

# ONE HEALTH: AN ECOSYSTEM- BASED ECOLOGY OF HEALTH

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Serge Morand is a researcher who specializes in the social ecology of health. A field ecologist and parasitologist, he studies relationships between biodiversity and health, the interfaces between people, wild and domestic animals, and the environment. He leads missions and projects looking at impact of land-use changes on the emergence of zoonotic diseases in southeast Asia. He is a CNRS-Cirad research scientist based in southeast Asia and Invited Professor at the Kasetsart University Faculty of Veterinarian Technology and Mahidol University Faculty of Tropical Medicine. He is a member of the One Health (OHHLEP)<sup>1</sup> international expert panel.

<sup>1</sup> One Health High Level Expert Panel, launched jointly by WHO-OIE-FAO-UNEP. See the list of members here: <https://www.who.int/groups/one-health-high-level-expert-panel/members>.

Scientific studies paint an alarming picture of environmental damage and the associated health risks. The challenges are numerous and the ecosystem approach offers a response to interlinked environmental and health challenges, thanks to the One Health concept that provides a systemic understanding of ecological transformation. The concept is used in international governance, by UN agencies, as well as in national governance. France has established a One Health monitoring group within the framework of its 4th National Health & Environment Plan. Concrete implementation of the concept using One Health social ecology methods is illustrated in the form of co-constructed projects in southeast Asia involving scientists, local authorities, economic actors and local administrations. Characterized by a new form of One Health governance that is more environmentally focused, the impacts of these projects will be felt over the medium or even long term to respond to global environmental and health issues.

## INTRODUCTION

The COVID-19 pandemic caused by the SARS-CoV-2 virus has created a global health, social and economic crisis that shines a spotlight on the systemic malfunctioning of our relationships with nature. Although the exact trigger for the epidemic remains little understood, there is no arguing that the origin of the virus lies with an Asiatic bat. We now have to understand how a virus, one of millions found among animals in the wild, was able to emerge and spread across the entire planet. The risks of such a pandemic were all too predictable. Emerging viruses and epidemics of infectious diseases affecting humans, animals and plants have been rising constantly for the past several decades. In report after report, scientists link these health risks to the damage done to how ecosystems operate. The current health crisis has reinforced the need to act by turning to holistic approaches, particularly those based on ecosystems.



## WIDELY ACKNOWLEDGED FACTS

Countless scientific works demonstrate the impacts on human health of global changes such as the climate change, loss of biodiversity, industrialization of agriculture, intensification of livestock rearing, damage to habitats and unchecked urbanization. Globally, close to 25% of all deaths and causes of morbidity can be attributed to environmental factors. The increase in epidemics of infectious diseases observed over the past few years appears directly linked to the uptick in livestock rearing and landuse changes, such as the conversion of forests into commercial plantations. The globalization of international trade favors the spread of epidemics that become increasingly global, resulting in pandemics. The last pandemic H1N1 swine fever emerged at a North American mega-farm in 2009 before spreading across the planet.

The environment’s role in health has long been recognized. Back in 1968, the UNESCO conference on the biosphere declared that “man is an integral part of most ecosystems, not only influencing but being influenced by his environment,

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that his physical and mental health, now and in the future, are intimately linked with the dynamic system of natural objects, forces and processes that interact within the biosphere and including also those of man’s culture.”

The Millennium Ecosystem Assessment, which ran from 2001 to 2005, again stressed the functional link between the environment, biodiversity, health and the well-being of human populations. This functional link is embodied in the ecosystem approach and the idea of ecosystemic services. The ecosystem approach is defined as an integrated strategy for management of land, water and living resources that seeks to promote the conservation and sustainable use of these natural resources, while also contributing to human fulfillment and well-being. This approach is based on the application of appropriate scientific methodologies at various levels of

biological organization, including the essential processes, functions and interactions among organisms, humans, and their environment. As applied to human health, the principles of an ecosystemic approach to health are interdisciplinarity, systemic thinking, participative research, sustainability, social and gender equality, and the shift from knowledge to action.

