry profitability was not privately attractive due to market uncertainties, the long time frame involved, recent bad experiences with regard to seizures, etc. Incentives through subsidies were successful because they were complemented by the creation of a credible environment for investment, guaranteed private property, and stable 'rules of the game'. With none of the above, subsidies would probably not have been as successful as they were. As economic tools when markets do not accurately reflect social values (as happens with regard to different environmental aspects related to forests) subsidies can be very useful in two senses: moving private operators towards the production of public goods desired by society, and revealing to society the real cost of producing them. The latter is of more significance when it gets to judging if the demands of society stick to reality.

## **Country Experience**

The following comprises a selected list of individual South and Central American country's experiences in afforestation and reforestation. While this is by no means an exhaustive summary of afforestation in the region, it does provide a broad overview of the kinds of government policies and incentive programs implemented for the purposes of afforestation and reforestation.

### **Argentina**

Argentina, or the Argentine Republic, occupies most of the southern portion of the continent of South America. The area of Argentina is 2,766,889 km<sup>2</sup>, making it the second largest South

American country after Brazil. Argentina comprises a diverse territory of mountains, upland areas, and plains. The western boundaries of the country fall entirely within the Andes, the great mountain system of the South American continent. For considerable stretches the continental divide demarcates the Argentine-Chilean frontier.

Argentina's forest regions cover around 12% of the country and span a variety of eco-regions, from shrub steppe, sub-tropical cloud forest and rain forest to highland riparian rainforest and shrubs, xerophilous forests, Andean-Patagonian temperate rainforest, and Patagonian Steppe and highlands. The country also has extensive forest plantations, comprised mainly of pine and eucalyptus species. The country has more than 40 national parks and reserves and numerous provincial protected areas.

Argentina's federal government has responsibility for policies related to sustainable development and environmental preservation. Jurisdiction over national forestry matters is divided among several organizations including the Environment and Sustainable Development Secretariat, the Agriculture, Food, Fishing, and Cattle Industry Secretariat, the National Institute of Farming Technology, and the Timber and Related Industries Research and Technology Center (CITEMA). Argentina is using an auction procedure to lower the costs of forestation incentives to the government. This procedure may work well with big and medium-sized landowners but may be more difficult to implement with small farmers with fewer skills to prepare forestation bids. Hueth (1995) proposes a similar procedure for a wider use in watershed management programs.

The government created an incentive program for the establishment of plantations in 1995, based on Law 21695 from 1992, and created the National Program of Forest Development (Tomaselli, 2001). The program includes allocation of funds for direct investment by the Government in the establishment and management of forest plantations. As a result, from 1997 to 2000 around US\$ 60 million were invested by the government in the program.

The Program defines priority regions for forest plantations. The program consulted subsidies to private investors. The amount made available by the Government to establish plantations depended on local conditions and varies from US\$ 340/ha to US\$ 700/ha, according to the conditions of plantation establishment. Additional funds are made available to manage the plantations: US\$ 40/ha for pruning and US\$ 50/ha for thinning.

The Program has been an important mechanism to enlarge forest plantations in Argentina. Most of the plantations are in small properties (so far over 4000 small landowners benefited from the Program) but funds were also made available to large landowners and companies.

In addition, the government carefully put in place policies that ensured stability for the investments in plantations, outlined in the Law of Fiscal Stability. Under this Law, fiscal obligations affecting plantation establishment and also their management, harvesting and trade of forest products from plantations were "stabilized" for a period of 33 years. This policy was, according to investors, a determining factor in their decision to invest and engage in forest plantation development, as stability in the rules is fundamental in long-term investments, such as in forest plantations.

The government disbursed some \$60 million to support plantation development during the period 1997-2000 and indications are that the total area under plantations by 2003, only 8 years after the policy was adopted, will reach some 1.5 million hectares, a 50% increase over the pre-program years.

Another program under development by the Government of Argentina, and many of its provincial governments, is designed to stimulate planting of large stands of pine, eucalyptus and auracaria by offering tax breaks and subsidies for investors in plantations. The federal Argentine government will reimburse a foreign or national plantation owner between US\$ 400 and US\$ 600 per ha of plantation, which will cover the cost of plantation establishment (including labour and

planting stock), or up to 80% of land costs. This amount is payable 18 months after establishment, up to a maximum of 675 hectares per year. The amount paid varies according to region and is supplemented by the provincial governments.

The intent is to stimulate development of the forest industry in the country and, although carbon sequestration is not a stated objective of the program, it is recognized as a side benefit. Argentina hopes to plant up to 200,000 ha/yr between 2000 and 2009. Incentive mechanisms in the country have been in place since 1992 and it has seen requests for plantings grow from 20,000 ha to 120,000 ha in 1999. Argentina believes that it has 20 million hectares of land outside of its agricultural zones that is suitable for afforestation. Land prices are low (but climbing as a result of the incentive program) and trees grow quickly (for example, genetically improved southern pine can be grown on a 20-year rotation compared to a 45-year rotation in its native southern USA). Investments from Brazil and Chile have already been made in plantations and mills, with Chilean investment alone exceeding US\$ 750 million since 1995.

### **Model Forests in Argentina**

Faced with increasing deterioration and degradation of its forest ecosystems, Argentina took the first step towards developing a model forest program following a workshop co-hosted by the IMFN Secretariat and the Province of Córdoba in May 1996. The main purpose of Argentina's model forest program is to improve the quality of life in marginalized and low-income communities, living in or near forested areas.

Based on an agreement with the IMFNS, Argentina created a National Coordinating Agency to shape and promote its model forest program. An advisory committee was also created to select sites based on national program criteria. All Argentine provinces were invited to submit proposals for the development of model forests. Of the eight proposals received, three have been approved to date: Futaleufú, Formosa and Jujuy model forests. Each of these programs focuses on the needs and requirements of the partners involved, beginning at the proposal stage.

The general objectives of the National Model Forest Program are to:

- \* streamline the implementation of sustainable development projects within the framework of integrated management of forest natural resources;
- \* develop innovative approaches, procedures, techniques and concepts for the management of forest ecosystems; and
- \* promote a participatory approach in planning and management processes.

In 2000, the National Model Forest Network was created to strengthen the national program's aims of preserving and managing forest ecosystems in a sustainable manner; to attain the goal of implementing one model forest per forest eco-region; and to facilitate technical cooperation among the local programs, and their integration to the activities of the International Model Forest Network.

Since Argentina was entering an economic recession during the establishment of its first model forest site, the program faced the added challenge of securing financial resources from the national government. To date, partners continue to pool resources and collaborate on projects, and several proposals are under review to secure support from the Food and Agriculture Organization (FAO), the Japanese International Cooperation Agency (JICA), and the German Technical Cooperation Agency (GTZ).

### **Model Forest Sites**

Futaleufú Model Forest: a 738,000 hectare site in the Province of Chubut, the proposal for which was approved in 1998. Two of the main challenges facing the region are the disintegration of

institutional activities and resource management issues, particularly related to the impact of cattle on the land and forest resources.

**Formosa Model Forest:** an 800,000 hectare site in the Province of Formosa. This site is located in a semi-arid, remote and poor region that faces a wide range of challenges including: improving living conditions in poor communities; management of scarce resources; involvement of indigenous communities; water management issues; and conservation of native tree species. Since the Formosa proposal was approved in 2001, work has focused on creating a model forest association and securing financial resources to implement the program.

**Los Pericos-Manatiales Basin Model Forest:** a 130,000 hectare site in the Province of Jujuy. Located in a temperate, mountainous region, this site has strong support from the municipal government and local population. The issues being addressed here are very similar to the other Argentine sites, including watershed management; expansion of pastureland and agricultural land; environmental education to raise awareness of the general issues; and the need for better coordination of efforts at both the municipal and provincial levels

### **3. Belize**

Belize (formerly British Honduras until the name of the country was changed in 1973) lies on the eastern or Caribbean coast of Central America, bounded on the north and part of the west by Mexico, and on the south and the remainder of the west by Guatemala. There is a low coastal plain, much of it covered with mangrove swamp, but the land rises gradually towards the interior. The Maya Mountains and the Cockscomb Range form the backbone of the southern half of the country. The area of the mainland and cayes is 8,867 square miles. The country's greatest length from north to south is 280 kilometres and its greatest width is 109 kilometres. The climate is subtropical, tempered by trade winds.

Agriculture currently provides some 71% of the country's total foreign exchange earnings, and employs approximately 29% of the total labour force.

Although about 1,998,230 acres or 38% of the total land area are considered potentially suitable for agricultural use, only perhaps 10 to 15% is in use in any one year. About half of this is under pasture, with the remainder in a variety of permanent and annual crops. The traditional system of "milpa" (shifting cultivation) involves the annual clearing of new land for crop production; however, there are an increasing number of farmers making permanent use of cleared land by mechanical means. A tax is levied on the unimproved "value" of the land.

The beginnings of a forestry industry started in 1763 when Spain, under the Treaty of Paris, allowed British settlers to engage in the logwood industry. The Treaty of Versailles in 1783 reaffirmed those boundaries and logwood concession was extended by the Convention of London in 1786.

In recent years there has been a resurgence in forestry. Reforestation and natural regeneration in the pine forest (mainly in the Cayo, Stann Creek and Toledo Districts) and artificial regeneration of fast-growing tropical hardwood species are currently in progress.

As part of this effort, the government of Belize is participating in the Rio Bravo Conservation and Forest Management Project (1994). The Rio Bravo project was originally developed by The Nature Conservancy with support from Wisconsin Electric Power Co. The project is located within the Rio Bravo Conservation Management Area (RBCMA) of Belize, managed by the Programme for Belize.

The RBCMA is a prime mahogany and Mexican cedar habitat; at one time it was considered the richest mahogany and Mexican cedar forest in Belize. The area was selectively logged for 150

years. These activities were carried out on a sustainable basis for most of that time. The national trend of conversion of forested land to cropland reached the north-west region of Belize in the 1950s. The area surrounding the RBCMA is actively being converted. The Rio Bravo project was structured to prevent the sale of the parcel to a Mennonite agricultural commune that had expressed its intent to purchase and farm the area.

Project Participants include the Government of Belize, The Nature Conservancy, Winrock International, Wisconsin Electric Power Company, Detroit Edison Corp., Cinergy, PacifiCorp., UtiliTree Carbon Co., and a consortium of approximately 40 utility companies.

The Rio Bravo project has two components. Component A involves the purchase of endangered forest land which without intervention would be lost to intensive agricultural use. Component B is developing a sustainable forestry management program designed to increase the total pool of sequestered carbon in a separate part of the project area. Pine savannah, for example, will be subject to management aimed at improving stocks of pine through promotion of regeneration. Specific measures to be employed by the project include:

- allowing primary timber stocks (broadleaf) and biomass of the area generally to recover to a higher maintenance level for carbon sequestration;
- creating conditions for regeneration of the primary timber species; sustainable harvesting of the broadleaf forest, applying a low-impact logging regime designed to minimize damage;
- marketing timber for use in durable products;
- protecting and enhancing pine forest stocks located on degraded savannah areas (including fire protection); and
- reforestation of cleared lands.

The project involves the purchase of a 6,014 ha parcel of endangered forest land that would have been converted to mechanized agriculture. If the protected forest area had been converted to agricultural land, it would have separated currently protected forest areas, thus compromising their ecological integrity.

The funds will be paid into a Nature Conservancy land bank fund over a 10-year period. TNC's fund acts as a bank and provides capital as needed to the project developer. Upon valuation, credits are lodged with U.S. Initiative on Joint Implementation (USIJI) and subsequently distributed to investors on a pro-rata basis. Credits are revalued annually by the program administrator. Project development expenses are partially funded by the utilities; however, the high costs associated with development of this early project prohibited full cost recovery.

If carbon credits are traded and sold in the future above their purchase price, a portion of the return (amount to be determined) will be payable to the government of Belize.

Total project cost is set at US\$2.6 million by project developers, including costs of land purchase, monitoring and verification, and project administration. Based on this project cost and the estimated CO<sub>2</sub> benefit of 4.8 million tons, the calculated cost of CO<sub>2</sub> is \$0.54/ton. This is also the CO<sub>2</sub> offset price in this case.

The project is the most complex offset project in existence in terms of the number of financial participants. Four individual utilities and one utility consortium of approximately 40 companies are involved in financing the project's US\$3 million cost. Each financial participant will receive 20% of the project's carbon benefits.

## Chile

The Republic of Chile is bounded on the north by Peru, on the east by Bolivia and Argentina, and on the south and west by the Pacific Ocean. The country has a total area of 756,626 km<sup>2</sup>, which is distributed in a long narrow strip that stretches 4,270 km from north to south but is only 427 km wide at its widest point. Forest ecologists estimate that 45% of Chile's surface area was originally forested, however this figure is now estimated to be 23% (FAO, 2003).

According to the FAO, twelve types of natural forest occur in Chile. Southern Chile houses one of the largest continuous blocks of temperate forest in the world; one third of the world's largest 'undisturbed' temperate forests are found in this country. The most extensive areas of natural forest are the temperate southern beech (*Nothofagus* spp.) rain forests, which comprise six distinct forest types.

Chile has an extensive protected areas system with 30 national parks and 40 national reserves covering almost 20% of Chile's land area, and representing around 11% of Chile's native forests. Chile is also notable for its extensive forest plantation estate covering more than 2 million hectares. *Pinus radiata* comprises around 75% of the plantations and eucalyptus species another 17%.

Most of the country's forests are concentrated in the southern temperate regions of the country which includes some 7.6 million hectares of unprotected (commercial) native hardwood forests. These forests are becoming increasingly valuable to the forest products industry, which is fast becoming one of the most promising expanding sectors within Chile's economy.

Chile's temperate forests contain at least 50 species of timber trees of which 95% are endemic and more than 700 vascular plants of which over half are endemic. The Southern Hemisphere's largest conifer, the alerce cedar and a tree which can live for over 3,000 years are found in Chile's natural forests (World Resource Institute). Practically all of Chile's 8.9 million hectares of commercially productive native forests are privately owned.

In addition to the native hardwood species, Chile has over 2 million hectares of commercial forest plantations, most of which are monocultures of radiata pine (*Pinus radiata*) and to a lesser extent, eucalyptus. These plantations originated as early as 1907 in Chile and their expansion to their current area of over 2 million hectares began in earnest in the 1970's. The radiata forests are concentrated primarily in the central portions of the country, just south of the capital, Santiago. Plantations supply 90% of the wood used in Chile's current forest industry. Chile's wood products associations (CORMA) projects that within twenty years the land area of tree plantations will double. These plantation style forests have been growing at a rate of about 76,000 ha per year due to their strong economic benefits.

INFOR (1998) provided the total planted area in Chile as 1,881,925 ha by the end of 1997. Annual plantings during 1996 and 1997 were 78,600 ha and 79,500 ha, of which new plantings were 42,500 ha and 44,300 ha respectively. Inventory reports based on results from the Global Forest Resources Assessment 2000, estimate the extent of Chile's forest cover in the year 2000 at 15.5 million hectares. The forest cover change between 1990 and 2000 was estimated to be negative 20,307 ha/yr, which corresponds to a 1% loss of forest cover every year. Such critical levels of deforestation have been attributed to such policies as Decree No 701 (Forestry Promotion Law) introduced in 1974 by the military regime. This decree granted a 75% subsidy to forestry expenses. As a result, ownership of forested areas came to be concentrated within a small group of large companies (Toro, 1999).

Though the area of plantations is expected to pick up in the coming years as the effects of a new law on subsidies (1998) takes hold (see below), a moderate new planting rate of 45,000 ha/yr has been assumed for the three year period of 1998-2000.

Chilean forestry practices have been held up as a model for other countries in the region. Management practices, introduced under the military regime of Augusto Pinochet were designed to attract foreign capital, but the adoption of environmental policy was implemented only after the transition to democracy in 1990. Forest Management (and lack of conservation) in Chile has been dictated by neo-liberal economics (Altieri, 1999).

Radiata pine is the commercially favoured species in Chile as it is the only forest species with economic value that is capable of growing on soils that have been eroded by over 150 years of intense agricultural use (Toro, 1999). It also is characterized by elevated growth rates, and promises high financial returns in less than 30 years. This species is easy to establish in a field, it is inexpensive to produce, and forest management is relatively simple. In comparison, native forest species are less economically valuable, difficult to establish on eroded soils, and require longer rotation periods (Toro, 1999). Chile first introduced radiata pine plantations in the 1940s, primarily to combat erosion along the Coastal Range in the south-central part of the country. Now forest plantations cover over 2 million hectares in Chile, with more than 80% devoted to radiata pine and the remainder mostly consisting of blue gum eucalyptus.

Strong debate exists in Chile, over the value attributed to forests and forestry. Logging advocates maintain that plantations have contributed to increases in employment rates, improvements to quality of life, and a diminishing of migration to urban centers (Toro, 1999). Proponents maintain that plantations “provide ecological, economic, and social values in Chile”, that plantations help inhibit soil erosion and facilitate the reestablishment of destroyed ecosystems. Such advocates value this industry as it is economically lucrative. In 1994, for example, the industry generated some US\$1,550 million (Toro, 1999).

In the case of Chile, as with that of Brazil, the availability of adequate incentives for the establishment of forest plantations was a minor factor contributing to forest industry growth, once a critical initial mass of plantations was established (Beattie, 1995). For example, Wunder (1994) claims that subsidies had only a secondary impact in promoting plantations in Chile. More important factors have been a comparative advantage and a favourable general economic environment. Today, many Chilean forest companies choose not to access incentives in order to avoid major government controls related to long-term tying of the land to forestry and restrictions on the management and harvesting of the plantations. It is therefore no surprise that Brazil has discontinued many of the incentives and that widespread criticism is mounting against their continued use in Chile in favour of large landowners and companies. Consideration is being given instead to their reorientation towards small farmers.

## **Incentive Programs**

In 1973, the Chilean government initiated a structural adjustment program that reduced the role of government and provided leeway for the private sector to operate. Privatization was a key element of the reforms, which created a dynamic, export-led, market-based economy. The program's main elements included the return of land and industries seized by the previous government to their original owners (Venezian and Muchnik, 1997).

As part of this reform package, a timber plantation subsidy program was initiated in 1974 to encourage private sector reforestation. Some of the tax exemptions that had been established in 1931 were maintained and direct payments of 75% of the costs of reforestation were given (Clapp, 1998). Further payments were made available for additional silvicultural activities. There were exemptions on property and inheritance taxes on reforested land as well as a special Central Bank line of credit for reforestation (FAO, 2000a). Between 1975 and 1979 the government sold its own plantations, complete with land, nurseries and machinery.

The incentive program accelerated private sector planting. The average annual reforestation level was 11,373 ha between 1940 through 1974 (Clapp, 1995), such that there were about 300,000



ha of state plantations by 1974. In 1990 the plantation area had increased to 1.45 million ha, mostly established by the private sector (Pandey and Ball, 1998).

In 1975 the government introduced measures to eliminate previous restrictions to the export of unprocessed logs and wood raw materials (Decree 259, Ministry of Agriculture). At that time this was a radical change in Latin America, a region where nearly all countries had strict log export prohibitions in place. With the liberalization policy, the previously restricted large log export market was now open to Chilean entrepreneurs. Shortly after, in 1979 the government also abolished prohibitions to the export of logs of small dimension (Supreme Decree 350). This policy reform offered possibilities for improving the cash flow situation for many investors that could not wait extended periods to get the returns on their plantation investments.

The net effect of these integrated policy reforms was to open enormous possibilities in the export market and for investments in plantations. With these reforms, the conditions were set for a massive export of logs. The high commercial profitability of producing and exporting logs (with internal rates of return 25% and 45%) generated strong incentives for further investment in plantations. At the same time, also exports of industrialized products based on plantation wood, such as wood-based panels, various types of wood pulp and paper, started to accelerate.

The government spent some \$150 million in subsidies during the 20 years Decree 701 was in force but, the Decree and its associated legislation contributed to catalyze for investments for \$4 billion (Raga, 2000). The government profited handsomely by receiving more than \$200 million a year in direct taxes alone (Contreras-Hermosilla, 1997a). Plantation establishment rates averaged almost 80,000 ha annually from 1974 to 1990 and the proportion of state reforestation fell from a high of 91% in 1973 to almost zero in 1979 (Clapp, 1995). Most plantations were established in wastelands (Unda and Ravera, 1994).

Studies carried out in Chile revealed that the fiscal incentive program for forest plantations achieved an attractive rate of return on the investments made (see Gregersen, 2001). The Chilean program attracted substantial amounts of private capital, increased employment and revenues and finally taxes returning to the government. When all aspects were considered, it was found that the internal rate of return (IRR) of fiscal incentives for forest plantations in Chile was around 15%, higher than most of the investments made in the country during the last decades.

While forest plantations still play an important part in checking soil erosion, they have also become the basis of a thriving pulp and solid wood industry in Chile. Beginning in 1974, when the Chilean government introduced subsidies to fund up to 75% of the cost of establishing and tending new plantations, private forest companies started expanding the land base devoted to plantation forests. Even years later, with the subsidies almost eliminated, (incentives continued to exist for small properties and to recover degraded lands) new plantings were at unsurpassed levels, signalling that the economic returns are worth the initial investment. In 1994, Chile's forest sector exports earned roughly U.S.\$1.95 billion, almost double the amount earned in 1990.

The planting subsidy was removed in 1994. Since then, plantation area has continued to increase, but at a slower pace. By the year 2000 the plantation area was expected to be almost 2 million ha, of which 80% would be *Pinus radiata* (Williams, 1998).

Chile began exploring model forests in 1997. Following a forum on the concept, a partnership was formed among the government of Chile and various institutions including the Corporacion Nacional Forestal (CONAF), the Chilean Institute for Forest Research (INFOR), NGOs, private sector companies, and interested partners from the Province of Chiloé.

The appeal, and success, of the model forest approach in Chile is due in large part to the involvement of small-scale farmers in protecting forest resources. The Chiloé Model Forest, launched in March 1998, has successfully identified ways to protect forests by developing new

sources of income derived from sustainably managed forest resources. This approach has garnered widespread public support for the model forest concept.

The model forest approach has facilitated open discussion of sustainable forest development issues between government and civil society, an approach that has attracted national attention. For example, the Ministry of Agriculture has adopted this approach to promote dialogue with farmers.

The model forest program has contributed to positive changes in INDAP policies relating to farming subsidies and loans. INDAP is a public organization with a mandate to support small-scale farming operations, which used to provide financial assistance for livestock operations if the land was cleared. Now, INDAP realizes that forest can be an integral part of the small farm productive system, and promotes the coexistence of forest and farming activities. In addition, INDAP policy highlights the potential to increase family revenue through this integrated approach to resource management.

In the non-energy sector, which includes emissions from agriculture, changes in land use and forestry measures aimed at sustainable resource management have also been applied. These must be evaluated in relation to climate change since they may have had a direct effect on the decrease of methane and CO<sub>2</sub> emissions as well as on the increase and/or continued existence of sinks.

Some of the measures that now apply to afforestation efforts include the creation of forestry administration plans, forestation programs for energy purposes and the economic incentives legally established in Decree Law No. 19,561 (1998) for forestation on fragile, eroded soils or those at a risk for desert encroachment.

These laws are particularly important because of the indirect effect their application may have on the increase of carbon dioxide sinks. Law No. 19,561 (1998) is, in practice, the renewal of Executive Decree No. 701 for an additional 15 years, until 2023, but it also modifies its focus and improves some of the administrative procedures.

The legal provisions of this law are based on the government's will to "regulate forestry activities on lands best suited for forestry and on eroded soils and to foster afforestation, especially by owners of small forest holdings and where necessary to prevent soil erosion and to protect and replenish the country's soils."

This new law to promote forestry also combines social with environmental objectives. In social terms, it provides incentives to owners of small tracts of forest land and, in environmental terms, it combats desert encroachment by regulating forestry activity on eroded soil.

From an operational point of view, these laws allow for a one time tax credit for the following activities:

- Reforestation of fragile soils, marshes or areas threatened by desert encroachment.
- Recovery and forestation activities for eroded non-arable dry soils.
- Sand dune stabilization and forestation.

It is estimated that there are 200,000 potential beneficiaries, with around two million hectares of land for planting and 27 million hectares in need of protection or reforestation. This new law includes new forestry production options in order to diversify by using species of trees other than the traditional plantations of Radiata Pine and Eucalyptus. Options include the Australian Gum, elm, chestnut and Oregon pine.

Current legal provisions state that any intervention in a native forest that is not legally classified as a protected area (park, monument or national reserve), requires CONAF's authorization. To

obtain this, a Forestry Management Plan and an Environmental Impact Study must first be presented and approved. The regional Conama office with jurisdiction must approve the environmental impact study. Forests classified as protected cannot be touched unless expressly authorized by law.

### **Chile's Model Forest Program**

The Chilean Model Forest Program encompasses a broad range of activities designed to improve living conditions in the region while protecting the fragile ecosystem and promoting the local culture. Through this program, the government is working with communities to help them identify their needs and make them custodians of their own land.

The program involves forest development activities based on integrated resource management. It encompasses the following components: community participation; forestry and industrial development; biodiversity conservation; applied research; technology transfer and extension activities; education; and tourism and culture.

### **Model Forest Sites**

Chiloé: launched in March 1998, this model forest is located on the island of Chiloé and spans some 918,000 ha, including the Chiloé National Park, and a large number of small privately-owned woodlots. Chiloé's forests have long been threatened by excessive timber harvesting and clearing land for agriculture. Local residents depend on the remains of undeveloped native forests for their livelihood, providing a unique and challenging opportunity to test the model forest concept. In fact, the area was chosen as Chile's first model forest site under the premise that if the concept could succeed there it could likely succeed anywhere.

Alto Malleco: located in the Chilean IX region, this Model Forest is currently being developed. Chile is in the process of forming the locally based partnership and defining the program for this second model forest site. One of the key goals is to involve the region's indigenous Mapuche Pehuenche communities in resource management.

A third Chilean site is expected to be under development by 2004.

At the site level, the Chiloé Model Forest has successfully developed a rural tourism project that is changing attitudes and slowing forest degradation. Local farmers who used to have recourse to slash-and-burn, are now caring for their forested lands for their newly recognized tourism potential. The project provided support and training to interested farmers to develop agro-tourism activities. There are now more than 1,000 houses in the country that will accommodate tourists overnight.

