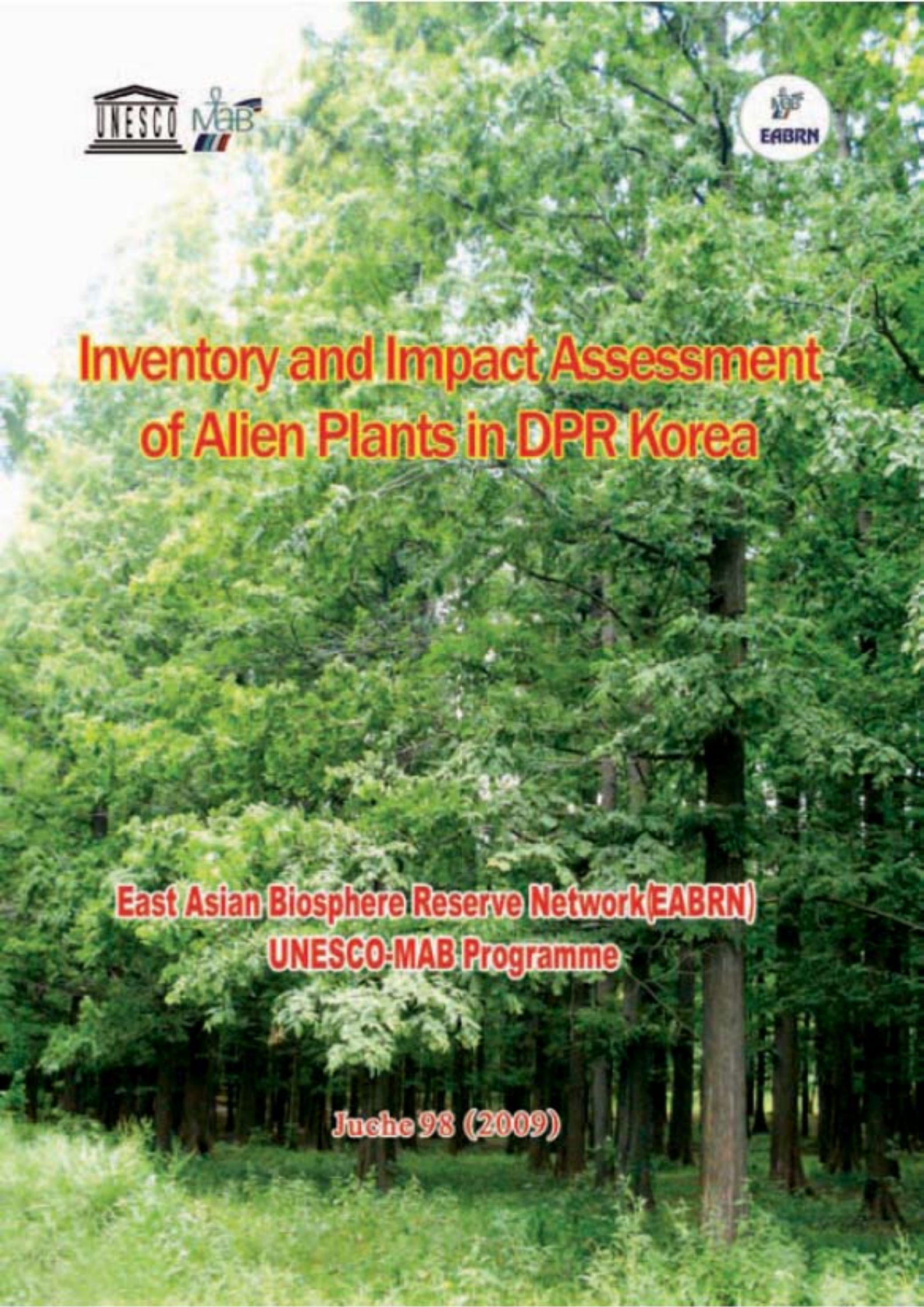

Inventory and Impact Assessment of Alien Plants in DPR Korea

East Asian Biosphere Reserve Network(EABRN)
UNESCO-MAB Programme

Juche 98 (2009)

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With support from
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MAB National Committee of DPR Korea

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Introduction

Korea, situated in the southeast of Eurasian continent, is a peninsular with 80% of mountainous areas. These peculiar biogeographical characteristics had made our country possible as an “immigration corridor” of many biological species that caused abundant in flora including endemic and alien plants, depending on which our ancestors had achieved great socio-economic development.

However, referring to the emphasis on the conservation and sustainable use of biodiversity in the modern times, the expansion of alien species was posed to be serious, and thus, interests and studies thereon are increasing.

Today, the worldwide expansion and invasion of alien species, together with habitat destruction, is one of the most threats for the global biodiversity conservation which plays important role in eco-environmental protection and sustainable economic development. In particular, the invasive alien species cause considerably a lot of negative impacts, as well as biological diversity, on eco-environmental and socio-economic sectors including agriculture, forestry, and human health. In addition, today’s expansion of trade and tourism due to the rapid increase of worldwide population and economy enables the risk of the expansion of alien species.

