

Unit 3-3: Environmental issues in agricultural and rural development

Chapter 1 Introduction

Global environmental issues such as global warming and deforestation of tropical forests have become obvious due to the heightened economical activity level mainly in advanced countries, and poverty, rapid expansion of population and its urban centralization mainly in developing countries, and further globalization of economy rapidly advanced in 1980's. Environmental issues even in developing countries have also been deepened their complexity and severity. While environmental disruption associated with the industrialization is proceeding, environmental disruption associated with poverty is also proceeding, and lives of many people those who depend on the use of natural resources are being threatened.

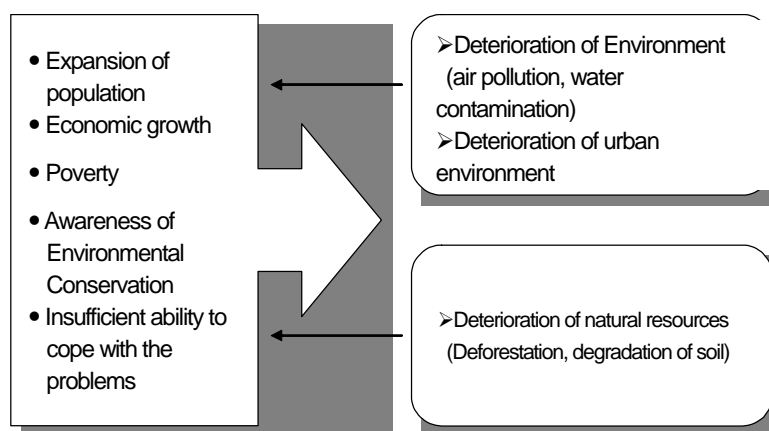
In this unit, putting these issues as background, we will explain the challenges towards solution regarding global environmental issues in detail.

Chapter 2 Global environmental issues and development

The earth is shared by all nations and their people, and the environment has its limitation. Thus it is a common issue for all humanity to conserve this limited global environment in order for all humanity on earth to enjoy healthy and cultured livings into the future, and to achieve sustainable development. In addition, this global environment is positioned as so-called "the global public goods", and its conservation is an important factor to solve the other issues such as peace keeping/building, eradication or reduction of poverty, maintenance and advancement of health, etc. that also are common issues for all the human beings on earth. Economic communities are carried on in globally very close mutual interdependent relationship, thus all nations are required to conserve this global environment and to maintain sustainable development under international partnership, and through this partnership, also required to contribute to and cope with other common issues for all humanity.

These are issues to be commonly shared by nations whether they are advanced countries or developing countries. Firstly, each nation should struggle with its own issue in a positive manner and promote international co-operation to cope with environmental issues towards "Building partnerships for conservation of the global environment and sustainable development" under the international partnership. In this building of partnership, each country is required firstly to try to overcome its own problems through planning and implementation, and then to collaborate one another based on their own abilities to act to realize the ideal.

Figure 2.1 Environmental issues in developing countries



2.1 Commencement of action for the global environment.

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obvious due to more heightened economical activity level mainly in advanced countries and poverty, rapid expansion of population and its urban centralization mainly in developing countries, and further globalization of economy rapidly advanced in 1980's. Environmental issues even in developing countries have also been deepened their complexity and severity. While environmental disruption associated with the industrialization is proceeding, environmental disruption associated with poverty is also proceeding, and lives of many people those who depend on the use of natural resources are being threatened.

To cope with these issues, development and environment are considered as international issues and thus had been discussed internationally through 1990s. U.N. Conference on Environment and Development (The earth summit, UNCED) was held in Rio de Janeiro, Brazil in June 1992, and an action plan "Agenda 21" which propounds sustainable development as its ideal was adopted, and Framework Convention on Climate Change, Biodiversity Treaty and Statement on Forestry Principles were adopted as well. After the summit, a number of global frameworks to contend with environmental issues in global level such as International Convention to Combat Desertification, Kyoto Protocol and Cartagena Protocol, etc were adopted or concluded, and the global efforts to the issues have been made.

2.2 Sustainable development

For achievement of sustainable development, it is required for advanced countries to take initiative action and for developing countries to act based on their own abilities, plus for all nations to act based on mutual partnerships.

