Risk management

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Risk management

Life is not without risks. Therefore people determine what these risks are and how they can best deal with them; this process is called risk management. However, in today's complex society it is not a simple task to estimate all risks. For example, is it hazardous to eat vegetables grown on contaminated soil? What are the risks of flooding in heavily populated areas? Are pesticides a public health hazard?

To answer such questions, multidisciplinary research is required because the risks and the methods for dealing with the risks are very divergent. To determine the risks of contaminated soil, expertise in soil science and hydrology is essential, but there are also issues about how specific substances are transported in plants and animals. When dealing with the risk of erosion, data about soils and water flows are essential, but insight is also required into the consequences of climate change. And with respect to air quality, researchers must measure what this quality is and determine the effects of building, vegetation or the weather.

It is usually not a simple matter to determine the seriousness of a specific risk. The situation is often so complex that it is unsatisfactory to answer the question "is there a risk or not?" with a simple yes or no. A risk usually elicits new questions, such as how people expose themselves to a risk, how large the risk area is, how toxic a specific substance is, which organisms are affected and how long the risk lasts. The answers to all these questions provide an indication of how people can deal with the risk. Scientific research is an important tool to provide clarity about what people can and cannot do.

What can we offer?

The Environmental Sciences Group of Wageningen University and Research Centre comprises the department of Environmental Sciences of Wageningen University and Alterra, the research institute for the green environment. This combination ensures an exchange between fundamental and applied research and a fertile interaction with education. In addition, Wageningen researchers participate in many national and international research projects.

Research and advisory services

The risk management research at the Environmental Sciences Group of Wageningen UR takes different approaches from various scientific disciplines towards the management of a wide range of risks such as soil contamination, erosion, air pollution, flooding, infectious animal diseases, drought, pesticide use and climate change. The research usually begins with estimating a risk and investigating the consequences of that risk. After this, research is conducted to determine whether a risk can be limited and to establish the appropriate standards, so that the risk can be dealt with in a responsible fashion.
The scientists of Wageningen UR therefore investigate how risks relate to their environment. This systematic, integral approach allows the inclusion of the many social, scientific and technical questions that arise concerning the risks.

As a result, the researchers do not provide a simple yes or no answer, but they do indicate the limits within which it is safe to deal with the risks and when it is no longer safe. They provide a framework within which it is possible to live with the risks. The scientists are fully involved in national and international scientific and societal discussions about themes such as environmental pollution, the world food issue and climate change. They participate in United Nations projects such as the Millennium Ecosystem Assessment and the Intergovernmental Panel on Climate Change (IPCC). In addition, they provide advisory services to the Dutch and other government about topics such as the implementation of the Soil Framework Directive and the Water Framework Directive of the European Union and the consequences of this policy for the environment, living conditions, agriculture, water management and nature.

Education

Wageningen UR offers Bachelors, Masters and PhD education at Wageningen University and Van Hall Larenstein School of Higher Professional Education. In addition, Wageningen UR offers many courses for scientists and professionals. Our students are not only from the Netherlands, but from everywhere in the world.

The Bachelors curriculum (with Dutch as the language of instruction) comprises the following programmes:

- Environmental technology: students combine knowledge about natural science with knowledge about technological possibilities and social aspects to search for solutions to environmental problems.
- Biology: students investigate the how and why of organisms, cells, organs and ecosystems.
- Soil, Water and Atmosphere: focusing on the physical, chemical and biological processes in soil, water and atmosphere and their mutual relationship.
- International Land and Water Management: focusing on dealing with and managing the natural resources of land and water.

The Masters curriculum (with English as the language of instruction) comprises the following programmes:

- Environmental Sciences: students learn innovative methods and sustainable solutions to improve the environment.
- Soil Science: the study concerns the sustainable management of one of the most important resources – the soil.
- Hydrology and Water Quality: students study the management of all kinds of water.
- Meteorology and Air Quality: students learn about the physical processes in the atmosphere and their interaction with the soil, water and vegetation on the Earth's surface.
- International Land and Water Management: the scientific analysis of physical, environmental, technical and socio-economic aspects of land and water management.
- Forest and Nature Conservation: graduates help to increase knowledge on forest and nature areas, effect conservation and realize sustainable management and policy of our natural resources.

Wageningen UR offers various PhD programmes where students can work on their PhDs in the multidisciplinary and international scientific climate of Wageningen.

