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We must protect biodiversity if we are to protect ourselves

Good health is a precious commodity. This year, more than 13 billion euros will be donated by wealthy nations to procure food and medicines and to improve sanitation and freshwater access for populations in need of improved quality of life. But other investments may be just as valuable, if not more so, for ensuring health. In particular, there may be no greater strategic investment in health than in the protection of biodiversity, or the variety of life on earth - including all species, their genes, and the ecosystems they form - as biodiversity underlies almost everything that keeps us healthy. While biodiversity has often been considered only relevant to biologists or ecologists, a growing body of research makes clear that it is equally relevant to health-related disciplines.

The biosphere is undergoing dramatic change. The most frequently cited statistics address rates of species loss, which indicate that species extinctions are occurring at a rate that is 100 to 1000 times faster than occurred before humans walked the earth. For comparison, this rate may put 50% or more of all species alive today at risk of extinction within the next century or so.

This Thematic Issue of Science for Environment Policy summarises recent scientific articles relating to the ties between biodiversity and ourselves.

'Nature provides treasure trove of medical inspiration' discusses new approaches to natural product drug discovery. Natural products have been the source of more than 60% of new drugs approved by the U.S. Food and Drug Administration (FDA) over the past three decades, an example that reveals just how heavily dependent we are upon nature for new medicines. The study explores new horizons in natural product drug discovery and, in particular, how new leads in drug discovery have accelerated through the use of new screening methods.

'From sweeteners to cancer treatments: nature points to new products' describes the potential loss of many useful compounds as a result of biodiversity loss.

As vital as nature may be as a source of new medicines, perhaps the greatest value of 'bioprospecting', the search for useful products in nature, may come from the scientific discoveries enabled by natural products. 'Species extinction is a disaster for human health' discusses the conopeptides, a group of around 100,000 or more molecules collectively produced in more than 600 species of the marine sea snail genus Conus. While one conopeptide has become a new painkiller, many more have proven invaluable molecular tools for scientists who have used them to better understand how our brains may be susceptible to diseases including Alzheimer's and Parkinson's.

Coral reefs, one of the planet’s richest sources of biodiversity, have come under multiple assaults. Warming ocean temperatures, driven by climate change, ocean acidification driven by the increased CO₂ concentration in the atmosphere, result in coral bleaching causing symbiotic algae, normally an essential source of oxygen and sugars for the coral, to become toxic. If we lose coral reefs we will lose protection against storm surges and waves as well as untold numbers of species that are dependent upon reef ecosystems and, with them, all the medicinal potential they may possess.

'What is the medical value of marine biodiversity?' estimates that there could be nearly 600,000 novel compounds, as yet undiscovered, in unstudied marine species.

Species loss may deny us the discovery of new medicines and serves as a clear connection between biodiversity loss and health. Equally important are the health consequences of ecological change, including the spread of human infectious diseases. The number of emerging infectious diseases, such as SARS, has grown steadily over the past several decades - mostly the result of pathogens moving from wildlife to humans. Although much more research is needed, early evidence, as described in 'Link between biodiversity and human disease', suggests that loss of biodiversity and ecological disruption may set the stage for disease spread from animals to humans. 'Changes in biodiversity can increase risk of infectious human disease' summarises the many ways in which disturbances to biodiversity can affect the spread of human disease.
'Alternative agriculture': key to preserving food security and biodiversity? reveals that farms, arguably the most important ecosystems for human health, have been put under severe stress to meet the demands of a growing population. The article implies that if we are to meet the world's nutritional demands, we have to pay greater attention to the limits of ecosystems.

