



Image: E. Rasmussen

## Environment matters

- Environmental factors play a role in more than 80 major diseases and injuries world-wide.
- Poor environmental health impacts development.
- Key challenges include: indoor air pollution, vector-borne disease, poor water and sanitation, chemical pollutants, rising urban populations and land degradation.
- Climate change will exacerbate many environmental risks to health.
- Integrating environment into development plans and policy can improve health and help reduce poverty.

Nearly one quarter of the global disease burden can be attributed to the environment. Indoor air pollution, vector-borne disease, limited access to clean water and sanitation and poor land management are among the biggest killers, costing more than 100 million disability-adjusted life years every year. Changing climates are set to worsen the problem — by 2030, an estimated 310 million people are expected to have suffered ill health from climate change. Nine out of ten of these people will be in developing countries. Improving environmental health — raising its profile at national, state and local levels, and integrating environmental health issues into development plans and activities — is critical if we are to reduce poverty and meet the Millennium Development Goals.

The surroundings in which we live and work — that is, our environment — play a huge role in promoting good health. For example, ecosystems support key ‘services’ — from providing food and clean water to regulating disease vectors and sequestering pollutants — that keep disease at bay. The environment also provides a vital source of medicine — an estimated quarter of all modern medicines are derived from natural products.

But if our environment can sustain health, it can also undermine it. An estimated one-quarter of the global disease burden — and more than a third of the burden among children — is associated with environmental risk

factors.<sup>1</sup> These risk factors include biological pathogens, chemical pollutants, physical hazards, and natural resource degradation. They play a role in more than 80 of the major diseases and injuries around the world.

For example, poor quality or insufficient water, and lack of sanitation and hygiene (including food safety) increase the prevalence of biological pathogens (and their vectors) and cause 88 per cent of all cases of diarrhoea.<sup>1</sup> Indoor and outdoor pollution leads to respiratory infections and other illnesses. And physical hazards, such as unsafe access to transport or cooking over an open fire can result in traffic accidents,

accidental fires and burns that cause ill health or premature death. Road traffic accidents alone kill more than one million people each year and injure up to 50 times that number.<sup>2</sup>

Overexploitation or degradation of natural resources pose an environmental risk to health by reducing the capacity of the land to produce crops and sustain livestock, so increasing food insecurity and malnutrition.

In all cases, climate change is set to exacerbate the links between environment and health risks (see Climate change and health). It is already contributing to more frequent and severe weather events such as floods and droughts, both of which

## Climate change and health

The Intergovernmental Panel on Climate Change predicts — with medium to high confidence — that climate change will:

- increase malnutrition;
- increase the number of people killed and injured by heatwaves, floods, storms, fires and droughts;
- change the range of some infectious disease vectors;
- increase the burden of diarrhoeal diseases; and
- increase incidence of, and death from, cardio-respiratory disease associated with ground-level ozone.

*Adapted from IPCC Working Group II Chapter 8 2007*

have dire consequences for access to clean water and waterborne disease. Both also impact crop yields and pest infestations, which can increase hunger and malnutrition. Climate change may also worsen the effects of air pollution because both temperature and humidity influence the fine particulates that contribute to respiratory disease.<sup>3</sup>

## Development challenges

The poor are particularly vulnerable to environmental risk factors and the impacts of climate change because they often live in the worst environmental conditions, have immune systems compromised by under-nutrition and have limited access to health care. Africa and Asia (excluding China) are most affected by environmental health-related diseases.<sup>1</sup> And while statistics vary across and within individual countries, the WHO estimates that a child is 12 times more likely to die from environmental causes if they live in a developing country.<sup>1</sup>

Poor environmental health impacts development efforts by undermining school attendance, incomes and livelihoods, and communities' efforts to improve their long-term quality of life. Improving environmental health conditions is essential if we are to reduce poverty and meet the Millennium Development Goals by 2015 (see Table). In particular, this means tackling six key challenges.

