

Conservational Education Based on Sustainability and Biodiversity*

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Conservational Activities of NGOs in Japan

Recently, environmental education (EE) has wide attracted attention not only in school education but also out-of-school or life-long education. The Nature Conservation Society of Japan (NACS-J) was organized in 1951 when it was planned to use the Ozegahara Moor as a water resource there for the generation of electricity. The former name of NACS-J was the Association for Conservation of Ozegahara Moor. NACS-J sent a resolution for the implementation of conservational education in schools to the Ministry of Education, Science and Culture in 1962, emphasizing that conservational education should be included not only in the teaching of science, but also in social studies, national language teaching and moral education. It was a very forward-looking idea in environmental education. When I attended an EE workshop after INTECOL (International Congress on Ecology) in Jerusalem in 1978, I was very interested in the inclusion of EE in all subjects in schools, such as music, language, science, social studies, and so on. The background of conservational education is based on the concepts and ideas of modern ecology (Table 1). I wrote a book on "The Ideas and Methods of Environmental Education-Relationship between Man and Environment" (Numata, 1982). Before that publication, I organized an International Symposium of Environmental Education in Tokyo in 1974 (Numata, Benninghoff and Whitford, 1977),

and I also organized a project team on EE, assisted by a subsidy from the Ministry of Education, Science and Culture, from 1972 to 1983. Another study team on EE, which produced "A Practice Programme of EE in the Social and Life-long Education", was aided by the Nihon-Seimei Foundation (Numata, 1984). I am now continuing theoretical studies on conservational education with my colleagues from various fields of natural and social science. I am responsible for the Nature Conservation Society of Japan, through which the Department of Education and Communication has endeavored to popularize the idea and practice of nature conservation as an NGO and to train future nature conservation leaders. NACS-J trainees already number more than 12,000. At the Natural History Museum and Institute, Chiba, there is Department of Environmental Education which gives lectures and conducts field work many times per year.

In addition, the Environmental Education Society of Japan was organized in 1989 and is chaired by me (Table 2). The Ministry of Education, Science and Culture has published a "Guidance Manual for EE in Schools" (1991, 1992); the Environmental Agency and some NGOs have also prepared guidance manuals and handbooks for EE; and the Nature Conservation Society of Japan issued several "Field Guide Series" such as "Handbook for Nature Study Leaders" (1978), "Dangerous Organisms in the Field" (1982), "Handbook for Nature Observation" (1984), "Indicator Organisms"

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Table 1. Basic concepts in ecology as the background of conservational education.

Struggle for existence
Food web-trophic cycle
Niche
Action-reaction
Coaction (Competition, cooperation, disoperation, parasitism, symbiosis)
Community-biome
Ecosystem (biocentric/anthropocentric)
Bio-indicator
Biometer (phytometer, zoometer)
Phenology
Life-form/Growth form
Plant climate
Morphological convergence
Adaptive radiation
Territoriality
Social hierarchy
Biocentric environment (Umgebung/Umwelt)
Biological time/space
Anthropocentric environment
Succession (primary, secondary, autogenic, allogenic)
Climax (climatic, edaphic, biotic, monocl意思, polyclimax)
Habitat segregation
Carrying capacity
Potential natural vegetation
Vegetational continuum/Phytosociological unit
Biodiversity
Sustainability
Co-evolution

(1985), "Nature Observation with Handicapped People" (1988), and others.

Sustainability and Biodiversity

In the "World Conservation Strategy" prepared by IUCN, UNEP and WWF in collaboration with FAO and UNESCO, the idea of sustainable development (SD) was stressed as well as sustainable utilization (SU). The subtitle of the World Conservation Strategy is "Living Resource Conservation for Sustainable Development". In "Our Common Future" (1987), prepared by the World Commission on Environment and Development and the United Nations Conference on Environment and Development (UNCED, 1992), SD was stressed as the keyword. The phrase "Environment and Development" has been in use since the United Nations Conference on Human Environment (1972), at which it was one of the six main problem fields,

Table 2. Non-governmental organization for nature conservation in Japan.