In 1990s, however, no sufficient visible accomplishments on the sustainable development in developing countries were achieved, some of the aid partakers reflected on their failed approaches to the aid for developing countries. At the U.N. Millennium Summit taken place in September 2000, they emphasized peace and security, development and poverty, environments, human rights and good governance, etc. and set the numeric targets to achieve by the year 2015 (MDGs: Millennium Development Goals) reflecting the failure in '90s and they agreed internationally to act to achieve the goals. In the goals are the following 8 fields as indices to show development goals clearly.

- (1) Eradication of extreme poverty and starvation.
- (2) Achievement of universalized primary education.
- (3) Promotion of equality of sexes and advancement in the status of women.
- (4) Reduction of child mortality rate.
- (5) Improvement of maternity health.
- (6) Prevention of spread of HIV/AIDS, malaria, and other diseases.
- (7) Securement of sustainable environment.
- (8) Promotion of global partnership for development.

In 2005, a U.N. secretary general's consultative body has concluded strategies to achieve these development goals. In response to the fact that the MDGs' progress has been deteriorated in sub-Sahara Africa, strategies to eradicate poverty was prepared and a concrete action plan which specifies time and regions was proposed to achieve MDGs. "Environmental Sustainability", which is one goal of MDGs, was positioned as an integral part of other total goals to achieve MDGs, and 10 proposals such as approaches to causes of air pollution/water contamination, mitigation of effect of global warming, reinforcement of organizations and governance ability, etc. were submitted. In September 2002, at U.N. World Summit on Sustainable Development taken place at Johannesburg, South Africa (WSSD), it is concluded that 10 years after UNCED, global environment has been deteriorating while developing countries cannot reap benefits from the globalization and progress of information and communication technology, and a gap between the rich and poor is widened. At the same time, it is proclaimed that collaboration of related bodies such as

governments, international bodies, business enterprises and NGOs, etc. is necessary, and necessity of ownership of the developing countries towards sustainable development and partnership by the international community that supports the ownership is reaffirmed. In addition to the adoption of “Johannesburg Plan of Implementation” that is a consensus document among the international governments, a “covenant” was edited as document for collaboration of multiple bodies working independently. At the 11th session of U.N. Commission on Sustainable Development (UN-CSD) which follows up Johannesburg Plan of Implementation, enforcement schedule for multiple years has been prepared, and an idea to emphasize on regions in progress management was come out with.

2.3 Role of advanced countries

When proceeding sustainable development, assurance of good governance in central governments/local governments, reinforcement of partnerships between governments and diverse bodies and reinforcement of corporate social responsibility as well as minimizing the adverse influences of the globalization, and narrowing the gap between the rich and the poor are being queried as issues.

These are not only the issues of the developing countries but also the issues of the advanced countries. On the other hand, “Changeover to the sustainable production and consumption patterns” in the advanced countries is not merely local issues of the advanced countries. It is necessary for the advanced countries to contribute to the achievement of sustainable development in developing countries through diffusion of the relevant technology and international trade. Developing countries are also uneven. Developing countries are varied from the medium-developed countries like some of the Association of Southeast Asian Nations (ASEAN) which already gain significant positions in the global economy to the countries like sub Sahara African least less-developed countries which still have many significant problems. We need to understand this fact and get rid of the old fashioned idea such as friction between the advanced countries versus developing countries, and respond to the issues of each region or country. To develop in a sustainable manner, it is indispensable to secure reinforcement of governance in the central government and local government level, and it is required to emphasize building up human resources and institutions. Further, we need to understand that improper management of natural resources sometimes causes conflicts between countries, thus it becomes important to eradicate poverty and properly manage the natural resources from the view point of conflict prevention and human security.

2.4 Global trend of agricultural production and its sustainability

It is expected that world's population will be expanded by 2.713 billions from the year 1995 to 2025 (WRI, 1994). This means that world's population will be expanded by nearly a half of current level in 2025 even when taking decrease of average annual growth rate of population into account. If the standard of living would be maintained as it is and demand for foodstuff would be satisfied, agricultural production should be increased by about 50% of current level. When standard of living would be improved in the whole world, the production needs to be enhanced more than this. Although it is impossible to affirm that production increase by about 50% cannot be achieved during this period, it is obvious that natural resources will be deteriorated in effect as a tendency to achieve the number, and its high output from the agricultural production cannot be sustainable.