## Indoor air pollution

**The challenge:** Nearly 3 billion people still cook with wood, coal, dung and crop waste on simple stoves or open fires. In Africa, 50–70 per cent of people cook with solid fuels, which release high levels of pollutants when used.<sup>4</sup> In poorly ventilated homes, indoor smoke can contain more than 100 times the acceptable levels of small particles that contribute to pneumonia and respiratory disease. There is emerging evidence that these pollutants may also increase the risk of tuberculosis, low birth weight and cataracts.<sup>5</sup> They are responsible for a larger proportion of the chronic obstructive pulmonary disease risk than smoking or outdoor air pollution. Women and children are often most exposed. According to the WHO, someone dies from indoor air pollution every 20 seconds — 59 per cent of whom are women.<sup>6</sup> This translates into around 1.5 million deaths every year — nearly twice the malaria burden. The use of open fires also increases the risk of burns and scalds, especially in cramped conditions.

**The solution:** Indoor pollution can be reduced by using cleaner fuels — such as biogas, or liquid petroleum gas — or cleaner energy sources, including solar power. In many cases, using cleaner fuels can also reduce carbon emissions that contribute to climate change.

Small changes to the design of cooking stoves or cooking environments can also reduce the level of



Image: Practical Action

**Improved cooking stoves reduce the level of pollutants and are more efficient, freeing up time spent collecting firewood.**

Table: Environmental health and some of the Millennium Development Goals

MDG	Environmental risk factors	Health impacts
<b>Goal 4: Reduce child mortality</b>	Poor access to water, sanitation and hygiene Inadequate food safety Indoor air pollution Exposure to disease vectors	Unhealthy and unsafe environments cause 1 in 4 child deaths worldwide <sup>17</sup> Waterborne disease kills 1.4 million children each year <sup>27</sup> Unsafe food, from poor quality supplies or inadequate hygiene, increases the risk of foodborne infections such as diarrhoea Indoor air pollution affects children since they tend to be at home with their mothers Malaria accounts for one in five of all childhood deaths in Africa <sup>17</sup>
<b>Goal 5: Improve maternal health</b>	Inadequate hygiene and clean water during childbirth Exposure to disease vectors Indoor air pollution	15 per cent of all maternal deaths are caused by infections in the six weeks after childbirth, mainly due to unhygienic practices and poor infection control during labour and delivery <sup>28</sup> Around 10,000 women die as a result from malaria infection during pregnancy
<b>Goal 6: Combat HIV/AIDS, malaria and other diseases</b>	Exposure to disease vectors Inadequate water resources management	Malaria kills an estimated one million people each year <sup>7</sup> The dengue virus infects about 50 million people every year <sup>8</sup>
<b>Goal 7: Ensure environmental sustainability</b>	Poor access to water, sanitation and hygiene Overcrowding Poor access to environmental services Overexploitation and degradation Air, soil and water pollution	Diarrhoeal diseases associated with lack of safe drinking water and sanitation kill nearly 1.7 million people each year Declining biodiversity erodes wild food resources that are vital to prevent malnutrition The urban poor living in slums are exposed to multiple environment health risks

pollutants.<sup>4</sup> Improved stoves are more efficient, meaning that people (usually women and children) spend less time collecting firewood. They are often also safer, preventing burns and scalds. Where fuel is bought, the cost of an improved stove can often be covered by the savings in fuel within a few months. And if verified emissions reductions are factored in, these stoves can be sold on the carbon market, enabling more development activity.

## Vector-borne disease

**The challenge:** Poor rural and urban land management create pools of standing water, which encourages the breeding of mosquitoes that carry malaria (*Anopheles*) and dengue (*Aedes aegypti*). These two diseases alone exert a heavy disease toll; malaria kills nearly 800,000 people each year,<sup>7</sup> while the dengue virus infects about 50 million people every year.<sup>8</sup> Many vectors of other diseases, including trachoma (face flies) and leishmaniasis (sandflies), thrive when there is poor drainage or inadequate sanitation and no piped water supplies.<sup>9</sup>

**The solution:** The WHO estimates that 42 per cent of the global malaria burden can be prevented by



**Safer practices for storing household water can help control vector-borne diseases such as malaria and dengue.**

# Every day 5,000 children die from water- and sanitation-related diseases

environmental management. The key environmental intervention is eliminating standing water. Strategies include: levelling land, contouring reservoirs, lining canals, intermittent irrigation, improving drainage and installing wastewater management

facilities. Vegetation management can also help control both malaria and dengue fever. So too can safer practices for storing household water — in Cambodia, long-

lasting insecticide-treated netting is being used to cover household water storage containers and prevent mosquitoes breeding. The WHO has suggested that dengue and dengue haemorrhagic fever could be almost entirely prevented by good management of water bodies in and around houses.<sup>1</sup> In Vietnam, scientists have eliminated dengue by releasing small crustaceans called Mesocyclops (Copepoda), which feeds on the newly hatched larvae of *Aedes aegypti* into water tanks.<sup>10</sup>