'Pollinator-dependence an underestimated risk?' highlights the importance of managing biodiversity to support ecosystem services, such as pollination, on which modern agriculture is dependent. Maintaining agricultural biodiversity, including the diversity of crops, livestock, agroforestry, fish, pollinators, insects, and soil organisms has a positive impact on food security through:

- Supporting soil-based processes that allow nutrient recycling, water retention and groundwater resources recharge; pollinators; and natural predation for pest control, all of which may contribute to more robust crop yields.
- Reducing reliance on external inputs and state subsidies to buy inorganic fertilisers and pesticides, thereby making small scale farmers less dependent on local retailers and money lenders.
- Providing a diversified, more nutritious, diet. Indigenous fruits contribute about 42% of the diet in rural households in southern Africa, and are an important source of vitamins and other micronutrients, as well as critical sustenance during lean seasons.
- Biodiverse agroecosystems mitigate risks from climate change including floods, droughts and heat waves as well as the invasion of new pests, weeds, and diseases. They also tend to sequester more carbon.

This Thematic Issue raises a broad range of policy issues – from land use planning and infrastructure projects to disease prevention. Some of these issues have a global dimension and call for international action, while others are relevant for decision making at the local level. Biodiversity and health has been of particular interest following the presentation by the European Commission in 2011 of the EU 2020 Biodiversity Strategy, and the adoption of a broad range of decisions at the Conference of the Parties (COP10) of the Convention on Biological Diversity. The EU 2020 Biodiversity strategy increases policy focus on ecosystem services, which are integrated into its main objectives.

However, some ecosystem services that contribute directly to human health are still difficult to assess, which remains an obstacle to their full integration in policymaking. The European Commission is supporting the assessment of the status and trends of medicinal plants in Europe. While ecosystem service research has progressed rapidly over the past 10 years, it is important to take stock of recent knowledge in view of future policy developments.

The ongoing simplification of nature is a vast uncontrolled and irreversible experiment. If we lose a gene, species or ecosystem, it is gone forever. While we have much to learn about life on earth, we know enough to recognise that we must protect biodiversity if we are to protect ourselves.

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1 See: http://ec.europa.eu/environment/nature/biodiversity/comm20062020.htm
2 See: http://www.cbd.int/cop10/
Nature provides treasure trove of medical inspiration

A recent analysis highlights the potential of natural products as an indispensable source for drug discovery. Natural compounds can be used directly as potential medicines or can provide templates for the design of synthetic and semisynthetic drugs. Furthermore, because of their ability to interact selectively with biological macromolecules, they also provide a tool to better understand biochemical processes and thus identify new potential targets for the treatment of human diseases.

Natural products are a very diverse group of molecules, often chemically distinct from synthetic compounds. Through the process of evolution, they have become biologically active, performing useful functions, such as regulating cell cycles or acting as chemical defences.

To identify new compounds researchers can look at plants, microbes or marine organisms that have not yet been investigated for biological activity. Technological advances are also making it possible to search for undiscovered molecules from existing, known sources. In the case of microorganisms, such as bacteria and fungi, genetic approaches are used to identify new compounds. It has been shown that microorganisms often have genes for many more natural chemicals than those they produce in standard laboratory conditions. Recent research is revealing how they can be persuaded to actually produce these substances. For example, interfering with certain enzymes has been found to influence the expression of genes in some fungi, which has enabled scientists to isolate a number of new compounds.

Another approach consists in integrating in the genome of an organism a fragment of DNA that can ‘de-silence’ a particular gene cluster that has been previously identified. This method has been applied to the fungus Aspergillus nidulans, and has also allowed the identification of new compounds. More efforts are needed to apply such approaches to a broader range of species.

In recent years significant technical improvements have also been made in isolation and purification methods, thus improving the prospects for discovering useful natural products. These include advanced chromatography methods that make it easier to isolate natural products from plant, animal and microbial extracts. This makes it quicker, cheaper and easier to identify novel structures.

Natural products are also helping researchers understand how drugs work and are suggesting new approaches to drug development. Approaches include screening large natural product libraries using chemical genetics and chemical proteomics (the study of proteins) procedures. These allow the proteins affected by the natural products to be identified and may suggest new avenues for drug discovery.

Source: Schmitt, E.K.
Moore, C.M. Krastel, P., Petersen, F. (2011)
Natural products as catalysts for innovation: a pharmaceutical industry perspective. Current Opinion in Chemical Biology 15:497-504.
From sweeteners to cancer treatments: nature points to new products

Throughout history people have turned to nature for relief from illnesses and this remains true today. With new technologies, researchers have an even greater ability to identify natural products that may lead to treatment or prevention of a wide range of health problems.

