Environmental Health Risks Reduction in Rural Egypt: A Holistic Ecosystem Approach

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ABSTRACT

The problem to be addressed in this paper is related to environmental health risks in rural Egypt originating from ecosystem degradation caused by factors such as improper ecosystem management and serious contamination with agricultural, industrial, and domestic wastes. The end result of the dominance of such resource degradation factors is the creation of an ***unhealthy ecosystem***, a main cause for the prevailing poverty and poor health. To tackle the poverty/poor health/ecosystem degradation nexus, a ***holistic ecosystem management approach*** is required. The authors of this article are advocates of the use of this holistic ecosystem approach--that was developed and articulated by many researchers over the past two decades--to the management of ecosystem resources in rural Egypt. We believe that deficiency in the use of ***multidisciplinary***, ***participative***, and ***gender-sensitive*** research approach in Egypt has minimized the expected impact of the research outcomes in the past. Our interdisciplinary research team is currently employing such approach to develop, test, validate, and communicate ecologically judicious resource management interventions and policies aimed at reducing the environmental health risks and consequently enhancing community health and wellbeing. The development of these interventions is to be based on a comprehensive understanding of the ecosystem components, i.e., the physical environment, the community, and the economy as well as the dynamics between them. We believe that through employing such approach with full participation of the community and other stakeholders, our team will have a better chance to help empower the community to improve their health and well-being. A case study from our own research in El-Faiyoum province is presented to illustrate how this holistic ecosystem management approach is being applied.

BACKGROUND

It is now a well-established fact that human health and well-being of communities is inextricably linked to the health and integrity of their ecosystems. In its 1997 report on ***the State of Health and the Environment***, WHO concluded that the poor quality of the environment (and of ecosystems) was directly responsible for 25 percent of all diseases that could be classed as preventable (e.g., acute respiratory infections, malaria, diarrhea, and occupational illnesses). In fact, the persistence of *Malaria* around the world and its progression in certain regions would seem to be invariably associated with environmental disturbances often linked to improper use of ecosystems. For example, there are numerous data that demonstrate vector/environment relationship (Hugi-jones, 1993). The environmental factors that influence malaria transmission and its intensity vary according to the different geographical areas. Some experts suggest that as much as 90 percent of this global scourge can be traced to environmental factors such as intensified farming practices,

mining, irrigation, or hydroelectric development and others which increase ecosystem resource degradation. But in spite of these alarming facts, degradation to the earth's ecosystems from human activity continues to grow at an unprecedented rate. Uncontrolled and unsustainable demands on the natural resources are severely threatening the future viability of humankind, and indeed, all species on earth (The World Conference on Sustainable Development, 2002). In this paper we are addressing the situation of the scarce and progressively degraded natural resources in rural Egypt (i.e., land and water) which is a cause of great concern for the country's future development and the health and wellbeing of its people.

Environmental Issues in Rural in Egypt

Egypt is among the most highly over-populated and over-urbanized countries in the world compared to countries with the same economic and natural resources. Over-population is burdening the resources and hampering economic and social development while over-urbanization has created environmental and societal imbalances as migrating rural poor burden the already inadequate urban social, economic, and infrastructure and services. Scarcity and degradation of land and water resource in Egypt have become the main constraint to development. According to the "Poverty and Poverty Alleviation Strategies in Egypt" report to the Ford Foundation (Assaad and Rouchdy, 1998), twenty five percent of the population is very poor and another twenty five percent fluctuates around the poverty line. Almost a third of Egypt's population live below the poverty line, defined as a total income of less than $30 per month (UNDP-SL Documents, Egypt Workshop Report, 1999). Poverty is not -at its root- a purely economic phenomenon, however, it is also a social one, that involves both ***"income poverty"*** and ***"human poverty".*** The latter is our concern in this study which includes issues such as poor health, low culture and educational opportunities, a lack of adequate housing, a lack of access to safe drinking water, absence of sanitation facilities, a low life expectancy, a limited access to public and private resources, and a limited participation in community development. This human poverty adversely affects poor individuals' and communities' ability to gain access to and use assets to improve their quality of life. Assets, in this particular context, are defined not only as natural/biological ones, but also social, political, human, physical, and economic ones.

Natural resource degradation in Egypt, particularly land and water, is a vital issue considering that more than 95% of the lands are deserts. Besides, more than 35% of the total agricultural land suffers from secondary salinization (UNDP, Egypt 2000). The major cause of soil degradation is excessive irrigation and poor drainage. Water is a very precious commodity and Egypt cannot afford to waste it to water degradation. Water resource related problems are two folds, quantity and quality. The annual renewable fresh water available per person was 1123 m^3 in 1990 dropped to 949 m^3 in 1998 (African Development Bank, 2000). According to the UN lowest population projections, it is expected to drop down to 681 m^3 in 2025, but could be as low as 584 m^3 with a high population growth rate (African Development Bank, 2000). On the other hand, the poor quality of available water supplies is a major environmental concern in Egypt. Water contamination by point sources of pollution from industrial and/or domestic discharge occurs in many parts of Egypt, particularly in the rural areas. Many industries discharge inadequately treated-wastes into waterways network which include irrigation canals and drains. Water degradation from non point sources of pollution, due to

