

G-1.1 Integration of Desertification Studies and Systematization of Diverse Technologies to Combat Desertification

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Abstracts With regard to integration of the desertification studies, we have developed a framework and a modeling method, called the "Desertification Integrated Model", which grasps a series of desertification processes systematically and quantitatively. We link the model development to "Benchmarks and Indicators" approach currently carried out at the CST of the UNCCD. Concerning systematization of diverse technologies to combat desertification, reviews and questionnaire surveys were implemented to identify and categorize technologies to control desertification more systematically, and to discuss about methodology for assessment of desertification control projects. According to the results, two-matrix methodology was proposed for systematic identification/categorization. Using the matrixes, appropriate assessment system of technologies was discussed.

Key Words Assessment of Desertification Control Technologies, Benchmarks and Indicators of Desertification, Convention to Combat Desertification (CCD), Desertification Integrated Model, Systematization/Categorization of Diverse Technologies

1. Introduction

It is reported that desertification affects a fourth of the total global land area and a sixth of the global population and thus, it is feared that desertification may affect future global environment and food supply^{1,2)}. So far, most of desertification studies have been carried out independently. Hence integration of the achievements of different desertification studies and systematization of the diverse technologies to combat desertification has not been fully attempted. Also, most of desertification control projects were implemented without common methodologies to systematize various technologies. Therefore, it is necessary to identify and categorize those technologies more systematic to promote desertification control efficiently. It is also required to assess and feedback the effect of desertification control projects.

2. Research Objective

To integrate the desertification studies, we set the following three points as targets of the research project: (1) to clarify the state of the art of model development and direction for the future, by reviewing existing desertification model studies; (2) to obtain a framework of "integrated desertification model" that can predict the future states of desertification in a comprehensive and numerical manner; and (3) to draw scatter diagram of the existing desertification studies.

To systematize various technologies to combat desertification, we set the following three points as target: (1) to identify and categorize technologies to control desertification more systematic, by analyzing the projects which have been successfully implemented in different regions with various characteristics, (2) to identify those technologies which should be rapidly developed and applied, and be most effective in controlling desertification, and (3) to identify appropriate assessment system of technologies which should be applied in different regions with various characteristics.

3. Research Methods

3.1 Integration of desertification studies

Existing model-related studies such as desertification model, integrated model, human-activity model and agricultural economic model studies were reviewed and analyzed to grasp the state-of-art model development and examine its future direction. Also, the discussion at the Committee of Science and Technology of the United Nations Convention to Combat Desertification (UNCCD) was reviewed to examine the possibility to link the model development to the Benchmarks and Indicators of Desertification.

3.2 Systematization of diverse technologies to combat desertification

Reports and documents concerning recent desertification control projects were collected and reviewed. Questionnaire survey was also implemented to collect practical information from scientists, experts of international organizations and NGOs. Information concerning new technologies were collected through reports and interview surveys. According to the results, methodologies were discussed to identify/categorize effective technologies and to assess desertification control projects.

4. Results and Discussion

4.1 Integration of desertification studies

We thought that the modeling approach could be a useful method to integrate desertification studies. A review of the existing desertification models has revealed no comprehensive model dealing with the total desertification processes including causes, states and effects of desertification, has been developed yet. Therefore, we examined the framework of an "integrated desertification model" to grasp desertification processes comprehensively and quantitatively and the methodologies to develop the model.

We set two spatial levels to develop the model: village scale and regional scale. The village level model will be developed on the basis of original detailed investigation and

will include human activities (socio-economic) module and biological production module to describe the biological production and its use, demand/supply balance and the changes in biological production quantitatively. On the other hand, the regional model is being developed by making use of existing statistical materials and will be linked to the desertification benchmarks and indicators, which is being discussed in the Committee of Science and Technology (CST) of the United Nations Convention to Combat Desertification (UNCCD).

The review of the existing desertification studies indicates relatively few^{3,4)} researches in the field of demand/supply balance of biological production and economic evaluation of production change. To develop a comprehensive and integrated desertification model, it is necessary first to collect original data through field investigation, so that the required information could be supplied to the model.

4.2 Systematization of diverse technologies to combat desertification

Technologies were categorized depending on their target issues derived from the results of the review of existing documents. Through the implementation of questionnaire survey, technologies were identified from four points of view.

To identify and categorize a variety of technologies to control desertification more systematically, two matrixes were proposed: (1) Technology categorization matrix; Three dimensions were proposed as follows; (a) what is the objectives to apply the technologies? (b) what kind of technologies can be applied to a project? And (c) to which factor the technology should be applied? (2) Technology assessment matrix; Social and cost effectiveness of technologies were reviewed and systematized with regional conditions, including climate, main problems of desertification, and factors of success/failure of the project. Applying these two matrixes, effective technology assessment using common methods could be implemented concerning different technologies in different regions/countries.

We tried to identify the possibility of popularization of new technologies. Energy supply technologies for small scale communities were surveyed and discussed for future application. There are two categories of new technologies: one is renewable energy including wind power, solar power and biogas, and the other is combination of those with micro gas turbine or fuel cells. Though rather big issues about technical, human and budget capacity are remaining, detailed case studies for regions should be implemented for the future application of those technologies.

We tried to propose an assessment system of technologies. Appropriate data are necessary to assess various technologies. Those data are also necessary to be collected easily and commonly in different desertified countries and most of those are developing countries. For example, "possibility of popularization" of technologies were discussed for the verification of technologies. Various technologies were assessed if it is traditional/new one, and its covered range of area is limited/wide. To assess the capacity of technology implementation and management of countries, GDP per Capita, adult literacy and net primary enrolment from Human Development Indicators (HDI) by UNDP were selected.

Using these data, the possibility of popularization of technologies were assessed. Applying this process, examples of optimal core set menu of technologies were identified.

The two-matrix methodology and assessment system will help project coordinators to plan and implement appropriate projects with best core set of technologies. The common methodologies will be also useful for the fair and effective assessment of those projects. Establishment of database and improvement of the assessment system through more collection and analysis of practical examples should be promoted in future.

References

- 1) Tropical Agriculture Research Center (1989) *Agriculture in Arid Regions and its Technologies*. Norin Toukei Kyoukai, Japan, 309p. (in Japanese)
- 2) Takeuchi K. and Tanaka M. (1998) *Sustainable Utilization of Biological Resources*. Iwanami, Japan, pp. 59-122. (in Japanese)
- 3) Mwandosya M. and Luhanga M.L. (1985) An analysis model for a biomass system. *Energy*, 10, 1023-1028.
- 4) Anantha R.K., Bhati G.N. and Goyla D. (1990) The economics of cooking energy scenario in arid Rajasthan. *Annals of Arid Zone*, 29, 333-338.