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Global Climate Change

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Abstract

Climate change is one of the major challenges of our time and adds considerable stress to our societies and to the environment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale. Without drastic action today, adapting to these impacts in the future will be more difficult and costly. This overview deals with the concept of Global Climate Change, the associated terms, causes, consequences, solutions and its potential health impact. It shows the need to act urgently if we are to avoid an irreversible build-up of greenhouse gases (GHGs) and global warming at a potentially huge cost to the economy and society worldwide. Therefore, addressing climate change requires an "unprecedented level of cooperation, not only between countries, but also between different levels of Governments, private sector and individuals.

Keywords

Global; Climate Change

1. Introduction

The evidence of climate change is compelling: sea levels are rising, glaciers are retreating, precipitation patterns are changing, and the world is getting warmer. According to the Intergovernmental Panel on Climate Change (IPCC), the current rate of greenhouse gas emissions is likely to cause average temperatures to rise by 0.2˚C per decade, reaching by 2050 the threshold of 2˚C above pre-industrial levels. Recent evidence suggests even more rapid change, which will greatly, and in some cases irreversibly, affect not just people, but also species and ecosystems (Elizabeth et al., 2010).

Climate change indeed is real. Super typhoon Haiyan is the latest natural disaster that has also led credence to the reality of climate change. This sad occurrence hit land and devastated the Philippines. This record-breaking storm is the strongest storm in history to make landfall. It tore apart buildings and left entire provinces without power or communication. The 370-mile-wide storm packed winds 3.5 times as strong as Hurricane Katrina. Winds reached 195 mph and had gusts of up to 235 mph. Walls of water as high as fifteen feet swept over the country washing away towns on many islands and washed ships ashore where homes once stood. The U.N. says, "Around 920,000 people were displaced by the storm and a total of 11.8 million people have been affected. Officials said the deadly storm left more than 3850 injured and at least 77 people reported missing across the Phil-

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ippines." (The Argo, 2013).

Climate change is a serious risk to poverty reduction and could undo decades of development efforts. While climate change is global, its negative impacts are more severely felt by poor people and poor countries. They are more vulnerable because of their high dependence on natural resources and limited capacity to cope with climate variability and extremes. Restoring and maintaining key ecosystems can help communities in their adaptation efforts and support livelihoods that depend upon the services of these ecosystems. Moving towards low-carbon societies can help reduce greenhouse gas emissions, improving human health and well-being and creating green jobs.

Climate change is a fact of life. We need to act urgently if we are to avoid an irreversible build-up of greenhouse gases (GHGs) and global warming at a potentially huge cost to the economy and society worldwide. Organisation for Economic Co-operation and Development (OECD) analysis suggests that if we act now, we have 10 to 15 years' "breathing space" during which action is possible at a relatively modest cost. But every year of delay reduces this breathing space, while requiring ever more stringent measures to make a difference. Current financial turmoil is not a reason to delay. Indeed, its macroeconomic consequences will be resolved in a relatively short time, after which growth will resume, while the consequences of inaction on global warming will continue to grow more and more costly over time.

This study presents an overview of Global Climate Change with a view to help appreciate the concept, its urgency and to give an insight to the ways it affects society and the natural environment and proffering solutions.

2. Defining Weather and Climate

Weather is the state of the atmosphere at a specific time in a specific place. Temperature, cloudiness, humidity, precipitation, and winds are examples of weather elements. Thunderstorms, tornadoes, and monsoons are also part of the weather of some places during some seasons.

Climate is defined as long-term weather patterns that describe a region. For example, the New York metropolitan region's climate is temperate, with rain evenly distributed throughout the year, cold winters, and hot summers.

2.1. Climate Variability and Climate Change

Climate variability refers to variations in the prevailing state of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system, or to variations in natural or anthropogenic (human-driven) external forcing. Global climate change indicates a change in either the mean state of the climate or in its variability, persisting for several decades or longer. This includes changes in average weather conditions on Earth, such as a change in average global temperature, as well as changes in how frequently regions experience heat waves, droughts, floods, storms, and other extreme weather. It is important to note that changes in individual weather events will potentially contribute substantially to changes in climate variability. Climate change could occur naturally as a result of a change in the sun's energy or Earth's orbital cycle (natural climate forcing), or it could occur as a result of persistent anthropogenic forcing, such as the addition of greenhouse gases, sulfate aerosols, or black carbon to the atmosphere, or through land-use change.