farmers' improper management of agrochemicals mainly fertilizers and pesticides, is already a serious problem in the Nile Delta region (Watts and El-Katsha, 1995). Water pollution, if allowed to grow uncontrolled, is likely to cause substantial economic and health ramifications to the country (UNDP, Egypt 2000). Within this context, it is estimated that the proportion of urban population in Egypt having access to safe drinking water dropped from 93% in 1982-85 to 82% in 1990-96, and the proportion of the rural population from 61% to 50% (world Bank, 2000), while sanitation services were available for only 23% of the urban population and 6% of the rural population (World Bank, 2000). Water-related diseases are endemic in Egypt, accounting for 90,000 deaths each year (UNDP, Egypt 2000). Outbreaks of diseases such as cholera, typhoid, and infectious hepatitis have occurred in several provinces because of drinking water pollution. For instance, 10% of the rural population in 1995 was affected by diseases as a result of contamination of surface water with human waste (GOE, 1996). The contamination of those surface and ground waters could also affect the food chain causing deadly intestinal diseases or poisoning.

In conclusion, we believe that environmental problems and issues in Egypt are dominated by the need for better management of the scarce and degraded natural resources (i.e., land and water) in a sustainable way to control degradation, reduce environmental and health risks, and meet the growing needs of the increased population. In this respect, we are in complete agreement with of what the Egyptian Environmental Affairs Agency (EEAA) has stated in the Environmental Action Plan of Egypt (1992), that "unless actions are taken to improve resource management, the nation will have to bear heavy coasts in terms of health and productivity of its population." Since the rural poor in most parts of Egypt depend heavily on agriculture for their livelihood, they will have to bear the brunt of the adverse socio-economic and health impact of land and water resource degradation in their ecosystem. In light of the above we may state that for communities living in rural Egypt, poverty levels, health status and the sustainability and productivity of their agro- ecosystem are inseparably linked. To tackle this poverty/poor health/ecosystem degradation nexus, it will be imperative to use a ***holistic approach to the management of ecosystem resources*** in order to enhance human health and wellbeing.

The Holistic Ecosystem Approach to Resource Management

Concepts and Terminology

In order to familiarize the reader with some of the terminology used in this article, it may be useful to provide a brief review of some of the ***concepts and terminology*** related to the application of the holistic ecosystem management approach. As will be shown, these concepts were developed, articulated, and adopted by many researchers over the recent years.

What is an Ecosystem?

The precise definition of an ecosystem may remain the subject of controversy but most researchers agree that, as a minimum, it implies ***the presence of a set of different***

living organisms interacting with their physical environment. The following working definition proposed by the Canadian Council of Ministers of the Environment (1996) is very appropriate in the context of an eco-system approach to resource management and human health: *"for purposes of planning and information gathering, the user, according to the task at hand and the scope of the process, may define the limits of a given ecosystem. While in general the limits selected will circumscribe an ecological space such as a watershed or a region, we can also designate a farm, an urban subdivision or a rural community as an ecosystem* (Forget and Lebel, 2001)".

While the term ***"ecosystem"*** refers to both the natural and human resources within some geographical boundaries with emphasis on inter-relationships among and between human and natural resource services, the term ***"environment"*** *(or the physical environment)* refers to only those resources provided by nature, distinct from human beings, with emphasis on human use and values of natural resources (e.g. water, air, soil, etc.)

What is an Agro-ecosystem?

For our purpose in this paper we will adopt the definition proposed by Peden (2000). ***An agro-ecosystem*** may be defined as *a geographically and functionally coherent domain of agricultural activity, including all living and non-living components (the physical environment, the community, and the economy) and the interactions among them.* Determining its precise physical boundaries is rather arbitrary and depends on the purpose of the analysis. The system may be a single farm, a rural community or micro watershed composed of many farms, or a major watershed. It may be also an entire region broadly defined by climate, vegetation, and other ecological traits.

What Makes an Ecosystem Healthy or Unhealthy?

The metaphor ***healthy ecosystem*** is a powerful and effective tool for creating awareness and promoting action against environmental degradation, because it highlights clearly the direct association that humans make between good and ill health, and applies it to an ecosystem. The ***"healthy ecosystem"*** metaphor is now becoming a part of the language of researchers, policymakers, managers, and the general public in discussing issues of environmental degradation. From being just a metaphor, the healthy ecosystem has come to represent a global approach to resource management that can be understood by reference to a very intimate human experience which is health. We refer the reader to the comprehensive review paper written by G. Forget and J. Lebel, (2001) on this subject. According to Costanza et al (1998) an ecosystem is healthy and not suffering from "***distress syndrome***" as long as it is ***sustainable***; in other words, as long as it remains active and can maintain its organization and its autonomy over time, and rebound from stress. This definition is important because it does not necessarily refer to the ***"initial"*** qualities of an ecosystem, and it is perfectly adaptable to ecosystems that have been heavily influenced by human activity, such as agro-ecosystems, urban ecosystems, or any other ecosystem subject to anthropogenic influence (industrial activities).

The Quest for Sustainability

Sustainability has been defined by many people in an almost equal number of ways. In effect, it is much easier to agree to be sustainable than it is to define or achieve it.

