National Biodiversity Strategy

REPUBLIC OF KOREA

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1997

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PREFACE

The Republic of Korea-has been blessed with an abundance of extraordinary plant and wildlife in addition to its beautiful natural environment. It is the present generation's mission to pass this rich biological diversity onto our descendants, and to contribute to its conservation and sustainable use.

The value of "Biodiversity", defined as the diversity of genes, species, and ecosystems, lies in the fact that it provides many of the necessities required for human welfare. In addition to maintaining ecological balance, it also supplies raw materials for food, clothing, housing and industrial products.

Despite its importance, however, the number of living organisms and species is rapidly declining due to accelerated urbanization, industrialization, and environmental pollution. Such reductions in biological diversity represent not only the loss of natural resources, but also the erosion of inhabitable land. Therefore, it is essential for Korea's future as well as that of humankind to curb reckless development that results in the mass destruction of biological resources and diversity.

As a responsible member of the global village, the Republic of Korea has been actively participating in various international environmental conservation programs. In this vein, the Republic of Korea acceded to the Convention on Biological Diversity in October 1994 for the conservation and sustainable use of biological diversity. And in accordance with the provisions of the Convention, the Korean government recently formulated a long-term National Biodiversity Strategy (NBS) to ensure the systematic management of Korea's biological diversity.

The formulation of Korea's NBS involved numerous public hearings and review meetings organized by the National Biodiversity Committee, whose members were drawn from related government Ministries, research institutions and several non-governmental organizations (NGO). A final draft of the NBS was submitted to and approved by the National Cabinet Council, the top governmental decision making body.

The NBS reflects the Republic of Korea's strong commitment to the objectives of the Convention on Biological Diversity, and is part of the Korean government's ongoing effort to implement policies that ensure the conservation and sustainable use of Korea's biological assets.

I hope that the unveiling of Korea's National Biodiversity Strategy will simulate the active exchange of information pertaining to the conservation of biological diversity here at home and abroad.

1997. 12

Minister of Environment,
The Republic of Korea

Yoon, Yeo-Joon

Introduction

1. Background

■ Threatening biological diversity in Korea due to rapid industrialization and urbanization that cause the destruction of habitat and increase of pollution

. Increased awareness for ecologically sound environment to country that hands down to our descendants

. Increase of a people's desire to sound environment. endemic fauna and flora In coincidence with to the increase of per capita GNP

. Strengthening global activities for protecting the loss and extinction of wild fauna and flora since the UN Conference on Environment and Development in 1992 -

- Globally, careless exploitation and pollution cause rapid loss of biological diversity. and MIS is expected to threaten eventually the survival of mankind

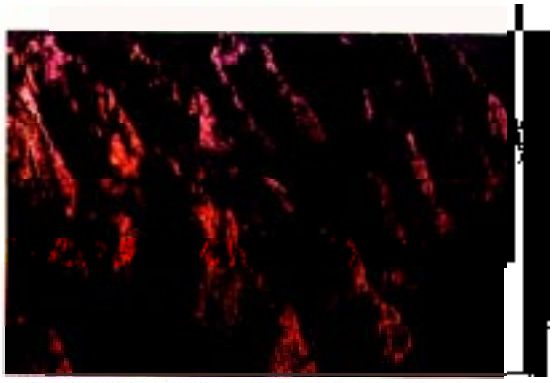
. Increasing competition for securing biological resources in th 21st century

- Competition among nations for securing biological resources that con be used as row materials for genetic engineering as the genetic engineering industry develops

. Urgent need for establishing a national strategy to accommodate the Convention on Biological Diversity

- After the Convention on Biological Diversity. biological resources ore regarded as the property of a nation. and this deeply influences international exchange. A strong national strategy should be established for the effective management ot biological diversity to the mutual use of resources for the country

Earth for various kinds of living organisms (Recently, increase of CO_2 and decrease in biodiversity have degraded environment on earth)



Topography of mountainous regions in Korea

Crow Tit (*Paradoxornis webbiana*)

2. Outline of the Action Plan

1) Objectives

- Establish a national management system for conservation of biodiversity
- Establish sustainable use system for biodiversity
- Strengthen research capabilities to manage biodiversity effectively

2) Guiding Principles

- Biological diversity and productivity of the earth should be conserved for the common benefit and be utilized sustainably for the present and future generations
- Ecological diversity should be balanced and harmonized with the national land development
- Particular genetic, wild fauna and flora should be protected, and biodiversity, ecosystems, and natural scenery should be preserved
- All citizens should participate in the conservation of biodiversity and sustainable use
- Burdens and benefits of biodiversity conservation should be equally divided
- International cooperation should be promoted for biodiversity conservation and sustainable use

3) Fundamental Strategy

- Raise people's awareness of the value of biological resources
- Improve legislation and instutional arrangements to enforce national biodiversity strategies effectively
- Enhance national capacity to manage biodiversity
- Pursue national policies for the ecologically sound and sustainable utilization of biological resources

4) Basic Framework for Implementation

- Establish an environmentally friendly land management system
- Introduce a national land use management system corresponding with an area of classification in order to protect the natural environment from destruction and conserve biodiversity
- Strengthen the enabling capabilities for surveying,

researching. [illegible]

. Strengthen [illegible] for [illegible] use and [illegible]

■ Strengthen [illegible] system between the [illegible] governments [illegible]

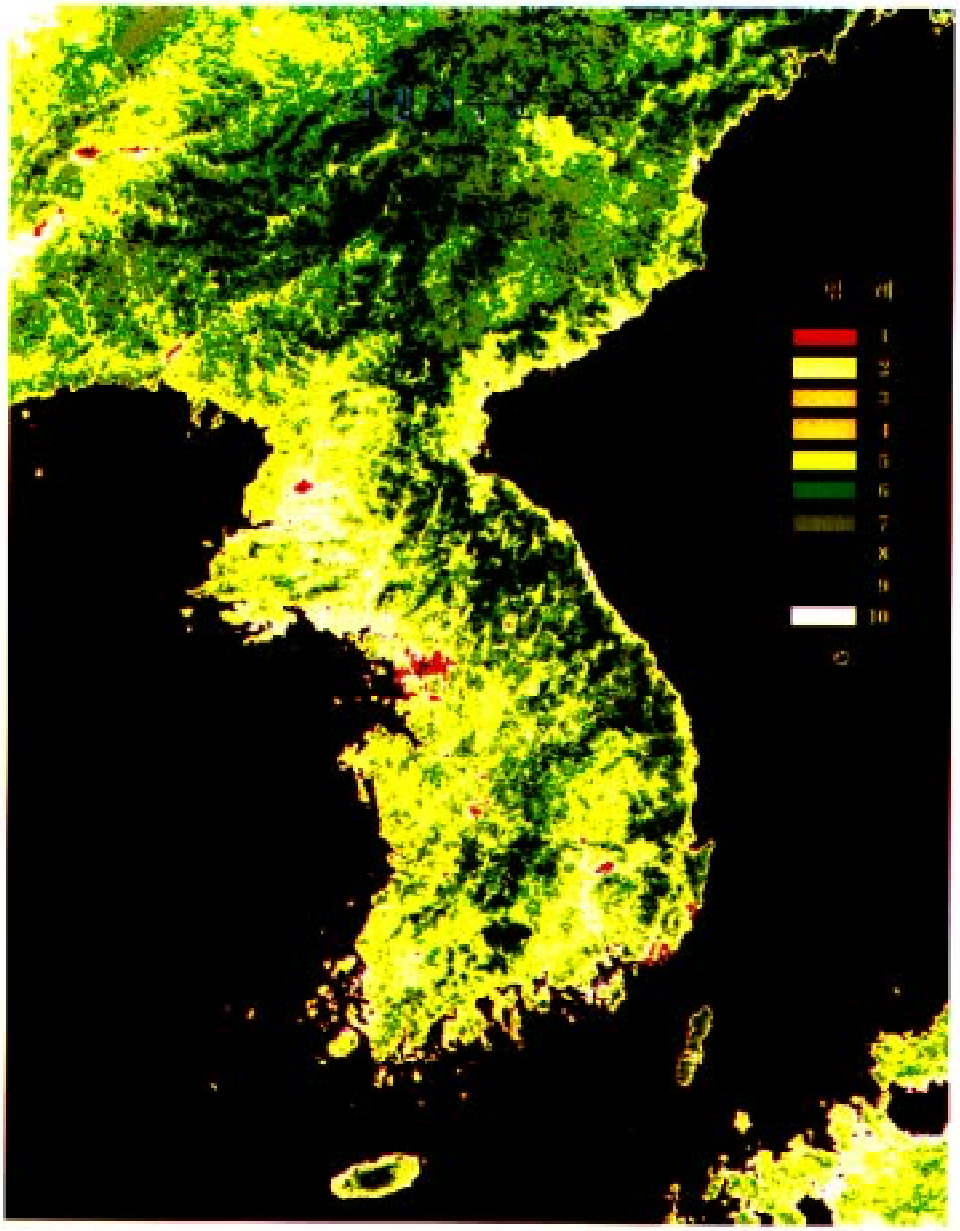
■ [illegible]

■ Encourage genetic [illegible] safety

. [illegible] and [illegible] of [illegible] diversity

. Strengthen support [illegible] with [illegible]

Mt. Seolak National Park



The vegetation index of Korea Peninsula

Overview of Biodiversity Base in Korea

1. Background

1) Physical Characteristics

(1) Topography and Geography

The Korea Peninsula is located between 33°06′ and 43°00′N and has a typical temperate region. The average land elevation is 420m with mountainous characteristics. Coastal areas are connected to a continental shelf and have a diversified geography. The size of the entire Korea Peninsula is 221,000 ㎢ and South Korea is 99,600 ㎢ (45%).

The mountainous area in the Korean Peninsula reaches over 70% of the total land mass, and in the case of Southern part of Korea, 65% of land surface is occupied by mountain. This is one of the highest percentages of mountains in the world. Agricultural lands in the South cover 2,031,000 ㏊(20%), forests 6,455,000 ㏊ (65%), cities, lakes, streams, roads, industrial areas and the rest cover 1,451,000 ㏊ (15%). The Korea Peninsula is surrounded by oceans so the range of marine ecosystems is broad and biological diversity is relatively high.

The mountain ranges stretch into the north and east, and these characteristics affect inland streams. The coast line are approximately 17,000 ㎞ long (including islands), and the coastal areas of the east, west and south have distinct characteristics. Soils in forests are granite and gneiss, so most soils are brown forest soils.

(2) Climate

Temperature is influenced by the dry-cold winter from inland and by the humid-hot summer from the tropics. Average annual temperature is 12~14℃ in the southern region

[illegible]

[illegible] there is a 10% difference between the [illegible] and south. Average temperature in January is the coldest. In the southern region, over [illegible], in the central region below [illegible] on the Gaema plateau. [illegible] August is the hottest month at over 22°C with slight variations over the Peninsula.

[illegible] it is distributed unevenly. However, the Korea Peninsula is [illegible] and there is great seasonal variation in the amount of rainfall. The wet season during June-September contributes more than 60% of the annual [illegible]. The spring, [illegible] planting season, is characterized by unsettled variable rainfall that causes a high risk of [illegible] disasters, such as dry spells, heavy rains, typhoons, and floods, and cold spells. These conditions are disadvantageous for [illegible] crops.

Korea is [illegible] in the temperate deciduous forest zone, and [illegible] differences in temperature and precipitation cause natural disasters and [illegible] in granite areas and sometimes impede seedling growth and grassland formation.

2) Sociological Characteristics

Wetlands in the West coast (Tidal flats and estuaries are well developed in the West coastal region)

(1) Population

Population in the south reached 44,450,000 in 1994, with a population growth rate of 0.90%. The population is expected to be [illegible] in 2000 and 49,683,000 in 2010. It [illegible] as 0.78% of world population and 1.32% of Asian [illegible], ranking 25th in the world and 13th in Asia. The current [illegible] is 447 persons/km², that ranks 3rd in the world after Bangladesh and Taiwan. Over 85% of [illegible] reside in cities (over 20,000 [illegible]).

Table 1. Change of urban population by year

(unit: thousand person)

	1960	1970	1980	1990	1994	2001
Cities[1]	9,784	15,750	25,738	35,558	37,427	41,639
Rural	15,205	15,685	11,711	7,382	7,023	5,511
Total	24,989	31,435	37,449	43,390	44,450	47,150
Urbanized rate(%)[2]	39.1	50.1	68.7	81.9	84.2	88.1

[1]over 20,000 population [2]population rate. Source: The 3rd revised land integrated development plan (1997, KDI)

(2) Economy and society

The economy of Korea has increased from 8.1 billion dollars(1970) to 376.9 billion dollars (1994), an increase of 17% annually. Per capita GNP has increased even faster, from 252 dollars(1970) to 10,000(1995). Total trade jumped from 2.82 billion dollars (1970) to 201.7 billion dollars(1995), and total export volume was over 100 million dollars in 1964, 1 billion in 1971, 10 billion in 1977, and over 100 billion dollars in 1990.

Table 2. Change of total economy by years

year	1970	1975	1980	1985	1990	1995
GNP (0.1 billion)	81	209	605	897	2,422	4,516
GNP per capita (dollar)	252	594	1,592	2,194	5,659	10,076
Total trade (0.1 billion)	28.2	123.5	397.9	614.2	1,348.6	2,017.7

Source : Environmental Vision (1996, Ministry of Environment)

Before the 1960s Korea remained an uncivilized agricultural economic society, and per capita GNP was only 80 dollars; however, after 1962 in the process of industrialization and

urbanization, due to the government's 5 year economic development plan, [illegible] made in infrastructure and social welfare system

Due to [illegible] and medical system, life expectancy rose from 50 to 72 years. Public education was improved: the middle school enrollment rate increased from 40% in early 1960s to very close to [illegible]

Due to the rapid economic growth, development pressure on [illegible] environment [illegible] whereas people's desire for natural environment increased.

