

Biodiversity and Conservation —From Herbals to the Red Data Book—

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Abstract Although I am an ecologist, I am very interested in the biota and its conservation. In 1958, I compiled the "Biological Flora of Chiba Prefecture", which was enlarged and revised in 1975. I also published "Biological Flora of Japan" in 1969, including methodology, which was based particularly on life-forms.

In early times, Chinese and Korean herbals developed in relation to oriental medicine, and these were imported into Japan from the 7th century. Among them, "Honzo Komoku" in Japanese ("Ben Chaw Gang-mu" in Chinese), which means "an outline of herbals", was written by Li Shi-Zhen. This book had a great influence on Japanese herbalists. One of them, Ekiken Kaibara, translated "Honzo Komoku" into Japanese and further published "Yamato Honzo" (Japan Herbals) containing his own opinions and ideas.

We have a long history of research on plants as related to herbals, natural history, and modern biology. Yoan Udagawa was the first Japanese botanist to be distinguished from a herbalist, and he wrote the book "Illustrated Flora of Japan" (1874). As you know, the convention on biological diversity was proposed and ratified at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992.

The main pioneers of Japanese botany were the three westerners, Kämpfer, Thunberg and von Siebold. On the basis of our rich knowledge of the local flora, we tried to compile a Red Data Book (RDB) of Plant Species in Japan (1989). We were then able to recognize those plants that were threatened, and consider appropriate countermeasures. Later, we progressed to compile the "RDB of Plant Communities" (1996).

We then considered the present state of plant species and communities for which conservation was necessary. The Japanese Archipelago is located in the temperate zone of mid-latitude and has a prominently rich flora. There are 5300 wild species of higher plants, among which about 1800 (34%) are endemic. These wild species have evolved to occupy a wide range of habitats. Recently, however, due to the high economic growth of Japan, habitat destruction has progressed rapidly. As a result, 17% of Japanese wild plants (894 species) are now threatened. The Red Data Book lists these endangered species, communities, landscapes and habitats.

With regard to nature conservation, threatened plants and plant communities need to be nominated, and appropriate countermeasures was considered. The most important principle for biodiversity and conservation is ecosystem sustainability, particularly sustainable utilization and sustainable management. The sustainable development proposed at the United Nations Conference on the Environment and Development (UNCED) in 1992 should be criticized.

Key words: herbal, natural history, RDB, plant species, plant community, Japan.

Prehistory

In early times (650-730 AD), Chinese and Korean herbals were imported into Japan (Table 1). Among them, the "Tang Dynasty Herbals" were the first to be imported in 659 A.D. These were subsequently edited into 20 volumes (1108). Thereafter, "Honzo Komoku" in Japanese (Ben Chaw Gang-mu in Chi-

nese), which means "An Outline of Herbals" (1579) edited by Li Shi-Zhen (1518-1593), was the most influential of the herbals. It was widely read by many people, including the first Shogun, Ieyasu Tokugawa. The botanist Razan Hayashi (1583-1657) wrote an explanation of "Honzo Komoku" with Japanese plant names in 1631.

Among the Japanese herbals, Ekiken Kai-

Table 1. Very short history of herbals.

Chinese (Korean) herbals (650–730)
 Tang Dynasty Herbals (659)
 Tang Herbals 20 vols. (1108)
 Honzo Komoku (Ben Chaw Gang-mu)=Outline of herbals
 Li Shi-Zhen (1579)
 The Shogun Ieyasu Tokugawa. He respected and loved this book.
 Ekiken Kaibara: famous herbalist
 Honzo Komoku Translation in Japanese (1672)
 Yamato Honzo (Japan Herbals)—The most representative description of Japanese biota 16 vols.
 with his own opinions and ideas (1707)
Three Dutch Physicians (in fact, not Dutch) on Dejima, Nagasaki;
 In the closed Tokugawa Era a few western scientists contributed to Japanese science very
 greatly.
 Engelbert Kämpfer (1651–1716)
 Geschichte und Beschreibung von Japan (1777),
 Bodart - Bailley: Kämpfer and Tsunayoshi Tokugawa (1994)
 Carl Peter Thunberg (1743–1828), Linnean Student, *Icones Plantarum Japonicarum*
 “Linné and Natural History” (1994) published by Natural History Museum and Institute, Chiba
 which bought 5000 items of the Lenskog Collection, Sweden, in relation to Thunberg, “Linné of
 Japan”
 Linné had the side of an ecologist, paludologist and plant geographer who studied plant habitat,
 phenology, indicator plants and succession.
 Franz von Siebold (1776–1866) *Fauna and Flora of Japan*, the greatest naturalist. The collection of
 plant specimens, mammals, birds, reptiles, fish and others are kept at the State Herbarium and
 the National Museum of Natural History (Leiden)