1934	Wild Bird Society of Japan
1947	Japanese Association for Preservation of Birds
1951	Nature Conservation Society of Japan
1961	Worldwide Fund for Nature-Japan
1977	Japan Environment Association
1978	Japan Wildlife Research Center
1989	Environmental Education Society of Japan

and the concept has been strengthened by the inclusion of the key phrase 'sustainable development'. "Our Common Future" stresses that sustainable development is not a fixed state of harmony, but rather a process of change. However, in my opinion, sustainability and development are contradictory (Table 3) and are related respectively to renewable or non-renewable resources. With renewable resources such as agriculture, forestry and fisheries, sustainable utilization is possible in the framework of carrying capacity, particularly in relation to appropriate technology, recycling and conserving the resources. With non-renewable resources such as fossil fuel, neither sustainable development nor sustainable utilization is possible, and sustainable management (SM) is the best that can be achieved with the aid of substitute resources. Many people refer to the harmony between the Environment and Development, but their feelings sometimes incline toward Development. This problem is also closely related to Population and Food, due to the limitation of available land on the earth. The carrying capacity was originally a zootechnical concept, to maintain good pasture productivity for domestic animals.

In "Caring for the Earth" (a New World Conservation Strategy) (1991), there is a section on "Sustainability: a question of definition". There, the word "sustainable" is used in several combinations, such as sustainable growth, some of which are contradictory, as well as in SD. SU is applicable only to renewable resources, as mentioned above.

The Biodiversity Convention (Table 4) was proposed in Rio de Janeiro in 1992. Before that, I put forward the idea of "Biodiversity as a basis of EE" at the International Conference on EE (Numata, 1989). Biodiversity includes rich-

Table 3. The idea of sustainability.

Environment and Development as the Basis of Sustainable Development
UNCHE (1972): United Nations Conference on Human Environment.
WCS (1980): World Conservation Strategy.
WCED (1987), World Commission on Environment and Development: Our Common Future.
CE (1991): Caring for the Earth. A Strategy for Sustainable Living.
UNCED (1992): United Nations Conference on Environment and Development
SD (Sustainable Development)
Keyword of WCS, WCED and UNCED (contradictory concept)
SU (Sustainable Utilization)
For renewable resources, e.g. fisheries, forestry, pasturing within the Earth's carrying capacity, wise and rational use.
SM (Sustainable Management)
For non-renewable resources, e.g. fossil fuel saving, recycling and substitution
S-D (Sustainability-Development) contradictory
S (Sustainability)
Maintaining a desirable state of an ecosystem and productivity-appropriate technology, Small is beautiful.
D (Development)
Changing a state to another state, to increase productivity, to bring to a more advanced or effective state, to bring out the capabilities or possibilities

Table 4. The idea of biodiversity (a contraction of Biological Diversity).

The number, variety and variability within the living world
In terms of richness in
genes: genetic diversity,
species: specific diversity,
communities: communal diversity,
habitats: habitat diversity,
ecosystems: ecosystem diversity.
In terms of quality in biodiversity of
poisonous organisms,
pathogenic bacteria,
insect pests,
parasites,
weeds.
Maintaining biodiversity
<i>In situ</i> conservation:
maintaining organisms in their original place with wild state and within their existing range known in Red Data Book, indigenous species, species within a community, in Biosphere Reserves, World Heritage sites, etc.
<i>Ex situ</i> conservation:
seed banks,
germplasm collections (gene banks),
botanic gardens,
zoos.

ness of species as well as of genetic resources, biological communities and ecosystems (Table 4). Natural biomes such as tropical forests, mangroves, coral reefs, wetlands, etc. are being globally destroyed. Also, the natural environment of the stratosphere, land and water sys-

tems, and the atmosphere are highly disturbed, as is well known through mass media communications and scientific journals. Biodiversity is in fact important for nature study, and education in natural history, biology, ecology and nature conservation, among the various kinds

of environmental education.

The Biodiversity Convention was adopted by UNCED in Rio (1992), and in this respect tropical forests, having a great number of species and genetic resources, have been the subject of serious concern. Before that, commercial whaling, the Ramsar Convention and the Washington Convention on endangered species were all concerned with the conservation of biodiversity of genetic resources. For this purpose, SU of the biotic resources is most important.

In relation to this, conservation '*in situ*' and restoration of the ecosystem are very important, as well as conservation '*ex situ*' in gene banks, zoos and botanical gardens. For conservation '*in situ*', conservational education of people living in the primeval forests is the most useful approach.