Apart from environmental management, key strategies to prevent mosquito-borne diseases such as malaria include intermittent presumptive treatment for pregnant women, indoor residual spraying and promotion of insecticide-treated nets. Insecticide-based vector control is particularly prominent in Sub-Saharan Africa, where the number of people protected by indoor

spraying has increased from 13 million in 2005 to 75 million in 2009. But the dependence on a single class of insecticides, pyrethroids, increases the risk that mosquitoes will develop resistance.

## Poor water, sanitation and hygiene (WASH)

**The challenge:** Despite much progress in improving access to water and sanitation over the past two decades, more than 800 million people across the world still lack clean drinking water.<sup>11</sup> 2.6 billion people, mostly in the developing world, have no access to toilets or sewage systems.<sup>12</sup> And 1.2 billion people, nearly one-fifth of the world's population, lack any sanitation facilities at all. Coupled with poor hygiene practices, the impacts on health are enormous. Every day, an average of 5,000 children die from WASH-related diseases.

Poor water, sanitation and hygiene also play an important role in malnutrition and several diseases associated with malnutrition including diarrhoeal diseases, which kill more than one million over-fives in Africa and South-East Asia alone every year. They also encourage diseases that have part of their life cycle in water, such as schistosomiasis, which has infected an estimated 260 million people worldwide.<sup>13</sup> Trachoma — a chronic contagious eye disease — has been called a 100 per cent environment-dependent disease, attributable to lack of facial cleanliness, poor access to water supplies and latrines, and a high number of flies.<sup>1</sup>

The absence of sewage treatment systems or adequate drainage means that 80 per cent of raw sewage is discharged into rivers and streams, further polluting the water supply.<sup>14</sup> This leads to continual re-infection with waterborne disease such as cholera and dysentery.

**The solution:** One approach to improving access to sanitation includes increasing access to latrines, by either supporting individual households to build or improve latrines, or helping community organisations build or improve communal provision. Dry latrines and biogas systems do not need sewers and may be a better option for poor communities where densities are low and settlement sizes not too large. Increasingly, efforts to improve sanitation focus on community-led total sanitation (CLTS), which focuses not on simply building latrines but on convincing communities to take action themselves. CLTS has already had a major impact in countries such as Bangladesh, where it has helped millions of people adopt safe sanitary practices.

Marketing sanitation offers another approach to ensuring that people get latrines. It treats sanitation as a consumer product and focuses on working in partnership with the private sector to both develop demand for sanitation and ensure the supply of appropriate, good quality toilets.



Image: Sustainable Sanitation

Supporting small-scale informal water providers (including water kiosks) can help improve access to clean water.

Supporting small-scale informal water providers, water kiosks and water vendor associations can help improve access to clean water. The UN Development Programme estimates that every dollar invested in improving water supplies yields an average economic return of US\$4.4. Supporting sanitation yields even higher average economic returns: US\$9.1 for every dollar invested.<sup>16</sup>

But global water and sanitation problems are principally rooted in the disinterest of governments and aid agencies, rather than physical availability. Reforming water governance that determines who gets water, when and how, is essential. In particular, efforts are required to decentralise water decision making, increase stakeholder participation, promote integrated water resources management, clarify institutional roles and responsibilities, and provide incentives for better public-private, and public-community, partnerships.

## Chemical pollutants

**The challenge:** Chemical pollutants, including lead, air pollution and toxic waste, can have a significantly detrimental effect on both human health and the environment.

Industrial emissions of sulphur dioxide, nitrogen oxides and fine particles can cause short- and long-term ill health. Such outdoor air pollution causes three per cent of all respiratory infection deaths and eight per cent of lung cancer deaths.<sup>17</sup>

Industry is also responsible for 300–400 million tons of hazardous waste — such as heavy metals, solvents and toxic sludge — which is often dumped, untreated, into rivers and lakes.

