

Izumi Washitani

Chair of the Organizing Committee

Professor, Graduate School of Agricultural and Life Sciences, The University of Tokyo

The year 2010 was the first International Year of Biodiversity declared by the United Nations. In October, the 10th Conference of the Parties to the Convention on Biological Diversity (COP10) hosted by Japan, was held in Nagoya City, Aichi Prefecture.

Biodiversity, which is the irreplaceable result of the long history of biological evolution, and has been built over the four billion years of the history of the life on the Earth, is a treasure box full of essential and useful “information” for human society. Ecosystems, functional entities of biodiversity, provide human society with various benefits (ecosystem services), while human activities have impacts to change conditions and functions of ecosystems. Currently, at spatial scales from local to global and at all biological levels from gene to ecosystem, the loss of biodiversity is continuing.

Unlike the past five mass extinctions, which are confirmed from fossil evidence, the sixth mass extinction we are now facing has been caused by the activities of humans, *Homo sapiens* that is the overwhelmingly dominant species on the current Earth. The consequent “irreversible loss” of ecosystem services is likely to be causing a serious crisis, which will threaten future generations through potential losses of many useful values and functions.

The international framework to address these issues is the Convention on Biological Diversity, which was adopted together with the Framework Convention on Climate Change in 1992. The COP10 was an important milestone meeting for achieving the goals of the convention. As the results of earnest effort of Japan to conciliate different opinions and to negotiate an compromise, many documents was adopted, including the “Nagoya Protocol” regarding access and equitable sharing of the benefits obtained by using genetic resources, and the “New Strategic Plans” including 20 goals to be achieved by 2020, despite of considerable difference of original opinions between developing and developed countries.

The targets of the New Strategic Plans, named Aichi Targets, have become both more practical and ambitious, according to the consideration on the failure in achieving the “2010 Targets” of to the parties of the Convention on Biological Diversity, “significantly reduce the speed of biodiversity loss”. The parties are required to develop national strategies or action plans to promote the implementation of the New Strategic Plans within the next two years. This requires not only the participation and cooperation of a wide range of social sectors, but also significant contribution of the science communities.

The Science Council of Japan, a science academy covering all the academic fields of humanities, social sciences, life sciences, medical sciences, natural sciences and engineering has held “The

International Conference on Science and Technology for Sustainability" ("The Conference for Sustainability") every year since 2003. This year saw the 8th conference with the theme of "Conservation and Sustainable Use of Biodiversity", held in Kanazawa City on December 16 and 17 and supported by the Ministry of the Environment, Ishikawa Prefecture, the United Nations University and Nikkei Inc (a newspaper publishing company).

The Science Council of Japan esteems discussion and information sharing with assembling wisdom from diverse academic fields. For the 2010 conference, three sub themes were chosen: 1) The Values of Biodiversity including Ecosystem Services and; 2) Climate Change and Land and Ocean Biodiversity; 3) Integrative Approaches to Management and Restoration of Ecosystems. Experts from Japan and other countries specializing in various academic fields, such as economics, psychology, ethics, ecology, biology, climatology and oceanography, participated in the conference's trans-disciplinary discussions.

Mr. Ahmed Djoghlaif, the Executive Secretary of the Convention on Biological Diversity, gave a keynote speech on the rapid deterioration of biodiversity with representing many facts of concern based on data from such sources as "Global Biodiversity Outlook 3" and warned of the drastic change caused by exceeding the "tipping point". He also summarized the outcomes of COP10 and referred to the negotiation of the early establishment of IPBES to enhance science-policy interface on biodiversity. Finally, he mentioned his expectation for enhancement of the sciences and technologies that support the policies and practices in the biodiversity field.

Dr. Anantha Kumar Duraiappah from United Nations University, an economist who was another keynote speaker, proposed a framework or system effectual to use, management and restoration of the "Satoyama" as "Land Use Mosaic" containing agricultural lands, referring the results of an assessment relevant to the issue performed in Japan. A compound ecosystem "Satoyama" composed by rice paddies and other farmlands, grasslands, and wetlands is a socio-ecological system providing a "bundle" of diverse "ecosystem services" depending on appropriate management by humans.

Although traditional systems like "Satoyama" can be found worldwide, currently they are all under rapid transformations and degradations due to modern development and abandonment of traditional practices for management and use. He proposed an integrated management system as a combination of markets, local communities, and governments and other public institutions, which could be called "New Commons", under which the ecosystem services differing in spatial range in which the benefits are received, or in presence or absence of their markets (most of the provision services have markets), are "bundled" to be used and managed effectively as a whole.

Recognition of the "value of biodiversity", including the "ecosystem services" human society can enjoy, is an indispensable prerequisite to public concern with the crisis of biodiversity, and to the economic and social decisions, which will be made to facilitate sustainability. This issue was the main theme of the first session.