bara (1630–1714) published “Honzo Komoku: Translation in Japanese” in 1672, and further published “Yamato Honzo” (Japan Herbals) in 16 volumes based on his own studies. This was not only a Japanese translation of the Chinese herbals, but also included his own opinions and ideas (1707). This is the most representative description of the Japanese biota. Kaibara was thus considered the first truly Japanese herbalist and naturalist, employing the word “hakubutsu”, meaning natural history.

An important person who introduced Japan to western countries was Engelbert Kämpfer (1651–1716), who stayed in Japan from 1690 to 1692 (years 3–5 of the Genroku Period). In Genroku year 4, he traveled to Edo (Tokyo) on horseback. Kämpfer’s notebook influenced Thunberg, who later wrote “Geschichte und Beschreibung von Japan” (1777) (Fig. 1), which formed a view of Japan for western people. Kämpfer left many notebooks and cards containing much information on Japan. Kämpfer also wrote a book called “Wonderful Sights in the Country” and made descriptions and figures of useful

plants with Japanese and Chinese names. The Kämpfer Festival in his honor of erection of stone monument in 1922 by Birnie, a British merchant, was held in 1990, the 300th anniversary of Kämpfer’s visit to Japan (Fig. 2).

After Kämpfer, the Linnean student Carl Peter Thunberg (1743–1828) stayed in Japan (1775–1776). He had studied the flora of Cape Town, South Africa, for three years. Thunberg came to Nagasaki via Batavia and stayed in Japan for 16 months. During his stay in Dejima, Nagasaki, he had an opportunity to travel to Edo. Afterwards he wrote the book “*Icones Plantarum Japonicarum*”, Uppsala.

Thunberg’s most excellent students were Hoshu Katsuragawa (1744–1809) and Jun-an Nakagawa (1739–1786). In the same period, Ranzan Ono (1727–1810), a true herbalist and botanist, wrote “An Outline of Honzo Komoku” for beginners, in 48 volumes (1803–1806). Ranzan Ono was a botanist rather than herbalist of medicinal plants. He collected plants with many students from the viewpoint of botany, and this was continued

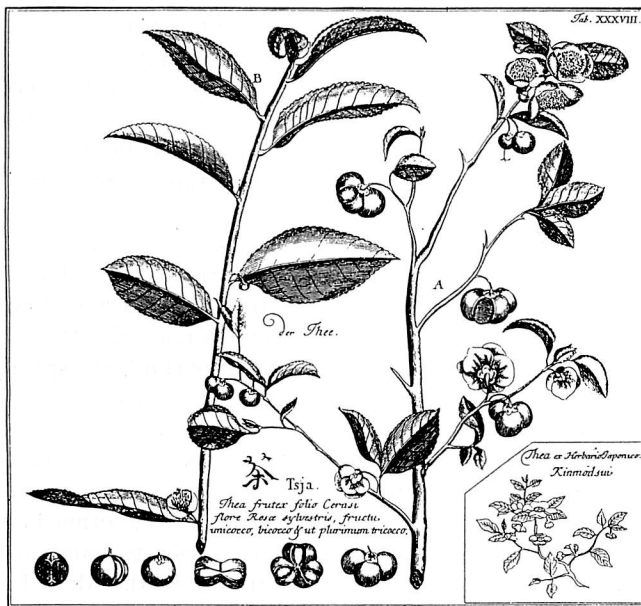
日本と日本民族を体系的に叙述した世界史的文献

改訂 日本誌

Geschichte und Beschreibung von Japan

エンゲルベルト・ケンペル著、今井 正訳編

全2巻、約1000ページ、人名・文献・事項索引および解説付



霞ヶ関出版株式会社

Fig. 1. Japanese advertisement on the translation of Kämpfer's book "History and Observation of Japan" (Imai, 1989).

by Tomitaro Makino (Fig. 3).

