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ECOSYSTEM APPROACH TO HUMAN HEALTH: A TRANSDISCIPLINARY STRATEGY

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ABSTRACT

This article presents the context and theory of the ecohealth system approach. It begins with a historical review of the miasma and hygienist theories and the initiatives of the bourgeoisie to create healthy cities and domestic environments, included for the working class. It then brings into focus the social medicine movement in the XIX Century that put the general conditions of production and reproduction into the center of the health agenda. The article also considers the environmental movement that developed rapidly after the Second World War and influenced the changing paradigms in the health area. This is emphasized in the Lalonde Model (Canada) and for the Ottawa Report of the World Health Organization. These documents introduce a comprehensive approach to the different determinants of the complex production of sanitation and disease patterns. The article presents the ecosystem approach to human health that has been under development since the 1970s, based on the Canadian experience. Their principles are: understand the context and complexity of the problems, but act locally; involve all the social actors (people, governors, managers, enterprisers, professionals and technicians) in the solution of the problems; use science and technology as a change strategy; work with social participation and empowerment of the individuals; take into account the different roles of men, women, children and elders in the social construction of the changes needed; adopt an inter- and trans-disciplinary perspective, in which disciplinary fragments are pulled together and deployed in pursuit of quality of life and a healthy environment.

Keywords: health and environment; ecosystem approach to human health; collective health.

INTRODUCTION

This paper addresses principally methodological issues, focusing on a integrative strategy for research and intervention – the ecosystem approach to human health – which has emerged as one key approach to problems located at the intersection of environment and health. We call this strategy “transdisciplinary”. *Transdisciplinarity* is here understood as an open and dialogical vision that draws on the “disciplinary fragments” of various specialists working cooperatively to understand the subject in question, and also draws on the intuition, imaginary, sensibility and common sense of lay participants. It rejects technocracy, in favor of a knowledge oriented to finding solutions to problems. However, transdisciplinarity is not a new metaphysics, nor a new philosophy, nor even a science of the sciences. It involves crossing disciplinary boundaries, thereby bringing knowledges into contact with each other and with the lifeworld in order to create a truly new knowledge, based on the harmonization of a plurality of voices, perspectives and explanations. We will first summarize some historical conceptions of the connection between environmental conditions and health, as well as proposals for interventions in this field.

Concern with the effects of environmental conditions on health dates back to Antiquity. In his treatise *On Airs, Waters and Places*, the physician Hippocrates describes the influence of the relation between environment and health, especially climate, topography, water quality, and also political organization (ROSEN, 1983). Starting in the 18th and 19th centuries, environmental problems began to be linked to health, living conditions and work, with the intensification of industrialization and urbanization in the West. However, interventions in sanitation measures in this context were based on the theory of miasmas, according to which external impurities and noxious exhalations from putrefaction of wastes should be eliminated to avoid spreading disease. Government hygienic programs were introduced as a strategy for monitoring urban spaces and particular human groups, especially the poor and working class. This strategy can be seen in such classic works as *The Condition of the Working Class in England* (ENGELS, 1974) and *Le petit travailleur infatigable* (MURAD and ZYLBERMAN, 1980), about coal mines in France. It is aimed at providing a sanitized domestic environment for workers and working class families, to ensure adequate conditions for the reproduction of the labour force.