## The effects of globalization of trade and mobility on the risks of emerging infectious diseases and pandemics in relation to land-use changes, increasing infrastructure and rising demand for natural resources

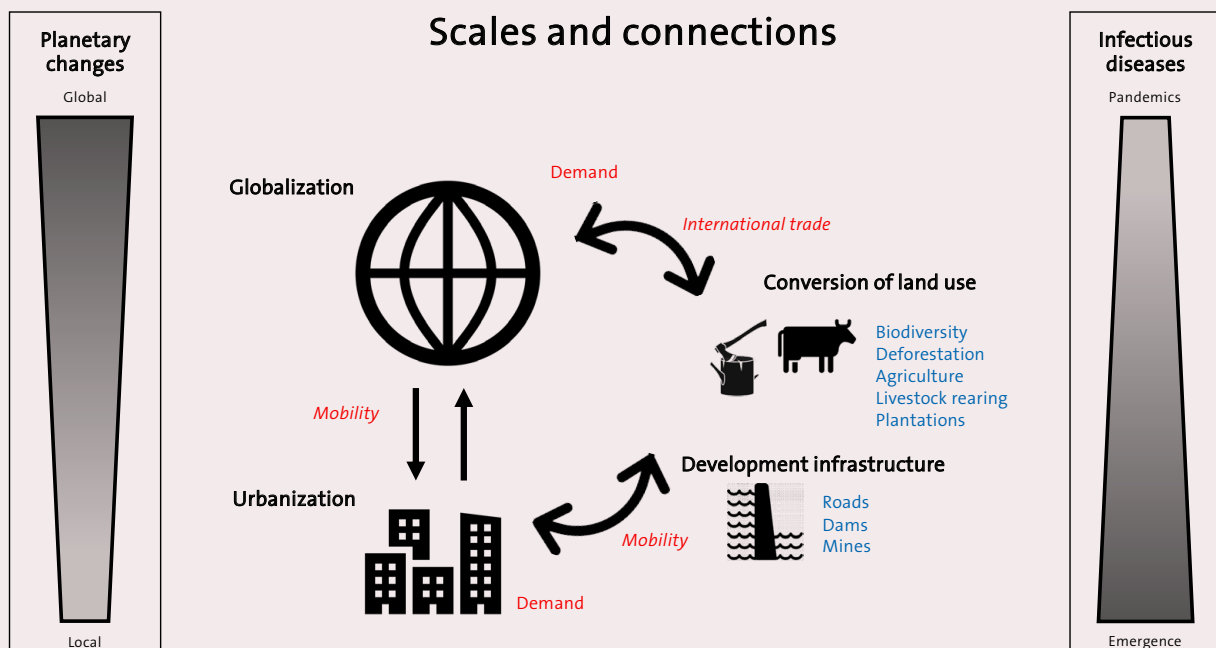


Figure 1



In June 2021, the United Nations Environment Programme (UNEP) joined the tripartite One Health program, encompassing the World Health Organization (WHO), the World Organization for Animal Health (OIE) and the Food and Agriculture Organization of the United Nations (FAO), in order to introduce an environmental dimension to the One Health approach. These four intergovernmental bodies appointed a One Health High Level Panel (OHHLEP) of experts tasked with providing an actionable scientific assessment to inform decision-making with a view to preventing the emergence and epidemics of zoonotic diseases caused by modifications to interfaces between humans and wild or domestic animals. Another recently launched body is the Planetary Health Alliance, which aims to promote and unify local initiatives able to achieve a transition to human activities that are aligned with nature.

France is also taking action. In September 2021, it set up a One Health monitoring group within the framework of the 4th National Health & Environment Plan. A white paper was published in November 2021 containing proposals for actions needed to establish a One Health policy for France. The country's national parks have also adopted a wildlife health strategy for the years up to 2027.

## CHALLENGES

However, there remain many challenges to an ecosystem-based approach to health targets. The ecosystemic approach requires a very different mindset from approaches governed by silos and sectoral thinking, even more so as human health policies increasingly focus on treatment rather than prevention. Environmental health is reduced to being simply a matter of avoiding exposure to chemical or biological substances that are harmful to individual health. In the face of repeated health crises, animal health is reduced to a focus on biosurveillance and biosecurity. This results in an alteration in our relationships with wild and domesticated animals, which are seen as potential dangers and a risk to humans. These sectoral policies encourage the clearance of natural environments and isolate the natural world, despite the fact that the psychological benefits of contacts with biodiversity and nature are increasingly recognized.