The Chiloé Model has also promoted environmental educational programs, which have been introduced in a great majority of schools on the Chiloé Island. Parents report that their children are telling them they should not log the forests indiscriminately, but in a sustainable manner.

The Chilean government believes that the Model Forest concept has shown great potential in Chiloé. Therefore, the approach will be tested in different ecosystems, starting with the Alto Malleco site, which is currently under development. Located in a traditionally conflict-prone area, this model forest will aim to encourage dialogue with the local Mapuche Pehuenche population. Development at this site will also contribute to furthering support to Aboriginal communities, and exploring the complementary nature of traditional knowledge and modern sustainable forest management field applications.

## 4. Costa Rica

The Republic of Costa Rica, located in southern Central America, is bounded on the north by Nicaragua, on the east by the Caribbean Sea, on the south-east by Panama, and on the south-west and west by the Pacific Ocean. Cocos Island, about 480 km to the south-west in the Pacific Ocean, is also part of Costa Rica. The total area is 51,100 km<sup>2</sup>.

Most of Costa Rica is comprised of rugged highlands, ranging from about 900 to 1,800 m above sea level. Several mountain ranges extend nearly the entire length of the country. A central plateau, the Meseta Central, is located between the ranges and is the country's chief agricultural region. Wide lowlands, much of it swampy tropical jungle, extend along the Caribbean coast. The lowlands along the Pacific are narrower and drier.

Costa Rica is moderately forested with more than 25% forest and woodland cover and a recent increase in forest cover due to regeneration of secondary forests and reforestation programs. Significant variations in elevation and topography have led to the development of a wide array of vegetative zones ranging from coastal mangroves to sub-alpine paramó. The predominant forests of Costa Rica can be broadly classified, according to elevation and precipitation. The most extensive are lowland humid tropical forests in the south east of the country and on the Peninsula de Osa. Common species are guacimo colorado (*Luehea seemanii*) and laurel (*Cordia alliodora*).

Dry tropical forests are characteristic of the Guanacaste province in the northwest. The most extensive montane forests occur in the Cordillera de Talamanca mountain range in the south. *Quercus* spp. is the most common tree at higher elevations. Costa Rica has an extensive network of protected areas with more than 25% of the country's land area protected as forest reserves, national parks, and reservations for indigenous peoples. Costa Rica has a significant plantation estate, based around *Gmelina arborea* and teak (*Tectona grandis*).

Costa Rica produces a moderate amount of roundwood, three-quarters of which is used as fuel. The majority of industrial roundwood is used for sawn timber, but Costa Rica also has small wood-based panels and paper industries. Most pulp and paper is imported.

The main vegetative covering areas throughout 95% of the country, at altitudes below 2,000 m, tend to be closed rainforest. This vegetation accounts for around 1,200 species of trees plus another 1,000 woody species. Forests seldom host more than 100 arboreal and woody species.

The number of species falls sharply at higher altitudes. At elevations over 2,000 m the original natural vegetation is a purer forest of various oaks, *Quercus costaricensis*, *Q. cugemarfolia*, *Q. alata*, etc. accounting for approximately 3,000 ha of land. At 3,100 m, in Villa Mills, Talamanca, there are only 23 species of trees.

Deciduous forests are found mainly in the Pacific region, particularly in the central and northern zones, while leafy evergreen forests are found mainly in the Atlantic region.

Before the 1950s, forest had slowly declined in area as the country's agricultural society emerged. Large coffee-producing landowners dominated, and a collection of laws had been passed which, on the one hand, tried to mitigate certain impacts of agriculture on the forest, and on the other hand, set the scene for dramatic deforestation. Amongst an educated elite there was also a growing sense of concern that efforts to protect the environment were needed.

Wholesale conversion of forest was first stimulated by government policy in the early 1950s, when a new government sought to build a powerbase through a policy of extending low-interest credit to cattle ranching. Colonists were able to secure lands outside the Central Valley by clearing the forest. Some of these colonists were displaced smallholders; others were wealthier interests seeking extensive lands for cattle ranching. Timber industries benefited through a

surplus of low-cost timber created by the conversion of forest land to grazing lands, while coffee growers in the Central Valley and the new plantation owners in the southern areas of the country profited from an increase in prices on the international market.

In 1946, the Tropical Agricultural Research and Higher Education Center (CATIE) initiated experimental plantations to test various species. Since then, more than 250 species have been introduced. During the 1960s, a number of extremely fast-growing species were identified, many of which were introduced by CATIE. Through this process plantations with exotic species have been emphasized.

Since 1979, the government has enacted several types of incentives to encourage plantation activities, with broadleaved species mainly being planted. Funds to finance these incentive schemes, however, were insufficient to meet the demand. In 1989, for example, the total area established by these incentives amounted to 9,257 ha, far shy of 50,000 to 60,000 ha/yr needed to offset the rate of deforestation.

Costa Rica had one of the highest deforestation rates in the world through much of the 1980s and into the 1990s. Estimates range from deforestation of 3.6% of the land in 1986 (World Bank, 2000) to between 4% and 7.6% in 1990 (WRI). Studies during the 1970s and 1980s showed forest fragmentation and a deforestation rate of 30,000 ha to 50,000 ha per year.

FAO data (2003) shows a clear reduction of the forest cover over this period, with a total loss of about 458,000 ha in 18 years or 26,700 ha per year over the period of 1979-1997. Predictably, receipts of the forest industry also grew as more trees were exported to world markets. During the early 1990s, for example, the contribution of forest plantations to the country's GDP increased from 0.18% in 1991, to 0.35% in 1995 (Gómez et al., 1997).

During this period trees in natural forests were also harvested through selective cutting, but the harvest level was not considered to be sustainable. This led to a massive decrease in the amount of natural forest during the period. This trend did not reverse itself until the late 1990s, when the deforestation rate started to fall (World Bank, 2000).

At the same time, from 1970 to 1990 the protected area system became firmly established, and the forest industry continued its rise. Financial incentives for reforestation became government's main policy tool in forestry. These incentives mostly benefited larger landowners and were generally insensitive to people's motivations for forest management and conservation. The main losers were the smallholders, who collectively own about two-thirds of the country's land. However, the short-comings of the incentives system generated considerable debate, and stimulated the formation of small-holder forestry organizations.

Incentive programs have also resulted in some unwanted side effects. Primary forests, for example, were sometimes cut in order to establish forest plantations. In addition, research has found that investment companies have planted trees to get credit and then sold the plantations without provision for replanting or maintenance (see below).

Finally, the species to which the programs apply are limited to those on the official species list. It does not include native species that are often planted. Some of these official species do not always grow well, especially when they are planted on infertile sites (Butterfield, 1994).

Four types of financing mechanisms were identified under Costa Rican law:

- tax exemption,
- special funds,
- reforestation contracts, and
- loans for reforestation.

These mechanisms were designed to: increase the supply of raw material for industry; establish agroforestry systems; promote a change of attitude among the people with respect to forest resources; and transfer funds to regions affected by low crop production.

## **Tax Exemption**

Through the income tax deduction introduced in 1979, the government promoted plantation forests to obtain the raw material the country needs in order to prevent the destruction of natural forests. The tax break allowed large investors to deduct the cost of establishing and maintaining plantation investments from their income tax liability, provided that portion was invested in government-prescribed forestry activities. The tax credit granted was valued at US\$800 per hectare. The incentive has been criticized for being too high, encouraging some companies to buy land covered with natural forest. They would then harvest the standing timber before taking advantage of the income tax deductions available for reforestation.

Although this incentive was intended to be extensive and motivate landowners, most of Costa Rica's rural population was excluded since only large landowners pay income taxes. When the incentive was instituted, reforestation technologies were not well developed. There also was not enough knowledge about nursery management of exotic and native species, or about reforestation techniques and silvicultural management. The quality of the first areas planted using this incentive was generally poor.

Still, by 1993, some 50,000 ha had been reforested in Costa Rica under tax exemptions. Initially, the mechanism focused only on taxpaying entrepreneurs, with the objective of increasing national supplies of industrial timber. At the request of small farmer organizations and technical experts, the mechanism was later extended to include farmers working their own small- and medium-sized farms. These farmers planted 10,000 ha of the 50,000 ha reforested. At the same time as this amendment was introduced, the additional objective of developing forest awareness was also included.

Another tax based initiative, Act 4465 of 1969, allows up to 16% of income tax liabilities to be invested in reforestation. The Act was set up with the aim of establishing forest plantations to supply the saw mills and to reduce pressure on the natural forests. This mechanism may only be used by individuals and companies with income tax liabilities who own or acquire land for the purpose of establishing their own reforestation projects. The tax relief scheme was not designed to promote community forestry activities.

## **Bank lending**

Costa Rica's Forestry Act 4465 also states that the state-owned commercial banks should allocate 3% of their total loan portfolio to funding for forestry. This scheme has not been used. The lack of demand was seen to be due to the availability of non-repayable loans and to the rates of interest at which these funds were made available.

In 1983, the National Banking System and a program known as COREMA AID-032 established soft loans for reforestation with an 8% interest rate and a ten-year grace period. Payment periods are as long as 30 years, depending on the species planted.

## **Certificado de Abonos Forestales (CAF)**

The Certificado de Abonos Forestales (CAF), or Forest Bond Certificate, was introduced in 1986 following amendments to the tax relief mechanism, allowing individuals and companies to take advantage of that mechanism without having to establish their own plantations. The bond can be used to pay any kind of tax, or sold for slightly less than the face value of approximately US\$650 per hectare. Payment is made when the investor provides proof that the plantation has been

established. Large companies benefited most as the terms of the CAF require the investor to pay the upfront reforestation costs before receiving the bond. The scheme had encouraged over 600 businesses to reforest approximately 38,000 ha by 1995.

The amendment also allowed for the establishment of companies specializing in promoting and implementing reforestation projects. The scheme also required the submission of a reforestation plan meeting the evaluation criteria established by the Forestry Department (DGF). It reimburses landowners for the entire cost of the first five years after planting.

### **Fund for Municipalities and Organizations**

Forest Law 7032 (1986) established a tax on forest activities and allocated 20% of the amount collected from the exploitation of timber to regional organizations and municipalities. These funds may be used to implement reforestation projects, manage watersheds, establish nurseries, promote the extension and development of forests, and build infrastructure like forest roads.

### **Forestry loan certificate (CAFA)**

CAFAs were created in 1988 because small landowners were unable to invest in reforestation and wait for the payment of titles. Since farmers working their own small farms don't pay income tax, they were not able to take advantage of either a tax relief scheme or subsidies. The CAFA was a redeemable bond for smallholders with plantations of less than 25 ha per family. The bond was worth US\$520 per hectare with 50% paid upon confirmation of contract and the remainder spread over the subsequent four years. To be eligible farmers must be members of a community development organization, which then submits one reforestation project on behalf of all its members. Each farmer signs a contract with the organization undertaking to meet his or her reforestation commitments. A major requirement of the CAFA was that farmers had to submit documents certifying that they were the legal owners of their land. The Department of Forest Development for Farmers (Departamento de Desarrollo Forestal Campesino) was instrumental in organizing small farmers for forest development purposes.

### **Fondo de Desarrollo Forestal (FDF)**

The FDF was established in 1988 for small landholders, and has similar objectives to the CAFA. It pays them the cost of the first five years of plantation activities, through a local farmer organization. The FDF grant requires that a revolving fund be established funded by farmer contributions equivalent to 30% of the expected value of the plantation output. The state calculated the cost of reforestation as US\$762 per hectare. The community organization receives 70% of this amount on the assumption that the remaining 30% of the cost will be contributed in the form of farmer's labour. The community development organization retains an administrative fee of US\$104 and passes US\$429 on to the participating farmer.

### **Forest Management Bond Certificate (CAFMA)**

The CAFMA, established in 1991, marked a change in government priority away from reforestation in favour of better forest management. CAFMA operates as a redeemable bond for landholders with between 30 and 300 ha. Landowners are required to enter a contractual agreement with the government whereby they agree to provide a management plan to the Directorate General of Forestry for approval. In return they receive a bond worth between US\$ 460 and 520 per hectare paid over five years following approval of the management plan.

### **Carbon Fixing (CARFIX)**

The CARFIX project was established in 1995 with the objectives of protecting carbon sinks in an important protected area, increasing carbon capture in the buffer zone, and providing investment

opportunities for foreign investors and local landowners. The National Fund for Financing Forestry (FONAFIFO) was also set up to access non-government finance for the promotion of forestry activities in privately owned forests. This was followed in 1996 by creation of the semi-autonomous Costa Rican Office of Joint Implementation (OCIC). The programme aims to generate carbon offsets from forest conservation and reforestation activities. Certified Tradable Offsets (CTOs) are sold internationally.

With support from the Centre of Financial Products, the World Bank and the Earth Council, OCIC hopes to sell 'certified tradable offsets' (CTOs) on the Chicago Stock Exchange. A number of USIJ approved agreements have been established between Costa Rica and private investors in Europe and North America. Whilst each project has its own business model all share the common purpose of increasing carbon sequestration.

The first batch of CTOs was sold in 1996 (although not on the stock exchange) to a Norwegian Consortium for \$2 million (200,000 tonnes of carbon at \$10/ tonne, equivalent to \$2.70/tonne CO<sub>2</sub>). This was reinvested in the system to create the next supply of CTOs. OCIC plans to sell CTOs for 18 million tonnes of carbon to be retained through the Protected Areas Programme, which seeks to consolidate the protection of some 28 national parks covering some 570,000 ha. Implementation will be checked and certified by SGS Forestry. The net carbon sink effect will take into account a historical rate of deforestation of about 3%. CTO receipts will also be used to make environmental service payments to forest owners and for various other environmental initiatives.

The Ecoland project involved purchasing between 2,000 ha and 3,000 ha of forest threatened by local farmers and turning it over to the National Park Service. The additionality of carbon sequestered is calculated as a result of the land not being deforested. The carbon offset benefit is shared equally between the government and investors. The Carfix project expanded an SFM pilot project to form a 230,000 hectare buffer zone around a 71,000 hectare national park. The project also funds measures to preserve the park itself.

The Costa Rican experience provides an institutional model for carbon trading. The National Forestry Finance Fund (FONAFIFO), which comes under the Ministry of Environment, receives and assesses project applications claiming carbon payments (in exchange for the transfer of carbon trading rights to the government), conducts field verification, makes the payments and monitors field implementation. These projects include pasture reforestation, buffer zone farming, NFM in primary and secondary forests, and measures to reduce illegal felling. FONAFIFO calculates the carbon fixing benefits from the projects and passes the figures to OCIC.

## **Incentive System Reform**

By the end of 1995, the third Structural Adjustment Loan from the World Bank cancelled many subsidies, including CAFs, CAFMAs, and Certificates of Forest Protection (Certificado de Protección de Bosques, CPBs). The incentive system was reformed following the passing of the 1996 Forest Law, which had greater emphasis on environmental values. Incentives are no longer employed to encourage reforestation but rather to achieve conservation and management objectives as well.

The mainstay of the revised system is a suite of measures designed to provide a mix of forest management, conservation and reforestation incentives. The CAFMA will continue as the main incentive mechanism for improving forest management but is now supported by CPB, the Forest Conservation Certificate (CCB), Payment of Environmental Services mechanism (PSA) and FONAFIFO.

Reforestation under the new Law continues to be supported, but is now done through the provision of credit rather than direct payments. Low interest financing for farmers is provided by FONAFIFO with resources drawn from timber taxes and national budget allocations. In addition,



FONAFIFO also negotiates carbon sequestration credits with farmers and prepares offset packages for the international market.

After the collapse of subsidies, Costa Rica's forest policy changed to Payment for Environmental Services (Pago de Servicios Ambientales, PSAs), which compensate landowners for the "services" that forests provide to the national and global community. This policy essentially evolved from dissatisfaction with earlier fiscal systems of stimulating forestry based on subsidies from the national budget.

Forest Law 7575 defines four environmental services for which forest owners should receive compensatory payments:

Reducing greenhouse gas emissions (by fixing, reducing, binding, storing and absorbing them),  
Protecting water for urban, rural or industrial use,  
Protecting biodiversity to conserve it and ensure its sustainable use for scientific and pharmaceutical purposes, and  
Protecting ecosystems, forms of life, and natural beauty for tourism and scientific purposes.

One-third of the tax on fossil fuels goes to forest owners, who may invest the payment in reforestation, management of natural forests, or forest protection. In 1997 and 1998, these funds were invested in reforestation 13.9% of the total planted area. PSAs provide compensation using the "polluters pay" principle through the fossil fuels tax.

Under the PSA, the Secretary of Finance would allocate about US\$7 million/year for the forest services payment from an annual yield of US\$30 million from fossil fuel taxes. However, since most Costa Ricans are unaware of the real meaning of the tax, they do not pressure the government to allocate the full amount to forests.

The Tropical Science Centre in Costa Rica undertook an economic study in 1996 to estimate the value of four public good benefits from forestry: carbon sequestration, water conservation, biodiversity conservation and 'natural beauty'. The estimated value was US \$58 per ha per year for primary forest, and \$42 for secondary forest; carbon sequestration accounted for about two-thirds of this value. The 1996 Forest Law formalized a system of incentive payments as part of the Private Forestry Programme.

For ease of implementation, the value of the PSA for reforestation is similar to that of the CAF: a sum about equal to reforestation expenses during the first five years. Forest owners would receive payments following the signing of a contract that they would maintain their forest under the same regime for a minimum of 20 years. For forest conservation, owners will receive \$56 per ha annually (totalling \$280 per ha) and be exempt from land tax. Those opting for natural forest management will receive \$47 per ha for five years (\$235 in total), while those proposing to reforest agricultural land will receive a series of payments related to the costs of plantation establishment up to a total of \$558 per ha.

Payment is made only once for planting and forest management activities. In reality, forests provide environmental services as long as they are standing, so the payment should be an annual amount corresponding to the flow of benefits or a one-time payment corresponding to the net present value (NPV) of the flow of benefits. Under the PSA, funds can be directed toward reforestation, forest management, and conservation, or for conservation alone. The funds collected through the tax are managed by FONAFIFO, but the Finance Ministry decides how funds are spent.

Proposed 'polluter and beneficiary pays' taxes include a 15% tax on fuel and petroleum products (the 'ecotax'); an annual 'forest conservation tax' of \$10/ha on the catchment areas of hydro-electric and water companies; and a tourist tax. One third of the fuel ecotax was earmarked for the environmental service payments. The expectation was that these charges would be passed

on to consumers in the form of higher prices, resulting in more frugal use of the 'polluting' resources (this assumes a price elastic demand).

Other sources of finance for the payments are debt swaps, the sale of carbon offsets (see below), and any profits from bio-prospecting deals with pharmaceutical companies. In 1996, about \$66 million was raised by the ecotax, theoretically making \$22 million available for the payments to forest owners.

It should be stressed that high transaction costs associated with complying with the conditions of the PSA scheme placed a disproportionate burden on small landowners who do not gain from economies of scale. To counter this, some NGOs have emerged in some cases to support small-holders. A good example is that of the Foundation for the Conservation of the Central Volcanic Range (FUNDECOR). FUNDECOR supports over 370 households with a total 22,000 ha, to apply for PSA funding. Not only does it help with paperwork, but it supplies the professional forestry services and monitors implementation of forest management plans. Other services offered include cheap credit, advance payments and technical advice. FUNDECOR receives support from the international Finance Corporation (IFC).

### **Certifiable Tradable Offsets (CTOs)**

Under the new PSA system, Costa Rica established a program that provides funds for reforestation and forest protection on private lands through the sale of carbon certificates to industrialized countries. In this program, Costa Rica pays thousands of private landowners to protect forest, to manage forest through selective harvesting or to establish plantations on their lands. The participating landowners are then paid from a national fund at a rate that is set each year and varies according to land use. In this respect, Costa Rica has designed a system that allows many producers to grow a "commodity" called carbon that they can sell domestically. The greenhouse gas emissions abatement activities in Costa Rica are called Certifiable Tradable Offsets (CTOs).

Through discussions with other countries, especially Norway, Costa Rica has found foreign investors willing to buy these high-quality carbon offsets to offset their CO<sub>2</sub> emissions at their domestic sources. Industrialized countries can use these offsets against their Kyoto Protocol emissions commitments through the Clean Development Mechanism established through the Kyoto Protocol.

The structure established under PSA uses payments for "environmental services" on private lands to encourage tree plantations, conservation and sustainable forest management. These activities provide greenhouse gas reduction benefits. Payments are made possible by the CTOs, which are given to entities that contribute to the National Fund for Forestry Financing. Norway is an early participant in this program (see below). Under the Protected Areas Project, Joint Initiative funding is also obtained by the sale of CTOs to purchase land from landowners with holdings in the national park system.

### **Costa Rica Certified Tradable Offsets (1997)**

Under the PSA scheme, the Costa Rican Government is now participating in a Joint Implementation project called the Costa Rica Certified Tradable Offsets. This project involved a 4,000-acre reforestation and conservation area developed over 10 years at a cost of US\$3.4 million. The project's objective is to conserve and rehabilitate the forest in the upper Virilla river basin to achieve a reduction of atmospheric GHG emissions through biomass growth and avoidance of future emissions.

The project is jointly implemented through the following partnership consisting of private and public entities in Costa Rica and Norway:

## Costa Rican Partners

National Power and Light Company, a private electricity generation and distribution company; Costa Rican Electrical Institute, the national utility; and Costa Rican Office on Joint Implementation.

## Norwegian Partners

- Eeg-Henriksen Anlegg, construction company;
- Kvaerner Energy, turbine producer;
- ABB Kraft, Norwegian subsidiary of Asea Brown Boveri (ABB);
- Royal Norwegian Ministry of Foreign Affairs;
- Department of Natural Resources and Environmental Affairs.

One of the objectives of the project is to ensure that forestry activities will improve existing hydrological resources in the watershed, increasing the efficiency of hydroelectric plants and enhancing the displacement of fossil fuel use in the national electricity system. Conservation of the forest area as a carbon sink will provide payments to private small and medium landholders for the environmental service of managing their lands, consistent with the objectives of Costa Rican Forest Law.

Four of CFNL's hydroelectric plants will benefit from the increased watershed area resulting from the project; they will contribute US\$1.39 million. The Norwegian government is providing US\$1.7 million as part of the "Norwegian Climate Fund." Norwegian private-sector parties are providing \$300,000.

Project development is taking place within the legal and institutional framework of Costa Rica's Forest Environmental Services Payment (FESP) program. The FESP program is based on the 1996 Forestry Law, under which one-third of a 15% sales tax revenue on fossil fuels will be used to compensate private forest-owners for environmental services (e.g. reduction of GHG emissions, protection of biodiversity, protection of aquifers and preservation of scenic areas for tourism) provided by forest protection and plantations.

The Costa Rican Office on Joint Implementation collects payments from investors and in return issues Certifiable Tradable Offsets (CTO) valid for at least 20 years. CTOs are then issued to investors at a rate of US\$10 per metric ton of carbon. Funds are passed along to the FESP financial administrator who compensates individual farmers upon proof of effective forest conservation or reforestation. For CTO purposes, proof of effective sequestration can be made anywhere in Costa Rica as long as it is part of the FESP program area.

## **5. Guatemala**

The Republic of Guatemala, located in Central America, is bounded on the west and north by Mexico; on the east by Belize and the Gulf of Honduras; on the south-east by Honduras and El Salvador and on the south by the Pacific Ocean. Its total area is 108,889 km<sup>2</sup>.

Most of the population lives in a region located near the great mountain chains stretching from the border with Mexico down to the border with Honduras, with the highest peaks being found in the west and deep valleys dividing the mountains. The main conifer forests are also found here, but are subject to an ever-increasing demand for farmland and pasture. To the east of this zone, pressure has been so great that conifer stands are now only residual.

Unequal exploitation of natural resources has been a feature of the nation's history. Much land was converted into banana plantations around the turn of the century to satisfy foreign markets. As a result of land reformations, there is a severe shortage of land available for the Guatemalan peasantry, giving rise to overpopulation in many areas and colonization into previously undisturbed rain forest regions (FAO, 2003).

On the low-lying Pacific coast is a fertile plain of volcanic soil that stretches along the Pacific coast. Once covered with tropical vegetation and grasslands, this area is now developed into plantations where sugar, rubber trees, and cattle are raised. The area is primarily agricultural, although the effects of deforestation of the highlands situated to the north are felt here too, particularly since it is a flood-prone zone.

Broadleaved tropical rainforests are found in El Petén, and a strong settlement policy has been pursued in this region in recent years, so that the forested area has shrunk considerably. Until very recently, only a small part of the El Petén region was accessible by road, river or tracks.

According to FRA 2000, during the last 10 years 55% of the coniferous forest and 25% of the broad-leaved disappeared, but mixed natural forest has increased almost three times and mangrove remain almost the same. According to official figures, from 1990 up to 1997 the reforestation rate averaged 1100 ha per year, but during the last two years a very extensive program of reforestation was launched, planting almost 18,000 ha between 1998 and 1999.

The main energy resource is fuelwood taken from natural forests. The country suffers from over-harvesting of the natural forests, exceeding the limit of natural regeneration and the pace of reforestation. Encouragement of agroforestry and silvopastoral systems is considered to be an option to supply fuelwood for rural people.

Plantations are scattered across the country, with a variety of species, many of them established without a clear purpose. The success of the plantations is variable in relation to quality and rate of growth. Many of the plantations show excessively slow growth due to the poor genetic quality of the seed and due to the characteristics of the selected sites. In 1997, procedures were designed to permit the compilation of plantation data.

According to the Ministry of Agriculture, in 1998 approximately 3,000,000 ha without forest cover was considered to be suitable for planting (MAG, 1998).

## **Forestry Policy**

Agricultural reform began during the 1940s, at which time all the "unused" land was made available for distribution to landless people. The concept of "unused" referred to those lands that were not already devoted to agriculture or cattle production, which meant mainly forested areas. The social reaction to establish and protect land ownership was to clear the land so that it would be perceived as "used" land.