Just as new approaches are making it easier to draw on nature for medical inspiration, researchers are raising concerns that loss of biodiversity may prevent the formulation of many useful compounds as the species that produce them may be lost before scientists have an opportunity to investigate their potential uses. Climate change, invasive species, habitat, over-harvesting, degradation, fragmentation and loss are the major contributors to this loss of potentially valuable species.

Drugs used to treat health complaints fall into two categories: those derived from natural sources (e.g. plants, marine organisms and microbes), and those synthesised by scientists. Both approaches have led to effective treatments. However, over the last three decades, about 60% of newly approved medicines in the United States have natural product origins.

Low calorie sugar substitutes and cancer treatments have been two foci of natural product discovery recently, and plants have proved fruitful sources of products in both areas.

Recent research has identified six new pervilleine compounds from the tropical plant, *Erythroxylumpervillei* (Baillon), harvested in Madagascar, that show promise for inhibiting the development of drug resistance to cancer treatments. Pervilleine A was found to restore the sensitivity of leukaemic cancer cells to chemotherapeutics, perhaps through inhibition of p-glycoprotein.

Low calorie alternatives to sugar are in great demand owing to health concerns surrounding high-calorie diets and obesity. At least eight sweeteners have been identified from plants and are commercially available. These include the Paraguayan herb, *Stevia rebaudiana* (Bertoni) which was noted for its sweetness in the early 20th century. Several sweet-tasting compounds have been isolated from this plant, the two most abundant of which (stevioside and rebaudioside A) are commercially available in many parts of the world. Stevioside and rebaudioside A are both diterpene glycosides and extracts containing these compounds have been used in Japan as sweeteners since the 1970s.

Although only a relatively small number of plants have been tested for biologically active substances, many have produced products with novel mechanisms of action. Not only may plants hold many undiscovered effective drugs or products, but because they yield novel structures, they open up new avenues for medicinal chemists to explore.


Species extinction is a disaster for human health

A species faced with extinction is more than a potential tragedy for the species concerned. Human wellbeing and economy depend on the world's biodiversity and ecosystem services, but human actions are damaging the environment and threatening the existence of countless organisms that have, or could provide, humankind with valuable medicines, according to a recent publication.

One such group of threatened organisms is cone snails. Cone snails are marine molluscs that live mostly in coral reefs and mangroves. Of the 700 or so estimated cone snail species, seven new ones were identified in 2004. Although only four cone snail species are classified as 'vulnerable' on the 2006 IUCN Red List of Threatened Species, a systematic assessment of the status of cone snails has never been carried out, so that there are no reliable estimates. In reality, a large number of cone snail species are likely to be threatened because of the rapid degradation and loss of their habitats around the world.

Climate change acts as an additional major threat on coral reefs already weakened through overexploitation and invasive species. Sea water that becomes more acidic from absorbed carbon dioxide emissions makes the development of the calcium skeletons of the coral difficult and finally if the trend cannot be reversed the corals will crumble and will no longer be able to provide their adaptation function protecting coastline against storm surges and waves. Rising sea surface temperatures can bleach corals (as they tend to lose the symbiotic algae on which they depend for oxygen and nutrients), leaving them susceptible to infectious diseases and eventual death. Mangrove systems are equally under threat - it is estimated that around 50% of mangroves have already been destroyed worldwide. In Southeast Asia, where more than half of cone snail species live, around 90% of coral reefs are threatened. It should be noted that cone snail species often have a narrow geographical range, making them even more vulnerable to habitat destruction.

Cone snails have venoms that they use to paralyse their prey. These venoms contain complex mixtures of toxic, small protein molecules (peptides), many of which have already been found to be useful for human medicine. For example, one of the toxins isolated from the cone snail C. magus has been synthetically produced, as a drug called ziconotide. It is a highly potent pain-relieving drug, around 1000 times more potent than morphine, but acts without addiction or the build-up of a patient's tolerance. Long-term management of pain for conditions, including cancer and AIDS, has traditionally relied on opiates, such as morphine, but over time, tolerance to opiates can develop, requiring higher and higher doses to be given. Because of the development of tolerance, opiates often lose their effectiveness.

