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ECOTOURISM AND FIELD RESEARCH : PARTNERSHIP AMONG RESEARCHERS, MANAGERS AND LOCAL PEOPLE IN PROTECTED AREAS[1]

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Introduction

Protected areas, especially biosphere reserves, national and provincial parks, and World Heritage Sites, are established in part to preserve natural, unaltered ecosystems and species as benchmarks and as areas for scientific study. In addition, parks are established for public use and experience of their intrinsic values, as well as means to demonstrate the potential for coexistence of nature and human activities (Saunier et al. (ed.) 1995). In other words, protected areas that contribute to biodiversity conservation provide both ecotourism sites and research sites.

This paper shows relationships between and roles of researchers, managers and local people in and around protected areas, focusing on the aspects of ecotourism and field-based research. Cases from Japan show especially cooperation between research work and park management in addition to cooperation with a private sector and local people. Cases from Indonesia show clearer relationships between research work, park management and local community.

Promotion of research work and environmental education through ecotourism can contribute to both nature conservation and the local economy. Mutual partnership between research work, protected area management and local community will accelerate it.

Cases from Japan

A total of 92 research stations/facilities concerning with nature conservation, established by universities or other institutes, were located in areas of 25 national parks out of 28 national parks in Japan and 315 scientists were engaged in research work there. Besides, 58 theme of long-term field research had been conducted in 19 national parks without specific research facilities. For the purpose of exhibiting their specimens or having lecture programs on nature, 55% of these facilities were opened to visitors, and 42% of the facilities were also connected with national park offices by means of exchanging study reports, dispatching staff as a lecturer, and

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so on (Takahashi 1990). Connections between researchers and national park managers may be increased at present time. However such connections are on voluntary basis.

It was proposed in "Draft Conservation Plan of Kushiro Wetland 1978" by the author that Kushiro Wetland be designated as a national park where the observation and research of nature will be the main uses. Kushiro Wetland was designated as a national park in 1987. The Kushiro Wetland Wildlife Center and the Onnenai Visitor Center in the park are opened not only for visitors but also for researchers. Researchers can use these facilities as a research station and they provide outputs of their research. Cooperation between researchers and park managers expects to reveal ecosystem of the wetland and to enhance biodiversity conservation.

The South-Kanto Regional Office for National Parks & Wildlife Conservation started in 1999 to request that a researcher submit reports after having studied when the regional office gives permission for collection of wildlife in a national park. Researchers from universities were provided with a park ranger station at the top of Mt. Fuji in order to study the relation between global climate change and alpine plants. The regional office also plans to cooperate with the Biodiversity Center of Japan located in the area of Fuji-Hakone-Izu National Park. The center was established in 1997 to monitor and evaluate natural environment and its present level of biodiversity, and to assemble and maintain a public library of objective information on this topic.

Exchanging information between researchers and park rangers is necessary to manage park. To promote it, a so-called "associate researcher" system, in which such researchers are provided with a desk, telephone and copy machine in park offices, should be considered not only at the local level but also at the government level. Research facilities, researchers, and outputs of studies in national parks should be integrated more systematically into the park management (Takahashi 1992).

Park authority (Environment Agency) has only low percentage of land in national parks. A lot of activities and development, such as forestry, agriculture, urban development and tourism, have been conducted within the parks. Management of national parks is, therefore, based on coordination and cooperation with not only other central and local government agencies but also landowners, local communities, and private sectors. Each national park has several consortiums to promote the cooperation for its management.

In addition, a total of 130 Park Volunteers, who consist of residents in and around Hakone area of Fuji-Hakone-Izu National Park, and from the Tokyo metropolitan area, conduct interpretation of nature for visitors, and collect information on the present status of wildlife. They cooperate with the park office and contribute to ecotourism and field research in the park.

Cases from Indonesia

Gunung Halimun National Park (GHNP) was designated as a national park in 1992. It is the best and most complete forest area remaining in Java, covering a total area of 40,000 hectares. GHNP has easier accessibility from Bogor and Jakarta that are the center area for research work. So far research work in GHNP has been conducted by researchers from the Indonesian Institute of Sciences (LIPI), universities and nongovernmental organizations (NGOs) such as the Biological Science Club (BScC). However it is still few

in number.

The Consortium of Ecotourism Development in GHNP (KPPETNGH) has developed the community-based tourism enterprise since 1995, targeting three villages (Leuwijamang in the north, Citalahab in the east and Sirnarasa in the south) (Renaldy 1997). Ecotourism lodges (Guesthouses) were provided to each village and training programs to local people were also conducted by KPPETNGH. However the number of visitors to the guesthouses is still small, a total of 845 from March 1997 to February 1998 (223 people at Leuwijamang, 414 at Citalahab and 208 at Sirnarasa) (source: KPPETNGH).