Agriculture and forestry policies have not been complementary. During agrarian reform in the 1950's, forested areas were considered "useless". Property rights were established by converting forested areas into agriculture land or cattle ranches. Decrees 900 and 1551 (1944 and 1954) had a big impact on forest cover change. They basically gave the "unused" land, which was mainly forestland, over to small- and medium-scale agriculture. A total of 107 national farms totalling around 173,000 ha (excluding Peten) were given to campesino associations.

Guatemala has primarily been an agriculture export country even though 51.1% of the territory has potential use for forestry. The Ministerio de Agricultura, Ganaderia y Alimentación (MAGA) provided subsidies and extension and training programs for agriculture and cattle production. Even though forests are also a responsibility of this Ministry, there was little co-ordination

between the agriculture and forestry offices. With the creation of INAB, better co-ordination is now taking place and subsidies for agriculture are not given in areas with potential forestry use.

Forest policy has changed at least three times during the last 20 years. However, during the entire period the Forestry Institute (Instituto Nacional Forestal – INAFOR) has remained under the mandate of the MAGA.

INAFOR was a very weak institution and their mandate was to "safeguard" the forest areas, especially in southern Guatemala. In northern Guatemala, where the largest areas of forest are located, the Fomento y Desarrollo del Petén (FYDEP, a military organization) controlled the forested areas and land distribution.

During the late 1980's forestry policies changed. The Consejo Nacional de Areas Protegidas (CONAP) was established and was given control of the protected areas in the country. FYDEP was eliminated. INAFOR was transformed into the Dirección General de Bosques (DIGEBOS). However, the distribution of duties and responsibility between CONAP and DIGEBOS was unclear.

During the 1990's, with the establishment of the Plan de Acción Forestal Tropical para Guatemala (PAFT-G), a new process was undertaken. Negotiation among forest stakeholders began. Forest industry, indigenous groups, forest professionals, universities, non-governmental organizations and women's groups were convoked in several meetings to present their perceptions on how to give the forest and trees real value.

In 1996, forest policy changed again. DIGEBOS disappeared with the creation of Instituto Nacional de Bosques (INAB). The legal figure of "institute" gives INAB a certain level of autonomy in relation to MAGA, which is important to fund-raising actions, decision making processes and implementation of activities. This new policy also establishes formal arrangements and supporting actions between INAB and CONAP, avoiding ambiguity between these institutions. It also establishes a strategy to work with the agriculture sector. No agriculture incentives are to be given for cultivation in areas that strictly have potential forestry use. Communal and industrial concessions are promoted in National Forest areas and buffer zones of protected areas as a mechanism to better use and monitor the forest.

To promote plantations and the conservation of natural forests, several incentive policies have been implemented over the years. A law promulgated in 1974, permitted partial tax deductions related to the establishment and maintenance costs of plantations of less than 5 ha. By 1995, over 15,000 ha of plantations had been established using this incentive scheme (MAGA, 1995). Other incentives included:

### **Communal forestry concessions**

Programs for long-term forest management by local groups have been promoted in Peten. Communities get rights to the forest and assume responsibility for implementing the management plan. The only difficulty is that the development of the management plan depends on external financial support, especially from international NGO's. Market mechanisms are also still very weak, especially for non-timber products.

### **Programa Incentivos Forestales or PINFOR (Program for forestry incentives)**

A new incentive programme for forest development called PINFOR was launched in 1997. This incentive scheme is promoted by INAB, Instituto Nacional de Bosques and involves a cash payment from the state to the owners of forest land to execute forestation projects. PINFOR provides US\$800 for every 2 ha of forest planted or natural forest area managed. An individual or a collective group must own the land. The objective of this incentive is to compete with agriculture

subsidies and to reduce the investment that is needed to develop a forest plantation. The target groups are landowners that traditionally have invested in agriculture. New types of incentives for non-landowners are now under consideration in the National Congress.

The objectives of PINFOR include not only plantations but also the promotion of sustainable forest production, the stimulation of investment in forest projects, increasing the forest sector participation in the national economy and increasing the national forest cover (Lopez and Veliz, 1999).

The present policy aims to provide forest industry with at least 200,000 ha of plantations within 20 to 30 years. Under this policy, in order to develop industrial plantations and to improve the competitiveness of the forestry sector, the main considerations are:

- site suitability and the location in relation to industrial users;
- concentration on a reduced number of species;
- systematic incorporation of silvicultural practices;
- increasing the quantity and quality of wood;
- encouraging the use of products from plantations as industrial material and improving genetic resources.

To promote planting of degraded sites the strategy includes elements such as identification of important water resources and protection of natural forests and plantations; involvement of local governments, organizations and people; and identifying, establishing and encouraging programs to restore watersheds (MAG, 1998).

## **Protected Areas**

The unification of protected areas into a national system took place in 1989 as a result of the Law of Protected Areas (Godoy, 1990). The Guatemalan System of Protected Areas (SIGAP) was created as a union of all protected areas throughout the country, whether previously established by law or not. SIGAP incorporates six reserves administered by CECON that had been without legal support, declaring them legally established, and has raised the status of 26 small areas managed by various other institutes to a higher level of legal protection. Finally, 44 new sites were declared areas of special protection (áreas de protección especial) to be studied and legally declared under the appropriate management categories at a later date (Godoy, 1990). At the same time, the National Council of Protected Areas (Consejo Nacional de Areas Protegidas) (CONAP) was established to coordinate protected area management.

With the creation of SIGAP, protected area coverage increased from less than 0.01% to around 2.22% of total land area. With the incorporation of the new areas, coverage will reach between 8 and 14%, and encompass nine of the 14 Holdridge life zones (Detlefsen et al., 1991; Godoy, 1990). Around 44.4% of the protected areas in SIGAP are located in the Department of Petén (Detlefsen et al., 1991). The national system employs 15 different management categories, grouped into six types based on the common characteristics (Godoy and Castro, 1990). The oldest management category in use is cultural monument (monumento cultural), and over half of the present protected areas are classified as such. However, as the primary objective of this category is the protection of national archaeological remains, the flora and fauna in the majority of areas has suffered severe degradation (Detlefsen et al., 1991).

## **F. Asia**

Asia as a whole contains about 548 million ha of forests (FAO, 2000), which corresponds to around 14% of the world total. Asian forests amount to 0.2 ha per capita, which is low compared to the world average. Most forests are located in the tropical ecological domain and Asia has about 21% of all tropical rain forests. Subtropical forests are extensive and Asia has more subtropical mountain forests than any other region and more than one third of the world total. More than 60% of the world's forest plantations are located in Asia. The net change of forest area is relatively low, with an annual net loss, based on country reports, estimated at 364,000 ha, corresponding to around 0.2% annually.

The green cover has to meet the diverse environmental, economic, cultural and social needs of more than half the world's people living in these countries. Asia's forests provide food, fodder, fuelwood, timber and livelihood to hundreds of millions of people. The forests also sustain one of the world's richest storehouses of biodiversity.

The use of plantation forests to substitute for wood from natural forests is increasing with Asia-Pacific countries leading the world in forest plantation development. However, deforestation continues because of weak regulation and law enforcement, and continuing incentives for competing land uses.

### **1. China**

The People's Republic of China at 9,596,960 km<sup>2</sup> is the world's third largest country in area (after Russia and Canada) and the most populous. China includes Hong Kong, Macau and Taiwan, as well as more than 3,400 offshore islands. The country also encompasses a great diversity of landscapes and a corresponding variety of natural resources. It ranges from sub-arctic regions in the north and west to tropical lowlands in the south; from fertile plains in the east to deserts in the west.

China presently has around 14% forest cover (about half the world average) almost evenly divided between coniferous and broadleaved forests (FAO, 2000). Although China is the fifth most forested country in the world, its timber resource is relatively small in comparison to the size of the country or its population. It has an average of about 0.1 ha per capita, which is significantly less than the world average of 0.6 ha. In economic terms forestry accounts for less than 1% of GDP, but is an essential source of energy for 40% of the rural population and supplies virtually all the timber input for the construction sector.

The largest forests in China are located in the northeast and inner Mongolian provinces; the ten southern provinces; and Sichuan and Yunnan provinces. Southern forests are mainly lowland rain forests and monsoon forests. In the north the majority of forests are mixed coniferous. The Chinese Government attaches great importance to forestry development. Afforestation and territory greening have been defined as a common duty of society. China has the world's most extensive plantation estate, in excess of 20 million hectares. The country is also implementing a number of large-scale shelterbelt programs to protect against erosion and desertification. China has around 800 nature reserves covering more than 6% of the country's land area.

China is the third largest sawnwood producer in the world after the United States and Canada and it accounts for over 30% of total bamboo based production and for 40% cent of rosin, an important chemical raw material for industry.

China's forest resources are not only small relative to its area and population, but are also small relative to demand. China is the second largest timber importer in the world. While the shortage

of timber has not led to significant deforestation at the national level, the pressure on natural forests, especially in poor mountainous areas, is enormous. To meet demands on forest resources and improve the environment, tree planting has been given great importance. Plantations account for some 45,083,000 ha, of the country's 133,700,000 ha forested area (MOF, 1995a) and are established at a rate exceeding 1,153,800 ha per year (FAO, 1999).

All forestland in China is state owned, but responsibility for the forests is split between forest bureaus (or enterprises), state forest farms and collectives.

## **History**

The country's long history has had a profound impact on the state and distribution of the natural woody vegetation. Nearly all suitable land has been developed for purposes of agriculture, urban areas, industry, and fibre plantations. Only mountains and inaccessible regions in the west have preserved tracts of natural woody vegetation, and often in these cases, the natural woody vegetation is highly fragmented. On the other hand, woody vegetation in China has its unique characteristics: The overwhelming majority of China's natural forests are closed forests, the evergreen and deciduous/evergreen forest/shrub vegetation in southern China is unique in the world, and the number of endemic woody species is high.

State forest bureaus, which currently number 134, were originally set up in the 1940s to manage forest production from the large nationalized natural forests. The forest bureaus are mostly located in the northeast and southwest regions and account for 28.4% of the forest area. Today, much of the natural forest area is protected and the bureaus manage large areas of plantations. They are jointly controlled by the central and provincial governments and, on average, each one employs over 10,000 permanent staff.

For a variety of reasons over its long history, much of China's original forests have long disappeared (MOF, 1995a), such that forest cover was estimated to be only 8.6% of the land area at the time of the foundation of the People's Republic of China in 1949. Since then, the country has carried out plain afforestation, primarily "Four-side" plantings, windbreak, and farmland shelterbelt plantations. "Four-side" plantings are utilized to establish plantations around rivers, roads, houses and villages.

State forest farms, which account for about 19% of the total forest area, were established later. The forest farms, which number about 4,200 today, aimed to increase forest cover through afforestation and were given responsibility for managing smaller secondary forests. State forest farms are spread all over the country, with the highest number located in the south. They are normally controlled by county governments that are in many cases directed by forest bureaus.

The initial motivation behind afforestation programs was primarily to control natural disasters such as wind and sandstorms, draughts and floods affecting China's Central plain areas, which constitute 45% of the farmland of the country. The major plantation areas, known as State-owned Forest Farms and Collectively owned Forest Farms, are located in this region (MOF, 1995a).

Collectives were introduced in the 1950s by bringing together individual private forests and woodlots that had not been allocated to forest bureaus or state forests. Collectives are concentrated in the south and come under the management of the centrally controlled "People's Communes". Accounting for around 53% of the forest area, they represent the largest area controlled by any single entity. In addition, trees in the northern regions are distributed amongst farm plots in agricultural collectives.

While collectives consist of a defined group (although ultimately answerable to the central government) who have considerable autonomy in organizing production and are responsible for their own income generation, state forest farms are managed directly by government employees



who earn a regular salary. It is in collectives that experimentation with new forms of tree tenure has been greatest.

As early as in the late 1950s and early 1960s, the Ministry of Forestry put forward a guideline for the establishment of timber plantations. This guideline stated that timber plantations should be established in selected areas and managed by forest farms for high timber yield. Due largely to the Cultural Revolution and the subsequent Great Leap Forward in 1958, the plan was never fully implemented.

In the mid-1970s, it was proposed to establish fast growing and high yield timber plantation areas in southern China with the support of special funds from the State government. By 1980, the total area of existing plantations was around 22,280,000 ha (The second National Forest Resources Inventory (NFRI) carried out during 1977-1981), with an annual growth rate of around 3,200,000 ha (FAO, 1997).

On March 5, 1980, the Central Committee and the State Council promulgated the "Directive on Vigorously Carrying out Tree-planting and Afforestation Activities", which stated that in order to speed up forestry development in China and to mitigate the shortage in the supply of timber and other forest products, all local authorities were to select favourable sites and suitable tree species for the establishment of fast growing and high yield timber plantations. Local authorities were also required to guarantee monetary and material supply for integrated management.

In a bid to obtain experience to guide the national undertaking for the establishment of fast growing and high yield plantations, the Ministry of Forestry set up, in succession, joint trial plots with provincial/autonomous region authorities in 111 counties and 106 State forest farms in 20 provinces and autonomous regions. By the end of 1986, over 100,000 ha of such trial plantations had been established with major species. Meanwhile, many provinces/autonomous regions started to establish fast growing and high yield plantations and over 1.5 million hectares of such plantations were established throughout China.

### **National Compulsory Tree Planting Campaign**

In December 1981, the Chinese Congress, under the Fourth Session of the Fifth National People's Congress, adopted the Resolution on the National Compulsory Tree Planting Campaign under which each and every Chinese citizen (excluding the young and the elderly) has an obligation to plant three to five trees per year. Under this plan:

"Every citizen of the People's Republic of China, 11-60 for male and 11-55 for female, except those who have lost ability to work, shall undertake the commitment of compulsory tree planting and all working units should report the actual number of employees to the local greening committee as a basis for allocation of workload,..."

and that

"...this compulsory labour is confined to the scope under jurisdiction of a given county/city for establishing State and collective forests.."

In a country with nearly one billion people, this plan provided for a fairly substantial tree-planting initiative. This plan also further contributed to plantation forestry. Between 1981 and 1985, over five billion trees were planted under the National Compulsory Tree Planting Campaign. In urban areas, about 100 million trees were planted each year, which doubled the annual planting level achieved before the National Compulsory Tree Planting Campaign. Statistics from 324 Chinese cities show that the number of cities with over 20% green cover increased from 37 prior to compulsory tree planting up to the current 89; the number of urban parks has increased, from the previous 728, by 70 each year; the number of cities with 3-5 square meters of per capita green commons has also increased from 45 to 101.

In rural China, compulsory tree planting has been carried out alongside rural reform. In some localities, farmers are organized to plant trees on barren mountains and along riverbanks under State ownership or collective tenure. In most cases, funds are raised from diverse channels and farmers contribute their labour in soil preparation and planting. The planted area is then divided into sections and contracted to farmers for long-term management and protection, in a bid to establish sustainable green areas such as shelterbelt forests.

Partly as a result of this campaign, new plantations established between 1980 and 1987 totalled some 28,920,000 ha, for an annual planting rate of over 4 million hectares per annum (FAO, 1997). This trend continued into the 1990s, as plantations established between 1988 and 1992 reached some 16,170,000 ha (FAO, 1997), with a further 5,932,000 ha planted in 1993 alone (MOF, 1995a).

The fourth NFRI carried out during 1989-1993 estimated the total plantation area as 34,251,000 ha, which included 11,180,000 ha of non-wood forest species, termed economic forest plantations (oil bearing seeds, spices, medicinal plants, rubber, etc.) and 1,050,000 ha of bamboo (MOF, 1999). Wood production from plantations in 1990 was 27.48 million m<sup>3</sup>, constituting about 45% of total production (MOF, 1995b).

## **International Aid**

Much of the funding for afforestation in China has come through bilateral or multilateral aid programs, largely the World Bank. In order to boost State investment, the World Bank Forestry Development Project (Credit 605-CHA) was introduced in 1985. In June, 1988, the Chinese government requested the World Bank to provide financing and co-operation under this credit to introduce advanced techniques for the establishment of fast growing and high yield timber plantations in 16 provinces/autonomous regions.

New ecological restoration programs involving tree plantations such as the Yangtze Shelterbelt Programme, the Coastal Shelterbelt, the Plain Afforestation Program, the Taihang Mountain Afforestation and Soil and Water Conservation of the Yangtze River were undertaken and an existing programme (Three-north Shelterbelt) was expanded. Many of these programs utilize a variety of incentive programs, often consisting of low-interest or interest free loans.

Some of these programs are briefly outlined below:

### **Shelterbelt Development Programme along the Upper and Middle Reaches of the Yangtze River**

The Yangtze River is the largest river in China with a total length of 6,300 kilometres, its drainage area and population account for respectively 18.8% and 33% of the country's total. In 1989, the Chinese government approved the Master Plan for the First Phase of the Shelterbelt Development Programme along the Upper and Middle Reaches of the Yangtze River which aims to increase the forest area by 6.67 million hectares by the year 2000 and by 20 million hectares in a time span of 30-40 years on the basis of sound protection of the existing forest vegetation.

### **The Coastal Shelterbelt Development Programme**

The Coastal Shelterbelt Development Programme covers 18,000 kilometres of the coastline from the mouth of Yalujiang River in the north to the mouth of Beilun River in the south. In 1988, the Chinese government made a decision to establish coastal Shelterbelt systems in 195 counties/cities/districts of 11 coastal provinces/autonomous regions/municipalities. According to the plan, 3.56 million hectares will be planted by the year 2010 so as to raise the forest cover

from 24.9% to 39.1%, bring 7.71 million hectares of farmland under the protection of shelterbelt networks, and reduce the volume of soil and water erosion by 50%.

During the Ninth Five-Year Plan period, priority will be given to prevention and control of wind and water erosion in the water and soil erosion areas along the coastline by establishing an integrated protective forest system incorporating coastal framework shelterbelts and farmland shelterbelt networks. This system will effectively control water and soil erosion in coastal areas, enhance the capacity to fight against natural calamities, improve functions of ecosystems and the macro environment for investment so as to support the economic development and help raise people's living standards in the coastal areas. The programme scope shall cover 1.002 million hectares.

### **Plain Afforestation Programme**

In China, there are ten major plains, e.g.: the Northeast Plain, the North China Plain and 918 plain, semi-plain and partial plain counties. The total land area, farmland and population of the plain areas account respectively for 15%, 45% and 50% of the country's total. They are major production bases for grain, cotton and edible oil, etc..

Promotion of plain afforestation and vigorous development of plain forestry is a major strategy to speed up the pace of territory greening and improvement of the ecosystems and environment in the plain areas. It has a far-reaching strategic importance for the advancement of economic development in China's agricultural areas, securing high and stable yield in agriculture and animal husbandry, increasing the potential of agricultural development, adjustment of the layout of domestic timber production, mitigating the conflict between forest protection and local timber and fuelwood demand, promoting adjustment of rural industrial structure, and increasing people's income.

### **Taihang Mountains Afforestation Programme**

During the Ninth Five-Year Plan period, priority will be given to the establishment of headwater conservation forest, water and soil conservation forest in the rocky and hilly areas of the Taihang Mountains, to the appropriate development of economic forests, rehabilitation of forest vegetation and enhancement of the capacity of water and soil conservation. Main activities include: water and soil conservation forests along the upper reaches of Haihe River and tributaries of the Yellow River, water and soil conservation forests in the eastern part of the Taihang Mountains featuring by development of "economic valleys", and the dry-fruit dominating economic forest bases in the western and south-eastern part of the Taihang Mountains. The total afforestation area will be 1.36 million hectares. The Programme was launched in 1994, and 358,000 ha of afforestation was accomplished in the very same year.

### **The Three-North Shelterbelt Development Programme**

The Chinese Government has since 1978, through the Three-North Shelterbelt Program (TNSP), implemented an elaborate network of shelterbelts and forestry plantations ("The Great Green Wall") across Northern China, with the objective of protecting agricultural and pastoral lands, as well as human settlements, from wind and water erosion. The TNSP aims to control shifting sand and soil erosion through the promotion of afforestation in 551 counties, districts and cities of 13 provinces, autonomous regions and municipalities covering some 4.069 million square kilometres, or about 42% of China's land area. The project includes various incentives for individuals such as low-interest or interest-free loans and by 2050 it is projected that just over 35 million hectares will have been reforested at a cost of 50 billion yuan (US\$6.25 billion).

Between 1978 and 2000, an estimated 20 million ha was established under the TNSP through planting or aerial seeding. However survival, growth, yields and protection to adjoining agricultural lands were sub-optimal due to poor site/species/provenance/clone matching; limited genetic

diversity in large scale plantings; and poor nursery, site preparation, establishment, maintenance, silviculture and protection practices.

A number of other programs (partially or wholly funded by foreign aid) are underway, including:

- National Programme to Combat Desertification
- Shelterbelt Development Programme for Comprehensive Management of Huaihe River and Taihu Lake Basin Area
- Shelterbelt Development Programme in the Pearl River Valley
- Integrated Shelterbelt Development Programme in Liaohe River Valley
- Shelterbelt Development Programme along the Middle Reaches of the Yellow River

## **Joint Ventures**

In China, the government has not only made possible joint ventures between local companies and co-operative groups, but has also encouraged partnerships with foreign companies, particularly for plantation establishment or forest regeneration. Partnerships with foreign companies have been concentrated in the coastal provinces where weather conditions support plantations of fast-growing species and where more developed infrastructure favours commercial production. Local government encourages these partnerships because they are thought to enhance forest management by increasing access to finance and technology and by raising supervision. Incentives for foreign investment are sometimes given in the form of exemptions from taxes and fees and priority access to utilities such as electricity and water.

One example is a joint venture involving Plantation Forest Timber Products Ltd., Robabank, the International Finance Corporation, local forestry industry bureaus and farmers. The joint venture, operating in three provinces, is valued at US\$124 million. The forestry industry bureaus act as paid mediators so the company does not have to deal with the hundreds of thousands of farmers who contribute timber. (The company claims to pay 600,000 farmers in Sichuan alone.) Local governments are paid forestry charges (J. Mayers, *Unasyva* - No. 200, Vol. 51- 2000/1).

## **Forestry loans from State banks.**

In recent years, many provinces and counties have allocated a certain amount of funds from agricultural loans to be utilized as forestry loans. The forestry sector then pays the interest using regeneration funds from collective forests along with afforestation subsidies from the State. This practice has been adopted in Fujian, Guangdong, Guangxi, Liaoning and Hubei. Guangdong Province releases RMB 10 million yuan<sup>4</sup> of forestry loans each year and Hubei Province has released RMB 20 million yuan of discount forestry loans every year since 1984 for this purpose. Since 1986, the State has also released discount loans worth RMB 300 million yuan for forestry projects of which 42% is for the establishment of high yield plantations.

## **Collection of refundable levies for regeneration funds.**

In Fujian Province, 20-50% of the price of logs is deducted by the forestry sector as regeneration funds, which are later returned to after regeneration is completed. In Sanming Prefecture, where such practice has proved successful, 80% of the afforestation financing is provided by production units from log sales. In Chongyi County of Jiangxi Province, RMB 10 yuan per cubic meter is deducted from log sales as the regeneration fund of the forest owner. This money is then deposited into a special bank account and managed by the county Forestry Station for silvicultural purposes. Misappropriation is forbidden. This system has made available about RMB 1.2-1.5 million yuan per annum as a silvicultural fund.

---

<sup>4</sup> 1 yuan = C\$0.1651 (May, 2003).

## **Investment by timber demanding sectors.**

Since the 1980s, some timber demanding regions or sectors have undertaken joint afforestation activities with rural collectives by means of compensation trade or joint forest farm ventures. In most cases, the timber demanding region or sector provides investment funds and technical support, while the rural collective contributes the labour. The timber produced from this scheme is mostly made available to the investor. This is a mutually beneficial practice that not only benefits regions with low timber supplies, but also helps farmers to vitalize regional forestry.

## **Forest Tenure Contracts**

Where degraded or mountainous areas are handed to private individuals to afforest, leases may be given for up to 100 years for areas as large as 10,000 ha. The longer lease and larger area are aimed at providing greater rewards to operators to compensate them for the greater capital input and additional risk. Leases in degraded areas tend to be allocated through a competitive bidding process and are required to pay a fee rather than donate a share of production to the collective. Over 10 provinces have used competitive auctions to allocate leases in 730,000 ha (Ai (1995), cited in Yaoqi Zhang *et al* (1998)). In Shanxi Province, for example, about 270,000 ha of wasteland (hills, mountains, riverbanks and other degraded areas) were tendered for afforestation between 1992 and 1995. Because wastelands require a large initial investment and farmers rarely have the money or the expertise to regenerate the areas, bids are often low or actual payments are much less than the bids (cited Yaoqi Zhang *et al*, 1998).

## **2. India**

India is the world's seventh largest country and one of the most heavily populated. The country covers a total of 3,287,590 km<sup>2</sup> and measures 3 200 km from north to south between the extreme latitudes and about 2 950 km from east to west between the extreme longitudes (FAO, 1998). India is bounded on the north by Afghanistan, China, Nepal, and Bhutan; on the east by Bangladesh, Myanmar, and the Bay of Bengal; on the south by the Palk Strait and the Gulf of Mannar -which separates it from Sri Lanka- and the Indian Ocean; and on the west by the Arabian Sea and Pakistan. It has a land frontier of about 15 200 km and a coastline of some 6 100 km.

India's population, which is 74% rural, was estimated in 1997 at 995 million, with a population density of 290/ha<sup>2</sup>. Of the total area, 43% is considered farmland 1.6% is savannah. India has about 65 million hectares of tree cover, equivalent to about 20% of its land area and of this just over 36 million hectares are closed forests (FAO, 1998). Cultivated trees and woodlots cover 1%, pasture 3.7%, and human settlements 6.7% (FSI, 2000a). With an annual population growth rate of 1.58% (World Fact Book, 2000), there is a constant and growing demand for food. Farmland cuts into forestland and the expansion of livestock herds encroaches upon the forest, where the herds often graze. Since the introduction of social forestry in 1980, a great many trees have been planted, of which 35-40% on private, communal or village lands outside the forest domain. The Government has sponsored tree-planting along roads, railways, canals and around ponds. Over 70% of these trees are growing outside forest areas (FSI, 2000b).

