GLOBAL CHANGE AND CHALLENGES FOR SUSTAINABLE DEVELOPMENT FOR THE 21st CENTURY

Julia Carabias (Professor, the Autonomous University of Mexico)

Mexico, the world 's fourth most mega-diverse country

I would like to begin with the location of Mexico. Mexico adjoins the United States to the north, and Central America to the south. The country is regionally considered part of Latin America. Mexico faces the Gulf of Mexico, the Caribbean Sea, the Sea of Cortes (Gulf of California) and the Pacific Ocean. My country has a long geological history. Its location between the two large continents, combined with high mountain ranges extending along the coastal areas, gives the country a unique topography, where most of the ecosystems in the world are concentrated.

As I mentioned, the mountains vertically cross the country. These mountain areas generally have a temperate climate, but there are also some dry regions. Mexico faces the Pacific Ocean to the west. We have also different types of ecosystems; you can find dry forests along the Pacific coast, and tropical rainforests further south. As well, Mexico has great diversity in the sea: cold waters moving down to the south, and hot tropical waters with coral reefs.

This is the area of Chiapas, in the Lacandón region where I work. This is the largest tropical forest we have in Mexico. Unfortunately, deforestation has progressed in this region, but we still have dense forests with many different animal and plant species. The Lacandón region also serves as the "factory for water" in Mexico, as it is a place where large rivers occur.

In terms of biodiversity, there are big trees called "Kapok," which have trunks more than 12 meters in diameter. This region is home to the jaguar and the howler monkey, as well as birds, such as the green macaw and the red macaw. These species are in danger of extinction.

If you go further along the coast, there are wetlands inhabited by flamingos and crocodiles. In the tropical waters there are rich coral reefs with thousands of different littoral species.

Meanwhile, the Sea of Cortes, also called the "Gulf of California" is one of the few places in the world where the gray whale reproduces. It has been found that gray whales come back to Mexico to reproduce. Move inland and north, and you will reach a desert area where different types of cactus grow. Here, you can see a characteristic

small shrub in an odd shape. This region is also home to the antelope, which is in danger of extinction.

If we move up to the hills we reach the very cold areas. This is Mt. Popocatépetl, more than 5,000 meters high. This snow-covered mountain is the home of the Mexican wolf and bear. Also, there is an area called Michoacán, where the monarch butterfly flies all through the winter. In spring, the monarchs move north, first to the United States, then to Canada. The monarchs reproduce in those countries, then five generations later, they come back to Mexico. We can say that this is also a mystery of nature.

As mentioned above, Mexico features truly abundant biodiversity. Countries with such a wealth of biodiversity are not homogeneously distributed in the world. There are only 17 mega-diverse countries, which hold between 60 and 70% of the total biodiversity of the planet. Mexico is the fourth most mega-diverse (most biologically diverse) country in the world.

I would also like to remind you of the importance of biodiversity. Biodiversity is absolutely crucial for human survival and well-being. Biodiversity has evolved since the beginning of life, and has resulted in many different species. This has to be continued.

One species has been benefiting particularly intensively from biodiversity: the human species. We use biodiversity for fresh water, fuel, fiber, biochemicals and genetic resources. Biodiversity is also influenced by climate, disease, flooding and various other environmental factors. As well, biodiversity comprises important spiritual and cultural elements for humans. Therefore, we humans benefit from biodiversity in many ways.

Looking back over the histories of humankind, nature and society, it appears to us that human society lived in harmony with nature some time ago. The Mayan culture provides some examples of this. We don't know what exactly happened with the Mayan culture, and perhaps it may not have been as good a way of using nature as we have thought. But I believe that it was a much more harmonious way of living with nature than the way we live in the present day. While humans once lived in harmony with the environment, as in the Mayan culture, today things have changed dramatically. We have various types of environmental pollution problems. We are using more resources than nature can provide, and we are putting waste back into nature faster than nature can absorb it.