Expertise, technology and facilities

The Environmental Sciences Group of Wageningen UR has access to outstanding research facilities icluding laboratories for entomology, freshwater ecology, soil biology, soil chemistry, soil fertility, microbiology, hydrology and chemistry. In addition, Wageningen UR maintains an important collection of databases, information systems and models in the areas of ecology, hydrology, climate and land use.

Cooperation

The Environmental Sciences Group of Wageningen University and Research Centre participates in a wide range of national and international research programmes together with research institutes, universities, government agencies and companies in the Netherlands and abroad.
A few examples of these projects:

International

- BERISP: European project focussing on the spatial behaviour of animals integrating this with the spatial occurence of contaminants (www.berisp.org)
- No Miracle: novel methods for integrated risk assessment of chemicals in europe (www.nomiracle.jrc.it/default.aspx)
- PERAP: Development of pesticide environmental risk assessment procedures to be used in the Chinese national pesticide registration system (www.perap.cn)
- Soil contamination: a framework of cooperation with institutes in Europe (including Germany, Poland, France, Spain, Italy) and outside Europe (such as China and Taiwan) in the area of food safety. The aim of the research is to arrive at a better indication of the suitability of contaminated soil for use as agricultural land

National

- BOP (Netherlands Research Programme on Particulate Matter): research into air pollution caused by particulate matter (www.mnp.nl/nl/dossiers/fijn_stof/index.html)
- GEMMA: this project focuses on the development of an expertise system for controlling contagious animal diseases
- Regional soil contamination: the Alterra research institute is conducting a survey in the Krimpenerwaard and the Veenweidegebied near the town of Woerden concerning the possible risks of soil contamination for the health of livestock and the soil ecosystem

contact www.alterra.wur.nl/uk/research

Netherlands Research Programme on Particulate Matter

Situation

The air quality in European countries leaves a great deal to be desired. The air is contaminated with particulate matter, which is a collective name for all suspended particles that are smaller than 100 µm. Emissions of particulate matter are caused partly by people, such as soot from diesel engines, and are partly natural in origin, such as crystals of sea salt and dust from soil. Particulate matter is hazardous to health and leads to problems such as premature mortality and increased hospital admissions for heart problems, respiratory symptoms and functional disturbances.

The harmfulness of particulate matter is related to the composition and size of the particles. If inhaled, the largest particles removed are removed in the nose and trachea, while the smaller particles penetrate deep into the lungs. In general terms, particulate matter in the atmosphere that is caused by human activity, such as soot and sulphur oxide, is smaller than natural particulate matter such as sea salt and soil dust Particulate matter causes serious health damage. For the year 2000, the Clean Air for Europe Programme estimated the number of premature deaths in Europe at 384,000. People living in the Benelux, North Italy and parts of Poland and Hungary run the greatest risk of health damage; in these regions, the average life expectancy is reduced by two years due to particulate matter. Consequently, there is every reason to acquire more understanding of how particulate matter enters the atmosphere, how it is distributed and how it can be reduced.

There is a great deal of attention for legislation and regulation in the area of particulate matter at both the national and European levels. This process has resulted in a dilemma: with strict legislation, countries with poor air quality must halt further development, even though there are many uncertainties about the health risks, measurements and modelling of particulate matter.

Aim

There are a many scientific questions in the area of particulate matter. For example, in the Netherlands the magnitude of the contribution of sea salt, soil dust and long-distance transport of particulate matter is unclear. When making calculations at the regional level, many

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steps are taken that lead to results with high levels of uncertainty. Moreover, it is difficult to measure particulate matter concentrations. The aim of the research is to reduce the uncertainties regarding particulate matter, so that models can make more precise calculations of the particulate matter in Europe and the region. This will allow researchers to determine the most effective strategy to solve problems with particulate matter at specific hotspots.

Approach

The point of departure of the research is the global model TM5, a three-dimensional, atmospheric and chemical transport model that can zoom into specific, large-scale areas. This model was recently used to quantify the import and export of particulate matter for Europe. In cooperation with the Netherlands Organisation for Applied Scientific Research (TNO), Wageningen UR is linking this model to a model that works at the regional scale. In this way, more precise calculations can be made about the transport of particulate matter at various scales.