Definitions range from a precise sustain-me approach that focuses on one concern only, such as the health of rural economies or environmental conservation, to an all-inclusive definition that addresses many considerations. However, a review of the economic and development literature shows that most definitions are centered on economic, environmental, and social welfare objectives (Cernea, 1993). It is difficult to get people to agree about what is sustainable when objectives are valued so differently. Although there are many interpretations, the three well-known definitions are: 1) sustainability as constant consumption, 2) sustainability as a constant stock of natural resources, and; 3) sustainability as intergenerational equity. For our purpose, we will adopt the third and more general definition i.e., ***sustainability as intergenerational equity*** which was created by the World Commission on the Environment and Development (1987). It contends that sustainability is a process "…of change in which the exploitation of resources, the direction of investment, the orientation of technological development, and institutional change are made consistent with future as well as present needs" (World Commission on Environment and Development, 1987, p. 13). In other words, ***sustainability requires that the needs of the present be met without compromising the ability of future generations to meet their needs.***

Importance of Maintaining Ecosystem Sustainability

Society's ability to produce goods depends on the availability and quality of inputs which may be natural, and either renewable or nonrenewable inputs. They may also be unnatural, or reproducible human made inputs, such as labor, technology, and physical capital. For a long time these delineations were unimportant. The rise of the popular sustainability movement has, however, given impetus to questions of where inputs come from and which resources are affected. Disregard for sustainability may reduce long-term economic productivity and encourage environmental and ecological losses. Sustainability of the production process requires that inputs from natural resources (the physical components of the ecosystem) be given equal consideration to outputs or consumption because resources provide more services to society than simply producing goods.

The Sustainable Ecosystem Management Approach

The principles of sustainable management of ecosystems include parameters such as*:* conservation of ecosystem resources (functions and integrity); management of ecological relationships; conservation of biological and cultural diversity; empowerment of local people; valuation of indigenous knowledge and culture of local inhabitants, attain equity and environmental justice to all stakeholders and value human health.

The potential payback of applying a sustainable ecosystem management approach for communities is manifold; it will help them achieve their social and economic development goals while protecting the environment**.** For example in ***the social dimension*** it helps communities meet goals such as food self-sufficiency; improve community health and well-being; social and gender equity; empowerment; conserve cultural diversity and indigenous knowledge. In ***the economic dimension*** it will help meet goals such as achieving sustainable productivity; reliance on local resources; economic viability and equity. In ***the environmental dimension*** it helps to conserve ecosystem integrity, health and functions; conserve ecosystem biodiversity and achieve environmental justice for members of the community. The term

environmental justice in this case refers to fairness in the distribution of the burdens (financial and non-financial) of environmental degradation among the different stakeholders.

Ecosystems Links to Human Health and Well-being

As was mentioned in the early part of this background section, the WHO in its 1997 report on "the State of Health and the Environment" concluded that the poor quality of the environment was directly responsible for 25 percent of all diseases that could be classed as preventable. Four years earlier the World Bank in its 1993 report "***Investing in Health***" stated that better management of the ecosystem could significantly reduce the burden now presented by various diseases, particularly in the Third World. The Bank argued that better management of the home environment could reduce morbidity from diarrhea-related diseases by 40 percent, through the use of already established interventions such as the supply of safe drinking water and environmental hygiene. A similar reduction in infection by intestinal parasites could be achieved through the same interventions in the ecosystem. Diseases such as *Trachoma*, *Schistosomiasis,* and *Chagas'* disease can be reduced by 30 percent with improved environmental hygiene, safe waste disposal, safe drinking water, and the elimination of breeding sites for vectors in the vicinity of residences.

Ecosystems links to human health can be approached in numerous ways through study of any ***impairment to ecosystem function*** that affects its components, such as: soil, water, air, vegetation, and any community activities that could impact human health, e.g. factors affecting vector or water-borne diseases. Other approaches are biological control of vector populations; nutrients cycling; erosion control; waste treatment, water purification; and maintenance of a diverse gene pool for medicine and agriculture (Peden, 2000).

The Ecosystem Approach to Human Health

Forget and Lebel (2001), in their paper promoting the ***ecosystem approach to human health*** explained that this approach explores the relationship between the various components of an ecosystem (the environment, the community, and the economy) and the dynamics between them in order to define and evaluate the priority determinants of human health and the sustainability of that ecosystem. In this approach, the focus will be on the development of solutions based on alternative forms of ecosystem management rather than on conventional health sector interventions. Their document emphasizes that the ecosystem management approach to human health demands a **"*systemic*"** approach to understanding problems and their solutions. The research must be conducted through a process of true collaboration between researchers from different, complementary fields. The body of knowledge generated during the course of such a research will go beyond a simple tally of the data collected. Hence the need for what is known now as a "***trans-disciplinary***" research approach. According to the same authors, this approach is based on true collaboration among several disciplines, not only in terms of developing research hypotheses but also in terms of conducting fieldwork and interpreting the integrated results. In addition to the requirement of an interdisciplinary research team working in a trans-disciplinary manner to conduct this type of research, two other features must be secured; research should be conducted in ***a participatory manner*** i.e., involving all stakeholders from the outset,

and researchers should use ***gender–sensitive methods*** in their collection and analysis of the research data.

Within the context of ecosystem approach to human health, it will be useful to draw the readers' attention to some fields of research that are directly related to this approach.

Environmental epidemiology is defined as the study of the spatial and temporal distribution of a disease in relation to possible environmental factors (Committee on Environmental Epidemiology, 1997). It provides a valuable tool for better understanding of the dynamics of parasitic infections and the development of suitable control measures and preventive strategies. Current disease control efforts have, to a degree, been compromised by factors such as: changes in vector behavior, agricultural development, environmental changes, and so on. It therefore became necessary to develop more integrated control systems. Environmental management measures available for vector control include: improved water management techniques, land reclamation, planning of communities, domestic sanitation and house construction, river management, and biological control.