By the middle of this century, the global population will reach 9 billion

The world population is about 6.3 billion people at present. Although the fertility rate has been declining and will continue to decline in the next 50 years, the global population is projected to grow to 9 billion by the middle of this century, though this is rather an optimistic scenario. Some predict that the world population will be 12 billion people, whereas other optimistic scenarios say that perhaps we can slow population growth to some extent. At any rate, the general consensus is that the global population is going to stabilize at around 9 billion people. That means that to the population of today, half again will be added. In other words, we will have 3 billion additional people on the planet in only the next 50 years. Such population growth will pose many challenges.

Human overpopulation is a major problem, but at the same time the population distribution also poses a great problem. In Mexico, the population is concentrated in approximately 500 cities, mainly Mexico City. The concentration of population in urban areas will accelerate increasingly in the future. It is projected that 60% of all the people on the planet will be in urban areas. Maybe by 2025, approximately 60% of the population of the world will live in urban areas. This implies a major challenge, because there will be increasing demand for certain kinds of food products, energy sources and water in cities, and urban dwellers will consume them at an even faster pace, having a greater impact on land and nature.

Moreover, not only the dispersion of population, but also the composition of population should be considered; the real problem is that urban areas are populated by many people, especially poor people, who cannot obtain enough water, enough nutrition, enough access to health and education. It is therefore our challenge to provide a good standard of living for the poor. This challenge involves economic efforts as well as efforts in planning better use of natural resources, to avoid impacting every single hectare on our planet.

Another problem is malnutrition. The proportion of people who are undernourished has decreased in all regions except Africa. In Asia particularly, the proportion has been reduced. This is a good indication. However, we still have 800 million people who are malnourished, which implies that food production must be doubled during the next 30 years to meet the needs of an additional 3 billion people. Accordingly, we have to produce a much larger amount of food than we are producing today. It is also true that one-third of the world population is now subject to water scarcity. To cope with this deficiency, we have to provide water for this one-third of the world's population of the world, in addition to the 3 billion of increased population. This is a real challenge.

Of the three pillars that sustain the Earth, the environmental pillar is the most vulnerable

As our first conclusion, we can say that the world is currently at high risk; society, economy and the environment are not moving in the same direction, and are not well coordinated. The three are indispensable pillars of development. This illustration shows that, of the three, the weakest is the environmental pillar.

Let me explain a little more about what I mean. Human activities are causing the loss of biodiversity. Biodiversity is extremely beautiful, and indispensable for human development. In the last few decades, biodiversity has been lost a thousand times faster than in the past.

Dinosaurs disappeared from the Earth about 65 million years ago; it took more than 20,000 years for them to become extinct. However, comparable extinctions of natural species have been occurring in the last 20 years; the rate of extinction has increasingly accelerated. Doctor Peter Raven, winner of the 2003 International Cosmos Prize, stated at his award lecture that, if the loss of biodiversity continues at the present pace, by the end of this century biodiversity will be half of what we have now. For the sake of human development, we cannot allow this to occur. As one species, humankind should not inhibit the evolution of other species. Also, we should not allow the current biodiversity to decline by half at the end of this century.

One of the factors impairing biodiversity is deforestation. In Mexico, more than 1% of the territory is being deforested every year. The same phenomenon is occurring in parts of Asia and Africa as well. Such deforestation has occurred mainly in tropical forests. Latin America, where 7.4 million hectares of tropical forest are destroyed each year, comprises a large percentage of global tropical deforestation.

The main causes of deforestation are cattle raising and agriculture. These two practices cause 75% of all deforestation. Fires are also a large contributing factor to deforestation.

Now, let me show you what happened in the tropical rain forests in Mexico. Here we have a picture of the tropical rain forest in the Lacandón region in 1972. This is the same place that I showed you in the first photograph, at the beginning of this lecture. This region is the “factory for water” and home of the jaguar. As you can see, the Lacandón region was covered with tropical rainforests in the 1970s. However, about 30 years later, most of the region has been deforested, apart from only a few areas that are isolated and fragmented. These areas are now conserved as a national park, and only they remain covered by forests. If we do not take any measures, deforestation will continue.

