

Man is small and, therefore, small is beautiful.
 “Small is Beautiful” by Ernst F. Schumacher

Schumacher published “Small is Beautiful” in 1973, based on awareness of the problem of how to secure and expand humanity in modern society. This book coincided with the environmental pollution that became a social problem mainly in developed countries. At the same time, the United Nations Conference on Human Environment was held in Stockholm and the Stockholm Declaration was adopted (1972), and the world was trying to move forward toward building a framework for a sustainable society on a global scale. However, there still were continuous mass production, mass consumption, and mass disposal, in a way that could not be called sustainable. The book says that these human activities and technologies cause a crisis of eating up limited natural resources.

The book says that people find little satisfaction and lose their humanity because such modern style of production splits the work that used to achieve humanity and life satisfaction into pieces of work. This is the first crisis that the world faces. The second crisis is the ones of the environment that

supports human life but now is showing signs of collapse. The third crisis is the depletion of natural resources.

Schumacher writes that we should create “intermediate technology” that is appropriate for humans. This way of thinking is summarized by the words “Man is small and, therefore, small is beautiful,” which became the title of the book.

In this book, Schumacher also makes some epigrams. Schumacher says that it is too optimistic to expect that we can deal with the destructive forces by solving environmental destruction, conserving wildlife, discovering new energy and achieving agreements on peaceful coexistence.

The moral choices, he says, are necessary and it is possible to obtain justice (*justitia*), courage (*fortitudo*), and temperance (*temperantia*) with knowledge (*prudential*).

These are virtues that are absolutely essential for the continued existence of civilization.

Section 2 Evaluation of Sustainability and Consideration of Quality of Life

1. The Current Status of the World’s Sustainability

“As seen in the previous section, the life satisfaction is based on stability of the following three viewpoints: sustainable environment, economy and society.” In order to evaluate whether human life is sustainable or not, it is necessary to consider whether each of the following systems have been established and maintained: an environmental conservation system that allows the consumption of natural resources at an acceptable level of the Earth’s environment (environmental sustainability), an economic system that enables fair and appropriate economic activities (economic sustainability), and a social system that will ensure fundamental human rights and cultural and social diversity (social sustainability) (Figure 1-2-1).

In this sense, it is possible to think that the environment is the foundation of our society and the economy, because if environmental sustainability is lost, it will lead to degradation of our life and depletion of natural resources, which would affect social and economic

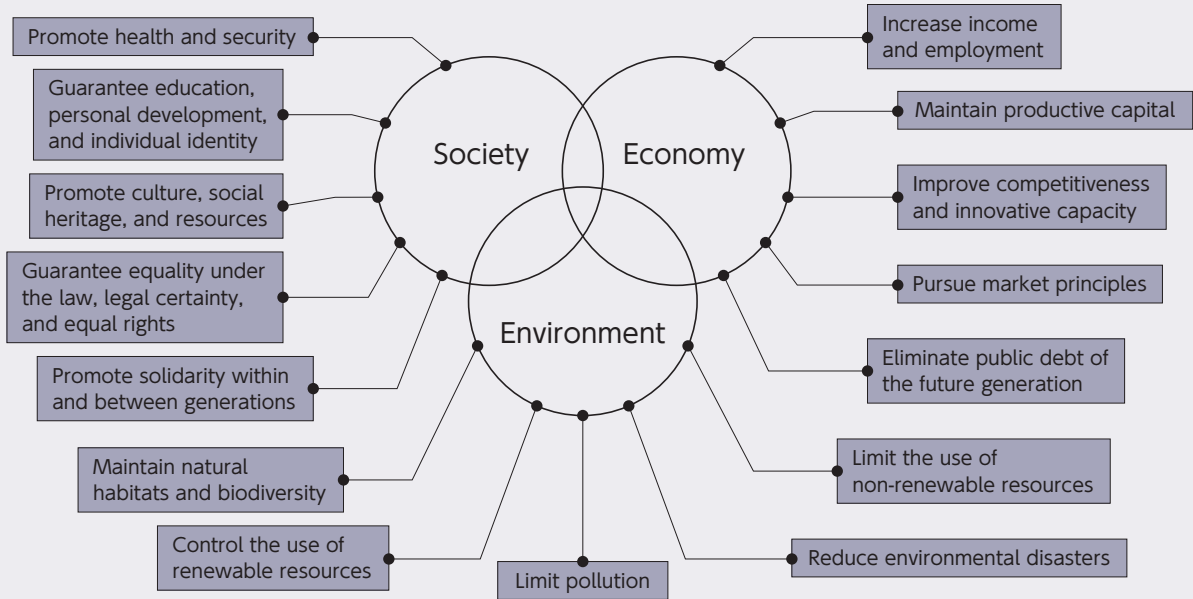
sustainability.

Dynamics in society and the economy affects the environment. For example, demographic dynamics is one example of important worldwide social changes in recent years. The world’s population, which was 3.7 billion in 1970, sharply rose to 6.8 billion in 2009. According to estimation by the United Nations Population Division, the increase of the world’s population has continued driven thus far by population increases in China and other East Asian countries, and India and the other Central and South Asian countries. From today until 2050, the population increase in East Asia will slow down, but the population in Central and South Asia will continue its remarkable increase, and the population increase in Africa will accelerate (Figure 1-2-2).

As for economic trends from 1970 to 2009, China had particularly remarkable growth in GDP, and Asia’s economy is growing, mainly in East Asia (Figure 1-2-3). Meanwhile, in Africa, GDP is not growing in comparison

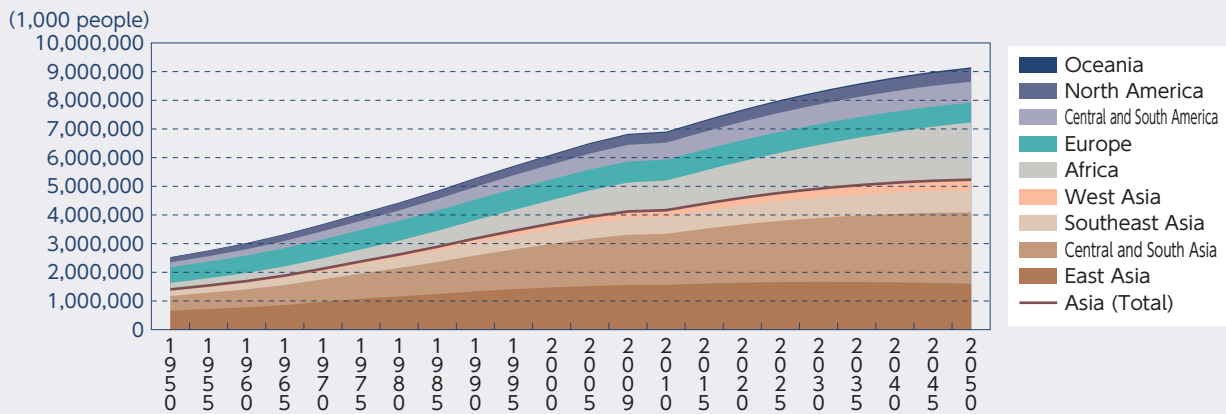


Figure 1-2-1 Three Aspects Related to Sustainability



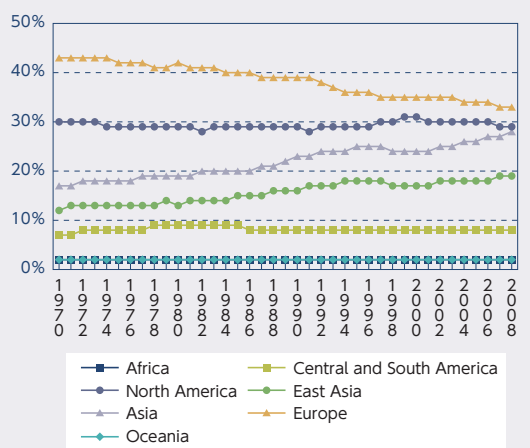
Source: Created by the Ministry of the Environment, based on information from Swiss Sustainability assessment

Figure 1-2-2 Changes in the World's Population



Source: United Nations Population Division

Figure 1-2-3 Trends in World GDP Ratios (By Region)



Source: United Nations Statistics Division
GDP/breakdown at constant 2005 prices in US Dollars (all regions)

to the trend of population growth, the ratio of poor people who live on USD1.25 or less per day surpassed 50% from the 1980s until 2005, and socio-economic inequality continues to expand on a global scale (Figure 1-2-4).

We will now discuss environmental sustainability from the viewpoint of how such dynamics in the socio-economic situation affect the environment.

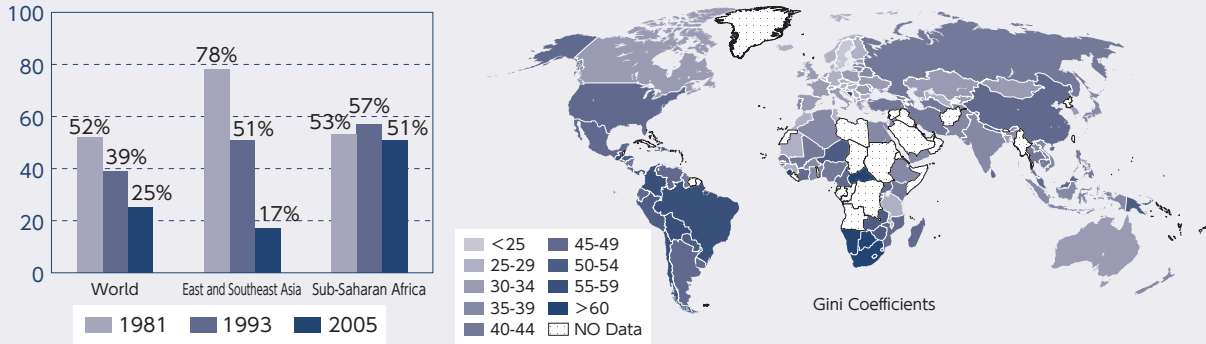
(1) Energy Supply and Global Warming

Here we will look at global warming, as an example of impacts on the global environment imposed by socio-economic dynamics such as the increased amount of energy supply as a result of increased population and economic growth.

During the time period from 1971 until 2008, the world's energy supply increased by 2.2 times. Breakdown by energy source shows that the ratio of coal, oil, and

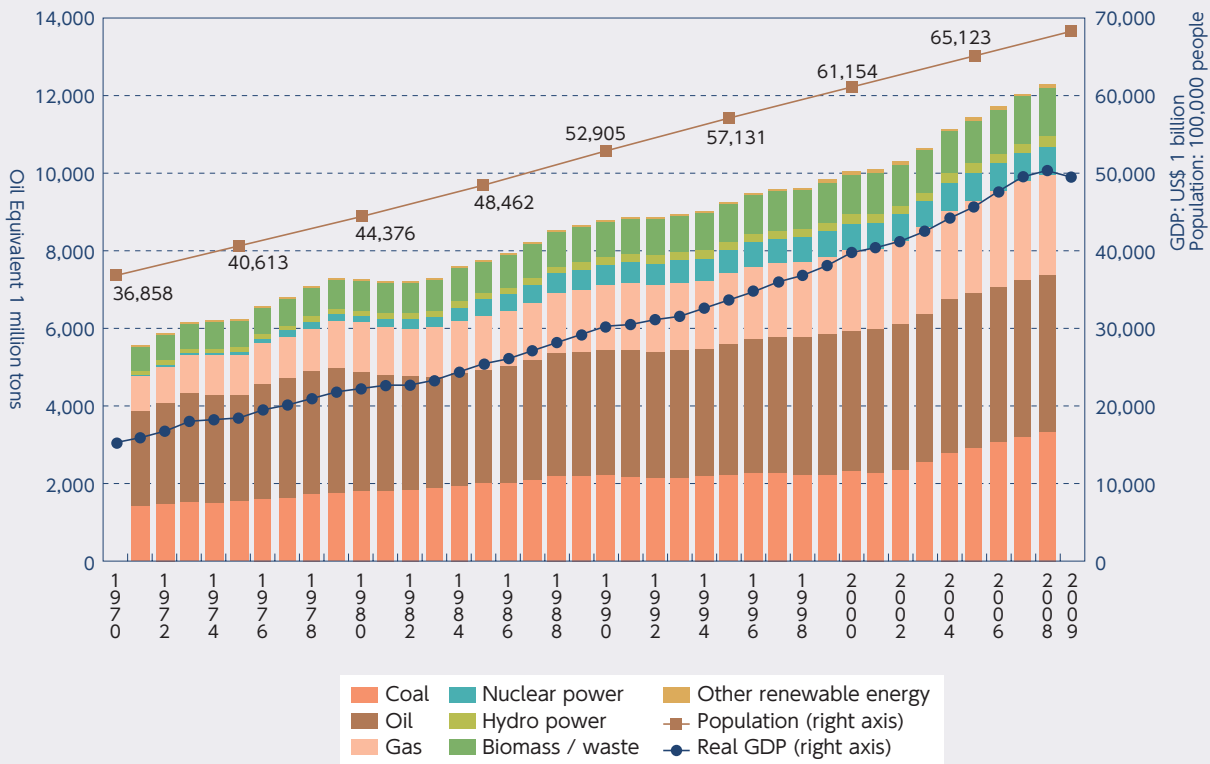


Figure 1-2-4 Ratio of Poor People Living on USD 1.25 or Less Per Day and Gini Coefficients of Each Country



Source: Created by the Ministry of the Environment, based on information from the World Bank's "PovcalNet" and the CIA's "The World Factbook 2009"