India has a large and diverse forest resource. The country's very large population means, however, that intense demands are placed on its forests. Its forest types vary from tropical rainforest in northeastern India, to desert and thorn forests in Gujarat and Rajasthan; mangrove forests in West Bengal, Orissa and other coastal areas; and dry alpine forests in the western Himalaya. The most common forest types are tropical moist deciduous forest, tropical dry deciduous forests, and wet tropical evergreen forests. India has established more than 12 million hectares of forest plantations, mainly for fuelwood purposes. Between 1951 and 1999, development plans were responsible for implementing tree-planting on 9.8% of the total land

area. Line planting along roads, canals and railways is also a very important wood source in India. The country has a large network of protected areas, including 80 national parks and around 450 wildlife sanctuaries (FAO, 1998).

## **History**

The earliest plantation in India is reported to be of a native species, *Tectona grandis*, planted in 1840 in Nilambur, Kerala State. Regular planting, mainly of teak, began in 1865 in many of the teak-growing central and southern provinces.

In 1910, *Eucalyptus* spp. was introduced in the Nilgiri Hills of the present Tamil Nadu State. Planting of other native species was accelerated after the taungya system was introduced in 1911. These plantations, however, did not cover an extensive area until much later.

Since it gained independence in 1947, population growth and agricultural development have put unprecedented pressure on India's forests. Not only have forests been officially converted to non-forest use, but also extensive areas have been deforested and degraded by illegal settlements, shifting cultivation and forest-based industries. India's per capita forest area is now only 0.1 ha, one of the lowest in the world, and more than 35% of the area is badly degraded and suffering continuous depletion. Planned afforestation for soil conservation, industrial wood, fuelwood and fodder started in the late 1950s. The total plantation area to the end of 1972 was about 2,100,000 ha (MOA, 1973). Establishment of plantations remained confined mostly to forest reserves until 1979.

The Forest (Conservation) Act of 1980 initiated a process by which India's forests were treated as an environmental and social resource rather than as a revenue or commercial resource. The strictest controls have been placed on the diversion of forestland to other uses. In the rare cases when this is permitted for developmental purposes, compensatory afforestation is a prior requirement.

The plantation boom occurred when the social forestry projects (similar to community forestry) were launched in many states along with several other afforestation projects carried out with the assistance of external donors. The annual planting rate increased to about 1,000,000 ha during 1980-1985. Most of plantations have since then been established outside forest reserves in wastelands owned by the government or on community or private farmers land.

Plantation forestry received further impetus when a National Wasteland Development Board was created in 1985. The annual rate of planting increased to 1,780,000 ha during 1985-1990. The area of plantations established during 1980-1990 was estimated by converting seedlings planted/distributed by a notional number, 2,000 seedlings equivalent to one ha.

Records of plantations established since 1991 are maintained, for planted area and distributed seedlings separately, by the National Afforestation and Eco-development Board (NAEB) created in 1992 at the Union Ministry of Environment and Forests. According to the NAEB (1999), the annual rate of planting since 1990 has been ranging between 1,400,000 and 1,600,000 ha.

## **Joint Forest Management (JFM)**

In the 1990s, attention has turned to Joint Forest Management (JFM; also referred to as Joint Forest Planning and Management, JFPM). At the heart of this approach is a recognition that for programs of forest management, planting and protection to succeed, the local community should be involved in management, and should have greater responsibility for, and access to, the forest resource. The idea is to encourage private investors to invest in afforestation in degraded areas by forming partnerships with local farmers.

The most recent National Forest Policy (NFP), passed in 1988, sets the highest priority on environmental protection (FAO, 2000b). The formal recognition of communities as partners in forest management led in 1990 to JFM legislation.

Under the JFM legislation, the Government issued guidelines to State Governments highlighting the need and the procedure for the involvement of village communities and voluntary agencies in the protection and development of degraded forests. In response to these guidelines, 22 out of 25 States issued orders for creating resolutions enabling mechanisms for public participation in the management of degraded forests.

In addition, the NFP specifies that wood industries must procure their own raw materials for forest-based industries, and that these industries are allowed to purchase supplies from persons practicing agroforestry in the private sector, provided food production is not adversely affected. Farmers have tapped into their traditional skills to breed, plant and manage fruit trees and the other useful species that used to be planted rather sparingly on their farms and around their fields. With the rise of social forestry in the early 1980s, farmers' decisions on which trees to plant came to depend on the availability of seedlings in the government tree nurseries, and quite a few farmers have learned to grow economically beneficial trees.

The Federal Government has primary responsibility for forest management and most forests are under its control with the work overseen by state forestry departments. An increasing proportion of area is under site-specific village forest management plans developed through JFM, which by January 2000 covered more than 10 million hectares of degraded forests (India MoEF, 2000).

The NFP remained consistent with its predecessor Act by maintaining a target of putting one-third of the national land area under forest. The country is far from meeting this target as only 19.5% (64 million ha) has tree cover (Ahmed, 1997). Furthermore, 35% of the forest is badly degraded and the general trend is downwards, due to population and grazing pressures.

To achieve the NFP target roughly 33 million ha needs to be afforested and 31 million ha of degraded and open forest need restocking, presuming no further deforestation. During the late 1990s, already low afforestation levels declined further, mainly due to funding reductions. In 1996-97, only 1.3 million ha were afforested, which was below the average of 1.5 million ha in previous three years (Ahmed, 1997). Of this, roughly 70% of plantation establishment was carried out by the State.

As the new Forest Policy was underachieving, the Government of India developed a National Forest Action Programme (NFAP). The NFAP outlines a 20-year forest management strategy, including a major afforestation programme and continued regeneration of degraded natural forests through JFM. An annual afforestation rate of 3 million ha is required for twenty years to meet the target (FAO, 2000b).

The key incentive in the JFM programme is the sharing of benefits between the MoEF and participating communities. The majority of new planting is on public lands under the "20 Points Programme for Afforestation", which provides free seedlings for planting on private lands (FAO, 2000a). In addition, direct government planting continues.

## **Other Programs**

Other programs that provide incentives include a 1989-90 federal "Integrated Afforestation & Eco-Development Projects" scheme that funds local reforestation projects, especially on ecologically fragile watersheds in mountainous areas. To address problems related to seed sourcing and quality, a "Seed Development Scheme" was initiated in which the federal government funds development of facilities for seed collection, testing, certification, storage and distribution.

Facing a serious shortage of raw material, the Western India Match Company (WIMCO) invested in developing high-quality clonal poplars, which they supplied to farmers at a reasonable cost (Saigal, 1998). On farmlands the clonal poplars could produce timber-size trees suitable for sawing within eight years. Farmers like the poplars because; being deciduous, they lose leaves during winter, the main vegetable and wheat-growing season. In the scheme begun in the late 1980s, WIMCO arranged credit for farmers from the National Bank for Agriculture and Rural Development (NABARD), paid over the eight-year period directly to WIMCO for the cost of each sapling and extension support.

To secure the loan farmers had to demonstrate that they had legal tenure over the land, and WIMCO guaranteed the loans by assuring farmers of a minimum buy-back price, although farmers were free to sell to other buyers if they could find a higher price. The terms of the agreements also stipulated that WIMCO would replace any saplings that died in the first two years and spelled out details of irrigation, pruning and rotation. WIMCO estimates that during the 1990s more than 20 million seedlings were sold to approximately 30,000 farmers covering about 40,000 ha.

However, after four to five years farmers began selling elsewhere, largely as a result of poor price forecasting by WIMCO: by the time the trees reached maturity the open market price was as much as twice the price initially guaranteed by WIMCO. Demand for high-quality nursery clonal stock became greater than the supply, and the credit scheme to encourage farmers was no longer necessary. Increased supplies of timber stimulated development of many small processing units producing plywood and peeled veneers.

Today, WIMCO concentrates on selling seedlings to farmers, about 1.5 million seedlings a year, without a guaranteed buy-back arrangement. The company's field staff continues to provide advice to farmers, and this helps keep the company competitive with other nurseries selling poplar stock. Thus, although the original scheme has died, it contributed to major growth in farm forestry and considerable rural employment.

Bhadrachalam Paper Mills in Andhra Pradesh provides farmers with a similar package. Fast-growing tree species are planted along field bunds, boundaries and irrigation channels in rows, and as blocks combined with intercrops. Output has increased significantly, thought to be largely due to the supply of improved seedlings, without any increase in supply from natural forests. It appears that even small farmers can benefit from industry links to markets (Planning Commission, 1998). However, from the company's point of view there were some difficulties with this scheme: many farmers sold directly to the market, where they could charge higher prices, or to the mill but via contractors who then demand higher prices. Thus the mill did not receive the assured supplies for which it had hoped, although the scheme did enable it to increase production. There were plans for the mill to separate the business of selling seedlings and offering technical advice from the farm forestry scheme, to reduce losses (Roberts and Dubois, 1996).

### **3. Indonesia**

The Republic of Indonesia occupies a total land area of 1,904,570 km<sup>2</sup> within the Southeast Asian archipelago. The Indonesian archipelago consists of some 13,600 islands, of which about 6,000 are inhabited. Common land boundaries are with Malaysia, with the states of Sabah and Sarawak on Borneo island; with East Timor and with Papua New Guinea. Otherwise, the archipelago lies between the Indian Ocean to the west and south and the Pacific Ocean to the northeast. It is separated from Peninsular Malaysia and Singapore by the Straits of Malacca and the South China Sea, from the Philippine islands by the Sulawesi Sea and from Australia by the Arafura Sea and Timor Sea.



The vast distances within the country are illustrated by the distance from the north-western tip of Aceh province in Sumatra to the south-eastern corner of Irian Jaya, approximately 5,300 km, and from Talaud island, close to the Philippine island of Mindanao; to Roti island, in the south-east of Timor island, roughly north-south at approximately 1,775 km.

General topography of the three largest islands: Sumatra, Kalimantan and Irian Jaya can be characterized by extensive coastal plain and hilly inland areas up to about 1,000 m. These amount to 74% of land area in central and southern Sumatra, 40% in northern Sumatra, 84% in western and central Kalimantan, 50% in eastern Kalimantan and 60% in Irian Jaya.

For an area that stretches for about 5,000 km along the equator with several recognized geological and phyto-geographical divisions, the flora of Indonesia is relatively uniform.

Indonesia is heavily forested with around 60% of the country covered by forests. The forests are very diverse and they represent about 10% of all tropical forests of the world. Indonesia's closed broadleaved forests can be divided into two broad classes: wetland forests; comprising mangroves, swamp, peat and heath forests; and dry land forests; comprising tropical, montane and sub-alpine rainforests, and monsoon forests. Indonesia also has small areas of naturally occurring coniferous forests, mainly *Pinus merkusii* and *Agathis* spp., and open savannah forests, particularly east of the Wallace Line. Indonesia has established significant areas of plantation forest. Forests are mainly owned and administered by the State. Production forests are granted to private or state companies under logging concessions issued for specified periods. Logging concessions are managed on a selective system, the so-called TPTI (Indonesian Selective Cutting and Planting System) with a cutting cycle of 35-years and including a provision for tree planting. Indonesia has a network of around 250 protected areas, covering an area in excess of 20 million hectares.

Indonesia's forest has been considered second only to that of Brazil's as the most important world heritage of tropical forest. There are two types of forest in Indonesia, convertible and non-convertible, with a total area of 143.3 million hectares (FAO, 1999). Non-convertible forest consists of protection forest, park and reservation forest, limited production forest, and fixed production forest. The non-convertible forest covers 85.4% of the total forest area. The convertible forest is to be allocated for other development production purposes, such as agriculture, estates, transmigration and settlements. Deforestation rate is estimated at 1.6 million ha annually (Republik Indonesia, 2001).

Indonesia has almost 110 million hectares of forest accounting for 60.6% of the country's total land area. 103.6 million hectares of this is natural forest, all of which is state owned. The forestry sector accounts for 7% of GDP and approximately 20% of non-oil exports (1998). In 1991 foreign exchange earnings from the export of timber products and rattan totalled US\$ 4.2 billion and recent estimates put the number of people directly dependent on the forest sector at 2.5 million workers with an additional 2 million people employed in forest related industries.

All natural forests are owned and administered by the State, which may temporarily assign property rights (e.g. as a timber concession) or irrevocably transfer land to private parties (Hammond, 1997). Forestry policies are linked to national development objectives defined under 25-year National Development Plans. Indonesia is now in its second development plan, running from 1994 to 2019 (FAO, 2000c). These plans are subdivided into five-year economic plans (Repelitas). From Repelita I through IV (1969-1989), the long-term national goals were to increase forestry development and establish large-scale forest-based industries.

### **Logging Concession Rights (HPHs) and Timber Utilization Permits (TUPs)**

The Ministry of Forestry and Crop Estates has authority over forest management. Within this ministry, the Directorate General of Production Forests has the authority to release logging concession rights (HPHs). The Department of Trade and Industry has the authority to issue

permits for the establishment of timber and forestry enterprises. Private sector use of Production forest is controlled through a concession system. At present 47.3 million hectares are under private sector concession management with a further 4.11 million hectares managed by state companies. The private sector has been awarded approximately 90% of all concessions with the remaining 10% managed by state enterprises<sup>19</sup> operating on a commercial basis.

Timber extraction from conversion forest land is regulated by Ministry of Forestry Decree (No. 495/1989), Ministry of Forestry Order (No. 227/Kpts-II/1998) and Presidential Decrees (No. 29/1990 and 30/1990). Companies seeking to harvest logs from Conversion forest must obtain a Timber Utilization Permit (TUP) which must be granted by the Ministry of Forestry. TUPs are issued to both state and private companies, co-operatives and transmigration settlers. However, TUPs are granted on a preferential basis to certain organizations, which depends on the original land classification of the Conversion Forest.

TUPs are granted based on area, except in the case of permits granted to transmigration settlers where the TUP is volume based and capped at a maximum volume of 5 m<sup>3</sup> per person. The charge levied on the extraction of timber from conversion forests is the same as for selective logging in permanent forest.

Law n° 41/1999 on forestry has given new a paradigm to forest development planning. Forest planning must be transparent, integrated, and participatory as well as taking into consideration local uniqueness and aspirations. The law accommodates the role and right of people living in and around conservation area in forest management.

The provision of HPH is the major cause for deforestation since concessionaires only focused on forest exploitation and ignore their obligation to conserve the forest. It was recorded that as many as 421 logging companies own HPH for a total forest area of 51,639,152 ha. Forest fires and illegal logging are another major cause. Lack of law enforcement and the gap between supply and demand for timber have enhanced illegal logging. Another contributing factor to the depletion of forest is land conversion for transmigration purposes. Up to March 1999, a total forest area of 1,298,990 ha had been converted, not only from the area of production forest but also from the protection and reservation forest area.

### **Development Plans (Repelitas)**

In the development context, every Five-Year Development Plan (Repelita) focuses on specific aspect of forestry, in accordance with the national focus. During Repelita I (1969-1973) and Repelita II (1974-1978) the main focus was on the promotion of forest utilization in the outer islands.; Repelita III (1979-1983) focussed on rehabilitation, conservation, and reforestation; Repelita IV (1984-1988) on balancing of utilization and conservation; and Repelita V (1989-1993) focussed on sustainable management of forest resources along with strengthening related institutions. The Repelita VI (1994-1998) focussed on maintaining conservation and sustainability of forest function, prioritizing conservation of natural resources and environmental issues, hydrologic functions, and promoting job opportunities to forest communities. Forest management must include land rehabilitation, conservation and sustainability of forest functions.

Aggressive exploitation is being replaced with emphasis on environmental protection and sustainable management. Repelita V (1989-1994) limited log extraction, froze the issuance of new mill licenses, increased reforestation taxes (charged on harvests of timber from the natural forest) by 150%, added an export tax on sawn timber (which has forced inefficient mills to close), encouraged public participation and improved training and monitoring. Repelita VI (1995-1999) has more strongly emphasized sustainable forest management.

## **Plantation History**

In spite of its rich forest resource, Indonesia started regular forest plantations in 1873, mostly in Java with *Tectona grandis* and in 1916 with *Pinus merkusii* in Sumatra. Later on, some fast-growing species were also introduced in trial plantations.

The estimated area of plantations to 1950 was 500,000 ha, constituting three-fourths of the total plantation area of the tropical countries (FAO, 2001). Due to pressure for land in Java, the plantation activity was reduced for a while.

In the late 1960s plantation programs were again stepped up, adding significant area in almost all provinces. Two agencies were made responsible for the reforestation of all state forestlands; Perum Perhutani for plantations in Java and the Directorate of Reforestation and Greening (DITSI) in provinces outside Java. Reforestation within concession areas by concessionaires was initiated in the 1970s. The total area of plantations in 1980 was 2,669,000 ha (FAO, 1981), with the major portion in Java.

Due to population pressure, the scope for additional plantations in Java is limited. In 1988, the Ministry of Forestry decided to establish 6,200,000 ha of additional industrial plantation forests in the long run (about 25 years) with an annual planting rate of 2,507,000 ha by state and private companies (MoF, 1996).

Plantations for industrial production, known as Industrial Timber Plantations or Hutan Tanaman Industri (HTI), are being done in the islands outside Java, mainly in Kalimantan and Sumatra. In addition, farmers establish small woodlots with soft-money loans from the Ministry of Forestry. It is estimated that there are 1,027,000 ha of such woodlots of which 1,000,000 ha are in Java (MoF, 1996).

Average annual production of roundwood from the plantations of Perum Perhutani was about 1.8 million m<sup>3</sup> during 1994-1997 against the total production of 25 million m<sup>3</sup> in the country. Industrial timber plantations being young, production has only recently started and is around 0.5 million m<sup>3</sup> annually.

The data on production from private wood lots is not consistent. During 1994-1995 it was in the order of 125,000 m<sup>3</sup>, increasing to 682,006 m<sup>3</sup> in 1996 and to 1,266,455 m<sup>3</sup> in 1997 (MoFE, 1998).

To support industrial plantations by HTI to bring the total planted area to 6,200,000 ha in the future, some seed centres and 8 modern nurseries have been established with a production capacity of over 80 million seedlings per year.

The increasing demand for oil palm nationally and internationally has attracted wealthy investors, especially in Kalimantan and Sumatra, which is detrimental to other land uses including forest plantations (Potter et al., 1998). Smallholders and private estates have increased the area of oil palm plantations by 650,000 ha, that is, by 50%, from 1994 to 1997.

## **The Reforestation Fund**

The reforestation fund (Dana Reboisasi), introduced in 1980, has been one of the most significant sources of revenue from the forest sector. When it was overhauled in March 1998 the fee ranged from Rp10,000 to Rp70,000 per cubic metre depending on species group, diameter class and log grade.

Legally the fee is a deposit that is returned to the concessionaire when the MOFEC has received verification of adequate replanting as specified in the concession management plan. In practice,

however, there is no evidence of any such refunds to date. To all intents and purposes the reforestation fee functions much as an additional tax rather than a performance bond.

### **Hutan Tanaman Industri (HTI)**

Income tax incentives for logging investments were generous up until 1983, typically including five to six year income tax holidays. However, the government ended all tax breaks in 1983 concluding that they were ineffective in stimulating investment and that the privilege was being abused.

The Industrial Timber Estate (Hutan Tanaman Industri - HTI) development programme was initiated in 1983 to establish industrial timber plantations. These were intended to supply wood for the burgeoning forest products sector and to reduce pressure on natural forests (Potter and Lee, 1998). HTI agreement holders are granted 35-year concessions, which may be extended by another 35 years.

A critical aspect of forest planning is the categorization of the forest estate, which is the basis for designating areas for natural forest concessions (Hak Pengusahaan Hutan – HPH), timber plantation concessions, and tree crop plantations (e.g. oil palm). “Unproductive” natural forestlands are designated as sites for the development of timber plantations under HTIs. “Unproductive” land is forest with a low available commercial species volume.

The HTI plantation scheme has relied on subsidization as a way of developing a large private sector pulpwood resource and financing the reforestation of unproductive areas of permanent production forest. The package offered to qualified private investors is a joint venture with the Government that includes subsidized equity, interest free financing and land grants.

The government has offered companies willing to establish HTIs interest-free loans drawn from a reforestation fund supplied by a reforestation tax levied on HPH concessionaires (Potter and Lee, 1998). Under the 'Joint Decision Letter of the Ministers of Forestry and Finance No. 421/1990/No. 931/1990', joint ventures are structured as follows:

- Government finances and takes equity of 14% (this is held by one of the state owned forestry companies (Inhutani);
- The private investor provides 21% of direct equity;
- An interest free loan is provided to the investor of 32.5% of the establishment cost;
- A commercial loan to the investor of 32.5% of the project cost is underwritten by the Government.

Government equity, held by a state owned Inhutani, is financed through interest free loans from the DR fund as are the interest free loans extended to private investors. In cases where state corporations operate alone 35% of the capital requirement can be obtained as a subsidy from the fund and an additional 32.5% can be borrowed in the form of an interest free loan, but must be repaid in seven years. By 1993, approximately US\$125 million had been allocated to companies in the form of equity or loans.

Although, HTI plantation concessions are granted for 300,000 ha the concessionaire is only required to plant 60,000 ha and is free to clear cut the remaining area. The result is a de facto land subsidy in addition to the formal monetary subsidy the concession holder receives. The scheme has led some to ask whether subsidization is actually necessary to create pulp resources.

The government has also supported companies borrowing establishment capital and has allowed some to further lower establishment costs by co-operating with a state forestry company. Other

incentives include low land taxes and, critically, the right to cut and sell any remnant vegetation on concessions (Potter and Lee, 1998).

In 1992, to accelerate the establishment of plantations and at the same time provide employment for transmigrants, HTI-Trans was developed (Indonesian Ministry of Forests, 1998; Potter and Lee, 1998). Under this program, the Government will provide 40% of the investment in a joint venture arrangement with private companies.

The government's objective was to establish 1.8 million ha of forest plantations under HTI by 1995, 2.3 million ha by 2000 and 10.5 million ha by 2030 (Sunderlin and Resosudarmo, 1996). Indonesia's Ministry of Forests (1997) reported that HTI programs are targeted to have achieved about 6.4 million ha by the year 2000 however estimates of the area allocated to the HTI program have tended to be over-optimistic.

## **G. Africa**

Africa's total land area covers 29.6 million km<sup>2</sup>, of which two-thirds is arid or semi-arid (UNEP, 1999a). Land is central to development in Africa since the livelihoods of about 60% of the population are dependent on agriculture (Moyo, 2000).

The main issues related to land in Africa include increasing degradation and desertification, together with inappropriate and inequitable land tenure systems, which have played a major role in exacerbating degradation. Other widespread problems include a decline in soil fertility, soil contamination, land management and conservation, gender imbalances in land tenure, and conversion of natural habitat to agricultural or urban uses.

Over the past 30 years, more and more land has been converted to agriculture, most noticeably during the 1980s in response to rising commodity prices. By 1999, about 202 million ha of land in Africa were under cultivation (32% of the potentially cultivable area), and 906 million ha were being used as permanent pasture (compiled from FAOSTAT, 2001). The percentage of agricultural land (cultivated and pasture) varies considerably across Africa, from 54.7% in Southern Africa and 46.6% in the Western Indian Ocean islands to 20% in Northern Africa and 19.3% in Central Africa. The extent to which African economies are dependent on agriculture is reflected in the contribution to GNP (approximately 17% during the 1990s), and to employment — more than 60% of the total labour force in 1996, although this had declined from 70% in 1980 (ADB, 2001).

Africa contains about 650 million hectares of forests (FAO, 2000), corresponding to 17% of the world total. African forests amount to 0.85 ha per capita, which is close to the world average. Almost all forests are located in the tropical ecological domain, and Africa has about one-quarter of all tropical rain forests. Only 1% of the forest area is classified as forest plantations. The net change of forest area is the highest among the world's regions, with an annual net loss, based on country reports, estimated at -5.3 million hectares annually, corresponding to -0.78% annually.

Per capita forest cover in sub-Saharan Africa (0.9 ha) is low in comparison with most other regions. Sub-Saharan forests have been largely destroyed or fragmented. In West Africa, nearly 80% of the original luxuriant moist forest has been cleared. The remaining patches are heavily degraded and have survived through protection as state forests or national parks. Some large blocks of tropical high forests can still be found in Central Africa, where they are threatened by large-scale human migration resulting from conflicts and the breakdown of law and order. The major threats to African forests are land clearing for commercial and subsistence agriculture, wood energy demand, logging, intensive grazing in woodlands, forest fires and human conflicts and associated population movements.

Funding for afforestation in Africa is largely driven by international development assistance, and forestry policy has not evolved very far in most cases. Some innovative financing is implemented, however, although its applicability to the Canadian context is questionable. The inclusion of the following three countries then, is meant more as an illustration of the kinds of problems facing many African nations.

### **Gambia**

The Republic of the Gambia, located on the western coast of Africa, extends inland along the river of same name. It runs in an east-west direction, cutting across Senegal for over 330 km, but is only about 50 km wide at its widest point. The country covers a total area of 11,295 km<sup>2</sup>. It is very level with an altitude not exceeding 50 m.

The river and seacoast are lined with mangrove swamps. Further inland, the land is seasonally flooded by the river. Sandy plateaus extend along the sides of the river to the borders with Senegal.

The Gambia is moderately forested with around 9% forest cover and an additional 19% of other wooded land. The country's closed forests are mainly riparian and comprise mangrove species in the estuarine section of the Gambia River (up to 150 km inland) and limited sections of gallery forests in the freshwater section. Two types of mangroves penetrate deep along the Gambia River and its tributaries. Both types of mangroves are used by villagers for fencing poles, in house construction and for fuelwood either for local consumption or for sale in Banjul.

*Gmelina arborea* is the species usually planted to provide poles, fuelwood and timber. It is also planted along with evergreens such as cashew surrounding forests and along roads (FD, 1998).

Gallery forests of "riparian woodland" are found along the streams above the limit of tidal waters and contain most of the useful commercial timber species, particularly mahogany (Dunsmore, 1976).

