In our society, human impacts on animal or environmental pathogen reservoirs are becoming increasingly frequent and intense. They involve emerging diseases such as avian influenza and some neglected endemic tropical diseases (bovine tuberculosis, brucellosis, etc.), or diseases with a strong economic impact (foot-and-mouth disease). Some of these diseases have caused world health crises that were catastrophic both economically and socially, with an even greater impact in the most underprivileged populations.

Permanent risks, limited resources

Effectively controlling these diseases means rapidly reacting to epizootic outbreaks. Meeting this challenge is vital in the South where resources (specific skills, funding, IT facilities, etc.) are limited. At present, the key to success lies in efficient, sustainable and inexpensive surveillance networks, which calls for a regular and objective assessment of surveillance methods.

The assessment methods used as a rule are qualitative or semi-qualitative and mainly rely on the knowledge and expertise of the experts. Based on its long tradition of research in developing countries, CIRAD has developed and adapted some novel quantitative tools based on multidisciplinary approaches (ecology, epidemiology, social and economic sciences), designed to assist in setting up surveillance networks, evaluate their efficiency and ensure their continuity.
Revasia: novel initiatives...

In Southeast Asia, CIRAD is coordinating the Revasia programme, which is intended to develop novel methods for the epidemiological and socio-economic evaluation of surveillance systems. These initiatives are also being developed in Egypt. They also fit in with the One Health context, which studies the interfaces between animals (wild and domestic), humans and ecosystems, by particularly analysing the relations existing between animal health and public health systems.

Several approaches have been developed:

- **risk analysis models** that describe the epidemiological surveillance system in the form of **scenario trees**, used to estimate the ability of a country to detect an infection at very low prevalence, by integrating past surveillance efforts
- **the capture-recapture technique** which reflects problems in detecting infected epidemiological units, notably helping to minimize problems of under-detection
- **economic evaluation methods** that take into account the cost and effectiveness of organizing surveillance in a given socio-economic context
- **mathematical modelling** of epidemics or of information flows from contact networks, which serves to test the different sampling techniques and surveillance strategies
- **participatory epidemiology methods**, which rely on the knowledge of livestock farmers.

CIRAD provides training in capture-recapture techniques and the use of social network modelling methods in an epidemiology context. At the request of FAO and OIE, it also organizes professional training in various regions of the world on epidemiological surveillance for staff from veterinary services, for which it uses dedicated electronic modules (Ranema and Ranema-Flu)

... applied to the surveillance of animal and zoonotic diseases

Work is being undertaken in foot-and-mouth surveillance taking participatory approaches and using capture-recapture methods to improve the declaration of this disease.

Avian influenza, which is endemic in several Asian countries, calls for the development of surveillance systems founded on risk-based surveillance principles, designed in accordance with the analysis of risks and their biological and economic consequences for health. In the case of this zoonotic disease, it involves developing a joint model for surveillance network operation and assessment, combining public health and animal health. This model can be applied to other zoonotic diseases. The generic tools proposed should be equally suited to animal health problems and to questions regarding the efficiency of public human health surveillance policies.