Figure 1-2-5 Trends in World Population, GDP, and Energy Supply



Source: Created by the Ministry of the Environment, based on information from the United Nations Population Division and the United Nations Statistics Division

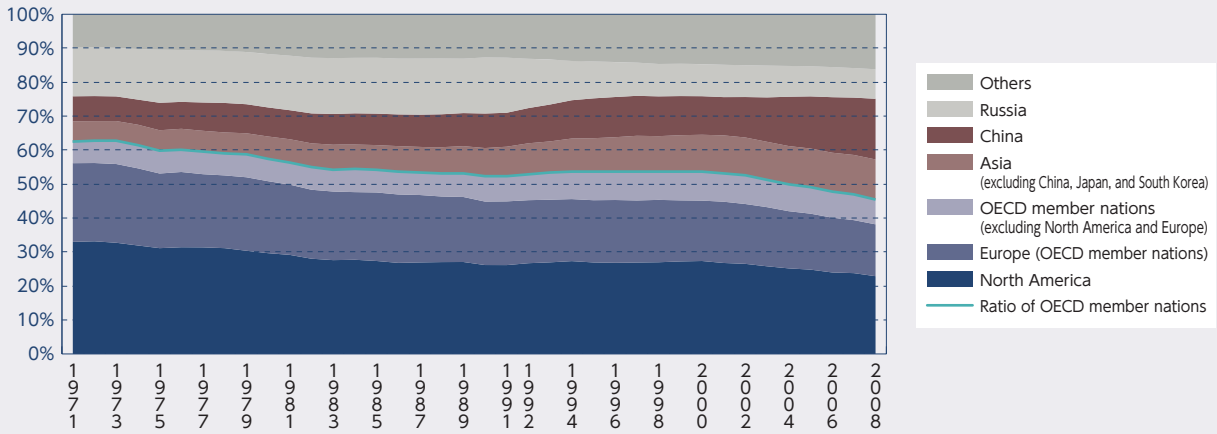
natural gas combined has been 80% or more from the 1970s until today (Figure 1-2-5). There is also a trend of increasing energy supply in developing nations, mainly in Asia (Figure 1-2-6).

Based on these findings, it is likely that economic growth mainly in developing nations will continue, and the increase of energy demand and the trend to rely heavily on fossil fuels will continue. The population increase and economic growth thus far have led to the increase of energy consumption, and according to the IEA's predictions, if governments do not change their existing policies and measures, fossil fuels will continue to be the world's primary energy sources until 2030.

Now we will look at carbon dioxide (CO₂), which

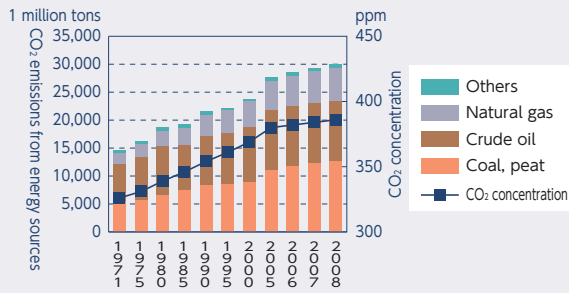
is a greenhouse gas that causes global warming. The emissions of carbon dioxide from energy sources are basically increasing in a consistent manner. The carbon dioxide emissions from energy sources approximately doubled from 1971 to 2008, increasing the CO₂ concentration level on the Earth as a result (Figure 1-2-7). According to the carbon dioxide distribution that the Japanese government estimates based on the world's measurement of carbon dioxide concentration, the global concentration of carbon dioxide in the atmosphere in 2009 was at the highest level in the history. By region, the annual average concentration is high in areas of high emissions, mainly in Europe, East Asia, and the eastern region of North America (Figure 1-2-8).

Figure 1-2-6 Trends in the World's Energy Supply (By Region)



Source: Created by the Ministry of the Environment, based on information from the IEA's "Energy Balances of OECD Countries 2010" and "Energy Balances of Non-OECD Countries 2010"

Figure 1-2-7 Trends in Concentrations of CO₂ in the Atmosphere and CO₂ Emissions from Energy Sources



Sources: CO₂ concentration: NOAA/ESRL and the US's Oak Ridge National Laboratory
CO₂ emissions from energy sources: IEA 2010 (CO₂ Emissions from Fuel Combustion 2010)

It is believed that this increase in CO₂ concentration is a factor of the increase in world temperature. Over the long term the world's annual average temperature has risen by a ratio of approximately 0.68 degrees centigrade per 100 years, and temperatures were high particularly in the late 1990s. In 2010, the world's temperature anomalies of the annual terrestrial and aquatic average surface temperatures, in other words, the average temperature minus the 30-year average from 1971 to 2000, was +0.34 degrees centigrade. This was the second highest value since observation started in 1891. Further, the average temperature in Japan in the summer of 2010 was the highest in the 113 years since observation started in 1898. We think this was caused not only by high atmospheric pressure and a cold air mass from the Sea of Okhotsk during that summer, the powerful high pressure from the Pacific Ocean which covered Japan after the rainy season, and effects from the El Nino phenomenon, but also by effects of global warming due to the increase of greenhouse gases such as carbon dioxide.

In this way, population increase and economic growth will lead to an increase of energy consumption in society and the economy, and the increase of carbon dioxide concentration caused by increase of energy consumption is a factor that places an environmental impact on the

Earth in the form of global warming.

(2) Consumption of Biomass Energy and Loss of Forest Resources

Since long ago, forest resources have supported people's daily lives. They served as energy in the form of fuel wood, as well as timber for commercial logging.

In recent years attention has been focused on the use of biomass resources as alternative energies to replace oil and other non-renewable resources. Around the world, there has been introduction of such resources, mostly bio-fuels obtained by refining plant-derived oil such as that from grains with high ratios of sugar and palm oil.

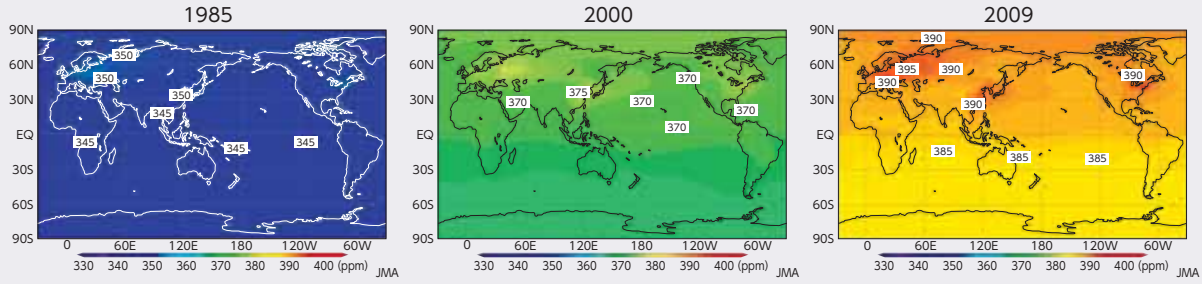
As for consumption of fuel wood and coal, a total of 3.4 billion m³ of forest are cut down annually in the world, and approximately half of that is consumed as fuel wood. This logging amount is approximately the same as Japan's entire natural growing stock of forests of 1.8 billion m³, and it places a significant impact on forest resources on a global scale. In particular, the ratio of use as fuel wood is high in Africa, Asia, and South America, where it makes up approximately 50 to 90 percent, as compared with Europe and North and Central America, where it makes up approximately 10 to 20 percent (Figure 1-2-10). Especially in Africa, due to poverty, forests are cut down excessively for fuel wood and to develop agricultural land.

As for the world's bio-ethanol production, 74 billion liters were produced in 2009, mainly in Brazil and the US, mainly from corn or sugarcane. As for bio-diesel, 15 billion liters are produced annually mainly in the EU, mostly from rapeseed. Production of oil palm, which is drawing attention as a source for bio-diesel, is increasing mainly in Malaysia and Indonesia. The land area for producing the palm trees that are used to manufacture palm oil has increased from 3.26 million ha in 1970 to 14.62 million ha in 2008, through conversion of tropical forests (Figure 1-2-11).

Additionally, with growing demand for food in recent years there is a trend of agricultural land area expanding and forest land area decreasing, primarily in tropical

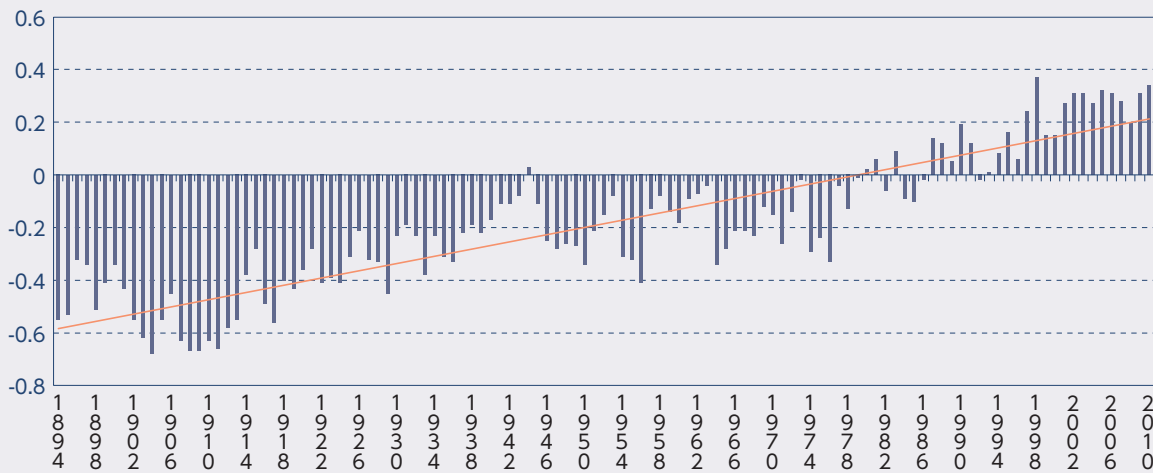


Figure 1-2-8 Secular Changes in Carbon Dioxide Concentration Distribution



Note: "Information on Carbon Dioxide Distribution" is an estimation of the concentration distribution in various regions of the Earth by using a computer to process the data observed on the land and sea around the world.
 Source: Japan Meteorological Agency's "Information on Carbon Dioxide Distribution"

Figure 1-2-9 Anomalies of Annual Average Temperature (degrees centigrade)

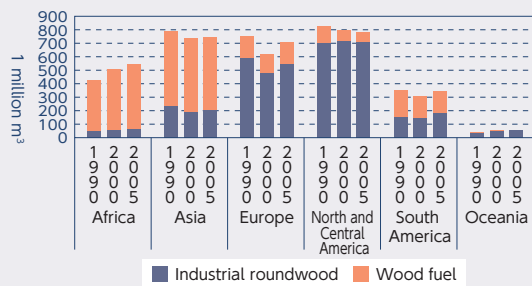


Source: Japan Meteorological Agency's "World Anomalies of Annual Average Temperature"

areas in Africa, South America, and Southeast Asia (Figure 1-2-12). While the amount of growing stock for forests (the total amount of volume of rough wood, including bark) steadily increased in North and Central America and Europe from 1990 until 2010, there is a trend of decline in growing stock for forests mainly in tropical areas, i.e., decreasing from 83 billion m³ to 77 billion m³ in Africa, decreasing from 191.5 billion m³ to 177.2 billion m³ in South America, and decreasing from 32.4 billion m³ in 1990 to 29 billion m³ in 2010 in Southeast Asia (Figure 1-2-13). Moreover, because the public statistical data do not reflect the illegal logging and other forest cutting that are not reported to public organizations, there are concerns that the actual amount of forests cut down may be higher than the figures publicly announced.

In the areas where a decline in these forest resources can be observed, it is necessary to strengthen governance in forest management that includes measures against poverty. In addition, as for bio-fuels such as bioethanol and bio-diesel, because there are concerns about

Figure 1-2-10 Trends in Wood removal (By Region)



Source: Created by the Ministry of the Environment, based on the information from the FAO "Global Forest Resources Assessment 2010"

competition with food if corn, sugarcane, and palm trees, etc. are used as the source, it is important to introduce waste biomass and unused biomass that will not compete with food. Technology developments in relation to this are necessary.