2.2. Climate System

Climate is a complex and interactive system. It consists of the atmosphere, land surface, snow and ice, oceans and other water bodies, and living beings. Among these, the first component, atmosphere characterizes climate.

Various external factors influence the internal dynamics of the Climate Systems and these include natural phenomena such as volcanic eruptions and solar radiations, as well as human-induced changes in atmospheric composition. The entire climate system gets the power and energy from the Sun. The radiation balance of the Earth may get modified by three fundamental ways: 1) by changing the incoming solar radiation; 2) by changing the fraction of solar radiation that is reflected (called "albedo"); and 3) by altering the long wave radiation from Earth back towards space Climate, in turn, responds directly to such changes, as well as indirectly, through a variety of feedback mechanisms.

2.3. Why "Global Warming" Is the Wrong Term

Global warming (as well as global cooling) refers specifically to any change in the global average surface temperature. Global warming is often misunderstood to imply that the world will warm uniformly. In fact, an increase in average global temperature will also cause the circulation of the atmosphere to change, resulting in some areas of the world warming more, others less. Some areas can even cool. Unfortunately, although it significantly misrepresents what really happens, the term 'global warming' is still often used by media and others to describe climate change. Climate change is more than a warming trend (which is why the term "global warming" is an inaccurate description of the phenomenon).

2.4. Brief History of International Agreements on Climate Change

For the first time in June 1988 at the World Conference on the Changing Atmosphere in Toronto, politicians and scientists conclude "humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war." The conference recommends reducing carbon dioxide emissions 20% by 2005. In the same year IPCC published its First Assessment Report, which highlighted the increasing accumulation of human-made greenhouse gases in the atmosphere. The first Conference of the Parties (1995) in Canada, realized the need of binding commitments by industrialized countries are required to reduce emissions. In December 1997 around 150 countries signed the Kyoto Protocol, which binds 38 industrialized countries (called Annex 1 countries) to reduce greenhouse gas emissions by an average of 5.2% below 1990 levels for the period of 2008-2012. The Kyoto Protocol became international law on 16 February 2005.

For any nation, the more urgent priorities like economic development always tends to take over threats like climate change or global environment change and this is why it is so difficult to achieve a coordinated international response to such issues. Recently, United Nations Climate Change Conference in Bali, Indonesia (December, 2007) was attended by representatives from over 180 countries, together with observers from intergovernmental and nongovernmental organizations. Participants agreed on "Bali roadmap", which provide guidelines to reach a treaty by the end of 2009 to replace the Kyoto Protocol. That year in April during the UN Climate Talks in Bangkok – the first meeting after the Bali conference—an ambitious timetable had been developed to complete the complex negotiations on a new climate deal in time for the UN Climate Conference in Copenhagen in December 2009.

2.5. Greenhouse Effect

A natural system known as the "greenhouse effect" regulates temperature on Earth. Just as glass in a greenhouse keeps heat in, our atmosphere traps the sun's heat near earth's surface, primarily through heat-trapping properties of certain "greenhouse gases". Earth is heated by sunlight. Most of the sun's energy passes through the atmosphere, to warm the earth's surface, oceans and atmosphere. However, in order to keep the atmosphere's energy budget in balance, the warmed earth also emits heat energy back to space as infrared radiation. As this energy radiates upward, most is absorbed by clouds and molecules of greenhouse gases in the lower atmosphere. These re-radiate the energy in all directions, some back towards the surface and some upward, where other molecules higher up can absorb the energy again. This process of absorption and re-emission is repeated until, finally, the energy does escape from the atmosphere to space. However, because much of the energy has been recycled downward, surface temperatures become much warmer than if the greenhouse gases were absent from the atmosphere. This natural process is known as the greenhouse effect. Without greenhouse gases, Earth's average temperature would be −19˚C instead of +14˚C, or 33˚C colder. Over the past 10,000 years, the amount of greenhouse gases in our atmosphere has been relatively stable. Then a few centuries ago, their concentrations began to increase due to the increasing demand for energy caused by industrialization and rising populations, and due to changing land use and human settlement patterns.