It is estimated that world's food production in 1980s was increased by 22%. If the production increase rate could be maintained in the following decade, there is a possibility that the agricultural production would be increased by approximately two thirds by 2025 compared to the middle of 90s. This level of production increase, however, might be extremely difficult. Production increase in 1980s were only possible by additional use of fertilizer, increase of irrigation area, use of tractors and heightened rate of introduction of other agricultural machines and conversion of forest/woods into plant area and improved grazing land.

Increase in agricultural output can be achieved by 2 ways: 1) expansion of plant area into newly cultivated land and 2) intensive farming. Both of these two processes have their limitation. If the existing forest/woods were converted to plant area and this converted area had the same productivity as the existing farmland, it would be possible to increase the output from agriculture by 80% of the current production level. Actually, productivity of this converted area will be far smaller than the productivity of area currently used as farmland. Further, this sort of conversion shall naturally bring the significant damages to the environment. As far as the agriculture concerns, enlargement or expansion has a imperative limitation.

The intensification of agriculture will be constrained by environmental aspects. Room for enlargement of irrigation is limited by water supply. Naturally, it is problematic in dry season especially. This sort of limitation of water supply is obvious in the most part of Asia. (Alauddin and Tisdell 1997). Although the increased use of artificial fertilizer is welcome by many developing countries as they seem it as an evidence for economic progress, the long term adverse element is not very clear that what this heavy usage will bring to the environment from the view point of sustainable production. For example, use of artificial fertilizer will turn the soil to acidic in the long run, and when you try to maintain yields by using the fertilizer, it is required later to use more fertilizer. In the whole process of recent progress in agriculture, it is not an exaggeration to say that it makes agriculture highly dependent on the resources that cannot be renewable in order to maintain the current level of production. Further, when wildlife habitat area is converted to farmland, enlargement of agriculture becomes a factor that contributes to the loss of biodiversity.

Under these circumstances, many indices for sustainability of agricultural system or many indices for substantial changes in sustainability become very important for policy target.

Chapter 3 Status of global environment

3.1 Acceptable environmental limit and global environmental issues

In fact, defining “environment” is a very difficult job. Global weather/climate was shaped by the balance of air, water and solar energy existing on the earth, which realize the conditions (temperature and precipitation, etc.) for living beings on the earth to exist, and the earth ecology is functioning as an interdependent system of material/energy cycle and the living beings. In this unit, we use roughly the words “the environment or the global environment” with these ecological system in mind. Ecological system has in some degree force of restitution (adaptability and self-regenerating ability of the living beings, and pollution cleaning ability by the physical dilution of environment), and when they are artificially changed, they maintain in some level the balance. Environmental issues (deterioration of environment and disruption of nature) is to break down the balance of ecological system which had been maintained so far, or to bring some significant unfavorable changes in the system. These problems used to be caused at many spots in comparatively small geographical extent such as urban area, rivers and the sea, etc. but today, impact by human activities on environment has become ultimately expanded enough to the whole earth.

Funnel fume come out of chimney is diffused into atmosphere and pollutants flowed into rivers are diluted in the wide sea. There is, however, an acceptable environmental limit—“an acceptable environmental limit of the earth”—once it seemed like huge enough to accept all and there was no limitation. As the first case that human beings recognized the fact that there is a limitation, there is an ozone layer depletion problem caused by chlorofluorocarbon (CFC) gas. When the issue was put on the discussion table for the first time that CFC used in sprays and cooling medium of refrigerators causes ozone depletion in the stratosphere over the aerosphere and volume of ultraviolet that reaches the ground increases, and then there is a fear that the incidence of skin cancer increases, most people thought it dubious. But later when this discussion was proved to be true by the observation in Antarctic air, “Vienna convention for ozone layer protection” (1985) and “Montreal protocol for ozone depletion materials” (1987) were adopted, and then movement to abolish the use of CFC commenced.

On the other hand, in the '70s, damages by acid precipitation were widely caused in Northern Europe, Eastern Europe and North America. The cause factor is sulfur oxide and nitrogen oxide contained in the emission originated mainly from factories and power plants. The emission is brought more than 1000km far by air current, and diluted in the mist and precipitation and then kills trees. And water of lakes and ponds is acidified and disrupts the habitat of fishes. The damages become severe in Germany and this became the background of the leap of the Green Party. And with this as a turning point, Germany became a banner man for environmental conservation in EU, which means that it is significantly important internationally to cope with issues like global warming and recycling of waste. In eastern Asia including Japan, Korea and China, acid precipitation is also observed in many spots in the region with the background of China's industrialization. Under these circumstances, "East Asia Acid Precipitation Monitoring Network" has been established (1995).