Results

The research has resulted in simulations of the composition of particulate matter in the atmosphere above the Netherlands with two models and at two scales. This reduces the uncertainty concerning the modelling of particulate matter. Wageningen University also uses the results of the research in its education. For students in the Environmental Sciences and the Soil, Water and Atmosphere programmes, particulate matter is an interesting issue with both scientific and governance aspects.

Follow-up

The project is the first step in improving the modelling of particulate matter at the national and European scales. In this way, the expertise in the area of particulate matter is being improved in close cooperation with TNO.

www.maq.wur.nl

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Soil contamination in Taiwan

Situation

Due to the geological characteristics of Taiwan, the majority of urban industrial and agricultural development takes place in the western and north-western regions of the country. In these regions, there is an extremely high population density and a concentration of industry, often smaller businesses. In addition, many small farmers grow rice on approximately 800,000 ha of agricultural land in the lower lying and heavily urbanised areas.
Due to the proximity of industry, many contaminants, such as heavy metals, enter the soil. It is especially the use of contaminated irrigation water that results in increasing concentrations of substances such as lead, cadmium and copper in the agricultural soil. Because the Taiwanese industry comprises a large number of small companies, it is difficult to regulate or control the emissions of pollutants, and the great diversity of companies results in many different types of pollutants.
To prevent excessive heavy metals in the rice, remediation is taking place in the most heavily contaminated areas. This is done by mixing the contaminated soil with underlying, cleaner soil; after treatment with acid and lime, the land is again used for farming. Another method is to replace the contaminated soil with clean soil. However, such methods have significant disadvantages. For example, when the soil is washed with acid, the functional biodiversity and the quantity of nutrients in the soil decline severely. Moreover, nothing is done about the primary sources of soil contamination – contaminated irrigation water and the high level of atmospheric deposition.
Another solution to limit the risks of contaminated soil is to search for alternative crops, for example non-food crops like flowers. It is also possible to place a thin layer of new, clean soil on top of the contaminated land and then grow shallow-rooted crops such as lettuce and cabbage. In addition, the contaminated soil that is removed can be used in housing construction and industry.

Aim

To ensure that rice cultivation in Taiwan can continue to exist and that farmers can produce rice that is safe to eat, it is necessary to determine the risks of soil

contamination and to search for new methods to reduce these risks. The ultimate aim is to derive soil standards for the safe cultivation of rice.

Approach

The soil contamination will be analysed using the system approach, where all components are taken into consideration. Alterra is investigating how the risks of soil contamination are related to soil ecology, the concentrations of contaminants and the groundwater; the uptake of these substances by the rice is also being investigated. In addition, the researchers, together with the Taiwan Agricultural Research Institute (TARI-Taichung) are comparing the contaminant uptake of different rice cultivars. Various methods for soil remediation are also being tested and evaluated.

Results

In this project, the Alterra research institute is focusing on soil chemistry, soil ecology, the uptake of toxic substances by plants and measures that can be taken to reduce the effects of soil contamination:

- The uptake of cadmium, the most toxic element, differs greatly between the tested rice cultivars. It is better to grow Japonica cultivars in soils with high calcium levels than Indica cultivars.
- In Taiwan, the risk areas for cadmium contamination in rice production have been mapped out using a combination of modelling, field data and soil properties such as pH and cadmium level.
- The farmers are in control to further reduce the uptake of cadmium in rice, for example by placing the land under water for a longer period or by providing additional lime.

Follow-up

The research in Taiwan has emerged from previous research conducted in the Netherlands, Belgium and Germany. By applying the system approach in various countries, the researchers are working on a scientific method to estimate the risks of soil contamination, establish soil standards for various crops and reduce the uptake of contaminants by crops. This results in a method that can be applied everywhere.