Practically all the woody vegetation of the country is away from the river in open savannah. This consists of a mixture or more or less degraded mixed forest-grassland formations of varying heights and densities. Characteristic species include "Parkland" or "woodland savannah" in frequently farmed areas with *Parkia biglobosa*, *Daniellia oliveri* and *Acacia* species. Gambia also has a modest network of protected areas, including three national parks. Almost 2% of the country's land area is in protected areas.

The most striking change in land-use is the increase of the class "Tree and Shrub Savannah". It seems that there is a reasonable conversion from agriculture back to open forest.

Fuelwood is the most important energy use in the country with around 85% of the energy requirement being met by wood. According to a study conducted in 1973, the country would need about 100,000 ha of plantations to meet the demand for timber and fuelwood by 2000 (FAO, 1991 and FD, 1992).

The first plantation was established with *Gmelina arborea* in 1959. The major purpose was to produce timber for construction and fuelwood.

After 1974, due to frequent draughts, plantation establishment became increasingly difficult and costly, as failure rates became high. In 1978, a national tree-planting program was initiated, but its results were disappointing due to the low survival rate of the seedlings.

Under the Banjul Declaration of 18 February 1977, the government's commitment to the conservation of flora and fauna was stated. The "Five-year plan for economic and social development, 1975/76-1979/80" established environmental policy. Activities defined to implement this policy included the strengthening of existing environmental control legislation, programs for the conservation of forests and other natural resources, and the creation of a new national parks service (Corson and Kux, 1981).

From 1979 to 1986, USAID supported the Gambia Forestry Project, which aimed at establishing 1,300 ha of plantations during that period. Actually, 600 ha were established. From 1985 to 1990, establishment of plantations was suspended. By the end of this period, the total area of plantations was 1,400 ha (FAO, 1991 and FD, 1992). In 1990, an attempt was made to reforest 200 ha but it was not possible due to low rainfall and damage by livestock and termites.

In the late 1980s, because of a rapidly growing population, the demand for raw material for housing construction was increasing steadily. It was feared at the time that this might cause a

shortage of suitable construction materials. It was felt by the government that an increase in Gmelina plantations could alleviate this problem (FAO, 1991).

Due to poor climatic conditions, however, the survival rate of plantations tended to be low. Moreover, the established area was not large enough to meet demand and reduce pressure on the natural forests (FD, 1992).

In 1991 Gambia launched an Environmental Action Plan. The National Environment Action Plan included programs to establish public and private fuelwood plantations with the intention of reducing the increasing pressure on natural forests (FD, 1992). In addition, the policy promoted tree planting by private individuals for forest products as well as windbreaks (FAO, 1991).

Objectives of this policy were, inter alia:

to reserve and maintain a national forest resource capable of protecting natural ecosystems and providing for an adequate supply of wood and other forest products for the rural population;  
to maintain a Forestry Service staffed with trained personnel to administer the forest resources;  
and  
to foster conservation awareness amongst the Gambian people (Edens, 1991).

Since 1998, both community forests and community participation in forest management are covered by forest law (Republic of Gambia, 1998). Agroforestry, Trees outside forests, non-forest trees (i.e. non-forest trees are trees planted outside the forest by a person or a community within existing vegetation which does not constitute a forest (Forest Bill, 1998, Gambia)) and urban forestry are all specifically mentioned. This law provides legal encouragement for tree-planting on farmland and pasture, and along roadsides. The Law seeks to encourage tree planting by stating specifically that anyone who, possessing a lawful right to do so, plants a tree, is thereafter the owner of that tree.

This is an innovative law with respect to tree access rights. People are allowed the usage of both forest and non-forest trees growing outside the forest, but the harvesting and felling of forest trees is regulated by Article 6 of the Forest Bill. Non-forest trees belong to the person or community planting or inheriting them, but the transport of logs from these trees requires a special permit (Article 7).

#### **4. Ghana**

The Republic of Ghana lies in central West Africa on the shores of the Gulf of Guinea. The coastline stretches over 565 km. The country reaches some 675 km from south to north and 540 km from east to west and has a total area of 238,538 km<sup>2</sup>.

Conservation of forests and wildlife has a long tradition, which has expressed itself in the creation of indigenous "law" and more comprehensive legislative instruments. Arising from a totemistic belief that people can have a mystical union with plants, animals or natural objects, local practices, customs and taboos have been developed to protect cultural and religious objects or natural areas with particular plant and animal species.

One of the first conservation initiatives was the creation of a number of game reserves by the Forestry Department under the Wild Animals Preservation Ordinance (Cap. 246, 1901).

Following World War I, efforts to curb deforestation involved the creation of forest reserves under native authority by-laws. A forest policy was also adopted with a view to "conserve sufficient areas of forest" to protect the forest ecosystem (Bennuah, 1987). Lack of public support for both measures prompted the Governor of the Gold Coast to pass the Forest Ordinance of 30 March 1927 (Cap. 157). This Ordinance allowed for the constitution of forest reserves, provided for the



appointment of a Reserve Settlement Commissioner, and set out the procedure involved in notification. Ownership of land was not altered by the creation of a forest reserve and it may be managed either by the owner under direction from the Forestry Division or by the Government for the benefit of the owner.

The Concessions Act No. 124, 1962 amended these provisions and established that all forest reserves are deemed to be vested in the President acting in trust for the customary landowners. It also abolished the creation of forest reserves under local by-laws (EPC, 1989). By virtue of the Forest Ordinance, the President may, by order published in the Gazette, direct that a given parcel of land ceases to be considered a forest reserve. The Ordinance also set out offences and penalties and matters dealing with the management of forest reserves.

After the 1960s, and until recently, little field level forest management such as the preparation of forest management plans or reforestation was undertaken either in or outside reserves. The only forest management activities undertaken were those that were voluntarily pursued, such as road building and maintenance and boundary demarcation. Within Reserves, operators were required to abide by the Harvesting Manual of 1962, but this added little to their harvesting tasks. Outside Reserves, there were no harvesting standards.

A National Forest and Wildlife Policy Statement was adopted in 1994, which aimed at the management and enhancement of the permanent forest and wildlife estates for preservation of vital soil and water resources, conservation of biodiversity and the environment. It is a three-phased 10-year investment program, which was eventually launched in September 1999. The program has four main components:

High Forest Resource Management;  
Savannah Resource Management;  
Wildlife Resource Management; and  
Biodiversity Conservation in the high forest zone.

In general, there is dearth of minimum information and data on forest resources for rational management decision making. Most of Ghana's forests continue to be managed in the absence of such vital data. Levels of annual allowable cut (AAC) to match yields, for example, cannot be made with any kind of precision. Establishment is underway of an electronic data bank at the Forestry Commission, which will incorporate all other management information systems with three key divisions of the Commission.

The two main tasks facing the Forestry Commission today are to secure and improve existing natural forests and to rehabilitate the degraded forestlands and thereby increase the area under forest plantation. To this end, the President of Ghana launched the National Plantation Development Program (NPDP) in September 2001, aimed at planting 20,000 ha/yr. The new plantings incorporate Agroforestry to improve food security and also generate rural employment. According to the government, the NPDP has successfully taken off in all the 10 regions of the country and over 19,000 ha had been planted as of June 2002.

### **Private/Public Partnerships**

In 1994, the last date for which accurate data was available, there were 810 concessions (282 in Reserves) held by 413 contractors (Kotey et al., 1998). Between 50% and 70% of the recorded timber harvested was done by small companies with fewer than 10 employees. If unrecorded extraction by farmers and other chainsaw operators were included, the small producers' share of total production would likely be higher.

Private-community partnerships such as out-grower schemes and contracts to supply seedlings are increasingly important as a way of extending plantations in farmland.

One interesting example is the case of the Swiss Lumber Company, which enters into contracts with farmers to plant trees on degraded land that is providing marginal yields under other crops, rather than competing with prime agricultural land. In this way the company increases its resource base to feed its sawmill.

Unlike neighbouring companies, the Swiss Lumber Company in southwestern Ghana does not have a timber concession but, rather, aims to meet its future timber needs through timber-growing contracts with farmers. The arrangements emphasize relatively slow-growing indigenous hardwoods rather than fast-growing exotics.

The company offers farmers four payment options: a lump-sum down payment, a percentage share of the timber at harvest (varying from 20 to 50%), an annual land rent, and the first option on a weeding contract on the plantation. Farmers are bound by their contract to give the company the first option in the purchase of their share of the timber at prevailing market prices. In addition, the farmers are given first option on a weeding contract with the Company.

Although this project is in its infancy, many farmers in the area have registered to participate, and there are signs that joint ownership of the timber is encouraging farmers to protect the trees from bush fires and illegal harvesting (Kotey et al., 1998).

## **5. South Africa**

The Republic of South Africa is located on the southern tip of the African continent. It is bordered on the north by Namibia, Botswana, Zimbabwe, Mozambique, and Swaziland; on the east and south by the Indian Ocean; and on the west by the Atlantic Ocean. It stretches 1,500 km from east to west, 1,000 km from north to south, and has an area of 1,221,040 km<sup>2</sup>.

An interior plateau occupies about two-thirds of South Africa. The Great Escarpment, a semicircular series of cliffs and mountains, rims the Plateau and drops steeply to the coastal regions. A narrow coastal strip extends along the southeast coast from Mozambique to the Cape Mountains Region. In the west, the Cape Mountains extend from the coastal strip to the Namib Desert.

The Republic of South Africa's (RSA's) forests and woodlands cover 8.5 million hectares, equal to 7% of its land area (FAO, 1997). Of this, about 3 million hectares have over 40% forest canopy cover, 85% of which is plantation forest (Bass et al., 1996). Forestry currently contributes 1.8% GDP, supplies 90% of domestic demand and accounts for 8.7% of agricultural output. Forests are of particular importance in poor rural communities that rely on them for timber and non-timber forest products (NTFPs). One-third of households are estimated to rely on wood for fuel, and in some regions 80% of households depend entirely on wood to meet their domestic energy requirements.

Until the early nineties, the government, communities and the private sector had clearly defined roles in managing RSA's forests. The administration of state forests was led by the Department for Water and Forests (DWAF), which was responsible for implementing field-level management. Private forests were utilized by the white landowners who, apart from being required to obtain afforestation permits limiting their water use, had a large degree of freedom to manage their operations. Community forests in the former Homelands were the responsibility of the Homeland administrations.

Under the post-Apartheid government, a new Forest Policy was put forward in March 1996 and in its wake a National Forestry Action Programme (NFAP) and a new National Forest Act (no. 84 of 1998) have been prepared. These documents outline a series of reforms that will have significant implications on the roles and responsibilities of the government, the private sector and communities in the forestry sector. While the reforms' emphasis on the need to raise efficiency

and ensure sustainable forest management (SFM) mirror forestry reforms in several other countries, the reforms stand out for the emphasis placed on social equity. The attention given to social equity is found in all sectors of the economy and reflects the government's commitment to tackle the tremendous inequalities in wealth left over from the Apartheid system.

A central aspect of the reform strategy set out in new legislation is measures to increase private sector participation (PSP) in forest utilization and management. The private sector is not only expected to increase its role through the purchase of leases in state and community forests and afforestation of degraded areas, but it is also encouraged to work with local people in community-owned forests through partnership arrangements such as outgrower schemes.

For natural forests on private land, a number of programs have been developed to inform landowners of the value of these resources and the need for their protection, and to enlist the support of landowners in protection. These are the establishment of conservancies, where a complex of private landowners commits themselves to the joint management of adjacent lands.

Private ownership of forests (not land) is not only being boosted by the privatization of state forests, but through government efforts to encourage private sector investment in new plantations. This is particularly true in communal areas. The government hopes that by attracting private finance, it will generate employment and income in these areas, while reducing pressure on already degraded forests.

Apart from 70,000 ha of natural forest that is protected by law, private forest use is determined by the owners. As with state forests, plantations are dominated by timber extraction and natural forests by conservation. Timber is the most important income earner for private forest owners and their production accounted for 78% of the national total in 1996/7. The sector is highly concentrated and owners either undertake the work themselves or hire others from the growing pool of contractors. Although timber predominates, in some cases forest owners have been known to earn significant revenue by selling rights to extract NTFPs.

Corporate-community partnerships have existed since the early 1980s and, although they currently account for less than 1% of plantation areas, they are growing rapidly as the demand for land for afforestation outstrips that held by the private sector and as the government increases its support. There are three main types of arrangements:

the outgrower scheme where individuals are contracted to plant trees on their land for a processor (see below);  
equity-sharing schemes where the private processor and the community invest jointly in afforestation; and  
co-operatives where groups of small growers join together to grow and harvest trees that are less common.

### **Outgrower schemes**

The international pulp and paper companies Sappi (which owns 18% of the nation's timberland) and Mondi have been establishing outgrower schemes with farmers in South Africa since the early 1980s. Under these schemes the company provides marketing and production services to farmers to grow trees on their own land under purchasing agreements laid out in a contract. Although such schemes started out as corporate social responsibility exercises, out-grower schemes have turned out to be good business for Sappi and Mondi, even though the fibre produced costs them more than the average mill transfer price. Company managers find the schemes attractive because there is no need to invest in developing the company's own forest assets, and the costs are dealt with in the profit and loss account rather than on the balance sheet, where forest assets can all too easily become expensive liabilities.

An early outgrower scheme was "Project Grow" in KwaZulu-Natal, introduced in 1982 by Sappi. Under this scheme local communities sign a contract with Sappi, which entitles them to free expertise, silvicultural training and seedlings, advanced payment for work and a guaranteed market for their trees at current market prices. When the trees are finally ready for harvest, Sappi pays the participants the value of the produce less any advance payments. By the end of 1997, 6,800 ha had been planted by 7,600 owners generating R2.4 million (US\$545,000) per year (LHA, 1998). Participants earn about US\$205 per hectare per year, which compares favourably with alternatives such as livestock grazing or sugar production.

Today Sappi's outgrown timber is sourced from an area of some 88,000 ha in Kwazulu-Natal which includes 11,000 ha owned by 8,000 black smallholders and the holdings of about 260 white farmers with 50 ha or more each.

Sappi introduced a second outgrower scheme in 1990 for title deed holders called the "Management Associated Programme" (MAP). MAP offers free seedlings and technical advice, a loan of up to R1,200 (US\$275) per hectare at the prime bank interest rate and a guaranteed market price for timber. To date some 28,000 ha have been planted and it is expected to grow to 36,000 ha. Average income is US\$115 per hectare per year. Under this scheme, the grower must follow the harvesting practices prescribed by Sappi and cannot sell the timber grown to anyone else.

## **H. Incentives for Afforestation**

### **1. Introduction**

This section begins with initial observations on some of the issues that can affect the success of incentive programs, such as cultural biases and structural factors. I then propose a number of "categories" of incentive mechanisms, which are based on the country case studies and a review of literature on the subject. In broad terms, these categories sub-divide the incentive mechanisms into (i) Direct Government Assistance / Program, (ii) Preferential Tax Treatment, (iii) Industry Partnerships and Third-Party Leasing Arrangements, (iv) Market-based Trading and (v) Non-traditional Incentive Mechanisms. Within each category incentive mechanisms are described, giving examples, where necessary, to illustrate a given mechanism, along with some pros and cons of each broad category of incentives. In the next phase of this project, these categories will be examined in more detail, in an attempt to judge their relative effectiveness, as well as their applicability to the Canadian context.

#### ***Designing an Incentive Program***

Gregersen (1984) defined incentives as "public subsidies given in various forms to the private sector to encourage socially desirable actions by private entities." Generally, when we think of government incentive programs we think of loans, tax concessions, grants, or subsidies. Although these direct incentives are certainly well-utilized, governments have a number of other incentive mechanisms at their disposal.

It can be difficult to design an incentive program that does not create unwanted market distortions. Subsidies, for example, tend to distort market conditions by unfairly affecting competing investments and can jeopardize trade agreements. Indeed, scrutiny is intensifying as bilateral and multilateral trade agreements become more the norm. This is particularly true for Canada, with some \$34 billion in forestry-related exports.

As noted by Enters et al. (2003), empirical research on the impacts and effectiveness of incentives on plantation development is scarce and even where it exists, it is often impossible to clearly identify a direct relationship between incentives offered and responses by landowners. The authors note, however, that direct incentives are most likely to be important in the initiation stage to raise awareness and to increase the pace and scale of afforestation, but these should be replaced by variable incentives and social services such as research and extension during the acceleration stage.

In fact, Incentives may be most important to help landowners overcome barriers such as a high initial capital cost of establishment and the long waiting period needed for returns to be realized. Farmers and rural communities often suffer, on the one hand, from interim cash flow problems before the eventual harvest of tree products and, on the other hand, from a lack of access to the equivalent of farm credit in forestry (Chipeta, 1997). In this case, help with the initial investment may be all that is needed. As Enters (2003) puts it, "...a good measure of an incentive's success may be that it becomes obsolete in the maturation stage."

The choice of an incentive, however, is often dependent on the perceived need of the incentive's purpose (in this case, to promote afforestation). Williams (2000) tells us that incentives are only appropriate when the private sector net returns are lower while the net returns are greater than the returns from other forms of land use. Incentives may not be needed, he goes on to say, if the private returns from forestry exceed those from other land uses or if the addition of incentives will still not provide an attractive private return. In selecting an appropriate level of assistance, then,

rates of return not only have to be compared with those from alternate land uses but also with investments in other sectors.

While this is largely true, cost effectiveness is not the only consideration in the establishment of incentives. It may be, for example, that greater returns are to be gained from the establishment of a forest plantation, but the landowner simply does not have enough information to make this determination. Indeed, there is often as much, if not more, of a motivation to enter into a planting contract for the planter as there is for the government. In this case, extension, information or an enabling environment may be far preferable from the outset than subsidization.

Another example of this might be found in the case of the creation of riparian buffers or windbreaks. Farmers may not be fully aware of the advantages of certain afforestation programs that could actually increase their current farm productivity. In this case, extension services or support for local grower communities might be appropriate.

### ***Cultural Biases***

Cultural biases must also be taken into account (DeMarsh, 1999). For farmers whose ancestors toiled to clear trees from their land, any suggestion of afforestation on their property may be met with derision. As DeMarsh points out:

"The most significant non-physical, non-financial constraint to expanding afforestation is landowner feelings that the land in question may/should be returned to agricultural production at some point in the future. This sense of keeping trust with the ancestors who cleared the land, or romantic attachment to a picture of cattle grazing in lush pasture around the homestead can be dismissed as sentimentality, but is a real and powerful motivation for some rural landowners. The strength of such sentiment will vary from one landowner to another. Where strongly held, we believe these attitudes need to be considered as both intractable and deserving of respect."

Although high enough subsidization may work in this case, a well-designed promotional program, information campaigns showing the gains to be made, or support for local woodlot programs, may be much more effective incentive mechanisms.

### ***Structural Factors***

Structural factors can also have profound impacts on the attractiveness of plantation investments and the effectiveness of subsidies (Williams, 2001). The risk that government policies or taxation levels may change during the life of a plantation is quite high in some countries and can thus inhibit plantation investment. To avoid this, land-use policies and tenure rights need to be clearly defined, and contractual agreements to afforest need to be carefully written.

When analyzing the effectiveness of incentive measures, it should also be noted that forest incentives are sometimes self-financing, as government taxation of income generated may result in eventual cost recovery. Chile's plantation subsidies, for example, are reported to have profited the state (Keipi, 1997).

### ***Types of Incentives***

While there are a number of mechanisms that governments can use to provide incentives, traditionally the majority of these fall under the broad categories of "direct" or "indirect" incentives. Although the distinction between the two is often somewhat blurred, in general the former influence returns to investment directly, whereas the latter have an indirect effect through setting or changing the overall framework conditions within and outside the forestry sector (Enters et al., 2003). For example, tax deductions or loans for plantings are examples of direct incentives as they directly affect the cost of plantation development, whereas tax incentives for the purchase of

farm equipment or fuel can be considered as indirect as they affect costs both inside and outside of plantation establishment.

Indirect incentives for afforestation programs can take a number of forms, both in terms of government policy initiatives and the involvement of third party institutions or organizations. Indirect incentives for afforestation are generally used to create an environment that encourages landowners to plant trees by making it in their best interest to do so. This is usually achieved on the demand side of the equation, through the creation of market demand or by facilitating access to that market. Indeed, McGaughey and Gregersen (1988), in their review of investment policies and financing mechanisms, tell us that indirect incentives respond to problems of 'information failure'.

Direct incentives are often designed according to the interests of the government, rather than the needs of the recipient. Enters et al. (2003) tell us that the available evidence indicates that enabling incentives play a much bigger role in encouraging investments than direct incentives.

For this reason, indirect incentives are usually categorized by the ways in which they affect market demand for a product or the legislative environment (e.g. policy failure problems like price controls, bureaucratic marketing regulations, transportation and permits) that regulates the market. They can also affect the demand side of the market through the provision of market information, extension (already discussed under direct incentives) and education, and research (Keipi, 1997).

Within the following sections, however, the majority of both direct and indirect incentives can be found under Direct Government Assistance / Program and Preferential Tax Treatment. For the categories of Industry Partnerships & Third-Party Leasing Arrangements and Market-based Trading, government intervention is often limited to the establishment of an enabling environment. It is felt that classifying incentives into the following five categories better reflects a more practical approach to looking at the different incentive mechanisms available for the establishment of an afforestation program.

## **2. Direct Government Assistance / Program Incentives**

These government incentives comprise the majority of "traditional" afforestation incentive mechanisms employed by governments. There are a large number of different tools in the form of government incentive mechanisms, and these credits and exemptions usually, though not always, relate to new investments in seedlings, site preparation costs, and equipment.

Examples of direct government assistance and program incentives that could be used for afforestation program include:

### ***Loans, Grants or Subsidies***

These direct incentives entail direct government financial support for afforestation, including state financing through low interest rates or nil interest loans, subsidies, exemptions, abatements, or outright cash grants. These schemes have been quite common in both developed and less developed countries, although they have not always been effective due to poor control systems. In Ireland, for example, new plantings financed through a compensatory allowance were often planted on ecologically and commercially unsuitable land. In contrast, some 120,000 ha of land were successfully planted over a 20-year period under New Zealand's loans and grants schemes, largely on land suitable for afforestation.

Subsidized or nil interest loans are often used as a way for the government to recoup much of their investment. A good example is in Indonesia, where the government uses nil interest rate loans to encourage the establishment of short rotation pulpwood forests. These loans cover

approximately one third of the re-establishment costs with repayment required within three years (Potter and Lee 1998).

### ***Loan guarantees (reduction of uncertainty)***

Under a loan guarantee program, the public sector will guarantee a loan made by a private sector lending institution, usually a commercial bank. Generally, these loan guarantees will provide the assurance of repayment of a percentage of the financial institution's loan to a company. A fee for this guarantee is usually required by the guarantying entity.

The main advantage of this type of instrument is that bank financing for start-up or expansion costs becomes available for those who might otherwise be ineligible. Moreover, loan processing time is often faster than other government lending instruments. On the government's side, the system minimizes paperwork and other overhead, as commercial banks use their own procedures and forms to administer the loans.

While access to concessional credit is essential, steps to reduce the risk of loan defaults to lending agencies are equally important.

### ***Revenue and General Obligation Bonds***

Bonds can be issued through public entities to assist in afforestation activities. These bonds can either be tax-exempt revenue bonds, which are not guaranteed by the government, general obligation bonds, which may be taxable, or tax-exempt bonds and are backed by the general "faith and credit" of the issuing entity to assure repayment of the bonds. Usually, the government is not obligated to repay bondholders and does not guarantee the bonds.

Bond proceeds can be loaned to finance eligible equipment costs, construction, certain design and consultation fees, seedlings, and many loan closing costs. Loans or bonds can be secured by a first or second lien on project land, buildings and equipment. Other assets may be required as loan security. Loan rates are set at the time bonds are sold. Interest rates are fixed and are typically lower than market rates.

Another type of bond is the Certificado de Abonos Forestales (CAF), or Forest Bond Certificate, which was introduced in Costa Rica in 1986, following amendments to the tax relief mechanism. The CAF allows individuals and companies to take advantage of that mechanism without having to establish their own plantations<sup>5</sup>. The bond can be used to pay any kind of tax, or sold for slightly less than the face value of approximately US\$650 per hectare. Payment is made when the investor provides proof that the plantation has been established. Large companies benefited most, as the terms of the CAF require the investor to pay the upfront reforestation costs before receiving the bond. The scheme had encouraged over 600 businesses to reforest approximately 38,000 ha by 1995.

### ***Technical Assistance and Extension Services***

A number of countries provide direct assistance in-kind (for free or below market prices) to individuals or communities through extension services. Extension usually involves the transfer of technical assistance and information to communities and individuals, but can also take the form of the provision of seedlings for afforestation (see below). As Keipi (1997) notes, owing to the failure of other mechanisms, the most common direct incentive is government cofinancing of inputs, such as plants, and the provision of extension.

---

<sup>5</sup> For details on the mechanism, see the section on Costa Rica



As previously noted, many farmers and other landowners may lack the expertise or be unaware of recent technological developments in forestry. Extension services, common in both developed and developing countries, can act as a source for this kind of information.

Moreover, farmers' land-use decisions are not always based on economic rationality, but may be based on traditional values or a dislike of longer rotation crops. Such cultural biases may be overcome through a carefully targeted informational campaign, although attitudinal change may take a generation to change. However, the lack of information is an obvious obstacle to the complete success of many an afforestation program, particularly where no other informational sources are evident.

For example, O'Leary et al. (2000) looked at regional differences in attitudes toward afforestation in Ireland, where they found strongly contrasting preferences, perceptions and attitudes in two populations. One area was strongly supportive of introducing forestry and other, within an agricultural community, was highly critical. They concluded that, rather than relying on a generic approach, different policies and strategies needed to be developed for parts of the country.

Extension services have been widely employed in Canada, notably through the Model Forest Program. These projects may include research, the development of alternative forest management tools and techniques, education and communication. Through their outreach programs, model forests put landowners and those interested in forestry, in closer contact with researchers and forest experts.

#### ***Direct Government Plantings or Provision of Seedlings***

Usually, but not necessarily, part of extension services, the provision of seedlings or planting services can help landowners to overcome initial start-up barriers to the establishment of trees on their property. Government support can also be provided in the form of financial support for local organizations, such as the Manitoba Seedling Program, in their efforts to achieve economies of scale for small landholders.