3.2 Typology of global environmental issues

Fujisaki et al (compiled by Fujisaki, 1992) typified "International environmental issues", which are today so-called global environmental issues, to the following 5 types in response to the structural difference in causes and countermeasures. They are 1) Crossing border wide area environmental pollution, 2) Environmental disruption arising from "export of deterioration of environment" 3) "Disruption of nature advanced through the structure of international relationship of industries and trades", 4) "Regional disruption of ecological system caused by advancement of vicious cyclic poverty and environmental disruption" 5) "Pollution and disruption of global environment as global commons. Even though you give generic name "global environmental issue" in 2 or 3 words, the meaning of it is varied, which shows that causes of the problems are intricately-intertwined with the conditions of both sides of advanced countries and developing countries.

3.3 Issue of global warming

Among many aspects of the global environmental issues, issues related to global warming capture people's attention the most. Its effect is literally global, and when we try to cope with this problem, we need to significantly reduce the consumption of fossil fuels that seems to be nearly impossible. The reduction of consumption could be a constraint factor to the economic growth and so draws much attention of economic world.

In 1985, "Conference for the evaluation of the influence of emissions of carbon dioxide and other greenhouse gases on the climate change" took place in a small town of Villach in Austria by climatologists. Its conclusion greatly turned the world. "Global warming is not an armchair theory of scientists. This is a pressing problem that could determine the fate of human beings. It is necessary for both scientists and policymakers to review cooperatively how to deal with the global warming." Acting in concert with this conclusion, IPCC (Intergovernmental Panel on Climate Change) was established in 1988. In 1992, signing to "U.N. Framework Convention on Climate Change (UNFCCC) started at the Earth summit.

Issues of global warming also have significant meaning for development in the developing countries. In the Kyoto protocol agreed in the Third Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3), while reduction target of greenhouse effect gases is prorated to each advanced country, but obligated quota is not imposed on developing countries. In advanced countries, however, where measures to conserve energy have already been thoroughly pursued, further reduction would bring a large sum of additional cost. On the other hand, in the developing countries where energy saving technologies are in low level and insufficient, there will be a large room for further reduction in lower cost. There is an idea of "Clean Development Mechanism (CDM)" created to fill this wide gap. This mechanism makes it possible that when an advanced country works together with a developing country to

reduce the emission produced by energy use, the reduced part can be counted in the reduction of that in the advanced country. With this mechanism, countermeasures for environment conservation link to motivation for pursuit of profit, and it also is expected to promote the transfer of technology from the advanced country to the developing country.

3.4 Land use, desertification and deforestation

One of the other irreversible changes brought by development is a change in land use and land cover. Forest and grass field remained as nature are changed to agricultural land, grazing land and urban usage along with the development, and once it has been done, there will almost be no chance to reverse to nature. Forest, especially rain forest in the Southeast Asia is rapidly disappearing. In the meantime, climate changes and aridification proceeds in inland regions of Eurasian continent and African continent, and as a result of it, desertification proceeds by 60 thousands km² every year. As a result of changes in land cover, extermination of species of animals and plants lives used to live there is also proceeding.

As for the causes of desertification, opinions are divided to 1) Number of livestock grazing grew beyond the capacity, 2) Even though trees were afforested, they cut down nursery trees to use as fuel wood, 3) Influence of the climate change in the global level, and are not clearly explained. The significant cause of depletion of forest, especially tropical rainforest is that export of logs is the easiest way to earn foreign currency. In the background that the cut down of trees proceeded faster than the speed of the growth of forest was not only by large scaled cut down of trees by the foreign capital but also the economical and financial status in the side of developing countries.



Flow out of surface soil due to the excessive cut down of forest



Sand storm approaching to farmland

Photograph: Japan Green Resources Agency, J-Green, (both)

Chapter 4 Concrete action

In the field of international cooperation of Japan for agricultural and rural development, in addition to the cooperation of the Ministry of Foreign Affairs and JICA, the Rural Development Bureau of the Ministry of Agriculture Forestry and Fisheries independently promotes development of technologies and methodologies required for cooperation through Japan Green Resources Agency (J-Green), Japanese Institute of Irrigation and Drainage (JIID), etc.