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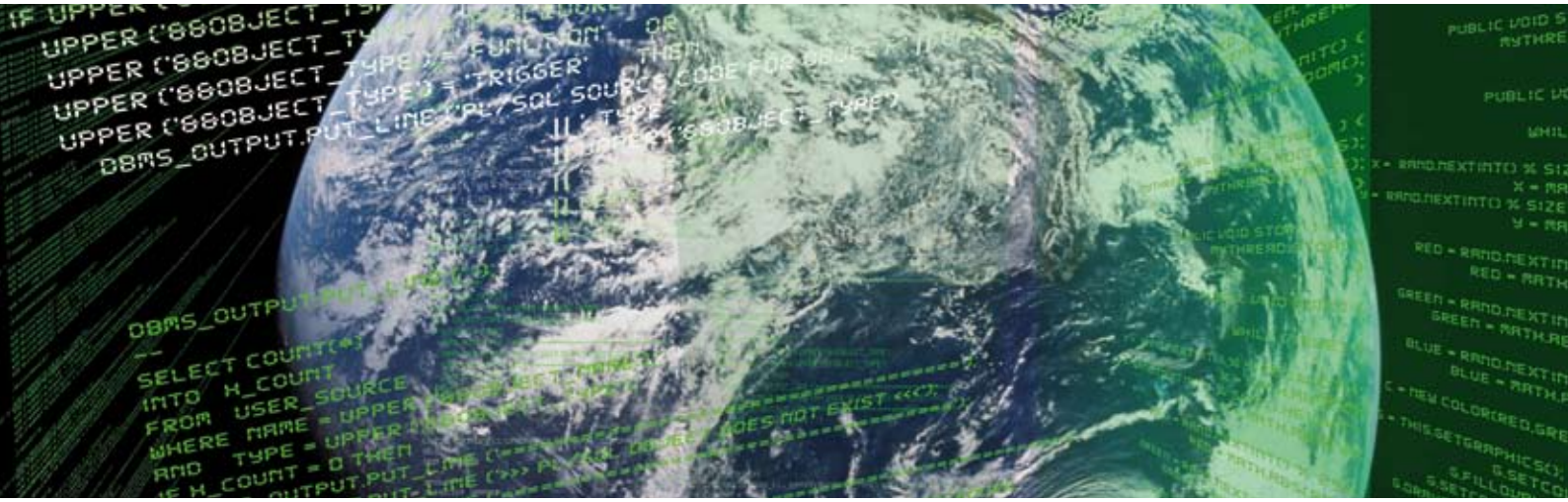
GEMMA: Geographic Event Management and Monitoring Application

Situation

Periodically, the Netherlands is startled by large-scale outbreaks of animal diseases, such as avian influenza with poultry, blue tongue with sheep, foot and mouth disease with cattle and swine fever with pigs. These outbreaks not only have a serious effect on the agricultural sectors concerned, but also on the regions where the diseases are rampant.
In such crisis situations, it is extremely important that the government can respond quickly to prevent the animal diseases from spreading. The Food and Consumer Product Safety Authority (VWA) of the Dutch Ministry of Agriculture, Nature and Food Quality (LNV) has a pivotal function in this process and uses computer systems to keep track of all available information about the crisis. This information is used to formulate the assignments for field staff and cleanup teams as well as the measures to prevent the spread of animal diseases, such as a transport ban in a radius around the affected farms.
For the VWA, the automated information system is a good tool for tracking animal diseases, but it is not yet complete. All the information from the various services is not yet available in the system. Moreover, the system is not yet accessible for 24 hours per day and seven days per week for all staff from all services.

Aim

The aim of the project is to provide access to all relevant information with a continuous, internet-based computer application. As part of this process, digital maps from Alterra are being linked to databases such as the farm data from the Regulations Service (the data about the dissemination of animal diseases from the Animal Health Service). As a result, the acute need of the VWA for information during animal disease crises will be met. Staff of the various services can use the system on portable computers to track which measures have been taken in a specific area, and to supply information about how the animal disease is spreading. In this way, a database is created that is always up to date with information on the crisis; as a result, the crisis can be effectively dealt with.



Results

With GEMMA, Alterra has delivered an operational GIS application that can be used for controlling animal diseases by exchanging all kinds of information about livestock farms on digital maps. The application has been tested in an experimental region. For this experimental region, Alterra – in cooperation with the Food and Consumer Product Safety Authority, the Regulations Service and the Animal Health Service – defined a protocol to link the various databases of the services together. In addition, a crisis simulation has been developed within GEMMA, with which staff of various services can practice using the GIS application in crisis situations.

Follow-up

The integral system was designed to allow expansion in the future. For example, it is possible to make the region-specific information about farms and land parcels also accessible via handheld computers of field staff or inspectors working in the field. The data about the dissemination of an animal disease that is placed in the system can not only be used for controlling such diseases, but also for conducting additional scientific research into disease dissemination. Moreover, the system can be developed for applications in other countries and can be used for outbreaks of diseases and pests in crops and in nature, such as Lyme disease, horse chestnut bleeding disease and the oak processionary moth.

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