Another cone snail toxin is being investigated to prevent brain cell death when blood flow is restricted, such as when people suffer head injuries or strokes. Still others have shown potential in the treatment of Alzheimer’s and Parkinson’s disease, epilepsy, and heart attacks.

Each cone snail species has a total of around 100 to 200 different and distinct peptides, so there may be as many as 70,000 to 140,000 toxic peptides, many of which could become medicines for human use. Cone snails may contain the largest number of medicines to treat human diseases and to relieve human suffering as compared to any other group of organisms on Earth. Yet only about 100 of its toxins have been characterised so far.

What is the medical value of marine biodiversity?

Undiscovered cancer treatments from marine organisms could be worth between US $563 billion (€428.5 billion) and US $5.69 trillion (€4.33 trillion), according to a recent study. The researchers estimate that there may be as many as 594,232 novel compounds waiting to be discovered in unstudied marine species, and that these could lead to between 55 and 214 new anti-cancer drugs. The study only accounted for anti-cancer drug revenues. In reality, these chemicals from the sea can have numerous other biomedical applications including antibacterial, antifungal, antiviral and anti-inflammatory uses.

Marine ecosystems are under pressure from human activities, such as fishing and coastal and offshore development. Legislation, such as the EU Marine Strategy Framework Directive, aims to protect the marine environment, but monitoring and conservation often comes with a substantial cost. Demonstrating the economic and social value of marine ecosystem services could help with raising awareness and informing management and policy decisions.

The results of this study provide a global estimate of the market value of one of the most important ecosystem services the oceans provide, and emphasise the need to protect our seas if we are to reap the health and economic benefits they could supply.

The researchers used a mathematical model to predict the value of undiscovered anti-cancer drugs from marine sources. They began by looking at how many novel marine products have already been identified, and how many marine species have been investigated. From there, the researchers used marine biodiversity estimates from international databases to calculate the proportion of species that had not yet been studied. This allowed them to estimate how many novel compounds awaited discovery.

They found that 18,552 marine products had already been discovered, at a rate of 2.12 new products per species studied. Using this figure, together with estimates of marine biodiversity, suggested that between 253,120 and 594,232 novel marine products could still be found. The animal kingdom and bacteria were the major sources, providing more products than other groups, such as plants and fungi.

The researchers conducted an overview of previous research to reveal how many existing anti-cancer drugs from marine species had made it to market. From this, they estimated that only around 1.18% of the novel compounds would make it to pre-clinical trials, 0.36% would reach clinical trials, and just 0.02% would make it to market. The researchers caution that the figures were likely to be conservative estimates as they were based on underestimates of biodiversity; of how many marine products could have anti-cancer properties; and of revenues from generic, not just patented, products.

Estimates based on economic data for existing anti-cancer drugs suggested that these novel compounds could be worth between US$563 billion and US$5.69 trillion, depending on estimates of total biodiversity and on the discount rates applied to calculate net present values. This economic assessment only included direct market values - in reality, improved cancer treatment is likely to lead to numerous indirect economic and social benefits that are only partially reflected in their market value.


1 See http://ec.europa.eu/environment/water/marine/directive_en.htm
Link between biodiversity and human disease

Preserving biodiversity seems to reduce the emergence and spread of human diseases in many cases, according to an investigation into the links between biodiversity and human health. It concludes that there is mounting evidence indicating that preserving ecosystems in their natural state generally decreases the occurrence of infectious diseases.

Changes in biodiversity that affect species involved in hosting or transmitting human diseases inevitably affect the incidence of these diseases. Changes that affect the diversity of the pathogens themselves, including bacteria and viruses, are also important. Climate change often further aggravates the situation.