The focus changed with the *social medicine* movement, which developed in three distinct stages: *State medicine* – an entirely state-driven model of medical practice in the mid 18th century in Germany; *urban medicine*, in the late 18th century in France, focused on problems created by urbanization; and *occupational medicine*, starting in the 19th century in England, aimed at controlling the poor and proletariat population, as a response to conflicts generated by industrial development (FOUCAULT, 1983). This movement was based on the idea of health as resulting from living and environmental conditions. Thus, the environment should not just be “medicalized” through rules, controls and monitoring. Health issues and the control of most illnesses require actions involving political and social mobilization aimed at achieving better conditions for family life, neighborhoods and the organization of cities (NUNES, 1999). Many current ideas in collective health have roots in this period, when great names in medicine such as Salomon Neuman, Rudolf Virchow, Jules Guérin, and William Farr (NUNES, 1985; 1999) emphasized the political dimension of the concept of health, linked with social issues, basic sanitation and policy formulation. These authors argued that the State should actively intervene in addressing health problems, which meant bringing about profound changes in the political and social structure, to transform the determinants of the health-illness process. Virchow’s recommendations to the Prussian government, based on an analysis of the 1848 typhoid epidemic, took this direction. Based on the assumption that epidemics are a manifestation of social and cultural imbalances, it would be necessary to intervene in the economic, social and political root causes. His recommendations included political reform and decentralization of responsibilities to local governments, investment in education, economic changes to democratize access to goods and services, reforms to agricultural production, road construction, and a requirement that professors and doctors speak the language of the population. Particularly instructive here is the work of McKeown and Löwe (1984), who attribute the drop in infant mortality and the increase of life expectancy – over the 19th century and up to the advent of penicillin in the mid-20th century – more to the improvement of general living conditions than to strictly medical interventions.

From the late 19th century to the mid 20th century, the social medicine movement went through a serious decline. The “bacteria revolution”, which brought so many benefits to humanity, had the collateral effect of marginalizing the ecological and social factors that were the focus of social medicine, and this approach permeates the mentality of most professionals in the biomedical area to the present day. The leading bacteriology

researchers thought that with the discoveries of biology, “social considerations and reflections on social policies” would disappear (NUNES, 1985, p. 34), as the solutions brought by science and technology would make it possible to supersede the political and ideological discourses that they considered to be contaminating medicine. The emphasis shifted to medical intervention and research devoted to the discovery of diseases as biologically defined entities and to the eradication of acute infectious diseases through vaccination, based on the utopia of elimination of all disease. With this return to a more hygienist and biologicistic vision, the discourse and practice of the new sanitationists came to be based on the application of technologies and on the rational organization of prophylactic activities aimed at the poor and miserable populations. From an environmental point of view, sanitation and control of vectors are the key strategies.

Since the Second World War, social thinking, embodying a more complex vision of the connection between environmental issues and health, regained its influence to the point where it is again part of political agendas and government policies. The threats of chemical and radioactive pollution and other disastrous events of this kind, along with the oil crisis, show the limits of natural resource exploitation. And the *environmental movement* was emerging and would gain strength, driven by various processes: 1) a growing level of environmental degradation and the ecological risks to life on the planet; 2) forecast scarcity of basic natural resources for production and consumption; 3) criticism of liberal thought based on the idea of infinite abundance of goods; 4) social pressure to control industrial risks (FREITAS et al., 1999), especially in the chemical industry. Such pressure in this sector resulted from the wide range of risks posed by production processes, including the countless basic, intermediate and final products, whose toxicological and eco-toxicological properties can create a wide range of pathological processes and/or environmental destruction, both acute and chronic.

Various approaches have been proposed in recent decades for analyzing the complex relations between the environments where daily life takes place and the health standards resulting from the social, economic and political structure and the organization of the health sector. One of the most important approaches is found in the “*Lalonde model*” (1974), adopted by the Canadian government in the reorganization of the country’s public health system starting in the late 1970s, and which contrasted with the dominant vision of a principally curative approach to health care. This model covers: 1) care of the

bio-physical space; 2) attention to social factors; 3) the importance of individual attributes, expressed in lifestyles, and 4) genetic influences. This approach is based on the understanding that each of these components must be considered in their specificity and in their interaction with the others. Lalonde's document emphasizes that the four component elements of the model work as modulators of the effects of the different causative agents of illnesses or of promotion of health.