After Kämpfer and Thunberg, the great naturalist Franz von Siebold (1776–1866) visited Japan twice, and wrote the books "Fauna of Japan", "Flora of Japan", "Travels in Japan" and "Introduction of Western Circumstances". Siebold arrived at Dejima (a small reclaimed island), Nagasaki, which was the only open port available for Holland. He made a private school (1826–1832) called Narutaki-juku where he taught botany, herbs, medicine and language. When he traveled to Edo, he met Yoan Udagawa and others.

Yoan Udagawa (1798–1846) was the first botanist in the true sense, and wrote "General Botany" (1822), which was not a book on herbs. Keisuke Ito (1803–1901), who stud-

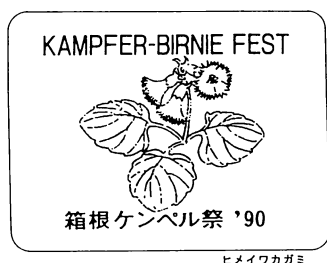
ied at Narutaki-juku, obtained Thunberg's "Flora of Japan" from Siebold and wrote the book "Illustrated Flora of Japan" (1874), the first plant taxonomy based on Thunberg's book. Another botanist, Yokusai Inuma (1782–1856), wrote a book with plant drawings.

The contribution of von Siebold to knowledge of the natural history of Japan became internationally known through the publications "Flora Japonica", "Fauna Japonica", and others. The basic material used for the compilation of these works, the collection of plant specimens as well as the mounted and preserved mammals, birds, fish and reptiles are presently kept at the State Herbarium, and the National Museum of Natural History, both in Leiden, the Netherlands.

第 5 回

ケンペル祭

—バーニーの碑を讀えて—



ケンペルとバーニーを讀える会刊

Fig. 2. Kämpfer Festival in Hakone with Birnie's erection of the stone monument.

The pioneers of Japanese botany were Yoan Udagawa and Keisuke Ito (Kimura, 1988). Whereas, the herbalists and biologists of Dejima, Nagasaki, during the period of Japanese exclusion were Kämpfer, Thunberg and Siebold (Kimura, 1988).

In relation to plant hunting, the Medicinal Plants Garden at Koishikawa in Edo (Table 2) was established in 1720, and this changed to the Botanical Garden of Tokyo University in 1869 (Meiji year 2). The 300th Anniversary of the Botanical Garden Establishment was held in 1984.

Following Keisuke Ito's book in 1874, the Tokyo Biological Society was established in 1882, and the first issue of the Botanical Magazine (Vol. 1, No.1) was issued in that year. Tomitaro Makino's "Illustrated Flora of Japan" was issued in 1888. This marked the 100th anniversary of the birth of Siebold, and symbolized the transition from the western science studied at Dejima, Nagasaki, to modern science after the Imperial Restoration in the Meiji Era.

Survey of Plants and Plant Communities Important for Conservation

The Natural History Bureau of the Interior Ministry was set up at the beginning of the Meiji Era, around the time Keisuke Ito's "Illustrated Flora of Japan" (1874) was pub-

lished. The Natural History Journal was issued in 1879. Working for the Ministry of Agriculture and Commerce, Jyo Tanaka made a field survey of Japan including Honshu, Shikoku and Kyushu. Tokuzo Takashima carried out a geological survey with some specialists in Yamanashi Prefecture, and later requested that a plant zone survey of the country be done. Therefore, a plant zone (vegetation zone) survey was implemented between 1879 and 1883, mainly by Jyo Tanaka.

A great descriptive work on the vegetation zones of Japan was the "Survey Report of Plant Zones" by Jyo Tanaka (1885). In this report, the meaning and general situation of forest zones were discussed in relation to horizontal geography, altitude, isotherms, sea currents, etc. This included the characteristic Yaku cedar (*Cryptomeria japonica* on Yakushima older than 1000 years), and the five important tree species in the Kiso Mountains (The "five species" are not the same according to places). Kiso's are *Chamaecyparis obtusa*, *C. pisifera*, *C. pisifera* var. *squarrosa*, *Sciadopitys verticillata* and *Juniperus rigida*. On the other hand, the succession of pine forests to bamboo brakes was also described. In the Meiji Era, some able young biologists studied in Germany and the U.S.A. But although university education was not build up at that time, to round off the result of field works based on plant taxonomy and plant geography was very excellent.