Parks,outskirts of Seoul (Korea is one of the fastest growing countries in economy)

2. Biodiversity

1) Major Ecosystems

(1) Forests

Forests in South Korea constitute 6,456 thousand ㏊ (65%) of a total of 9,939 thousand ㏊. 6,274 thousand ㏊ (97%) of forest consist of planted trees, and denuded areas are limited to only 182 thousand ㏊ (3%). Privately owned forests cover 4,578 thousand ㏊ (71%); national forests 1,386 thousand ㏊ (21%), and public forests 492 thousand ㏊(8%). In the composition of tree species,coniferous forests cover 2,894 thousand ㏊(46%); deciduous 1,673 thousand ㏊; mixed forests 1,722 thousand ㏊.

The biomass of forest was 308,826 thousand㎥ in 1995, or 48㎥ per ㏊. The accumulation of coniferous trees was 122,832 thousand㎥ (45%); deciduous trees 77,112 thousand㎥; mixed trees 72,442 thousand㎥. Eight-one percent of the accumulation of coniferous forests was 11-30 year old planted trees, while 43% of deciduous forests were 21-30 years old trees. In mixed forests, 79% of the trees were composed by 11-30 years old planted trees. In summary, forests in Korea are characterized by young trees under 30 years old, and the major species are coniferous trees.

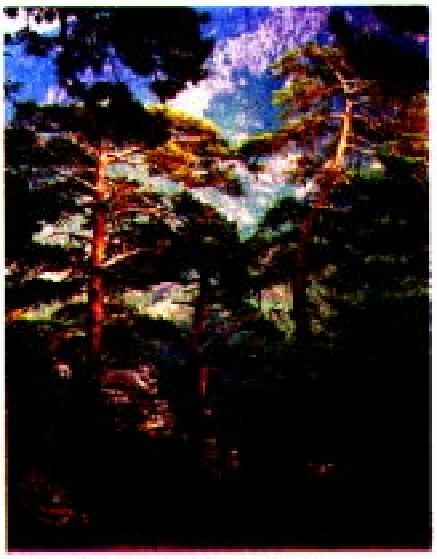
Coniferous trees in mountainous regions (Natural and geographical beauty in Korea are most attributed to characteristics of mountains)

Table 3. Change of forests in Korea

Classification	Before plantation (1972)	During plantation (1987)	Forestry resources(1995)
Accumulation per unit area (㎥)	11	31	48
Trees under 20 years(%)	85	83	56
Planted forests(%)	14	29	32
Recreation forests (no.)	-	-	51
Forest bath (no.)	-	-	13
Arboretum, Forest museum (no.)	-	1	10
Forest erosion control (㏊)	6,263	1,535	291

Source : The 4th Forest Basic Plan (1997, Forestry Administration)

The parental rock of forest soils is granite-gneiss, which is easily wind-eroded, and mountains are steep. Over half of the annual precipitation is concentrated in July-August, causing soil erosion that possibly denudes forests. Furthermore, exploitation or overharvesting due to war, slash and burn farming and natural disasters aggravated forest degradation. However, since the 1962 Forest Erosion Control Law has been entered into force, and the green plantation campaign of 1973-87 contributed to tree plantation on a large scale, the number of trees in recovering denuded areas has increased.



Red pine (*Pinus densiflora*), Korea's representative tree

Forest Zones in the Korea Peninsula

While Korean forest vegetation like oaks, maples, and hornbeams belongs to temperate deciduous forests, coniferous pine trees are distributed over the largest areas as a single species. However, evergreen deciduous trees grow in the coastal areas of south and the islands, and taiga coniferous trees grow in alpine and northern regions.

◇ Warm forests : evergreen deciduous forest zone

Warm forests are south of 34° N, especially in coastal areas of south of 35° 30′ that average over 14°C annually. A narrow coastal zone and low areas in Cheju Island and the southern islands are included in this zone.

○ Characteristic species are :

- evergreen deciduous trees : Common camellia (Camellia japonica), Oak (Quercus myrsinaefolia), Sloumi (Daphniphyllum macropodum), Japanese pittosporum (Pittosporum tobira), Chestnut (Castanopsis spp.), Hazel (Distilium racemosum), Japanese eurya (Eurya japonica), Japanese coral tree (Viburnum awabuki), Camphor tree (Cinnamomum camphora), Machilus camphor tree (Machilus japonica), Machilus (M. thunbergii), Japanese aucuba (Aucuba japonica), and Mochi tree (Ilex integra)
- broad-leaf deciduous trees : Japanese bead tree (Melia azedarach)

Community of oaks (*Quercus mongolica*) (Korea belongs to temperate deciduous forests in vegetation classification)

◇ Temperate forests : broad-leaf deciduous tree zone

Temperate forests are distributed in less elevated areas between 35° 0' -43° 20' N excluding high mountains and plateaus. Average annual temperature ranges from 5-14℃. Oaks predominate, and the dominant species are the Oriental chestnut oak (Quercus acutissima) in the south, and the Mongolian oak (Q. mongolica) in the north. However, the distribution of oaks is well connected into areas that produce mixed species.

○ Species that characterize in this zone are : Oaks (Quercus spp.), Loose flower hornbeam (Carpinus laxiflora), Japanese maple (Acer palmatum), Korean ash (Fraxinus rhynchophylla), and Korean beech (Fagus orensta). Among them, Korean beech only is identified on Ulleung Islands (not in the Peninsula).

① Southern temperate zone : Temperate forests occupy over 85% of all forests in Korea. The southern temperate region ranges from 38° N (south of Kangneung) in the east, 36° N in the south, 37° N in the west (south of Chungnam Province).

② Central region of temperate zone : 40° N on east coast (south of Hamnam), 38° N in the central region (Kyunggi, Kangwon, and Hwanghae provinces), and 39° N on west coast (south of Pyungnam province).

③ Northern temperate zone : North the central region, excluding high elevations in the Pyungan and Hamgyung provinces

Community of coniferous trees representative in the sub alpine region (Kangwon Province, Mt. Sobaeng)

◇ Cold forests : evergreen coniferous tree zone

Cold forest zones include plateaus in north Korea and areas of high elevation

○ Species representing this zone are:

- Yeda spruce (Picea jezoensis), Needle fir (Abies nolophylla), Korean pine (Pinus koraiensis), Manchurian fir (A. nephrolepis), Japanese stone pine (Pinus pumila), and Japanese yew (Taxus cuspidata) as evergreen coniferous tree species; and Prince Rupprecht larch (Larix gmelini) as deciduous coniferous tree species.

(2) Agricultural fields

The agricultural fields is 2,031 thousand ha, 20% of total landmass of Korea. Rice fields with constant water condition during harvest season are 60% of the total fields. In the south most fields are used for rice planting, excluding areas of winter crops (wheat and barley) and double rice harvest. Although it is possible to harvest corn, minor grains, vegetables and fruits, in ordinary fields annual harvest rate in Korea is only 108% as a whole.

Traditional agricultural paddies in Korea (Kangwon Province)

Agricultural families and total agricultural population are decreasing. In 1967 it peaked in 2,587,000 agricultural families with 16,078,000 people, and since then it has continued on declining. At the end of 1996, there are 1,480,000 agricultural families, a 1.4% decrease compared to 1,501,000 at the end of 1995. People in agriculture number 4,692,000, a 3.3% decline from 1995.

32~42% of rice and ordinary soil are normal, but sandy silt soil and immature soil also account for 41~55%. Sandy silt soil is low in absorption and high in perforation. Immature soil is low in productivity and physio-chemical quality because of new cultivation. The acidity of soil for rice, ordinary crops and grasslands is relatively high ranging between pH 5.3~5.5.

Agricultural fields in Korea are declining due to the development and re-zoning of lands for industry. Increased use of pesticides, fertilization, mono-cultures, and machinery has contributed to the loss of biological organisms that reside in rural areas.

(3) Freshwater

<Lakes and marshes>

There are only few number of natural lakes in Korea

The Plain of Naju and Youngsan river (Eastern part of Korea is mountainous, and western part is a plain)

and they are small in size. Since surveys and research on natural lakes incomplete, it is recommended that these lakes be preserved because of the abundance of biodiversity and scientific value as habitats for endangered wetland species and bottom fossil organisms.

Man-made reservoirs in Korea are mostly for flood control, securing municipal water supplies, and reservoir construction. Soyang, Chungju, Andong, and Daechung Reservoirs are newly constructed dams that have led to major changes in the ecosystem and animals living in previously non-existent deep-water habitats Biological surveys have been conducted in 207 reservoirs of 10,000 plants, animals and plankton

Submergent vegetation in wetlands (surroundings of Tamjin river)

<Streams>

Due to topographical features, large streams leading to the Southern Sea and West Sea run slowly, streams leading to the East Sea run quickly. There is a radical seasonal variation of running water due to differences of precipitation in summer and normal times.

Stream ecosystems are extremely disturbed because of 1) physical changes in streams (e.g., dam construction, dredging, pebble exploitation in river bank development, overutilization of stream water for water supply), and disturbance of surrounding areas (tree removal by forest fire, slope land cultivation, wetland reclamation), 2) chemical changes in streams (e.g., water pollution from factories, household sewage, farm wastes, and oil spill) 3) biological changes by introduced species such as bluegill, bass and giant bull frogs.

<Estuaries>

Estuarine ecosystems are degraded due to various pollutants from inland. In this area rich biological diversity (saltwater-freshwater) forms an ecotone that provides various habitats for freshwater, mixed, and seawater organisms

Recently, estuarine ecosystems has undergone a chanine from mixed water systems to closed freshwater system due to dam and crossboard construction.

<Other inland wetlands>

Major onshore wetlands are classified based on location: lake-nearby wetlands, stream-nearby wetlands, and alpine streams. In Korea, there is a lack of lake-nearby wetlands due to man-made lakes causing changes in surface levels. However, wetlands near big-rivers (e.g., Woopo in Nakdong River) are relatively well maintained due to the difficulty of filling in lakes. Korea joined the Ramsar Convention in recognition of an increased concern to preserve wetlands, and Yong Marsh on Daeam Mountain was designated as a Ramsar site.

(4) Coast and marine areas

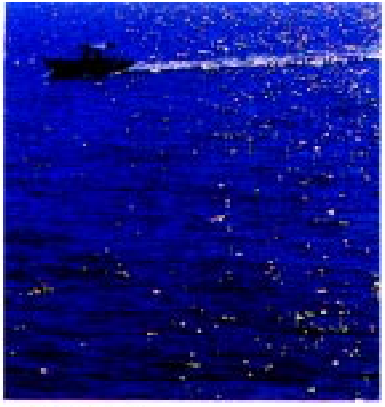
The three sides of national boundary are surrounded by seas, and the coastline is 11,500 km long (including islands). The eastern, western and southern coast lines are individually distinct: the East coast is steep, deep, simply shaped, and directly connected to the bottom of the sea due to Hamkyung and Taebaek mountains. However, sandbanks, sanddunes, sandponds are well developed along the coast lines and are characterized by special scene.

Contrary to the east coast, the south and west coasts are complex, and many islands are scattered around the shallow seas. Due to shallow water depth, tidal flats have developed, the continental shelf is distinctive and the tidal difference is large. The total area of continental shelf including tidal flats is 345,000 ㎢ comprising 3.5 times the entire land area. 80% of these areas are located in the west. Near the shallow sea, cold and warm currents meet, creating good conditions for fisheries.

In shallow seas, there tends to be a decrease in kind and number of fish species, and low average ages of fish population. This is mostly due to the reclamation of tidal flats, the destruction by hatcheries and growing

Taeland in the west coast (One of the five largest tidal flats in the world)

Living organisms in the tidal zone (Various environment in the coastal lines is important for biodiversity conservation)



East sea

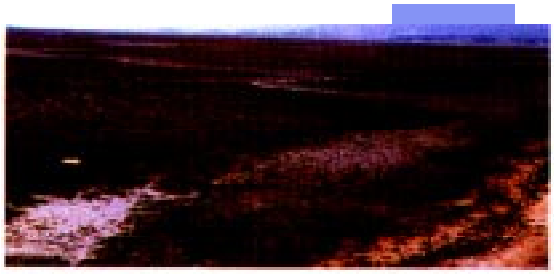
farms, various kinds of pollutants from inland, oil spills from ship wrecks, and over harvesting. The deterioration of the marine ecosystem is most apparent in commercial fish species and probably even worse in non-commercial species. A lack of knowledge for the marine ecosystem emerges a concern in marine environmental management.

Tidelands in Korea are well developed compared to others in the world, occupying 2.8% of entire country.

Table 4. Major characteristics of coastal areas in Korea

Classification	Current status	Remarks
Coastal areas governed by nation	447,000 ㎢	including 200 sea mile economic water zone, inland water, and far sea
Continental shelf	345,000 ㎢	3.5 times larger than entire inland areas
Far sea	71,000 ㎢	including inland water, 71.2% of entire areas of the Peninsula
Within 20m in depth	21,000 ㎢	29 6% of inland water, and far seg
Within 3 sea miles	13,000 ㎢	18 3% of inland water, and far seg
Tideland	2,815 ㎢	
Number of islands	3,153	464 excluding uninhabitable island
Entire area of nation	99,514 ㎢	122,800 ㎢ (north Korea)

Source : Marine handbook (1990, KOI), Control of Korea Administration District (1995, Control of Korea Administration District Published), Reviews of Island (1996, Ministry of Home Affairs)



Halophyte in the tidal zone of west coast (A rapid decrease of halophyte due to filling-in and reclamation)

Eighty-three percent of tidelands are distributed on the west coast and the rest on the south. Tidelands are shallow, and active in mater al changes due to ebb and flow being high in biological productivity. Due to periodic air-exposure, precip tation, high light exposure, rapid increases in temperature, and changes in salinity, animals that have adopted to -he conditions in this area represent a unique biota.