Environment and Development is the basis of SD, and it was used as the title of one session at the UN Conference on the Human Environment (1972). However, the World Commission on Environment and Development (1982–1987) and UNCED (1992) were entirely devoted to "Environment and Development", rather than its being restricted to a single session. In Agenda 21, we can find the phrase "integration of environment and development in the policy making". This is only one example, but care must be taken not to be deceived by honeyed words. The key phrase should not be "Environment and Development", but "Nature Conservation and Sustainable Living Based on Biological Diversity". In relation to the aspects of

sustainability and biodiversity, biological productivity and human adaptability were studied in the IBP (International Biological Programme). After that, the impact of human activities on the earth's ecosystems have been studied in the framework of MAB (Man and the Biosphere). The most important biomes were designated as the World Natural Heritage following zonation of the Biosphere Reserve. We can use natural resources for our daily needs, as well as having such preserved core areas, by adopting the idea of wise and rational use as proposed at IUCN.

Some Examples of Nature Conservation

Some examples in Japan will be described here in relation to conservation and conservational education (Table 5). To conserve genetic resources in an ecosystem, we must have large nature reserves (Table 6). The extinction of bird species in Brazilian forests in the 19th century occurred faster in small areas than in large ones (Soulé and Wilcox, 1980). The conservation of genetic resources in Japan is implemented by 1) gene banks for plants, animals and microorganisms used for agriculture, forestry and fisheries; 2) botanical gardens and zoos for living plants and animals; 3) *in situ* conservation, such as protected forests, forest ecosystem conservation areas, national parks, wilderness areas, natural monuments, and so on (Table 7). National Parks in Japan have a zonation system, being classified as special protection areas, first, second and third special areas, and ordinary areas. However,

Table 5. Conservation education in relation to ecological science.

Ecological Science and Education	Conservation and Conservational Education
Plant Ecology	Conservation of Lower Plants
Animal Ecology	Conservation of Higher Plants
Microbial Ecology	Conservation of Wildlife
Bio-ecology	Conservation of Large Animals
Ecosystem Ecology	Conservation of Ecosystems
	Conservation and Protection
	Wise and Rational Use
	Recycling and Saving of Energy and Matters
	Alternative Use of Energy and Matters
Biological Education	Conservational Education
Ecological Education	Environmental Education
Natural History Education	Environmental Science Education
Natural Education	Environmental Technology Education

Table 6. The area of nature reserves*.

Kind	Area (ha)
Wilderness Areas	5,631
Nature Conservation Areas (National)	7,550
Nature Conservation Areas (Prefectural Special Areas)	21,916
National Wildlife Protection Areas	411,042
Natural Monuments	150,085
Special Protection Areas of National Parks	250,050
The First Class Special Areas of National Parks	157,042
Special Protection Areas of Quasi-national Parks	64,457
The First Class Special Areas of Quasi-national Parks	162,654
The First Special Areas of Prefectural National Parks	76,402
Protection Forests	148,967

* The total area of Japan is 377,851 km².

Table 7. The flow of promulgation for nature conservation for the past 100 years.

1897	Forest Law
1911	A proposal for the preservation of historic sites and natural monuments to the House of Peers
1915	A circular notice on protected forests
1918	Wildlife Protection Law
1919	The Historic Sites, Scenic Beauty and Natural Monuments Preservation Law
1931	National Parks Law
1950	The Law for the Protection of Cultural Properties
1951	Law for Protection Forests
1957	Natural Parks Law
1972	Nature Conservation Law
1993	Basic Law for Environment

this zoning is based mainly on the balance with forestry, because the land in the national parks nearly all belongs to the national forest of the Forestry Agency. Even in the special areas, forestry is legally permitted to some extent. In ordinary areas, there are no regulations on forestry, housing, etc. Therefore, only the special protection area is the core, and the others (special areas) are not buffer zones in a real sense.

In the Shiretoko Peninsula, Hokkaido, there is a natural mixed forest with northern conifers and deciduous broad-leaved trees which is the typical natural forest of Hokkaido. The Forestry Agency formerly wanted to cut conifers as good timber. However, they have recently proposed the felling of hardwood also, as it is good material for furniture. Besides this, the foresters say that it is better to cut down old over-mature forests so that they will be rejuvenated. A natural climax forest is composed of seedlings and saplings in the open spaces, as well as young, mature and old trees. The normal forest composition is a continuing

process (Watt, 1947), and a similar principle is seen in grassland vegetation (Numata, 1988) based on cyclic succession. There are old and over-mature trees in a climax forest, but there is no such things as an "over-mature" forest.