Scientific ecology, on the other hand, has begun to concern itself with environmental and global health issues only very recently. The ecological sciences struggle to communicate complex notions, particularly when these involve references to systemic thinking, to practitioners seeking to treat health-adjacent problems or to provide emergency responses to health crises. With considerable efforts focused on the ecology of conserving natural environments and wild areas, scientific ecology has failed to interact

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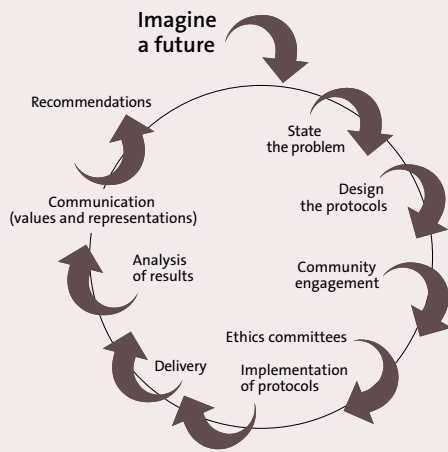
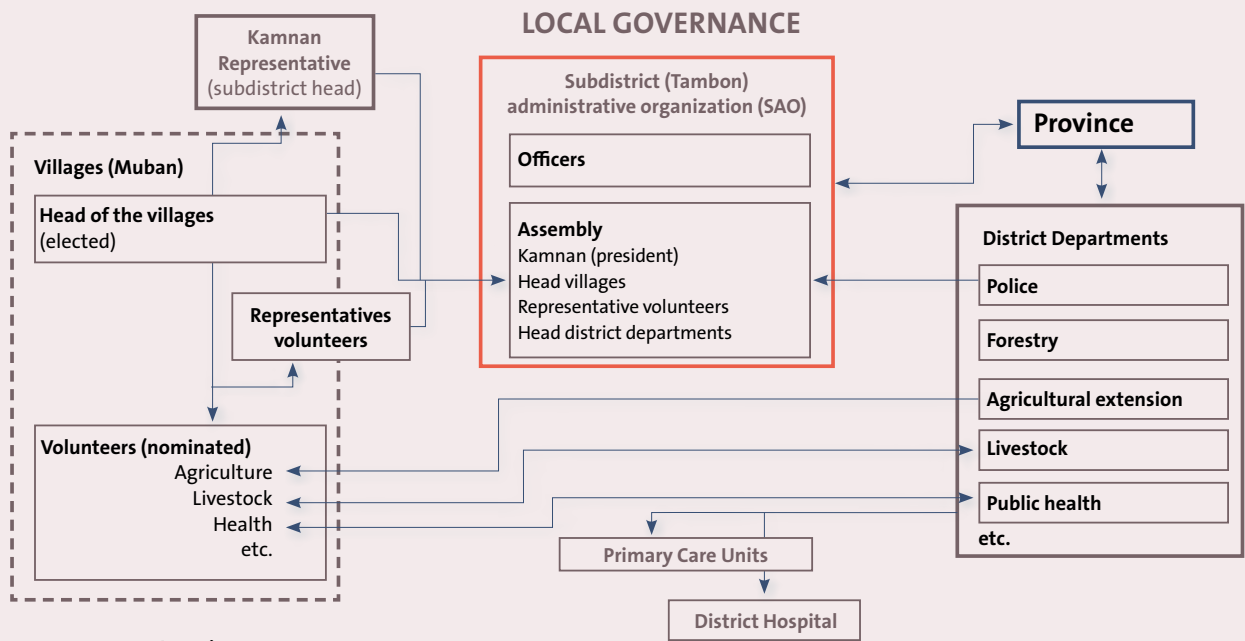
sufficiently with human and animal health. Yet, following the WHO's "Health in all Policies" recommendations has never been more urgent. We still have a long road to travel, as can be seen in the paucity of dialogue and inter-sectoral actions during health crises. In a similar vein, the idea is

to incorporate ecology in all policies, including those that impact the health of humans, animals or plants. The One Health approach offers this opportunity for dialogue and actions that can provide a response to environmental and health challenges.

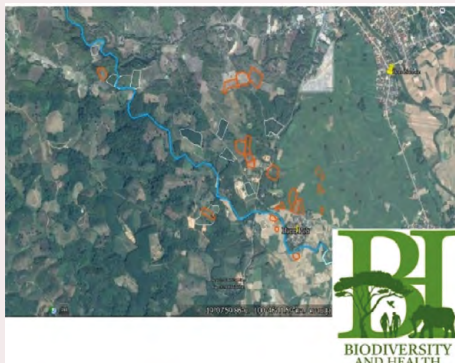
Ecology of health is a recent scientific field that seeks to contribute to our understanding of health problems at the interfaces between humans, wild and domestic animals, and their environments. Ecology of health requires abandoning silos between disciplines and sectors, instead developing collaborative projects constructed jointly by scientists, residents, economic actors and administrations. A One Health social ecology that is truly inter-sectoral in its expertise requires knowledge and representations to be shared between scientists, administrations, civil society communities and economic actors. The goal is to move beyond a traditional vision of educating citizens and other actors, shifting instead to a shared understanding of the knowledge, values and visions espoused by these various actors. This development requires a methodology and some real-life examples for inspiration.