Tidal flats on the west coast are easy to fill" thereby causing short-sighted and careless development. which brings habitat degradat on due to the loss of hatcheries and growing sites for fishes

Table 5. Total tidal flat areas

Total areas	West coast	South coast	Remarks
2,815 ㎢	2,330 ㎢ (82.8%)	485 ㎢ (17.2%)	3% of entire country

source : Data of Marine Utilization Plan (1990, Ministry of Construction and Transportation)

(5) Islands

The total number of islands in Korea Peninsula is relatively high There are 3.153 464-inhabitable islands and 2.689-uninhabitable islands. They are extensively used as habitats and breeding grounds by rare biro species Many islands ore habitats for rare evergreen coniferous forests which are important for biological diversity conservation. However, systematic, scientific study of island ecosystems is limited to only a few islands and there will be an Increased deterioration of island ecosystems due to the various development plan

Uninhabited Maeng island (Conservation of uninhabited islands is important to rare species for habitat and migration)

2) Biological Species

Up to now a total 29,828 species are reported: 18,029 animals, 8,271 plants, 1,625 fungi, 736 protista, and 1,167 prokaryotes.

These animal species are relatively few compared with other countries with similar biogeography. The number of species is expected to increase through continuous survey and research.

Table 6. The current status of biological species in Korea

Phylum	Taxa	No. of species		Phylum	Taxa	No. of species
Animals	Vertebrates	Mammals	100	Plants	Higher Plants	Monocotyledons	842
		Fishes	906			Dicotyledons	2,815
		Amphibians · Reptiles	41			Ferns · Gymnosperms	314
		Birds*	394				
	Invertebrates I*	Porifera	204	Cnidaria	224	Bryophytes	691
		Platyhelminthes	123	Rotifera	159	Diatoms	1,512
		Acanthocephala	1	Entoprocta	1	Flagellates	316
		Bryozoa	145	Brachiopoda	9	Freshwater green algae	1,064
		Sipunculida	9	Mollusca	997		
		Annelida	380	Tardigrada	40	Charophytes	27
		Arthropoda	1,028	Chaetognatha	39	Marine algae	690
		Echinodermata	107	Urochordata	89		
	Invertebrates II*	Insects	11,853	Fungi			1,625
		Spiders	1,172	Protista			736
				Prokaryotes			1,167
Total 29,828 Species							

source : Literature survey of biological species in Korea (1996, Ministry of Environment). *: List of Animals in Korea (1997, The Korean Society of Systematic Zoology)

3) Threatened Biodiversity

Biological diversity in Korea is declining due to rapid economic development. The tiger and Siberian leopard are regarded as extinct, and the fox, wolf and sika deer are no longer observed. Amur goral, musk deer, otter, and Eurasian flying squirrels are endangered.

KACN (Korea Association for the Conservation of Nature) listed 179 species as extinct or endangered. Many of insects and other lower invertebrates are believed to be endangered, but the exact status is unknown due to the lack of research.

Loss of biodiversity is mostly due to overexploitation of land and resources, which causes the degradation of forests and natural ecosystems. Overexploitation of biological resources, environmental pollution and other reasons have complexly contributed to the decrease of biodiversity.

Table 7. Number of species by degree of endangered

Classification	Total	Extinct	Endangered	Rare	Declining
Total	179	6	43	110	20
Mammals	21	1	8	8	4
Birds	54	1	23	30	-
Amphibians, Reptiles	12	-	1	6	5
Fishes	29	1	3	18	7
Insects	24	-	1	23	-
Plants	39	3	7	25	4

source : Report of survey of Nature Conservation (1992), KACN)

Loss of endemic species in the country is high in agronomy crops for agricultural productivity. For example, the superior genes of dwarf wheat that allowed a 'green revolution' in the world because it would not fall over due to its height are endemic in Korea. However, it is now extremely difficult to find this species. Many other endemic species are disappearing from agricultural areas. Based on the survey of the Institute of Agricultural Science and Technology, 74% of endemic crops species in Korea were lost in the ten years following 1985.

Development of forest areas (Mt. Dukyoo)

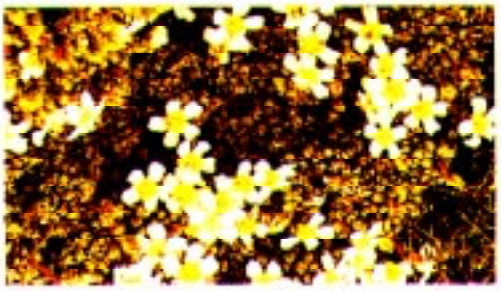
① Asian Black Bear (*Ursus thibetanus ussuricus*)

② *Phoca paigna*

③ Spoonbill (*Platalea leucorodia*)

④ Eagle Owl (*Bubo bubo*)

⑤ Japanese lady's slipper (*Cypripedium japonicum*)



⑥ *Diapensia lapponica* var. *obovata*

⑦ Long-horned beetle (*Callipogon relictus*)

⑧ *Abaria arataegi*

Endangered wild fauna and flora in Korea

3. Jurisdictional Arrangements and Legislation

Land use management in Korea is classified into **five categories based on land use: Cities. Semi-cities. Agro-forests. Semi agro-forests. and Natural environment conservation areas.**

Table 8. Classification of land use in National Land Management Law

Land \ Classification		Total areas (㎢) (%)	Terrestrial areas (㎢) (%)	Marine areas (㎢) (%)
Total		105.125 (100%)	99,697 (100%)	5.428 (100%)
Conservation use areas	Agro-forests areas	51.371 (48.9%)	51.371 (51.6%)	
	Natural environment conservation areas	11.808 (11.2%)	7.003 (7.0%)	4.805 (88.5%)
Conservation and development areas	Semi agro-forest areas	26.319 (25.0%)	26,319 (26.4%)	-
Development areas	City areas	14,564(13.9%)	13,975(14.0%)	589(11.2%)
	Semi-city areas	1,043 (1.0%)	1.029 (1.0%)	14 (0.43%)

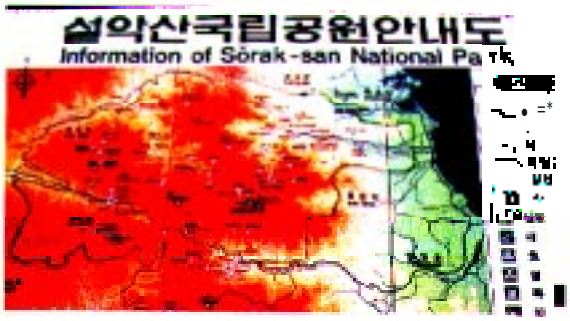
source : Report on land use (1997, Ministry of construction and Transportation)

Major conservation strategies for biodiversity conservation are **'Natural environment conservation area', 'Natural ecosystem conservation areas', Cultural monument protection districts(provincial monument protection districts)', 'Natural parks', 'Biosphere** Reserves', **and** Ramsar Convention designated wetlands for forests. 'Natural protection forests' ore designated for virgin trees, and 'Bird sanctuaries' for the protection of wildbirds.

Alpine wetland at Mt. Daeam (Ramsar registered area)

Table 9. current status of designation of protected areas in Korea

Name of protected areas	Related laws (appointed minister)	Objectives	Status of designation
Natural environment conservation district	Land Use and Management Law (Minister of Construction and Transportation)	natural scenery, water resources, ecosystem, cultural minument	areas ; 8,691㎢ (sea area 2,302㎢)
Natural ecosystem conservation district	Natural Environment Conservation Law (Minister of Environment)	Natural ecosystem conservation	8areas(99.8㎢)
Natural parks	Natural Park Law (Minister of Home Affairs)	Preservation of scenic areas and their proper use	National park ; 20 (6,473㎢) Province park ; 20 (7[illegible]㎢) County park ; 27 (239㎢)
Cultural monument protection district (Natural monument portection)	Cultural Property Protection Law (Minister of Culture and Sports)	Enhancement of people's culture through protection of national monument	282sites(693㎢)
Biosphere Reserve	MAB of UNESCO	Biodiversity and natural scenery protection	1 site (393㎢)
Birds/Mammalia protection district	Preservation and Game Act (Head of Forestry Administration)	Protection of wild birds and mammalia	507 sites(113,196㏊)
Virgin forest protection	Forest Law(Head of Forestry Administration)	Protection of virgin trees	134 sites (1,394㏊)
Reserved forest	Forest Law(Head of Forestry Administration)	Protection of water, natural scenery	1,975 ㎢
Ramsar convention district	Ramsar convention (Minister of Environment)	Wetland protection	1 site (1 ㎢)



Guide map of Mt. Seolak National Park

203 species of wild fauna and flora are protected by the 'Natural Environment Conservation Act (1991)'; all species of birds and mammals (476 species) by the 'Preservation and Game Act(1993)'; and natural monument species (124 cases) by the 'Cultural Property Protection Law(1982)'

The Korean government carries out a systematic natural survey every 10 years to protect and manage the natural environment based on "the Master Plan for Natural Environment Conservation."

Private organizations such as the Korea Association of Conservation of Nature (KACN), the KNCCN (Korean National Council of Conservation of Nature), and the Korea Association of Biological Diversity are participating in the study and research of biodiversity conservation. The Korea Association of Biological Diversity was founded in early 1994, and held a "Symposium and Open Discussion" in June of that year. In September of 1994, "A National Strategy for Biological Diversity Conservation in Korea" was published as a part of the biological diversity conservation research project.

Yong wetland in the alpine region (Natural Ecosystem Conservation Area)

Woopo wetland for various bird habitat (Natural Ecosystem Conservation Area)

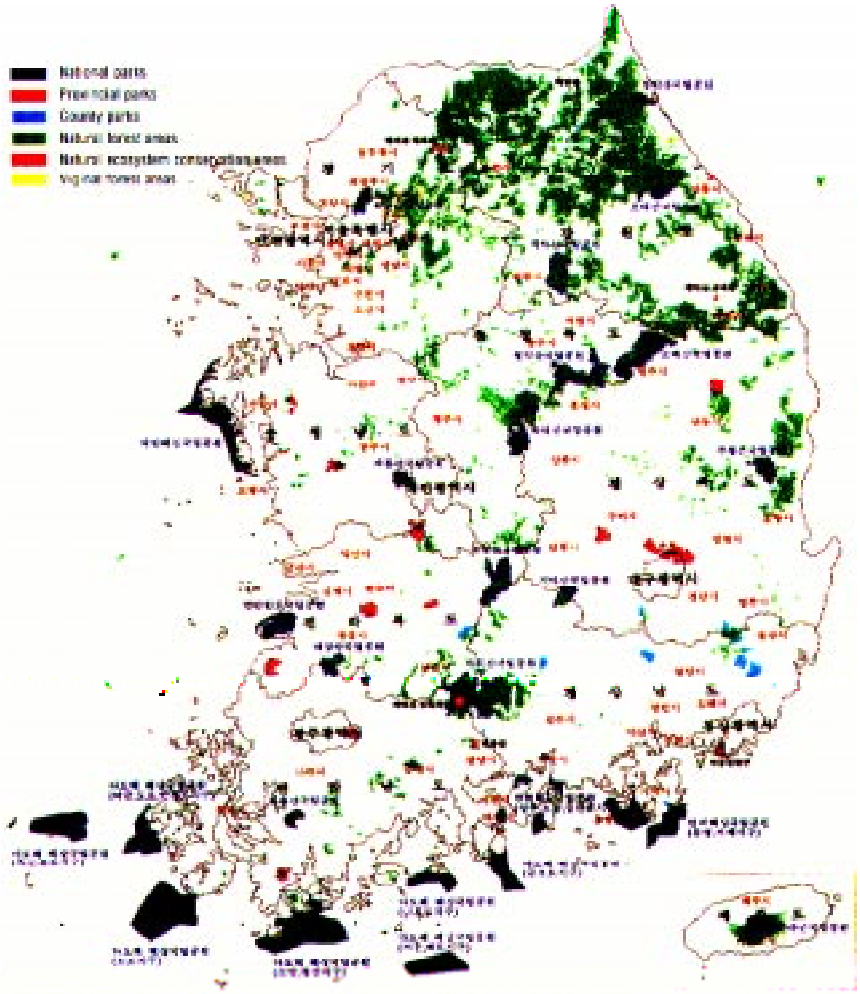
In Korea, the Environmental Impact Assessment (EIA) system was first introduced in 1977, and the system has been activated since 1981. In 1993 a special law for EIAs was enacted to promote specialization in EIA, in line with this, the Korea Environment Institute was founded in 1997.