Such dumping affects the salinity, acidity or other characteristics of water, affecting ecosystems and severely reducing its suitability for irrigation or human consumption. It can damage biodiversity by killing fish and other aquatic animals. If consumed by people, it can cause physical disability and cancers. The poor tend to be heavily affected by toxic waste because they are more likely to work and live near factories or industrial sites.

Some industries also threaten health by exposing workers to poisonous chemicals. For example, dangerous pesticides are often used in agriculture but workers in poor countries rarely have access to protective equipment. More than 25 million agricultural workers in developing countries suffer from acute pesticide poisoning each year.<sup>18</sup>

**The solution:** Policy, legislation and education or awareness campaigns to ban harmful chemicals or ensure their safe disposal can help reduce this environmental health risk. International treaties

such as the Rotterdam Convention promote shared responsibilities when it comes to importing hazardous chemicals. National legislation can also be effective. In 1989, India outlawed the production of PCPs (in response to a German ban on imported goods containing them), and standardised testing methods to ensure compliance.<sup>19</sup>

Industrial wastewater is difficult to ban, but it can be treated before being reused — using, for example, slurries, skimming devices, separators, or filters.

Regulating pesticide use is a key strategy for reducing risk in the agricultural sector. Many African countries

## Involving stakeholders

Involving stakeholders in making decisions about environmental health can help prioritise issues, set an agenda for action, ensure interventions are implemented, and monitor impacts.

In Kenya, for example, NGOs Intermediate Technology Group and Practical Action have used participatory approaches to find solutions for reducing indoor pollution among a Masai community. The community's cooks (women) identified a simple and affordable smoke hood as the option best-suited to their needs. Use of these hoods has reduced the concentration of fine particles by 80 per cent. It also provides employment to local artisans, who build the hoods.<sup>19</sup>

If people are given information about how an environmental risk affects their health, and they are consulted about potential solutions, they are more likely to find, and support, effective interventions.



Image: Fareena Chanda

**By 2030, 60 per cent of the world's population will live in urban areas, where the poorest groups often face the most serious environmental health risks.**

# One quarter of global disease is associated with environmental factors

lack the human resources to register or regulate pesticides. But some nongovernment organisations, such as Work and Health in Southern Africa, are working to build the capacity of regulators by running training workshops and connecting them to agricultural workers to improve their understanding of pesticides' health and other impacts.

## Rising urban populations

**The challenge:** Populations in developing countries are increasingly becoming urban. The UN estimates that by 2030, 60 per cent of the world will live in urban areas — more than three-quarters of these people will reside in developing countries. In most urban centres, it is the poorer groups that face the most serious environmental health risks. Many of these groups live in homes built on land that is illegally occupied or subdivided and this illegal status discourages or prevents municipal investment in infrastructure.

Living conditions for deprived urban populations can be even more squalid than in poor villages. People tend to live in extremely crowded housing, which increases the risk of respiratory disease such as tuberculosis. They have little access to clean water or sanitation, which puts them at high risk of waterborne and foodborne disease. Children do not fall under standard

vaccination programmes and so often miss out on basic immunisations such as diphtheria, measles and whooping cough. The urban poor also tend to fall through the gaps when it comes to health care. A lack of social identity documentation, or an inability to pay, means they cannot easily access health facilities.

**The solution:** Governments of developing countries need to prioritise environmental health in urban areas. In particular, they must allow and support low-income populations to buy, build or rent safe homes on safe sites served by piped water, good sanitation and drainage. This includes ensuring adherence to planning laws where, for example, it should be a planning requirement that houses are built with latrines. In Monrovia, Liberia, most of the rented houses in the poor parts of the city have no latrines provided, reducing access to sanitation for hundreds of thousands of people.

Environmental health hazards vary enormously both within and between cities. This means that programmes to control hazards and reduce risks need to be based on city-specific and neighbourhood-specific information.

Any effort to improve environmental health in urban (and rural) areas must be complemented with strategies to provide better health care and emergency services. This requires working with local groups, local doctors and other local associations to find solutions that can work on the ground (see Involving stakeholders).

## Overexploitation and degradation of natural resources

**The challenge:** Overexploitation and degradation of natural resources reduces the land's capacity to produce crops and support livestock and is a key factor in undermining food security. Food shortages result in malnutrition and, in some cases, starvation. The FAO estimate that there are nearly one billion hungry people in the world, including 16 per cent of the population in developing countries. Malnutrition reduces immunity to other diseases, affects children most severely and undermines development (see Malnutrition).