2.6. Greenhouse Gases

The greenhouse gases and their sources are as follows:

Water vapour is the most common greenhouse gas but others are very important too. Some occur naturally and some come from human activity.

Carbon dioxide or CO_2 is the most significant greenhouse gas released by human activities, mostly through the burning of fossil fuels. It is the main contributor to climate change.

Methane is produced when vegetation is burned, digested or rotted with no oxygen present. Garbage dumps, rice paddies, and grazing cows and other livestock release lots of methane

Nitrous oxide can be found naturally in the environment but human activities are increasing the amounts. Nitrous oxide is released when chemical fertilizers. Nitrous oxide is released when chemical fertilizers and manure are used in agriculture.

Halocarbons are a family of chemicals that include CFCs (which also damage the ozone layer), and other human-made chemicals that contain chlorine and fluorine.

2.7. Since Greenhouse Gases Make up Such a Small Percentage of the Atmosphere, Why Do Changes in Their Concentrations Have Such a Big Effect on Climate?

Most greenhouse gases are extremely effective at absorbing heat escaping from the earth and keeping it trapped. In other words, it takes only small amounts of these gases to significantly change the properties of the atmosphere. 99% of the dry atmosphere consists of nitrogen and oxygen, which are relatively transparent to sunlight and infrared energy, and have little effect on the flow of sunlight and heat energy through the air. By comparison, the atmospheric greenhouse gases that cause the earth's natural greenhouse effect total less than 1% of the atmosphere. But that tiny amount increases the earth's average surface temperature from −19˚C to +14˚C—a difference of about 33˚C. A little bit of greenhouse gas goes a long way. Because the concentration of greenhouse gases in the atmosphere is so low, human emissions can have a significant effect. For example, human emissions of carbon dioxide (CO_2) currently amount to roughly 28 billion tonnes per year. Over the next century human emissions will increase the concentration of carbon dioxide in the atmosphere from about 0.03% today to almost certainly 0.06% (a doubling), and possibly to 0.09% (a tripling).

2.8. Causes of Global Climate Change

Earth’s climate changes naturally. Changes in the intensity of sunlight reaching the earth cause cycles of warming and cooling that have been a regular feature of the Earth's climatic history. Some of these solar cycles—like the four glacial-interglacial swings during the past 400,000 years—extend over very long time scales and can have large amplitudes of 5˚C to 6˚C. For the past 10,000 years, the earth has been in the warm interglacial phase of such a cycle. Other solar cycles are much shorter, with the shortest being the 11 year sunspot cycle. Other natural causes of climate change include variations in ocean currents (which can alter the distribution of heat and precipitation) and large eruptions of volcanoes (which can sporadically increase the concentration of atmospheric particles, blocking out more sunlight). Still, for thousands of years, the Earth’s atmosphere has changed very little. Temperature and the balance of heat-trapping greenhouse gases have remained just right for humans, animals and plants to survive. But today we’re having problems keeping this balance. Because we burn fossil fuels to heat our homes, run our cars, produce electricity, and manufacture all sorts of products, we are adding more greenhouse gases to the atmosphere. By increasing the amount of these gases, we have enhanced the warming capability of the natural greenhouse effect. It’s the human-induced enhanced greenhouse effect that causes environmental concern, because it has the potential to warm the planet at a rate that has never been experienced in human history.

2.9. Consequences of Global Climate Change

Although the consequences of climate change could be discussed under a number of different categories, the scope of this discussion limits it to both natural and economic consequences.

2.9.1. Natural Consequences

These are already visible, for instance, temperatures are rising, polar caps are melting, sea level is rising, the desertification increases and the winters in Europe become ever wetter. It has been scientifically demonstrated that Mount Kilimanjaro through the years contains less and less snow as a consequence of global heating. It is questionable whether this mountain in Tanzania will be covered with snow at all in 50 years. It is also concluded that the number of natural disasters increases more and more. Tsunamis, floods and extreme drought occur more

frequent than in times past. In the period 1950-1960 worldwide 13 natural disasters have been registered, against 72 in the period 1990-1998. Now already the consequences are clearly demonstrable and most likely they will only increase in extent and frequency in the future.