Therefore, the 7th Conference of Parties to the Convention on Biological Diversity in 2004 emphasized the issue on the invasion interception and reasonable managements of alien plants that threats ecosystem, habitat and species.

Recently in many countries, the study on the alien plants is a major trend in protection biology, and is applicable in different sciences involved biogeography, population ecology, genetics, dietetics, resource economics etc.

Also the DPR Korea, considering the international efforts for alien species management and the biodiversity of the country, has constantly carried out the sustainable management on alien species by its monitoring/control and impact assessment.

The great leader General **Kim Jong Il** has recently put forth the profound lines of policy to improve the protection and sustainable management of the forest resources, and led wisely to turn every corner of the country into a beautiful socialist land.

The current manuscript on the inventory and impacts of alien plants in DPR Korea is based on the data collected in the northern half of the Korean Peninsula and deals mainly with seed plant, due to the information lack on southern part by the division of the country.

The book “Inventory and Impact Assessment of Alien Plants in DPR Korea” classified into two parts: the chapter I describes the general knowledge on the conception, introduction pathway and impacts of alien species, and the chapter 2 inventory, impact assessment and recommendations for its management in our country.

We will step up further regular monitoring and detailed investigation on alien plants and the correct assessment on environmental and economic impacts, thus, contribute to manage sustainably the precious plant resources of the country,.

Publishing this book within the framework of UNESCO’s Ecological and Earth Sciences activities under Man & Biosphere Programme (MAB) and East Asian Biosphere Reserve Network (EABRN), we hope the book to help workers, scientists and students in their efforts for building up the country as a socialist land of bliss and a prosperous land abundant with plant resources.

Chapter 1. General Knowledge on Alien Species

Section 1. Conception and Introduction Pathway of Alien Species

1. Conception of Alien Species

The human has cultivated crops and created fruit farms, aquaria and artificial forests through the introduction of alien species, from which he gets foods and various crude materials with great economic benefit.

The unreasonable introduction of alien species, however, causes the changes of the structure and functions of ecosystem and also generates large adverse socio-economic and cultural effects. Therefore, for being well aware of the risk of alien species on biodiversity and sustainable socio-economic development, it is necessary to understand the basic conception of alien species.

Moreover, because the subject is relatively new, it is important to be correctly aware of different concepts and terms thereon used by different persons. When consulting documents written by other people, particularly non-biologists, there are slightly or very different key words and expressions, and they should be adjusted and unified.

Alien species is simply the general name of the bio-species that were spread through diverse pathways from their native habitats to and inhabit in new area or ecosystems, that is, the concept opposite to natives or indigenous and endemic species which are naturally developed, evolved and bred to constitute the structure of pertinent ecosystems, and it comprise the bio-species (animals, plants and microbes) that have migrated to and established in their non-native areas.

Some people define that an alien species is one that enters an ecosystem beyond its historic range, including any organisms transferred from one country or province to another, and recent years include even the genetically modified species.

There are a number of essentially synonymous terms used to describe such species, including “introduced”, “aliens”, “exotics”, “non-natives”, “immigrants", “adventives”, “neophytes” or “non-indigenous”. The 1992 Convention on Biological Diversity uses the term “alien” to describe these kinds of organisms and hence this is the term now predominantly favored in the ecological and management literature.

On the other hand, among the alien species, serious problems are posed by the naturalized species which invade into and naturally grow and reproduce in new areas, but not by such species including crops, fruit and flowering plants as they need continuous care of people and goes out of existence without further spreading in mountains or forests when being abandoned.

Such alien species, whose introduction into new natural ecosystem produces a change in terms of structure or ecosystem processes, displaces native species by life competition and does or is likely to cause crops and forest harm or harm to human health and life are called as “harmful exotics” and/or “invasive alien species”. The alien species affect intensively not only biodiversity, but also socio-economy.

2. Introduction Pathway of Alien species

To be well aware of the introduction pathway of alien species is of great significance in protecting the invasion of new alien species and the spread of already invaded ones.

Alien species are introduced through artificial or natural pathway from one region to another.

In former case, there are intentional or of-policy introduction of the high grades of crops and livestock, ornamental plants and animals and natural enemies of insects; and the unintentional accidental introduction through diverse trade (railway, shipping, airplane etc.) and/or tourism.

The second case involves the natural transfer by wind, air stream, river flow, animal’s migration and so on.

2.1 Intentional introduction

In ancient times, mount ranges and oceans formed vast natural obstacles and therefore ecosystems have developed and evolved in the relatively isolated and balanced conditions, while bio-species have gradually and continuously spread their distribution by natural and casual factors such as wind, waterflow, birds and animals. The emergence of human generated intentional introduction of alien species through active migration and interchange of human.