The Japan International Cooperation Agency (JICA) started the Biodiversity Conservation Project in 1995 cooperating with the Government of Indonesia. Cooperation and information exchange between LIPI (a research sector) and the Directorate General of Forest Protection and Nature Conservation (PHPA) (a conservation sector) is one of the main targets of the project. Project activities were conducted by the three components ; (1) Information Processing & Network ; (2) Research & Survey - divided into two subcomponents, Natural Environment and Socio Economics ; (3) National Park Planning & Management - divided into two subcomponents, Park Management and Environmental Education. During the first phase of the project (1995-1998), research work in GHNP is concentrated on completing inventories as a basic information for making a management plan of the park and conservation of biodiversity (Takahashi 1998a). JICA provided a research station and canopy walkways, in addition to a National Park Headquarters, a Nature Conservation Information Center (NCIC-PHPA), and a Zoological Museum (Collection & Information Center) of LIPI with necessary equipment.

Management of the Research Station

The Cikaniki Research Station (Cikaniki RS), canopy walkways and permanent plots have been established to promote not only research work, such as studies on inventory, distribution of fauna and flora, and ecological dynamics, but also educational programs. The research station has five twin-bed rooms, a study room, a meeting room and storage space, where equipment such as microscopes, refrigerator and dry-box are installed. Cikaniki RS has, however, still some obstacles to the promotion of its use by researchers. Takahashi (1998b) pointed out and recommended:

(1) Access to Cikaniki RS. Condition of an access road to Cikaniki RS and telecommunication still dissatisfy. It takes two hours by four-wheel-drive car for 20km distance between Kabandungan and Cikaniki. On the other hand, in terms of cost and time, GHNP is easier to access from the center area for research work, such as Jakarta, Bogor and Bandung, than other research sites located in other islands such as Kalimantan and Irian Jaya. Unimproved accessibility prevents nature in Gunung Halimun area from being damaged by mass tourism. Telecommunication is available at the national park headquarters.

(2) Regulation and information. In relation to the following items, regulation and information materials for users should be established and circulated as soon as possible.

(3) Research manager. There is no research manager to coordinate programs and give advice to visitors. So far the park office dispatches park rangers every week only to secure a building and equipment. The project, therefore, hires university students monthly to be in charge of monitoring research such as collecting camera trap data. It can be compatible with benefits of students. It is

necessary to establish cooperation based on formal agreements with a university or research facility.

(4) Maintenance cost. Lack of maintenance cost of Cikaniki RS brings some inconvenience to research work. For instance, equipment such as an installed refrigerator and dry-box cannot be used all days because of saving fuel for electric generator. An appropriate budget for maintenance and additional fund from research programs should be considered to keep equipment working well. User fee from researchers can also cover a part of the cost.

(5) User fee. User fee is also expected to be collected and allocated to manage Cikaniki RS appropriately, i.e. fuel for generator and bed and board as mentioned in (4) and (7). For the time being, user fee for Cikaniki RS is the same rate as surrounding ecotourism lodges' so as not to disturb their activities. The rates should be classified so as to be applied to several user groups such as researchers, students and other visitors, or foreigners and Indonesians, or short-term visitors and long-term visitors.

(6) Specimens or reports. A copy of research reports and examples of specimens derived from the park should be installed at Cikaniki RS or the national park headquarters. However there are no rule or space to keep them. They will be useful for the promotion of research work and education in GHNP.

(7) Support system. It may become hard work for researchers to cook their meals by themselves even after their daily fieldwork. Employment of local people to provide board, guide and other assistance to research work, including collection of basic data, will give benefits both to researchers and the local economy. The nearest village (Kampung) is Citalahab that is located at a distance of one-hour walk from Cikaniki RS. A part of above mentioned user fee should be returned to local communities to establish such support system by local staff. Besides, cooperation and network with other ecotourism lodges is useful to conduct field research in other part of the park.

Integrating Research and Ecotourism

Field research is expected to contribute to the management for biodiversity in protected areas, such as national parks and biosphere reserves, through increasing scientific knowledge such as basic data for zoning and rehabilitation. Probably the best way to foster research in a protected natural area is to establish a field station (Harmon (ed.) 1994). More continuous research work and active utilization of a research station by researchers are needed to reveal ecosystems and also to improve the situation of a research station.

It is crucial to keep permanent plots for monitoring of forest dynamics and other studies. Protected areas will ensure it. Besides, the involvement of park rangers and local people in field research is useful. With a minimum of training, park rangers and other field personnel including local people could collect other basic data, such as weather observations and the reading of monitoring equipment, as part of their everyday work (Harmon (ed.) 1994).

Academic institutions can provide a knowledge base to better understand ecological and societal health and therefore inform tourists or local communities on how to sustainable manage their resources (Brandon 1996). In addition, expansion of research work will contribute to promotion of ecotourism by researchers. Research work is an original type of utilization of parks, although it may contribute little to the local economy (Takahashi

1992). Local people are also expected to be involved in the management of a research station and promotion of research work as assistants. Involvement like this will be able to give the same benefits to local people that ecotourism by tourists does. Utilization of a research station by researchers could contribute to increasing the local economy. Takahashi (1998b) also estimated that user fee of a research station could cover the cost of oil for generator and the cost of the other management fee including allowance for local people to assist researchers.