Overexploitation and pollution also increase water scarcity, which can further exacerbate food insecurity—lack of water is a constraint to producing food for hundreds of millions of people.

And overexploitation and degradation of natural resources can damage ecosystem services such as biodiversity, which is a key source of traditional and undiscovered medicine.

**The solution:** There needs to be a greater focus on sustainable natural resource management, including sustainable agriculture that focuses on minimum

## Malnutrition

Malnutrition is largely associated with infectious diseases such as diarrhoea that result from poor access to water, sanitation, hygiene and food safety.<sup>20</sup> It is also related to feeding habits and food security, both of which can be affected by land degradation and climate change. Some researchers suggest that climate change could even make current crops less nutritious, by altering the relative protein content in major staple foods.<sup>21</sup>

Child malnutrition in particular has significant impacts on development — it has been associated with less schooling, reduced economic productivity and a higher risk of chronic diseases such as diabetes and obesity in adulthood. Malnutrition also weakens the immune system and increases susceptibility to infection. Infection, in turn, runs down nutrient and energy stores, creating a vicious cycle of ill health.

Improving nutrition is not just about providing more food. The 'nutrition transition' seen in some rapidly developing countries as people shift away from traditional diets does not seem to increase access to micronutrient-rich foods. Deficiencies in vitamin A and zinc alone contribute to the deaths of one million children each year.<sup>22</sup>

Proven nutritional interventions include micronutrient supplementation, food fortification (for example iodised salt) and sprinkles.

Environmental interventions to improve nutrition include sustainable agriculture,<sup>23</sup> increasing access to clean water and sanitation services, and improving food safety.

tillage, the use of nitrogen-fixing plants and 'green' manures, biological pest control, crop rotations, mixed farming and the productive use and disposal of plant and animal residues.

Agricultural researchers have for decades been breeding crop strains that can resist insects and other pests. Now, they have additional challenges on their hands to develop strains that can adapt to climate change, by being resistant to drought and extreme heat.<sup>24</sup> Researchers are also working to create more nutritious crops to combat malnutrition, such as 'golden rice', which is supplemented with beta carotene.

## The climate change challenge

Climate change is set to impact health in many ways (see Climate change and health). This includes direct impacts such as extreme weather events — cyclone Nargis, which hit Myanmar in 2008, killed more than 100,000 people — and temperature-related illness and death, as seen in August 2003, when Europe's summer was 3.5 degrees Celsius warmer than average and an estimated 70,000 people died over two weeks.

Climate change will also change rainfall patterns, growing seasons, and patterns of crop pests, which could undermine food security and increase malnutrition. It is also likely to affect vector-borne diseases such as dengue fever and malaria (see Climate change and malaria). And, by contributing to desertification, sea level rise and deteriorating soil and water conditions, it is already causing mass migrations. By 2050, climate change is expected to push hundreds of millions of people — up to a billion, by some estimates — to leave their homes seeking better land, jobs and other resources.

Poor communities are most vulnerable to ill health related to climate change because they are often the most exposed to its impacts, but the least able to adapt.

About 310 million people are expected to have suffered ill health from climate change by 2030.<sup>26</sup> Nine out of ten of these people will be in developing countries — the number of healthy years of life lost to environmental change, including climate change, is set to be 500 times higher in Africa than Europe.<sup>26</sup>

## The path to mainstreaming

Improving environmental conditions to improve health and reduce poverty requires us to raise the profile of environmental health issues at national, state and local levels, and to integrate, or 'mainstream' them more effectively in development plans and activities.

A range of approaches are needed.

**Aligning policies.** Environment and health policies need to be better aligned to harmonise efforts and ensure

that environment plans don't clash with those made by the health department for instance. In some instances, budgets could be combined to avoid wasting money.

**Collaboration** is needed in other sectors too – donors, NGOs, activists, and researchers in environment and health rarely communicate, yet there is much scope for collaboration.

## Climate change and malaria

Researchers studying climate change and vector-borne disease focus much of their attention on malaria, which is spread by the bite of mosquitoes. Outbreaks of malaria seem linked to climate — increased rainfall in normally dry areas, for example, can create standing pools of water where disease-carrying mosquitoes breed.