Deforestation has progressed and certain species have thereby become threatened with extinction. This also means that the ecosystems have been endangered, posing a risk of widespread extinction of species. For example, 24% of earth's mammals, 12% of birds, 25% of plants and reptiles, 20% of amphibians and 30% of freshwater fish are threatened with extinction. At the same time, coral reefs, mangroves and other ecosystems are at great risk.

This loss of biological diversity is due to various reasons, including deforestation, erosion, pollution, global climate changes, illegal commerce, human activities and habitat destruction. Desertification is also a cause of biodiversity loss; 15% of the earth is already eroded, and 70% of the land in the dry regions is already eroded.

Half of the global population will suffer from water shortage in 2025

Let's now move on to the issue of water. Blessed with abundant water, the earth is called the "blue planet." About 70% of its surface is water; the other 30% is land. However, of the total amount of the planet's water, 97.5% is salt water, which we cannot use for development. Perhaps sometime in the future we may be able to do so, but for now there are limitations to salt water use. The remainder is fresh water, which comprises only 2.5% of the earth's water. Of this 2.5% freshwater, nearly 70% is frozen, and so we cannot use it. Consequently, currently we can only use less than 0.5% of the water on the planet. In other words, 9 billion people will need to survive with less than 0.5% of the water.

How can we do it? The demand for water is increasing very quickly. During the 20th century, the demand for water increased over 6-fold. Water-related issues have become obvious, such as health problems, water quality degradation and increasing competition among users, regions and countries for access to water. Water is used for domestic, industrial and agricultural purposes, with most of the available water on the planet being used for agriculture. However, we can see here how useless and inefficient is the way we are using water for agriculture. For example, 70% of the water used in irrigation is lost through evaporation or leakage, due to technical problems and other reasons.

Please look at this map, which shows the regions with scarcity of water in 1995. You can see that, in 2025, even the United States will suffer from water shortage. Also, Mexico, North Africa, China and Asia are projected to suffer from serious water scarcity.

We should consider not only the amount of water, but also how we use it and who uses it. It is true that the population with access to water has increased, but 1.3 billion people still have no access to clean water. It is estimated that polluted water

causes 80% of the disease in developing countries. Also, 10 million people die every year because of contaminated water.

There are various water-related regulations and conventions. Among them, the Ramsar Convention has played a particularly important role in helping conserve wetlands. For example, this is a photograph of the Pantanal wetlands in the Republic of Bolivia and Brazil. Located near the coastal areas, the Pantanal wetlands are places where salt water of the ocean mixes with fresh water from inland. There are presently 1,387 wetland sites, totaling more than 122,7 million hectares, designated for inclusion on the Ramsar List of Wetlands of International Importance.

Climate change will continue in the future

Now I would like to talk about climate change, which is a contributing factor to water shortage. Climate change also leads to increased risk of flooding, because of heavier precipitation and the rise in sea level. Japan has been hit by an unprecedented number of typhoons, and you had a major one just last week. Let's consider what is happening now all over the inter-tropics. There is a correlation between climate change and the fact that we are having more frequent hurricanes, cyclones and typhoons. Although this correlation has not yet been exactly proven by science, what is clear to us is that the higher the temperature, the greater the impact and changes in climate. It is not unusual that we experience such climate changes in everyday life in our countries.

Let's look at climate change in a little more detail. The solar radiation passes through the atmosphere. The atmosphere absorbs some of the radiation, but some is reflected by the Earth and the atmosphere. However, if we change the composition of the atmosphere, then the radiation is not reflected, or the amount reflected becomes smaller. As a result, infrared radiation is reflected back to, or remains on, the Earth's surface. This causes major climate change.