Conclusion

Cases from Japan and Indonesia show some examples of partnership among researchers, park managers and local people. Management of a research station ties clearly mutual relationships among them.

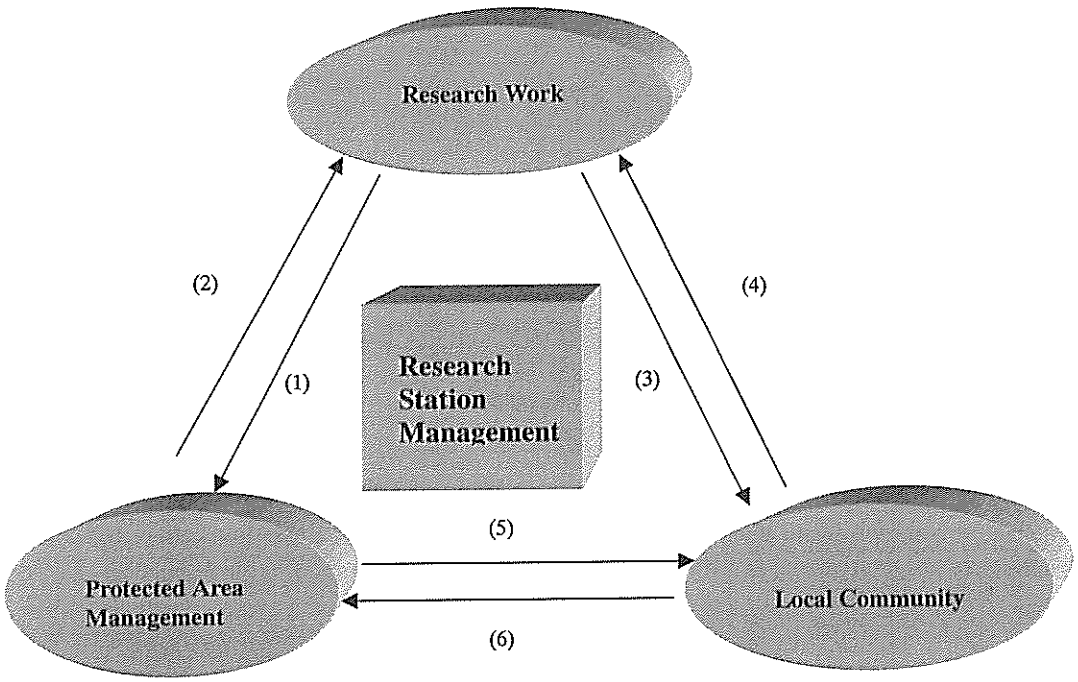

Figure 1.
Relationships between Research Work, Protected Area Management, and Local Community

(1) Research work will contribute to protected area management for biodiversity through increasing scientific knowledge such as basic data for zoning and rehabilitation.
(2) Protected area management will ensure research site in long-term. Protected area authority will also assist research work by providing facilities such as a research station, and by involving staff (park rangers) to monitoring.
(3) Research work will provide benefits (income, employment, scientific information for ecotourism etc.) to local community.
(4) Local community will support researchers in collecting specimens, providing meals etc.
(5) Protected area management will provide benefits (income, employment, education, natural resources etc.) to local community.
(6) Local community will collaborate with management of protected areas.

(Resource: Takahashi 1998b)

Relationships between Research Work, Protected Area Management and Local Community are summarized:

(1) Research work will contribute to protected area management for biodiversity through increasing scientific knowledge such as basic data for zoning and rehabilitation.

(2) Protected area management will ensure research sites in long-term. Protected area authority will also assist research work by providing facilities such as a research station, and by involving staff (park rangers) to monitoring.

(3) Research work will provide benefits (income, employment, scientific information for ecotourism, and so on) to local community.

(4) Local community will support researchers in collecting specimens, providing meals, and so on.

(5) Protected area management will provide benefits (income, employment, education, natural resources, and so on) to local community.

(6) Local community will collaborate with management of protected areas.

Mass tourism will harm nature in the protected areas while it may give some benefits to the local economy. Nature tourism is one of the most important sectors where environmental conservation may effectively be combined with economic development in remote rural areas of developing countries on a meaningful scale (Wells 1997). Ecotourism should give benefits both to local community and to nature. Promotion of research work and environmental education by the way of ecotourism form can contribute both to biodiversity conservation and the local economy despite the fact that research work itself may be limited to contribution to the economy (Takahashi 1992). Integrating ecotourism and research work mentioned above could be one of such typical examples.

It should be stressed that the partnership among researchers, protected area managers and local people is essential to the management of protected areas. Besides, NGOs can enhance the partnership among them. NGOs play an each part in research work, protected area management and community development, assisting a sector such as researchers, protected area managers, and local people.