## Schematic diagram of a social ecology of health research project, rooted in actors' local governance (leaders and volunteers from village communities, administrations, and clinics), whose involvement is depicted in the form of a dynamic network



### ACQUISITION OF SHARED DATA PARTICIPATIVE MAPPING



### NETWORK OF ACTORS, COMMUNITIES, ADMINISTRATIONS, AND RESEARCHERS

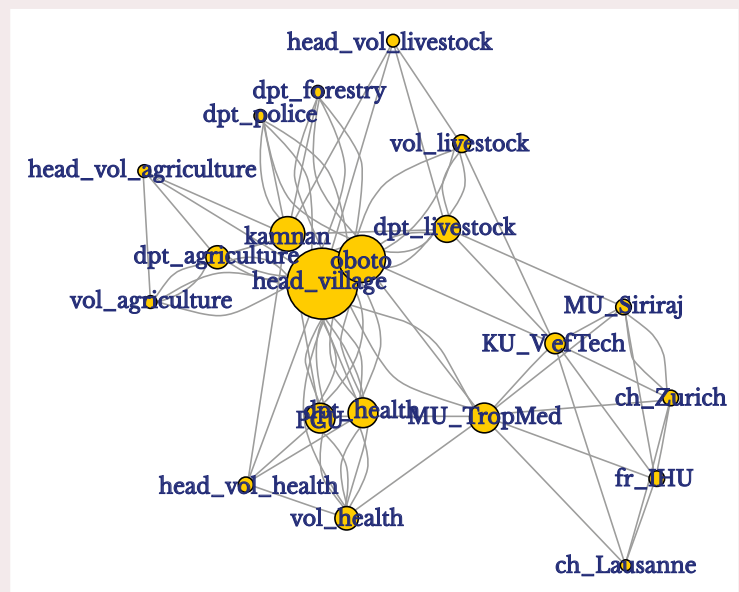


Figure 2





## PUTTING IT INTO PRACTICE

In France, a large number of initiatives sponsored by local authorities and non-profits are emerging, or in the process of consolidation. But if we turn our focus to southeast Asia, there is much we can learn from local experiments that bring together communities, administrations and research projects looking into health and biodiversity.<sup>2</sup>

Local governance of health, environment and agriculture in Thailand, and other countries of southeast Asia, centers on village communities. Every Thai village is represented by one or more health volunteers, as well as volunteers focused on agriculture, livestock and fisheries. These volunteers act as the link between their communities, health clinics and authorities responsible for public health, veterinary health and agriculture, all as part of a local administration exercising devolved power. The volunteers' role is to inform their communities of risks to the health of humans, animals and plants, take part in training people to prevent risks, such as by combatting local vectors, and organize activities, together with the relevant administrations, designed to improve agricultural production or encourage a shift to organic farming. This being the case, all research projects have to be guided by an understanding and explicit description of the local governance framework and its administrative actors, representatives and volunteers from village communities, and its forums for deliberation and collective action (see diagram 2).

Many research projects are run by local universities, sometimes in partnership with universities from other countries. But every research project implemented locally inevitably creates a specific network of actors, made up of researchers, different administrations (health, agriculture, conservation areas), the territorial assembly, leaders and volunteers from the villages concerned by the project. This network of actors also contains a wide range of expertise (scientific, technocratic, political and practical) as well as varying visions and perceptions. Every research project has to describe this dynamic network, within which circulate information, economic and political power, individual and collective action. Describing the governance and network of actors engaged in such a project is the first step along the road to systemic thinking.

Implementing a research project centering on human health from a One Health perspective, and including ecosystem health, will involve large segments of local governance, countless local actors and a great volume of outside scientific expertise. Setting up an interdisciplinary and inter-sectoral research project is a sizeable undertaking.