Table 10. Current status of wild fauna and flora protected by laws

Ministry	Related laws	Number of species						
		Total	plants	mammals	birds	insects	fishes	amphibians, reptiles
Ministry of Environment	Natural Environment Conservation Law (Special wild fauna and flora)	203	126	-	-	31	24	22
Ministry of Culture and Sports	Cultural Property Protection Law (Natural monuments)	124	71	9	38	2	4	-
Forestry Administration	Preservation and Game Act(Wild Birds/Mammalia)	-	-	All species	All species	-	-	-

Table 11. Related ministry and laws for biological diversity in Korea

Ministry	Laws	Major contents	District and region	Conservation system
Ministry of Environment	Natural Environment Conservation Act	Special wild fauna and flora protection	Natural ecosystem conservation district	*in-situ, ex-situ*
Ministry of Agriculture and Forests	Plant Protection	Plant quarantine, Prevention of harmful animals and plants		*ex-situ*
	Rural Enhancement	Protection of valuable genetic resources		*ex-situ*
Forestry Administration	Preservation and Game Act Forest Law	Protection of wildlife	Wildlife sanctuary	*in-situ*
	Forest Law	Protection of virgin forests	Designation and management of virgin forest	*in-situ*
		The protection of rare and endangered plants	Botanical garden	*ex-situ*
Ministry of Sea and Fisheries	Enhancement of Fisheries Law	Protection of marine resources	Marine ecosystem	*in-situ, ex-situ*
Ministry of Construction and Transportation	Urban Park Law	Protection and management of urban park district	Urban areas	*ex-situ*
	Land Utilization and Management Law	Flora and fauna of Nature preserve district	Forest preservation areas, Natural environment Preservation areas	*in-situ*
Division of Cultural Monument	Cultural Property Protection Law	Protection of rare species as natural monument	Natural monument protection areas	*in-situ*
Office of Science and Technology	Natural Museum Law	Exhibition of specimen	Zoo and botanical gardens	*ex-situ*
Ministry of Home Affairs	Natural Park Law	Protection of fauna and flora in natural park district	National park, provincial park, county park	*in-situ*



The protected areas and natural forest areas in Republic of Korea

The Master Plan for Natural Environment Conservation

1. Background of Master Plan

The Natural Environment Conservation Act (enacted in 1992. 9) was enforced to respond to an increased need to natural environment, and to reduce ecosystem and natural environment destruction due to rapid economic growth and land development and use. The same law requires a new Master Plan of Natural Environment Conservation every 10 years.

According to the Master Plan, an corrdinated and cooperative approoch was needed among divisions that independently carry out affairs for natural ecosystem conservation, green management, protection of wild fauna and flora, and protection of natural scenery in order to suggest basic directions and execution plans for each area. Therefore the results of the First Basic National Survey of Natural Ecosystems (1986~ 1990) and the opinions from related government organizations were integrated to establish the first Master Plan of Natural Environment Conservation.

2. Characteristics and foundation of the plan

Foundation of the plan : Natural Environment Conservation Act, Article 11, the 1st Sub-section

- The Minister of Environment should establish a Master Plan of Natural Environment Conservation every 10 years to preserve the natural environment, after discussing with related ministers of central government agencies, and to finalize it after consulting with the Committee on Environmental Conservation.

Characteristics

-The basic national plan to set a national goal and to give practical directions regarding to natural environment conservation

-It is integrated plan to provide central government agencies and local autonomous bodies with recommendations for preservation, utilization, development of natural environment

- It informs citizens of the goals and direction of natural environment conservation to promote participation

3. Scope of the plan

Duration of the plan : 1994-2003 (10 years)

Scope of the plan : An integrated plan including organic connections among agencies related to the natural environment

Major government agencies : Ministries of Home Affairs, Culture and Sports, Construction and Transportation, the Rural Development Administration and the Forestry Administration

Natural ecosystem conservation, protection of wild fauna and flora, biological diversity conservation, sustainable use, protection of natural scenery, designation of improvements for the natural environment, nourishment of related organizations, international cooperation, and other utilization and conservation of the natural environment.

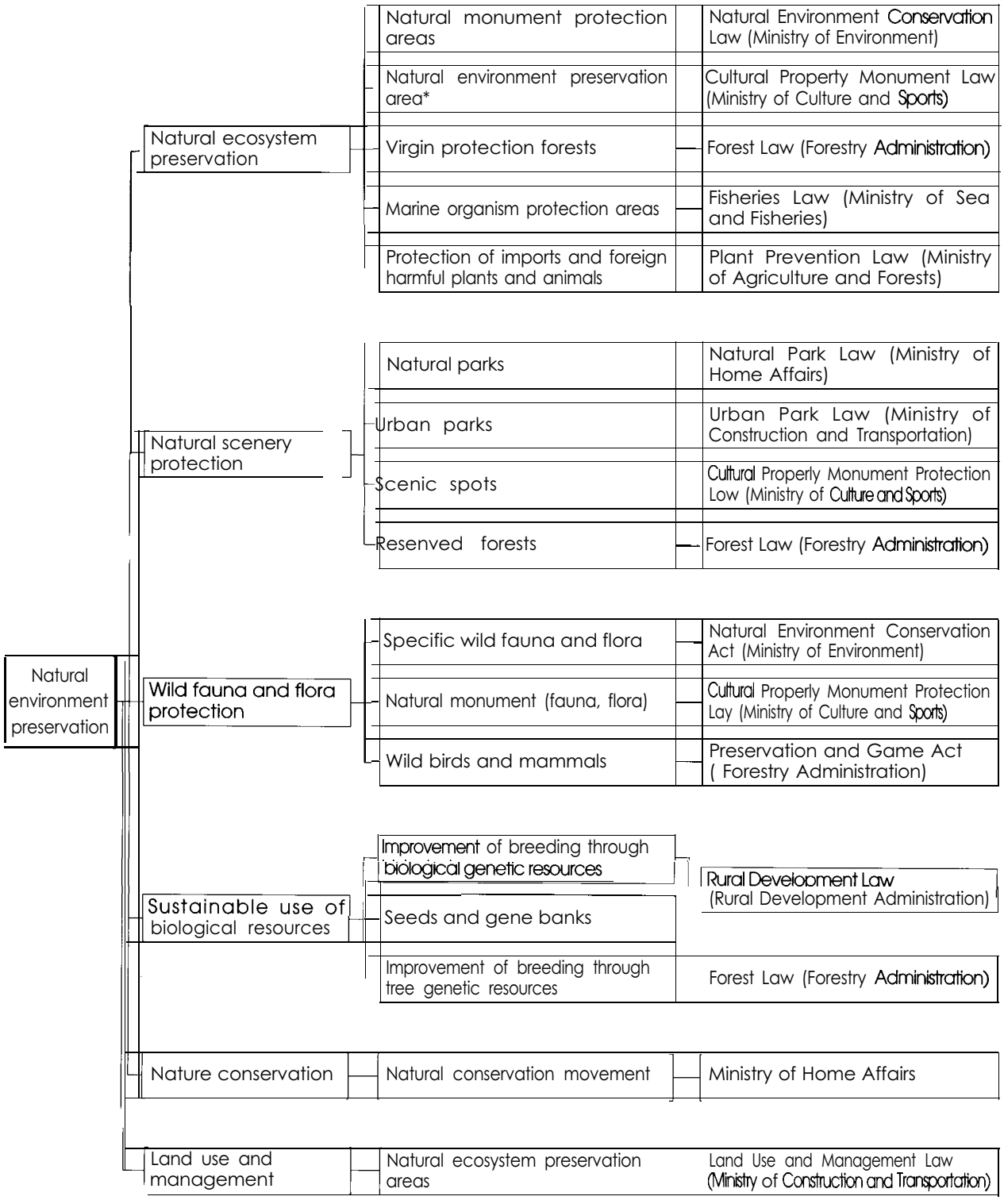
4. Operation of the plan

The execution of the Master Plan guides other plans that are directly related to the conservation of the nations natural environment.

Related central government agencies should establish detailed self-accomplishment plans in relation to the concerns of the Master Plan

Majors and governor of a province should establish local natural environment conservation plans based on the Master Plan

A flow chart of biological diversitv affairs



* Natural Environment Conservation Areas include natural parks, cultural monuments (natural monuments), green Conservation areas, municipal water conservation areas, absolute agriculture, forest conservation areas.

- areas with rich biological diversity
- areas with high natural productivity
- wetlands as migrating species habitats
- areas with high social, economic, and cultural values
- areas with considerable ecological, and evolutionary importance

Strategy : Development of scientific, systematic evaluation and monitoring methods

Detailed survey in the Natural Ecosystem Area (Mt. Kwangdeok Chonan)

A exact evaluation of national biological diversity is not yet established due to the various survey and research programs, and because of this, there are difficulties establishing basic policies and developing programs for national biodiversity conservation

- Develop survey methods, criteria, and methods for biodiversity monitoring
- Complete conservation evaluations and continuous monitoring of biodiversity status
  - Procedures of biodiversity impact include these activities estimate of ecological and economic values through scientific methods during development and conservation and development of economic incentives for biodiversity conservation
- Carry out mapping for ecosystem modification and vegetation systems to provide basic data for effective ecosystem management
- Build a database of biodiversity survey and evaluation results to use for developing monitoring systems, including national land Information system

Strategy : Strengthen classification capability

Classification skills, recognized as the most important factors in biodiversity activities should be developed for checking biological diversity

Biodiversity Conservation Strategy

1. Identification of Biodiversity Components and Follow-up Monitoring

Strategy : Carry out a systematic survey

Most survey on biodiversity are not systematic or comprehensive. Furthermore. there is a lack of functional approaches that ore needed for the effective management of biodiversity. For a sustainable "se of biodiversity. agriculture, forests, fisheries and medical and genetic resources should be systematically surveyed. Harmful effects influencing biodiversity components have not been studied as yet.

. A national biodiversity survey has been conducted every 10 years primarily to complete the national basic survey of the natural environment prescribed by the Natural Environment Conservation Act.

. The distribution of valuable biological resources. utilization status. and trends in changes of resources for agriculture, forest, fisheries, recreation and sightseeing and genes are continuously surveyed.

. Complete a survey of the distribution status, development activities that negatively influence biological diversity components of social. economic, cultural or scientific value

. A detailed survey of the current status of primary biological species, habitat and ecosystem

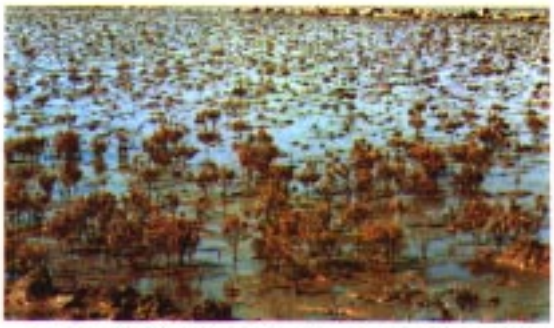
- endemic (indigenous) species, rare species, endangered wild species, protected wild species. and species of social. economic. and cultural value

components and for monitoring the conservation of biological diversity and sustainable use. However, recently the number of taxonomists are declining and there is a lack of counterplans, so the effective execution of the biodiversity convention is expected to face difficulties.

- Strengthen various supports for enhancing taxonomy skill
- Strengthen the institutional arrangements to increase the number of taxonomists
- Strengthen regional cooperation among nations to develop taxonomy

Plant collection

2. In-situ Conservation



Community of *Suaeda japonica* in the tideland of the West coast

1) *Designation and Management of Protected Areas*

The loss of biological diversity is mostly caused by intensive economic development which necessarily accompanies various industrial activities and increased land demand followed by habitat destruction and fragmentation. Therefore, the designation of protected areas is recognized as an essential part of conserving biological diversity.

When designating protected areas, one should consider native beauty, biological diversity, habitat characteristics, rare species, and socio-economic needs that harmonize the surrounding ecosystem with human life.

Strategy : Expand the designation of protected areas

Natural ecosystem conservation areas in Korea constitute only 0.1% of total protected areas, and this is a relatively small portion of areas compared with those of the other foreign countries.

- Active attainment of the protected areas that are highly valuable for conserving biological diversity.
- Enforce various incentives that reduce residents' inconvenience in protected areas.
- Establish network of protected areas when designating protected areas that facilitate the movement of wildlife.
- Maintain the DMZ and surrounding areas (civilian access prohibition zone) in less human disturbance since the 1953 suspension of Korean war as the essential role for conserving biological diversity.
- Strengthen conservation efforts in uninhabitable island ecosystems for rare fauna and flora.

Demilitarized Zone as a treasure place for biodiversity (Chulwon, Kangwon Province)

- Endeavor to exchange privately owned areas.

worth conserving with government owned forests

Strategy : Strengthen management of protected areas

Most protected areas are so heavily disturbed due to insufficient financial and expert support, exploitation by tourists, and unconditional collection that systematic management in these areas is urgently needed

- Management goals and action plans for protected areas should include conserving biological diversity and sustainable use
- Establish a management network of protected areas in consideration of the characteristics of individual protected areas

Roundtable conference with local residents for designation of Natural Ecosystem Conservation Area

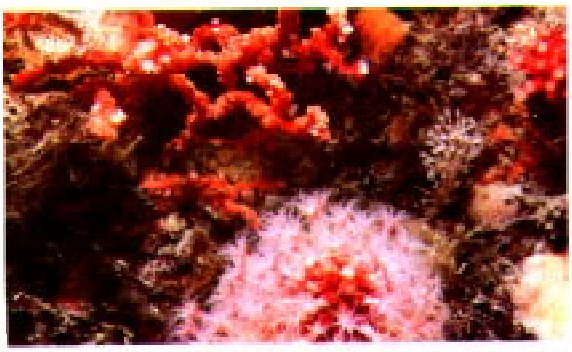
- Propose the [illegible] of both general [illegible] and [illegible] by improving the [illegible]

2) Protection of Wild Animals and Plants

Wild fauna and flora are going to be extinct due to the destruction of natural ecosystems caused by the overexploitation of animals, plants, resources and lands and by increased environmental pollution and other reasons

Strategy : Strengthen management activities and expand the designation of protected animals and plants

- Expand legally protected species, including endangered wild animals and plants protected wild animals and plants
- Establish a conservation programme to protect individual species
- Strengthen legislation and systems to protect wild animals and plants



Tidal zone for various living organisms (Ganghwa-do island)

Frogs are one of the most sensitive species to the climate change

- Strengthen control of international trade and administrative action against illegal poaching, exploitation, collection and trade
- Enhance efficiency of protecting and managing endangered species
- Strengthen advertising and education for the protection of wild animals and plants

Strategy : Establish a habitat-focused protection plan

- Perform a habitat-centered protection plan such as the designation of ecosystem conservation area and natural monument protection areas for protecting endangered and protected wild species
- Expand the designation of bird sanctuaries and the formation of surrounding habitats
- Enlarge the designation of protected sea surface areas and protection of marine animal and plant propagation

Strategy : Strengthen research, survey and advertising for the protection of wild animals and plants

Plant genes adapt to various environment

- Strengthen continuous research and survey of wild animals and plants
  - Especially, strengthen and protect conservation plans for less known taxonomic groups (fungi, lichens, invertebrates, microorganisms, etc)
- Strengthen quantitative research on the proper evaluation of the economic value of wild animals and plants
- Strengthen advertising and education about the value of wild animals and plants

3. Ex-situ Conservation

Due to rapid development of bioengineering, the importance of *ex-situ* conservation of biological resources for securing biological and genetic resources is growing

Facilities and various means for *ex-situ* conservation of wild species, breeding species and biodiversity components such as genetic resources are needed

In *ex-situ* conservation securing various groups of individuals is neeced to conserve genetic diversity efficiently because several populations of one species are not enough, but populations of several species should be ensured

Plants in *ex-situ* conservation facilities

Strategy : Enhance the expansion and management capability of *ex-situ* conservation facilities

Ex-situ conservation facilities such as seed banks, gene banks, zoos, arboretums, aquariums, and microorganism resources centers are not enough to carry out systematic management

- Perform appropriate *ex-situ* conservation to secure, maintain, and manage genetic resources
- Upgrade the gene bank industry which approaches to the level of developed countries by accumulating a number of fungi in gene banks and possessing a range of valuable biological resources
- Strengthen investment in conservation facilities and manage ment program.
- Establish a computer management system for *ex-situ* biological resources

Strategy : Enhance research capability of *ex-situ* conservation

For efficient *ex-situ* conservation, studies on ecological [illegible] of protected species should [illegible] and particularly research [illegible] wildlife [illegible] the [illegible] is necessary.

