Wildfire Protection – Forest Protection
(What does it really mean?)

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ABSTRACT

The concept of Wildfire Protection has generally been viewed or thought of as being synonymous with fire suppression. This has been to the detriment of the practice of mitigation or the effective application of fire management. Modern research however has shown mitigation as being the most effective activity in reducing direct wildfire losses than activities at any other scale. This includes strict fire suppression which has quantifiable fire environment limitations and if successful can result in escalated landscape level fuel hazards.

This research is empowering to property owners and land managers in that they have ultimate authority and responsibility for property maintenance and fuel mitigations. Unlike wildfire suppression which is reactive, property owners and land managers have many preemptive choices. As a result it is the property owners' and land managers' actions that will determine the condition of "Wildfire Protection" and therefore "Wildfire Protection Areas or Zones".

Unfortunately there remains a substantial disparity in application favoring response over mitigation. This disparity will need to be corrected if ecosystem health is to be maintained, landscape level fuel hazards are to be managed, and ultimately if a condition of "Wildfire Protection" is to prevail. Fire suppression programs can only be as successful as the land management programs' commitment to landscape level fuel hazard management. It will require balanced and objective, integrated land and fire management.

INTRODUCTION

Heinselman (1971) referred to strict fire suppression in the form of fire control or exclusion as a societal obsession with climax forest landscapes as well as a grand ecological experiment, the consequences of which not even ecologists could entirely comprehend. Today, the consequences of past land and fire suppression practices could not be more obvious it terms of degraded ecosystems and unprecedented landscape fuel hazards.

Fire suppression technology has never been better, yet over the past decade, every year has witnessed unparalleled wildfires plus associated costs and losses somewhere in the world and most certainly in North America. Williams (2004), and others have acknowledged land and wildland fire policy and practices in promoting late-seral (climax) forest conditions while inadvertently managing the landscape towards catastrophic wildfires. Alas, it provided certainty to the very fires that fire control policy was intended to avoid. Policy was to drive nature but nature did not comply.

Fire control policy in fire dependant ecosystems was in practice protecting the forest ecosystem from itself. It was the cure for a disease that did not exist and in extreme cases it may have loved the forest to death. A serious contravention to fundamentals of the Yukon Environment and Socio-economic Assessment Act (YESAA 2003).

If successful, fire control would ensure an inventory of high hazard forest fuels for future fires. Severe fire seasons were answered with increased budgets and larger fire suppression forces, without regard to fire

regime dynamics or recognition that successful fire suppression necessitates commensurate fuel management. In this context it formed a model for job security.

There can be little wonder that wildfire administrators would be attracted to a scheme that would match severe fire environment events with increasing budgets. This would be even more seductive when coupled with the support of property owners and land managers clamoring for more fire suppression and not to forget the burgeoning wildfire suppression industry. As the fire control business grew it drove land management increasingly from mitigation to response and fire exclusion was peddled like snake oil. The only difference being that the fire control business was naively sincere in its fire exclusion beliefs.

As the land managers' budget diminished the fire manager's budget grew incrementally. It was a recipe for disaster. The only element of the fire environment over which managers can exert some meaningful degree of control is the fuels. The responsible manager in this instance is the land manager and landscapes have seldom (at least in the era of fire control) been managed for fuel flammability. What the land manager either would not or could not manage the fire manager make worse. Wildfire Protection or Forest Protection it wasn't.

Definitions:

Fuel Mitigation:
Is synonymous with fuel management.

Land Manager:
Are those persons or organizations which have the ownership or delegated authority and responsibility for the management of a specified area and corresponding resources. Resources may be wildlife habitat, commercial timber, fuel wood, rangeland, etc.

Property Owner:
Are those persons or organizations which have ownership over the land and occupying buildings. Buildings may be houses, businesses, animal shelters, storage shelters, etc.

Regressive Management*:*
Represents land and/or resource management policies or practices that will ultimately result in the degradation of the environment from its natural state. Attempted fire exclusion practices plus the wholesale application of 10:00 AM fire control in fire dependant ecosystems is an example of "Regressive Management".