These graphs show various indicators of human influence on the atmosphere in the last 1,000 years. We can see there is a large increase in the amount of CO2 in the atmosphere in 2000, just as with methane and nitrous oxide. All these are contaminants produced by human activities. Here is a figure that provides more detail on the large increases in the carbon dioxide level during the last 50 years. As you can see, CO2 in the atmosphere increased by 12% during those 30 years.

The CO2 concentration in the atmosphere goes up and down over time; it decreased during the glacial and interglacial periods. Changes in the CO2 concentration are related to global warming and changes in temperature. Let me show you this figure,

indicating the projected concentration of CO2: if we take some measures now, the increase in CO2 concentration may be curbed like this, but if no measures are taken, the CO2 concentration could rise to the level shown here. In terms of temperature, depending on whether appropriate measures are implemented, the temperature rise may vary from less than 1 degree to more than 5 degrees. This difference would be really catastrophic. In other words, global warming could cause the sea level to rise by between less than 20cm and more than one meter. If the sea level rises by one meter, much land in many countries would be below sea level.

Here are the real measurements of temperature changes during the last few years. We can see here that some areas have already registered a significant temperature rise. The regions with more than one-degree increase are indicated by a dot of the size shown at the far right.

These are photographs of the Arctic sea in 1973 and 2003. We can also see how much the ice in the Arctic has retreated during the last 30 years.

The major cause of climate change is the increase in energy consumption. In terms of energy consumption per capita, the world's largest consumer is the United States, followed by Canada, Russia, the UK and Japan. In terms of total amount, again the United States, China, and Russia are the highest consumers of energy.

One cause of the increase in CO2 emissions is the growing use of vehicles. This creates not only a problem of climate change, but also causes the problem of pollution in our cities.

Over the 20th century, we have already experienced climate change that caused the average global surface temperature to rise by probably 0.6 +/- 0.2 . By 2100, the average global surface air temperature is predicted to rise by between 1.4 and 5.8 degrees, which is a catastrophic increase. Moreover, by the same year, the globally averaged sea level rise is estimated at 0.09 to 0.88 m.

As I have mentioned thus far, climate change greatly impacts air quality, forestry, water, desertification and biodiversity, thereby greatly affecting all sectors of our economies, lifestyles and quality of life.

Expectations for the Kyoto Protocol

However, we have a new hope. Fortunately the Kyoto Protocol has been adopted. Now Russia has ratified the Protocol and it is going to come into effect. I believe that Japan can be justly proud of it.

What is going to happen if all the countries ratify the Protocol and accomplish their commitments? Here is a graph showing the global carbon emission projections, according to scenarios with and without implementation of the Kyoto Protocol. Without the Protocol, the emission level will continue to increase as shown here. However, if the Protocol is put into effect soon, then the emission increase will slow down, like this line indicated by "7.6" on the graph. We can thus improve the situation. If everybody does their best to curb emissions, we can go back to the situation of the past, when the emission level was much lower, and so resolve many problems.

However, it will not be possible for us to achieve this earlier than 2250, because the amount of gases we are presently emitting into the atmosphere will last for a long time; some of these gases, particularly argon, will remain for more than 50 years. It is therefore said that even if we stop all emissions right at this moment, the problem of climate change will continue. Nevertheless, the sooner we stop the emissions, the quicker the emissions can be reduced. So we can attribute future success in resolving emission-related problems to the Kyoto Protocol.

Now, we are at the point where the Kyoto Protocol has been ratified, with commitment by signatory countries, and is moving toward its implementation. While developed countries have consumed most of energy on the planet and accounted for a major portion of greenhouse gas emissions, we should also consider what developing countries have to do. If we continue today's consumption trends, energy consumption will reach these levels. Then, even though developed countries can stabilize their energy consumption, if the developing countries continue to increase energy consumption, it will lead to a disastrous result. Therefore, now that the Kyoto Protocol has been ratified, I think it is time for developing countries to start discussing what commitments we should make, and not just wait for implementation of the Protocol. And I hope that at COP7, discussions will commence regarding a new framework enabling movement in such a direction.