Figure 1-2-11 Trends in Amount of Production and Production Land Area of Palm Trees (World)

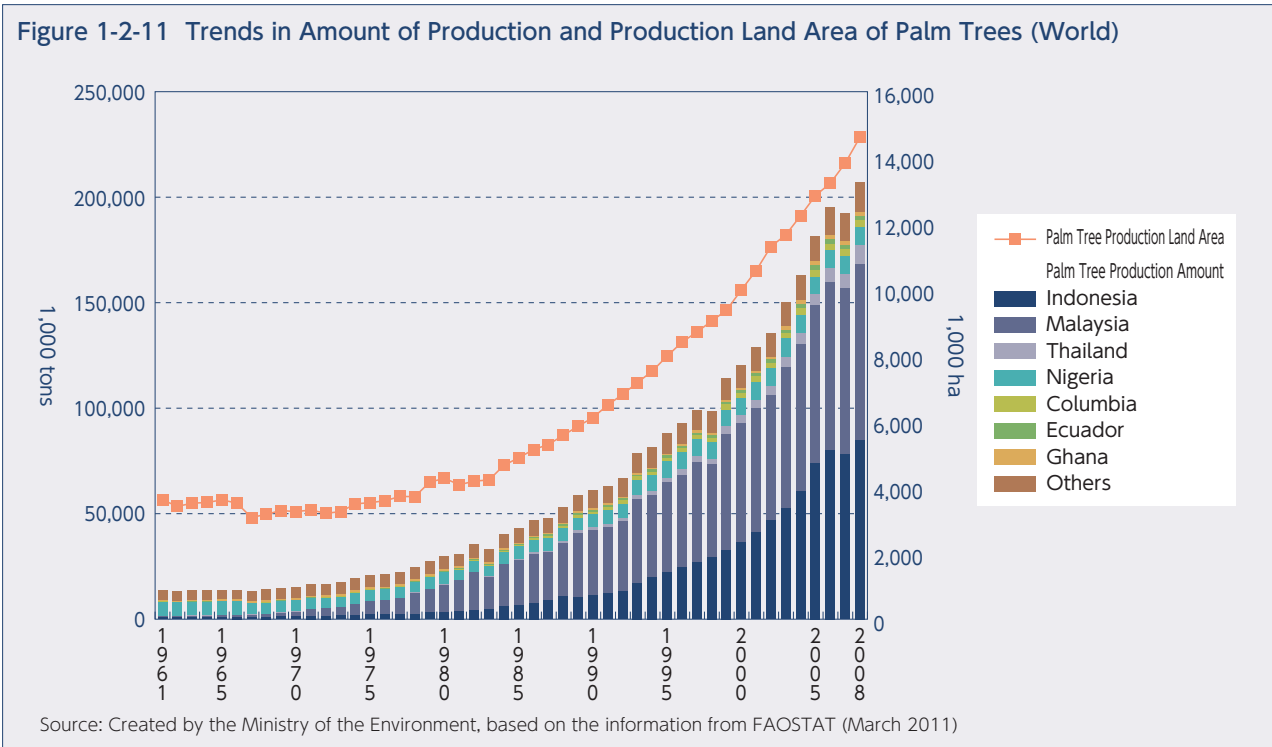


Figure 1-2-12 Trends in Forest Land Area and Agricultural Land Area (By Region)

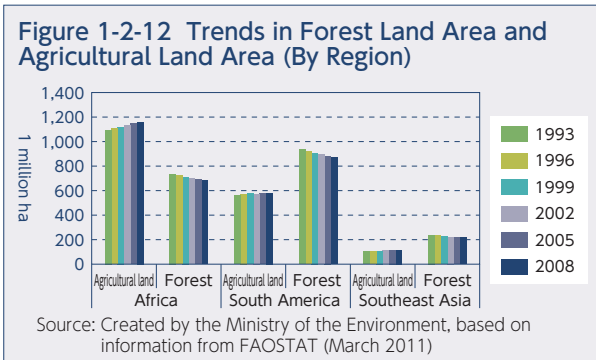
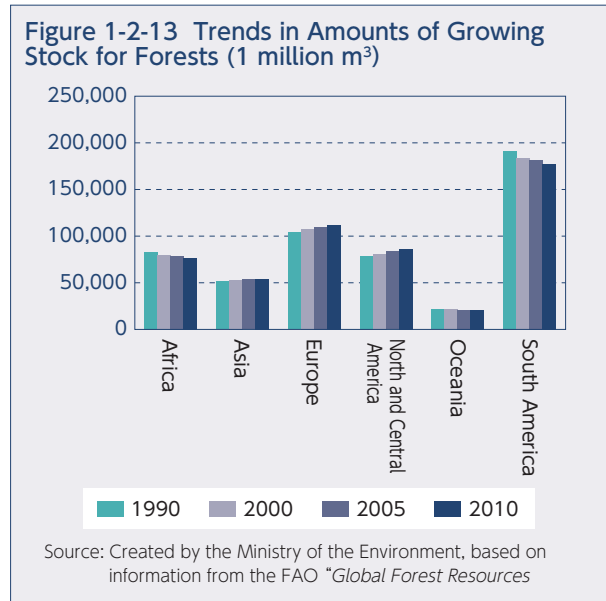


Figure 1-2-13 Trends in Amounts of Growing Stock for Forests (1 million m³)



(3) Changes in Supply and Demand for Food, and Depletion of Water Resources

The dynamics of supply and demand for food, especially changes in dietary habits, is an example of the fact that economic growth may change the way resources are consumed and may increase the impact on the environment. It has been pointed out that along with economic growth there has been a change in dietary habits from plant-derived food such as grains to animal-derived food from livestock farming.

The amount of food production approximately doubled in the period from around 1970 until 2007, due to population growth and an increase of demand for food. This also led to expansion of the area of cultivated farm land. Since the beginning of the 1990s, that expansion of the area of farm land has stopped, but because the amount of grain harvested per unit area has increased, the amount of grain produced continues to increase (Figure 1-2-14).

The amount of calories supplied per person of the world population has increased from approximately 2,200kcal per person in 1961 to approximately 2,800kcal

per person in 2007, and the status of nutrition supply for the world as a whole continues to be improved. However, the population of people around the world who suffer from malnutrition still remains at a high level. We have to note that there is a problem of unequal distribution of food.

As for the dynamics of calorie supply during this time period, although the ratio of calories supplied by animal-derived food slightly increased from 15.4% in 1961 to 17.2% in 2007, it is thought that overall the change is due to increased production of plant-derived food such as grains (Figure 1-2-15).

On the other hand, a different trend can be seen in the Asian region, which has shown remarkable economic growth in recent years. Asia's GDP made up approximately 17% of world GDP in the 1970s, but



in 2009 that ratio had risen to 28%. Looking at the dynamics of calories supplied in Asia during that time, while the total amount of calories supplied from around 1960 to 2007 increased by approximately 1.5 times, the ratio of calories supplied from animal-derived food rose from approximately 7% in 1970 to 15% in 2007. This trend is typical in East Asia, where the total amount of calories supplied has approximately doubled and the ratio of calories supplied by animal-derived food rose three times from 7% in 1970 to 21% in 2007 (Figure 1-2-16).

According to a report by the United Nations' World Water Assessment Programme and Plan (WWAP), in general, if livestock and grain are produced using the same amount of water, livestock is found more inefficient. Specifically, with 1 m³ of water, the amount of wheat that can be produced is 0.2-1.2kg, while the amount of corn that can be produced is 0.3-2.0kg, and the amount of beef is 0.03-0.1kg. From now until 2050, it is expected that the demand for grain will increase due to growth in demand for grain for livestock, especially in East Asia, and there are concerns that this may lead to a shortage of water resources (Figure 1-2-17). In fact, there is a broad distribution of areas that suffer from a shortage of water resources, mainly in the west coast of South America, Africa, and Asia, where excessive use of water has led not only to water shortages that will seriously affect people's daily life, but also to a significant decrease of the water levels of lakes and other wetlands.

In summary, the dynamics of dietary habits associated with economic growth affect supply and demand of water resources and as a result may have adverse impacts on a broad range of areas in the environment, the economy, and society. In Japan, it is important to work to preserve water resources and water sources while keeping in mind the status of the world's water resources as mentioned above.

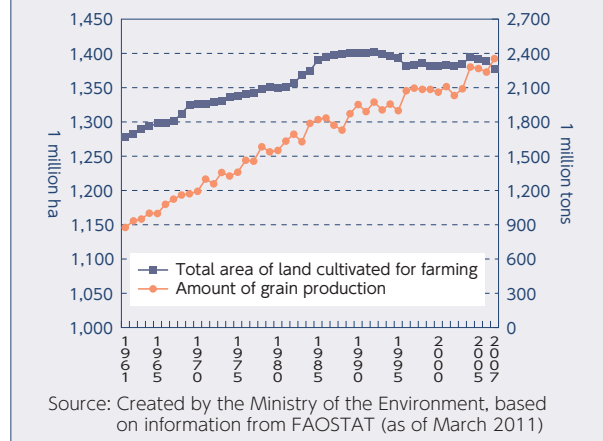
(4) Mining of Underground Resources, and the Environmental Impact

Underground resources such as mineral resources and fossil fuels are limited. The reserves/production ratio of resources is mostly less than 100 years, specifically, 70 years for iron ore, 20 years for lead, 35 years for copper, 20 years for gold, 15 years for chrome, and 46 years for oil (Figure 1-2-18). If the pace of production continues at its current speed, there is no doubt that the steady supply of underground resources for the current generation will become difficult, or worse, that we may not be able to leave resources for future generations.

In addition, underground resources generate a large amount of mine waste during processing. Some underground resources, even though their collection is technically feasible, may be found in a difficult location or the content rate may be low. In such cases, mining requires a large amount of energy and generates a large amount of waste, thus causing impacts on the environment. This is referred to as the hidden flow, and in order to verify sustainability related to underground resources it is important to also evaluate intermediate resources input for mining and the environmental impact caused by the amount of disposal.

In Japan, although there has been improvement in

Figure 1-2-14 Trends in Area of Land Cultivated for Farming and Amount of Grain Production



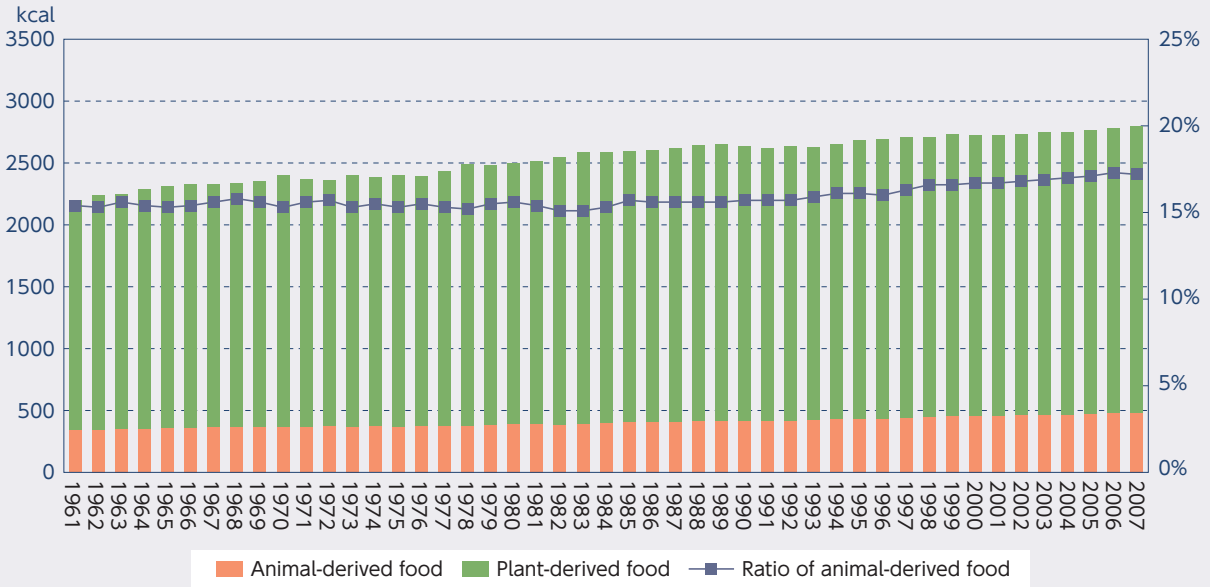
energy and resource conservation thanks to technological progress, a large amount of limited resources still continue to be consumed. Consumption of such resources, especially fossil fuels that cannot be reused after being consumed, iron and copper that are consumed in enormous amounts due to human activities, and mineral resources that are very useful but also very scarce such as rare metals and rare earths, will have a significant impact on our future generations.

Here we will look at copper as an example of hidden flow. Copper plays an important role as a mineral resource that serves as a base for economic development; it is used as electrical wire and various copper-based alloy products in fields of transportation equipment and consumables such as construction, electric equipment, construction machinery, and automobiles. However, its regional distribution is remarkably uneven, and the top 10 mines produce 34% of the world's production. For example, among the 8 copper deposits that have reserves exceeding 10 million tons, 6 deposits are concentrated in Chile. From the perspective of securing stable copper resources, it is important to maintain the amount of production from these vast mines.

In general, the purity of crude ore obtained from mines is approximately 0.8-3% and even after it has been refined into a mineral concentration the purity is approximately 40%, and there are concerns that the quality of copper ore in the world's major currently operating mines is declining (Figure 1-2-19). The purity of copper ore imported by Japan declined from approximately 32% in 2001 to approximately 29% in 2008 (Figure 1-2-20). One of the reasons is that all of the high-quality mineral ore on the Earth's surface layer has already been dug up and now we have to dig to deeper layers where the quality of mineral ore is lower.