Another very relevant field of research that is gaining recognition in this context is ***eco-toxicology*** (or environmental toxicology) which is a coupling of the terms ecology and toxicology. Eco-toxicology refers to the field of research that concerns itself with the study of the impact of environmental pollutants on the structure and function of ecological systems (Hoffman *et al.*, 1995). By analyzing effects of pollutants on the structure and function of ecological systems, conclusions can be drawn by terrestrial and aquatic ecologists, chemists, molecular biologists, geneticists, and mathematicians. The broad scope of eco-toxicology requires a multidisciplinary approach (Chenglis, 1992 and Gad, 1992).

Are Poverty and Poor Health Products of Ecosystem Degradation?

Ecosystems contain most of the fundamental ***determinants of human health*** particularly those that affect the rural poor. In agro-ecosystems, while agricultural institutions and their personnel often make significant contributions to improving human health, ignorance of the human health consequences of natural resource management ***(NRM)*** can undermine or conceal those gains. However, better understanding of the complex nature of human health within agro-ecosystems can pave the way for active delivery of preventative NRM and agricultural interventions that help achieve consciously formulated human health objectives (Peden, 2000).

We would like to reiterate the established links between ecosystem health on the one hand and human health and poverty on the other. Based on our own observations during the extensive and frequent travel we made within rural Egypt as well as on the information we collected from members of the communities and the officials from MOH and MOA, it was evidently clear that there is an unambiguous correlation between environmental degradation, poverty, and poor health. It was also evident to us that poverty could be both a cause and a result of ecosystem degradation. Poor health is largely the outcome of unfavorable agro-ecosystem-based factors such as poor water quality, insufficient and nutritionally inadequate food supplies, inadequate (unhealthy) housing condition, and exposure to pesticides, mycotoxins, vector-borne diseases, and natural determinants. The direct result of poor health is lower productivity, the adoption of less sustainable natural resource management (***NRM***) practices, and a downward spiral of poverty. The low farm

profitability and unsustainable land management practices that emerge from poverty and poor health reinforce the factors that compromised human well-being in the first place. The end result of the dominance of such environmental stressors is the creation of an unhealthy ecosystem, a main cause for the prevailing poverty and poor human health ***(see Fig.1).*** The momentum of the poverty cycle is thus maintained. To break that cycle in poor rural communities requires a multi-pronged attack on ecosystem degradation and related threats to human health.

We may conclude this concepts review section by reiterating that the "holistic ecosystem management Approach" is an approach to sustainable resource management that would integrate the community's social aspirations including health and wellbeing, human activities, and biophysical characteristics of the ecosystem (fauna, flora, geography, air, water and soil) in order to ensure their integrity, continued development, and optimal utilization.

Environmental Health Risks as Products of Ecosystem Degradation: The Case of El-Faiyoum Province, Egypt

El-Faiyoum province is a large agricultural oasis-like ecosystem located 60 km south west of Cairo. It occupies an area of about 6,000 km^2 with a population of around 2.0 million (GOE, 1999). The province has an extensive open irrigation system consisting of more than 39,000 km of waterways. Because of its peculiar topography-- its lands slope gradually from 20 m above sea level in the east to 20 m below sea level in the west-- the province is irrigated by gravity (surface irrigation) method that requires no pumping. This method of irrigation tempts farmers in some areas where water is readily available to overuse the irrigation water and over burden the agricultural drainage system. Agriculture represents the major economic activity of the province. Rice cultivation is the most problematic where there is an established relationship between rice husbandry and mosquitoes breeding. The soils of El-Faiyoum are generally characterized by low land and flat topography. Since most of the province lands lays below sea level, its lands are subjected to serious drainage problems and salt-water intrusions from Lake Qaroun. Excessive irrigation and poor drainage systems have resulted in a high water table, which causes subsurface water to appear often on the soil surface in many parts of the province (water-logging). These unfavorable hydrologic characteristics of the ecosystem contribute to the enhancement of disease vectors breeding in areas where water stagnates long enough on the ground. A major consequence of this condition is the enhancement of water-associated diseases such as ***schistosomiasis, malaria,*** and others (Gaddal, 1990).

As in the rest of rural Egypt, ***schistosomiasis***, which is an important water-borne disease, is considered as one of the most serious rural health problems in El-Faiyoum province (Abdel-Wahab *et al.*, 1993 & 2000). Environmental factors affect the essential link in the life cycle of the snail, which is the intermediate host. Thus, the provision of adequate water supply and safe sewage disposal system should be the most effective method of *Schistosomiasis* control.

Bassiouny (1997) and Abd-Allah (1999**)** reviewed the ***malaria*** situation in El-Faiyoum and the common practices for malaria surveillance during the period of 1997-2000. According to these researchers, the problem of malaria in El- Faiyoum province could be the result of various interacting factors that cause persistence of malaria in that area, such as the hydrologic situation, ineffective vector control efforts due to

thick cover of wild water weeds that hinders spraying with larvicidal chemicals, inaccessibility of many mosquitoes breeding sites to the spraying workers, the favorable meteorological conditions (i.e., temperature and relative humidity in particular) that enhance the breeding of anopheline fauna, the formation of lowlands by land excavation (for brick-making industry), and finally the localization of most of the community houses in the vicinity of waterways which increases the probability of contact between man and vector mosquitoes.