- Strengthen researches on developing *ex-situ* conservation technology
- Strengthen research on [illegible] technology for [illegible]
- Strengthen research, programs and related arrangements for restoring the population of rare species such as endangered species, and protected wild species in *ex-situ* accommodation facilities

Microorganism (Gene banks serve as *ex-situ* conservation facilities for microorganisms)

4. Control of Threatening Activities

1) Control of Influx of Harmful Materials and Ecosystem Destruction

Major activities causing a harmful influence on biological diversity could be illustrated as follows : development activities for accommodating high population density, discharge of pollutants due to rapid industrialization, and destruction of the natural environment

There is a need to strengthen environmental infrastructure and expand basic facilities to decrease the increasing discharge of pollutants emission like CO_2, and NOx and to increase regulations that minimize the destruction of biological habitats

Strategy : Strengthen control of pollutants

- Strengthen control of pollution source in areas with important value in biological diversity
- Strengthen management of pollution sources for streams, lakes, and coastal areas
- Introduce environmental regulation based on aggregate amount of pollutants
- Establish speedy monitoring system to minimize pollutant dispersion.

Strategy : Expand environmental foundation and basic facilities

- Expand and rearrange environmental infrastrusture
- Enhance the recycling of wastes and ensure the treatment of waste matter

Strategy : Strengthen environmental impact assessment

Despite the continuous improvement of the evaluation process for Environmental Impact Assessments (EIA)

Factory producing various polluted matter

introduced in 1977 and the foundation of the Korea Environment Institute, specializing in EIA, in 1997, the contents of EIAs tend to be formal (lack of substantial assessment) and should therefore be improved.

From the viewpoint of the conservation and sustainable use of biological diversity, the assessment of harmful biological and abiological factors should be expanded to be in various developments, activities, policies, in order to reduce potential harm to biological diversity.

Destruction of forests

- Strengthen advance environmental evaluation for development activities and post-approval monitoring.
- Enhance the capability of institutions specializing in EIA, through the introduction of socio-economic evaluations.
- Increase the opportunities of public participation in order to ensure reliability in EIAs.
- Enhance the specialization of EIA personnel and the accumulation of information and data on biological diversity.

2) Management of LMOs and Alien Species

Safety and ethical validity of biotechnology are emerging as national / international issues. In Korea the discharge of LMOs (Living genetically Modified Organisms), prohibition of expansion, and experiments to recombine human genes are regarded as problems.

Legislation and management systems are not sufficient for protecting from the hazards of biotechnology despite the nourishment of bioengineering as an essential technology for the next generation in order to join a group of the developed countries in the 21st century.

Ink Bush (*Phytolacca americana*), alien species

Endemic ecosystems are threatened by alien species.

Especially since the 1970s, bluegill and bass have been threatening onshore wetland ecosystems in the process of their predation on endemic species.

Strategy : Strengthen Living genetically Modified Organism (LMO) management

To minimize environmental hazards from LMOs, the Government must establish a management system and legislation to evaluate and manage hazards caused by LMOs on a national level.

. Establish an evaluation system and an institutional arrangement for environmental hazards of LMOs that controls and manages the proliferation of LMOs that have been generated and introduced.

. Strengthen management capabilities for evaluating environmental hazards of LMOs.

. Establish a national network to manage LMOs systematically

. Prepare for Biosafety Technological Measures for bioengineering safety

Strategy : Strengthen management of alien species from foreign countries

There is a lack of information regarding alien species that are harmful to biological diversity in Korea and their influence on the environment. The present management system does not control introduced species effectively.

. Strengthen risk assessment to better evaluate the potential hazards of alien species.

. Improve legislation and systems for controlling import and proliferation of alien species.

- Strengthen the ecological and physiological

Bullfrog (*Rana catesbeiana*) (Alien species disrubs endemic ecosystem in Korea)

research on eradicating environmentally hazardous, alien species.

. Develop and execute a program to control alien species that are hazardous to ecosystems.

- Strengthen public education and advertising on alien species.

5. Ecosystem Rehabilitation

Recently, in the process of industrialization and urbanization, urban areas, rural communities and forests have become degraded and lifeless. Therefore, through the environmental restoration of ecological degraded areas, the Government established 'Country Green Networking (CGN)' to maintain endemic biological diversity and to form environmental communities in which nature and organisms live together.

Strategy : Enforce 'Country Green Networking (CGN)'

Green areas around metropolitan areas (Green areas in the cities are important space for living organisms)

. Rear landscape and Mt. Halla serve as the backbone for ecosystem conservation and biological diversity enhancement. The surrounding agricultural areas, streams and wetlands should be systematically linked and both serve to revitalize ecological activity in urban areas and connect major mountains and parks into ecological corridors

. Protect the habitat environment of ecological organisms in the process of rearrangement of farming land under WTO system and create habitats for small organisms in ecological corridors of forests and wetlands. These habitats are valuable for both agricultural activities and leisure space.

. Establish Country Green Networking in each city to restore native beauty, which will rejuvenate living organisms. This means converting gray cities to green cities where humans and nature coexist and live together.

. Streams and brooks in rural and urban areas serve as places to control water and harmonize biological species with nature by improving the living environment. Therefore, straightened concrete banked streams should be turned back into natural state with care and harmony.

'Countryside Green Networking』 Plan

Definition

'Countryside Green Networking' can be defined as the green framework in which wild animals, plants and humans live together. To achieve this, the natural environment should be preserved more efficiently, destroyed ecosystems must be restored, and desolate areas where no living organisms survive should be turned into areas that form habitats where living organisms and humans coexist.

Purpose

The purpose of this plan is to restore and conserve cities, agricultural areas, forests, and other areas that become degraded and lifeless in the process of industrialization and urbanization. Through conservation and restoration we can maintain endemic biological diversity and make the entire country a place where humanity, nature, and living organisms live together.

Basic Formation

First, five major mountain ranges including Taebaek Mountain, Sobaek Mountain and Halla Mountain are the basic framework for ecosystem and biodiversity conservation. This framework will concentrate on connecting the green spaces of the entire country to allow organisms to live;

Second, not through simply the "protection" of nature, but also through the restoration of degraded nature, spaces provided for human and organisms to live together will be enlarged.

Lastly, for future unification, 『Green Networking』 in the Korea Peninsula will continue from the DMZ to Pyongyang, Baekdoo and major mountain ranges

Goals

First, through a wildlife corridor that considers the habitats of five major mountain ranges including Taebaek and Sobaek, and with five mountains as the central artery, meaningfully connect plains, rivers and cities to a total『Green Networking,. Thus, wildlife habitats that were destroyed by development will be restored and connected.

Second, 『Green Networking』 in each city will form and activate natural areas for organisms to resume living, changing lifeless cities to green cities where humans and organisms live together.

Third, a new land use precedence emphasizing environmental conservation should be formed by being faithful to the nature and ecosystem conservation plan. During public and civilian development projects, natural environments where wildlife can live should be positively considered.

- Acknowledge the importance of wetlands and tidelands that are targeted for reclamation and development. The original function should be maintained by restoring degraded areas.

- Strengthen research and surveys of coastal / marine areas, maintain sound coastal areas / marine ecosystems and reinforce required actions for the sustainable use of marine resources.

- Strengthen efforts to conserve island ecosystems where rare living organisms are carelessly removed.

II Forests

Five major mountain ranges form the backbone of the country and their forests are the treasure of biodiversity and a major source of biological organisms. National and public parks are scattered around the five major mountain ranges and the large mountains around the cities are of themselves important habitats for biological organisms. These areas also act as the [illegible] of 'Green Network' providing [illegible] food chain.

Securing minimal habitat areas in forests is necessary [illegible] roads.

Strategy 1 : Enforce the conservation and restoration of forests as treasures of biological diversity

- Introduce a forest management system to manage forests as treasures of biodiversity and genetic resources.

[illegible] excellent

Dae Chung peak at Mt. Seorak National Park *(Overuse of National Park leads to fragmentation of space for living organisms)*

Forest ecosystem is relatively less disturbed by human (Upper stream of Jeohang, Gapyung County, Kyunggi Province)

- Restore forest areas destroyed by natural or artificial catastrophes by ensuring artificial connection with the surrounding natural environment.

- Minimize habitat fragmentation during road construction and connect other previously fragmented habitats step by step through various ecological methods.

- Connect the five major mountain ranges (including intensive protection areas) by an ecological corridor that offers enough space ecologically.

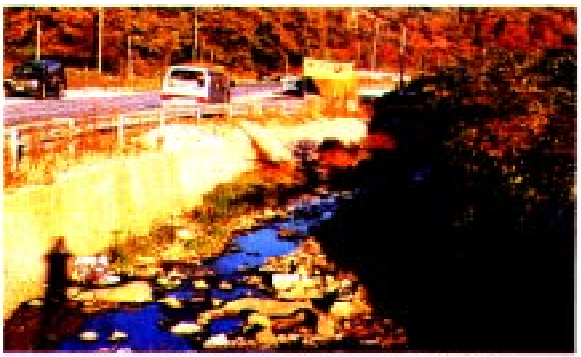
- Enforce various methods of enhancing biodiversity in protected areas, e.g. national parks as sources of various biological organisms and habitats for top consumers.

- Introduce an improved management system for streams located in the forest area and plant of shrubs and herbs as food sources for animals when needed.

- Investigate how the development activities in forested areas influence biodiversity and ecosystems (including stream fishes in currents and small ponds) and Determine target areas for conservation in the forested areas of the country.

2) Streams, Rivers, and Inland Waters

Streams and rivers close to various environments are the essential habitat for aquatic vegetation and animals. The surrounding wetlands and vegetation serve as both habitats for living organisms and as the ecological corridor through which organisms move. Rivers and streams act as the eco-bridge that link mountains to residential areas, agricultural fields, and seas.



Concrete-covered stream banks (Straightening, construction of dam and crossboard disturb stream ecosystem)

The straightening, concretization and culverting of rivers and streams altered the condition of natural environment, and the influx of organic and inorganic pollutants (e.g. industrial water pollution, household sewage, harmful toxins and oil spills) deteriorated the condition of environment. Furthermore, introduced species (e.g., bass, bluegill, and giant bull frogs) disturbed endemic stream ecosystems.

Strategy : Strengthen the management and restoration of streams functioning as amicable ecosystems

- Shift the emphasis of river and stream management as water supply source for industrial activities to the integrated management of environmentally friendly, functional streams (integrating ecology and amenity).
- Secure safety from disasters while allowing natural dynamics-het are safe and comfortable to people.
- Expand habitats for fishes and purify pollutants in order to reinforce the ecological functions of streams and rivers.
  - Utilize natural constituents that fit the environmental characteristics of surrounding areas in maintainance activities for rivers, streams, waterways, and reservoirs.
  - Use environmentally friendly materials to create living environments for aquatic organisms when using man-made products to do repairs.
  - Create a variety of habitat condition appropriate for the living organisms in order to link natural

Natural stream (Recently, actions for restoration of damaged stream ecosystem are active in Korea)

swamps to their nearby rivers and streams

- Provide ecological corridors when installing artificial structures such as dams and crossings.

3) Seas and Coastal and marine Zones

Coastlines offer hatching / breeding grounds for fishes and play an important role in the conservation of biodiversity through the production of marine biological resources by directly connecting the sea with estuaries. Recently, overharvesting of marine biological resources, frequent outbreaks of red-tide, oil spills from ship wrecks, and an influx of pollutants from inland are threatening the biological diversity of marine ecosystems.

Tidal flats in the West coast (Tidal flats serve as areas for purification of pollution, habitat for various living organisms)

Tidal flats located to the western coast of the Korean peninsula are recognized as one of the top five coastlines in the world (the Baltic Sea in Europe, the east coast of Canada, the Georgia coastline in the USA, and the Amazon estuary in South America).