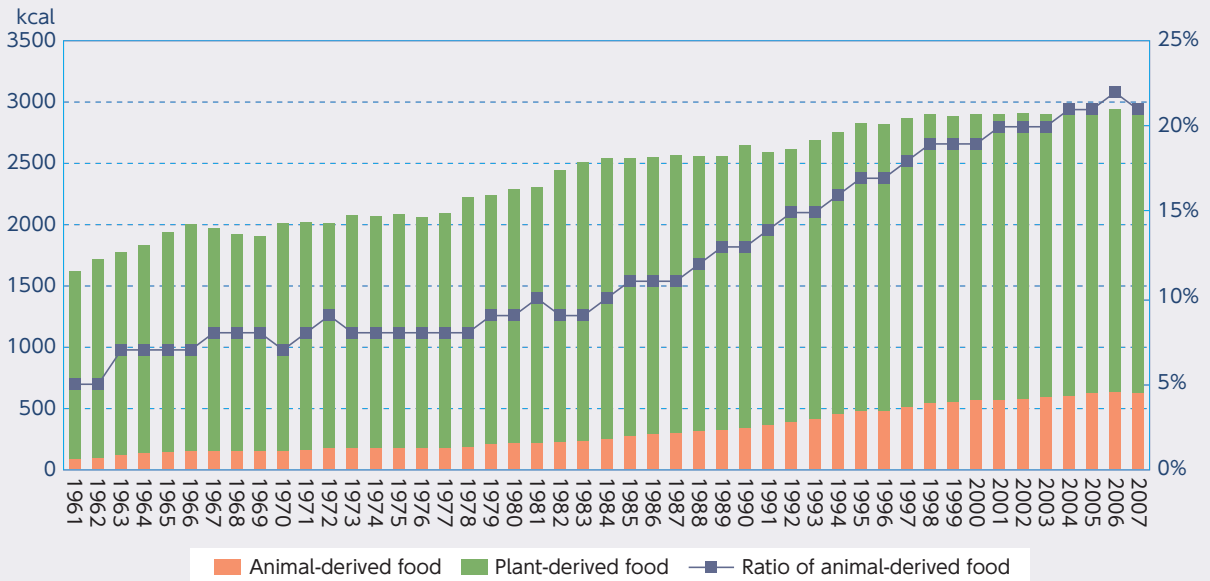
Because a decline in the quality of copper ore will lead to an increase in the volume of mine waste from processing of each unit of copper and the amount of energy required to refine the copper, it is also necessary to evaluate the environmental impact caused by mining mineral resources and consider the total material requirement (TMR), including such hidden flows. Trends in TMR show that the TMR value is increasing even though there have not been any major changes in copper

Figure 1-2-15 Trends in the Amount of Calories Supplied Per Person of the Population (World)



Source: Created by the Ministry of the Environment, based on information from FAOSTAT (as of March 2011)

Figure 1-2-16 Trends in the Amount of Calories Supplied Per Person of the Population (East Asia)



Source: Created by the Ministry of the Environment, based on information from FAOSTAT (as of March 2011)

Figure 1-2-17 Prediction of Demand for Grain and the Status of Water Resource Depletion

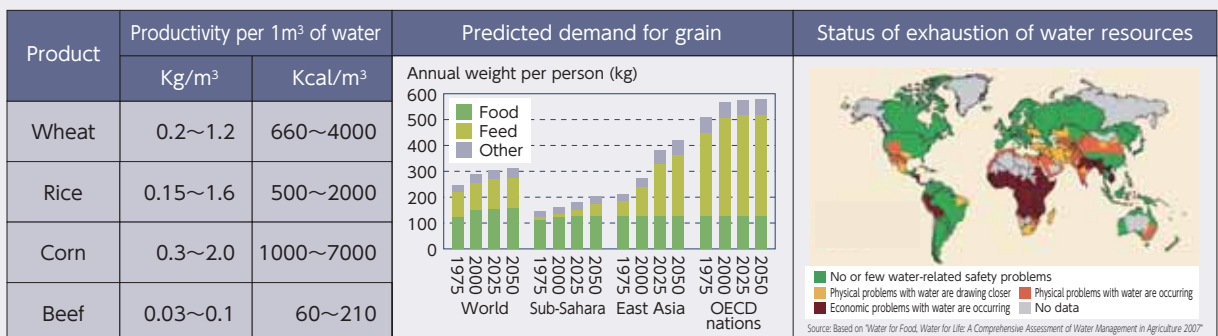
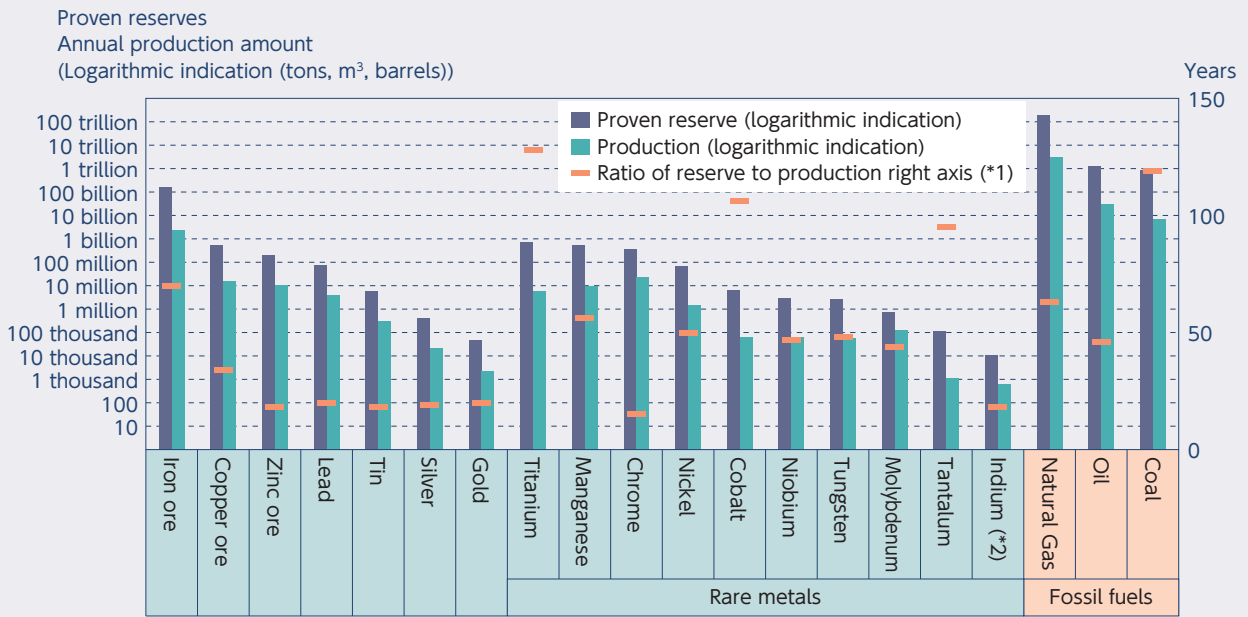




Figure 1-2-18 Proven Reserves and Annual Production Amounts (Left Axis, Logarithmic Indication) and Ratio of Reserves to Production (Right Axis) of the World's Main Underground Resources



Major item	Rare metals							Fossil fuels												
Item	Iron ore	Copper ore	Zinc ore	Lead	Tin	Silver	Gold	Titanium	Manganese	Chrome	Nickel	Cobalt	Niobium	Tungsten	Molybdenum	Tantalum	Indium (*2)	Natural gas	Oil	Coal
Ratio of reserves to production(*1)	70	35	18	20	18	19	20	128	56	15	50	106	47	48	44	95	18	63	46	119
Proven(mineral)reserves	160,000	540	200	79,000	5,600	400,000	47,000	730,000	540,000	350	71,000	6,600	2,900	2,800	8,700	110,000	11,000	187,490	1,333	826,000
Production	2,300	15.8	11	3,900	307	21,400	2,350	5,720	9,600	23	1,430	62	62	58	200	1,160	600	2,990	29	6,940
Unit	1 million tons	1 million tons	1 million tons	1 thousand tons	1 thousand tons	Tons	Tons	1 thousand tons	1 thousand tons	1 million tons	1 thousand tons	1 thousand tons	1 thousand tons	1 thousand tons	1 thousand tons	Tons	Tons	1 billion m³	1 billion barrels	1 million tons
Notes	Oxide	Oxide	Oxide	Net	Oxide	Net	Net	Oxide	Oxide	Net	Net	Net	Net	Net	Net	Net	Net			

(*1) The value for ratio of reserves to production is the amount of proven (mineral) reserves divided by the 2009 amount of production. The number of mineable years changes in relation to the confirmed reserves and the amount of production.

(*2) Only for indium, the proven (mineral) reserve is the 2007 value.

Source: Created by the Ministry of the Environment, based on information from the U.S. Geological Survey "Mineral Commodity Summaries 2010"

ore production in the world since 2001. There are concerns about the effects of the environmental impact caused by the decline in the quality of copper ore (Figure 1-2-21).

(5) Economic Development and the Environmental Impact

Thus far we have looked at individual human activities and the associated impacts placed on the environment. Lastly, in order to discuss a comprehensive relationship between human economic and social activities and their environmental impact, we now look at how economic development is related to the ecological footprint and the amount of CO₂ emissions.

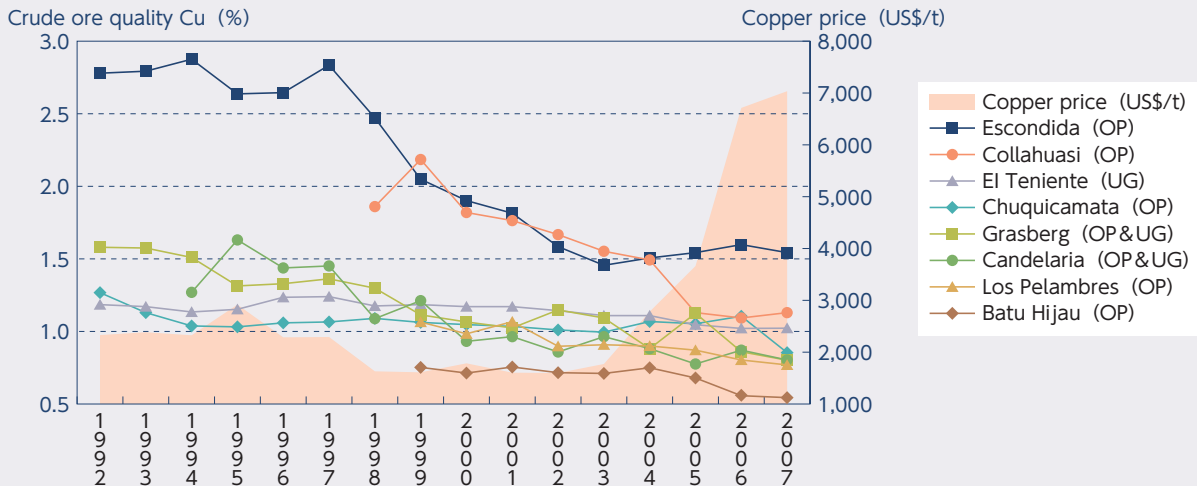
In order for us to achieve sustainable development, it is important to decouple economic growth from the environmental impact, both of which have increased in parallel thus far. In other words, it is important to achieve decoupling, that is, to ensure that the rate of increase of environmental impact is lower than the rate

of economic growth, and that economic growth does not cause environmental impacts.

There is a correlation between growth of the world's GDP and growth of the world's carbon dioxide emissions. As GDP increases, carbon dioxide emissions also increase (Figure 1-2-22). GDP growth and increase of carbon dioxide emissions indicates that relative decoupling is progressing, but absolute decoupling may not be.

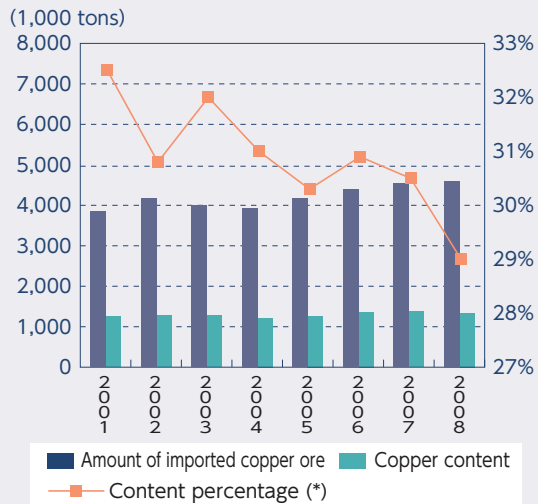
There is also a correlation between GDP and the values for ecological footprint that the WWF released in 2010 for approximately 140 countries in the world. Countries that have a high per-person GDP also have a high ecological footprint value (Figure 1-2-23). The ecological footprint is an indicator for comparison of people's amount of consumption of resources and nature's production capacity. It uses values indicated by converting the land area necessary for reproducing resources and purifying emissions, and it suggests that the world's economic growth still continues to cause impacts on nature's capacity to reproduce.