The IPCC predicts that climate change will become apparent in the following main ways:

- By around 2100 global temperatures will have risen by between 1.1˚C and 6.4˚C. The exact increase depends on future emissions of greenhouse gases and other pollutants and on the combined action of physical and chemical processes in the atmosphere.
- Some parts of the world will receive more precipitation, with others becoming drier.
- In the course of the present century sea levels will rise by between 18 and 59 centimetres. This is because warmer water occupies more space than cold water and because of the retreat of glaciers and polar ice sheets. Our understanding of the melting of the Greenland and Antarctic ice sheets is still incomplete. This, together with the fact that there may be large regional variations in sea level rise, means that in some parts of the world the consequences may be even more dramatic than predicted by IPCC.
- The Gulf Stream, which transports relatively warm water from the Caribbean to Europe, is expected to decline in strength, causing temperatures in northwest Europe to rise less markedly than elsewhere. Standard climate models, however, make no allowance for an abrupt change in the Gulf Stream.

2.9.2. Economic Consequences

Changes in global climate will have enormous consequences for living nature as well as the economy. Even a small rise in mean annual temperature can have a major impact on a region's ecology and biological diversity (Pounds & Puschendorf, 2004). Biodiversity is of crucial importance for the stability of ecosystems as well as for human health (Harvard, 2002). The economic impact of drought, floods and other climate change effects will become quite substantial. Some researchers estimate that these costs are set to rise to between 5% and 20% of global income (Stern, 2006). The IPCC has not yet managed to provide a rock-solid cost estimate of the consequences of climate change. It has estimated the cost of limiting further change, though. If such action is taken, global income will grow by only slightly less than if nothing is done: overall economic growth up to the year 2030 would then be 3 percentage points lower (57% instead of 60%, for example).

Avoiding extreme climate change is also important if the "Millennium Development Goals" are to be achieved, formulated by the United Nations as follows:

- Eradicate extreme poverty and hunger.
- Achieve universal primary education.
- Promote gender equality and empower women.
- Reduce child mortality.
- Improve maternal health.
- Combat HIV/AIDS, malaria and other diseases.
- Ensure environmental sustainability.
- Develop a global partnership for development.

That climate policy and the Millennium Goals go hand in hand is readily illustrated. In regions where climate change leads to more severe drought, for example, poverty and hunger will be exacerbated rather than eradicated. Climate change will mean that malaria spreads further round the globe rather than being effectively combated. The multiple impacts of climate change on biodiversity will mean less environmental sustainability, not more. The message is clear: if climate change is not halted, the Millennium Goals will simply not be achieved.

2.10. Potential Health Impacts of Climate Change

Global climate change would affect human health via pathways of varying complexity, scale and directness and with different timing. Similarly, impacts would vary geographically as a function both of environment and topography and of the vulnerability of the local population. Impacts would be both positive and negative (although expert scientific reviews anticipate predominantly negative). This is no surprise since climatic change would disrupt or otherwise alter a large range of natural ecological and physical systems that are an integral part of Earth's life support system. Via climate change humans are contributing to a change in the conditions of life on Earth.

The main pathways and categories of health impact of climate change are shown in **Figure 1**.