Strategy : Strengthen conservation / reinstatement of coastlines and seas

Community of marine algae in tidal zone (Tidal zones are transition areas that are rich in biodiversity)

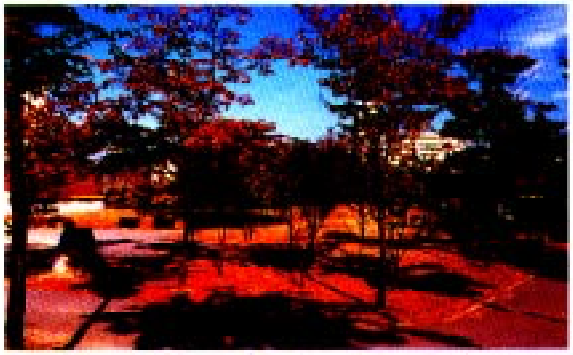
- Reinforce research activities and surveys of the current status of marine / coastline utilization, biological resources and natural environments in order to manage the biological resources and environments of both coastlines and seas.
- Develop and implement a program to restore marine ecosystems through propagating artificially breeded marine organisms and replacing aquatic vegetation of destroyed wetlands.
- Strengthen the designation of major natural tidal flats as protected areas.
- Increase public advertising about the ecological importance of tidal flats.

- Enhance the ecological network of destroyed coastlines and natural areas.

- Strengthen the formation of substitute wetlands during large-scale landfill and land reclamation projects.

4) Residential Areas

As residential ecosystems are full of artificial facilities, blocking of those ecosystems is emerged as serious environmental concerns. In residential ecosystems, the enhancement of environmental quality / quantity is the main object of ecosystem restoration. Residential ecosystems can be divided into urban and rural ecosystems, and so far, the two systems have been managed separately, but were recently unified in a more organized manner while retaining their own characteristics.



Agricultural fields in Cheju island (vegetation fence that protects wind serves as habitat for living organisms)

The threatened biodiversity in residential areas tend to be accelerated. Rural areas function as both farming spaces and as ecological links to other ecosystems. However, the loss of biodiversity occurs due to unplanned environmental activities, development pressure and a cavity phenomenon. The loss of green space in the city is caused by unplanned arrangement of urban facilities that lead to shrinking natural parks and habitats for living organisms.

Rural ecosystems

Typical rural environments are composed of farming fields, swamps, and forests that provide habitats for various small organisms. These are systematically connected with agricultural activities, provide food for humans, and serve as flood control reservoirs.

Swallow's nest (Swallows were rapidly declining in the population)

Agricultural fields themselves act as habitats and resting places for various living organisms, and swamps and other wetland areas provide habitats with rich biodiversity. Agricultural fields linking strongpoints and nuclei can become ecological corridors.

Birds that can be observed in Seoul

Fishes in the artificial ponds (Small ponds in cities provide space for living organisms)

Strategy : Restore habitat space for living organism in rural areas

Recently, not only in urban but also in rural areas, biodiversity is decreasing and construction activities are increasing so much that there is a need to restore the natural environment to conserve biodiversity in harmony with agricultural production. This would lead to sound environments with a variety of habitats, settings that would allow inhabitation by wildlife, trees and plants.

. Present wetlands and vegetation management should be harmonized with the historical background, and culture of rural areas, so as to minimize the destruction of wildlife habitats such approach would offer an opportunity for increased income for rural residents by ensuring resort areas.

. Strengthen the conservation and propagation of bushes, shrubs, and trees along agricultural roads when rearranging agricultural fields.

. Strengthen the conservation of vegetation resources to the ecological edges, hiding places, and breeding grounds of wildlife and plant fruit trees [redacted] rds, and conserve vegetation and [redacted] agricultural roads.

. Change [redacted] for abandoned marginal agricultural fields into spaces for living organisms.

Urban ecosystems

Korea is composed mostly of mountains and the population density of urban areas is high. Therefore, space for living organisms has greatly deteriorated.

Recently, as rural areas merged into urban areas, the expanded urban area tends to degrade the scenery of the agricultural areas. The altered land management system of the public property to change sub-agricultural and forest lands wound the

city into development plans thereby threatening the conservation of biodiversity.

Cities are the focal point of natural restoration through Green Networking, and calls for small- and medium sized spaces for living organisms. It is important to utilize and connect these areas into ecological corridors.

Secret Garden of old Palace in Seoul (Raccoon dogs can be observed in Secret Garden)

Strategy : Maintain habitat for living organisms within the cities

- For existing cities, strengthen maintenance and restoration of inhabitation spaces for living organisms, such as present forests, wetlands, and streams.

. Strengthen the conservation of ecologically important areas and inhabitation spaces for living organisms in large scale metropolitan newly developing.

. Expand inhabitation spaces for living organisms utilizing gardens, housetops, and vacant lots.

. Strengthen the protection of marginal areas that link between residential and forested areas.

Strategy : Enhance a quality of natural environment within urban area / nearby cities

. Expand the function of greenery areas, inhabitation spaces for living organisms in order to maintain biodiversity in urban areas.
  - Enforce standards and criteria to conserve natural ecosystems in urban areas.

. Introduce incentives that maintain existing topography and landscape in order to protect urban environments and biodiversity.

. Increase surveys of urban biological resources and ecological aspects, policies in the development of inhabitation spaces for living organisms.

. Convert quantitative regulations into qualitative

- [illegible] to [illegible] and [illegible]
  [illegible] cities
- To achieve [illegible] in [illegible]
  [illegible] government [illegible]

■ Expanding the past concept of greenbelts not only for urban [illegible] but also for living organisms' [illegible]

5) Islands

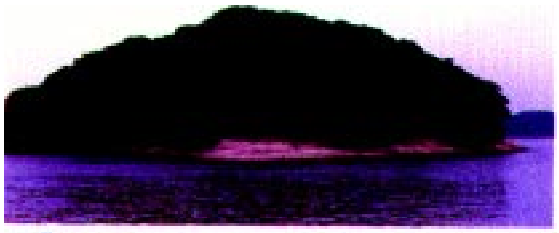
Uninhabited island of Yoo-do in Demilitarized Zone (Yoo-do serves as habitat for rare bird species due to lack of human disturbance since 1953 Korean War)

Unlike inland ecosystems, island ecosystems are [illegible] form unique biota and [illegible] that have resulted from long, independent [illegible] Therefore, [illegible] by 'hot spot' investment domestically and [illegible] often [illegible] highly worth preserving.

Nonetheless, a comprehensive survey (except an [illegible] scale) has not yet been done, [illegible] lack of [illegible] island ecosystems are heavily degraded due [illegible] overharvesting of stow collecting, plants for potting, unplanned [illegible] the [illegible] of [illegible] animals, [illegible]

Strategy : Strengthen the conservation and restoration of island ecosystems

■ Carry out comprehensive surveys and collect data on humans, society, and natural ecosystems of all islands in the country.



Evergreen forests in the islands (Jeo-do, Chonnam Province)

. Enforce [illegible] and [illegible] the [illegible] of island ecosystems
  . For islands that need absolute [illegible] of many species.
  . For islands [illegible] use, [illegible]
  . For islands [illegible] including [illegible] and pebble [illegible]

■ Designate 'protected areas' as highly worth preserving

Strategy for the Sustainable Use of Biodiversity

1. Agriculture

Agriculture is an industry for meeting demands for basic human necessities. such as food. etc., and it is the main industry of rural societies. In addition. local economies have been maintained and improved through agriculture, and agriculture has also played a role in preserving and developing various functions. including conserving the environment and maintaining cultural traditions.

Agricultural policy has so far negatively affected the agricultural ecosystem due to the development and supply of high-yield varieties to enhance food production, the expansion of fertilizer and chemical use. the development of stockbreeding. the promotion of converting to machinery, etc. The policy must also deal with problems of environmental pollution prohibition in preparation for natural environmental conservation and safe agricultural and livestock products which have recently become hot issues worldwide. The conservation of agricultural ecosystems. agricultural practices for less investment and resource saving. and the safety of agricultural and livestock products

Strategy : Induce ecologically sound agricultural activity

. Foster ecologically sound and environmentally conservative agriculture and agricultural communities.

. Encourage environmentally sound farming methods such as pest management systems and avoid excessive utilization of chemical fertilizers and insecticides.

Agricultural paddies (Mostly of farmers live with r ce fields)

- Expand the certification of quality on organic agricultural products.
- Promote the diversity of agricultural ecosystems as well as stabilize agricultural production through the introduction of various planting systems.
- Sponsor through financial aid to local community that implements ecologically sound agricultural programs.

Strategy : Prevent the degradation of farming soil

The degradation of agricultural soil has recently become an issue, presumably due to several factors, including the excessive use of pesticides and chemical fertilizers, heavy cultivation, the influx of pollutants and waste water into farm lands. However, there has been lack of precise data on farm land pollution and the investigation of and research on the causes is still insufficient.

Post rice harvest

- Grasp the present condition of farm land pollution and prepare a measure to eradicate sources of farm land pollution throughout the country.
- Develop technologies for improving polluted farm lands and promoting crop rotation.
- Establish a measure to prevent degradation of the soil.

Strategy : Promote and utilize marginal farm lands

Due to a shortage of farmers, uncultivated lands are increasing around marginal farm lands where there are unfavorable conditions for mechanized farming, so the revitalization of farming and fishing villages has been inhibited, and land degradation has become a concern. On the other hand, it is necessary to devise a measure to conserve, utilize, and efficiently improve the condition of marginal lands, because the demand

for land is continually increasing due to urbanization, industrialization, and increasing attraction to suburban life.

- Increase the investigation of resources on farm lands other than agricultural promotion areas. Based on this, increasingly promote the development of marginal farm lands and forest regions.

- Prepare a managing system in consideration of the physical / locational conditions of farm land.
  - Develop cash crops, such as flowers, fruits, and pastures, etc., in agriculturally suitable locations.
  - Where natural scenery is good, promote exchanges between the city and country by building up plantations for weekend tourists, where both urbanites and farmers can relax.
  - Where there are favorable conditions for development, utilize and develop in environmentally friendly ways together with adjacent forest regions.

Fields in winter (Mountainous regions are used for farming in Korea)

Strategy : Prevent environmental pollution by the livestock industry

As the demand for livestock products increases with economic development, the number of livestock has increased, and waste water produced by livestock seriously contaminating watercourses will be a concern.

- Expand facility investment for livestock sewage disposal.

- Offer various incentives for the practical use of, and support the research and development of technologies for livestock sewage disposal.

- Strengthen education, public information, and provide economic incentive measures for livestock-breeders to settle down environmentally friendly livestock-breeding.

Agricultural fields in Cheju Island

Strategy : Develop / disseminate environmentally sustainable agricultural technology

Because the current use of excessive agricultural chemicals causes concerns for both the safety of agricultural products and food and the destruction of ecosystems, we should promote research and development of environmentally friendly agricultural technologies to reduce environmental pollution, produce safe agricultural products, and distribute these technologies.

- Systematize operational organic farming, prepare standard fertilization relevant to the characteristics of soil according to individual crops, and introduce an integrated pest management system as early as possible.

- Promotion to focus researches on biological control and development of minimization technology of remaining hazardous material in soil and agricultural products.

- Promote the supply and development of low-pollution equipment for agricultural production.

- Continually promote research on cultivating systems for rice farming in order to reduce the amount of methane gas.

- Strengthen public information and education for farmers on the treatment, spread, and conservation of agricultural chemicals.

2. Forestry

Korea, driven by strong government policy as well as by the participation of the entire nation, is a country successful in forestation and erosion control projects for rehabilitating areas degraded by various artificial and natural factors, such as landslides, drought, war, etc. However, measures that weaken the productivity and health of forest ecosystems, including the expansion of monocultures, frequent occurrence of damages by fire and pests, increase of air pollution, and increase of conversion of forests for other purposes have increased. Thus, a forest policy that will maintain the ecological soundness of forest resources, display the best of various forest functions, and improve forest productivity is requested.

To manage forest resources efficiently, a nationwide forestry planning system with a basic forest plan for the country, a local forest plan for cities and provinces, and a forest management plan for individual forest areas has been operated.

Strategy : Improve and maintain sound productivity of forest ecosystems

- Continually promote research on the development of environmentally sound harvesting.

- Promote the improvement of various endemic tree species for planting, in order to enhance the health and diversification of forest ecosystems.
  - Enforce limiting silvicultural areas to areas damaged by fire and pests, harvest areas, and inadequate forest areas.

- Promote secondary natural forests as areas for producing economically valuable forest products and for maintaining the health of ecosystems through breeding and nourishing.

Planted forests of needle fir (*Abies holophylla*) (Wood production is one of the most important functions of forests)

. Enforce a legislative and administrative

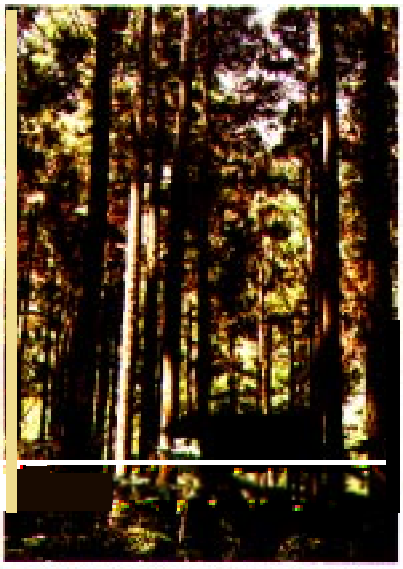
management system for forests to conserve biodiversity by intensifying foreign species, pests, and acid rain monitoring in forests.

- Promote the industrialization of forests by concentrating forest road facilities in forests designated for commercial purposes.

- Develop environmentally sound methods for forest road construction in order to minimize damage to forest ecosystems due to forest road facilities.

- Organize a cooperative system centering on forest promotion regions, and activate management of private forests through proxy or composite management.

Strategy : Establish an efficient management system for forests



Well-managed planted forests (Most forests were denuded 50 years ago)

Thanks to the 1st and the 2nd Forest Greening Projects from 1973 along with economic development policy since the 1960s, most of the forests were replanted with trees, allowing degraded forests to disappear. Efficient management of forests will become a main policy in the future.