According to the researchers, who drew their conclusions from an assessment of available evidence from the recent literature, biodiversity loss can affect disease transmission in three ways: through changes to the number of hosts, or vectors (organisms such as mosquitoes that transmit disease from one species to another); through changes to host, vector or parasite behaviour; and through changes to the condition of a host or vector that may affect their ability to infect.

For instance, there are examples of studies suggesting that the incidence of malaria, Lyme disease, West Nile fever, and schistosomiasis (also known as bilharzia or snail fever) can increase under the influence of human-induced biodiversity loss. Although biodiversity loss can reduce the number of hosts for a disease, such as the number of opossums (an American marsupial) in the case of Lyme disease, this has knock-on effects that still very often lead to an increase in the prevalence of the disease.

In the Lyme disease example, the opossum is a poor host because the animals groom and kill the ticks that carry the disease. Because they absorb pathogens but are poor at transmitting them, they act as ‘buffers’, deflecting the disease away from white-footed mice, which are better hosts. Therefore, if opossums are in decline, the incidence of Lyme disease should increase, although due to the complex interactions between different species in real communities, it is difficult to prove this is the case.

The authors of the study say that, although there is still much to learn about the links between biodiversity and human health, the connections are clear enough to make local, regional and global efforts to protect biodiversity a matter of urgency.

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Changes in biodiversity can increase risk of infectious human disease

It is increasingly evident that human health is closely linked to the environment, and to biodiversity. A study commissioned by the European Commission summarises the many and varied ways in which disturbances to biodiversity affect the spread of human diseases.

Vector-borne diseases cause 1.4 million deaths every year worldwide. Vectors are organisms that can transmit a disease from one species to another. For example, mosquitoes transmit the malaria parasite, *Plasmodium*, to humans from other animals through their bites. Human-induced changes in ecosystems that affect host or vector species also affect the nature and availability of the pathogens they carry and can therefore increase our exposure to infectious diseases. For example, in Lake Malawi, the population of *Bulinus* species of freshwater snails has increased to overfishing of their natural predators, and appears to have caused a rise in human infection with schistosomiasis. Many diseases have multiple hosts, so biodiversity changes can influence their spread via many different routes.

The effects of deforestation are complex and have been the subject of considerable study. Deforestation destroys natural boundaries that protect humans against exposure to certain diseases, and it can also create new ecological niches favouring the proliferation of vectors. Increased incidence of malaria has been related to deforestation in Africa, Asia, and South America. Biodiversity changes that affect the interface between wild and agricultural communities are some of the most risky to humans, since the contact rate between vectors and hosts is high. For instance, where deforestation occurs and land at the edge of forests is converted to farmland, people are brought into closer contact with forest species that carry leishmaniasis and tick-borne diseases.

In addition, intensive farming contributes to the risk of deadly new strains of influenza emerging when genes from wild birds mix with those in poultry. The study recommends managing interactions between humans, livestock and wildlife to avert disease risk.

In European countries, the diseases causing the greatest concern are those that have recently reached Europe. The voluntary or involuntary introduction of exotic species into temperate climate countries has increased rapidly, as well as human migration, leading to an increase in the incidence of viral infections and parasitic diseases outside their natural distribution area. Climate change may also be an important influence on the survival of pathogens and host species in areas newly affected by these diseases. For instance, there is widespread discussion of malaria re-emerging in former USSR countries and possibly moving into Western Europe. Cases are monitored under the WHO’s Roll Back Malaria EURO programme. However, research in the Mediterranean region suggests that, although the mosquitoes that usually carry the disease are expanding their range, the malaria parasite is currently absent in this region.

Other diseases potentially of concern include the West Nile virus, which is also transmitted by mosquitoes and has reached the Mediterranean basin, causing outbreaks in Italy in 1998, 2008 and 2009, and Leishmaniasis, which has been endemic to Southern Europe for decades. Leishmaniasis, monitored by the EU LEISH MED network, is starting to occur more commonly in urban areas, with stray dogs acting as hosts. Likely to be influenced by climate change, it is spreading northwards with cases in Germany and the Netherlands also occurring.