Figure 1-2-19 Trends in Crude Ore Quality and Price at Major Copper Mines



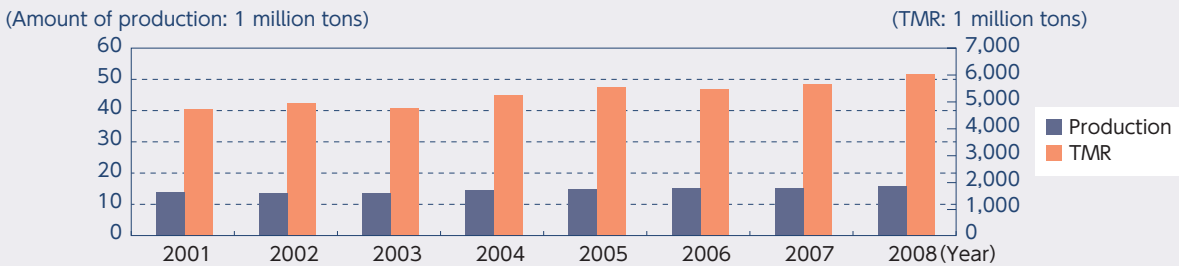
(Notes) OP: Open-pit mining UG: Underground mining
 Source: JOGMEC Current Topics 2008, Issue 56, "Trend of Decline in Copper Quality"

Figure 1-2-20 Shifts in Content of Copper Ore Imported into Japan



(*) Content percentage = Copper content / Amount of imported copper ore
 Source: Created by the Ministry of the Environment, based on information from "Statistics on Resources and Energy"

Figure 1-2-21 Trends in Amount of World Copper Production and Total Material Requirement (TMR)

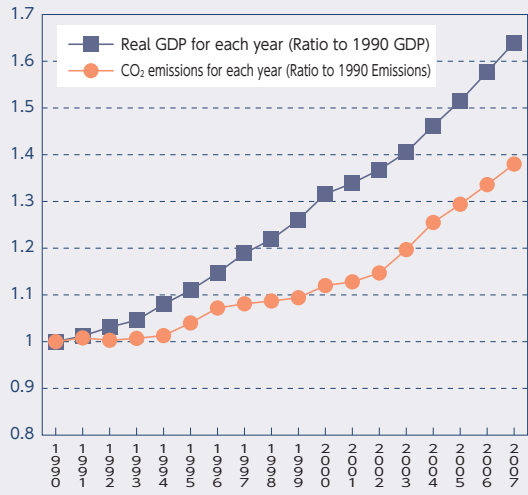


	2001	2002	2003	2004	2005	2006	2007	2008
Amount of production (1 thousand tons)	13,700	13,600	13,600	14,600	15,000	15,100	15,400	15,700
TMR (1 million tons)	4,713	4,941	4,749	5,256	5,525	5,461	5,649	6,050
Estimated TMR coefficient	344	363	349	360	368	362	367	385

Source: Ministry of the Environment estimated figures considering the percentage of decline in quality of copper ore imported into Japan, based on 2004 TMR coefficients calculated by Komei Harada and others of the National Institute for Materials Science

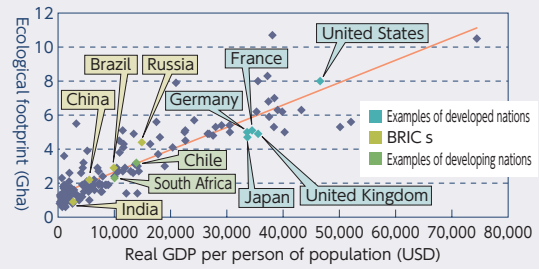


Figure 1-2-22 Relative Decoupling of the Economy and the Amount of CO₂ Emissions



Source: Created by the Ministry of the Environment, based on information from the United Nations Statistics Division and the OECD Factbook

Figure 1-2-23 Relationship Between GDP Per Person and Ecological Footprint by Country



Source: Created by the Ministry of the Environment, based on information from IMF statistics and the Global Footprint Network

2. Japan's Sustainability and Quality of Life

As seen in the previous subsection, there are great concerns about sustainability, mainly about environmental sustainability.

Because Japan's socio-economic activities rely on both domestic natural resources and the world's natural resources, sustainability on a global scale may also affect Japan. Accordingly, what is the status of Japan's sustainability and quality of life?

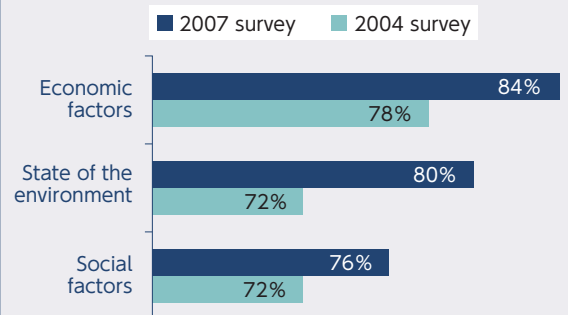
Quality of life and environmental sustainability are closely related. According to research that the EU released in 2008 in regard to factors affecting "quality of life," 84% of people in the EU say that economic factors have a large influence, and 80% of people say that the status of the environment affects quality of life (Figure 1-2-24).

There are a variety of issues for measuring quality of life, and various research and experiments are being carried out in Japan and in other countries. In the report by the Commission on the Measurement of Economic Performance and Social Progress (CMEPSP) that was mentioned in Section 1, quality of life is understood to have multiple factors, including physical living standard (income, consumption, wealth), health, education, and peace of mind and safety (physical and mental). In Japan, in addition to efforts made to calculate net national welfare (NNW), at present the Cabinet Office is conducting a study on the level of happiness, and further findings and observation are expected.

Here we will use the points of view suggested in the CMEPSP report as a clue to Japan's sustainability and quality of life, mainly in relation to environmental aspects. First, we will use several indexes related to environmental impacts and biodiversity in order to give an overview of Japan's sustainability, and then focus on environmental aspects, keeping in mind relationships with various factors.

Figure 1-2-24 EU Survey Results Concerning Quality of Life, Released in 2008 (Summary)

Question: In your opinion, to what degree do the following factors influence your "quality of life"?



Note: The choices of answers for this question were "Very much," "Quite a lot," "Not much," "Not at all," and "DK (Don't know)." The numbers shown in the figures above are sums of the ratios for "Very much" and "Quite a lot."

Source: The European Commission's "Special Eurobarometer 295"

(1) The Current status of Japan's Sustainability

What is the current status of sustainability in Japan? First, among the environmental impacts related to the sustainability problems for which there are global concerns, we will look at the status of greenhouse gases and consumption of natural resources. We will also take a look at the current overall condition of biodiversity, from the perspective of the stock of natural resources.

As the amount of input of domestic non-metallic mineral resources significantly declined, the amount of input of natural resources, etc. declined from approximately 2.2 billion tons in 1990 to 1.5 billion tons

Figure 1-2-25 Amount of Input of Domestic and Imported Natural Resources, Etc. by Type

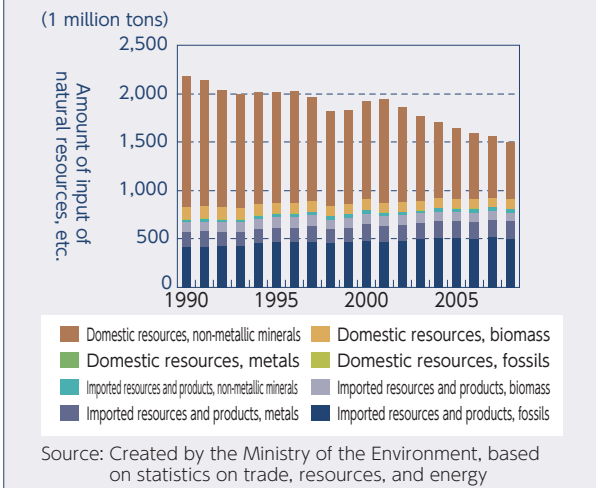
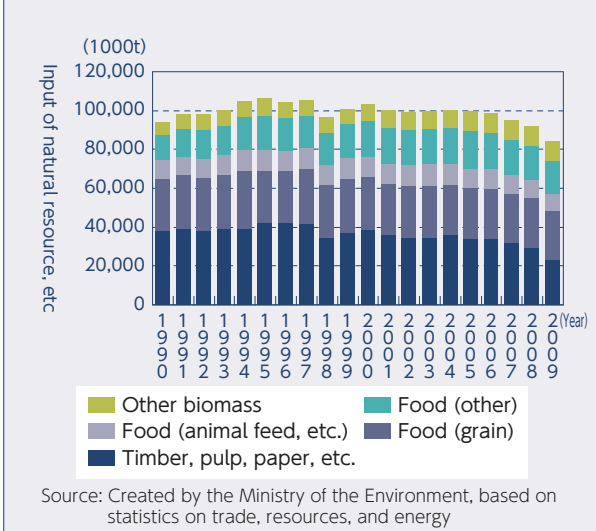


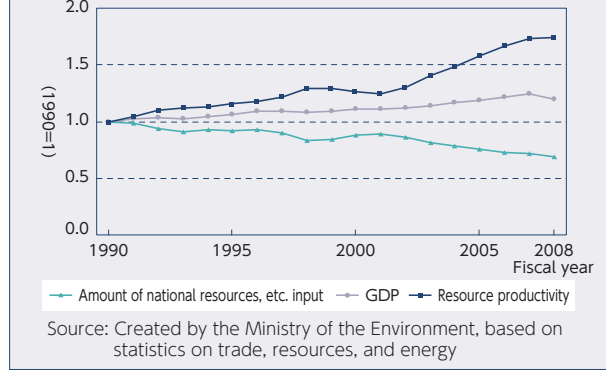
Figure 1-2-26 Amount of Biomass Resources Input



in 2008 (Figure 1-2-25). In detail, although the amount of imports of fossil resources and products was gradually increasing, the amount of input of biomass resources such as timber (excluding waste) was decreasing (Figure 1-2-26). Japan’s resource productivity (amount of resources input per unit GDP), which is an indicator that shows the level of efficient use of resources in people’s daily lives and in industry, is increasing, and changes can be seen in the way that natural resources are consumed in Japan’s society and economy (Figure 1-2-27).

Next, we will take a look at the emissions of greenhouse gases, using as an example the environmental impact associated with economic activities. The total emissions of greenhouse gases (final figure) in 2009 was 1.209 billion tons* (note: hereinafter the “*” indicates CO₂ equivalent). That was 4.1% less than the total emissions of 1.261 billion tons in the base year stipulated by the Kyoto Protocol (1990; however, HFCs, PFCs, and SF₆ are based on 1995). Compared with the total emissions in 2008, there was a 5.7% reduction, as the emissions from the industrial and other sectors declined. One of the reasons behind the reduction in emissions from 2008 to 2009 is that in 2009 there was continuous decline in

Figure 1-2-27 Trends in Amount of Natural Resources Input, GDP, and Resource Productivity



demand for energy in the industrial and other sectors due to the economic recession that followed the financial crisis that started in October 2008. (Figure 1-2-28).

Lastly, we will take a look at the status of biodiversity, from the perspective of Japan’s stock of natural resources. According to the National Biodiversity Strategy 2010, which was approved by the Cabinet in March 2010, Japan’s biodiversity now faces the “3 types of crises” discussed below and a “crisis due to global warming.”

The first type of crisis (crisis caused by human activity and development) is environmental damage associated with the economic growth that Japan experienced after World War II, specifically in coastal and inland water areas where revetments were built along river banks and coastlines for developing industrial zones and implementing disaster prevention. For example, tidal flats, which made up 841 km² around 1945 right after the War, had decreased by 34% to 553 km² around 1978, and decreased to 496 km² around 1996. This means that compared with 1945, 41% of tidal flats had disappeared. Approximately 61% of wetlands such as inland water areas disappeared from 1900 to 1996 (Figure 1-2-29).

The second type of crisis (crisis due to lack of human activities) is changes in the quality of the environment and the status of wildlife’s habitats, caused by the decline or withdrawal of human activities and involvement with nature, due to changes in lifestyles and industrial structures and socio-economic changes such as population decline. For example, the area of abandoned agricultural land increased by approximately 2.9 times from 1985 to 2005 (Figure 1-2-30). Many areas where interactions between humans and nature have been well maintained, represented by satochi-satoyama (community-based forest areas and the surrounding countryside), are now undergoing major environmental changes, with a reduction of cyclical use of natural resources through satoyama forests and secondary grasslands, due to population decline, aging populations, and industrial structure change.

The third type of crisis (a crisis caused by species brought in by humans) is the problem of alien species. In recent years aggressive invasive species are continuously being introduced and established in Japan’s natural environment, and there is growing concern about their influence on Japan’s indigenous ecosystem (Figure 1-2-31).

We have thus far made a cursory review of the current



Figure 1-2-28 Japan's Greenhouse Gas Emissions

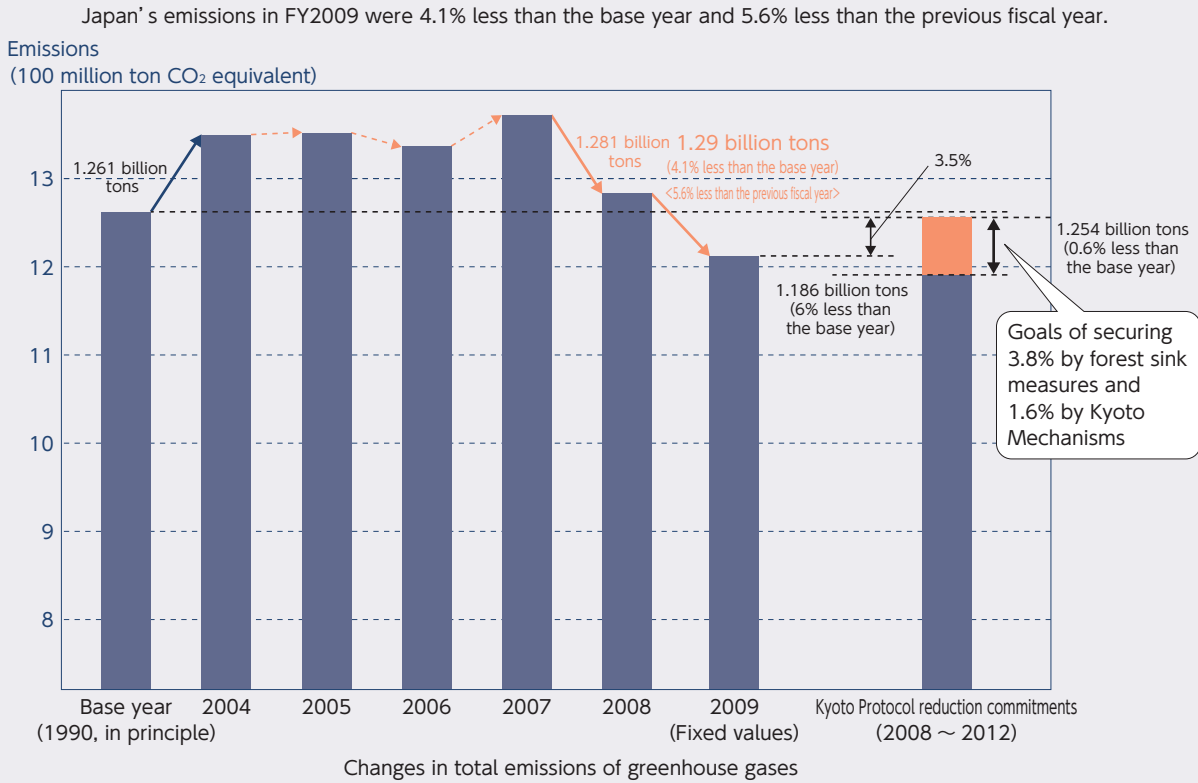


Figure 1-2-29 Trends in Area of Japan's Intertidal Flats (the First Crisis)