With the increase of people's income, forests should serve various ecological functions, such as providing clear water, clean air, scenic landscapes, comfortable resting areas, wild animal and plant protection, etc. In response to such a request, it is necessary to establish an efficient management system for forests in order to actively stimulate various forest functions as well as to maintain forests as environmentally sound ecosystems.

- Classify national forests by function of site environment and social / economic circumstances of the society. These functions can be further detailed into production of woods, conservation of water resources, protection of national lands and ecosystem, recreation for health, etc.

- Strengthen forest management in order to simultaneously maintain biodiversity and make sustainable production feasible.

- Conservation of biodiversity should serve as the main goal of forest management for public forests and appropriate management methods should be developed for their designated function.

- Manage artificial forests through systematic nourishing for the purpose of timber production.

- Manage natural forests for biodiversity conservation as well as sustainable use of various forest by-products in addition to wood production.

- Strengthen support to private forests for efficient management and expand national forests to both maintain and increase public interest in the forests. (Expand national forests from 21 % of the total forest area to 30 %.)

- In national forests, expand the size of conservation areas to secure public benefit functions such as recreational forests, natural protection areas, natural ecosystem conservation areas, and to manage national forests based on public benefits.

Working place of wood production

Strategy : Enforce the function of public benefits of forests

Conservation of forests is a current subject to maintain the public benefits of forests due to a rapid increase in GNP and the demands on the functions provided by the environmental conservation of forests, such as clear water, clean air, green space, etc.

In the past, restoration of desolate forest areas was a main project for the management of forests. It has become an important issue for maintaining and increasing the various public benefits of forests, such as source of headwater, purification of air, recreation,

For planted forests more nourishment is necessary

protection of wild animals and plants, etc., along with the increase of forest production.

- Manage forests around cities and industrial complexes as city forests for urban living.
  - Reduce pollutants and create comfortable green spaces.

- Increase the creation of natural recreational forests to provide and develop comfortable spaces for relaxation.

- Designate and manage woodlands with beautiful scenic views as scenery conservation forests.

- For wild plant and animal biodiversity, found a forest museum, an arboretum, and a wild zoo as ex situ conservation facilities and natural conservation forests and bird sanctuaries as an in situ conservation measure.

- Promote the founding of a national arboretum to systematically investigate, collect, register, and classify species of wild plants to link up arboretums and museums nationwide.

- Raise awareness of love of nature by strengthening forest ecology education for both youth and the general public.

Deciduous forests in Korea (Recently the natural forests are highly evaluated)

3. Fisheries

A major objective of coastal management is protecting important coastal areas for the sustainable use of marine resources and safely conserving living creatures.

To enhance the conservation of marine fish resources and their sustainable use, close cooperation between local citizens and related government agencies as well as an integrated management system are necessary.

Especially, efforts to form an integrated system for a national land use planning are being requested to conserve the marine environment as a national treasure of biodiversity.

Strategy : Efficiently manage coastal regions

- Investigate in advance the present status of resources in coastal areas, the actual condition of utilization, natural environment, etc.
- Establish [illegible] system for [illegible] eff[illegible]
  - [illegible] named [illegible] the [illegible] of [illegible]
- Establish [illegible] for the sustainable use of [illegible]
- Reinforce support for traditional fisheries activities that use marine resources sustainably.
- Designate "Special Management Coastal Areas" when serious obstacles to conserving the marine environment appear.
- Introduce ecological methods for harvesting fishes within the best sustainable range.

The front part of fisheries, Ulreung island

- Strengthen support for local residents through ecologically sound development of coast.

Strategy : Conserve marine biological resources

Fishes collected in Woopo wetland (traditional fisheries are important method for sustainable use of fishes)

The seashore and river mouths have eroded naturally, and soil from landslides and organic material have accumulated, thereby providing various natural habitats for living organisms. However, breakwaters as well as projects for both land reclamation and landfill have damaged habitats of seashore living organisms over considerable areas.

Because biodiversity in the ocean is being greatly reduced by the overexploitation of biological resources and the frequent occurrence of pollution, it is necessary to establish a countermeasure for the sustainable use of coastal and marine biodiversity. In addition, as information gathered on the seashore and marine biodiversity is very poor, and marine biological resources have considerable economic importance, investigation and research on this subject is imperative.

A mullet fishing in Hakin port, the East coast

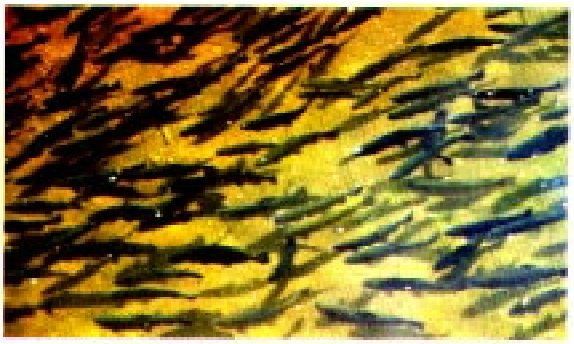
- Reinforce marine environment management by strengthening environmental impact assessment for oceans.
- Seek strategic measures to conserve marine biodiversity.
- Integrate the concept of conservative management of biodiversity into ocean management.
- Strengthen incentives to enhance biodiversity conservation activities.
- Reassess the economic and environmental value of tidal flats and marine ecosystems.
- Emphasize research on the causes of red tide.

- Reinforce investigation and research on the scale of fishing with regard to biodiversity and on environmental capacity.

Strategy : Sustainable use of inland water biological resources

Inland biological resources in Korea are mostly distributed in artificial lakes, rivers and estuaries; however, the resources are being depleted due to overutilization, increased pollutants, and introduced species from foreign countries.

- Strengthen management of introduced species from foreign countries.
- Prohibit the careless introduction of foreign species to enhance the productivity of inland water fisheries.
- [redacted] the [redacted]
- Strengthen the inland cultivating industry in consideration of inland ecosystem capacity.



Freshwater fishes (Pen culture in inland stream s important for income of local residents)

4. Tourism and Recreation

Recently. the number of tourists who wont to use the natural environment and comfortable recreation and leisure sports have increased greatly. For example. visitors to notional parks have increased 3 times during the last 15 years. from 10.497.000 people in [illegible] and 32,636,000 in 1994

However, considering that most of the famous places for [illegible] in the [illegible] are [illegible] recent thoughtless [illegible] system [illegible] to the [illegible] ecosystem. and [illegible] to the reduction of [illegible]

Strategy : Enforce a sustainable use policy for tourism and recreation resources

Tidal flat expedition in west coast (Ecotourists are rapidly increasing)

For the sustainable use of tourism resources and the conservation of [illegible] the [illegible] of ecology and sound measures for [illegible] tourism ought to be planned and strengthened, however, plans and policies to achieve this are weak.

. Focus the evaluation and research of impacts of tourism activities, including [illegible] target areas and management [illegible]

. Encourage the [illegible] of continuously used tourism resources in the process of development and land use.

■ Include [illegible] for conservation management of biodiversity in tourism and [illegible]

. Execute [illegible] for the sustainable use of notional. provincial and county natural parks.

Strategy : Develop ecotourism

The recent trend in tourism is changing from [illegible] concept of [illegible] seeing scenic places to [illegible]

wider concept (ecotourism), which feels and understands nature's principles through observing and experiencing natural resources. which include specific areas or specific ecosystems

Ecotourism as a form of sustainable utilization of natural resources has been evaluated as an Important industry for improving the income of local residents without damage to the ecosystem

. Strengthen systemic and legislative measures to develop ecotourism.

. Develop a program of ecotourism to maintain biodiversity sustainably without damaging ecosystems.

. Strengthen environmental education for tourists and local residents to ensure proper ecotourism.

. In the case of ecologically sensitive regions. small scale 'ecotrips' or 'ecovisits' can be undertaken.

. Provide various Incentives for local communities that attract ecotourism and stimulate voluntary participation

Nature education center (Mt. Byungpoong, Damyang County, Chonnam Province)

5. Genetic Resources

Japanese yew (*Taxus cuspidata*) producing taxol for cancer(Mt. Baiwang)

1) Exploitation and Protection

The conservation of biodiversity is accompanied by the practicalities of conserving genetic resources. To breed new species, a genotype of a similar species in the wild needs to be introduced into an existing species. Also, recent developments in biotechnology allow the transfer of any genes from one clone to another regardless of biological variety, so securing genetic resources through biodiversity has become a key to the success or failure of biotechnology.

The conservation of the genetic resources can be classified into in situ methods of ecosystem conservation and ex situ conservation by establishing seed banks. Thus, more aggressive activities to protect habitats should be implemented and, in addition, genetic resources could be conserved effectively if various technologies and facilities for ex situ conservation are ensured.

Strategy : Conserve traditional practices

White forsythia (*Abeliophyllum distichum*), Korean endemic species.

The traditional knowledge and customs of local residents who utilize and conserve biological resources sustainably are also properties of the residents that are as important as the conservation of biological resources. To protect this property as well as to recognize the ownership of these assets will be a essential means for the conservation and utilization of biodiversity.

- Exploit / share traditional practices which correspond to ecologically sound uses of biological resources.
- Develop new techniques for utilizing traditional biological resourcese which is colgically sound .
- Strengthen incentives for activating traditional practices that conserve and utilize biodiversity at

sustainable manner

- Establish a joint network among industries, academies, research institutes for exploitation, conservation and management of genetic resources

Strategy : Ensure support to local residents for sustainable utilization of genetic resources

Genetic resources can be used excessively when local residents use the resources subject to external ownership. However, the resources can be used sustainably when the residents manage the ownership. In particular, in the case of the plants used for medicine and food in danger of extinction by excessive exploitation, a sustainable collection should be maintained by strengthening the indigenous rights of the local residents.

Local bee box (Mt. Chiri)

- Reinforce support to the local residents to widen markets for wild biological resources harvested in sustainable manner.
- Appreciate the economic value of a region's wild biological resources during a land-use planning / development.
- Arrange a relevant measures to secure the sustainable use of biological resources by local residents.
- Strengthen incentives for local residents to use biological resources sustainably.

Traditional short-necked clam aquaculture in tidal flats (Tokkeland of Buan-gun bay in the West coast)

2) Management of Valuable Genetic Resources

The development of biotechnology in Korea is hindered due to insufficient genetic resources and a lack of genetic engineering technologies. Moreover, the reduction of biodiversity and damage to the habitats of living organisms by environmental pollution (due to the recent rapid industrialization in the nation)

obviously leads to the destruction of ecosystems. Therefore, an integrated management system should be established to collect, preserve, and manage genetic resources.

Collection of plant gene resources (Varieties of various plants signify rich in gene resources)

While plant genetic resources for agriculture are essential for satisfying the food demands and low-income crops are rapidly disappearing in the transition process from an agricultural society to an industrial society, efforts for developing, utilizing, and conserving the safety and genetic diversity of these resources are insufficient.

Strategy : Search for and manage plant genetic resources

The inventory for plant resources and genetic resources of agricultural crops has not been systematically documented in Korea. Currently, the genetic resources of approximately 135,000 collections identified already are mainly classified as food and vegetables. Thus, a systemic action-plan must be set up to preserve and utilize various plant resources, including agricultural crops.

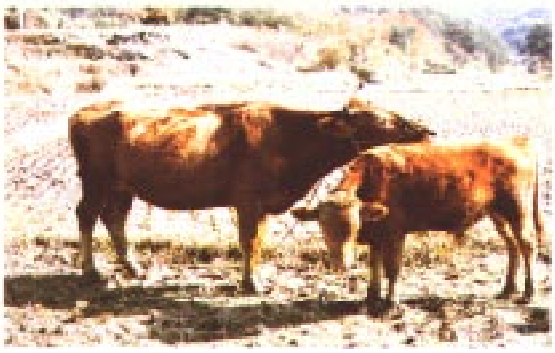
- [illegible] the [illegible] resources.

Hamnabu mallow (Hibiscus hamabo), protected wild plant

- Establish a systematic management system for agricultural genetic resources.
- Provide incentives to the local residents to maintain and sustain endemic crops, horticultural plants, and mutations in their region.
- Encourage plant breeding research by using various genetic resources.
- Establish an information network system for plant genetic resources.
- Secure a systematic foundation to collect, preserve, manage, and utilize plant genetic resources efficiently.

Strategy : Search for and manage livestock resources

The conservation of diversity in existing livestock as well as the introduction of biotechnology is important to satisfy an increasing demand for livestock products in both quality and quantity. Because Korea has mainly focused on economic value in livestock development policy to meet the demand for meat and livestock products, the project for conserving and developing livestock genetic resources, including traditional livestock, has been very limited.



Domestic bull

In particular, traditional species have special characteristics such as adaptability, disease resistance, usefulness for certain functions, etc., besides social and cultural values, but a conservation measure must be set in policy, because they face the danger of extinction if neglected.

- Comprehend the present status of domestic livestock, such as traditional and bred livestock species, mutations, varieties, etc.
- Establish an information network system for livestock genetic resources.
- Strengthen efforts to breed new varieties by using traditional and bred livestock.
- Devise conservation measures to maintain the genetic diversity of traditional and bred livestock.
- Strengthen support to conservation facilities f conservation and maintenance.

Strategy : Search and management of less known biological resources such as microorganisms, insects, invertebrates

Although less-known biological resources such as microorganisms, insects, invertebrates are valued immeasurably, research and investigation on these

is -he less

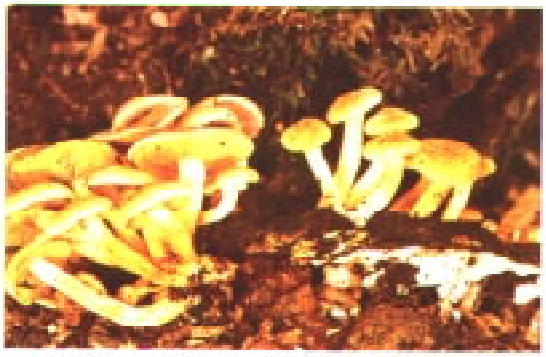
- Reinforce research and development on less-known biological resources such as microorganisms, insects and invertebrates.