In this chapter, we introduce representative example of technology and methodology developed in the field of agricultural and rural community as the prevention measures for desertification and that for soil erosion.







4.1 The preventive measures for desertification

To cope with desertification, we have developed prevention technology against desertification through

empirical researches in the West Africa funded by subsidy from the MAFF. And we applied the developed technology to the establishment of preventive plan for desertification.

Further, we applied these results to develop technology to prevent environment from desertification in East Africa, and technology as measures for the release source of yellow sand in Asia.

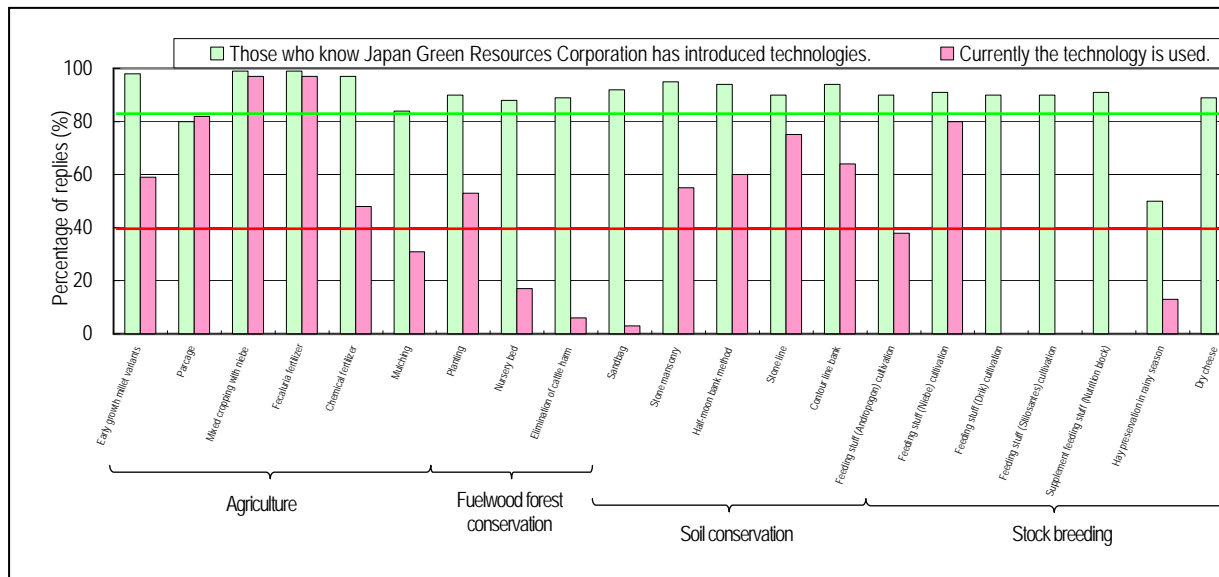
(1) Brief overview of developed preventive measures for desertification

<p>Water resource development</p>  <p>Elastic wave exploration</p> <ul style="list-style-type: none"> - Introduction of elastic wave exploration to estimate ground water level. - The estimated water level was verified with actual level by drilling, which results show high correlativity (0.8 to 0.9). 	<p>Use of water resources</p>  <p>Use of wadi flood plain (Cultivation of dry season vegetables)</p> <ul style="list-style-type: none"> - Wells were excavated in the wadi (dried up rivers) flood plain and the ground water is used for dry season vegetable. - Around the well, the local residents cultivated vegetable field at their own initiative. 	<p>Farm land conservation</p>  <p>Half-moon bank</p> <ul style="list-style-type: none"> - Soil banks were constructed in shape of a half-moon opened towards the upper side of the slope. - Effect of vegetation restoration is high (Photo at the left shows inner side of the half-moon bank where green is restored) - Where stones are available, the bank becomes more effective when stones are used as part of the bank.
<p>Agriculture</p>  <p>Vegetable cultivation (Rotational cropping system)</p> <ul style="list-style-type: none"> - 4-year rotational cropping system including vegetable cultivation (tomato, etc.) was introduced, and high yield and preventive effect for damages caused by pests were confirmed. 	<p>Livestock farming</p>  <p>Parcage</p> <ul style="list-style-type: none"> - After harvest of millet, cattle are released in the vegetable field. Cattle feed harvest residuum like culm and their fecaluria can be used as fertilizer. When 5 to 10 tons of fecaluria per year is applied biyearly, higher yield is expected. 	<p>Afforestation</p>  <p>Protective fence</p> <ul style="list-style-type: none"> - Introduction of protective fence in order to protect sapling from feeding damages. - Wooden baskets are less expensive and highly endurable.