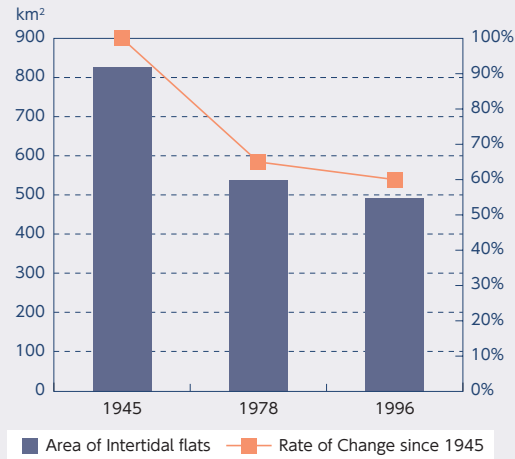
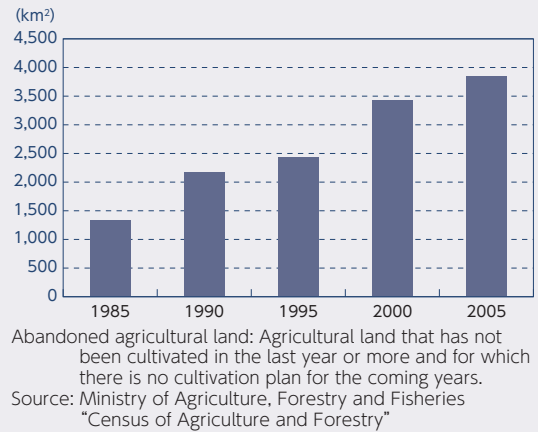


Figure 1-2-30 Area of Abandoned Agricultural Land (the Second Crisis)



situation of Japan's environmental impact caused by socio-economic activities and the status of biodiversity. Although there is a trend of improvement such as the reduction of the use of natural resources, as a whole sustainability is a major concern. In order to be able to continue to enjoy a good quality of life in the future, it is necessary to preserve biodiversity, which is the foundation of our lives, and to reduce the impact on the environment.

(2) Environmental Quality as a Factor of Quality of Life

A pollution-free environment is the foundation for leading a healthy life, and a good environment with clean water, clean air, and abundant greenery enhances the quality of our lives. Measuring environmental quality will provide an indicator of the quality of life from an environmental perspective.

Many people demand a good environment without air pollution in order to enjoy healthy lives. The degree of

Figure 1-2-31 Invasive Alien Species in Rivers (1991-2005)



Source: OECD Third Environmental Performance Review: Japan (2010)

air pollution in Japan is heading toward improvement as the concentrations of sulfur dioxide, nitrogen dioxide, and nitrogen monoxide in the ambient air are declining (Figure 1-2-32).

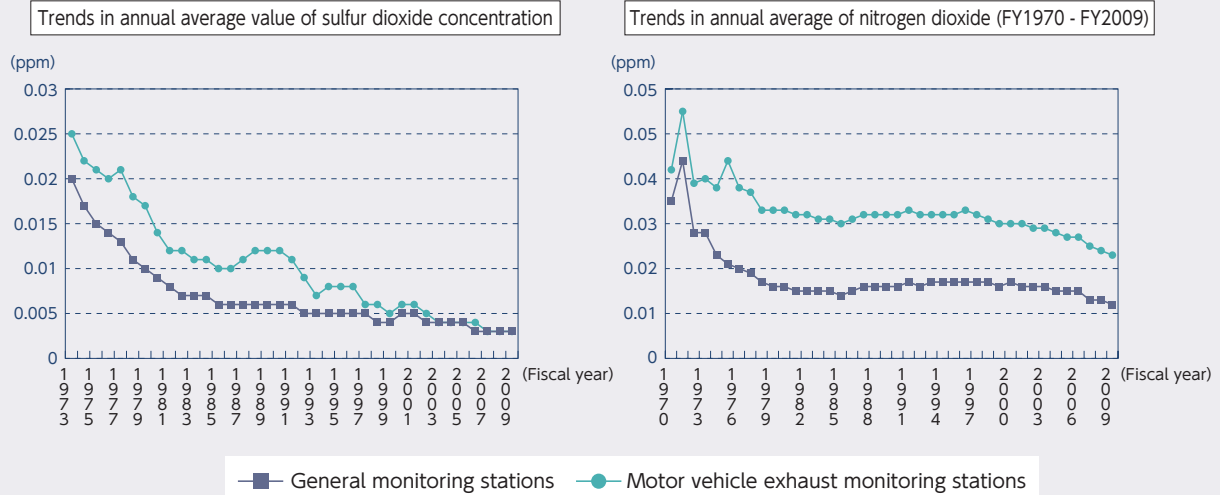
Next, as for Japan’s water quality, the nationwide achievement rate for Environmental Quality Standards for Water is 87%, which is relatively good. In particular, improvement of the water quality of rivers is making good progress, meeting 92% of the environmental standards. On the other hand, the achievement rate for environmental standards for inland lakes and reservoirs is low at 53%, which we suspect is due to a large volume of organic substances and an overabundance of nutrients in those inland lakes and reservoirs (Figure 1-2-33). As for the water quality of groundwater, it continues to have rates that exceed environmental standards for nitrate nitrogen and nitrite nitrogen (Figure 1-2-34). For that

reason, we are reviewing measures to facilitate effective pollution prevention, reduce the pollution load, and increase use of purification technology in regions that have groundwater pollution from nitrate nitrogen.

Now, we will look at the status of the green tracts (parks and forest) around us. The area of the nation’s total area of city parks, which are the green spaces closest to people who live in urban areas, was approximately 116,667ha (98,568 parks) as of the end of 2009, which is an area of approximately 9.7 m² per person. The area of Japan’s forests is around 25 million ha, which makes up two-thirds of the nation’s entire land area. The amount of growing stock of forest, which indicates the volume of the main portion of trees in forests, more than doubled from 1966 to 2007, mainly through forest plantations, and thus forest resources are continuing to mature (Figures 1-2-35, 36, 37).

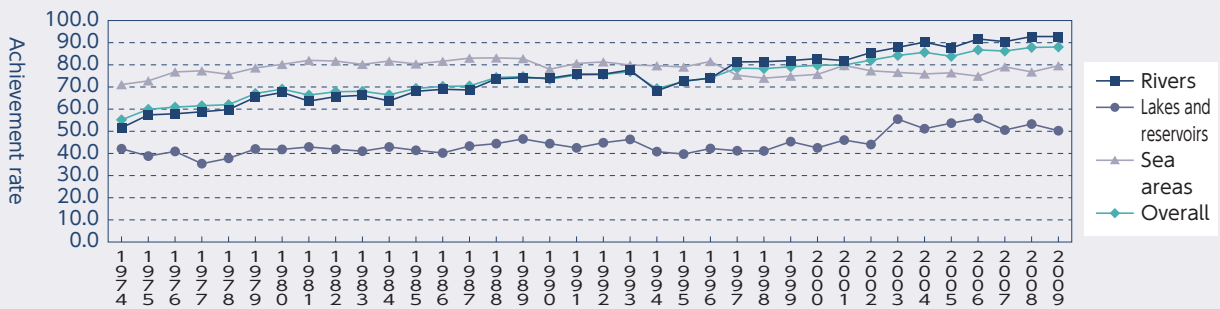


Figure 1-2-32 Trends in Concentration of Air Pollutants



Source: Ministry of the Environment, Environment Management Bureau, "The Status of Air Pollution in FY2009 (press release material)"

Figure 1-2-33 Trends toward Achieving EQSs (BOD or COD)



Note 1: BOD is used for rivers, and COD is used for lakes, reservoirs and sea areas.

Note 2: Achievement rate (%) = (Number of water areas that have achieved BOD/COD / Number of designated water areas) X 100

Source: Ministry of the Environment, Environment Management Bureau, Water Environment Division, "FY2009 Results of Measurement of Water Quality in Public Water Areas"

Thanks to these efforts and the relatively good status of the environment, people can find it easy to interact with nature, and they willingly come in contact with the environment. According to a survey on the current status of water quality of Class A rivers in Japan conducted by the Ministry of Land, Infrastructure, Transport and Tourism, more than 70% of the nation's Class A rivers were ranked as "a river that is easy to play in" according to the "indicator for future river management," which comprehensively evaluates the current status of a river environment from various perspectives (Figure 1-2-38). In addition, the Ministry of the Environment has been introducing organizations that conduct ecotourism around the country through a website called Ecotour Comprehensive since its 2005 launch. As of December 2010 the number of businesses registered was 728, which was 1.9 times as much as when it first started operating. The total number of registered ecotours was 2,603, which was 3.4 times as much as the number at the beginning. All these changes indicate that people are increasingly willing to become more familiar with the environment (Figure 1-2-39).

We have taken a look at several major aspects of the

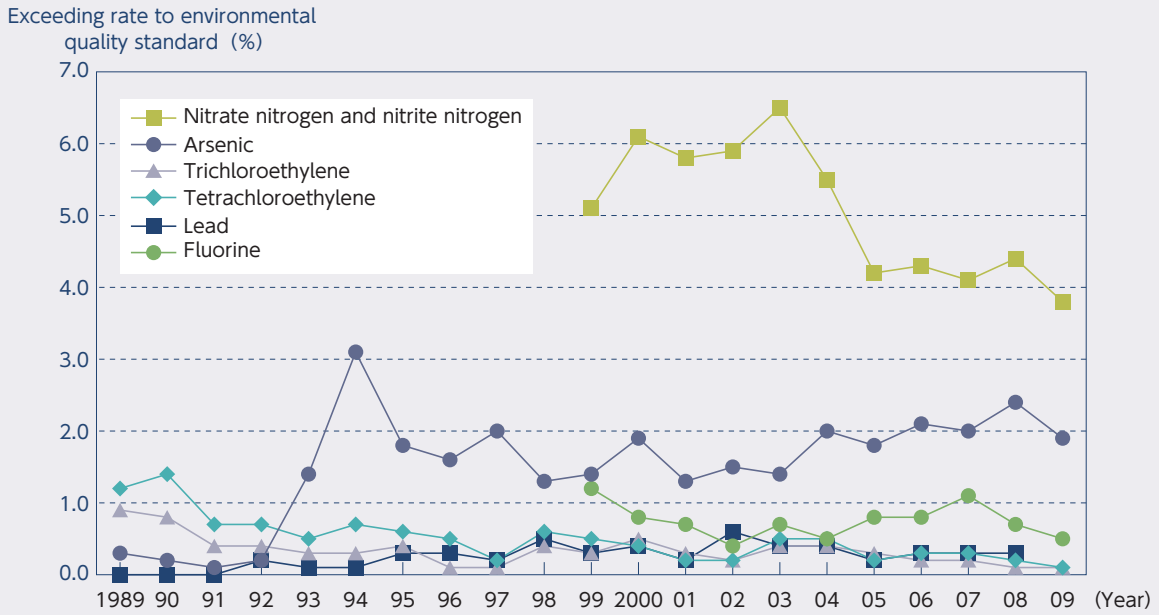
quality of the environment, and as a whole the status of the environment is relatively favorable or is continuously improving. These aspects are the foundation for leading healthy and good lives, and it is important to continue to work for further improvement.

(3) Status of Various Elements Related to Quality of Life and the Relationship with the Environment

Quality of life comprises of various elements related to the environment, the economy, and society. From those elements listed in the previously mentioned CMEPSP report, we will now focus on some of the leading indicators in aspects related to health, individual free activities (e.g. leisure), social connections, and material living standards such as consumption, and give an overview of Japan's sustainability and quality of life.