Passive Management:
Represents the cessation of those policies or practices that are causing the degradation or preventing recovery. It has been sometimes equated to hands-off management in the hopes that the natural order will ultimately prevail. It can be somewhat fatalistic in its approach and in extreme circumstances may be equated to mere neglect. The cessation of indiscriminate fire suppression would serve as an example of "Passive Management".

Active Management:
Recognizes that a simple cessation of policies or practices of Regressive Management and hoping for the best may not result in the restoration or maintenance of natural landscapes. This is particularly important where anthropogenic fire use has been a significant factor in the ecology of those landscapes. The application of Active Management is also important where the risks from Regressive or Passive Management to life, property and commercial resources may be unacceptable.

WILDFIRE PROTECTION – FOREST PROTECTION

The term "Wildfire Protection" or "Forest Protection" has been largely misunderstood or misused over the years. In most instances, people think only of "Fire Suppression" when the topic of Wildfire or Forest Protection arises. But the simple act of fire suppression does not constitute the condition of ***protection.*** Figure 1. outlines the three elements of Controlling Ignitions, Controlling Fires and Controlling Fuels in combination as the requirement to meeting the condition of ***protection.*** Of these three elements Controlling Fuels is by far the most important, yet by present practices the most neglected.

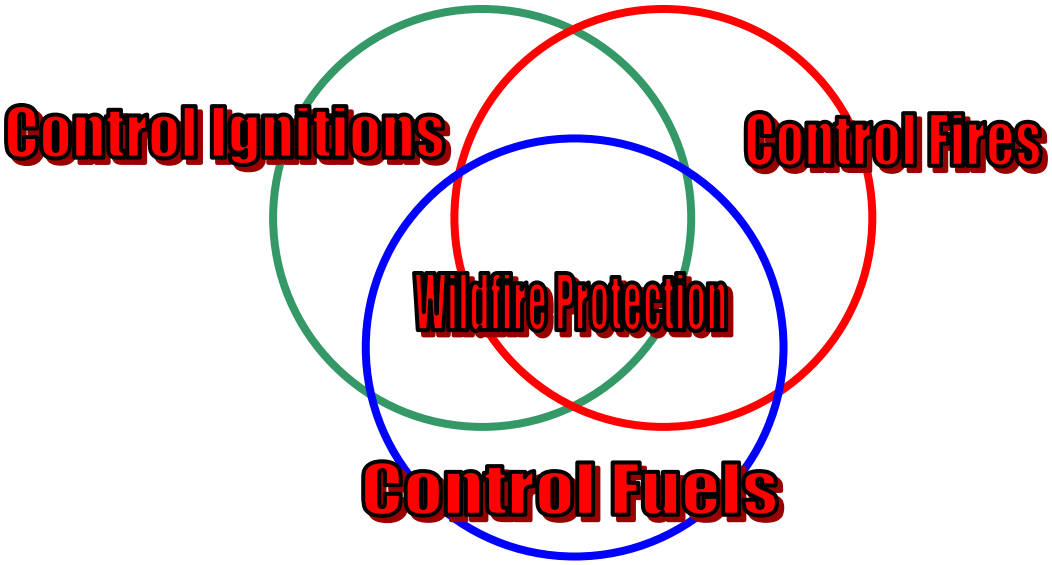


Figure 1. Wildfire protection elements.

Controlling Ignitions:

Controlling Ignitions represents the activities of fire prevention targeting the reduction or elimination of anthropogenic fire starts through such activities as education, burning permit programs, fire bans, area closures, etc. However, in the active pursuit of controlling ignitions fire agencies have also curtailed the traditional fire use ignitions of indigenous people and early European settlers that were ignited for the purpose of controlling fuels (Pyne 1984, Pyne 1995, Bonnicksen 1999). The principle being that a wildfire can not burn what a hazard reduction fire has already consumed (Pyne 1995).