(2) Villagers' recognition on each technology tried to be introduced (Niger)

- Villagers from 184 households out of total 252 in the object village surveyed. (Those who replied are men: 167, women 17) This questionnaire was carried out in January through February 2002, nearly 2 years after

the end of the surveillance.



Source: Evaluation report for technical development of preventive measures for desertification, Japan Green Resources Corporation, (2003)

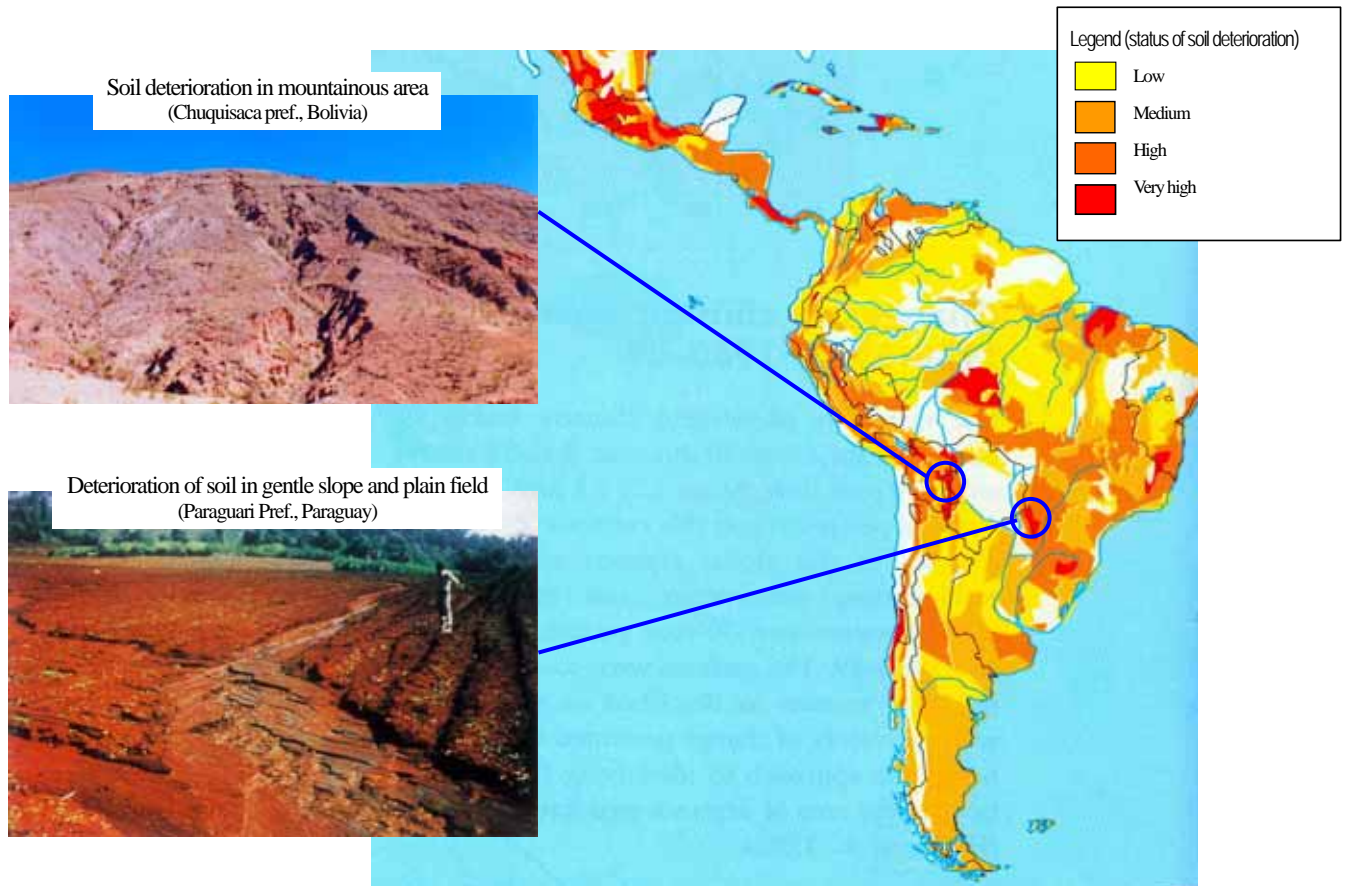
4.2 Preventive measures for soil erosion