- Strengthen support for research that maximizes the value of the usefulness of biological resources, such as microorganisms, insects and invertebrates.

for biologica on that b c

3) Supporting for the Bioengineering Industry and the Rational Distribution of Benefits

Strategy : Nourish the bioindustry, including biotechnology



Mushrooms (Majority of biological species are less known in values of genetic resources)

Controversial points should be recognized and minimized in the process of the continually developing bioengineering technology. At the same time, a system should be established to support research related to the bioindustry, including bioengineering and manufacturing goods.

- Establish a foundation for enhancing people's awareness and widening civilian investment in the bioindustry.

- Strengthen connections between industries, colleges, and institutions for developing bioindustry.

- Establish a biotechnology information foundation to continuously collect, analyze, produce, and supply technological information on the research, development, and industrialization of internal and external biotechnology.

- Establish a cooperative network in developing

countries that are rich in biological resources in order to strengthen support on the basis of biotechnology related institutes.

Strategy : Evenly and fairly distribute the results of genetic resource utilization

Thus far, patents were only recognized for developers who discovered new material and plant breeders who developed new varieties through biotechnology: however. the rights of providers, including local residents. who provide materials from crop samples and genes hove been neglected. This means benefits from using genetic resources have not been fairly and evenly distributed between providers and users

- Review related laws and policies between users and providers of genetic resources to fairly distribute benefits.

. Consider a measure which providers. developers, and users of genetic material can Jointly own and evenly enjoy the benefits and results of biotechnology.

boundaries of the interested parties, and prepare incentives and local community conferences to contribute to the decision process.

- Develop a long-term strategy to resolve the differences of political, social and economic cycles including fiscal year and election periods, and simultaneously develop a short-term strategy to acknowledge the necessities of policy-decisions.

- Develop a conservation strategy to incorporate institutional changes as well as to meet the progress of related research and changes in the character of ecosystems.

Vegetation around river

Shrub zones at Mt. Halla Cheju Island

Capacity Building for Biodiversity Management

1. Improvement of Management System

Biodiversity management should be based on ecological processes ond the needs and concerns of local communities. and the establishment and enforcement of biological diversity conservation should be based on biological regions that reflect ecological and social circumstances.

Cooperation from related government agencies and international assistance should form a bio-regional approach. The bio-regional approach varies depending on the characterlstics of the conditions Of authority, the sensitivity to variations in local conditions. and the comprehension of socio-economic goals. For broadening participation in the decision process. government agencies must be reformed.

In the local governing system. decision-making authority is bestowed to local residents, thus deeply influencing the designation and management of protected areas. Therefore. we should make efforts to resolve conflicts between the central government. provincial governments. ond local residents In order to ascertain the designation and management of protected areas. For local resources. incentive measures for collaborative management between the central government. provincial governments, and local residents should be considered.

Strategy : Enforce and develop a new biodiversity management system

- Clearly define management goals and set priorities based on lung term sustainability

. Understanding humans as major component of ecosystem. recognize the spatial

Ecosystem Approach

Concept

An "ecosystem" is a community in which biotic and abiotic organisms are reciprocally related, and it includes human and physical environments which interact with the community.

The "ecosystem approach" is a method of sustaining and/or rehabilitating natural systems as well as its functions and value. Being goal-oriented and based on a vision of future conditions, which are desirable and developed jointly, it integrates ecological, economic, and social factors. This approach is mainly applicable to the range of local borders as defined as ecological boundaries.

The goal of this approach is to maintain and to sustain the health of ecosystems, productivity, biodiversity, and quality of life. This goal can be accomplished through a method that approaches natural resource management by fully integrating social and economic goals. These are essential to preserve the air we breathe, the water we drink, and the food we eat and also to conserve natural resources sustainably for future generations.

Frame of ecosystem approach

Define the range of interests and concerns (considering economic, social, cultural, and ecological factors)

Participation of all persons concerned (participating as a principle body)

Develop a common vision regarding the future desirable conditions of ecosystems

Characterize a historical ecosystem and present economical, environmental, social conditions and trends in the ecosystem concerned.

Establish the goal of the ecosystem.

Establish and execute an action plan to achieve the goal.

Evaluate the result and monitor conditions.

Implement applicable management based on changes of circumstances.

Characteristics of ecosystem approach

Generalization (a comprehensive approach method to protect, preserve, and utilize ecological resources, communities, and economies sustainably).

Integration (strengthening an imperative relation between economic prosperity and environmental welfare through ecological conservation and human necessity)

Participation of citizens as a principal body.

Recognition of a fundamental relationship between human communities and the environment

Collaborative management of biodiversity by local and central government

Biological resources such as forests and ecosystems cannot be sustainably managed exclusively by communities or governments.

Governments should recognize interests and privileges of local communities, as local communities should acknowledge that their privileges accompany relevant responsibilities and limits.

Central and local governments should meet the six following basic requirements If collaborative management is to be successful

. Government organizations and managers should acquire new attitudes and skills to respect the necessary conditions and knowledge of local communities. This should serve as a part of managing resources not as an obstacle.

. Collaborative management is necessary to bestow privilege to weak social groups in local communities, especially to women and those who do not own property.

. Local communities should be sufficiently organized to negotiate with the central government with relative equality.

. Collaborative management means mixing new and old ideas and technology. "Traditional" or '*modern" methods are not substantially better or worse.

. A collaborative management plan should generate visible economic benefits for the community and, at the same time, meet national management goals.

• The collaborative management system should be supported through clear endowments of legal privilege and responsibilities, including the processes of possession privilege, contract agreement, and debate settlement

2. Incentive Measures

Strategy : Reform legislation and system

For biodiversity conservation, the current incentives and compensation system are insufficient, so deterioration of biodiversity is accelerating and conflicts between central and local communities are continuing.

Furthermore, although legislation related to biodiversity is very broadly separated into air, waste, land development, seas, cities, streams, parks, forests, animals, birds, and natural monuments, the legislative autonomy of local government organizations is very weak and insignificant.

Therefore, considering changes to the environment of national biodiversity, social requests, and the importance of biodiversity management after the Rio Conference, the current biodiversity conservation system is insufficient, and the management system should be strengthened to meet new environment policies.

- Reform existing legislature and systems to effectively enforce the National Biodiversity Strategy.
- Include biodiversity conservation measures into important national plans and laws, such as integrated land use planning and 5 year economic-social development plans.
- Reform the system and laws that adversely affect biodiversity conservation and sustainable use.
- Strengthen economic incentives that encourage the active participation of local communities.
- Strengthen legislative autonomy of local self-governing organizations related to biodiversity conservation.

Autumn in Korea

. Enforce laws and systems that secure funding for successfully accomplishing the National Biodiversity strategy

Strategy: Strengthen the financial system

Stable and continuous financial support is important to successfully implementing the National Biodiversity Strategy. However since the Investment in biodiversity conservation is so low in priority, various ways of securing financial support should be considered.

- Consider converting part of budgets from biodiversity use into funding.
- Through strengthening environmental impact assessments, positively consider increasing the percentage of current cooperative funding from some biodiversity related development funding. At the same time, consider expanding limits on cooperation.
- Encourage voluntary donations by private enterprises engaged related to the non-consumptive use of biological resources, ecotourism.

Traditional house in Korea

3. Research, Education and Advertising

For the efficient management of biodiversity, it is important to strengthen education, research, and advertising along with setting appropriate management concepts. Above all, it is essential for biological resource management and conservation to understand the biodiversity of earth and to comprehend its significance. It is particularly important for biodiversity conservation to discover the functions and structure of ecosystems and to enlighten the symbiosis of components of ecosystems.

Strategy : Strengthen research capabilities and nourish experts

- Strengthen support to colleges, institutes, and companies to encourage biodiversity conservation and research on ecologically sound use.
- Create social circumstances that increase the activities of experts related to biodiversity conservation
- Expand museum, research institutions to accomodate experts.
- Establish a "Biodiversity Research Institution" that surveys and studies national biological resources. The Institute should also accommodate experts in biology, sociology, economics, laws, policy analysis, ethics, etc. in order to accomplish biodiversity conservation and sustainable use.
- Consider introducing special certificates in ecology to strengthen the capabilities of specialized researchers.

Soil collection

Strategy : Strengthen education and Public awareness

- Develop educational programs on biodiversity conservation for common people and school students.

Ecotourism

Species collection, part of natural environment education

- Include the contents of biodiversity conservation in a regular educational course beginning from the low grades.
- Support and correct regular educational courses that train experts in education, research, and socio-economy regarding biodiversity.
- Nourish organizations and groups that bring biodiversity education to common people.
- Strengthen advertising through publications and billboards regarding the value, importance, and necessity of biodiversity conservation.
- Develop and execute programs that induce citizen participation in biodiversity conservation and sustainable use.
- Actively support public organization activities through the publication of pamphlets, programs on biodiversity conservation development, and the media.
- Maintain museums, local natural history exhibitions, national parks, and visitor's centers in natural ecosystem conservation areas for biodiversity data collection, education, and Public awareness.

4. Exchange of Information and Technology

The information exchange and technology transfer between countries and regions has become an important issue for conservation and sustainable use.

Since securing accurate information assists in the efficient enforcement of biodiversity conservation, the accumulation and proper management of information are an important task. Furthermore, for conservation of biodiversity and sustainable use, it is essential for the various social classes to participate. The participation of many people is only possible if easy access to and utilization of information is guaranteed. Therefore, establishing efficient information management is indispensable for biodiversity conservation.

Strategy : Manage and establish Clearing House Mechanism

Information on biodiversity is scattered over a broad range of fields: distribution, circumstances, characteristics, value, threats, conservation technology, its utilization, etc. This information is being managed and preserved separately by government organizations, national and public institutions, colleges, academic organizations, individuals, etc. Some areas lack research, so information is poorly accumulated.

- Establish a 'Clearing House Mechanism' network to facilitate biodiversity information and technology exchange inside and outside the country.
  - Manage a comprehensive biodiversity information network to connect biodiversity-related organizations, like government agencies, institutes, colleges, enterprises, etc.

- Build an environment information system that connects with a national rapid communication network and include biodiversity in one of the environment information system.

Mt. Seolak National Park

- Establish easy access to biodiversity-related information for various research organizations and related individuals.

. Publish a newsletter on the collection and exchange of information related to biodiversity.

Strategy : Facilitate technology transfers

Systematically collect and manage biodiversity information currently scattered through the government. Institutes, colleges and NGOs, and facilitate the transfer and exchange of information on biodiversity conservation technology. methods and technology for sustainable use. and bioengineering-related technology and Information.

. Facilitate technology transfers through the 'Clearing House Mechanism' network both domestically and internationally.

. Strengthen cooperative systems and collaborative projects in order to facilitate the exchange of biodiversity technology information between government agencies. research institutes, colleges, enterprises, etc.

5. International Cooperation

Biodiversity conservation is a worldwide concern, and international cooperation is 3 fundamental requirement to resolve it effectively. Korea should strengthen efforts to conserve its own biodiversity, actively participate in global b·odiversity conservation and sustainable use issues, a-d strengthen activities related to regional issues

Marine algae in tidal zone

Srotegy : Join International agreements and participate in the formation of new international norms

. Support to joining various international agreements relatoa to biodiversity conservation and sustainable use

. Investigate the present status and progress of all international multi- and bi-lateral agreements related to biod versity that Korea has joined, and strengthen necessary actions for facilitating their implementation.

. As a member of the international community, accept Korea's international responsibilities, and to strengthen Korea's status, actively participate in the development of new internat on31 agreements and norms.

. Actively participate in activities and collaborative projects of biod versity-related interrational organizations and parties like the UN and the OECD

Strategy : Strengthen cooperation with regional countries and developing countries

- Strengthen internat onal cooperation for fac l to-irg biodiversity conservation when forming agreements with foreign governments and NGOs

. Execute a collaborat ve survey of environmental influences on the biodiversity of the region and of neighboring countries, and cstabish and promote

joint countermeasures for the proper management of hazardous elements.

- Carry out all cooperative, international projects in such a way as to not create negative influences, and reflect influences on recipient countries' biodiversity when setting up and evaluating assistance programs for foreign countries.

- Include foreign aid-projects for underdeveloped and developing countries that consider primarily biodiversity related policy set-up and implementation and development of biodiversity capabilities.

- Facilitate the transfer of advanced biodiversity technology to foreign countries by dispatching experts to developing countries and expanding the supply of business facilities and equipment.

Clouds floating over mountains

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CORRECTIONS

Page	Line	Corrections
6	20, 26	dvided → divided, instutional →institutional
9	17	are → is
11	14	imfrasture → infrastructure
12	17	Eight-one → Eighty one
14	30	North the central → North of the central
16	2	lakes incomplete → lakes are incomplete
17	2, last line	charine → change, last line : by → of
18	1	farms → areas
20	Table 6	Mannals → Mammals, Mallusca→Mollusca
22	Figure ①	Asian Black Beer → Asian Black Bear
25	4	wich → with
32	10	A exact → An exact
34	16	total protected areas → total areas
35	16	manahement → management
39	23	foudation → foundation
41	10	instutional → institutional
43	20	destuaction → destruction
50	34	encourage → encourages
53	14	The conservation → Additionally with the conservation
62	Figure	Hakin port → Whajin port
66	26	a → an
67	23, Figure	Arronge → Arrange, Ducyang → Dukyang
68	Figure	rich → richness