Controlling Fires:

Controlling Fires represents the activities of fire suppression aimed at controlling and extinguishing a fire following detection (Merrill and Alexander 1987). Of particular importance in the boreal forest is that while traditional fire suppression technology and methodology is limited to fire intensities of approximately

4,000 kW/m (Alexander and Cole 1995, Alexander 2000, Beaver 2001) the majority of area burned does so as high intensity, forest-renewing fires. Such fires regularly burn at fire intensities exceeding 10,000 kW/m (Johnson 1992, Weber and Stocks 1998) and therefore beyond the limits of fire suppression technology. Strict fire suppression in the form of fire exclusion has nonetheless been applied as a one-size-fits-all solution to wildfires in what is a complex ecosystem challenge. In doing so it produced an environment for the very conflagration fires it was to eliminate.

Applied in isolation of a substitute, flammability reducing disturbance to wildland fire, strict fire control serves to exacerbate the fuel hazard over time since the last fire event. This is a direct result of the many fire promoting traits inherent in the ecology of the boreal forest (Pickett and White 1985, Barnes *et al* 1998).

Controlling Fuels:

Controlling Fuels represents the activities aimed at reducing the overall flammability of the forest fuels plus building construction and maintenance. There are a number of reasons why controlling or managing fuels plays a paramount role in satisfying the condition of ***wildfire protection***. In the pursuit of controlling ignitions and controlling fires, if successful, and in the absence of controlling fuels, it will succeed in exacerbating the landscape fuel hazard, ensuring future occurrence of high intensity wildfires including concomitant costs and losses. Conversely, a failure in controlling ignitions and controlling fires will produce an indiscriminate reduction in the available fuel. Successful fuel management will on the other hand compliment both the controlling of ignitions (Lawson *et al* 1993, Lawson and Armitage 1997) and the controlling of fires (Pyne 1984, Amiro *et al* 2001, Hirsch *et al* 2001).

In this respect a failure in controlling fires will in effect ameliorate the fuel hazard conditions. But in its capacity for controlling fuels wildland fire does not discriminate between commercial and non-commercial timber or the processed wildland fuels that compose various buildings or subdivisions leaving them vulnerable to combustion. It is this indiscriminate nature of wildland fire that necessitates fire suppression (Controlling Fires) and therefore fuel mitigation (Controlling Fuel). It is equally important to understand that only the complete removal of wildland fuel will eliminate combustion. Fuel mitigation seeks to modify the behaviour of an ignition to a level where fire suppression can be successful and building survivability is enhanced.

The 2004 fire season in the Yukon witnessed a cumulative burned area of 1.7 million hectares, or 5.8% of the total vegetated area. Spawned by record fire weather conditions and an abundance of mature conifer forest the 2004 fire season reconfirmed that fuel discontinuity has the greatest influence on limiting fire spread than any other single factor, including fire suppression. Whether it is a topographical fuel discontinuity or a fire maintained mosaic fuel discontinuity, it has the greatest influence on overall burned area for both managed and unmanaged fires. Fuel discontinuities play a paramount role in the success of managed (suppressed) fires by providing tactical advantages. Aside from the biodiversity benefits from this mosaic of forest vegetation in various seral stages and flammability, the mosaic itself becomes self-protecting. It represents a form of natural FireSmart, and frequently at bargain basement prices.

A qualitative assessment of the ignition origins and area burned in the 2004 fire season shows fire as having a strong preference for late-seral conifer forests over early seral forests. It is ironic that fire control objectives would marginalize its greatest ally in terms of ignitions, area burned and tactical advantages.

Table 1. provides a comparison of Probability of Sustained Ignition (Lawson and Armitage 1997), Rate of Spread and Head Fire Intensity for selected FBP fuel types (Forestry Canada Fire Danger Group 1992) plus Probability of Containment calculations (Hirsch *et al* 1998). The comparison is based upon weather elements common to a standard drying day; wind and moisture code values of; Wind 13 km/h, FFMC 89, plus DMC 55 and DC 400 (Van Wagner 1987) plus area growth calculations of 60 minutes from a point source ignition. The comparison reveals a great deal of variability throughout the comparison fuel types under these constant fire danger conditions which are commonly exceeded throughout the Yukon's wildland fire season.