The foresters wanted to cut down some hardwood trees in the Shiretoko National Park. Cutting only 1-5 old trees per hectare and collecting the timbers by helicopter would be no problem, they said. However, they actually cut mature, not old, trees, because cutting mature trees would make more profit for the Forestry Agency. Some conservation groups warned that even such a small amount of cutting would destroy the original structure of natural forest and the unique wildlife there, such as fish-eating owls and black woodpeckers. Some of them emulated the so-called Chipko Movement, in which Indian women fought against cutting by foresters by embracing the trees.

In the beech forest on Mt. Shirakami in northern Honshu, designated as a World Natural

Heritage in 1992, there was a similar issue after World War II. Before the War, there were a lot of natural stands of beech forest. However, between and after the War, the natural beech forests were the main target of felling by the Forestry Agency. At that time, the value of beech timber was not very high; however, recently its value has become higher, because the timber is very good for furniture.

In the Shirakami area, including Mt. Moriyoshi, with similar beech forest, we have been insisting that the core and buffer area of 41,000 ha should be designated only for research, education and monitoring, particularly in the buffer zone. The core area is, needless to say, a strict reserve. In this area, the black woodpecker was found. It exists in Hokkaido, but not in Honshu as had been believed for a long time. The border between Hokkaido and Honshu was named the Blakiston's line based on the distribution of bird species, etc. I requested the District Forest Office to preserve that forest as the habitat of the black woodpecker and the other rich wildlife fauna. When I revisited the area after three years, I found only solitary old beech trees remaining for the use of the black woodpecker. Except for them, all the other beech trees had been felled, to my surprise. A local Fisheries Association had given a warning about the possibility of landslide, and they were fighting the felling of the natural beech forests. This fact was very instructive.

There is a proverb by the Chinese philosopher Meng Tzu which says "Climbing up a tree, and harvesting fish", which seems to mean attempting some impossible or unreasonable thing. However, attempting to save the beech forests is not actually unreasonable. When beech forests are preserved, they protect against landslide and stabilize the sand and mud, and the rivers remain in good condition for fish. Therefore, the trees grow well and we can harvest the fish. This is my new interpretation of the proverb. At last, the Mt. Shirakami area has recently been designated as part of the world natural heritage by UNESCO.

In Yanbaru, in the northern part of Okinawa Island, the natural forests (evergreen broad-leaved forests dominated by evergreen oak) have been widely cut by the Prefectural Forest-

ry Department. In this forest, there are many endemic and endangered species, such as Noguuchi woodpeckers, Yanbaru water rail, the Yanbaru long-legged beetle, etc.

After cutting the evergreen oak forest, the site is usually used as farmland for pineapple and sugar cane, and the surface red soil erodes into the rivers. The red soil accumulates on the previously healthy coral reef. The coral reef lagoon is a good fish-spawning and sea-weed growing site. People living along the sea coast have long harvested the fish, shellfish, and sea-weeds by traditional and sustainable methods. Therefore, the coral reef biota is balanced with the people's demand for food. The relationship between the coral reef at Shiraho on Ishigaki Island and the life of the inhabitants is a typical case of sustainability (Table 3). On such a coral reef, the Okinawa Prefectural Government planned to construct a new airport runway of 2,000 m. There is already a 1,500 m runway elsewhere on Ishigaki Island. However, at this planned site, very old, huge blue corals and others in a healthy condition were found as a result of scientific investigation by IUCN, NACS-J and WWF-J. After that, two or three alternative runway sites proposed and examined.

NACS-J conducted a comprehensive survey of the natural features of Yaku Island with a project team under the auspices of the Environment Agency. Yaku Island is 60 km from the southern edge of Osumi Peninsula, Kyushu. On this small island, there are more than thirty mountains over 1,000 m in altitude, with the highest peak being Mt. Miyanoura at 1,935 m. When Japanese speak of Yaku Island, everyone thinks of Yakusugi (the Yaku cedar) a long-lived tree supplying excellent quality timber. Yakusugi and its forests have been designated a National Natural Monument and National Park (the Kirishima-Yaku N.P.), and a Wilderness Area by Japanese Government and Biosphere Reserve by UNESCO (Tables 6, 7). In addition to this, it has recently been designated a World Natural Heritage.