This type of government intervention is sometimes preferable, as it limits government expenditure to supporting start-up costs only, allowing them to avoid any dependency cycle often associated with subsidies. It also ensures, to some degree, that government programs only attract "serious" growers who are interested in the longer-term viability of their plantings, as opposed to landowners that are looking for tax breaks or ongoing subsidization.

#### ***Government Support for Model Forest Programs***

Model forests undertake projects that will help them to meet their goal of achieving sustainable forest management. These projects may include research, the development of alternative forest management tools and techniques, education and communication. Through their outreach programs, model forests put landowners and those interested in forestry, in closer contact with researchers and forest experts.

The Government of Canada, through the Canadian Forest Service, launched Canada's Model Forest Program to address the challenge of balancing the extensive range of demands placed on Canadian forests today. By developing partnerships, each model forest works towards achieving sustainable forest management (sfm) in their area. Each model forest serves as a demonstration of partners representing a diversity of forest values.

Canada's Model Forest Program has always recognized the importance of private woodlots in the quest for SFM. Four out of the 12 model forest sites throughout the network have very significant private ownership (Fundy, Nova Forest Alliance, Bas-Saint-Laurent and Eastern Ontario). These model forest sites have undertaken comprehensive projects and programs, which integrate and accentuate SFM initiatives on private lands.

### **Government Support of Forestry Co-operatives**

For landowners planting smaller forested areas, start-up costs can be prohibitive, particularly in terms of fencing, seedlings and specialized equipment, and small plots may be too small to become viable economic units (Bulfin, 1993). Forest co-operatives help by allowing landholders to take advantage of economies of scale, both in terms of helping landowners to plant in adjoining areas, and by providing access to bulk pricing on goods and services. Government support for such co-operatives can be an efficient use of resources.

Although there are long traditions of farm co-operatives to aid small operators in many countries, forestry co-operatives are not as common. Typically, farm co-operatives are engaged in processing and marketing, whereas forestry co-operatives get involved much earlier on. A co-operative provides a framework within which the members (or shareholders) can formalize their relations with each other. It also has the ability to raise money, which may make it easier for small businesses to grow and develop. Moreover, it is a 'body corporate', with the ability to give credit and to borrow money.

An example of such a system is the Western Forestry Co-Operative Society, which was established in Ireland in the mid-1980s. In all, each of the twenty local co-operatives are serviced by a professional forester, with an overall co-ordination role in the running of local farmer forestry producer co-operatives in the Western and North Eastern counties. Overall their role is to promote planned farm afforestation and co-ordinate the activities of all relevant statutory and voluntary development agencies within each forestry co-operative area. The major organizational challenge for the co-operative is to promote the release of areas of marginal land present on almost every farm into forestry and to group these into viable well laid out blocks. The Co-operative is assisted in its development programme by funding under the Operational Programme for Agriculture, Rural Development and Forestry.

### **Provision of Government Supported Insurance**

Government-supported insurance schemes can be critical in protecting against risk against crop failure or loss, particularly where private insurance schemes are expensive or non-existent. Insurance has an influence on the behaviour of landowners in terms of disaster mitigation and preparedness, through insurance instruments such as the levels of premiums, deductibles and limits of coverage. Moreover, in Canada forest tenant farmers are classified as entrepreneurs running businesses, not as labourers, and therefore cannot benefit from unemployment insurance.

Lessons can be learned from the experience in the agricultural sector where, in general, two types of income insurance are utilized (Skees, 1999):

- 1) those that pay for revenue shortfalls for an individual commodity; and
- 2) those that pay for whole farm income shortfalls.

For agricultural purposes, both Canada and the United States have extensively utilized Type 1 contracts in the form of a Gross Revenue Insurance Program (GRIP) contract, with the U.S. also employing three other basic revenue insurance contracts. The Canadian GRIP contract differed from the US contracts in that it used a moving average of previous years of income.

The GRIP in Canada, however, was largely abandoned by 1998. Due to a 15-year moving average of prices, the GRIP was costly and distorted markets. The Canadian government learned that the premiums being charged were not high enough, such that insuring prices at levels that are higher than the expected price became very difficult.

The GRIP was replaced by Net Income Stabilization Accounts (NISA), which offer an alternative income support mechanism. The farmer and the government contribute to a special interest-earning account in good years, which the farmer can then draw from in bad years. The U.S. Adjusted Gross Revenue (AGR) contract is another example of this type of contract.

The key to NISA accounts is that they are explicitly tied to an individual farmer, such that these accounts are not pooling risk. NISA provides incentives for farmers to build equity that can be used when times are difficult. Participation in NISA has been very strong in most Canadian provinces.

One of the operational difficulties with insurance schemes is that it is sometimes not clear if they should be classified as risk management tools or subsidies. Sometimes the latter can be construed of as contravening trade agreements.

### ***Forest Protection Agreements<sup>6</sup>***

Forest Protection Agreements provide risk reduction for landowners through agreements that include extensive co-operation between landowners and government agencies for fire fighting efforts. They may also cover damage due to insects and/or disease.

It is a dangerous, costly and time consuming endeavour to suppress wildfires in forested areas, as wildfires often occur randomly and threaten losses to private land values and valuable commercial forests. Man-made fires can be extremely difficult to predict, particularly when it comes to arson. Moreover, the number of fires and the area burned in Canada have been escalating dramatically during the past three or four decades, representing an increasing concern to forest holders.

These agreements assist government in setting fire legislation, priorities and policy development, and usually contain fire prevention campaigns, including burning permits, fire bans and media campaigns to reduce the incidence of human caused fire. They can also entail the co-management of community forests and forestry development; and the development of fire breaks and possible prescribed burns. Providing assistance to outside agencies, communities, rural municipalities and industries, when requested, is an important role in any such agreement.

In general, within fire control agreements, landholders have a limitation of liability for damage caused by controlled burns that escape, provided the controlled burns were carried out under the approval the local fire authority.

### ***Cost Sharing***

Governments have traditionally offered cost-share programs to aid farmers in managing their land to increase yields and preserve and improve the environment. Since good woodland management is an important part of the overall land husbandry on many farms, forestry practices have been included in many such programs, including funds to encourage land conversion to forestry.

The program is usually authorized to reimburse the landowner for a set rate (say, 75%) of the cost of doing the work (including labour), with a maximum amount for each unit of work done. This maximum depends on the particular practice and the program specifications. In return for the agreement by the landowner to undertake conversion, the program agrees to share the cost of implementing those forestry practices and measures set out in the agreement.

---

<sup>6</sup> Another type of FPA, involving direct payments to landowners to preserve, or relegate government control of, ecologically important land, was essentially covered under grants, as it entails direct financial transfers to landowners.

The purpose of the practice can be to establish a stand of forest trees for timber production, and to preserve and improve the environment. Cost-sharing is usually limited to the planting of trees on sites where the potential productivity meets or exceeds established minimum standards. Cost-sharing is authorized for preparing the site for planting, which normally involves the clearing of brush and other undesirable vegetation which may interfere with the growth of tree seedlings. Tree seedlings for planting are generally purchased by the landowner from the Division of Forestry.

### ***Privatization***

The privatization of government forestry institutions is one approach that countries have taken to create more efficient markets, and thus encourage more private sector participation. Although full-scale deregulation does not always lead to more efficient markets, privatization of inefficient government agencies or regulations.

Perhaps the strongest case for privatization is the New Zealand model, where privatization and the elimination of subsidies in the early 1990s eventually led to a surge in new plantings, with plantings increasing by about 60-80,000 hectares a year by the mid 1990s. Although this increase was partially enhanced by a global price spike for logs, the industry remains robust.

In New Zealand, privatization did improve competition and innovation, largely through the provision of a broader base of forest management strategies and innovative investment strategies introduced by new players in the market. There are, however, some undesirable issues often associated with privatization, such as the issue of foreign ownership of formerly public assets.

### ***Institutional Reform***

As an alternative to full privatization, institutional reform can also be undertaken to correct inefficient government agencies or regulations. Although such reforms are very much case dependent, institutional reform often targets issues like:

- log pricing: elimination of disincentives brought about by low stumpage rates
- log trade control: trade liberalization can create more efficient markets, particularly through the removal of monopoly privileges to concessionaires (Castilleja 1993).
- reduction of barriers: allowing for access to external markets
- removal of structural impediments and operational constraints: i.e. the elimination of unnecessary bureaucracy (e.g. licensing and permits)
- ensuring consistent policies over time: administrative stability and consistent policy approaches are one of the strongest incentives to private sector participation
- ensuring follow through of supportive policies with strategies: consistency

### ***Market Access***

As an extension to institutional reform, governments need to ensure that critical export markets remain open to forest products and that new markets are developed in order to ensure market access for new timber. In Canada, for instance, the CFS contributes to initiatives to liberalize international trade, and acts to protect the legal rights of Canadian exporters when trade disputes arise.

### ***Public Partnership in Policy Development and Implementation***

As another extension to institutional reform, public participation in policy development and implementation is often a key factor in the formulation of policy necessary to encourage participation in the sector. Perley (2001) notes that one of the major issues in sustainable forestry management in developing countries as being the failure of government forestry agencies to

incorporate local knowledge and skills in both forestry policy formulation, and its implementation. This is also true for developed nations, where regional differences still prevail.

In fact, public-private dialogue has become the norm in policy development in Canada, particularly when it comes to natural resources. For example, industry representatives as well as other stakeholder groups were all active participants in the development of the National Forest Service.

### ***Infrastructure Development***

The development of infrastructure, such as roads, railways, port facilities, and electric power stations by government has encouraged private sector involvement in the forestry industry the world over. These kinds of public sector investments provide assurance to potential planters that the government is serious in its support of a viable forestry industry.

Although perhaps not as relevant in Canada as it is in less developed countries, such infrastructure can also provide market access to remote rural areas and native lands, while also providing large processors with infrastructure necessary to establish larger scale operations and processing plants.

### ***Land-use Policies***

Land-use policies can have both direct and indirect influence on plantation development. This can take the form of zoning, but is more evident in the form of conflicting land-use incentives. Policies providing incentives for agricultural land-use, for example, are generally disincentives for the establishment of forest plantations. The competing effects of the European Community agricultural support program in this area are well documented.

Similarly, environmental land-use policies designed for biological and ecological protection, or water and soil conservation can strongly affect the afforestation of both marginal and non-marginal agricultural land. Along with extension services (which provide information on windbreaks and other erosion control methods), environmental land-use policies provide the strongest government incentives for non-plantation afforestation efforts. These environmental policies are either implemented through an enabling process that encourages a bottom-up voluntary (and audited) compliance, through such mechanisms as the development of industry codes of best practice, or policies are imposed through top-down, general regulations involving inflexibility, stakeholder resistance, and high cost (Perley, 2001).

An example of this is the East Coast Forestry Project, which was initiated by the government of New Zealand in 1992, with the objective of planting 7,000 hectares of commercially productive forest each year for 28 years on this eroding and erodible land (MAF Information Paper, 2002). The objective was subsequently refined to achieving by 2020 sustainable land management on the worst 60,000 hectares of severely eroding land (defined by mapped land use capability units) in the East Coast region by afforestation, reversion to indigenous woody vegetation, gully planting or approved alternative treatments.

### ***National Environment Funds (NEFs)***

As an extension to environmental land-use policies, NEFs represent another important institutional mechanism for funding afforestation efforts, and have been particularly important in developing economies. NEFs are usually legally constituted as a non-profit foundation (in civil law countries) or a trust fund (in common law countries) able to operate independently of the government, but governed by a Board of Directors from the public as well as private sector (Richards, 1999).

A good example of such a fund can be found in Costa Rica, where the National Forest Finance Fund (FONAFIFO) was set up, in part, to access non-government finance for the promotion of forestry activities in privately owned forests. Low interest financing for farmers is also provided by FONAFIFO, with resources drawn from timber taxes and national budget allocations. In addition, FONAFIFO also negotiates carbon sequestration credits with farmers and prepares offset packages for the international market. Essentially, FONAFIFO is a parastatal able to handle monetary flows independent of the state budget (Richards, 1999). FONAFIFO is also expected to finance itself so there is a big incentive to develop new sources of financing.

### **Land Tenure**

Related to Land-use policies, but more a problem in developing countries, the provision of land tenure is an important prerequisite to plantation development. Without secure rights, forest users have few incentives, and often lack legal status, to invest in managing and protecting their forest resources. In fact, as with tax regimes, a political environment that does not ensure the provision of land tenure security through land delineation presents an investment risk to investors, and thus a disincentive for small landholder afforestation efforts. While secure property rights cannot ensure sustained protection and investments in an asset, they are often a necessary condition.

The length and security of tenure of resource rights are considered to be important in this regard. Tenures longer than one rotation encourage operators to invest in future forest yields. The shorter the expected tenure, the more interested the operator will be in maximizing current revenue by extracting as much as possible today.

### **Forestry Concessions**

With forestry concessions, production forests are granted to private companies, individuals or communities under logging concessions or lease agreements issued for specified periods. In other cases the state may issue volume permits which give private entities access to a specific amount of standing timber, or sign contractual arrangements whereby private entities are hired to undertake specific tasks, e.g. harvesting or replanting. In the case of contractual arrangements, the government normally retains resource ownership and pays the contractor a fixed fee.

For example, programs for long-term forest management by local groups have been promoted in Peten, Guatemala, where communities get rights to the forest and assume responsibility for implementing a management plan, including reforestation.

#### ▪ *Industrial forestry concessions*

In Indonesia, production forests are granted to private or state companies under logging concessions issued for specified periods. Logging concessions are managed on a selective system, the so-called TPTI (Indonesian Selective Cutting and Planting System) with a cutting cycle of 35-years and including a provision for tree planting. Indonesia has a network of around 250 protected areas, covering an area in excess of 20 million hectares. The provision of Indonesia's concessions, however, is cited as the major cause for deforestation since concessionaires only focused on forest exploitation and ignore their obligation to conserve the forest.

In Peru the forestry sector is undergoing a paradigm shift. In April 2001 Peru approved the Forestry and Wildlife Law that established 24.5 million hectares of permanent production forests (about 34 percent of all forestlands in Peru). Forest administration and management is shifting from short-term contracts of limited area to long term and large scale forestry concessions in areas identified for permanent production forests. These concessions are for 40 years and are awarded through a public bidding process. Concessions range from 20,000 to 50,000 hectares, with a maximum annual operating unit of 5,000 hectares.

▪ *Service concessions*

An innovative approach to concessions can be found in Costa Rica, where service concessions have been granted in protected areas. In the Volcán Poás National Park, for example, a Concession Fund was set up on the basis of auctioning service concession contracts. Contracts are awarded to private sector contractors following auctions, and are used to operate cafeterias, souvenir shops, and, in the case of Volcán Poás National Park, an insect museum.

***Industrial Development***

Although a controversial term due to its alleged association with the deforestation of old-growth forests and destruction of wildlife habitat, industrial development is nonetheless important for the development of domestic markets for small woodlot owners. Proactive forest industry policies can promote the use of domestic wood in commercial, industrial and other construction work, as well as find export markets for these products, thus providing incentives for the involvement of private landholders in afforestation.

In fact, small scale commercial, public and industrial development are compatible with the objectives of sustainability and environmental protection if properly controlled, particularly in the context of developing markets for previously unforested land. Sustainable building and forestry activities can be achieved with a modest input of capital and technology, along with environmental initiatives such as certification and eco-labelling.

For many countries, the role in international forest product trade has traditionally been that of an importer of softwood and hardwood timber, and pulp and paper products. Through industrial development efforts, a maturing plantation softwood resource has the potential to alter this role through import substitution or sectoral segregation<sup>7</sup> and export a greater range of products.

Similarly, industrial development can also contribute to the goals of regional development, employment and other social equity goals

***Pros and Cons of Direct Government Assistance / Programs***

Although it is difficult to make generalizations about such a broad category of incentive mechanisms, some general observations can be made about government involvement in setting incentives for afforestation.

*Pros*

In general, it can be said that the direct government provision of incentives: helps landowners to get beyond the hurdle of initial high capital costs (fences, seedlings, etc.), allows for targeted funding by the government, and facilitates the transfer of knowledge.

*Cons*

On the negative side, the direct government provision of incentives can result in:

- plantings on unsuitable land (e.g. Ireland),
- involvement in program for “wrong” reasons,
- an excess supply of timber if an analysis is not made of the market,
- an approach that may not overcome “cultural biases”,
- jeopardizing trade agreements (subsidization),

---

<sup>7</sup> Import substitution is any trade policy designed to promote the domestic consumption of goods over imports, usually through a “buy local” program. The purpose of sectoral segregation, on the other hand, is to develop and promote a domestic industry that is capable of producing goods that can be substituted for imports.

- difficulties in managing on a large scale, and
- can create a “dependency cycle”.

### **3. Preferential Tax Treatment**

Taxation incentives include the application of lower marginal rates of taxation, favourable capital gains treatments, property tax exemptions, tax holidays and income tax deductibility of costs. Although not direct business finance options, tax credits and exemptions can be vitally important to business investment decisions, although some argue that tax incentives are inefficient, as beneficiaries are often more interested in receiving shorter-term tax relief than in implementing longer-term land-use changes.

Tax incentives are conceptually different from loans, grants and subsidies in that they affect the income side of the government's balance sheet as opposed to the expenditure side.

A number of taxation schemes have been applied, with mixed results. In Costa Rica, for example, some 50,000 ha were planted under a tax exemption scheme, and another tax based initiative allowed for up to 16% of tax liabilities to be invested in reforestation. Tax incentives, however, were not distributed equitably, with large-scale operations usually benefiting more than small ones.

In several countries, forestry related activities are completely exempt from taxes that other economic activities are subjected to. Revenues from timber sales, for example, are tax-exempt in several EU-member states (Ottitsch, 2002).

Property tax exemptions may also be provided, particularly during the more cost intensive establishment period. In some areas, land taxes on forests may be lower than on other developed land, including agricultural land, providing strong incentives to convert land. For example, in 1997 Ontario changed its property tax system to enable 100,000 woodlot owners with over 4 ha to apply for a 75% reduction in their tax rate if they submitted and implemented a Forestry Management Plan (FMP). Due to the relatively long rotation of forest land, however, the risk of changes to a given tax regime may act as a disincentive.

As Ottitsch (2002) points out, in some countries real-estate taxes are often based on some sort of “income-equivalent” rather than the actual market price of the property. In essence this is effectively a preferred treatment of investments in “land”, in comparison to other forms of capital investment. Under the right circumstances, this kind of property designation could work as an incentive to convert land.

Federal inheritance taxes can also be lowered for specific cases of private landowners. Historically in many countries, including Canada, some woodlot owners find that the only way to pay the taxes arising from the transfer of a family owned woodlot from one generation to the next is to sell the land or harvest the trees. As forests are broken up into successively smaller parcels, their potential to offer a viable forestry operation declines and it is more likely they will be converted to alternative uses.

In Norway, the state mandated Forest Trust Fund requires forest owners to contribute between 5% and 25% of their timber receipts into a trust fund. Similar to an RRSP, these earnings are exempt from taxation, but may be used later to pay for longer-term investments, such as silvicultural activities or road construction, which can also be deducted from annual income taxes. Interest earned from the Fund is used by the government for Forestry activities.

Norway also allows forest owners to average their income over five years for tax purposes.



In the U.S., forestry owners can claim forestry receipts as capital gains for income tax purposes. Tax regulations also encourage long-term stewardship in order to offset an incentive in the original tax to engage in shorter rotation schedules (Lindstad, 2002).

Concessions on value-added taxes (VAT) or other indirect taxes for certain supplies for forest enterprises could also act as incentives during initial planting stages. An example of this might be a reduction on taxes for seedlings, fuel (e.g. Australia), or extension services.

Incremental tax financing is a mechanism that is sometimes used to pay back public financial support to establish a private industrial facility through a special fund. This mechanism can also be used in leveraging private-sector investment in forest product industries.

Other tax incentives include those proposed by Greene (1997) for the United States:

Income-averaging over three years.

A 17% flat tax on wages (above a certain level), modelled after the Arney-Shelby proposal.

Excluding 35% of long-term capital gains from taxable income.

Excluding 5% of capital gains for each year of ownership, up to a 50% maximum.

Amortizing up to \$20,000 of reforestation expenses over five years.

Deducting reforestation expenses in the year they occur.

Subtracting an allowance for reforestation expenses from harvest returns.

Green Saving Account, in which forest owners can accumulate pre-tax dollars to pay upcoming management expenses.

Green IRA (Investment/Reinvestment Account), in which owners can accumulate pre-tax dollars to pay future forest management expenses and to provide retirement income.

### ***Pros and Cons of Preferential Tax Treatment***

Many of the pros and cons with Direct Government Assistance / Programs also apply to the provision of government tax incentives to promote afforestation.

#### *Pros*

In general, it can be said that the provision of tax incentives:  
helps landowners to get beyond hurdle of initial high capital costs (fences, seedlings, etc.),  
allows for targeted funding by the government (e.g. certain income groups or certain equipment)  
can be easier to administer than many payment schemes

#### *Cons*

On the negative side, the direct government provision of incentives can result in:

- plantings on unsuitable land (e.g. Ireland),
- involvement in program for “wrong” reasons (e.g. for tax shelter purposes),
- may result in an excess supply of timber,
- may not overcome “cultural biases”,
- may jeopardize trade agreements (subsidization),
- may create a dependency cycle, and
- may decrease tax receipts that could have been reinvested in supporting the industry.

## **Industry Partnerships and Third-Party Leasing Arrangements**

In many countries in recent years, the forest sector has undergone a fundamental transformation, largely as a result of restructuring, downsizing, changes in ownership and increased recognition of the multiple benefits that forests provide. One of the most significant trends is increased

management by groups of people and by individuals. In addition to the 22% of the world's forests that are now privately owned, community ownership accounts for about 11%, a figure expected to reach 40% by 2050 (FAO, 2001).

Many of these changes spring from, in part, increasingly restricted access to public forest land for productive uses (e.g. the United States). Increasing global demand for wood fibre makes it seem likely that these trends will continue and that the private holdings of private enterprise may be inadequate to cover demand totally.

As a result, the forest industry in many countries is currently turning to outgrower schemes, where smallholders produce wood and fibre for private enterprise on a systematic basis. A recent global review of private-sector involvement in forestry (Landell-Mills and Ford, 1999) revealed at least one example of a company-community initiative over the past decade in 57% of the 76 countries covered. Such agreements with farmers and other small landowners will, in all likelihood, become more frequent, providing an increasing share of raw material for industry.

There are several such partnerships in Canada, notably ALPAC in Alberta, MacMillan Bloedel in British Columbia, Domtar in Ontario, and ACI in Québec. In most of these programs, the forestry companies also provide extension services to landowners for forestry development. Another good example of a private-private partnership is in Piqro, Mexico, where a Mexican hardwood flooring company entered into a partnership with a New Jersey flooring distribution company, which is helping to modernize its plants and export products to developed nations.

The obvious advantage of such schemes from the government's perspective is that they have little or no involvement in the process in terms of financial outlay. Of course, government can help by creating an enabling legislative environment for such activities, or they could act as an intermediary in the distribution of information.

One example of a joint venture with a larger amount of government involvement is a venture in China involving Plantation Forest Timber Products Ltd., Robabank, the International Finance Corporation, local forestry industry bureaus and farmers. The joint venture, operating in three provinces, is valued at US\$124 million. The forestry industry bureaus act as paid mediators so the company does not have to deal with the hundreds of thousands of farmers who contribute timber (the company claims to pay 600,000 farmers in Sichuan alone.) Local governments are paid forestry charges (J. Mayers, *Unasylya* - No. 200, Vol. 51- 2000/1).

### ***Biomass Power***

Afforestation for the purposes of producing biomass fuel is a type of industry partnership that has been gaining momentum following years of research on short-rotation woody crops in New York. This arrangement was partially motivated by the growing concern about environmental issues, and prompted the formation of the Salix Consortium in 1994. Over 20 organizations have collaborated to facilitate the development of willow biomass crops. This crop will provide a renewable feedstock for bioenergy and bioproducts that produces multiple rural development and environmental benefits.

Midway through the Biomass Power for Rural Development project over 242 ha (600 acres) of willow biomass crops have been planted in New York State. The goals of the Biomass Power for Rural Development initiative include increased production of renewable energy using biomass resources to generate power; creation of new jobs and markets, especially in rural areas; and a net reduction in greenhouse gas emissions.

Regional trials have been established in nine states and Canada. The near term use for willow biomass crops is co-firing with coal. The Greenidge power plant has demonstrated continuous co-firing for several years. A successful test firing of willow biomass has been performed, and co-firing retrofits at the Dunkirk power plant have been completed. Research is underway on the

fabrication of materials and chemicals from willow biomass that are currently derived from non-renewable fossil fuels.

### ***Domestic Tradable Development Rights***

Tradable development rights (TDRs) are rights to development in areas designated for conservation that can be sold to public or private sector conservation interests, or that can be exchanged for development rights on land outside of the designated restricted use areas. Only the development rights that are sold or exchanged, not the land itself. In this way, landowners or communities may enter into in order to protect or recreate natural features of their land or continue with 'friendly' activities such as eco-tourism. In theory, the value of the TDRs reflects the market equilibrium of a buyer's willingness to pay for the good, and the seller's estimate of forgone development benefits.

TDRs have been used in the United States, where zoning regulations have divided land use between conservation areas and areas that are available to be developed. In Virginia, for example, development rights in a mountain conservation area were to be purchased by local government using a range of finance options including a property transfer tax, a cellular phone tax, meals and lodging taxes, grants and private contributions (Preston, 1997).

### ***Conservation Easements***

A conservation easement is a special type of TDR in which a landowner and conservation organization enter into a voluntary legal agreement in which the former is compensated for restricted use of the land in order to protect a specific habitat (Kwasniak, 1997). Basically, a conservation easement is a voluntary legal agreement between a landowner and a "qualifying organization" to protect the natural values of land, for a specified time or forever (i.e. in "perpetuity").