FBP Fuel Type	Probability of Sustained Ignition (%)	Rate of Spread (m/min)	Head Fire Intensity (kW/m)	Probability of Containment
C-1 (Spruce-Lichen Woodland)	93%	1.1	398	97%
C-2 (Boreal Spruce)	78%	9.1	10,194	0%
C-3 (Mature Jack or Lodgepole Pine)	70%	2.3	1,788	97%
C-4 (Imature Pine)	87%	9.3	9,803	0%
C-7 (Ponderosa Pine – Douglas Fir)	91%	1.7	1,487	98%
D-1 (Leafless Aspen)	44%	1.6	575	99%
D-2 (Aspen, Green)	6%	N/A	N/A	N/A
M-2 (Mixedwood, 75% Conifer)	N/A	6.8	5,885	8%
M-2 (Mixedwood, 50% Conifer)	N/A	4.8	3,063	76%
M-2 (Mixedwood, 25% Conifer)	N/A	2.6	1,268	98%
Average	**67%**	**4.4**	**3,829**	**64%**
Standard Deviation	**32%**	**33**	**3,866**	**46%**

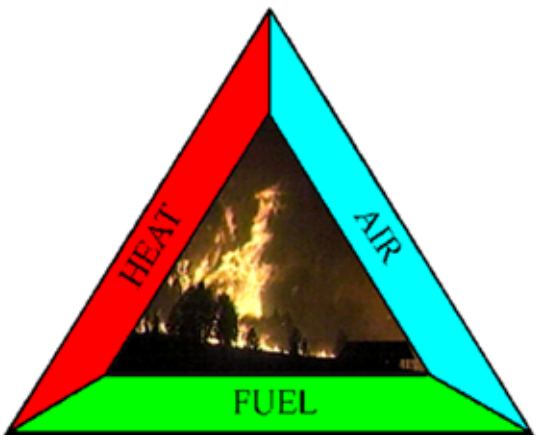
Table 1. FBP fuel type comparison.

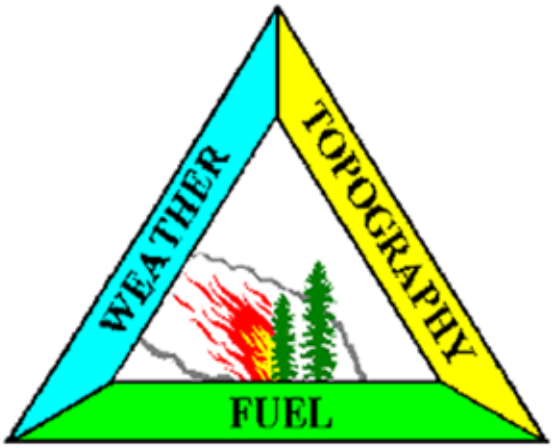
Brown and Davis (1973) bring to our attention the principal importance of fuel to the ignition and behavior of forest fires. “The ignition, buildup, and behavior of fire is dependant upon fuel more than any other single factor. It is the fuel that burns, that stores and releases the energy with which the firefighter must cope, and that largely determines the rate of spread and level of intensity of that energy release. Other factors that are important to fire behavior (that is, moisture, wind, etc.) must always be considered in relation to fuels. In short, no fuel, no fire!” Here lies an important distinction between “total fuel” and “fuel available” to the combustion process.

The concept of ***available fuel*** is important when examining timber harvesting as a method of fuel management. Timber harvesting in itself will remove the large stems for which fire has little interest. If the post harvest site treatment does not prescribe the removal of the medium (< 7cm) and the fine fuels ($\leq$ 0.5 cm) in particular it will not have accomplished anything towards managing the ***available fuels***.

The importance of fuel management is most notable in context with Countryman’s observations (1974) that the methodologies for controlling forest fires has not changed, nor has it been entirely successful since the inception of organized fire suppression in the United States in 1910 (Pyne 1997). While mechanization has made the bucket brigade and the fire shovel larger, faster and more powerful, radical advancements in technology or methodology seem unlikely. Like Brown and Davis (1973), Countryman recognized the need to reduce the overall fuel hazard to a level against which fire suppression technology can cope (< 4,000 kW/m) under the historic extremes of fire danger. Three decades later Countryman’s observations could not have been more profound or prophetic.