1. www.euro.who.int/en/what-we-do/health-topics/communicable-diseases/malaria
2. LEISH MED was supported by the European Commission under the Sixth Framework Programme: http://cordis.europa.eu/ftech/CALLER-FP7_PROJ_EN&ACTION=Do&RCN=75641
Agriculture represents one of the biggest challenges to protecting biodiversity. Industrialised, high-input, high-yielding practices dominate global agricultural land use, while less than 2% of agricultural land is under ‘alternative’ agriculture. Industrialised methods concentrate on a narrow range of crops, whilst relying on the use of synthetic fertilisers and pesticides. The 2% of global agricultural land use devoted to ‘alternative agriculture’ ranges from traditional indigenous practices to processes involving ‘sustainable’, ‘organic’ and ‘low-input’ methods. Previous research has suggested that alternative agriculture can increase biodiversity, with an average of 30% more species and 50% more individuals around farmed areas than in conventional agriculture. Approaches to protecting biodiversity include avoiding soil compaction via low till or no till practices and reducing heavy machinery use, and planting traditional, diverse, locally adapted crop varieties. These actions tend to promote lower incidence of crop pests and pathogens and reduce the need for synthetic inputs such as pesticides and fertilisers.

Some have argued that the only means to feed a human population of 9-10 billion will be to expand agricultural land use and intensify production, and that only conventional agriculture can produce enough food to feed the world. However, emerging evidence suggests alternative agricultural methods could also provide enough food on a global basis to sustain the world population.

A study examining 293 examples comparing alternative and conventional agriculture concluded that in principle, intensification to increase yields and feed a population of 10 billion people could be done with either alternative or conventional methods, even without using more land. Small farms in developing nations generally produce higher output levels per unit area than larger farms because of multiple cropping, more efficient use of irrigation, higher labour quality, and lower reliance on agrochemicals. There is also less variation in yields from year-to-year in alternative agriculture because it uses a more diverse range of crops. Total energy output/input ratios from alternative systems may range from 11:1 (corn) to 1:20 (beef), while modern/conventional systems may see ratios from 2.5:1 (corn) to 1:40 (beef).

Integrated plant nutrient systems, which aim to improve soil’s fertility while reducing environmental degradation, can provide 10 to 30% greater efficiency in fertiliser use, whilst no-till/conservation agriculture can avoid the problems of degradation seen in conventional soil tillage, reduce the need for herbicides and raise yields by 20-50%. Plant protection based on integrated pest management can help decrease overdependence on pesticides, improve production and reduce costs.

Evidence from case studies in Cuba and Brazil illustrate how greater regional food security can be achieved by adopting alternative agricultural practices. In Cuba, significant land reform has been carried out by breaking large, conventional state farms into cooperatively owned organic operations, creating new organic farms, and fostering urban and peri-urban agriculture. Some farms have up to 180 species under cultivation and integrated polycultures are the norm. The city of Belo Horizonte in Brazil has created a Secretariat of Municipal (food) Supply (SMAB), which encourages alternative agriculture through the support of farmers’ markets. The SMAB has overseen a reduction in infant mortality and malnutrition by at least 50% since its inception.
Pollinator-dependence an underestimated risk?

Researchers have found that crops which rely heavily on pollinators have lower yields compared to less pollinator-dependent crops. They also have slower growth in yields and less stable yields from year to year. The results highlight the importance of managing biodiversity to support ecosystem services, such as pollination, on which much modern agriculture depends.

Pollination, whether by managed hives of honeybees or by wild pollinators, is often a limiting factor for crop growth. Many crops depend on pollination in whole or in part, for instance, pollinators can increase productivity by around 75% for the 115 globally most important crops. However, the diversity of wild pollinators is declining, and this could have a detrimental effect on global food security.

Using a model of the effects of human and environmental resource availability on crop yields, the researchers made four predictions about the impact of pollinator dependence on global crop yields. Although the researchers concentrated on pollination, their model could be applied to any ecosystem service which limits crop growth.