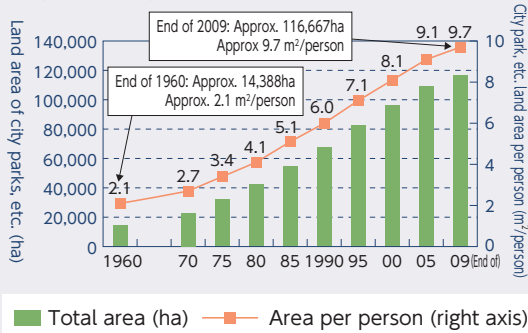
As for health, average life expectancy data shows that lifespan in Japan has continued to grow longer since the end of the World War II. Life-spans were around 65 years for men and around 70 years for women in the late 1950s and early 1960s, and they have extended to 79.59

Figure 1-2-34 Trends in Rate of Achieving Environmental Standards for Major Materials Related to Underground Water Pollution



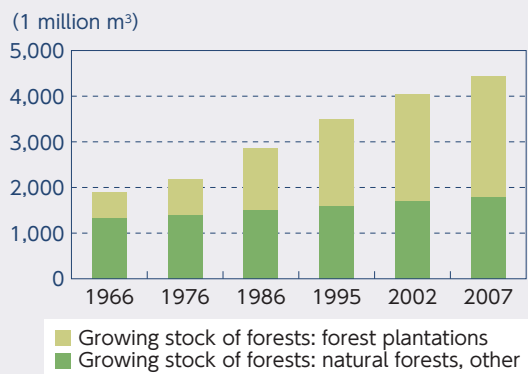
Notes: 1) The wells measured for the general survey differed by year (the same wells were not necessarily measured every year).
 2) Environmental standards for underground water pollution were established in 1997. Standards before 1997 were used as evaluation standards. In 1993, the evaluation standard for arsenic was changed from "0.05mg/L or less" to "0.01mg/L or less," and the evaluation standard for lead was changed from "0.1mg/L or less" to "0.05mg/L or less."
 3) Nitrate nitrogen and nitrite nitrogen, and fluorine were added to the environmental standards in 1999.
 4) This graph only shows items for which the exceeding rate to environmental quality standard was relatively high.
 Source: Ministry of the Environment, "FY2009 Underground Water Quality Measurement Results"

Figure 1-2-35 Trends in Land Area and Numbers of Japan's City Parks, Etc.



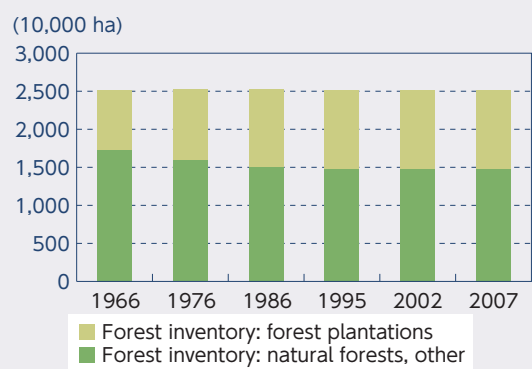
Source: Information from the Ministry of Land, Infrastructure, Transport and Tourism

Figure 1-2-36 Trends in Growing Stock of Forests



Source: Ministry of Agriculture, Forestry and Fisheries, The Status of Japan's Forests and Forest Management -The Second Country Report on the Montreal Process -

Figure 1-2-37 Trends in Extent of Forest and Other Wooded Land



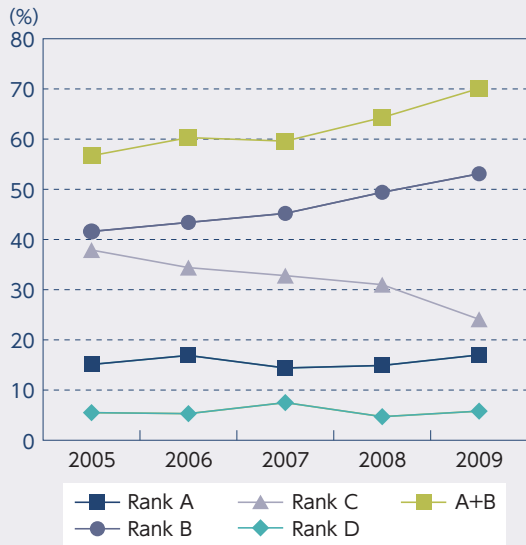
Source: Ministry of Agriculture, Forestry and Fisheries The Status of Japan's Forests and Forest Management -The Second Country Report on the Montreal Process -

years for men and 86.44 years for women as of 2009 (Figure 1-2-40). The ratio of people whose daily lives are affected by their health status increases with age, and among older people aged 65 or over the ratio was around 20% from 1995 to 2007.

Furthermore, the ratio of people aged 85 or over whose daily lives are affected by their health status is around 40%, and now more than half of the people aged 85 or over can independently carry out their daily lives. Also, when we measure the relationship between GDP per person in a country and the life expectancy of the people in that country, there is a general trend that the life expectancy extends as GDP grows. On the other hand, in Japan average life expectancy extends even in a period where there is little or no growth in GDP (Figure

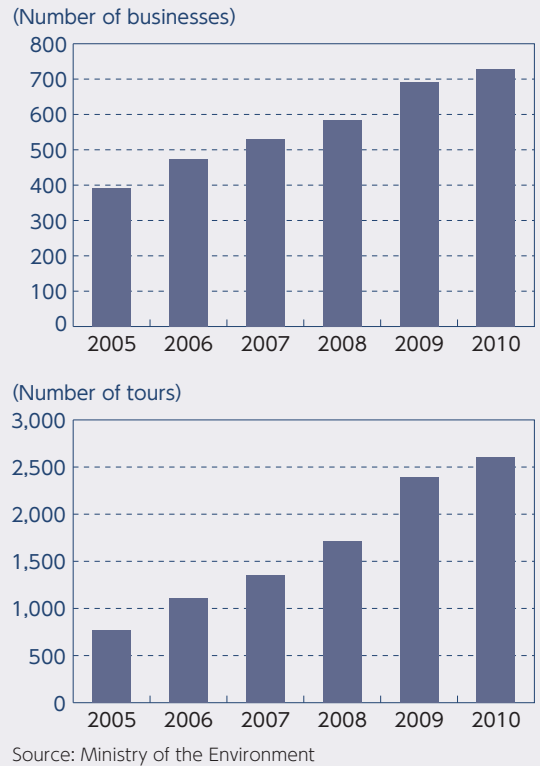


Figure 1-2-38 Trends of Indicators Related to Fulfilling Interactions with Rivers



(Notes)
 Rank A: It is easy to put one's face in the river's water (a clean river people would want to swim in).
 Rank B: It is easy to play in the river.
 Rank C: People would not want to go in the river, but it is possible to go near it.
 Rank D: There is nothing appealing about the river, and it is difficult to go near it.
 Source: Created by the Ministry of the Environment, based on information from the Ministry of Land, Infrastructure, Transport and Tourism's "Current status of Water Quality in the Nation's Class A Rivers (Indicators for Future Management of Water

Figure 1-2-39 Trends in the Number of Businesses Conducting Ecotours (Upper Graph) and the Number of Registered Tours



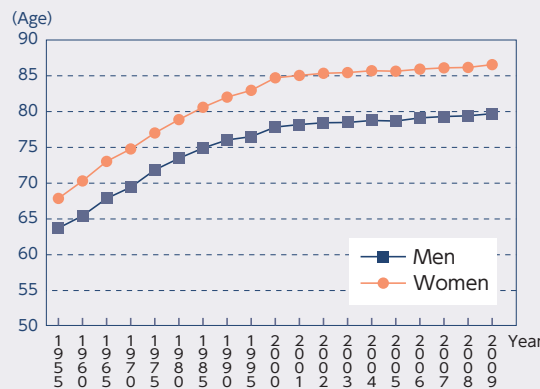
Source: Ministry of the Environment

1-2-41), unlike other countries. From an international perspective, Japan has not only a long average life expectancy but also a long healthy life-span (the age at which a person can live independently and in good health). As for older people's awareness about health in Japan, many people consider themselves in good health, thus the people in Japan can have long life-spans and at the same time lead healthy lives.

Next, we will look at changes in the way people use their time in their daily lives. Since 1976, the number of working hours on weekdays remained around 8 hours and there have not been any major changes, but the number of working hours on Saturday and Sunday is declining. By contrast, the number of hours spent on leisure activities increased from 4.5 hours in 1976 to 5.7 hours in 2006 on Saturdays and from 6.3 hours to 6.8 hours on Sundays (Figure 1-2-42). As for the way that leisure time is spent, on weekdays older people have more leisure time than employed people, with employed people having 3.7 hours in FY2006, compared to 7.0 hours for older people aged 65 or older.

Now, we will take a look at the interaction of people and society. There is a trend that the level of people's interaction with neighbors declines with age (Figure 1-2-43). A survey conducted by the Cabinet Office concerning people's interaction with their communities showed that as many as 60% of people in Japan think that human relations have become difficult. As for the causes, 54% of people think that it is due to weakening of ties with communities, and more than 30% of people think that it is due to the trend of nuclear families and weakening of parent-child relationships (Figure 1-2-44).

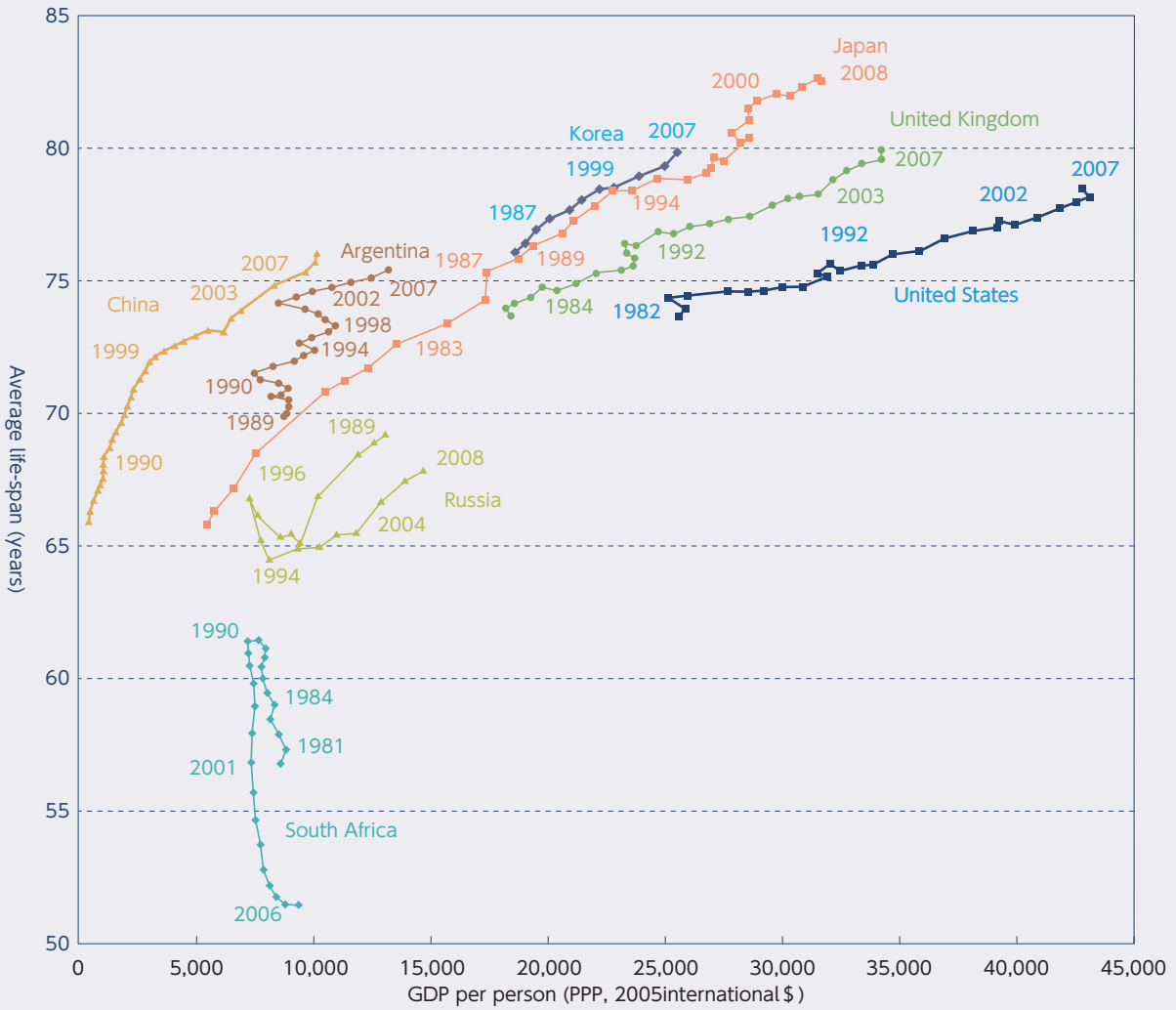
Figure 1-2-40 Trends in Average Life-Spans of Men and Women in Japan



Source: Created by the Ministry of the Environment, based on information from the Ministry of Health, Labour and Welfare's FY2009 abridged life table

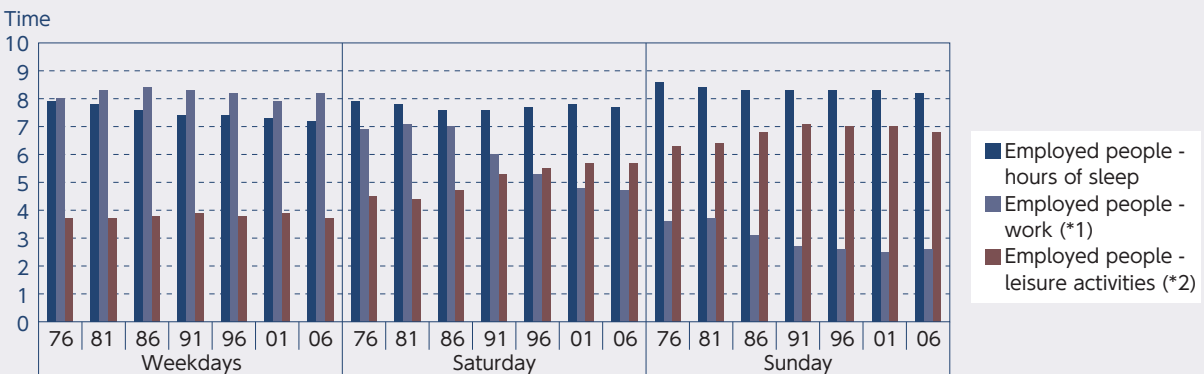
However, there is a trend that people seek personal relationships through activities to preserve the environment. People who participate in volunteer activities to protect nature or the environment have a high ratio of joining such activities through regional or school organizations or with family members, and this shows that such activities are being conducted through interaction between individuals, society, and families (Figure 1-2-45). In particular, among the people participating in volunteer activities with their family members, the ratio of protection of nature or the environment is higher than any other types of volunteer activities in terms of type of activities. In other words, preservation of the environment provides people with opportunities for family interaction (Figure 1-2-46).