The restrictions on development will only apply to the conservation easement area, so a landowner is free to use the rest of their land as they like. Even in the conservation easement area, the agreement may allow uses, provided that they do not conflict with the purposes for protecting the land. For example, a conservation easement might allow the construction of a modest trail through the conservation easement area to allow foot access, or it might allow habitat enhancement and restoration. While a system of conservation easements has been suggested for the Amazon, the only documented examples are from North America (Preston, 1997).

One drawback of conservation easements is that a considerable degree of risk is assumed by the landowner (Mitchell and Edwards, 2000). The use of the land would be greatly restricted, since the landowner would be bound to the land management practices stipulated in the original agreement. And since the agreement remains with the land, future landowners would be restricted as well. This could potentially result in lower land values, thereby discouraging landowners from entering the market.

### ***Pros and Cons of Industry Partnerships and Third-Party Leasing***

Industry Partnerships and Third Party Leasing arrangements are increasingly used to promote afforestation. In general, this approach seems to have more pros and fewer cons than government sponsored programs, both from the government's perspective and that of private interests.

#### ***Pros***

In general, it can be said that Industry Partnerships and Third Party Leasing arrangements: result in little or no government involvement, therefore low financial cost to the government,

ensure that a market exists (as opposed to non-market schemes that may ignore market conditions), usually include extension services provided by company or conservation agency, involve a low initial investment by landowner, and help companies to increase wood supply.

### *Cons*

On the negative side, these kinds of arrangements mean that the landowner: effectively relinquishes control of land, thereby forgoing alternative land uses, and is effectively dependent on the continued existence of an individual company or organization, and is therefore taking on some of their risk.

## **Market-based Carbon Trading**

Forestry-based carbon offset trading, or carbon trading, has gained a lot of attention in recent years, particularly in the context of international discussions on climate mitigation measures. Joint Implementation, involving carbon trading between two countries with the intention of achieving cost-effective reductions in greenhouse gases, was first encouraged by the 1992 UN Framework Convention on Climate Change (FCCC).

Basically, a company (or country) unable to meet anti-pollution targets may either buy carbon credits from an under-polluting company or operation, invest in making its operations less polluting, or plant forests to soak up carbon. With carbon trading, a CO<sub>2</sub> emitting company can pay forest owners or users in the same or other countries to set aside forest for the purpose of atmospheric carbon mitigation (i.e. carbon sequestration through growing trees). Essentially, carbon trading allows companies and countries to share the financial burden of environmental protection through the transfer of funds (Stuart and Moura Costa, 1998).

The Costa Rican experience provides an institutional model for carbon trading. The National Forestry Finance Fund (FONAFIFO), which comes under the Ministry of Environment, receives and assesses project applications claiming carbon payments (in exchange for the transfer of carbon trading rights to the government), conducts field verification, makes the payments and monitors field implementation. These projects include pasture reforestation, buffer zone farming, NFM in primary and secondary forests, and measures to reduce illegal felling.

The Costa Rican program is, in part, funded by selling Certified Tradable Carbon Offsets (CTOs) to international investors and donors through a Joint Implementation Office. Among the buyers, the government of Norway and a Norwegian consortium of private firms agreed to purchase CTOs for 249,242 tons of carbon over a 25-year period for US\$3.4 million, as part of a larger project.

Another good example is found in the UK, where Climate Care Warranties allow consumers to purchase carbon offsets with particular consumer goods, such as cars or airline tickets. The warranties are then guaranteed by Climate Care, which purchases offsets generated by carbon sequestration and renewable energy projects.

There are also private arrangements among companies. Toyota Motor Corporation, Mitsui Co. Ltd., and Nippon Paper Industries Co. Ltd., for example, established a new company, Australian Afforestation Pty. Ltd., to plant and manage some 5,000 ha of eucalyptus forests. Most of the investment funds are provided by Toyota, which keeps the carbon credits and sells the wood to Nippon paper.

For the most part, carbon trading has been experimental due to uncertainties and unresolved issues regarding the rules that govern them. These rules are expected to be finalized for the first commitment period (2008-2012) at the Conference of the Parties in November 2003.

### ***Emission Reduction Credits (ERCs)***

With ERCs, landowners could commit to designating their land as a permanent carbon sink, maintained by the perpetual use of carbon sequestering land management practices (Mitchell and Edwards, 2000). Landowners entering into such an agreement would be legally bound to maintain the sink, thus ensuring that the credits generated by it would be permanent, and therefore secure. Because the soil carbon levels will approach a new equilibrium over about 15 to 30 years, the land would remain locked into a conservation easement long after it has ceased to generate significant numbers of Emission Reduction Credits (ERCs).

Any subsequent transfer of land ownership would not threaten the security of any credits already generated, as conservation easements are tied to the land. In this case, the easement would simply shift to the new owner. As Mitchell and Edwards (2000) point out, the landowner could be paid to keep the carbon sequestered: as with any non-renewable natural resource, the price would naturally increase as the supply decreases, thereby justifying further compensation of the landowner.

### ***Pros and Cons of Market-based Carbon Trading***

The pros and cons of Market-based Carbon Trading are difficult to qualify at this point, largely due to the fact that the rules of such a system in Canada are yet to be determined. However, a few general observations can be made, based on similar systems and plans for systems around the globe.

#### *Pros*

In general, it can be said that Market-based Carbon Trading:  
can provide an opportunity for landowners to generate income while the trees are growing,  
likely involves low initial investment by landowner,  
may involve permits that adjust automatically for inflation and external price shocks,  
provides a cost-effective way for companies to reduce emissions, and  
provides an opportunity to landowners to pool land.

#### *Cons*

On the negative side, Market-based Carbon Trading:  
currently involves a lot of risk, due to unresolved issues regarding rules that govern them,  
is depending on location, such that the marketing of timber products from the planted forest may  
prove difficult,  
means that landowners likely have to either re-purchase carbon credits at the time of harvest, or  
replant the planted forest,  
may not cover up front costs immediately, due to the lag involved in verification,  
means that the decision on whether or not to harvest will depend on the relative value of timber  
and carbon at the time, and  
provides no guarantee of a market for trees harvested

## **4. Non-traditional Incentive Mechanisms**

### ***National Compulsory Tree Planting Campaign***

Compulsory national tree planting campaigns have a huge potential to increase afforestation, particularly in countries with large populations. For example, in December 1981, the Chinese Congress adopted a resolution on the National Compulsory Tree Planting Campaign under which each and every Chinese citizen (excluding the young and the elderly) has an obligation to plant three to five trees per year.

In rural China, compulsory tree planting has been carried out alongside rural reform. In some localities, farmers are organized to plant trees on barren mountains and along riverbanks under State ownership or collective tenure. In most cases, funds are raised from diverse channels and farmers contribute their labour in soil preparation and planting. The planted area is then divided into sections and contracted to farmers for long-term management and protection, in a bid to establish sustainable green areas such as shelterbelt forests.

Partly as a result of this campaign, new plantations established between 1980 and 1987 totalled some 28,920,000 ha, for an annual planting rate of over 4 million hectares per annum (FAO, 1997).

### ***Tree Ownership***

Another innovative approach to providing incentives for afforestation exists in Gambia, where the 1998 Forest Law seeks to encourage tree planting by stating specifically that anyone who, possessing a lawful right to do so, plants a tree, is thereafter the owner of that tree. Since 1998, both community forests and community participation in forest management are covered by forest law. Agroforestry, Trees outside forests, non-forest trees (i.e. non-forest trees are trees planted outside the forest by a person or a community within existing vegetation which does not constitute a forest [Forest Bill, 1998, Gambia]) and urban forestry are all specifically mentioned in the law. This law provides legal encouragement for tree-planting on farmland and pasture, and along roadsides.

This is an innovative law with respect to tree access rights. People are allowed the usage of both forest and non-forest trees growing outside the forest, but the harvesting and felling of forest trees is regulated by Article 6 of the Forest Bill. Non-forest trees belong to the person or community planting or inheriting them, but the transport of logs from these trees requires a special permit.

### ***Specific Charges to Fund Afforestation***

Increasingly, specific charges are being levied on activities that potentially damage or cut down trees and then put back into a fund used for afforestation or to promote good forest stewardship. While these do not directly provide incentives to plant trees, many of these schemes provide disincentives to cutting down trees. Moreover, many such charges are generally more politically acceptable than other kinds of income generation such as tax increases, as payees often don't mind paying fees that are assured to be put back into afforestation efforts.

One example of such charges is biodiversity patents, or bio-prospecting fees, which involve creating a legal basis for licensing biodiversity use and extracting a payment equal to its economic value. Costa Rica has taken advantage of this innovative plan for generating capital by entering into a contract with the pharmaceutical company Merck. Money charged through this funding mechanism can then be put into a fund for afforestation purposes .

Other charges that can be levied for the purposes of creating afforestation funds include:

- **Watershed charges:** Charges imposed by the government on downstream water users for the protection and reforestation of hillside forests which ensure the regular flow of clean fresh water into cities. Such a scheme has long been used in Japan for upland conservation.
- **Deforestation Charges:** Charges levied against firms whose activities cause deforestation are increasingly used as a way to simultaneously protect trees and raise revenue that can be put back into afforestation.
- **Ecotourism Charges:** Charges imposed on park entrance fees, hotel taxes, and other park services. Funds collected from eco-tourists can then be used for afforestation efforts, including the expansion of park boundaries.

## **5. Conclusions**

Certainly the key to developing efficient afforestation incentives that will result in the planting of sustainable plantations involves finding and promoting other non-artificial incentives (i.e. not program-based incentives) that will motivate private landholders to plant trees on their own, or utilizing private sector partnerships. Examples of these would include the establishment of shelterbelts, which are cost effective for farmers due to their benefits for erosion control, or woodlots, which enable landowners to supplement their income off of planted land. The end results of these programs form strong incentives in and of themselves.

The historical record is full of examples where afforestation rates are highly correlated with direct subsidization, which all but disappear after subsidies are withdrawn. These types of incentives are not only inefficient due to the market distortions they create, but they are often not sustainable.

Phase 2 of this project will involve a more in-depth analysis of the incentive programs contained in the case studies, along with an analysis of their applicability to the Canadian context.

## I. Bibliography

AFFA, 2002, *Impact of incentives on the development of forest plantation resources in the Asia-Pacific region*, Commonwealth of Australia.

*Afforestation, Forestry Research, Planning and Development in the Three North Region of China: Technical Project Review Document*, 1991-2002, China,  
<http://www.fao.org/DOCREP/005/AC613E/AC613E00.HTM>

Agriculture & Agri-Food Canada Prairie Farm Rehabilitation Administration, 1997, *Auditor general of Canada report on the PFRA*,  
<http://www.oag-bvg.gc.ca/domino/reports.nsf/html/ch9724e.html>

Agriculture & Agri-Food Canada Prairie Farm Rehabilitation Administration Shelterbelt Centre Website, Canada,  
<http://www.agr.gc.ca/pfra/shelterbelt.htm>

Ahmed, M. F., 1997, *Asia-Pacific forestry sector outlook studies*, India, Document APFSOS/WP/26, FAO.

Ajavon, A.N., Pilifosova, O., Adler, S., Raquet, M., & Simeonova, K., July 2000, *Report on the in-depth review of the first and second national communications of Belgium*.

Alberta-Pacific Forest Industries Inc., 1997, *Detailed forest management plan* (April 30, 1997 draft). Alberta-Pacific Forest Industries Inc., Edmonton.

Alberta-Pacific Forest Industries Inc., 2001, *Greenhouse gas emissions: VCR report*, Prepared for Participation in the Canadian Voluntary Challenge Registry, September 2002, Prepared By: BW McCloy & Associates,  
<http://www.vcr-mvr.ca/registry%5Cout%5CC3207-APFI-02-PDF.PDF>

Altieri, M., 1999, *Ecological impacts of Chile's neoliberal policies, with special emphasis on agroecosystems*, In Environment, Development and Sustainability. Vol: 1, Issue: 1, pp. 55-72.

Amadou, T., Collas, P., Ellis, J., Matsarski, V., August 2000, *Report on the in-depth review of the second national communication of France to the FCCC*.

Ammer, U., Feb 2000, *Comments on primary afforestation in Bavaria*, p 119-126 of *New Forests for Europe: Afforestation at the Turn of the Century*.

Arnold, M. and Dewees, P. (eds.), 1997, *Farms, Trees and Farmers: Responses to Agricultural Intensification*, London: Earthscan.

Asia-Pacific forestry Commission, 2002, *Impact of incentives on the development of forest plantation resources in the Asia-Pacific region: Australian case study*, Report to the 19<sup>th</sup> Session, Asia-Pacific forestry Commission, Australia.

Austrian Embassy in Australia  
<http://www.austriaemb.org.au/>

Bass, S., R. Nussbaum, H. Speechly & E. Morrison, 1996, *Paper farming: the role of plantations in the sustainable paper cycle*, Towards a Sustainable Paper Cycle: Sub-study series 5, Appendix 2. IIED.



- BC Ministry of Forests, 1991, *Ecosystems of British Columbia*.
- Bélanger, L., M. Grenier and S. Deslandes, 1999. Report on habitat and land use in southern Québec. Environment Canada, Canadian Wildlife Service, Québec Region, Internet page, <http://www.qc.ec.gc.ca/faune/bilan/bilanhabitat.html>
- Binkley, C., Brand, D., Harkin, Z., Bull, G., Ravindranath, N., Obersteiner, M., Nilsson, S., Yamagata, Y., and Krott, M., 2002, *Carbon sink by the forest sector—options and needs for implementation*, Forest Policy and Economics 4 (2002) 65–77
- Birdsey R.A., 1992, *Carbon storage and accumulation in United States forest ecosystems*, August Washington DC: U.S. Department of Agriculture, Forest Service. Gen. Tech. Rep. WO-59
- Bishop, J., 1998, *The economics of non-timber forest benefits: An overview*.
- Blanchez, J-L. & Dube, Y.C., 1997, *Funding forestry in Africa*, Unasyva, 48(1) Issue No. 188.
- British Forestry Commission, 2003 , *British Forestry Statistics 2002*, Economics & Statistics Unit, Forestry Commission, Edinburgh, UK
- Buck, L.E. 1995, *Agroforestry policy issues and research directions in the US and less developed countries: Insights and challenges from recent experience*. Agrofor. Syst. 30:57-73.
- Buckley, P., Johnston, P., Bulfin, M., 1997, *Survey of the market potential for small-scale applications of short rotation forestry for energy in Ireland*, 1997, Project Number - 96089, National Council for Forest Research and Development (COFORD), Ireland Christensen, E. J., 1996, *Prepared for the approaches to extension in forestry - experiences and future developments symposium*, Forestry Extension Denmark, Freising, Germany.
- Bulfin, M., 1993, *Private forestry in Ireland: progress and problems*, In Afforestation of agricultural land, CEC report, Brussels
- Butterfield, R. P., 1994, *Forestry in Costa Rica: status, research priorities, and the role of la selva biological station*, La Selva; ecology and natural history of a neotropical rain forest.
- Castilleja, G., 1993, *Changing trends in forest policy in Latin America: Chile, Nicaragua and Mexico*, Unasyva 43(4) (Issue 175).
- CCS, 1997, *Responding to global climate change in the British Columbia and Yukon region executive summary*, The Canada Country Study on Global Climate Change, Climate Impacts and Adaptation
- Cherry, 2001, *Options for allocating stock in Ontario with anticipated climate change*, Ontario Forest Research Institute, Forest Research Information Paper, No. 148
- Chipeta, M. E., 1997, *Funding forestry development in Asia and the Pacific, Africa and Latin America and the Caribbean*, Unasyva, 48(1) Issue No. 188.
- Chomitz, K., Brenes, E., & Constantino, L., 1998, *Financing environmental services: the Costa Rican experience*. Economic Notes, Central American Country Management Unit, Latin America and Caribbean Region, The World Bank, No.10.
- Clapp, R.A., 1998, *Regions of refuge and the agrarian question: peasant agriculture and plantations in Chilean araucania*, In World Development, Vol 26, No 4, pp.571-589.

- Clinch, J.P., & Convery, F.J., 2000, *Valuing the benefits of greenhouse gas reductions*, Department of Environmental Studies, UCD, Dublin
- Consultative Group on Indonesia Forestry, 1998, *Objectives and process of implementation*, Bureau of International Cooperation and Investment, Ministry of Forestry, Jakarta.
- Coons, C.F. 1981. Reforestation on Private Lands in Ontario. Ministry of Natural Resources. February 1981. 31pp.
- Coons, C.F. 1988. Introduction to Agroforestry in Ontario. Ministry of Agriculture and Food. Kemptville. May 1988. 68pp.
- Crossley, R.A., Lent, T., Propper de Callejon, D & Sethare, C., 1997, *Funding sustainable forestry - Innovative financing for sustainable forestry*, Unasyuva, 48(1) Issue No. 188
- Danish Forest and Nature Agency, 2002, *The Danish national forest programme in an international perspective*, Ministry Of The Environment.
- D'Silva, E., S. Appanah, and D. Kariyawasam, 1994. Sustainable forestry management in developing countries: experiences from Asia. *Natural Resources Forum* 18 (4): 251-262.
- de Camino, R. & Alfaro, M., 1998, *Teak*, *Tectona grandis* in Central America.
- de Camino, R., Segura, O., Arias, L.G., Pérez, I., 2000, *Evaluation country case study series: Costa Rica forest strategy and the evolution of land use*, The World Bank.
- DeMarsh, P., 1999, *Potential for afforestation on private woodlots in Canada*, Joint Forest Sector Table / Sinks Table, National Climate Change Process.
- Detlefsen, G., Castañeda, L.A., Oliva, E. (eds), 1991, *Plan de acción forestal para Guatemala* (PAFG), Oficina del Plan de Acción Forestal para Guatemala, Guatemala.
- Deweese, P., FAO, 1995, *Social and economic incentives for smallholder tree growing: A case study from murang'a district, Kenya*,  
<http://www.fao.org/docrep/U8995E/U8995E00.htm>
- Dyck, B., 2003, *Benefits of planted forests: Social, ecological and economic*, For delivery at: UNFF Intersessional Experts Meeting on the Role of Planted Forests in Sustainable Forest Management, New Zealand
- EEA & UNEP, 2000, *Down to earth: soil degradation and sustainable development in Europe. a challenge for the 21st century*. Environmental Issues Series No 16. Copenhagen, European Environment Agency,  
[http://reports.eea.eu.int/Environmental\\_issue\\_series\\_16/en/envissue16.pdf](http://reports.eea.eu.int/Environmental_issue_series_16/en/envissue16.pdf)
- EEA, 1999, *Environment in the European union at the turn of the century*, European Environment Agency, Copenhagen.
- EEC, 1997, Report to Parliament and the Council on the application of Regulation (EEC) No 2080/92 instituting a Community aid scheme for forestry measures in agriculture [COM(1997) 630, 28.11.1997]
- EFFE, 2002, Quality of life and management of living resources: evaluating financing of forestry in Europe,  
[www.efi.fi/projects/effe/Reports/ EFFE\\_technical\\_annex.pdf](http://www.efi.fi/projects/effe/Reports/ EFFE_technical_annex.pdf)

Eckerberg, K., 1994, *A consensus, conflict or compromise? the Swedish case*, pp. 76-97 in Eckerberg.

Elliot, C., 1999, *Forest certification in Sweden, from: forest certification: analysis from a policy network perspective*. Department of Rural Engineering, Swiss Federal Institute of Technology, Lausanne, Doctoral Thesis.

Enters, T., Durst, P.B., & Brown, C., 2003, *What does it take? The role of incentives in forest plantation development in the Asia-Pacific region*, UNFF Intersessional Experts Meeting on the Role of Planted Forests in Sustainable Forest Management, New Zealand.

Environment Canada, 2003, *Report on Habitats and Land Use in the St Lawrence Valley*, <http://www.qc.ec.gc.ca/faune/bilan/html/untitled6.html>

European Commission, Candidate technical measure: afforestation (and reforestation), <http://europa.eu.int/comm/environment>

FAO, 1981, *Forest resources of tropical Asia*, Tropical Forest Resources Assessment Project, In Technical Report 3, UN 32/6.1301-78-04, Rome.

FAO, 1993, *Forest resources assessment 1990- tropical countries*. FAO Forestry Paper No. 112. Rome.

FAO, 1998, *Forest plantation areas, 1995, November 1997*, Report to the FAO project GCP/INT/628/UK, (unpublished), Rome.

FAO, 1999, *State of the World's Forests*, FAO, Rome, Italy. 154 p.

FAO, 2001, *Global forest resources assessment 2000*, Main report, FAO Forestry Paper 140, Food and Agriculture Organization, Rome, Ital, 479 p., <http://www.fao.org/forestry/fo/fra/>

FAO, 2001, *Role of plantations as substitutes for natural forests in wood supply – lessons learned from the Asia Pacific Region*, Report based on the work of T. Waggener. Forest Plantation Thematic Papers, Working Paper 7. Forest Resources Development Service, Forest Resources Division. FAO, Rome (unpublished).

FAO, 2003, *State of the world's forests*, Food And Agriculture Organization Of The United Nations, Rome.

FAOSTAT (2001). *FAOSTAT Statistical Database*. Food and Agriculture Organization, <http://www.fao.org/>

Finnish Forest Research Institute (FFRI). 2003. *The Finnish Statistical Yearbook of Forestry 2002*. Helsinki, Finland

Forest Plantation Division of Malaysia, 2002, *FRIM and survey data*.

Forest Service British Columbia, 1995, *Interior watershed assessment procedure guidebook (IWAP) level 1 analysis*, Forest Practices Code of British Columbia.

Forest Trends, 2002, *Strategies to Enhance the Security of Forest Tenure*, Technical Forestry Brief sponsored by USDA and USAID, Washington

FRA, 2000, *Global Forest Resources Assessment*.

Frawley, J.P. & Leavy, A., 2001, *Farm forestry: land availability, take-up rates and economics*, Teagasc, Rural Economy Research Centre, Dublin.

FRIM, *Area planted with different forest plantation species*, 2002, Plantation Division of FRIM, Database.

Gaddis, D. A., New, B. D., Cubbage, F. W., Abt, R. C., & Moulton, R. J., 1995, *Accomplishments and economic evaluations of the forestry incentives program: a review*. SCFER Working Paper(78):1-52. Southeastern Center for Forest Economics Research, Research Triangle Park, NC.

Gardiner, J.J., Nieuwenhuis, M. & Gallagher, G., 2001, *Carbon storage in Irish forests - current knowledge and research needs*, Department of Crop Science, Horticulture and Forestry, UCD, Dublin,  
[www.ucd.ie/~chf/maarten.html](http://www.ucd.ie/~chf/maarten.html)

*Ghana country profile*, 2002, submitted to the World Summit on Sustainable Development, Johannesburg.

Ghana Ministry Of Lands And Forestry,  
<http://www.ghana.gov.gh/governing/ministries/infrastructure/forestry.php>

Global Forest Resources Assessment, 2000, France,  
<http://www.fao.org/forestry/fo/fra/main/index.jsp>

Gómez, M., Shultz, S. & Ramírez, O., 1997, *Contribución de las plantaciones forestales a las cuentas nacionales*. Revista FORESTAL centroamericana, 18, (6), 1997

Government of Canada, 2003, Offset System Discussion Paper,  
[http://www.climatechange.gc.ca/english/publications/offset\\_dp/dp/dp\\_e.pdf](http://www.climatechange.gc.ca/english/publications/offset_dp/dp/dp_e.pdf)

Gregersen, H. & Contreras, A., 2001, *Investing in the Future: The Private Sector and Sustainable Forestry Management*, International workshop of experts on financing sustainable forest Management, Oslo, Norway, 22 – 25 January 2001,  
<http://www.cifor.cgiar.org/fsfm/Papers/03Gregersen.pdf>

Gregersen, H.M., 1984, *Incentives for forestation: A Comparative assessment*. in K.F. Wiersum, ed. *Strategies and Designs for Afforestation, Reforestation and Tree Planting*, Wageningen, the Netherlands, Wageningen Agricultural University.

Greene, J. L., 1997, *Federal income tax incentives for private forest owners in the United States*, An international journal of forestry and forest industries - Vol. 48 - 1997/2

Guy, R.D., Benowicz, A., 1998, *Can afforestation contribute to a reduction in Canada's net CO<sub>2</sub> emissions?*, Department of Forest Sciences, Faculty of Forestry, University of British Columbia.

Haener, M. K., & Adamowicz, W. L., 2000, *Regional forest resource accounting: a northern Alberta case study*, Canadian Journal for Forest Research 30, pp264-73.

Haltia, O. & Keipi, K., 1997, *Financing forest investments in Latin America: the issue of incentives*, European Investment Bank (EIB) and Inter-American Development Bank (IADB), Washington, DC.

Hansen, E.A., Netzer, D.A., & Tolsted, D.N., 1993, *Guidelines for establishing poplar plantations in the north-central U.S.* USDA Forest Service Research, North-Central Forest Experiment Station Forest Service. USDA. St. Paul, MN. Note NC-363.

Heindrichs, T., 1997, *Innovative financing instruments in the forestry and nature conservation sector of Costa Rica.* Sector Project Support for the Implementation of International Programs of Relevance to Tropical Forests (TWRP), GTZ. Eschborn, Germany.

Herbohn, K.F., Harrison, S.R., Herbohn, J.L., 2000, *Lessons from small-scale forestry initiatives in Australia: the effective integration of environmental and commercial values,* Forest Ecology and Management, Australia.

Hoff, H., Bouwer, L., Berz, G., Kron, W., Loster, T., 2003, *Risk Management in Water and Climate: the Role of Insurance and Other Financial Services,* Dialogue on Water and Climate

Huang, C., and Kronrad, D., 2000, *The cost of sequestering carbon on private forest lands,* *Forest Policy and Economics* 2 (2001) 133-142

Hunter, M. L., 1990, *Wildlife, Forests and Forestry,* Prentice Hall, Englewood Cliffs, NJ.

IDB, 1995, *Proceedings of workshop on the use of financial incentives for industrial forest plantations,* Interamerican Development Bank, Washington, DC.

IBRD/IDA, 2000, *IBRD/IDA Project information document: Costa Rica ecomarkets,* Ministry of Environment and Energy, Republic of Costa Rica.