To deal with soil erosion in South America, we developed technical measures to prevent farmland/soil erosion through empirical researches in mountain farmland in Bolivia where conditions are the severest, funded by the Ministry of agriculture, forestry and fisheries' granted project.

The developed technologies were adapted to this developing country and JICA technical cooperation project as well as the developing country's own efforts were implemented.

Further, empirical researches have been launched, funded by MAFF's granted project at farmlands cultivated in gentle slopes and plain fields in Paraguay.

(1) Current status of soil deterioration in South America



(2) Example of preventive measures for soil erosion



Stone line

- To prevent flow out of surface soil, stone lines were made.
- Farmers made their own efforts for improvement by using "the contest system".



Bench-terrace

- To prevent farmland cultivated in sharp slope from soil runoff, stone walls were built stepwise.



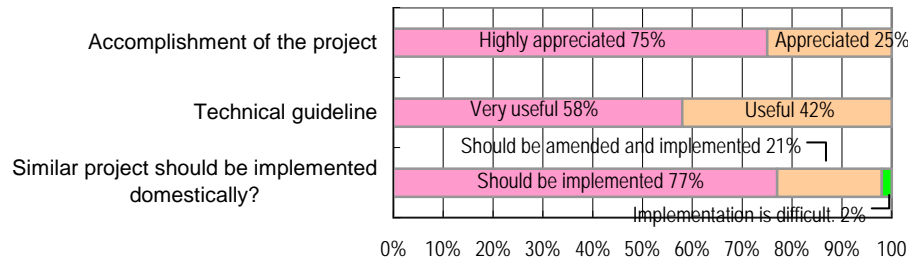
Fascine

- To prevent surface soil runoff, fascine and vegetation are placed parallel along the contour.

Annotation: "The contest system" is a system to group village farmers by 5 to 6 members and let the groups compete in progress level point of view, and to evaluate the results one another and implement the project.

(3) Evaluation by those who are not research partakers (Bolivia).

This evaluation questionnaire was made for the participants to the international workshop taken place to communicate the result of this research. 32 participants in total (Consultant related: 30%, NGO:24% and Government engineer:20%, etc.) were questioned and replied.



Source: Empirical research reports on preventive measures for farmland/soil erosion- Bolivia(5th year), J-Green, 2004

Chapter 5 Conclusion

Japan had achieved high economic growth for years while Japan had suffered serious deterioration of environment. In the process to overcome the deterioration, we have piled up many experiences and lessons that have been built into technologies to cope with these problems. In addition, we have built the most energy efficient community in the world through the struggles by enhancing energy saving policies to overcome the effect of oil crisis for two times, and sharply increased value of the yen against the dollar.

Economical growth is often accompanied with waste increase. We have been dealing with this problem by trying to reduce the generation of waste/trash and repeatedly using them where possible, and also trying to build cyclical society by reusing them as resources. Japan, as people have these experiences, has been actively involved with realization of global environment conservation and sustainable development.

In particular, Japan has been involved in constructing and reinforcing a mechanism for environmental management in the global and regional level, mainly in the field where needs is much high from the viewpoint to conserve the global environment and where it is possible to put experience of Japan to use, such as measures for global warming and promotion of 3Rs: Recycle, Reuse and Reduce (minimizing the volume of final disposal).

It is necessary to make further reference to the fact that what supports to overcome the deterioration of environment, to build a highly energy efficient community and cyclical society are various bodies such as the central government, local governments, corporations, academic institutes, NGO/NPOs and regional communities, and their coalitions. To cope with environmental issues that will become more multifaceted and be deepened in the future, it is necessary for more diversified parties to get involved in keeping coalition and cooperation.

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