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THE PROGRESS FOR DIWPA-IBOY 2001 (THE INTERNATIONAL BIODIVERSITY OBSERVATION YEAR)

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The International Network for DIVERSITAS in Western Pacific and Asia (DIWPA) was established in 1994 as an initiative of concerned scientists in the region. It is closely related to DIVERSITAS, the International Programme of Biodiversity Science, originally organized by IUBS, SCOPE and UNESCO in 1991 and then in collaboration with ICSU, IUMS and IGBP-GCTE from 1996 to promote and catalyze the knowledge of biodiversity, its conservation and sustainable use: to determine its origin, composition and ecosystem function, through inventorying and monitoring (Younes, 1996).

DIWPA is a non-governmental, apolitical, regional organization focused on the integration of the efforts and resources towards the study of the unique ecosystems of the Western Pacific and Asia including the terrestrial Green Belt from Siberia to New Zealand and the marine Blue Belt along its east border (Inoue, 1996) as well as the Pacific East-West Island Belt connecting the tropical archipelagoes whose biota are largely derived from continental islands in the Western Pacific (Mueller-Dombois, 1998).

Membership of DIWPA is open not only to scientists but to anyone who are interested in biodiversity and hope to join activities for research and conservation in biodiversity. Although DIWPA activities are confined to the region of Western Pacific and Asia, anyone can join DIWPA from outside the region. Scientists who work in the region are particular welcomed. At present, DIWPA has about 415 members from 41 countries and areas at the moment of August 1999.

DIWPA is planning DIWPA-IBOY 2001 (International Biodiversity Observation Year in 2001) as a monumental event in the first year of 21st century. DIWPA-IBOY 2001 is "Global monitoring on Biodiversity" using a standardized protocol at as many field station as possible in Western Pacific and Asia region. We are planning to have several workshops and symposia for the preparation

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of the implementation of DIWPA-IBOY and for the discussion after DIWPA-IBOY 2001.

The DIWPA-IBOY aims (1) to establish an international network for preservation and identification of biological specimen and (2) to elucidate the effects of biodiversity on ecosystem functioning by inventorying and monitoring biodiversity simultaneously with a standardized manual in three ecosystems, forest ecosystem, lake ecosystem, and coastal ecosystem. For the implementation of DIWPA-IBOY, we have to decide (i) research sites (DIWPA-IBOY sites) and (ii) standardized methods or protocols for all research sites, as shown below.

One of the important scientific objectives is to record the situation of biodiversity of the first year of 21st century. The data which should be obtained in 2001 could be the base stone to monitor the global climatic changes on the biosphere in the next millenary. We thus identify the activity of DIWPA-IBOY 2001 as the first year of a long-term biodiversity monitoring program to continue throughout "The Century of the Environment". Another objective is to detect the pattern between biodiversity and ecosystem function along the primary gradient from north to south, and also along the secondary gradient, from west to east in Pacific islands, altitudinal gradient or human disturbance. The parameters which describe the ecosystem function, such as primary production, turn-over ratio and so on can be compared among different ecosystems along several gradients, as a function of biodiversity pattern.

The other aspect of DIWPA-IBOY 2001 is a kind of public campaign. The importance of biodiversity has already noticed among people, especially since Rio Earth Summit in 1992. However, the priorities for research and conservation of biodiversity are still low, and social investments for the research and education on inventorying and monitoring works, the upbringing the young taxonomists among all, are not enough. Many national organizations which have agriculture and forestry sectors have to deal with the national and international issues about inventorying and monitoring biodiversity, but the organization of most of them is too out-of-date to cope with such new issues. The social aspect of DIWPA-IBOY is an event which evoke the public attention to biodiversity research, to build or reorganize the infrastructures in many field stations, and to recruit the younger generation into the biodiversity research.

This workshop confirmed the agreement for site selection to establish the "Core Sites" and "Satellite Sites". At the Core Sites, intensive studies on prerequisite subjects will be done, where as at the Satellite Sites, some studies are not required. Each working group selected the candidates of core and satellite sites on the basis of criteria: (1) infrastructure including (i) facilities, (ii) accommodation, (iii) existing research program, (iv) human resource, (2) baseline information, (3) reasonable natural environment, (4) long-term commitment of the site, and (5) potential for monitoring site. In total, 44, 25 and 21 sites for forest, coastal and lake ecosystems, respectively, were nominated (Yumoto, 1999). However, the information of countries and areas which had not sent the representatives to DIWPA meeting is very limited. We are trying to find key persons in such vacuum areas to complete the geographic map in this region.

Also, at the workshop in Kyoto, three working groups discussed on the protocol of DIWPA-IBOY 2001. Discussion was done about the following questions: (i) which taxa or functional groups of organisms

should be monitored in relation to ecosystem functions ? (ii) what methods can be applied in concrete for the monitoring, including biotic and abiotic factors? (iii) how can we identify the collected specimen ? or how can we collaborate with the researchers on systematics ? and (iv) how can we manage the data sets obtained ?

Forest ecosystem working group selected the functional groups as (i) vascular plants, (ii) anthropods, (ii) soil animals besides anthropods, and (iv) vertebrates, and lake ecosystem working group as (i) water grass, (ii) mollusks, (iii) crustaceans and (iv) pelagic vertebrates. Coastal ecosystem working group did as (i) macro-algae, (ii) sea grass, (iii) mollusks, (iv) decapods, (v) echinoderms, (vi) fish and (v) corals.