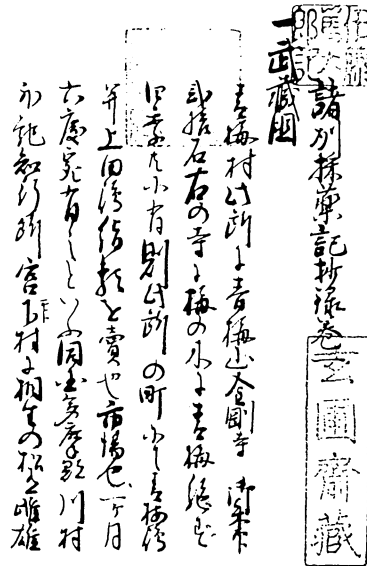
Seiroku Honda arranged and developed the Tanaka's work, and wrote two books "Forest Zones of Japan" (1900) and "Forest Zones of the World" (1915). Manabu Miyoshi (1861-1939) returned from Germany (having studied under Prof. W. F. P. Pfeffer, Leipzig), and wrote "Plant Society" (1903), "General Plant Ecology" (1908), and "Natural Monuments" (1931). He played an important role in introducing advanced German science, and learnt not only plant ecology but also plant physiology and systematics.

Regarding semi-natural grasslands in Japan, Motoo Oseko's "Research on Japanese Grasslands" (1937) was a very fundamental work on the geographical distribution of grassland species, and the effects of management (fire, fertilization, shade, grazing,

江戸時代の採薬記を集大成！
採薬志〔I・II〕
 The Plant Hunting in Yedo Era (I・II)

浅見 恵・安田 健訳編

各巻約1,000ページ、人名・文献・事項索引付、解説文を併載



科学書院

(Kagaku Shoin Co., Ltd.)

Fig. 3. Japanese advertisement on the collection of “The Plant Hunting in Yedo Era” (Asami and Yasuda, 1995, 1996).

Table 2. Famous scientists contributed to Japanese science are included exhibition and anniversary.

Kämpfer	Visiting Japan 300th Anniversary and Exhibition (1990–1991)
Thunberg	Visiting Japan 200th Anniversary and Exhibition (1978)
Siebold	Exhibition for 150th Anniversary of the National Museum of Ethnology and 380 Years of Friendly Relations between Japan and the Netherlands (1988)
	100th Anniversary of the Birth of Siebold
Yokusai Inuma	200th Anniversary of the Birth
Koishikawa Botanical Garden	300th Anniversary of Establishment (Medicinal Plants Garden of Edo) (1984)
Jyo Tanaka	The Report of Survey on the Vegetation Zone of Japan (1885)
	The first physical geographer in Meiji Era based on the forest vegetation zonation.

etc.). His study was based on Clements’ “Plant Succession and Indicators” (1928). Thereafter, H. Nakano’s “Grassland Research” (1944), and Numata’s “Ecology of

Grasslands and Bamboolands of the World” (1979) were written.

After World War II, the Agriculture, Forestry and Fisheries Research Council was es-

Table 3. Botanists in Japan and R.D.B.

Yoan Udagawa (1798–1846), the first botanist, and wrote a book on botany (1822).
Ranzan Ono (1727–1810), a true herbalist and botanist, and he was a botanist rather than herbalist.
He wrote "The Outline of Honzo Komoku for the Beginners, 48 vols." He collected plants with many students from the viewpoint of botany which was continued to Tomitaro Makino.
Jyo Tanaka (1885) in the Meiji Era. In his report, the forest zone was discussed in relation to horizontal geography, altitude, isothermal line, tidal current, etc.
Seiroku Honda (1900, 1915) developed Tanaka's result.
Motoo Oseko (1937) made basic survey on semi-natural grassland on fire, fertilization, shade, grazing, etc.
Results of IBP: Handbook for Nature Conservation (1976)
Convention on Biodiversity (1992)
For species: Extinct, Endangered, Vulnerable, Rare, etc. (Red Data Book for Plant Species, 1989)
For Plant Communities: Disintegration, Protection-bad, not so good, partly good, good, partly bad, good (Red Data Book for Plant Communities, 1996)