The Ecological Society of Japan and a research group from the Kyushu District have repeatedly sent a resolution about the protection of the characteristic nature of Yaku Island

to the Government, referring to the laurel-leaved forest on the lower part of the island as well as the Yakusugi forest. Study of the structure, composition, function, dynamics and history of a such typical biotope located at the southernmost limit of the warm-temperate region of Japan would help in the interpretation of the features of the island ecosystem as a prototype of the natural history of Japan. The Yaku Island ecosystem is located in the north of the Ryukyu Islands group, and it can be broadly included in the Southwest (Nansei) Islands. Clouds, mist and high rainfall are characteristic, caused by ascending air currents influenced by the Kuroshio (warm Pacific current), and frequent typhoons. The rainfall amounts to 3,000 to 4,000 mm on the coast, and 8,000 to 10,000 mm in mountainous areas.

Deer and monkeys are endemic subspecies of those on the Japanese mainland, and the ecosystem contains the northern limit of the tropical dragonfly and the southern limit of the dragonfly endemic to the Japanese mainland. There are also several endemic species and subspecies of cicadas, butterflies, beetles and birds. Yaku island supports 1,200 species of higher plants and 600 species of bryophyte. Along the rivers, there are rheophytes similar to those found in the tropics.

During the ice age, the sea level dropped 80–120 m. If so, Yaku Island must then have had a land bridge with the Osumi Peninsula of Kyushu, which would have permitted the migration of plants and animals. Regarding the vegetational zonation, below 800 m there is the laurel-leaved forest zone, 800–1,200 m is the ecotone of laurel-leaved forest and coniferous forest, and at 1,200–1,700 m there is a coniferous forest zone composed of Yakusugi (*Cryptomeria japonica*) (Numata 1986).

Conclusion and Summary

There are many NGOs in Japan promoting nature conservation and conservational education. Environmental Education is widely practiced, and includes nature education, natural history education, anti-pollution education, environmental protection education, environmental science education, and environmental technology education as well as conservational

education (Table 5).

Conservational education is promoted on the background of sustainability and biodiversity as well as including the basic concepts and ideas of modern ecology.

Examples of suitable subjects for inclusion in courses of conservation and conservational education are 1) the felling of deciduous broad-leaved trees in mixed forest in the Shiretoko National Park, Hokkaido; 2) preservation of natural beech forest in the Shirakami mountain area, which was designated as part of the world natural heritage by UNESCO; 3) felling evergreen broad-leaved forests in Yanbaru in the north of Okinawa Island, allowing red soil to accumulate on the coral reef lagoon, and the planning of a runway on the coral reef, which would result in the destruction of the traditional daily life of the Shiraho village people; 4) Yaku Island, famous for Yakusugi (Yaku cedar), in the southernmost part of the warm-temperate zone, south of Kyushu, furnished another good example. It has a unique biota and characteristic meteorological conditions, and has been designated as part of the world natural heritage, together with the Shirakami mountain area.

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持続性と生物多様性にもとづく自然保護教育

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最近自然教育に対する関心が、学校教育のみならず、学校外の教育や生涯教育でも高まっている。日本自然保護協会では、1962年に早くも、自然保護教育(理科や社会科のみならず、国語科や道徳においても)が必要であることを文部省に対して要望した。これは極めて先見的な意見の表明であったと思う。その後われわれも同様の意見書を1970年代に出したことがあるが、それらに対する対応は全くなく、文部省が高校以下の「環境教育指導資料」を出したのは、1991-1992年であった。環境教育は巾が広く、自然保護教育のほか、自然教育、自然誌教育、公害教育、環境保全教育、環境科学教育、環境技術教育などを含む。ここでは特に自然保護教育について、その基礎にある現代生態学の概念の他、持続性と生物多様性を背景として推進されることを、最近の具体的な事例をあげつつそれらの関係を論じた。事例としてとりあげたのは、知床国立公園の広葉樹の伐採、白神山地のブナ林の保護、沖縄島ヤンバルの常緑広葉樹林の伐採、赤土のサンゴ礁への流出堆積、サンゴ礁上の滑走路計画と白保地域住民の伝統的な生活の破壊のおそれ、屋久島における屋久杉林や常緑広葉樹林の保護、白神や屋久の世界遺産への指定などである。