The methods which can be applied in DIWPA-IBOY 2001 are those which are already well-established. The most important matter is that the methods should not be biased by the skill of sampling persons. Thus, the trapping methods are most recommendable. The methods should be different from "Core Sites" and "Satellite Sites". Forest ecosystem working group proposed three different protocols according to different purposes and different condition of sites. The same types of data loggers or sampling traps are most necessary to providing the exactly comparable data.

As for the collaboration with experts in systematics, we have to discuss more about how to get funds necessary for capacity building, and also on size of study sites, depository of collections and procedures for comprehensive analysis and examination. Special care should be paid for the possibility for genetic or biochemical studies. Project "Gaia List 21" and "Species 2000" can be good candidates to collaborate with.

The first and incomplete manuscript of DIWPA-IBOY Protocol Manual was presented in DIWPA Steering Committee meeting, Sydney, 4 July 1999. The comments from the following aspects were recognized as particular importance.

1) General strategy and purposes of the IBOY Integration of the results
2) Methodology to relate biodiversity data to functional aspects
3) Common methods among lake and coastal marine ecosystems
4) Applied aspects of the IBOY
5) Monitoring in landscape level
6) PABITRA as branch activity
7) Compromise with other existing standard methods

After the revision according to the comments above, a new manuscript will be released in September (but delayed to October). It will be reviewed also by scientists (including scientists outside of DIWPA) with experts' view. It will be also on web page. The tentative manual will be released in July 2000 to be in time for the IFBC in March.

It will be revised again according to the discussion in the workshop in November 2000 (Kyoto) including the results obtained in the Pilot Studies. Then, the final version will be published in the end of 2000. The DIWPA Secretary will find the funding for the publication.

The 5th IFBC (International Field Biology Course) will be held in March 2000, at tropical rain forests in Australia. This is specially designed as a part of the DIWPA Training Program and a precursor to DIWPA-IBOY 8-31 March 2000, Cairns, Australia. The Cooperative Research Centre for Tropical Rainforest Ecology and Management (Rainforest CRC) in Australia is organising a Training Course on Insects and Forests as part of the DIWPA and IBOY.

The course will be led by Professor Nigel

Stork (Chief Executive Officer, Rainforest CRC), Professor Roger Kitching (Griffith University) and Professor Richard Pearson (James Cook University) and will provide training in the sampling, sorting and identification of arthropods in tropical forests. The course will be a practical field course located in the tropical rainforests of North Queensland and will comprise field work, laboratory work and lectures. There will be specialist lectures on various group of arthropods and on various aspects on entomology, ecology and forest science from experts from Australia, Japan and elsewhere. The course is designed to cater for the needs of postgraduates, field and laboratory technicians and once completed will allow trainees to carry out independent sampling and research on arthropod biodiversity in forests. The course will also include training in establishment of permanent forest plots and measurement of trees.

Pilot studies can be started in several sites in forest, lake and coastal marine ecosystems. The 5th IFBC also will be included in the Pilot Study. DIWPA secretary can invite a few scientists to join the pilot studies which will be held in Lake Biwa and Tomakomai Experimental Forest in 2000. Also, scientists form other sites who want to join the pilot studies are welcome.

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WORLD CONFERENCE ON SCIENCE

A New Commitment ; Science for the Twenty-First Century

DECLARATION ON SCIENCE AND THE USE OF SCIENTIFIC KNOWLEDGE

Version adopted by the Conference
1 July 1999

Preamble

1. We all live on the same planet and are part of the biosphere. We have come to recognize that we are in a situation of increasing interdependence, and that our future is intrinsically linked to the preservation of the global life-support systems and to the survival of all forms of life. The nations and the scientists of the world are called upon to acknowledge the urgency of using knowledge from all fields of science in a responsible manner to address human needs and aspirations without misusing this knowledge. We seek active collaboration across all the fields of scientific endeavour, i.e. the natural sciences such as the physical, earth and biological sciences, the biomedical and engineering sciences, and the social and human sciences. While the Framework for Action emphasizes the promises, the dynamism but also the potential adverse effects that came with the natural sciences, and the need to understand their impact on and relations with society, the commitment to science, as well as the challenges and the responsibilities set out in this Declaration, pertain to all fields of the sciences. All cultures can contribute scientific knowledge of universal value. The sciences should be at the service of humanity as a whole, and should contribute to providing everyone with a deeper understanding of nature and society, a better quality of life and a sustainable and healthy environment for present and future generations.

2. Scientific knowledge has led to remarkable innovations that have been of great benefit to humankind. Life expectancy has increased strikingly, and cures have been discovered for many diseases. Agricultural output has risen significantly in many parts of the world to meet growing population needs. Technological developments and the use of new energy sources have created the opportunity for freeing humankind from arduous labour. They have also enabled the generation of an expanding and complex range of industrial products and processes. Technologies based on new methods of communication, information handling and computation have brought unprecedented opportunities and challenges for the scientific endeavour as well as for society

at large. Steadily improving scientific knowledge on the origin, functions and evolution of the universe and of life provides humankind with conceptual and practical approaches that profoundly influence its conduct and prospects.