- The first phase in the life of a project centers on formulating a given One Health problem. For example, the impact of biocides (pesticides and antibiotics) on the health of humans, animals (domesticated and wild) and ecosystems

(soil and water). The project's network of actors must have the capacity to describe and share its knowledge, whether scientific, medical, technical, practical or traditional. This sharing process makes it possible to formulate the problem and design the protocols to follow. The protocols will then be approved via community engagement (local communities and their leaders, administrations, clinics, and scientists) and then by the appropriate ethics committee (human ethics and experimentation on animals) and authorities concerned (national parks, provincial government, universities, etc.).

- The second phase involves implementing the protocols and deliverables. The protocols may cover topics such as interviews, questionnaires, participative mapping and group interview sessions. They may require biological samples to be taken from humans or animals, or from the environment, and will in addition require data on the environment, climate and biodiversity. These protocols will generate a large set of qualitative and quantitative data for analysis by scientists from various disciplines (anthropology, sociology, medicine, ecology, molecular genetics, etc.). Rules for saving, sharing and accessing data have to be explicitly defined in the ethical protocols and research license (protection of individuals and communities, protection of traditional knowledge, and safety).
- The third phase is presenting the scientific results. This is the most complex phase as it requires, from the outset, researchers to open up to other fields outside their specialty as well as to other forms of non-scientific knowledge. This entails moving beyond a traditional vision of educating citizens, communities, practitioners and decision-makers, shifting instead to a shared understanding of the knowledge, representations, values and visions espoused by the various actors. Conventional scientific expertise needs to be left behind, and we need instead to embrace an integrative, pluralistic expertise based on scientific knowledge and forms of understanding rooted in the lived experience of population groups and administrations. The experience we gained in southeast Asia serves to highlight the great number of practical and cultural (scientific and administrative) difficulties involved in rolling out One Health social ecology projects based on the ecosystem approach.

## CONCLUSION

Ecosystem-based One Health social ecology is what can be called an involved science, and only once the barriers between disciplines and sectors are set aside are its findings considered within the larger public debate. Achieving this breakthrough calls for collaborative projects that are co-constructed by scientists, local authorities, local economic actors and administrations, characterized by a new form of One Health governance that is more environmentally focused and whose impacts will be felt over the medium or even long term.

<sup>2</sup> See, for example: "Quels sont les impacts des changements d'usage des terres sur l'émergence de maladies infectieuses en Asie du Sud-Est ?", [What are the Impacts of Changing Land-Use on the Emergence of Infectious Diseases in southeast Asia?]: Agence Nationale de la Recherche (ANR), 2020.



## THE SOUTHEAST ASIAN EXAMPLE



Two scientific articles published in the late 2000s focused attention on southeast Asia. The first examined factors driving the emergence of infectious diseases and identified southeast Asia as one of the regions at high risk of the emergence of new infectious agents related to wildlife. The second article described the distribution of endangered biodiversity and also pointed to southeast Asia as the region where mammal species in the wild face the highest risk of extinction. Some of the most important infectious diseases of the past 20 years have certainly emerged in southeast Asia, or southern China, such as H5N1 bird flu, the Nipah virus, the first SARS-CoV virus, and now the SARS-CoV-2 virus at the origin of the COVID-19 pandemic. Loss of biodiversity and natural habitats are seen as significant factors behind the emergence of these viruses.

As part of the ANR project CERoPath (2008-2012), we<sup>3</sup> analyzed diversity and dynamics in the rodent populations that are agents for infectious diseases at several sites in countries along the Mekong River. Fine spatial resolution made it possible to characterize the reservoirs' environmental niches and the prevalence of infection by different agents infectious to humans. This revealed that the mosaics of landscapes maintained dynamically by local people had the effect of promoting biodiversity while minimizing risks of infection and epidemic when compared to heavily modified habitats.

The CERoPath project highlighted the importance of incorporating social and public policy components into the study of links between biodiversity and health, issues at the heart of a second ANR project, BiodivHealthSEA (2013-2016). Using the results of these projects, we are now studying the impacts that economic corridors have on human health and the environment in a further ANR project, FutureHealthSEA (2018-2022). Rapid changes in land use, integration into regional and international trade, and climate-related pressures illustrate the importance of being able to better anticipate local epidemics of infectious diseases, based on data collection and modelling. These three interdisciplinary projects encouraged the establishment of an international network of researchers into biodiversity and health, and have contributed their expertise to international bodies such as the WHO-FAO-OIE tripartite collaboration, UNEP and UNESCO. They have further underlined the importance of developing collaborative ecology of health projects that are co-constructed with communities and administrations at the local and national levels, and generate results over the medium or long term.

<sup>3</sup> Serge Morand and his CNRS colleagues.