The First International Conference on Health Promotion, held in 1986 in Ottawa, Canada (Brazil, 1996), whose thinking was based on the model of the Canadian health system, sought principally to propose action strategies for environmental protection and health promotion. It focused both on the quality of sectoral systems and services and on encouraging personal responsibility for prevention of illness and the promotion of healthy behavior, attitudes and practices. This Conference was very important, in that it broke down the classic division that had traditionally separated public and clinical health, and that between the duty of the State to provide care and services and the responsibility of citizens. The importance of the Ottawa Charter is also indicated by its affinity with the conclusions of health researchers about the various types of epidemiological transitions that have been taking place in the world, where social and environmental conditions and lifestyle have increasingly been taking precedence over infectious and transmissible diseases. These accelerating changes can no longer be addressed from a narrow medical perspective, because they show that we are all (governments, professionals and the population) responsible for the level of health that we choose (consciously or unconsciously) for ourselves as individuals and for the society we live in. The transformation in perspective provided by the Ottawa Charter required a new form of thinking and management for the health sector. Health professionals were encouraged to take an approach that considered the range of determinants of the complex production of patterns of sanitation and illness, going beyond the reductionist explanations of the Flexnerian paradigm and the traditional biologicistic focus.

In 1986, Brazil held the VIII National Health Conference, considered a landmark in the development of a new conception that incorporates a social perspective on the determinants of processes leading to illness or to a healthy life. This event saw the formulation of guidelines for the financial, organizational and institutional restructuring of the public health sector. However, from the environmental point of view, the final

Conference document only called attention to the relations between health and basic sanitation, within the classical sanitationist tradition.

Integrated approaches to health and the environment date back to the end of the 1980s, when environmentalists and sanitationists, researchers and managers began to perceive the need for a better integration of theory and action with the idea of quality of life of concrete population groups. This idea grew out of the conviction that there could be no sustainable development without taking into account human beings and their relation to the ecosystem. However, understanding the impact of human activities on the environment, and the influence of this impact on human health, requires creating specific strategies which, based on disciplinary knowledges and sectoral practice, lead in the direction of a transdisciplinary approach.

The “*ecosystem approach to human health*” aims precisely at a theoretical and practical interdisciplinary integration of health and the environment through the development of science and technology, generated and applied in cooperation with public and private managers, civil society and the affected populations.

For many reasons, traditional methods have not been able to improve welfare, health and the sanitary conditions of the poor population or to create a more solidary world for all citizens. The biomedical model on its own is too narrow. A social vision lacking ecological understanding is also reductionist. And a technological fix is insufficient to address the interaction of the various factors. To achieve a balance between ecosystem and human health, it is necessary to experiment with new strategies.

It is in this context that a new relation between health and environment was developed – *the ecosystem approach to human health* – which is relatively new, but whose results are already recognized worldwide for their effectiveness in creating solutions to a range of problems where two factors play key roles.

ECOSYSTEM APPROACH TO HUMAN HEALTH

Linking ecosystem and human health, the foundation of the *ecosystem approach to human health*, emerges from practical challenges. It responds to an ecological concern that Americans and Canadians have shown in relation to the Great Lakes Region, which contains 21% of the world's fresh water. Its shorelines were invaded by agricultural and industrial development that accompanied the post-war North American economic boom, under the dominant idea that the ecosystems would be capable of assimilating all the processes of human domination over nature. Based on the expansion and deepening of environmental awareness in the 1970s, and concern of citizens about increased pollution and destructive practices involving the Great Lakes, a range of studies, meetings and analyses began to be carried out by a commission created by the Canadian and U.S. governments. Called the International Joint Commission (IJC) (1978), this body conducted a diagnosis of the intense economic exploitation of the socio-political-cultural-environmental space, the process of ecological degradation, and the health threats posed to the human inhabitants of the region (FORGET and LEBEL, 2001).

These studies show the theoretical shortcomings of unidisciplinary approaches in understanding the dimensions of the problems created by, in this case, uncontrolled use of water and soil, and in arriving at adequate solutions. They also show that the success of strategic proposals depend on the degree of involvement of regulators, managers, companies and citizens. These conclusions led to a new theoretical and practical strategy: integrating the analyses generated individually and involving civil society and government to participate in discussions and to commit to implementing solutions.