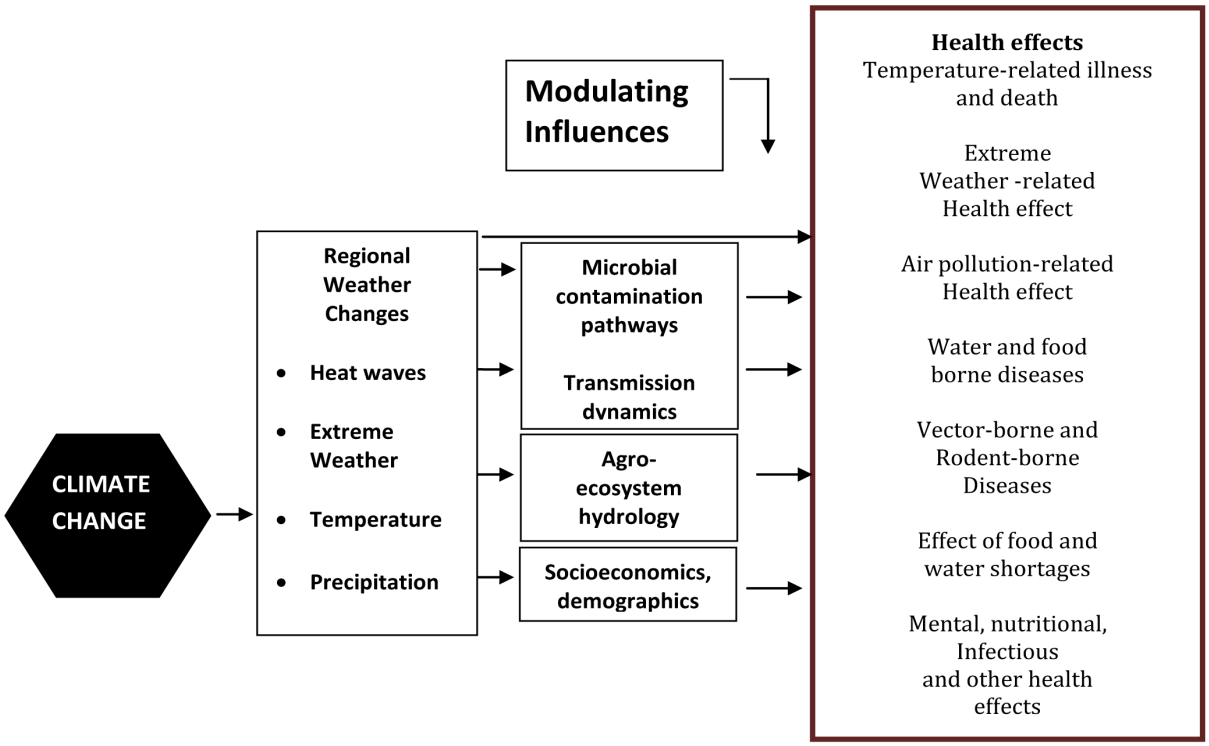

Figure 1. Pathways by which climate change affects human health including local modulating influences and the feedback influence of adaptation measures. Source: adapted from Patz et al., 2000.

The more direct impacts on health include those due to changes in exposure to weather extremes (heatwaves, winter cold); increases in other extreme weather events (floods, cyclones, storm-surges, droughts); and increased production of certain air pollutants and aeroallergens (spores and moulds). Decreases in winter mortality due to milder winters may compensate for increases in summer mortality due to the increased frequency of heatwaves. In countries with a high level of excess winter mortality, such as the United Kingdom, the beneficial impact may outweigh the detrimental (Langford & Bentham, 1995; Rooney et al. 1998). The extent of change in the frequency, intensity and location of extreme weather events due to climate change remains uncertain.

Climate change, acting via less direct mechanisms, would affect the transmission of many infectious diseases (especially water, food and vector-borne diseases) and regional food productivity (especially cereal grains). In the longer term and with considerable variation between populations as a function of geography and vulnerability, these indirect impacts are likely to have greater magnitude than the more direct (McMichael & Githeko, 2001; Epstein, 1999).

For vector-borne infections, the distribution and abundance of vector organisms and intermediate hosts are affected by various physical (temperature, precipitation, humidity, surface water and wind) and biotic factors (vegetation, host species, predators, competitors, parasites and human interventions).

By reflecting the increased retention of heat energy in the lower atmosphere, global warming also affects the atmospheric heat budget so as to increase the cooling of the stratosphere (Shindell et al., 1998) Should this cooling persist, the process of ozone depletion could continue even after chlorine and bromine loading (by human emission of ozone-destroying gases) starts to decline. If so, the potential health consequences of stratospheric ozone depletion (increase in incidence of skin cancer in fair-skinned populations; eye lesions such as cataracts; and, perhaps, suppression of immune activity) would become an issue for climate change.

2.11. Mitigation Solutions

Between 1970 and 2004 global emissions of greenhouse gases rose by 70%, mainly as a result of rising energy consumption. The CO_2 emissions of electrical power stations, factories, motor vehicles, homes, offices and other sources grew even greater: by 80%. Developed countries are responsible for half the world's CO_2 emissions.