But the links between climate and malaria are not simple. The same increase in rainfall in wet areas could reduce malaria by washing away immature mosquitoes.

Changes in temperature can have similarly opposite effects. Malaria mosquitoes tend to reproduce more quickly and bite more often at higher temperatures, which could speed up rates of infection and the spread of disease.

But higher temperatures in already hot regions could reduce the spread of malaria mosquitoes, which tend not to survive above 40 degrees Celsius. Senegal, for example, has seen malaria prevalence drop by more than 60 per cent in the past 30 years.<sup>25</sup>

Even if climate change increases the number of mosquitoes, this does not necessarily mean an increase in disease. Transmission depends both on people's immunity and the parasite's level of drug resistance. Other environmental factors are equally important — including water storage, agricultural practices, deforestation, living conditions, use of bednets and health infrastructure.



Image: International Rivers

**Climate change will increase the number of people killed and injured by extreme events such as cyclones and floods.**

**Investing in R&D.** Much more knowledge about the links between environment, climate change and health is needed. Researchers also support to devise low-cost, innovative ways to mitigate poor environmental health such as new methods of agriculture and water conservation, genetically modified crop strains, and better ways to contain infection in resource-poor settings.

**Taxing private industry.** Industries that have major impacts on environmental health are often multinational companies that make enormous profits and could afford to spend more on reducing pollution and toxic waste, and on restoring eroded habitats. These could be designed similar to carbon credit systems in which high emitters of greenhouse gases compensate by, for example, investing in clean energy.

**Strengthening legislation.** Better monitoring and oversight of industry and agricultural activities will be crucial to improving environmental health, but this will require stronger legal systems that include a framework in which environment and health issues are linked. Regulatory frameworks also need to be updated every few years to account for new studies on the links between environmental conditions and health.

**Communication and education.** Education about environmental health and climate change must be incorporated in health workers' training in developing countries. Many countries need basic public health education programmes to teach them essential hygiene techniques such as hand-washing and covering food and water. Education about the links between environment and health is also needed among journalists and the media to avoid misreporting. Awareness raising is often needed within and across government departments. It is even needed among researchers — many environmental specialists, for example, do not understand key environmental health issues.

**Internal integration.** Health-focused organisations need first to be aware of the importance of environmental health and climate change to their objectives. But they must also incorporate these issues into everything they do, particularly around individual project cycles.

**Involving stakeholders.** Encouraging the participation of vulnerable stakeholders in decision making is particularly important to help prioritise issues and find locally relevant solutions that will work in practice. For example, rolling out improved stoves is of no practical help if local communities do not want to, or are not able to, adopt and use them. Stakeholder participation can also help in monitoring the impacts of individual interventions.