The objective of the *ecosystem approach* is to develop new knowledge about the health-environmental interface, focusing on concrete realities, leading to the introduction of appropriate and healthy activities for the people living there. This is based on a union of science and lifeworld in improving the quality of social life and of the planet, with collective and individual responsibility. This approach can be seen as a concrete strategy for developing the capacities of individual subjects and for strengthening community actions in order to make healthy choices, within a holistic and ecological perspective of health promotion.

It is based on three key pillars: transdisciplinarity, social participation and gender equality.

Transdisciplinarity, in this approach, is an epistemological requirement for dealing with the complexity of interaction of various social, economic and environmental components of the ecosystem, especially when the intention is not just to diagnose problems, but also to find solutions. Finding effective solutions requires not only researchers from various disciplines, but also involvement of local populations and community representatives – as bearers of experiences, knowledge and expectations – and committed managers, as described in the introduction. Thus transdisciplinarity, along with being a way of seeing the world and a dialogical perspective, is principally a theoretical and practical construction required in carrying out research following the ecosystem approach to health. It results from the active participation of researchers and community members in the production of knowledge and identification of solutions as agents of change. Shared knowledge, based on a common interest and respect among all involved, leads to a vision of reality impossible to achieve within isolated disciplines.

The concept of *social participation* used in this strategy refers to the integration of all those with an interest in and responsible for the construction of knowledge and solutions to problems. For this reason, the concept also includes the idea of “popular participation” which involves including people from the population vulnerable to the health and environmental problems. But it is much broader. It includes public officials, business leaders, managers and workers, all making their particular contribution to creating a healthy perspective. When researchers confuse social participation with popular participation, they are victim of a misunderstanding, which involves blaming the population for their incapacity to resolve their problems, when in fact the solution does not depend on them alone, but also on other social and institutional actors.

Gender equality implies drawing a distinction between sex – the biological *status* of being a man or woman – and the socially constructed attributes in relations between them. It takes into account the fact that men and women, in their social life and in production processes and creation of wealth, have specific roles. Gender is thus the dimension of relations between the sexes, which defines social behavior and the distinct forms of relations within the family, the workplace and the community. For this reason, gender can be considered a political and socio-economic variable through which roles, responsibilities, contradictions and difficulties between men and women can be analyzed.

The focus on gender lends a different significance to the collaboration of both sexes in defining problems and finding solutions.

Along with gender, there are other categories which differentiate people in a social group. The most powerful such category is *social class* (the perspectives and contributions of each group are different). But there is also *age* (children, youth, adults and the elderly participate in solving problems in different ways), and others such as *ethnicity* and *religion*. Such characteristics need to be considered, because they often serve to facilitate or prevent actions that require a range of views and perspectives.

Some principles derived from the international environmental movement, which have been gradually adapted to the realities of specific countries and places have inspired the approach, which calls for:

Understanding global problems and acting locally, since international actions and national, local, group and individual initiatives can cause transformative or negative impacts on the collective environment;

Take into account the different roles of men and women and between the various age groups and different social, political and economic actors in their relations with nature and the environment. Understanding the responsibilities and rights of each allows specific approaches, practices and forms of participation in management processes and interventions.

Adopt a methodology whose philosophical basis is communicative, open, inclusive and with responsibilities shared among all. Thus both research and practical actions should involve the various actors responsible for the issues related to the environment, in an approach that scientists from the area call “post-normal science” (Funtowicz and Ravetz, 1997) or “extended peer community”, to refer to the different categories of actors that should be included throughout all the stages necessary to design and carry out the activities.

In accordance with the systemic paradigm, the work should recognize the complexity of phenomenon, the instability of the world of living beings and intersubjectivity in the process of construction of reality and its understanding.

Three epistemological dimensions set traditional theories apart from the systemic approach: 1) the idea of simplicity of phenomenon is replaced by the notion of complexity; 2) the notion of stability and of regularity is counterposed to the notion of the instability of the world of living beings; 3) the belief in objectivity gives way to the idea of intersubjectivity in the constitution of reality and understanding of it.