Figure 1-2-41 Relationship Between GDP per Person and Life-Span in Each Country



Source: Created by the Ministry of the Environment, based on information from the World Bank's World Development Indicators 2010

Figure 1-2-42 Trends in Ways of Using Time in Daily Life (Sleep, Employment, Leisure)



Source: Created by the Ministry of the Environment, based on information from the FY2006 survey on basic social life "Shifts in Overall Average Times by Gender, Usual Status of Employment, Day of the Week, and Type of Activity"
 (*1) The total of time for work and commuting, taken from secondary activities
 (*2) Excluding doctor visits, medical care, and other, taken from tertiary activities

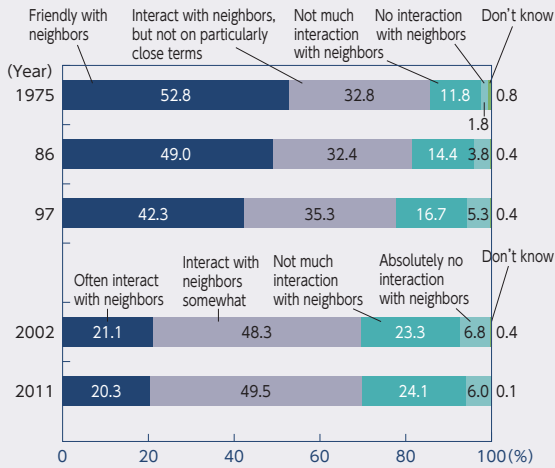
There is also an increasing trend in the number of NPO groups that conduct activities to conserve the environment (Figure 1-2-47). People can feel their relationship to the community through their activities in

the environment, because it is deeply connected to their own lives.

Looking at changes in household consumption expenditures, in recent years the consumption of durable goods

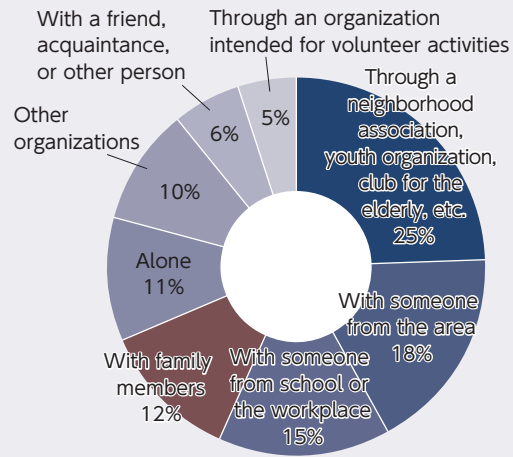


Figure 1-2-43 Trends in Degree of Neighborhood Interaction



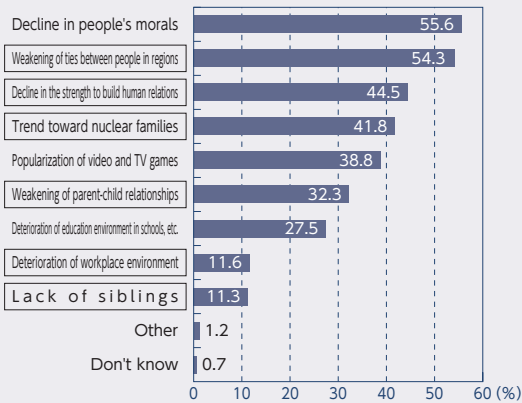
(Notes) 1. Created by the Ministry of the Environment, based on information from the Cabinet Office's "Survey of Public Opinion on Social Awareness"
 2. For 1975, 1986, and 1997, numbers are the ratio of people who answered the question, "How much do you interact with your neighbors? Please choose from these options."
 3. For 2002 and 2011, numbers are the ratio of people who answered the question, "How much do you interact with people in your area? Please choose only one of the following answers."
 Source: Created by the Ministry of the Environment, based on information from the Cabinet Office's "Survey of Public Opinion on Social Awareness"

Figure 1-2-45 Volunteer Activities for Protecting Nature and the Environment (By Activity Type)



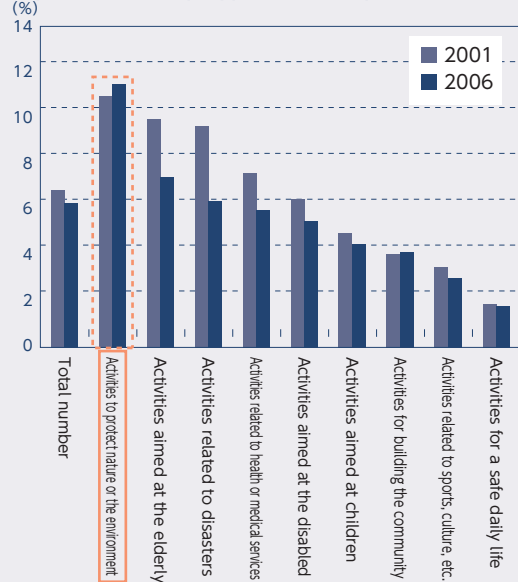
Source: Created by the Ministry of the Environment, based on information from the Ministry of Internal Affairs and Communications' Fundamental Survey on Social Life (FY2006)

Figure 1-2-44 Reasons Why Human Relations Have Become Difficult



(Notes) 1. Created from the Cabinet Office's "Special Survey of Public Opinion on Safety and Peace of Mind" (2004)
 2. The survey asked people who had answered the question "In general, what do you think about the status of "human relations" recently? Please choose only one of the following answers" by circling "They've become difficult" or "They've become somewhat difficult" to answer the question "What do you think are the causes for this? Please choose as many of the following answers as you like."
 3. The respondents were 1,364 people aged 20 or older from all over Japan.
 Source: Cabinet Office's FY2007 White Paper on Citizens' Lifestyles

Figure 1-2-46 Ratios of People Who Volunteer with Family Members (By Type of Activity)



Source: Created by the Ministry of the Environment, based on information from the Ministry of Internal Affairs and Communications' Fundamental Survey on Social Life (FY2006, FY2001)

such as household appliances and automobiles peaked in the 1990s and has been in a trend of consistent decline ever since, having declined to approximately 15% as of 2010. Consumption of non-durables such as food and consumables has been declining consistently since the 1980s, and at present has fallen to approximately 25%. On the other hand, consumption of services such as medical care, education, communications, and transport surpassed 50% around 1990, and as of 2010 its ratio had climbed to nearly 60%. In summary, in order to achieve a

good quality of life, the consumption of services has become more important than the consumption of materials (Figure 1-2-48).

Based on such social and economic elements and environmental elements, what is the status of Japan's quality of life as a whole? In an attempt to answer such a question, we will now look at the results of the National Survey on Lifestyle Preferences, in relation to one of the questions, "How happy are you?" This was a question that people were asked to answer on a scale of 1-10, and the trend in Japan is that the most-chosen answers were 5, and 7 or 8.

This trend observed in Japan is quite different from Great Britain's and Denmark's results for a social survey conducted in Europe, for which most people chose 8. This

Figure 1-2-47 Shifts in the Number of Specified Non-Profit Corporations that Carry Out Activities to Preserve the Environment

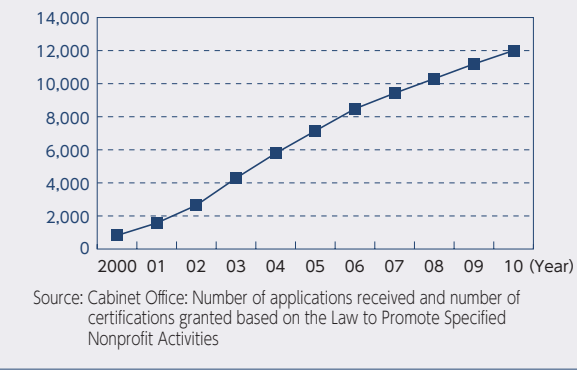


Figure 1-2-49 Ten-Level Evaluation of “How Happy are You?” (Comparison among Japan and 4 European Countries)

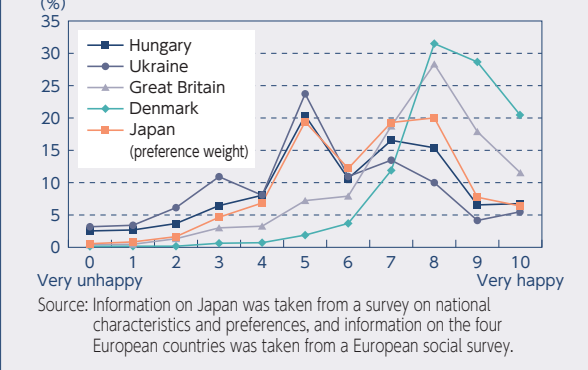
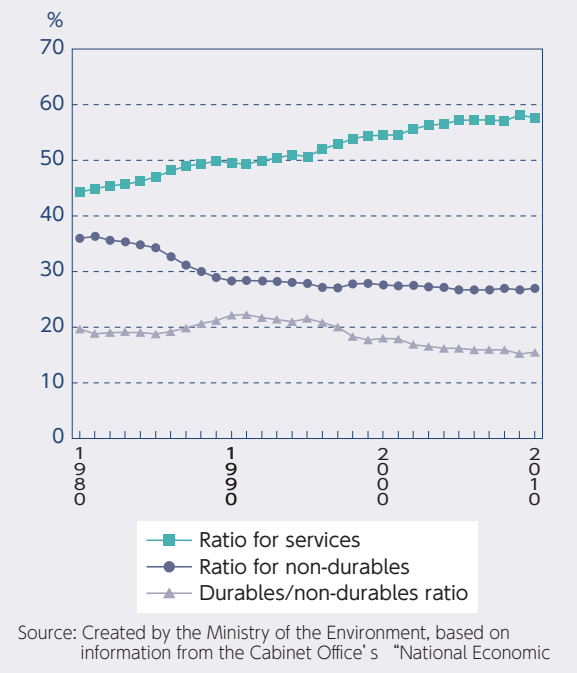


Figure 1-2-48 Shifts in Ratios of Households Consumption Expenditures



indicates that in Japan many people do not feel a great deal of happiness (Figure 1-2-49).

Now let's think about the meanings of these various elements and overall trends discussed here, particularly in regard to the current necessity of reducing the impacts on the environment.

First, the trend of increasing consumption of services and reduction of amount of input natural resources suggests that it may be possible to improve quality of life through development of service consumption without increasing the environmental impact caused by consumption of natural resources and energy.

Conclusions

In Chapter 1 we have looked mainly at sustainability and quality of life in our daily lives, based on various data that is related to such things. We have to achieve a sustainable society and pass on to the next generation the quality of life that the current generation enjoys. We believe it is necessary for us to promote sustainable

Second, while the connections between people and society are weakening, the trend of rising volunteer activities to protect nature and the environment will serve as a foothold for improving the environment. The longer life-spans and increased leisure hours also suggest that this will become an increasingly important perspective in the future.

In addition, establishing a safe society in which people can live safely and securely is one of the most fundamental elements required to achieve a good and sustainable society. For example, environmental problems and natural disasters are closely related. Rising sea levels and meteorological disasters caused by climate change, and declines in the water-retaining functions of forests and flooding caused by excessive logging of forests are examples of environmental deterioration that further worsen the damage from natural disasters. On the other hand, a large-scale natural disaster not only breaks down the foundation of our lives and production, but also leads to environmental problems such as generation of huge volumes of waste.

For this reason, it is important to promote the prevention of natural disasters and preservation of a good environment in normal times, and when natural disasters do occur, it is important to take immediate actions to deal with environmental issues such as disaster waste to facilitate efforts for recovery.

In comparison to a perspective that emphasizes only the scale of economic activities and material living standards, reviewing the elements of quality of life in depth will open up the possibility for simultaneous improvement of both sustainability for the future and current quality of life. Further efforts aimed at evaluating and measuring sustainability and quality of life will be necessary, and it is important for each of us as individuals to think deeply about what true quality of life is.

use without exhausting all of the natural resources, and to keep a healthy environment without excessive environmental impacts on the Earth, because natural resources support our lives and the Earth is the foundation of our survival.

In order to achieve sustainability and good quality of

life, it is necessary to gather various forms of knowledge, including traditional wisdom and new science and technology, and establish not only domestic rules but also international rules and turn them into reliable actions.

For further consideration of environmental aspects in relation to this issue, in Chapter 2 we will review knowledge for sustainable use of ecosystem services, which are the Earth's benefits. In Chapter 3 we will discuss biodiversity, which is the basis of such ecosystem services, and make proposals about the necessity of rules and actions in order for humans, nature, and the

Earth to coexist. In particular, we will focus mainly on the 10th Conference of the Parties to the Convention on Biological Diversity. In Chapter 4 we will focus on actions to contribute to the world's green growth through Japan's technologies, and to improve global sustainability, particularly a material-cycle society and a low-carbon society.

In this report, we added Chapter 5 and discussed in "Toward Recovery from the Great East Japan Earthquake" the massive magnitude 9.0 earthquake that was centered off the Sanriku coast.