## Notes

- <sup>1</sup> Prüss-Üstün, A., Corvalán, C. 2006. *Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease*. WHO, Geneva ■ <sup>2</sup> *Global status report on road safety: time for action*. 2009. WHO, Geneva. ■ <sup>3</sup> IPCC. 2007. *Contribution of Working Group II to the Fourth Assessment Report of the IPCC*. Parry, M. L. et al. (eds). Cambridge University Press. ■ <sup>4</sup> *Solutions to the Indoor Air Pollution Problem*. WHO Thematic Briefing 3. WHO, Geneva. [www.who.int/indoorair/publications/iabriefing3.pdf](http://www.who.int/indoorair/publications/iabriefing3.pdf) ■ <sup>5</sup> Cohen A, Mehta S. 2007. Pollution and tuberculosis: outdoor sources. *PLoS Medicine*. 4(3) ■ <sup>6</sup> WHO Fact Sheet No. 292: Indoor air pollution and health [www.who.int/mediacentre/factsheets/fs292](http://www.who.int/mediacentre/factsheets/fs292) ■ <sup>7</sup> WHO Global Malaria Programme. 2010. *World Malaria Report 2010*. WHO, Geneva. ■ <sup>8</sup> Guzman, M.G. et al. 2010. Dengue: a continuing global threat. *Nature Reviews Microbiology*. S7-S16. ■ <sup>9</sup> Satterthwaite, D. 1993. The impact on health of urban environments. *Environment and Urbanization*. 5(87) ■ <sup>10</sup> *Better environmental management for control of dengue*. Health and Environment Linkages Policy Series. WHO, Geneva. ■ <sup>11</sup> WHO/UNICEF. 2010. *Progress on sanitation and drinking-water: 2010 update*. Joint Monitoring Programme Report. ■ <sup>12</sup> WHO/UNICEF. 2005. *Water for life: making it happen*. Joint Monitoring Programme Report. ■ <sup>13</sup> See [www.who.int/water\\_sanitation\\_health/facts\\_figures](http://www.who.int/water_sanitation_health/facts_figures) ■ <sup>14</sup> Chiramba, T., Manyara, P. 2010. The effects of industrial pollution on ecosystems and human well-being. *Emerging Issues*. ■ <sup>15</sup> WSP. 2004. The case for marketing sanitation. Water and Sanitation Program (WSP) Field Note. [www.wsp.org/wsp/sites/wsp.org/files/publications/af\\_marketing.pdf](http://www.wsp.org/wsp/sites/wsp.org/files/publications/af_marketing.pdf) ■ <sup>16</sup> See UNDP Water supply and sanitation. [www.undp.org/water/priorityareas/supply.html](http://www.undp.org/water/priorityareas/supply.html) ■ <sup>17</sup> WHO. 2009. *Global health risks: Mortality and burden of disease attributable to selected major risks*. WHO, Geneva. ■ <sup>18</sup> WAHSA. 2008. *Reducing pesticide risks through building capacity of African regulators*. WAHSA Policy Brief. ■ <sup>19</sup> Poverty-Environment Partnership. 2008. *Poverty, health and environment: placing environmental health on countries' development agendas*. Joint Agency Paper. ■ <sup>20</sup> Prüss-Üstün, A., Kay, D., Fewtrell, L., Bartram, J. 2004. Unsafe water, sanitation and hygiene. In: Ezzati M. et al. (eds) *Comparative quantification of health risks*. WHO, Geneva. ■ <sup>21</sup> See [www.scidev.net/en/opinions/the-hidden-hunger-caused-by-climate-change.html](http://www.scidev.net/en/opinions/the-hidden-hunger-caused-by-climate-change.html). ■ <sup>22</sup> See [www.scidev.net/en/opinions/nutrition-key-to-cutting-infection-rates.html](http://www.scidev.net/en/opinions/nutrition-key-to-cutting-infection-rates.html). ■ <sup>23</sup> See Agriculture briefing. LINK ■ <sup>24</sup> McMichael, A.J. et al. 2004. Global climate change. In: Ezzati M. et al. (eds) *Comparative quantification of health risks*. WHO, Geneva. ■ <sup>25</sup> Githeko, A.K. et al. 2000. *Climate change and vector-borne diseases: A regional analysis*. Bulletin of the WHO. 78. ■ <sup>26</sup> GHF. 2009. *The anatomy of a silent crisis*. Global Humanitarian Forum, Geneva. ■ <sup>27</sup> See [www.water.org/learn-about-the-water-crisis/facts](http://www.water.org/learn-about-the-water-crisis/facts). ■ <sup>28</sup> Yardley, S. 2010. *Joining the dots: why better water, sanitation and hygiene are necessary for progress on maternal, newborn and child health*. Tearfund.

This briefing is a joint publication of the International Institute for Environment and Development (IIED) and Irish Aid. It is one of a series that builds on, and provides an update to, Irish Aid's 'Environment Key Sheets', available at [www.irishaid.gov.ie/article.asp?article=1147](http://www.irishaid.gov.ie/article.asp?article=1147). This series aims to clarify the links between the environment, climate change and key development sectors, and provide guidance on strategies available for mainstreaming the environment and climate change into national policies.

IIED is an independent, nonprofit research institute working in the field of sustainable development.

Irish Aid is the Government of Ireland's programme of assistance to developing countries.

Contact: [info@iied.org](mailto:info@iied.org)  
3 Endsleigh Street,  
London WC1H 0DD, UK  
Tel: +44 (0)20 7388 2117  
Fax: +44 (0)20 7388 2826  
Website: [www.iied.org](http://www.iied.org)



International Institute for  
Environment and Development

In association with



Irish Aid

Department of Foreign Affairs  
An Roinn Gnóthaí Eachtracha