While the share of emerging economies like China and Latin America in global CO_2 emissions is rising, it is still far less than that of Europe and the United States taken together (both in absolute terms and per head of the population). If no action is taken, global CO_2 emissions are projected to rise by a further 45% to 110% between 2000 and 2030.

In many of the world's regions and countries governments have introduced policies to reduce emissions of CO_2 and other greenhouse gases. This is often referred to as mitigation policy. A case in point is the Kyoto Protocol, under which industrialized countries have committed themselves to a certain cut in emissions; this has not been ratified by Australia or the US, however. The European Union has an additional policy target of reducing its CO_2 emissions by twenty to thirty percent by the year 2020 relative to 1990. One of the key instruments for securing these targets is the European "carbon emissions trading scheme". At the national and local level, too, action is being taken by governments as well as environmental organizations. One example of the latter type of action is Green4sure, a green energy plan presented to the Dutch government in 2007 by the Netherlands' largest environmental and trades unions organizations.

Young people themselves can also take action to limit climate change. The first step is for them to realize that many everyday activities—computer gaming, showering, travel, and so on—consume energy and that energy is also required to produce food, clothing, cars, buildings and all kinds of other products. Everyone uses energy and every unit of energy consumed can further exacerbate climate change. It's therefore important to realize that all of us share some of the responsibility for climate change. What we ourselves can do to tackle climate change depends very much on our personal situation. It therefore makes sense to first work out how high your greenhouse gas emissions are, for example by going to one of the following websites:

- www.carbonfootprint.com
- www.climateneutralgroup.com
- www.carbonneutral.com
- www.co2meter.nl

These sites will then point you to ways of reducing your emissions.

There are three golden rules for cutting your personal CO_2 emissions:

1) Use as little energy as possible.

- Replace old window panes with double-glazing (HR++ grade) and improve your home by insulating the floor, cavity-walls, loft and roof.
- Replace your old central heating system with a high-efficiency heater and make sure the system gets regular maintenance.
- Turn your central heating down a degree or two and put it on the night-time setting half an hour earlier.
- Avoid using air-conditioning systems if you can, using a fan, for example; if you do buy an airco, have a good look at the energy label.
- Use power sockets with on-off switches for your adapters, to ensure that energy is not being wasted when equipment is on stand-by.
- Replace old incandescent light bulbs with compact fluorescent ones.
- To save (heated) water, fit a low-energy shower head and take shorter showers; use a solar boiler for your hot water.
- Only use appliances with an A-label or better for energy use.
- Say no to energy-guzzlers like tumble dryers, plasma TVs and water beds.

2) Try and ensure the energy you do use comes from renewable sources (wind, water, solar).

3) Compensate for any fossil energy you use by supporting energy efficiency projects or by other means (a variety of schemes are available).

When it comes to reducing emissions of the other main greenhouse gases—methane and nitrous oxide—the single best tip is to eat less meat and more organically grown food.

2.12. Adaptation Solutions

Adaptation is processes through which societies make themselves better able to cope with an uncertain future. Adapting to climate change entails taking the right measures to reduce the negative effects of climate change (or exploit the positive ones) by making the appropriate adjustments and changes (UNFCCC, 2007). The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as 'adjustment in natural or human systems in

response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2009). The consequences of climate change can be seen all over the world. Sea level rise, flooding, hotter summers and wetter winters are the picture of present and future. The key question is to what extent these changes will persist and how we should adapt to them. Contrary to mitigating measures, adaptive solutions do not contribute to a reduction of the climatological problems. Instead, we reconcile ourselves to the changes and adapt ourselves as best we can to the consequences. This means that much infrastructural development will be needed: raising of dikes, improving of sewer systems, making more space for water and similar measures. We must become conscious of the fact that we will not always be safe any more (from flooding), but we must adapt ourselves to the changes:

- Sea level rising/floods/water nuisance.