tablished, and this body planned to survey the true productivity of Japanese pastures and meadows. The country was divided into northern, central and southern parts, and mainly vegetation and soil of semi-natural grassland were studied. From 1957 to 1958, a survey on the actual conditions of pasture and meadows throughout Japan was conducted by the Ministry of Agriculture and Forestry. Numata (1969) described progressive and retrogressive gradients of grassland vegetation measured by the degree of succession. Before this, the Grassland Ecology Research Group was established in 1962, the IBP (International Biological Programme) was started in 1964, and "JIBP Synthesis" Vols. 1–20 were completed in 1975. Among the "JIBP Synthesis", Vol. 8: Vegetation and Its Conservation, Vol. 9: Animal Communities, and Vol. 13: Ecological Studies in Japanese Grasslands with Special Reference to the IBP Area are related to the subsequent RDB. Among the 7 sections of the IBP, one is CT (Conservation of Terrestrial Communities) which is related to the RDB. The "Handbook to the Conservation Section on the International Biological Programme" (E. M. Nicholson, 1968) describes the selection and surveying of areas, assessment of conservation requirements for rare and threatened species, the scientific basis for the protection of areas and species, herbivore-vegetation-soil studies, uninhabited islands, check sheet surveys, and conservation of aquatic ecosystems. With regard to Japanese CT activities, the "Handbook for Nature Conservation"

(Numata, 1976) lists plant communities, plants and animals important for conservation in relation to the RDB (Table 3).

In the same year as the United Nations Conference on the Human Environment at Stockholm, the Man and the Biosphere (MAB) Programme and the World Heritage Convention initiated a new plan. In the MAB, a new type of Biosphere Reserve with a core area, a buffer zone and a transition zone was designated. In Japan, only 4 Biosphere Reserves are designated: Yakushima, Shiga Heights, Hakusan National Park and Omine-Odai National Park. However, these are not representative of Japan. With regard to the World Natural Heritage, the Shirakami Mountains and Yakushima were first designated. On the other hand, there are other different nature reserves in Japan, including Natural Monuments (Ozegahara Moor, etc.) designated by the Cultural Agency, Special Nature Reserves of National Park designated by the Environmental Agency, and Forest Ecosystem Conservation Areas designated by the Forestry Agency (e.g. the virgin beech forest in the Shirakami Mountains).

Compilation of a RDB of Plant Species and Communities in Japan

Recently many researchers have been focusing on biodiversity. At the UNCED or "Earth Summit" at Rio de Janeiro in 1992, the Convention on Biodiversity was finalized, and administrators as well as scientists discussed measures that might be effective. The Nature Conservation Society of Japan

Table 4. Red Data Book of plant species.

Flowering plants and ferns in Japan	
Total	5300
Extinct	35
Endangered	147
Vulnerable	677
unknown	36
	} 895/5300 = 17%
Rare	272/895 = 30.4%
Reckless collection	254/895 = 28.4%
Land development	387/895 = 43.3%
New R.D.B.	on Plant communities
	on Plant community complexes
	on Landscape
	on Habitat
They are mainly included in;	
National Parks	
Biosphere Reserve (core, buffer, corridor)	
Natural Heritage	
Biodiversity Convention	
Forest Ecosystem Conservation Area	
Natural Monument	
Wilderness Area	

(NACS-J) published the "RDB of Plant Species" in 1989 in collaboration with the World Wide Fund for Nature, Japan Committee (WWF-J). It was then planned to publish a "RDB of Plant Communities" as a continuation of the former one. However, an enormous amount of data had to be obtained, and 7 years were needed for completion.

The Japanese Archipelago is located in the temperate zone of mid-latitude, and has a prominently rich flora. There are 5300 wild species of higher plants (spermatophytes and pteridophytes), of which about 1800 (34%) are endemic. These wild species have evolved through adaptation to the diverse habitats found in the Japanese Archipelago. Recently, however, due to rapid economic growth, habitat destruction has occurred on a wide scale, and a large number of species are now threatened.

With regard to the ranking of species important for conservation, the following five categories have been designated: 1. Extinct species, 2. Endangered species, 3. Vulnerable species, 4. Rare species, and 5. Unknown species. Under the Committee for Research on Plant Species and Plant Communities Important for Conservation, the Plant Species Subcommittee investigated the actual circum-

stances of endangered species for three years, and concluded that 17% of all Japanese wild plants (895 species) are threatened (Table 4). If we do not try to protect and conserve these endangered species, they will eventually become extinct. However, the response of the government to the conservation of species has come very late.

Japanese wild plants are an important element of the natural environment. The importance of wild plants as a potential genetic resource is stated widely, and Japan in particular has reason to value the resources it holds. Therefore appropriate countermeasures must be implemented without delay.