Complex phenomenon or systems, in contrast to simple ones, consist of large numbers of constitutive and inter-related elements, which maintain a permanent, but at the same time instable, structure. Research issues are understood as objects in context, which requires logical procedures that are the opposite of separation and reduction, emphasizing the fact that the phenomenon has its specific qualities, but is integrated into the whole that it forms part of. The phenomenon being researched thus has to be understood in its interactions and treated as part of a system interconnected with other systems.

The idea of instability comes from the realization that the world is always in a process of “becoming” and in flux, and there is thus a logic in the disorder. It is an element necessary to self-organization, described by Atlan (1992) as self-organization through noise (noise as a synonym of crisis), which can lead living beings to a higher level of complexity.

Intersubjectivity in the construction of reality and knowledge contrasts with the idea of the possibility of an objective knowledge external to the subjects. From that point of view, the subject and object only exist relationally and in the interactions they establish between themselves.

From an operational point of view, systemic thought doesn't propose techniques, but enables the use of resources developed in the paradigms of traditional science. It requires a perspective and approach different from a unidimensional vision, and seeks to make differences and oppositions communicate, in contrast to the conventional approach that only recognizes regularities and rules. It shows the things that remain permanent and emphasizes “what” changes and “how” things transform, through selforganization.

Researchers who have adopted and assessed the ecosystem approach to human health demonstrate that there is no one pre-defined ecosystem upon which one can impose a definition. Rather, it is the actors that act on it – whether researchers, residents or managers – who should assume the responsibility for defining it, in accordance with the objectives of the change or intervention, taking into account the fact that the space thus delimited is situated within larger systems (Forget and Lebel, 2001). Therefore, the notion of ecosystem is used much more as an analytical unit than as a biological entity.

From the point of view of sanitation, the health-illness duality is a collective process, and it is thus necessary to recover, from within this collective, the sense of “place” as an organized space for analysis and intervention, seeking in each specific situation to identify the relations between health conditions and their cultural, social and environmental determinants, within ecosystems modified by production and other human interventions.

The ecosystem approach to health issues, as part of a process of sustainable development process, is based on the following assumptions:

There is a dynamic interaction between the various components of the ecosystem, social and economic aspirations of communities, their well-being, and human health;

Interdisciplinary projects that draw on gender analysis and participatory methods in understanding reality and to generate actions and transformation can produce more precise research results and allow the promotion of improvements in standards of human health and the environment.

Coordination between the components of health and the ecosystem require new methodologies to evaluate impact.

Some of the principal methodological challenges include:

Changing the linear focus of different disciplinary perspectives to a dynamic interactive focus, drawing on transdisciplinarity and establishing a common language among those involved, which requires a great capacity for synthesis and sensibility to recognize the contributions of others and one’s own limitations;

Integrating quantitative and qualitative data and indicators;

Adequately incorporating the concept of gender into the methodology;

Commitment by public and private managers, with full participation in terms of comprehension of the approach and implementation of policies suggested by the research results;

Achieving the participation of all the social actors involved in the problem being analyzed, either because they are carrying out the environmental interventions or because they suffer from the health problems;

Ensure the effective participation of the beneficiary communities in assessment of the interventions and in the interpretation of the progress achieved;

Ensuring financial support over the entire period of the project;

Going beyond a mere accumulation of data and problem description, to identifying, throughout the research, spaces for intersectoral negotiation and viable and practical solutions.

Financing institutions and agencies should include other criteria in the allocation of resources and assessment of results beyond merely calculating the number of papers published.

Along with these methodological issues are others of a more operational nature, such as:

Historical mapping of interactions that caused or are causing environmental degradation and health problems;

Delimitation of the universe to be examined, to allow representation of the principal problems to be studied;

Diagnosis, over distinct and synchronized times, which includes specific technical and disciplinary analysis of the different components of the situation with a gender focus, and includes historical, economic, biological, geophysical, cultural and social factors, along with the exercise of power, productive and reproductive activity, epidemiological profile of the population, etc.