Perhaps most notable in highlighting the premier role of fuel in wildland fire is not found in advanced fire research but in basic fire behaviour training. The two most identifiable symbols in basic fire behaviour training are the “Fire Triangle” and the “Fire Behaviour Triangle” (Figures 2 & 3). What is obviously common to both is “FUEL” which suitably forms the base of each triangle. What is also obvious to both is that of all of the elements (heat, oxygen, weather, topography and fuel) fuel is the only element over which managers can exert some meaningful degree of control.





Figures 2 & 3. The fire triangle and the fire behaviour triangle

As to why the controlling of ignitions and the controlling of fires has been so successful while the controlling of fuels has faltered might be speculated as; in most jurisdictions the authority for controlling ignitions and controlling fires has been largely delegated to a few specified authorities. The ownership of the fuel however, is distributed amongst many property owners and land managers. In some instances and particularly in post fire instances it is difficult to find anyone who is willing to take ownership of the fuel. With ownership comes responsibility and with responsibility comes accountability. Simply, wildland fire is a critically important ecosystem process and as a process it is not a liability in itself. It is the fuel that will determine if an ignition will occur and the resulting fire behaviour. It is therefore the fuel that is the liability.

INTEGRATED WILDFIRE PROTECTION

The question of who is responsible or who has ownership of individual fire protection may be as simple as comparing who is responsible for ones health? The obvious answer to this question is each individual person makes decisions that impact their personal well being and therefore have the final responsibility for their personal health. The health and medical community can provide advice and reactive response to medical emergencies up to the limits of medical technology, but the ultimate decisions concerning personal health lies with each individual.

Every person has many health related choices such as to smoke or not, exercise, diet, regular medical check-ups, the list is near endless. With these choices come consequences for which only they can take responsibility. If a person chooses a less than healthy life style and suffers a heart attack, the medical service (if available) can try to revive that person but they are not capable of working miracles. The reality of human health is that we will not live forever. The ecology of fire dependant forest ecosystems is that they will burn.

Beyond a threshold limit of fire behaviour the individual property or value owner/manager has choices. They can construct and maintain their property appropriately, they can manage the available fuels such that the fire behaviour remains within fire suppression limits at the extremes of fire weather, they can purchase insurance, or they can accept the consequences of an uncontrollable wildfire (Figure 4.).

These choices and consequences are valid whether the property or value is a home, subdivision, wildlife habitat, or commercial timber. Williams (2004) reports that of all the homes destroyed in California in the 2003 fire season, most were meant to burn in that they were properties constructed and maintained such that they would be vulnerable to wildfire. In many of these cases that was the very way the property owners wanted it. It was their choice.

Just as people cannot expect the health and medical systems to assume responsible for their personal health or the choices they make, neither can they expect the wildland fire suppression authorities to assume the responsibility for their fire protection choices. Further to the health care analogy, strict fire suppression in the absence of mitigation can be likened to very expensive life-support. It inevitably fails (Williams 2004).

This is not dissimilar to fire protection as previously discussed. The actions of the individual property or value owners/managers have the greatest preemptive influence to guard against wildfire fire losses. Fire suppression technology on the other hand is reactive and limited to measurable degrees of fire behaviour to which significant technological advancements remain doubtful.

Consider the homeowner who chooses to every day throw an oily rag into their basement and incurs a loss as a result. This is not the fault of the responder although it is all too frequently the responder to which the blame fixing finger is frequently pointed.

It is possible to substitute the process of wildland fire to some extent (Chandler *et al* 1983) but unlikely that it can be outright eliminated, outside of total fuel removal (Countryman 1974). This distinction further defines the choices that people have. Choices however are also empowering in that property owners and land managers have the ownership and responsibility over their wildfire protection.