Japan made up of 5 major islands and 5000 islets spread from north to south in the mid-latitude region, and the steep and complex geomorphology is occupied by a large and varied flora. All organisms including humans exist in close proximity with physiotores and biotopes. As a result of this relationship, extinct species are increasing with the rapid extension of human activities. Rapid harmonization of human activities and conservation of the natural environment is an urgent priority. To conserve biodiversity, habitat conservation is necessary. This means maintaining the original relationships of the life histories of all species. The Red Data Book lists endangered species communities, landscapes and habitats. At first, we published a book entitled "Present State of Important Species for Conservation" (1989). This species problem is closely related to the community problem.

In the RDB of plant communities (Table 5), natural plant communities including climax communities as well as artificial and early communities in succession will include many plant communities that are important for conservation. However, a common plant such as *Pulsatilla cernua*, widely distributed in light pasture, is endangered. Mt. Sanbe, Shimane Prefecture, once had beautiful grassland for grazing of beef cattle, but *Zoysia japonica*, which was common in this grassland, has disappeared due to the decline of pasture grazing. *Eupatium chinense* was a very common species, but it is now endangered. *Lespedeza bicolor*, *Miscanthus sinensis*, *Pueraria lobata*, *Dianthus superbus*

Table 5. RDB of plant community and plant community complex in Japan.

Single plant community	6259	} 7492
Plant community complex	1233	
Urgent measure needed		
single plant community	185	(3%)
plant community complex	125	(10%)
Any urgent measure is desired not to become worse		
single plant community	2195	(35%)
plant community complex	853	(69%)
Disintegration		
single plant community	103	(2%)
plant community complex	49	(4%)
Bad or poor		
single plant community	806	(13%)
plant community complex	384	(31%)
Under legally protected		
single plant community	381	(6%)
plant community complex	94	(8%)

Table 6. The idea of conservation.

Protection	Conservation
Don't touch	Keep harmonial state of man and nature
If trees fallen keep things intact	Carrying out fallen trees in some case
No herbicide	Use pesticide limitatively in some case
No insecticide	
Maintain the structure and functions of an ecosystem	Rational and wise use of nature and natural resources
Keep the carrying capacity of species composition	Keep the carrying capacity of natural sustained yield

var. longicalycinus, *Patrinia scabiosaefolia*, *Eupatorium fortunei* and *Platycodon grandiflorum* are the so-called "seven autumn flowers", and are common species of *Miscanthus sinensis* meadows which are used for "moon-viewing" parties under the full moon in September. (Some of these species are also endangered because of the decrease in these meadows.)

There are two views about the plant community: quantitative plant ecology (Pflanzen-gemeinschaft) based on a quantitative standpoint with regard to dominance, and plant sociology (Pflanzengesellschaft) based on a qualitative standpoint (fidelity and characteristic species). Plant species are located ecologically and conservationally from the above two standpoints. In addition, when compiling a RDB of plant communities, each plant species and plant community must be represented in terms of conservation (Table 6), biodiversity (Table 7) and importance. Importance for conservation indicates the ur-

gency of conservation (Table 8), vulnerability to human influence, speciality and rarity of plant communities, and on the other hand, representative and typical habitats and communities, and their importance scientifically. "The Research Committee on Plant Species and Plant Communities Important for Conservation" was established in 1986 and published the "Red Data Book on Plant Species" in 1989. The Plant Communities Subcommittee completed the "RDB of Plant Communities" in April, 1996 with the cooperation of researchers all over the country. There are two important points here: one is to survey simultaneously as many plant communities as possible; the other is to classify and quantify of information such as impact, protection and management, for each community (Table 9). This was our first experience of quantifying and summarizing such information.

Table 7. 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.

In terms of quality in biodiversity of
poisonous organisms,
pathogenic bacteria,
insect pests,
parasites,
weeds.

Maintaining biodiversity

In situ 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.

Ex situ conservation:
seed banks,
germplasm collections (gene banks),
botanic gardens,
zoos.

Table 8. Urgency and necessity of protection.

1. Countermeasures-urgent and necessary
2. Countermeasures-necessary
3. Disintegration-endangered for all
4. Disintegration-partly endangered
5. Warning and Attention

The Red Data Book does not cover all the data completely. If some data are not described in the RDB, they must not be used as an excuse for development. Also, some unscrupulous individuals might use the RDB to find invaluable species or communities. Therefore the RDB must be used in a responsible way, and not abused.

Use of the RDB

The ranking of plant communities is based on their conservation and management. The Red Data Book lists those plant communities which require urgent protection and conservation in Japan. The survey has been carried out on the basis of two categories: the "plant

Table 9. Protected and managed state of plant communities.