3. In addition to their demonstrable benefits, the applications of scientific advances and the development and expansion of human activity have also led to environmental degradation and technological disasters, and have contributed to social imbalance or exclusion. As one example, scientific progress has made it possible to manufacture sophisticated weapons, including conventional weapons and weapons of mass destruction. There is now an opportunity to call for a reduction in the resources allocated to the development and manufacture of new weapons and to encourage the conversion, at least partially, of military production and research facilities to civilian use. The United Nations has proclaimed the year 2000 as the International Year for the Culture of Peace and the year 2001 as the United Nations Year of Dialogue among Civilizations as steps towards a lasting peace; the scientific community, together with other sectors of society, can and should play an essential role in this process.

4. Today, whilst unprecedented advances in the sciences are foreseen, there is need for a vigorous and informed democratic debate on the production and use of scientific knowledge. The scientific community and decision-makers should seek the strengthening of public trust and support for science through such a debate. Greater interdisciplinary efforts, involving both natural and social sciences, are a prerequisite for dealing with ethical, social, cultural, environmental, gender, economic and health issues. Enhancing the role of science for a more equitable, prosperous and sustainable world requires a long-term commitment of all stakeholders, public and private, through greater investment, review of investment priorities accordingly, and the sharing of scientific knowledge.

5. Most of the benefits of science are unevenly distributed, as a result of structural asymmetries among countries, regions and social groups, and between the sexes. As scientific knowledge has become a crucial factor in the production of wealth, so its distribution has become more inequitable. What distinguishes the poor (be it people or countries) from the rich is not only that they have fewer assets, but also that they are largely excluded from the creation and the benefits of scientific knowledge.

6. We, participants in the World Conference on "Science for the Twenty-first Century: a New Commitment", assembled in Budapest, Hungary, from 26 June to 1 July 1999 under the aegis of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Council for Science (ICSU):

Considering

7. where the natural sciences stand today and where they are heading, what their social impact has been and what society expects from them,

8. that in the twenty-first century science must become a shared asset benefiting all peoples on a basis of solidarity, that science is a powerful resource for understanding natural and social phenomena, and that its role promises to be even greater in the future as the growing complexity of the relationship between society and the environment is better

understood,

9. the ever-increasing need for scientific knowledge in public and private decision-making, including notably the influential role to be played by science in the formulation of policy and regulatory decisions,

10. that access to scientific knowledge for peaceful purposes from a very early age is part of the right to education belonging to all men and women, and that science education is essential for human development, for creating endogenous scientific capacity and for having active and informed citizens,

11. that scientific research and its applications may yield significant returns towards economic growth, sustainable human development, including poverty alleviation, and that the future of humankind will become more dependent on the equitable production, distribution and use of knowledge than ever before,

12. that scientific research is a major driving force in the field of health and social care and that making further use of scientific knowledge has great potential for improving the quality of health for humankind,

13. the current process of globalization and the strategic role of scientific and technological knowledge within it,

14. the urgent need to reduce the gap between the developing and developed countries by improving the scientific capacity and infrastructure in developing countries,

15. that the information and communication revolution offers new and more effective means of exchanging scientific knowledge and advancing education and research,

16. the importance for scientific research and education of full and open access to information and data belonging to the public domain,

17. the role played by the social sciences in the analysis of social transformations related to scientific and technological developments and the search for solutions to the problems generated in the process,

18. the recommendations of major conferences convened by the organizations of the United Nations system and others, and of the meetings associated with the World Conference on Science,

19. that scientific research and the use of scientific knowledge should respect human rights and the dignity of human beings, in accordance with the Universal Declaration of Human Rights and in the light of the Universal Declaration on the Human Genome and Human Rights,

20. that some applications of science can be detrimental to individuals and society, the environment and human health, possibly even threatening the continuing existence of the human species, and that the contribution of science is indispensable to the cause of peace and development, global safety and security,

21. that scientists with other major actors have a special responsibility for seeking to avert applications of science which are ethically wrong or have adverse impact,

22. the need to practice and apply the sciences in line with appropriate ethical requirements developed on the basis of an enhanced public

debate,

23. that the pursuit of science and use of scientific knowledge should respect and maintain life in all its diversity, as well as the life-support systems of our planet,

24. that there is a historical imbalance in the participation of men and women in all science-related activities,

25. that there are barriers which have precluded the full participation of other groups, of both sexes, including disabled people, indigenous peoples and ethnic minorities hereafter referred to as disadvantaged groups,

26. that traditional and local knowledge systems as dynamic expressions of perceiving and understanding the world, can make and historically have made, a valuable contribution to science and technology, and that there is a need to preserve, protect, research and promote this cultural heritage and empirical knowledge,

27. that a new relationship between science and society is necessary to cope with such pressing global problems as poverty, environmental degradation, inadequate public health, and food and water security, in particular associated with population growth,

28. the need for a strong commitment to science on the part of governments, civil society and the productive sector, as well as an equally strong commitment of scientists to the well-being of society,

Proclaim the following :

1. Science for knowledge; knowledge for progress

29. The inherent function of the scientific endeavour is to carry out a comprehensive and thorough enquiry into nature and society leading to new knowledge. This new knowledge provides educational, cultural and intellectual enrichment and leads to technological advances and economic benefits. Promoting fundamental and problem-oriented research is essential for achieving endogenous development and progress.