Description of the practical and participatory instruments for ensuring transdisciplinarity and transectoriality;

Participation of common people who live with the environmental and health problems in their day to day lives as a fundamental and indispensable premise.

Various researchers have been working on applying and refining this approach in North America, South America, Central America, the Middle East, Asia and Africa, showing the importance of this type of strategy, which frees the examination of the intersection of health and environment from reductionist models and removes it from the repetitive agendas of political speeches.

Two examples taken from Lebel (2005) can serve to illustrate this approach.

1. Interdisciplinary management of mercury contamination in the Amazon region

In 1995, a team financed by the International Development Research Centre (IDRC) from Canada, and made up of researchers from the Federal University of Pará, Federal University of Rio de Janeiro and the University of Quebec made a surprising discovery: contamination of soil, fish and the population by mercury, until then believed to result from mining operations, was in fact closely linked to certain agricultural practices. This discovery was possible thanks to the transdisciplinary contribution of specialists from the area of fisheries, aquatic ecology, toxicology, epidemiology, biology, agriculture, human health, social sciences, nutrition and education and health, along with the participation of local residents.

Since 1970, the banks of the Tapajós River had been settled by gold miners, in an unregulated gold rush. The artisanal method for extracting gold was through amalgamation with mercury. The population was contaminated through inhalation of mercury vapor liberated during the heating of the amalgam and ingestion of fish, the principal food source in the region. When they arrived at the site, the researchers expected to find that mercury contamination, then attributed to mining, would decrease as distance between the Tapajós River and the mining sites increased. But to their surprise, mercury concentrations remained high up to 400 km from the gold mining sites. This indicated that mercury contamination was coming from sources other than mining.

The studies showed that long ago the volcanoes that had existed in the region had discharged mercury, which was deposited on the soil. It is estimated that the most affected soils in the Amazon region accumulated mercury over 500,000 to a million years. Since the 1950s, settlers attracted by the availability of arable land have cleared and

burned more than 2.5 million hectares of the Amazon forest, especially along the riverbanks. The constant rainfall on the denuded soil washed the mercury into the rivers, where bacteria converted it into toxic methylmercury. The contaminated bacteria pass the methylmercury to small fish, which serve as food for larger fish, many of which become food for the human populations along the rivers.

A painstaking and continuous interdisciplinary field study, made possible through a gradual process of relationship-building between the researchers and the population, showed that although the mercury levels in the hair of the populations along the rivers were within the standards established by the WHO, many residents showed signs and the effects of contamination, such as loss of motor coordination and manual dexterity and vision problems. It appeared that the amount of methylmercury in the bodies of the local population was related to the type of fish they ate. Those eating herbivorous fish were less affected.

Based on the initial diagnostic, the second phase of the projects involved working with the local population to find potential solutions to the health problems. The group of researchers established a close relationship with the community, especially with the women, local teachers, health professionals and fisherfolk. One of the results of this effort was the distribution of posters with illustrations of the different types of fish and their level of contamination by methylmercury. Today everyone in this community knows that it is best not to eat fish that eat other fish, because the increased concentration of methylmercury contamination in the large carnivorous fish affects the health of people who eat them. The interventions based on scientific evidence and in collaboration with the school, the health clinic and the population have had concrete benefits: from 1995 to now, the concentration of mercury among the residents dropped 40%.

Over several months, women respected by the community made a daily record of what 30 families ate. A hair analysis showed that the level of mercury was lower in people who ate more fruit. This initiative led to the selection of foods that contributed to reducing the contamination of the population (Lebel, 2005).

Local residents also began to change agricultural techniques. In a joint initiative with the researchers, small farmers identified the crops that could improve diets and

reduce the intake of mercury. The researchers also worked with local fisherfolk to identify the stretches of the river with the least chance of transforming mercury into methylmercury, and which would thus be more appropriate for fishing.

In collaboration with the community, the scientific results are still being applied to improve health, respect the environment and improve quality of life.