INFOR, 1998, *Estadísticas forestal 1997, boletín estadístico no 61, Instituto Forestal, Subgerencia de Estudios y del Ambiente,* Santiago, Chile.

IISD, 1996, *Offsetting CO<sub>2</sub> emissions; tree planting on the prairies.* International Institute for Sustainable Development, Canada.

IISD, 1998, *A guide to Kyoto: Climate change and what it means to Canadians,* International Institute for Sustainable Development, Canada

IPCC, 2000, Land-use, land-use change and forestry: IPCC.

Jozic, J., & Monchuk, D., 2000, Uncertainty, early action, and soil sinks, *Economic Issues and Reports*

Kearney, B., 2001, *A review of relevant studies concernin farm forestry trends and farmers' attitudes to forestry,* COFORD, Dublin.

Keipi, K., 1997, *Financing forest plantation in Latin America: government incentives,* Unasylya, 48(1) Issue No.188,

Keipi, K., 2001. *Forest financing in Latin America and the caribbean: a view from the inter American development bank.* In: The private sector speaks: investing in sustainable forest management, eds. M.E. Chipeta and M. Joshi, 219-234, Bogor: Center for International Forestry Research.

Kengen, H., 1997, *Funding sustainable forestry – linking forest valuation and financing,* Unasylya, 48(1) Issue No. 188.

Klooster, D, 1999, Community-based Forestry in Mexico: Can it Reverse Processes of Degradation?, *Land Degradation and Development*, 10, 365-381.

Koppelman, R., Lai, C.K., Durst, P.B. & Naewboonnien, J. (eds.), 1996, *Asia-Pacific Agroforestry Profiles: Second Edition*, APAN Field Doc. No. 4/RAP Publication 1996/20. FAO and APAN.

Kotey, N.A., Francois, J.G.K., Owusu, R. Yeboah, K.S., Antwi, A. & Antwi, L., 1998, *Falling into place: ghana country study*, Policy that Works for Forests and People Series No.4. IIED, London.

Kowalski, J., (Ed.), 2000, *Climate Change Handbook For Agriculture 2000*, University of Saskatchewan

Krishnapillay, B. & Ong, T.H., 2003, *Private sector forest plantation development in peninsular Malaysia*, FAO,  
<http://www.fao.org/DOCREP/005/AC787E/AC787E00.HTM>

Kull, S., Kurz, W., & Banfield, E., 2003, *Carbon accounting at the operational scale*, In; Pilot Project Pilot Site And Model Forest Network Contact Group Progress Report, Canada.

Kunshan, S., Zhiyong, L., Fenming, L. & Rui, Z., 1997, *China's country report on forestry, Asia-Pacific forestry sector outlook study*, Asia-Pacific Forestry Commission.

Kwasniak, A., 1997, *Conservation Easement Guide for Alberta*, Environmental Law Centre: Edmonton, AB.

Landell-Mills, N., & Ford, J., 1999, *Privatizing sustainable forestry: A global review of trends and challenges*, IISD.

Lanly, J.P., 1982, *Tropical forest resources*, FAO Forestry Paper No. 30. Rome.

Lehane, M., Le Bolloch, O. & Crawley, P. (ed), 2002, *Environment in focus 2002: key environmental indicators for Ireland*, Environmental Protection Agency, Ireland,  
<http://www.epa.ie/pubs/docs/Environment%20in%20Focus2002.pdf>

LHA Management Consultants, 1998, *Restructuring options for the forest resources of the former homelands*, Draft and the Recommendations of the Steering Committee on the options for restructuring.

Lindenbach-Gibson, R., & Mitchell, D., 2000, *Agroforestry: carbon sequestration and farm diversification*, Economic Issues and Reports

Lindstad, B.H., 2002. *A comparative study of forestry in Finland, Norway, Sweden, and the United States, with special emphasis on policy measures for non-industrial private forests in Norway and the United States*. Gen. Tech. Rep. PNW-GTR-538. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Lopez, C., Rapsun, M., Alfsen, K., Mullins, F., Matsarski, V., August 1999, *Report on the in-depth review of the second national communication of Germany*.

Lopez J A. and Veliz R., 1999, *Breve descripción de los recursos boscosos de Guatemala*.

Luzuriaga, C., 1997, *Costa Rica - evaluation of the joint implementation programme*, Report for GTZ Sectoral Project Support to International Programs in Tropical Forestry. Germany.

Machlis, G.E., & D.L. Tichnell, 1985, *The state of the world's parks: An international assessment for resource management, policy and research..* Boulder, CO: Westview Press.

- MAG, 1998, *Política forestal de Guatemala*. Guatemala, Ministerio de Agricultura y Ganadería.
- MAGA, 1995, *Diagnóstico y propuesta de políticas forestales (Propuesta para el grupo de trabajo subsectorial forestal)*. Guatemala. Ministerio de Agricultura, Ganadería y Alimentación.
- Maguire, B., 2001, *A review of legislation that impacts on Irish forestry*, National Council for Forest Research and Development, COFORD.
- Manful, G., van Amstel, A., Keppler J., Stiansen, P., 1996, *Report on the in-depth review of the national communication of Austria to the FCCC*, Austria.
- Mayers, J., 2000, *Company-community forestry partnerships: a growing phenomenon, in Unasylva No. 200: Trees outside forests, An international journal of forestry and forest industries - Vol. 51- 2000/1*
- McCarthy, S., Matthews, A., & Riordan, B., 2003, *Economic determinants of private afforestation in the republic of Ireland*, Land Use Policy, Dublin, Ireland.
- McGaughey, S.E. and Gregersen, H.M., 1988, *Investing Policies and Financial Mechanisms for Sustainable Forest Management*, Washington, D.C: Inter-American Development Bank.
- Merlo, M. and Paveri, M., 1997, *Formation and Implementation of Forest Policies: A Focus on the Policy Tools Mix*, Prepared for the XI World Forestry Congress, Antalya, Turkey
- Mitchell, D., & Edwards, C.K., 2000, Market potential for emissions trading, Economic Issues and Reports, in Climate Change Handbook For Agriculture 2000, University of Saskatchewan
- MOA, 1973, *National progress report on forestry in India*, 9th Session of Asia Pacific Forestry Commission, Canberra, Australia, New Delhi, Ministry of Agriculture.
- MOE, 1997, *State of Forest Report*, Forest Survey of India, Ministry of Environment and Forests, Dehradun, India.
- MOEF, 1999, *National forestry action programme- India, 2*, Issues and Programs, In FAO-UNDP Project IND93/021, New Delhi, Ministry of Environment and Forests.
- MOF, 1991, *New development of forestry in China*, Country report In World Forestry Congress, Paris, France. Beijing, Ministry of Forestry.
- MOF, 1995a, *Forestry development and environmental protection in China*. Beijing, Ministry of Forestry.
- MOF, 1995b, *Questionnaire reply on the evaluation of forest plantations*, Beijing, Ministry of Forestry.
- MOF, 1998, *1997/98 Forest utilization statistical yearbook*. Statistik Pengusahaan Hutan Tahun. Jakarta. Directorate General of Forest Utilization, Ministry of Forestry and Estate Crops.
- MOF, China PR, 1998, Fifth National Forest Resources Inventory (1994-1998).
- Morales, E., 2002, *Changing ownership and management of state forest plantations: Chile's experience*, Draft study submitted to the International Conference Changing Ownership and Management of State Forest Plantations: Issues, Approaches, Implications

- Morell, M., 1997, *Financing community forestry activities*, Unasylva - No. 188 - Funding sustainable forestry, Vol. 48 - 1997/1,  
<http://www.fao.org/docrep/w3247E/w3247E00.htm>
- Muturi, H., Punning, J., Glatzel, W., 1999, *Austria: Report on the in-depth review of the second national communication of Austria to the FCCC*.
- Mydin, M. Y., Rahman, A., 2003, *Factors affecting the facilitation of Sustainable management in planted forests In developing countries: An overview*, Paper presented at the UNFF intersessional Experts Meeting On The Role of Planted Forests in Sustainable Forest Management, New Zealand, March 2003.
- Mydske, K., Niemi-lilahti, P.K., Pedersen, A. & Pedersen, K.H. (eds), 1994, *A comparing Nordic and Baltic countries: environmental problems and policies in agriculture and forestry*, Nordic Council of Ministers, Copenhagen.
- Myers, N., 1996, *Deforestation, Encyclopedia of climate and weather*, Oxford Press.
- NAEB, 1999, *Statewise yearwise target and achievements for afforestation/tree planting activities under 20 point programme*, (informe inédito), New Delhi, National Afforestation and Eco-development Board, Ministry of Environment and Forests.
- Nagle, G.S., 1990, *Technical background paper on trees in Canada program*. Prepared for Forestry Canada by Nawitka Renewable Resource Consultants Ltd., Victoria, BC.
- Nagy, C., 2000, *Variable energy use in agricultural production systems*, Economic Issues and Reports
- National Board of Forestry, 1998, *The Swedish Forestry Act*,  
<http://www.svo.se/eng/englaw.htm>
- National Climate Change Process, 1999, *Sinks table options paper; land-use, land-use change and forestry in Canada and the Kyoto protocol*, Canada.
- National Forest Programme Germany, October 2000,  
<http://www.verbraucherministerium.de/>
- National Forestry Database Program, 1996, *Compendium of Canadian Forestry Statistics*,  
[http://www.nrcan.gc.ca/cfs/proj/iepb/nfdp/cp95/text\\_e/sulconte.htm#1](http://www.nrcan.gc.ca/cfs/proj/iepb/nfdp/cp95/text_e/sulconte.htm#1)
- National Stakeholders Workshops on Climate Change, 2002, *Report on the Regina workshop*, Regina, Saskatchewan, Canada.
- Natural Resources Canada, Energy Sector,  
<http://netra.es.emr.ca/WWW-data/ceo/nexsumd.html>
- New, B. D., Cabbage, F. W., & Moulton, R. J., 1997, *The stewardship incentive program, 1992-1994: an accomplishment and program review*. SCFER Working Paper(83):1-37, The Southeastern Center for Forest Economics Research, Research Triangle Park, NC.
- Nash, T., McAuley, G., Goodman, J., Nelson, L., 1998, *Alberta Fire Review 1998*, Prepared for the Alberta Forest Protection Advisory Committee
- National Inventory of Woodland and Trees (NIWT), 2001, UK Forestry Commission, Edinburgh



NRC, 1997, *The State of Canada's Forests: 1996-1997 Learning from History*, Natural Resources Canada-Canadian Forest Service, Ottawa, Canada.

NRC, 1998, *The State of Canada's Forests: 1997-1998 The People's Forests*, Natural Resources Canada-Canadian Forest Service, Ottawa, Canada.

NRC, 1999. *Forest health: context for the Canadian forest service's science program*, Science Branch, Canadian Forest Service, Natural Resources Canada,  
[http://www.nrcan.gc.ca/cfs-scf/science/context\\_health/pdf/forhealth\\_e.pdf](http://www.nrcan.gc.ca/cfs-scf/science/context_health/pdf/forhealth_e.pdf)

NRC, 2000, *The state of Canada's forests: 1999-2000 Forests in the New Millennium*, Natural Resources Canada-Canadian Forest Service, Ottawa, Canada.

NRC, 2002, *The State of Canada's Forests: 2001-2002 Reflections of a Decade*, Natural Resources Canada-Canadian Forest Service, Ottawa, Canada.

OECD, 1999, *OECD Environmental data compendium*, Organization for Economic Cooperation and Development, Paris.

O'Leary, T. N., McCormack, A. G & Clinch, P. J., 2000, *Afforestation in Ireland – regional differences in attitude*, Land Use Policy 17: 39-48.

Puttock, D., 2001, *Critical review of historical and current tree planning programs on private lands in Ontario*, prepared for Ontario Ministry of Natural Resources, March, 2001,  
<http://www.ene.gov.on.ca/envision/climatechange/critical.pdf>

Ottitsch A., 2002, *Theoretical framework for the evaluation of financial instruments of forest policy*. In Ottitsch et al. *Financial Instruments of Forest Policy*, EFI-Proceedings Nr. 42, European Forest Institute, Joensuu.

Ouedraogo, A., Senhaji, F., Thorstensson, M., Dallman, T., 1999, *Report on the in-depth review of the second national communication of Norway to the FCCC*.

Pagiola, S. and Platais G., May 2002, *Payments for Environmental Services*, World Bank Environment Strategy Notes, No. 3

Pearson, D., 2001, *Market Investigation for Shand Greenhouse*.

Pembina Institute, 2000, *Provincial government performance on climate change*.

Perley, C.J.K., 2001, *The impact of forest policies and legislation on forest plantations*, FAO Forest Plantations Thematic Papers, Rome.

Umeh, L.I, Omoluabi, C., Salleh, M.N., Prins, C., Tomaselli, I., Abdel Nour, Perlis, A. (ed.), 2001, *Forests and the future: regional perspectives*, An International Journal of Forestry & Forest Industries, Unasyva Vol. 52, No. 1 (No. 204), FAO, USA,  
[http://www.fao.org/DOCREP/003/X8820E/x8820e08.htm#P0\\_0](http://www.fao.org/DOCREP/003/X8820E/x8820e08.htm#P0_0)

Peterson, E.B., Bonnor, G.M., Robinson, G.C., & Person, N.M., 1999, *Carbon sequestration aspects of an afforestation program in Canada's prairie provinces*, Joint Forest Sector Table/sinks Table, National Climate Change Process.

Planning Commission, 1998, *Leasing of degraded forest lands. Working Group's report on the prospects of making degraded forests available to private entrepreneurs*. Planning Commission, Government of India.

- Plantinga, A. J., Mauldin, & T., Miller, D. J., 1999, *An econometric analysis of the costs of sequestering carbon in forests*, American Journal of Agriculture 81 (Nov. 1999): 812-824.
- Poffenberger, M., 1997, *Rethinking Indonesian forest policy: beyond the timber barons' Asian survey*, Vol. XXXVII, No. 5.
- Potter, L., & Justice, L., 1998, *Tree planting in Indonesia: trends, impacts and directions*. Occasional Paper No. 18. Centre for International Forestry Research (CIFOR). Indonesia.
- Preston, L. (ed.), 1997, *Investing in Mountains: Innovative Mechanisms and Promising Examples for Financing Conservation and Sustainable Development*, Franklin, USA: The Mountain Institute/FAO/Swiss Agency for Development and Cooperation.
- Prieler, S., Lesko, A.P., Anderberg, S., 1998, *Three scenarios for land-use change: a case study in central Europe*, International Institute for Applied Systems Analysis, Austria.
- Probe FCM, 2002, *Forest Carbon Management; Probe's Forest Carbon Management Workshop Series Discussion Paper*, Canada.
- Racevskis, L., Ahearnt, M., Alberini, A., Bergstrom, J., Boyle, K., Libby, L., Paterson, R., & Welsch, M., 2000, Improved information in support of a national strategy for open land policies; a review of literature and report on research in progress, Prepared for the 24<sup>th</sup> International Conference of Agricultural Economists, Berlin, Germany.
- REGEN (2002). Regeneration Treatments in Canada. [http://nfdp.ccfm.org/regen/index\\_e.php](http://nfdp.ccfm.org/regen/index_e.php)
- Replenishing the Prairies: The Canadian Permanent Cover Program (PCP) Website, <http://iisd1.iisd.ca/greenbud/replen.htm>
- Rhodes, D., Novis, J., 2002, *The impact of incentives on the development of plantation forest resources in New Zealand*, MAF Information Paper No: 45, Prepared for MAF Policy.
- Richards, M., 1999, *Internalising the externalities' of tropical forestry: a review of innovative financing and incentive mechanisms*, European Union Tropical , Forestry Paper 1, Overseas Development Institute, London
- Roberts, S. & Dubois, O., 1996, *The role of social/ farm forestry schemes in supplying fibre to the pulp and paper industry*, Towards A Sustainable Paper Cycle, Sub-study no. 6. IIED, London.
- Robinson, G.C., Peterson, E.B., Smith, S.M. & Nagle, G.S., 1999, Estimating the carbon sequestration associated with reforestation in western Canada, Nawitka Renewable Resource Consultants, National Climate Change Process.
- Ruitenbeek, J. & Cartier, C., 1998, *Rational Exploitations: Economic Criteria and Indicators for Sustainable Management of Tropical Forests*. H.J. Ruitenbeek Resource Consulting Limited, Canada.
- Saigal, S, 1998, *Participatory forestry in India: analysis and lessons*, MSc thesis, Oxford Forestry Institute, University of Oxford.
- Samson, R., Girouard, P., Zan, C., Mehdi, B., Martin, R. & Henning, J., 1999, *The implications of growing short-rotation tree species for carbon sequestration in Canada: final report*, Resource Efficient Agricultural Production (REAP) - Canada.
- SaskPower, 2001, *Climate change action plan progress report*.

Sedjo, R.A., 2001, *From foraging to cropping: the transition to plantation forestry, and implications for wood supply and demand*, Unasylva Vol. 52, No. 1 (No. 204)

Selby, A., 1993, *Field afforestation in Finland: Aims and experiences*, In Afforestation of agricultural land, CEC report, Brussels

Selby, J.A. & Petäjistö, L., 1995, *Attitudinal aspects of the resistance to field afforestation in Finland*, In the Journal of the European Society for Rural Sociology, Finnish Forest Research Institute, Helsinki, Finland.

Selby, J.A. & Petäjistö, L., 2000, *A critical appraisal of afforestation programs in the light of Finnish and Irish experiences*, Finnish Forest Research Institute, p 51-66 of New Forests for Europe: Afforestation at the Turn of the Century.

Selby, A., Petäjistö, L. & Koskela, T. 2003, *Field afforestation in the context of rural development: a preliminary study of farmers' and rural advisors' perceptions*, The Finnish Forest Research Institute, Research Papers 884.

Skees, J. R., 1999, *Policy Implications of Income Insurance: Lessons Learned from the US and Canada*, Paper prepared for the European Agricultural Economics Association in Warsaw, Poland (August 1999).

Skogstyrelsen, 1997, *Statistical yearbook of forestry 1997: official statistics of Sweden*. National Board of Forestry, Jonkoping, Sweden.

Smith, S.A., 2002, *Creating new native woodlands in Scotland, basic paper prepared for afforestation in the context of sustainable forest management; an international seminar*, Irish Forest Service, Department of the Marine and Natural Resources in Ennis, Ireland.

Soil Conservation Council of Canada, 1998, *Carbon sequestration and trading implications for Canadian agriculture*; discussion paper.

Solberg, B., & Rykowski, K., 2000, *Institutional and legal framework for forest policies in eca region and selected oecd countries - a comparative analysis*, Forest Policy Review and Strategy Development: Analytical Studies/Issues Paper, The World Bank Group

Southworth, T. in *Forestry Ontario* 1896 pp. 40-42

Stuart, M. & Moura-Costa, P., 1998, *Greenhouse gas mitigation: a review of international policies and initiatives*, Policy that works for forests and people series no.8, Discussion Paper, London: International Institute for Environment and Development.

Subak, S., 1999, *Forest protection and reforestation in Costa Rica: evaluation of a clean development mechanism prototype*, Environmental Management.

Suchanek, P., Shaik, S. L., van Kooten, G. C., 2001, *Carbon incentive mechanisms and land-use implications for Canadian agriculture*, Sustainable Forest Management Network Paper 2001 (6).

TBFRA, 2000, *Report forest resources of Europe, CIS, North America, Australia, Japan and New Zealand*, UNECE

*Third Communication From The European Community Under The UN Framework, Convention On Climate Change*, 2001.

Thornley, J.H.M., & Cannell, M.G.R., 1999, *Managing forests for wood yield and carbon storage: a theoretical study*, Institute of Terrestrial Ecology, U.K.

Tomaselli, I., 2000, *Investing in the future: the private sector and sustainable forest management – South America perspective*. Paper prepared for the International Workshop of Experts on Financing Sustainable Forest Management, Oslo, Norway

Tomaselli, I., 2000, *The private sector and sustainable forest management*, Paper prepared for the International Workshop of Experts on Financing Sustainable Forest Management, Oslo, Norway.

Toro, J., & Gessel, S., 1999, *Radiata pine plantation in Chili; in new forests*. 18: 33-44. Netherlands: Kluwer Academic Publishers.

*Trees outside forest resource of Haryana*, 1997, Forest Survey of India: Northern Zone, Shimla, India.

Tyrchniewicz, A. & Wilson, A., 1994, *Sustainable development for the great plains: policy analysis*, International Institute for Sustainable Development, Winnipeg,  
[http://www.iisd.org/pdf/sd\\_for\\_gp.pdf](http://www.iisd.org/pdf/sd_for_gp.pdf)

UNCCC, 2001, Third National Communication of Switzerland 2001

UNECE & FAO, 2000, *Forest resources of Europe, CIS, North America, Australia, Japan and New Zealand (industrialized temperate/boreal countries) or TBFRA-2000*. Geneva Timber and Forest Study Papers, No. 17. New York and Geneva, United Nations.

UNEP, 2000, *GEO Latin America and the Caribbean environment outlook*, Mexico City, United Nations Environment Programme, Regional Office for Latin America and the Caribbean.

USEP, 2002, U.S. *Climate action report – 2002*, Third National Communication of the United States of America, Under the United Nations Framework Convention on Climate Change,

UNEP, 2002, State of the environment and policy retrospective: 1972–2002  
<http://www.epa.gov/globalwarming/publications/car/index.html>.

USDA, 1997, *America's forests: 1997 health update*. US Department of Agriculture, Forest Service,  
[http://www.fs.fed.us/foresthealth/fh\\_update/update97/index.htm](http://www.fs.fed.us/foresthealth/fh_update/update97/index.htm)

USDA, *Southern forest resource assessment: final summary report*, USDA Forest Service's Southern Research Station & Southern Region Website, USA,  
<http://www.srs.fs.usda.gov/sustain/report/summry/summary-35.htm>

U.S. Department of State, U.S. Climate Action Report 2002, Washington, D.C., May 2002

Vaisey, J.S., Weins, T.W. & Wettlaufer, R.J. ,1996, *The permanent cover program - is twice enough?* Paper presented at Soil and Water Conservation Policies: Successes and Failures, Prague, Czech Republic, 17–20 September 1996,  
<http://www.agr.gc.ca/pfra/pub/pcpaper2.htm>

van Kooten, G.C., 1999, *Economic dynamics of tree planting for carbon uptake on marginal agricultural lands*, Forest Economics and Policy Aalysis Research Unit, University of British Columbia, Canada.

van Kooten, G.C., 2003, *A primer on the economics of climate change*, Department of Economics, University of Victoria, Canada.

Victor, D., 2003, Forest plantations and a vision for restoring the forests, For delivery at: UNFF Intersessional Experts Meeting on the Role of Planted Forests in Sustainable Forest Management, New Zealand

Voller, J., Harrison, S., Editors, 1998, *Conservation biology principles of forested landscapes*, B.C. Ministry of Forests and UBC Press, Vancouver, BC.

Volk, T.A., Abrahamson, L.P., White, E.H., Neuhauser, E., Gray, E., Demeter, C., Lindsey, C., Jarnefeld, J., Aneshansley, D.J., Pellerin, R., & Edick, S., 2000, *Developing a willow biomass crop enterprise for bioenergy and bioproducts in the United States*.

Volz, K.R. & Weber, N. (eds.), 1993, *Afforestation of agricultural land*, Proc. EC Workshop, Brussels, 12-13.12.1991, Commission of the European Communities, Report EUR 14804, Brussels.

Watson, R. T., Zinyowera, M. C., Moss, R. H., Dokken, D. J., 1997, *The regional impacts of climate change*, IPCC Working Group II, IPCC.

Watson, V., Cervantes, S., Castro, c., Mora, L., Solis, M., Porrás, I.T., & Cornejo, B., 1998, *Making space for better forestry: Costa Rica country study*, Policy that Works for Forests and People Series IIED.

WBIEN Environmental Economics and Development Policy, 2002, Applying Environmental Policy Instruments: 'Green' and Blue' Sectors

WCFS, 1999, *Our forests, our future*, World Commission on Forests and Sustainable Development, International Institute for Sustainable Development (IISD).

Wear, David N.; Greis, John G., eds. 2002. Southern forest resource assessment. Gen. Tech. Rep. SRS-53. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 635 p.

Weber, N., (ed), 2000, Proceedings 35, *New forests for Europe: afforestation at the turn of the century*.

White, A., 1899, *A history of Crown timber regulations from the date of the French Occupation to the present time*, Annual Report of the Clerk of Forestry, for the Province of Ontario, Reprinted in 1957 by the Ontario Department of Lands and Forests.

Williams, J., Griss, P., 1999, *Design and implementation options for a national afforestation program*, Joint Forest Sector Table/Sinks Table Afforestation Study #6; Assessing design and implementation options of a national afforestation program.

Williams, J., 2001, *Financial and other incentives for plantation forestry*. In: Proceedings of the International Conference on Timber Plantation Development, 87-101. Quezon City: Department of Environment and Natural Resources.

Williams, J., 2001, *Financial and other incentives for plantation establishment*, FAO Forest Plantations Thematic Papers, Rome.

World Bank, 1998, *Community-managed programs in forestry: A synthesis of good practices*, Environment Sector Management Unit, East Asia Region

World Bank/WWF Alliance, 1999, *Production forest estimates for selected countries*

World Resources Institute, 1994-1995, *A guide to the global environment: People in the environment*.

World Resources Institute, 1996-1997, *A guide to the global environment, The urban environment*.

Wu, Y. & Shepherd, G., 1996, *Forestry extension in China*, International Union of Forestry Research Organizations.

Xiaoping, L., 1999, *Forestry policy in China: the past, present and future*, Chinese Society of Forestry, China

Zhang, Y., Dai, G., Huang, H., & Kong, F., Wang, Z.T.X., & Zhang, L., 1998, *The forest sector in China: towards a market economy*, In Palo, M, and J. Uusivuori (eds.) "World Forests, Society and Environment" Vol. 1. World Bank. China: Forest Resource Development and Protection Project. World Bank, Washington, DC. 1994.

Zinn, J., 1994, *Conservation reserve program: policy issues for the 1995 farm bill*. National Library for the Environment, Congressional Research Service Reports,  
<http://www.cnre.org/nle/nrgen-21.html>