30. Governments, through national science policies and in acting as catalysts to facilitate interaction and communication between stakeholders, should give recognition to the key role of scientific research in the acquisition of knowledge, in the training of scientists and in the education of the public. Scientific research funded by the private sector has become a crucial factor for socio-economic development, but this cannot exclude the need for publicly funded research. Both sectors should work in close collaboration and in a complementary manner in the financing of scientific research for long-term goals.

2. Science for peace

31. The essence of scientific thinking is the ability to examine problems from different perspectives and seek explanations of natural and social phenomena, constantly submitted to critical analysis. Science thus relies on critical and free thinking, which is essential in a democratic world. The scientific community, sharing a long-standing tradition that transcends nations, religions or ethnicity, should promote, as stated in the Constitution of UNESCO, the "intellectual and moral solidarity of mankind", which is the basis of a culture of peace. Worldwide cooperation among scientists is a valuable and constructive contribution to global security and to the development of peaceful interactions

between different nations, societies and cultures, and could give encouragement to further steps in disarmament, including nuclear disarmament.

32. Governments and society at large should be aware of the need to use natural and social sciences and technology as tools to address the root causes and impacts of conflict. Investment in scientific research which addresses them should be increased.

3. Science for development

33. Today, more than ever, science and its applications are indispensable for development. Governments at all levels and the private sector should provide enhanced support for building up an adequate and well-shared scientific and technological capacity through appropriate education and research programmes as an indispensable foundation for economic, social, cultural and environmentally sound development. This is particularly urgent for developing countries. Technological development requires a solid scientific basis and needs to be resolutely directed towards safe and clean production, greater efficiency in resource use and more environmentally friendly products. Science and technology should also be resolutely directed towards prospects for better employment, improving competitiveness and social justice. Investment in science and technology aimed both at these objectives and at a better understanding and safeguarding of the planet's natural resources base, biodiversity and life-support systems must be increased. The objective should be a move towards sustainable development strategies through the integration of economic, social, cultural and environmental dimensions.

34. Science education, in the broad sense, without discrimination and encompassing all levels and modalities is a fundamental prerequisite for democracy and for ensuring sustainable development. In recent years, worldwide measures have been undertaken to promote basic education for all. It is essential that the fundamental role played by women in the application of scientific development to food production and health care be fully recognized, and efforts made to strengthen their understanding of scientific advances in these areas. It is on this platform that science education, communication and popularization need to be built. Special attention is still required for marginalized groups. It is more than ever necessary to develop and expand science literacy in all cultures and sectors of society as well as reasoning ability and skills and an appreciation of ethical values, so as to improve public participation in decision-making related to the application of new knowledge. Progress in science makes the role of universities particularly important in the promotion and modernization of science teaching and its coordination at all levels of education. In all countries, and in particular the developing countries, there is a need to strengthen scientific research in higher education and postgraduate programmes, taking into account national priorities.

35. The building of scientific capacity should be supported by regional and international cooperation, to ensure both equitable development and the spread and utilization of human creativity without discrimination of any kind against countries, groups or individuals. Cooperation between developed and developing countries should be carried out in conformity with the principles of full and open access to information, equity and mutual benefit. In all efforts of cooperation, diversity of traditions and cultures should be

given due consideration. There is a responsibility of the developed world to enhance partnership activities in science with developing countries and countries in transition. Helping to create a critical mass of national research in the sciences through regional and international cooperation is especially important for small states and least developed countries. The presence of scientific structures, such as universities, is an essential element for the training of personnel in their own country with a view to a subsequent career in that country. Through these and other efforts favourable conditions should be created that will tend to reduce or reverse the brain drain. However, any measures should not restrict the free circulation of scientists.

36. Progress in science requires various types of cooperation at and between the intergovernmental, governmental and non-governmental levels, such as: multilateral projects; research networks, including South-South networking; partnerships involving scientific communities of developed and developing countries to meet the needs of all countries and facilitate their progress; fellowships and grants and promotion of joint research; programmes to facilitate the exchange of knowledge; the development of internationally recognized scientific research centres, particularly in developing countries; international agreements for the joint promotion, evaluation and funding of megaprojects and broad access to them; international panels for the scientific assessment of complex issues; and international arrangements for the promotion of postgraduate training. New initiatives are required for interdisciplinary collaboration. The international character of fundamental research should be strengthened by significantly increasing support for long-term research projects and for international collaborative projects, especially those of global interest. In this respect particular attention should be given to the need for continuity of support for research. Access to these facilities for scientists from developing countries should be actively supported and open to all on the basis of scientific merit. The use of information and communication technology, particularly through networking, is to be expanded as a means to promote the free flow of knowledge. At the same time, care must be taken to ensure that the use of these technologies does not lead to a denial or restriction of the richness of the various cultures and means of expression.