Dr. Gretchen Cara Daily, a professor of Stanford University and one of the advocates for the concept of "ecosystem services", represented the method of evaluating an economic value as a monetary value, taking the "pollination services" essential to bearing fruits of crops and wild plants as an example. 70% of 1,300 kinds of crop plants grown in the world require pollination services by bees or other pollinators to set fruits. The pollination services facilitating the coffee production decrease with increasing distance from the tropical forests, and profit brought via the pollination services from the tropical forests was estimated at \$60,000 per farm in a region in Costa Rica.

Among the attempts to scaling up the valuation of individual ecosystem services from a local or regional scale to the whole bundle of services at global scale, which have been activated in Western countries, Dr. Daily referred to the "natural capital project", a global demonstration-oriented program carried out in collaboration among Stanford University, the World Wildlife Fund, and other institutions, and also to the software "the integrated valuation of ecosystem services and trade-offs", which has been developed as a tool for the program.

Professor Koichi Kuriyama of Kyoto University, specializing in environmental economics, mainly addressed the CV method, which is an evaluation method for the monetary value of natural resources based on the willingness to pay. Taking Yakushima island and area surrounding Kabukurinuma Marsh in Miyagi Prefecture as examples of actual applications, he discussed how people's recognition and awareness influence on the amount of virtual pay, requirement for correcting method for appropriate evaluation, and the prospects of the future development of the evaluation method.

Professor Shuichi Kito of Tokyo University, specializing in environmental ethics, referred to the importance of the natural and cultural aspects of the interdependent relationships in "Satoyama", which are different from the conventional, confrontational view of the relationships between humans and nature, and stressed the importance of focusing on the significance of the biodiversity that stimulates and enriches human "spiritual life", that is, the spiritual "services" which are different from material benefits such as the provision services among ecosystem services, and can contribute to enhancing the quality of human life together with increased social justice.

Professor Mariko Hasegawa from the Graduate University for Advanced Studies, specializing in ethology, represented a point of view or a framework based on human evolutionary history, especially on evolution of behavior and cognition, and reviewed mass extinction that occurred in New Zealand, the Pacific Islands, Madagascar and the United States at the age of human invasion followed by the human range expansion, focusing traits of the behavior of hunter-gatherers. She also noted the fact that introduction of "market economy", which was enabled by the invention of "money" incarnating abstract values, followed overexploitation everywhere.

In the second session with the theme of climate change and biodiversity, focusing not only land ecosystems, but also ocean biodiversity and ecosystems, discussion went on the importance of

inter-linkages between climate, biodiversity and ecosystems, and integrative models involving human activities such as fossil fuel combustion and land use, which will also lead to policy recommendations.

Dr. Jelle Bijma, a professor at the Alfred Wegener Institute for Polar and Marine Research, focused on ocean acidification, which is less clarified among the impacts of climate change. With an integration of approaches from various academic fields such as biogeochemistry, thalassiochemistry, geological history, marine biology, etc., he summarized the broad range of information about various potential effects of ocean acidification on ocean fauna and ecosystems and their predictability. It is no doubt that ocean acidification is in progress, and future progress is also sure. Interacting with global warming, ocean acidification will greatly enhance the impacts on ocean life and ecosystems. He noted the current difficulties to predict the consequences of the acidification on ecosystems and evolutionary responses of species, due to lack of relevant scientific knowledge.

Dr. Yoshihisa Shirayama, Director of the Field Science Education and Research Center, Kyoto University, represented the vast diversity of ocean life that was revealed as a result of the recent ocean life investigation project, CoML (2000-2010; 2,700 scientists from 80 countries participated). The results of the research project obtained by using many advanced observation techniques have been compiled in a database and would be utilized as background data for monitoring the influences of environmental changes such as climate change and ocean acidification on ocean ecosystems.

Dr. Pavel Kabat, Chair and Director, Royal Dutch Academy of Science Institute for Integrated Research on Wadden Sea Region, The Netherlands, outlined the most updated scientific understanding and current models regarding the complicated global climate system which includes, as integrative elements, vegetation cover and land use having strong effects on the exchange of energy, water, carbon dioxide, other gasses and aerosols between soil surface and atmosphere. As the complicated feedback system regarding the influences of various aspects of anthropogenic changes in composition and of functions of vegetation and biodiversity on regional and global climate, and counter-influences of the climate change on vegetation, taking the analytic evaluation through an integrative approach to Amazon region as an model case, he stressed the necessity of the development of further extensive trans-disciplinary integrative research for precise prediction of the global climate system as a system coupled with physical, biogeochemistry and human activity elements.