Problem Identification

From the outset and based on our previous work and a comprehensive review of the published literatures on the health and environmental problems in El-Faiyoum province, the following represents how the research team conceptualized the problem originally, its possible causes, and the type of research required to tackle it:

1. El-Faiyoum province's land and water resources are deteriorating due to a number of factors such as intensification of agriculture without appropriate land and water management system, water logging due to a high water table and the consequences result of soil salinization, and loss of land productivity.
2. Stagnation of water has encouraged breeding of mosquitoes, with the result that second only to Sinai; El-Faiyoum is one of the few remaining foci in Egypt where malaria is still endemic. Schistosomiasis is also highly prevalent.
3. Prior health interventions that were not based on sound ecological principles have failed to provide long lasting solutions to the province's health problems.
4. Since the environmental health risks facing the communities of this province appear to be the result of a serious impairment to their ecosystem, it is deemed necessary to employ a more ***holistic approach*** for the development of community-based solutions to the ecosystem problems.

The Research Hypotheses

Based on our experience in this area and in similar situations in Egypt, the main objective of the research is ***to test the hypothesis that postulates the potential link between the health and well-being of a community and the health of the ecosystem they live in and to find out whether the community members subscribe to such assumption***. The followings are the specific research hypotheses that were developed by the University of Alexandria multidisciplinary research team.

- Agro-ecosystems in their broad definition contain some of the fundamental determinants of human health particularly those that affect the rural poor. Thus, a better understanding of the complex nature of human health within ecosystems will be necessary to develop preventative and judicious natural resource management (NRM) and other interventions that will help achieve community health objectives.
- Environmental health risks caused by improper ecosystem management and contamination with industrial, agricultural, and domestic wastes is a major issue adversely affecting community health and livelihood and thus a major concern for the community.

- Water-associated diseases enhanced by poor land and water management and non-point sources of pollution from agricultural activities are a high health priority for El-Faiyoum community.
- Lack of reliable information and data on the ecosystem structure and dynamics made it difficult to establish the inter-relationships between ecosystem impairment and community health and well-being.
- Previous developmental research in this region may have not succeeded to achieve its anticipated impact due to reasons such as absence of community participation, failure to use gender-sensitive methods for data collection and analysis and deficiency in inter-disciplinarity of the research team.

To test the validity of the above stated research hypotheses, we are currently conducting with support from the International Development Research Centre (IDRC, Canada) and the Ford Foundation, a comprehensive field and laboratory study in a representative village of El-Faiyoum province. The main objective of this research project is to promote community health and well being in El-Faiyoum province, Egypt, through the development and implementation of ecologically sound resource management interventions to the province's ecosystem. In the following sections we report on what the research team in collaboration with the community has achieved during the first 12 months of the life of this 3-year project.

The research approach

As stated above, the main objective of this research project is to promote community health and well being in El-Faiyoum province, Egypt, through the development and implementation of ecologically sound resource management and health interventions. To achieve this objective, it was imperative to employ a **holistic and participatory approach** for assessing the ecosystem structures in order to develop community-based solutions to the health problems. Within this approach, it was possible to determine the **gender-specific** impacts of ecosystem health risks.

To implement this research approach it was necessary to form an interdisciplinary team from different complementary disciplines who would collaborate in a truly ***trans-disciplinary*** manner. The interdisciplinary team of researchers that we formed for this project is composed of environmentalists, epidemiologists, eco-toxicologists, GIS/RS and system analysis specialist, farming systems analyst, rural sociologist, and an agro-economist/policy analyst. The team involved key members of the local community from the outset to ensure that the community perceives that its needs and concerns are the same as those of the researchers. The team also collaborates with an active NGO in the district where the research is being conducted. Our team worked amicably with the community to build mutual confidence and trust between the researchers and the local populace (men and women). This was achieved through several preparatory meetings and interviews designed to get their views and concerns on what they perceive as priority health, environment and land productivity issues. A flowchart illustrating the research methodology we are currently using is shown in ***Fig. 2*** at the end of this paper.

A Report on First Year Research Activities

The research team concentrated its efforts during the first year on generating its primary data as well as collecting and evaluating available secondary data

that reflect the interactions between human health and ecosystem health. Relevant field and laboratory data that will enable our team and the community to analyze links between human health and the physical and biological environment and their mediation by socio-economic conditions were obtained. The following activities were conducted during the stated period.

- Collection and analysis of official data.
- Selection of the study area.
- Community Diagnosis.
- Ecosystem characterization and monitoring.
- Community health Assessment and monitoring.

Collection and analysis of official data

We have held meetings with the province top officials (i.e., Governor, Secretary General). The governor was very supportive of the study and offered his own and the Province staff assistance. We also had meetings with officials from MOH, MOA, and MWRI to gather the official data relevant to community health, environment, and agriculture in El-Faiyoum Province.

We have collected and analyzed the official MOH epidemiological data in El-Faiyoum province over a period of 10 years (1990-2000). Because of their importance for this region, we focused our analyses on the water-associated diseases. We analyzed the official data as to the prevalence of these diseases and the spatial and temporal distribution of confirmed cases and the disease vectors in the province. The data showed that malaria is currently localized in only two high-risk districts, Sinnuris and Faiyoum. The data indicated that the prevalence of the malaria parasite *P.vivax* has been decreasing sharply over the past ten years while *P.falciparum* malaria became the predominant species. Spatial and temporal distribution of malaria cases in El-Faiyoum province has shown that malaria cases decreased rapidly after several outbreaks during the period 1994-1996. It was also evident that the multi-sector integrated malaria control campaign of 1996 has been successful in controlling the malaria vector in Sinnuris district while it was not as successful in Faiyoum district. In the past four years there were practically no officially *recorded* new cases of malaria in the Province. The dynamics of *P. falciparum* malaria transmission in Sinnuris and Faiyoum districts indicate a situation of a prevalently hypo-endemic unstable and focal disease, subjected to epidemic cyclic exacerbation almost every 3-5 years.