37. For all countries to respond to the objectives set out in this Declaration, in parallel with international approaches, in the first place national strategies and institutional arrangements and financing systems should be set up or revised to enhance the role of sciences in sustainable development within the new context. In particular they should include: a long-term national policy on science to be developed together with the major public and private actors; support to science education and scientific research; the development of cooperation between R&D institutions, universities and industry as part of national innovation systems; the creation and maintenance of national institutions for risk assessment and management, vulnerability reduction, safety and health; and incentives for investment, research and innovation. Parliaments and governments should be invited to provide a legal, institutional and economic basis for enhancing scientific and technological capacity in the public and private sectors and facilitate their interaction. Science decision-making and priority-setting should be made an integral part of the overall development planning and formulation of

sustainable development strategies. In this context, the recent initiative by the major G8 creditor countries to embark on the process of reducing the debt of certain developing countries will be conducive to a joint effort by the developing and developed countries towards establishing appropriate mechanisms for the funding of science in order to strengthen national and regional scientific and technological research systems.

38. Intellectual property rights need to be appropriately protected on a global basis, and access to data and information is essential for undertaking scientific work and for translating the results of scientific research into tangible benefits for society. Measures should be taken to enhance those relationships between the protection of intellectual property rights and the dissemination of scientific knowledge that are mutually supportive. There is a need to consider the scope, extent and application of intellectual property rights in relation to the equitable production, distribution and use of knowledge. There is also a need to further develop appropriate national legal frameworks to accommodate the specific requirements of developing countries and traditional knowledge, sources and products, to ensure their recognition and adequate protection on the basis of the informed consent of the customary or traditional owners of this knowledge.

4. Science in society and science for society

39. The practice of scientific research and the use of knowledge from that research should always aim at the welfare of humankind, including the reduction of poverty, be respectful of the dignity and rights of human beings, and of the global environment, and take fully into account our responsibility towards present and future generations. There should be a new commitment to these important principles by all parties concerned.

40. A free flow of information on all possible uses and consequences of new discoveries and newly developed technologies should be secured so that ethical issues can be debated in an appropriate way. Each country should establish suitable measures to address the ethics of the practice of science and of the use of scientific knowledge and its applications. These should include due process procedures for dealing with dissent and dissenters in a fair and responsive manner. The World Commission on the Ethics of Scientific Knowledge and Technology of UNESCO can provide a means of interaction in this respect.

41. All scientists should commit themselves to high ethical standards, and a code of ethics based on relevant norms enshrined in international human rights instruments should be established for scientific professions. The social responsibility of scientists requires that they maintain high standards of scientific integrity and quality control, share their knowledge, communicate with the public and educate the younger generation. Political authorities should respect such action by scientists. Science curricula should include science ethics, as well as training in history, philosophy and the cultural impact of science.

42. Equality in access to science is not only a social and ethical requirement for human development, but also a necessity for realizing the full potential of scientific communities worldwide and for orienting scientific progress towards meeting the needs of humankind. The difficulties encountered by women, constituting over half of the population in the world, in entering, pursuing and

advancing in a career in the sciences and in participating in decision-making in science and technology should be addressed urgently. There is an equally urgent need to address the difficulties faced by disadvantaged groups which preclude their full and effective participation.

43. Governments and scientists of the world should address the complex problems of poor health and the increasing inequalities in health across different countries and between communities within the same country with the objective of achieving an enhanced, equitable standard of health and an improved provision of quality health care for all. This should be undertaken through education, by using scientific and technological advances, by developing robust long-term partnerships between all stakeholders and by harnessing programmes to the task.

44. We, participants in the World Conference on "Science for the Twenty-first Century: a New Commitment", commit ourselves to making every effort to realize the possibility of promoting dialogue between the scientific community and society, to remove all discrimination with respect to education for and the benefits of science, to act ethically and cooperatively within our own spheres of responsibility, to strengthen scientific culture and its peaceful application throughout the world, and to promote the use of scientific knowledge for the well-being of populations and for sustainable peace and development, taking into account the social and ethical principles illustrated above.

45. We consider that the Conference document Science Agenda - Framework for Action gives practical expression to a new commitment to science, and can serve as a strategic guide for partnership within the United Nations system and between all stakeholders in the scientific endeavour in the years to come.

46. We adopt therefore this Declaration on Science and the Use of Scientific Knowledge and agree upon the Science Agenda - Framework for Action as a means of achieving the goals set forth in the Declaration, and call upon UNESCO and ICSU to submit both documents to the General Conference and the General Assembly respectively. These documents will be also seized by the United Nations General Assembly. The purpose is to enable both organizations to identify and implement follow-up action in their respective programmes, and to mobilize the support of all partners, particularly those in the United Nations system, in order to reinforce international coordination and cooperation in science.