Now, let me say something about the ozone layer. You know that the ozone layer has holes in it that allow hazardous radiation to pass, which is dangerous to humans, animals and plants. Fortunately, however, the ozone layer is currently stabilizing. Although ozone depletion was accelerating, after some years of action the depletion began to slow. This means that if we do something, we can stop problems. Loss of the ozone layer can be prevented by reducing the generation of chlorofluorocarbons (CFCs). Recently, we have been coming increasingly closer to our reduction goals, and if we continue our efforts the amount of CFCs will continue to drop, as shown in this graph. Moreover, if we can reduce the use of CFCs to zero, the levels shown in this graph will be even lower. It will be a success story coming

from multilateral agreements like the Kyoto Protocol. We need to develop such protocols to address other environmental problems, as well.

Challenges for people on the Earth in the 21st century

Let's consider what we can do now on a global scale. First we need to stabilize the global population. We also need to hold back or rationalize the demand for energy and resources per capita. Further, it is necessary to develop new environmentally friendly technologies, consider ecologically cost effective development and establish global financial criteria so as to promote ecological efficiency, in addition to economic efficiency. We also need to adopt the new ethic of sustainable development, i.e., development that guarantees well-being for the present and future population without damaging the natural environment. That is exactly what is proclaimed in the theme of Flower Expo '90, "Harmonious Coexistence of Nature and Mankind."

Sustainable development should be considered not only at global, national and government levels, but also at the individual level; it involves everyday activities of each individual on the planet. The ways in which individual people use electricity and gas at home, and transport facilities are major factors in achieving sustainable development. To achieve sustainable development, it is necessary to consider how to develop and use renewable energy, as well as to develop energy-efficient cars and promote their widespread use. We also need to produce and use goods with low environmental impact, and recyclable products. In addition, we have to insist that our governments and political parties give higher priority to environmental issues.

It is necessary to achieve a good balance between the needs of the environment and the benefits that the environment gives us – the social and economic benefits. We should not increase social and economic benefits at the expense of diminished environmental benefits.

If we can successfully achieve a balance between them, we will be able to create a sustainable world, where the three pillars that sustain the planet, i.e., the social, economic and environmental pillars, will have the same importance and balance. To this end, we should continue our efforts.

I am sure that this is a new ethic, a new philosophy, and a new way of living on this planet. There is no model or recipe for sustainable development. Each country should therefore find its own way to achieve it. However, the above-mentioned principles for sustainable development can be applied to all countries around the globe.

To put it very simply, developing countries are faced with a major challenge: to alleviate poverty, but without repeating the same problems that developing countries have experienced. Developing nations are not allowed to develop by using the same amount of energy, water and natural resources that developed countries used to achieve their current standards of living. Meanwhile, developed countries are also confronted with a major challenge as well. They should change their patterns of consumption and production. The high standards of living in the developed nations cannot be enjoyed by all 9 billion people on the planet, because there is not enough energy and water, not enough animals and plants. Accordingly, the challenge for developed countries is to change their current ways of producing and consuming.

I am sure that Japan has great potential for leadership in addressing this issue, since Japan has culture and tradition of very long history, and a very high level of education. I believe that Japan can play a leading role in changing people's consumption pattern and lifestyles, making use of the discipline developed by such cultural and educational backgrounds.

Another distinctive characteristic of Japan is its technological development capabilities. People around the world are using products from Nikon, Sony, Mitsubishi, and Toshiba. They are using a lot of technology that comes from Japan. Thus, Japan has high ability to develop and distribute technologies. I hope that Japan takes up the challenge of developing environmentally friendly technologies, and of spreading them to all countries around the world. I expect that Japan will develop technologies that will not damage the environment, but rather will help improve the environment, and disseminate these eco-friendly technologies to the world. Since Japan has a strong economy, I believe that these tasks are achievable for Japan. I am confident that Japan can be a leader of the developed countries in achieving sustainable development to salvage our planet. So please take on the challenge of leadership, and help our planet.