Selection of the study area

The research team selected the village of ***Kafr Fazara*** for the project's in-depth research work. This selection was based on a comprehensive analysis of the official epidemiological data of the province and its districts during the past ten years and on the extensive discussions we had with government officials as well as representatives of other agencies working in the area. A comprehensive situation analysis of the village was completed in collaboration with some key members of the community which indicated that Kafr Fazara is a good representative village of other villages in the Province.

Community diagnosis

The research team used the ***participatory rural appraisal (PRA***) approach to conduct a ***community diagnosis*** of the health, environment, and land productivity issues and their priorities as perceived by the village community. The PRA may be defined as an intensive, systematic, but semi-structured learning experience carried out in a community by a multidisciplinary team with an active and full participation of the community members (Chambers, 1994; Mikkelsen, 1995). PRA provides the team/community with a powerful tool for diagnosing specific problems and highlighting possible solutions. Community diagnosis is an excellent research tool for tackling developmental problems. When local people are involved in research, they will have a real desire to resolve the problems in question, and our researchers will need such enthusiastic participation during the course of the research work and afterwards. We used the PRA techniques to help define the research issues that relate the ecosystem characteristics to environmental, agricultural, and health issues. Within this context, we employed several suitable PRA techniques namely: review of secondary sources; direct observation; key indicators; general community "*town hall"* meetings; semi-structured interviews (chain of one-on-one interviews, probing questions); construction of maps; and ranking and scoring of priorities.

As an important tool of the PRA methodology, we organized and held a ***general town- hall meeting*** in the village. Most of its inhabitants are farmers but some of the residents have other occupations e.g. merchants, civil servants and workers in the adjacent brick-making factories. The meeting was attended by a large number of the community's men and women of the village in addition to other stakeholders' e.g. local government officials, MOH officials, and agricultural co-op extension staff. The meeting was designed to identify how the community's men and women perceive and prioritize their environmental, health and land productivity issues facing them. The meeting also served as a good entry point for the research team to the village community, established good links and initiated our collaborative research efforts.

We identified an active non-governmental organization (***gameia)*** "***The Tersa association for community development***" in the village and succeeded in establishing a good working relation with them. They proved to be an excellent community partner for our research effort in the village. Based on their track record in community development work and on the community feedback, we have determined that this *gameia* has established good credibility among the village residents. Since its inception in the early eighties the *gameia* has provided and continues to provide their constituency with much needed services in areas related to education, health and welfare. Their staff was extremely helpful and enthusiastic; they provided our team with the necessary working space and logistics. Many of their educated young staff and associates participated actively and enthusiastically in our work with the community. We plan to strengthen our research partnership with them further particularly in the next phase of the project which will be concerned with the development and testing of community-based ecosystem interventions.

Ecosystem characterization and monitoring

A .The Community (The Human System)

In collaboration with the community and the village NGO, we completed a micro-level study designed to obtain a detailed description of the ecosystem

structures including the community and the dynamics between these structures. It is important for the research team to understand the behavioral aspects of the community's men, women and children i.e. to find out why people do what they do. The aim of the micro-level study was to better define the environmental, agricultural, and health-related issues as perceived by the community. We were particularly interested in getting the community's perceptions of the ecosystem degradation problems and how they are currently coping with them. Interviews were designed to collect the community's views in a gender-differentiated manner. We selected 60 households at random where we interviewed the head of the household and his/her spouse separately. Both sexes were requested to respond to the same set of questions in separate sessions using different interviewers.

Although the responses of the community are currently being analyzed; we may draw attention to some of the early findings. Community members in the village have identified schistosomiasis as a prevalent disease followed by infectious hepatitis and renal dysfunction. They were very vocal about the inadequacy of health care services that are supposed to be provided by the governmental health care unit in the village. They also raised concerns about the quality and safety of their drinking water. The low productivity of the agricultural lands and the poor quality and frequent shortages of irrigation water were some of their main concerns. The community recognized some environmental problems such as the lack of adequate sanitation system, the serious problem of solid and domestic wastes disposal as well as the prevalence of mosquitoes and house flies. It was interesting to find out that many of the community members (particularly those educated men and women) were quite convinced that there is a causal linkage between their own health and that of their environment.

B. The Physical Resources:

In order to better understand the physical components of the villages' ecosystem, we made a complete assessment and evaluation of the village's land and water resources. To do this, we acquired the topographic maps of the village and digitized these maps as the first step towards building our InfoBase. In order to make an in-depth assessment of the land resources, it was necessary to use two different types of soil evaluation techniques. The first technique was to perform a detailed survey of the land resources and obtain land capability and suitability maps. This was done by analyzing soil samples taken from thirty soil profiles representing the 1,500 acres land area of the village. The collected soil samples were to be analyzed to determine their physical, chemical, microbiological, and nutritional characteristics. We have completed the physical and chemical analyses and we are currently working on determining the microbiological and nutritional properties. The second evaluation technique was the assessment of the ***soil health*** through measuring some soil health indicators such as soil enzymes, soil organic matter, and soil biomass in surface and subsurface soil samples. The early laboratory results together with observed landscape and morphological features of the soil profiles indicate that land degradation such as secondary salinization, sodicity, and water- logging is occurring in the study area, a situation that is adversely affecting land productivity.