When considering the rising of the sea level and the increased possibility of floods in a country, the Netherlands for example, there are two courses to a solution. On the one side the Dutch can protect their country even better by raising the dikes and reinforcing the coastal areas. But by doing this, the consequences in case of a failure (the bursting of a dike) will only be worse. In fact, raising dikes will only be like building a high protecting wall around the country, creating a kind of 'bath tub' at the same time. If the protection wall fails the consequences will be greater. Another adaptive solution is learning to live with floods. Instead of concentrating on reinforcing the protecting areas (dunes and dikes) we rather put our efforts in limiting the consequences. This too will reduce the risk. After all, risk is defined as opportunity x consequence. If the opportunity remains the same, but the consequences are less severe, the risk will decrease. And exactly the limiting of the consequences can be started off on local government level. You could think of local policies like "no constructions in lower areas of the country" or on the contrary "specially adapted constructions in lower areas of the country".

- Drought and desertification.

The UN-plan that was passed in 1994 underlines a "bottom-up"-approach, with which one wants to find particularly local solutions to prevent desertification together with the local communities. One tries to find the solution in sustainable development, tackling social, economic and ecologic problems at one time. A similar attitude requires quite a co-ordination and close collaboration between regional, national and international bodies, but environmentalists are not convinced that the political will to take measures is strong enough to turn the tide. To resist the advancing desertification, in 1994 the Convention to Combat Desertification (CCD) was established, as a consequence of the Earth summit of 1992. The Convention, which in the meantime has been signed by 191 countries, entered into force in December 1996. To make degraded ecosystems fertile again is a long lasting process and requires an integrated approach of rural development, expansion of irrigation systems and application of new technologies. Still, it is possible. In China the quantity of fertile soil vanishing yearly dropped between 2000 and 2004. In February the Chinese government launched a plan to reclaim 250.000 square kilometres from the desert by 2020 by means of planting trees and grass. Also, the Chinese government wants to invest in dry regions in the efficient use of water and renewable energy sources, such as wind and water. Furthermore it is the opinion of the UN-Environmental organization (UNEP) that where it is difficult to turn the tide, one should make a virtue of necessity. The story of a report that was published 5 June ran as: "As long as deserts become more inhospitable and less suitable for human habitation, we must be imaginative and take advantage of the new situation". UNEP sees an important potential particularly for the exploitation of solar energy, fish-production, research of the medicinal properties of desert plants and the breeding of crops resistant to drought and salinity. Also, new technologies to develop more efficient irrigation systems and to desalinate estuaries could help.

Heat

Temperature rise caused by climate change can in extreme situations (heat) have a direct negative impact on the human health. Possible health effects in Europe are: problems by heat stress, increase of the spreading of Lyme's disease, effects of bad air quality (summer smog) and an increase of allergies. Population groups at high risk (such as the elderly, children or asthmatic people) may experience stronger effects (a greater sickness burden). Policy can play an important role in the limiting of the health effects of climate change. The Netherlands ought to be capable to resist certain health effects of climate change, by means of the maintaining/improving of existing policies or with new policy decisions. Little is known about biological or passive adaptation of man to climate change (for example acclimatization, immunization). Possible policy options/adaptation possibilities are amongst others:

- Improving of living conditions, e.g. air conditioning, ventilation.

- Improving of preventive/curative health care, e.g. personnel with special educations, vaccination.
- Monitoring/alarm systems.
- Public information/education.

Some adaptation possibilities will be more effective and/or cost-effective than others.

3. Conclusion

Climate change is happening and it is caused largely by human activity. Its impacts are beginning to be felt and will be worsen in the decades ahead unless we take action. The increasing rate of global warming—courtesy of carbon dioxide and other green house gas emissions from human activities—have led to climatic changes and environmental degradation, which in turn have resulted to great challenges in relation to diseases and human health. Many diseases which were previously unknown in certain climatic zones are now finding their way to such areas, due to changes in the weather conditions. Further, many diseases that had been thought extinct are reemerging in areas with altered climatic conditions that favor their comeback. It is therefore important that stakeholders and decision makers at industrial, government and international policy levels come up with stringent and workable means of cutting down on green house gases emission to combat the spread of global warming effects, and the resultant climate change, which has produced devastating impacts especially among poorer nations. Further, there should be increased funding of adaptation and coping programs and projects in affected areas to minimize the impacts on human health and curtail the spread of diseases.

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