2. Banning use of DDT in Mexico

During the 1940s and 50s, 2.4 million Mexicans contracted malaria each year and 24,000 people died as a result. To eradicate the disease, government efforts focused on the widespread use of the insecticide DDT. However, the continued use of DDT posed a threat to ecosystem health. Under the North American Free Trade Agreement (NAFTA), Mexico was required to completely eliminate use of DDT by 2002.

Seeking a more ecologically sound way to address the problem of malaria, researchers from the National Public Health Institute began a research project following the ecosystem health approach, bringing together knowledge from specialists in epidemiology, entomology and social sciences, along with representatives from government and local communities.

This team accumulated a great amount of information on the incidence of malaria in 2000 communities. The data obtained was put into a georeferencing system, and led to the conclusion that the mosquitoes (malaria vectors) didn't travel very far from sites with a suitable environment for them to feed and lay their eggs. Thus, humans were the vectors of malaria, which was why researchers found more cases of malaria in populations located along highways.

With the help of the community, the social scientists studied living conditions of the populations involved in the project, including differences in behavior between men and women. It was found, for example, that the women had more chances of being bitten in the morning, when they went out to get water for household activities. Men, on the other hand, are bitten in the evening, in the coffee plantations.

A range of preventative measures were implemented and continue to the present day. The scientists proposed another insecticide which did not persist in the environment. They built a more powerful spray nozzle that used less insecticide, able to cover up to 40 houses per day. A new instrument was also developed that could detect the presence or absence of malaria in a patient's blood in a few minutes. This instrument was a great improvement over laboratory exams that take three or four weeks to confirm a diagnosis. Currently a team of local volunteers are carrying out the exam in 60 communities.

Thus, the elimination of malaria in Mexico is under way, and is no longer seen as the responsibility of the government alone. Every two weeks, women from the communities included in the program remove algae that provide the environment suitable for mosquito larvae in the water. As a result the number of malaria cases in Oaxaca, the region where the project has been implemented, fell from 15,000 in 1998 to only 400 in 2002, without the use of DDT. According to project coordinator Dr. Mário H. Rodriguez, Director of Research on infectious diseases from the National Public Health Institute, "our experience shows us that we should strengthen research in the social sciences component if we want to extend this program to other parts of the country. The challenge is to obtain experiences that lead us to an expanded scale".

FINAL REMARKS

Many other experiences in applying this model are being carried out in ecosystems both large and small, in rural and urban areas, in very different places and regions. The reasons for the adoption of this approach include the nature of the problems in question, the institutional context, the position of public managers, the degree of mobilization of the populations, the disciplinary commitments of the researchers, and finally, the actors that took the initiative to go ahead with the project.

The set of guiding parameters for these localized actions permit the possibility of overcoming the destructive anthropocentric environmental paradigm. The methodological approach and operational guidance are clear and specific, as is the requirement for interdisciplinary treatment, the pursuit of equity, including gender equity, and the participation of all actors involved. These are new forms of investigation that involve practices such as coordination with social movements, a protagonist role for community

members, and government involvement, with the goal of introducing concrete changes environmental and health conditions. This promising perspective could be interpreted as a re-reading of community development strategies – which reached their peak in the second half of the 20th century and are today reemerging as a new understanding of the health-environment relationship – which is not limited to incorporating the widest range of levels of community and popular participation, but also pursues the effective engagement of public officials, politicians, business leaders and other individual or collective actors involved in the problem to be addressed. In this regard it is worth asking what, after all these years of work inspired by this model and taking into account the variety of communities where this practice has been carried out, are the indispensable elements in undertaking activities of this nature.

Based on the description of the model and its application in a range of spaces, one could conclude that there is no one established paradigm as a scientific method for this approach. All those involved are considered builders of this phase of consolidation of the ecosystem approach. In this regard, the observation of the formulators of this approach, Forget and Lebell (2001), is appropriate: far from making exaggerated claims, they recognize that this model is not intended as a new scientific paradigm, but rather it offers a *metaphor* for theoretical and practical work.

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