To assess the quality of the water resources, we collected water samples from each site where the soil was sampled (i.e., water table, irrigation and drainage canals

where available). Water samples were analyzed for parameters determining its quality as well as for the presence of some specific contaminants (e.g., pesticide residues and heavy metals). Water samples were also collected from the tested ***breeding sites*** for mosquitoes and/or snails to explore the relationships between water quality and presence and distribution of disease vectors.

The global positioning system (***GPS***) technique was used to accurately define the locations of soil and water samples, vector breeding sites, the village houses in which positive cases of schistosomiasis or malaria were confirmed or had a previous history of malaria infection. These locations were overlaid on the digitized topographic maps to start creating ***a geo-spatial and geo-referenced InfoBase*** using the Geographic Information System (***GIS***).

C. Environmental Health Risks:

Based on our field observations and community inputs , the potential environmental health risk factors identified in this study could be summarized as follows: water contact practices, closeness of residential areas to vector breeding sites, lack of accessibility to sanitation facilities and safe drinking water, low socio-economic status due to low land productivity, presence of potential hidden malaria cases, previous history of the disease, air pollution due to brick-making factories, and waterways contamination with organic pollutants particularly pesticides. Further studies will be conducted to explore these potential risk factors, relative risks, and exposure odds ratios.

Community health assessment and monitoring

Schistosomiasis and malaria are two major water-associated diseases. Malaria prevalence has been drastically declining in most of Egypt, but there are several reports of its occurrence in El-Faiyoum Province. Our own early results indicate the presence of sporadic cases of malaria particularly in the high risk areas. Likewise, both species of *Schistosoma*; *S.haematobium* and to a lesser extent *S.mansoni* have been reported to occur in this Province.

A longitudinal study was implemented in Kafr Fazara village as a representative village of the district for active case detection of the two major water-related diseases. The study was conducted on a spatial-temporal basis to cover 20% of the village's total population. Population census and mapping of the houses were carried out. The total sample size comprised around 2000 individuals. Parasitological, haematological, and biochemical studies in addition to some clinical manifestations and ultrasonographic examinations of liver, spleen, and kidneys are being carried out in order to assess the morbidity markers due to parasitic infection and the surrounding environmental health risks.

A knowledge, attitude, and practices (***KAP***) questionnaire was designed to test the current state of people's knowledge, awareness, and to get information about their clinical pictures, disease contraction, water contact activities, environmental factors which facilitate transmission, and their ways of diagnosis as well as their ways of coping with the disease. The KAP results will be incorporated into the outcomes of our laboratory examination in order to examine the inter-relationships between current infection, people knowledge/practices and the surrounding environmental health risks.

Furthermore, a prospective study was similarly conducted on previously infected *falciparum* malaria cases (80 cases during the period 1994-2001). The study also included these positive cases that were infected with either *S.mansoni* or *S. haematobium.*

Since the immune detoxification mechanisms are not fully developed in children they are especially vulnerable to environmental heath risks, it was important for us to pay closer attention to this age group. Hence, cross-sectional studies were conducted on children from two age groups (pre-school children < 5y, school children< 15y) who were subjected to the above-described clinical and laboratory examinations.

Working children (<18yrs) in the brick-making factories represent another group that is very vulnerable to environmental health risks. It was found that the prevalence of schistosomiasis among them was higher than the other village residents (23% for *S. mansoni* and 5% for *S.haematobium*) coupled with pallor malnutrition and splenomegaly. These notable results certainly justify our decision to treat this group as an especially vulnerable group. We will investigate the link between their health status on the one hand and their existing socio-economic and work conditions.

The complete data collected through these investigations are still being analyzed. However, our early findings indicate that malaria in the study area appears to be a hypo-endemic disease with stable low endemicity during the last few years. As to schistosomiasis, the data obtained so far indicate low prevalence of urinary and intestinal schistosomiasis (2% and 1%; respectively). The infection rate was higher among females due to their frequent water contact activities. Women proved to be another vulnerable group to environmental health risks due to their daily contacts with contaminated water in canals and drains. Our research team found that schistosomiasis distribution in Kafr Fazara occurs in clustered areas where both the community behavior and the surrounding environment facilitate the infection. Characterization of the ecosystem components in those areas will be explored further.

Laboratory examinations of a substantial number of subjects in the community revealed the prevalence of other parasitic diseases (e.g., intestinal helminthes, faschiola, etc). Blood analysis revealed prevalence of hepatitis C and renal dysfunction among the investigated population which was accompanied by altered liver functions and frequent increase in the detoxification enzyme activity.

What is next?

In light of the findings of the potential ecosystem-based health determinants, our team in partnership with the community will be in a better position to proceed to develop and eventually test and validate a number of community-based ecosystem management and health interventions for reducing environmental health risks and enhancing community health and wellbeing. These interventions, which will eventually translate into policy recommendations, will have to be socially acceptable and economically feasible, and environmentally-sound. The interventions will be conceived at the ***behavioral, technical,*** and ***institutional*** levels.

SUMMARY AND CONCLUSIONS

A multidisciplinary team used the participatory rural appraisal (PRA) research approach to identify how communities in El-Faiyoum province perceive their environmental, health, and land productivity problems, to describe farmers' livelihood sources and how they cope with ecosystem degradation. Related health risk factors were examined through an extensive epidemiological/clinical field survey as well as continuous monitoring of the environmental health risk factors on a spatial and temporal basis.