They predicted that crops such as apples, cucumbers, pears and plums, which depend most on pollinators, would have lower average yields relative to the theoretical maximum yield of the crop, and slower increases in yield as farming practices improved. They would also have less stability in yields year to year, and faster growth to compensate for slower increases in yield. As a result, overall production would vary less than crop yield or cultivated area alone.

The researchers then compared their predictions to data on actual global crop growth from the Food and Agriculture Organization of the United Nations. The data, collected annually between 1961 and 2008, included yield and cultivated area for 99 different crops categorised according to how dependent on pollinators they were, from no dependence through to complete dependence.

As predicted, relative yields of pollinator-dependent crops were lower than for crops with less dependence on pollinators. The most pollinator-dependent crops also had the least stable yields, with a much greater annual fluctuation. Variations in pollen supply accounted for around half of the changes in yield between years, demonstrating that pollen supply does limit crop yields.

Likewise, significant pollinator-dependence reduced the effects of farming improvements on yields, slowing yield growth. In response, the cultivated area of pollinator-dependent crops increased more rapidly. Finally, the data confirmed that production levels did not increase as quickly with increased pollinator dependence as did yield or area alone.

However, six crops that were entirely dependent on pollinators, including brazil nuts, watermelon, cantaloupe, cocoa, vanilla and a group containing pumpkin, squash, gourd, marrow and zucchini, did not follow these trends. The researchers believe this was because these crops were hand-pollinated, indicating that greater yield growth could be achieved for other crops through more careful pollination management. Yield growth and stability would also benefit from active management of local biodiversity, specifically of wild pollinators and their habitats.

Contact with nature can reduce the risk of allergies (6 July 2012)
Loss of biodiversity may be connected to the rising incidence of allergies and other chronic inflammatory diseases, such as asthma, in people living in urban areas, according to recent research. Contact with the natural environment appears to be good for health, not only for a feeling of wellbeing, but also for boosting the human immune system.

Lyme disease ticks more prevalent in deciduous forests (7 June 2012)
Ticks that are able to transmit Lyme disease are more abundant in deciduous oak forests than pine forests, according to a study conducted in Belgium, which provides an example of how landscape can influence human health. To help prevent tick attacks and the incidence of Lyme disease, the researchers suggest increased efforts are needed to raise public awareness of control measures, such as protective clothing and repellants.

European health experts warn of climate change’s effects on disease (11 May 2012)
Climate change will affect the spread and risk of many infectious diseases in Europe, according to a recent survey of leading health experts. The results suggest that more needs to be done to prepare for the expected changes in infectious disease levels, such as improved monitoring of disease.

Risk of sleeping sickness in Africa spreads under climate change (22 March 2012)
By 2090, up to 76.7 million more people in Africa could be at risk of infection by the parasite that causes sleeping sickness, according to recent research. The study predicted which areas of Africa would be at greatest risk in future.

Climate and land use change to affect malaria spread in tropical Africa (13 January 2011)
A recent study has projected changes in the spread of malaria caused by climate change and climate variability in Africa by including the effect of variations in land use on local climate. It concludes that the risk of malaria epidemics is likely to shift from the north to the south of the Sahel, and to highland areas previously free of the disease.

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**FP7:**
- **EO2HEAVEN** Earth Observation and Environmental modelling for the mitigation of Health risks
  [http://www.eo2heaven.org/](http://www.eo2heaven.org/)

**FP6:**
- **EDEN** Emerging Diseases in a Changing European Environment
  [http://www.eden-fp6project.net/](http://www.eden-fp6project.net/)
- **HENVINET** Health and Environment Network
- **2-FUN** Full-chain and Uncertainty approaches for assessing health risks in Future environmental scenarios
  [http://www.innovationseeds.eu/Virtual_Library/Results/2-FUN.kl](http://www.innovationseeds.eu/Virtual_Library/Results/2-FUN.kl)

More information about EU-funded research projects under the Environment Theme of the 7th Framework Programme for Research can be found here: [http://cordis.europa.eu/fp7/environment/home_en.html](http://cordis.europa.eu/fp7/environment/home_en.html)

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