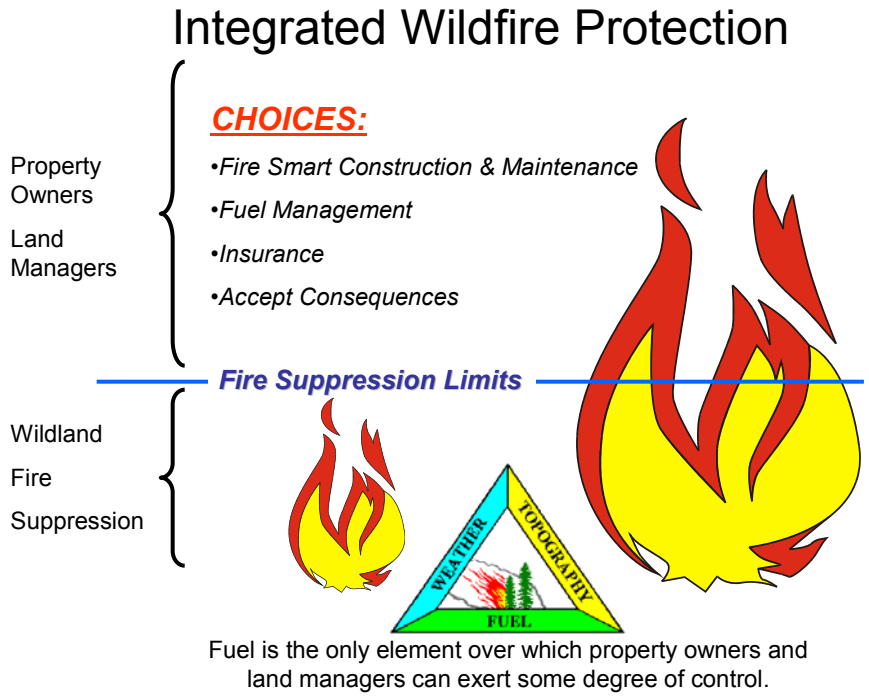


Figure 4. Integrated wildfire protection

DISCUSSION:

The concept of managing fuels as a paramount activity to wildfire protection is not some epiphany of today's fire managers. The truth is that indigenous people globally have recognized this need over the millennium, and applied hazard reduction measures with great expertise. Their fuel management tool of choice was predominantly fire and the more flammable the fire regime was, the more fire that was applied in its management. As the fire response technology and industrialization grew, and for those agencies with the financial means, it drove land management increasingly from mitigation to response and response from indirect to direct attack. The success that industrialization brought to fire response fueled the emphasis on combating nature as opposed to harmonizing with it.

While the traditional use of fire may not be transferable to modern land management in its entirety, the principle behind it is. To satisfy the condition of wildfire protection, landscape disturbance needs to be increased not curtailed and it needs to effectively address the available fuels. This principle should not come as a surprise as disturbance ecologists have identified disturbance as tracking a power law where frequent disturbance events will be generally less severe than infrequent disturbance events (Pickett and White 1985, Averill *et al* 1994).

Thus people can have a choice of disturbances but do not have the choice of "no disturbance". The land and resource management doctrine of "Ecosystem Based Management" could be more aptly referred to as "Management by Disturbance". Similarly, wildfire response zones or areas need to be more accurately acknowledged and managed as fire substitution zones.

Nonetheless, the fuel is the responsibility of the fuel owner, the property owner or the land manager. This is certainly not a new concept for a commonwealth country as Justice Stretton (1939) wrote in the report of the Royal Commission inquiry into the 1939 bushfires in Australia.

"There is one fundamental policy of fire prevention and of protection against fire. There is only one basis upon which that policy can safely rest, namely, the full recognition by each person or department who has dominion over the right to enter the forests of the paramount duty to safeguard the property and the rights of others. No person or department can be allowed to use or neglect the forest in such a way as to create a state of danger to others.

If conformity to this rule cannot be brought about, the offender must be put out of the forest, or, in the case of a public department its authority curtailed, or enlarged so that the rule may be enforced or voluntarily observed as the case may require. "

Stretton (1939) went on to point out that government agencies or public should not rely on the bushfire brigades to put out the fires because their activities (controlling fires) only started after the fire had started and they had no authority to carry out any preemptive action (controlling fuels). The property owner or land manager on the other hand had many options available. Justice Stretton could also have concluded that bushfire brigades, in 1939 as today, are no match for the extremes of nature.

Kumagai *et al* (2004) brings this very principle into the present citing Wildland – Urban Interface research that indicates that the measures taken by property owners to manage proximal fuel hazards plus structure construction and maintenance has far greater impact on mitigating damages than actions taken at any other scale. This includes controlling fires (fire suppression) for reasons previously described.