Dr. Nobuko Saegusa, Chief of the Office for Terrestrial Monitoring, Center for Global Environmental Research, National Institute for Environmental Studies, Japan, represented the data demonstrating the importance of such data from the observatory networks of AsiaFlux including 77 sites, its Japanese version JapanFlux and the Japan Long-Term Ecological Research Network (JaLTER), for predicting the impacts of anthropogenic climate change on ecosystem functioning in East Asia where the annual variability of precipitation is large under the influence of the monsoonal climate. She also reported the latest results of evaluation of the effects of abnormal climate conditions on the productivities of Asian forests.

In the third session, based on the reports on the results of a wide range of ecological studies including those with experimental approaches or meta analysis on the effects of biodiversity on ecosystem functioning and services, and also on those of ecology-based research coupled with regional practices, discussion was held on integrative ecosystem management.

Dr. Patricia Balvanera, professor of Research Center on Ecosystems, National Autonomous University of Mexico, proposed a framework to evaluate the relationships between biodiversity and human well-being via ecosystem processes and services, based on empirical data. For individual links at local scales, analysis and evaluation have been well advanced, for example, regarding the relationship between biodiversity and ecosystem functions, the result of meta- analysis of data from 103 of the experimental research projects revealed the positive effects of biodiversity on many ecosystem services. On the other hand, there are a number of scientific problems to be solved in the future for comprehensive evaluation, since the relationships are scale dependent and have complicated structures

Considering such a state of science, she recommended enhancing research on relationship linkages at various spatial and temporal scales and in diverse ecological and social situations, as well as to take precautionary approaches to conserve biodiversity for securing human well-being under uncertainties.

Dr. David Tilman, professor of Minnesota University, who has been long engaging in ecological research on the effects of grass species diversity, which can be predicted from the theories of the relationship between species diversity and ecosystem functioning. Through long-term, large-scale experiments at a prairie reserve, he has demonstrated the positive effects of grass species diversity on biomass productivity, resistance and resilience against an environmental change, resistance to pests and competitive species invasion, and carbon capture and storage in the soil. Based on such a great scientific achievement, Dr. Tilman represented a prospect for agricultural technological development with utilization of biodiversity.

If such ecological research outcome is practically incorporated in the technical systems of agriculture in the future, we can enjoy not only short-term monetary benefits such as stable crop production, chemicals cost reduction, reduction in emission of global warming gases, water quality improvement and higher pricing as an effect of branding, but also many non-monetary benefits for future generations. Including the viewpoints of “Satoyama” and “ecosystem services”, biodiversity is a keyword for designing sustainable agriculture, forestry and fisheries.

Dr. Kanehiro Kitayama, professor of Kyoto University introduced some regional research from Sabah, Borneo in Malaysia regarding forest management based on an ecosystem enabling the sustainable use of tropical forests and their biodiversity. He mentioned that sustainable forest management not only made it possible to secure more net carbon absorption than conventional forest management, but also is effective for biodiversity conservation, in spite of management costs due to the limitation of amount of cutting wood. Therefore, economic compensation through such as forest certification would be required

to spread the sustainable forest management.

Dr. Takehito Yoshida, associate professor at Tokyo University, referred to a multi-disciplinary collaboration research project for scientifically planning “nature regeneration” of Lake Mikata and its basin in Fukui Prefecture. Not only natural scientists, but also social scientists, local municipalities and NGOs were involved in this research project aiming at the restoration of the aquatic habitat network of the lake and its basin. An immediate sharing of the information obtained by research with the local public has been attempted through participatory collaborative programs involving fisheries and farmer, because sharing scientific information among various stakeholders who can contribute to ecosystem management should be a key to sustainable ecosystem management.

At the Concluding Session, considering the lectures and discussions at the conference, documents adopted at COP10 and the resolution to set 2011 to 2020 as the “United Nations Decade on Biodiversity”, which was anticipated to be adopted at the United Nations General Assembly immediately after the conference, and was actually adopted, a conference statement focusing research fields required to be enhanced for future conservation and sustainable use of biodiversity was proposed. It was concluded that the finalization of the statement would be delegated to the co-chair of the Concluding Session.

Not only at the keynote lectures and the first session, values of biodiversity were repeatedly highlighted throughout the conference. The participants of the conference agreed that in addition to economic values including monetary values, a wide range of values such as social ones and those for future generation should be evaluated along the multiple axes or scales to exert influences on social decisions. The development of more sophisticated rational evaluation methods, which can adapt to the individual sites of practices, should be prioritized in science community in near future. This was mentioned first in the statement.

Since briefness took precedence and the statement mainly focused on the contents especially related to international activities within the framework of the Convention on Biological Diversity, there were some matters not clearly mentioned in the statement, although they were actively discussed at the conference. Among them, we would like to note and highlight the importance of the promotion of comprehensive research to deepen scientific understanding about inter-linkages and feedbacks on the climate system, biodiversity and ecosystem functions, and especially the dramatic enhancement of research on those of ocean biodiversity, ocean ecosystems, ocean acidification and global warming, on which we currently have much less knowledge and understanding than land systems.