1. Disintegration
2. Protection-bad
3. Protection-not so good, partly good
4. Protection-good, partly bad
5. Protection-good

In addition to this, factors that impact plant communities, appropriate measures to prevent community disintegration, and conditions in the areas surrounding plant communities were carefully described.

community", which is composed of a single homogeneous community, and the "community complex" in which a mosaic of more than one plant community is integrated. The survey was started in 1990, and the data were finally checked in December 1993.

As a result of the nationwide survey, a total of 7492 plant communities including 1233 community complexes were sampled, and urgent measures needed for protecting and conserving them were suggested. Communities with the highest urgency rank of "in danger of destruction unless urgent measures are taken immediately" numbered 185 (5% of all single plant communities) and 125 "community complexes" (10% of total). These were followed by communities for which some measures are expected to be taken immediately to protect them from "being further aggravated": 2195 plant communities (55% of all single communities) and 853 community complexes (69% of the total). This clearly confirmed that nationwide protective control measures should be instituted quickly for plant communities. Plant communities judged to be "in the process of destruction" (disintegration) include 103 areas of forest and wetland vegetation and 49 wetland community complexes. When the "poor" and "bad" categories are combined, they include 806 "plant communities" and 384 "community complexes".

Factors affecting these communities are, in order of importance, "invasion by humans" (such as treading, secret collecting and gathering trees, etc.), followed by "agriculture and forestry development" (deforestation and afforestation), "natural disasters" (typhoons, aridity, etc.), "road construction", and "dispos-

Table 10. 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. agriculture, fishery, 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	

al and discharge of pollutants" (garbage, waste, domestic waste water).

In addition to this, factors that impact plant communities, appropriate measures to prevent community disintegration, and conditions in the areas surrounding plant communities were carefully described. For example, with regard to the urgency and necessity of protection, communities were classified into the following five categories; 1. Countermeasures-urgent and necessary, 2. Countermeasures-necessary, 3. Disintegration-endangered, 4. Disintegration-partly endangered, 5. Warning and attention (Table 8). The Red Data Book does not cover all the data completely. If some data are not described in the RDB, they must not be used as an excuse for "development". Also, some unscrupulous individuals might use the RDB to find invaluable species or communities. Therefore the RDB must be used in a responsible way, and not abused.

This article has thus focused on biological diversity (Table 4) and its conservation (Table 6), from the very early herbals of ancient times to recent local flora, and the Red Data Book. With regard to nature conserva-

tion, the nomination and listing of threatened plants and plant communities, and appropriate countermeasures against their destruction have been considered. The most important principle for biodiversity and conservation is ecosystem sustainability, particularly sustainable utilization or management (Table 10). The sustainable development proposed at the UNCED (1992) should be criticized on this basis.

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生物多様性と自然保護

——本草書からレッドデータブックへ——

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現在注目をあびている生物多様性と自然保護の問題を、わが国の歴史における、古く中国や韓国から輸入された本草学から、自然誌学、ひいては植物の種や植物群落のレッドデータブックに至る流れの中から考察しようところみだ。

古くは中国や韓国の本草学がとり入れられたのは650-730 A. D. といわれるが、唐時代に新しく編集された李時珍の本草綱目はわが国の本草学にも最も大きな影響を与えた。わが国ではこれを単に翻訳するだけでなく、自らの考え方や見解を加えた大和本草(貝原益軒)をまとめた。徳川時代には鎖国していたのでオランダのみに門戸を開く形となり、Kämpfer, Thunberg, Siebold が日本の自然を調べて、西欧諸国に紹介した。明治時代になって鎖国をといてから、新しい研究者がつぎつぎと生まれ、諸外国との交流が増大した。

宇田川榕庵は19世紀初期の植物学者であり、「一般植物学」(1822)の最初の著書(「はたにかきょう善多尼訶経」)がある。伊藤圭介はシーボルトの塾に学び「日本植物図説」(1874)の著がある。20世紀後半になると地方植物誌が出はじめ、われわれも「千葉県植物誌」(1958)をまとめ、その増補改訂版(1975)を出した。このような植物誌がそろうようになって、それらをベースとして「日本における植物種のレッドデータブック(我が国における保護上重要な植物種の現状)」が準備された(1989)。さらに引きつづいて植物群落のレッドデータブックもまとめられるに至った(1996)。