Both Stretton (1939) and Kumagai *et al* (2004) provide legitimacy to the assertion by Cohen (personal communication 2001) that if a person chooses to do nothing in guarding against wildfire damages they are a participant in a wildfire disaster, not a victim.

The fire suppression induced fuel hazard concept has sparked some debate over the principles of disturbance ecology in the boreal forest fire regime of high intensity, forest-renewing, crown fires. One topic of the debate is the effectiveness of fire suppression technology to extend the fire cycle in any meaningful way. Like great topics of debate the positions on this topic are polarized and hotly defended. Nonetheless, fuel mitigation as a result of fire suppression would only be required if it did indeed enjoy a degree of success, or preemptively if the burning of a particular value was socially and/or economically undesirable.

Successful or not it exposes the fire suppression business to some serious criticisms. If fire suppression in the boreal forest is successful over the long-term it is then subject to environmental criticisms (YESAA 2003). If it does not enjoy a long-term success then it exposes itself to serious economic criticisms.

If a property owner or land manager chooses fire response for a particular area they then by default choose fuel mitigation. How much mitigation is then required? By the framework discussed the requirement to mitigate is a direct result of applied and successful fire suppression. Fuel mitigation will therefore need to

at least match the degree to which fire suppression has been successful. In the boreal forest of high intensity, forest renewing fires the fuel mitigation will need to reduce the subsequent fire behaviour at the historic extremes of fire weather to a level complimentary to fire suppression technology.

While this may seem a daunting task it need not be that intimidating. The application of fire suppression will need to be rigorously and judiciously examined. If the fuels can not be successfully managed can the application of fire suppression be justified? Integrated land and resource management can be effective in mitigating fuel hazards providing it is established as a property and land management objective. This would need to extend to building codes, community planning and such activities as FireSmart forest management (Hirsch *et al* 2001).

While it is wildland fire suppression and not wildland fire that must be justified, the complete cessation of fire suppression is not practical and would only serve as passive land management. Active land management is required for the condition of wildfire protection to prevail and it is the land and property owners and managers that need to seize the active role.

CONCLUSION:

The ability to control fire is inextricably tied to the ability or inability to control fuels. Those fuels could be wildland fuels or those processed wildland fuels that compose the particular value at risk from wildfire losses. Land management and wildland fire policy has produced landscape level fuel hazards that will bring certainty to the very fires that it was meant to eliminate. By this understanding the greatest fuel hazards will have accumulated in the areas of greatest fire suppression success. Frequently this will also be in areas of the greatest values.

Accordingly, property owners and land managers can not expect wildland fire suppression organizations to provide a condition or state of wildfire protection. Wildfire protection and therefore wildfire protection areas are defined by fuel mitigation. Simply, if the fuel hazard can not be mitigated there is no condition of protection.

This highlights that most areas do not have a wildfire problem; they have both a people problem and a fuel problem. If people did not choose to live, work and play in flammable environments nature would run it's course and all would be well. However, such is not the case and if one chooses to exist in such an environment then there is a need to manage its flammability. Pre European contact, indigenous people understood this and thrived in these environments long before fire engines, power pumps and air tankers. There is a lesson to be learned here.

If you own the fuel you own the problem but you also own the solution. Property owners and land managers need to understand this and embrace it. They have choices available to them and they need the support to act upon those choices.

One way or another, the fuel will get managed. It can be managed mechanically, it can be burned as a choice under prescribed conditions or it will get managed by a wildfire that is beyond the limits of fire suppression technology. Property owners and land managers have choices over their disturbance preference but not the choice of "no disturbance".

It is the property owner and land manager who will ultimately determine the status of wildfire protection. Wildfire protection can not succeed in an environment of failed property and land management. Land management policies must address landscape fuel hazards as a management objective in the same manner in which it addresses other land use objectives.

One can only imagine what the wildland fire business and related industry would look like today if severe fires or fire seasons had been answered with increased mitigation as opposed to increased response. The current state of organized wildland fire response and technology has evolved over the last 100 years and at great public and private expense. Wildland fire mitigation can not be expected to match the current level of fire response overnight.

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