Based on our PRA-community diagnosis, water-associated diseases particularly ***schistosomiasis*** were found to represent a high priority health issue for El-Faiyoum community. The early findings of our epidemiological survey of the representative community revealed that malaria is currently a hypo-endemic disease while schistosomiasis is more prevalent. Laboratory examinations of a substantial number of subjects in the community revealed the prevalence of other parasitic diseases (e.g., intestinal helminthes, faschiola, etc) in addition to hepatitis C and renal dysfunction. This finding necessitated that we broaden our epidemiological survey to include these other diseases. Furthermore, the issue of contamination of water-resources available for irrigation and drinking purposes was one of the main community's concerns that were raised during participatory meetings which prompted us to pay due attention to water quality issues.

The *potential* health risk factors identified in this study could be summarized as follows: water contact practices, closeness of residential areas to vector breeding sites, accessibility to sanitation facilities and safe drinking water, low socio-economic status due to low land productivity, presence of potential hidden malaria cases, previous history of the disease, air pollution due to brick-making factories smug, and waterways contamination with organic pollutants particularly pesticides. Further studies will be conducted to explore these potential risk factors, relative risks, and exposure odds ratios.

Finally, in light of the work completed so far, we may conclude that the ecosystem under investigation is potentially vulnerable to land and water resource degradation, which could have an adverse socio-economic and health ramifications, particularly on the vulnerable groups such as women, children and the very poor. The impacts of ecosystem degradation on the community's health and wellbeing are currently being identified in collaboration with the community. Based on the results of ecosystem characterization and the identified ecosystem-based determinants of health, the research team in partnership with the community will proceed to develop and eventually test and validate a number of suitable community-based ecosystem management and health interventions for reducing environmental health risks and enhancing community health and wellbeing.

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Figure1. Conceptualization of the cycle linking poverty and poor health to ecosystem resources degradation

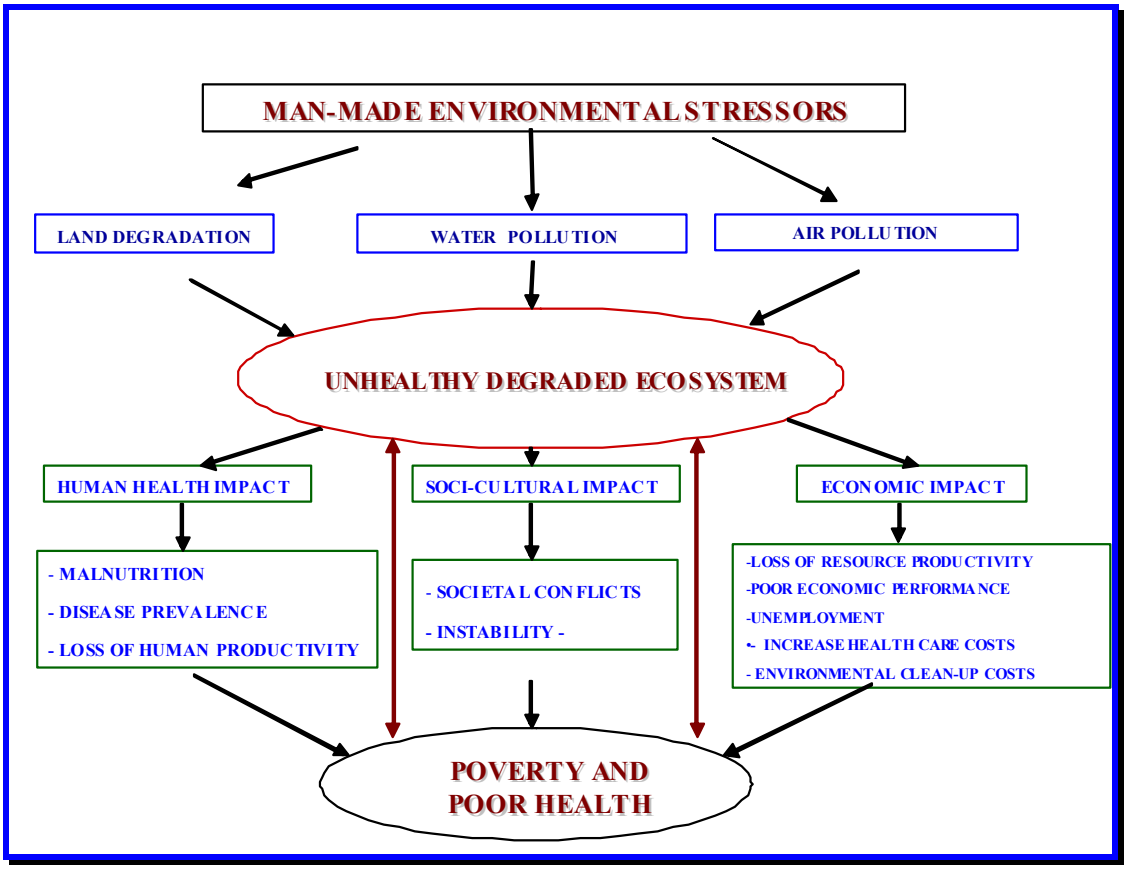

Figure 2. The holistic ecosystem approach for developing community-based health interventions: A flowchart illustrating the research methodology