The intentional introduction of alien species comprises cases for:

- food, timber, medicinal, or other crop;
- seeds and seedlings for scientific research;

- microorganisms , insects and plants for a biological control for another pest species;
- ornamental plants and pet animals for ornamental or sentimental requirement;
- alien species for nature remarking and so on.

Following plant species are being cultivated and used with great practical utility for people in new areas across oceans and continents far away from their original habitat: rice originated from the middle area of India, potato from the Andes, sugar cane and mango from tropic Asia, gum tree from the downstream of the Amazon River, coffee tree from tropic Africa, pumpkin from Mexico and the northwest of South America etc.

Not a little of irreversible aftereffects are caused within the deliberate introduction of alien species for immediate benefit with the deficiency of knowledge related to ecology and biodiversity and without considering the effect of alien species to new ecosystem. For example, in 1870, the introduction of *Pueraria lobata* to America for feed using its stems and leaves that had high content of protein were considered to be harmful weed in 1960s, because the plant have covered wide areas of houses, power poles, living trees, forests and railways, and its eradication requires great effort.

2.2 Unintentional (casual) introduction

Alien species can also be transferred by chance by seeds, spores or larva through:

- stuck to people's (or domestic animal's) clothing or shoes;
- stuck on wood, packing material and/or containers;
- stuck in the mud on vehicle types;
- in ships' ballast tanks;
- importing route of foods, fruits and vegetables and so on.

This is the unintentional transfer fundamentally other to the people’s intentional action. Weeds like *Ambrosia artemisifolia*, nematodes and other pests like avian influenza virus are spread in such ways as mentioned above, and cause great economic loss and threats to local biodiversity.

Moreover, the present worldwide activation of trade, tourism and travels facilitate the spread and introduction of lots of alien species here and there without knowing it in surprising speed.

Section 2. Impact of Alien Species on Ecosystem and Socio-economy

It was estimated that about 480 000 alien species have been introduced into the varied ecosystems on earth. People have for a long time introduced alien species and used to meet diverse needs for their existence and well-being as foods, industrial raw materials and ornamentals and so on.

As representatives, such introduced species, like corn *(Zea mays* L.), wheat *(Triticum* spp.), rice *(Oryza sativa* L.), domestic chicken *(Gallus* spp.), cattle *(Bos taurus*), and others are beneficial and indispensable for human's life and provide more than 98% of the world food supply with a value of over US$ *5* trillion per year.

However, the introduction of alien species does not only benefit people, but affect negatively various fields including environment and economy.

In the recent past, the rate and risk associated with alien species introductions have increased enormously because human population growth and human activities altering the environment have escalated rapidly. Currently, global population is over 6 billion. Large numbers of humans are traveling faster and farther, while more goods and materials are being traded among nations. These human activities are increasing the spread of alien species worldwide.

As invasive alien species essentially account for the negative effects of alien species, the book addressed mainly the adverse impacts of invasive species.

1. Impacts of Alien Species on Biodiversity

As being the constitutional element of ecosystem, each animal and/or plant species has its own niche within food chain in the natural environment of its original habitat and attributes to the maintenance and stability of its community and ecological balance.

Once alien species, especially invasive ones, invade into new place, they impact native species and ecosystems by competing directly for resources that native species require, by altering ecosystem functions and processes such as nutrient and hydrologic cycles, and fire frequency and/or intensity. There are virtually no natural areas left that have not felt the effect of alien invaders.

Firstly, after the alien invaders introduced to and established in new ecosystems,

they impact adversely on biodiversity composition by competitions with or preying on native species. That is to say, they compete with native species for such resources necessary for their existence as light, air, water and nutrients and thus gradually displace and/or remove the native species relying on their vigorous capacity of growth and proliferation, resulting in the loss of the biodiversity of invaded areas.

The unreasonable introduction of alien species considering only its high productivity causes large loss of native species in many cases. For example, the 1954 introduction of Nile perch of good taste and high social call into the Victoria Lake in Africa produced a certain extent of economic benefit at first, but according to the analysis after 50 years, over 200 species of fishes had disappeared in the lake and consequently posed a change for the worse of the life of local people as well as a series of environmental problems.

About 5 000 alien plants have become established in the USA natural ecosystems, displacing several native plant species and nearly 700 000 ha per year of the USA of wildlife habitat are invaded by alien weeds. The European purple loosestrife *(Lythrum salicaria)* which was introduced in the early 19th century as an ornamental plant has been spreading at a rate of 115 000 ha per year and is changing the basic structure of most of the wetlands it has invaded.

A St.-John's-worth (*Hypericum perforatum*), perennial weed in Europe and Asia, introduced early in the 20th century into the USA and rapidly spread, causing displace of pasturage. Among 225 key agricultural pests introduced in the USA, more species were invasive than only 80 ones anticipated to be invasive. And since 1850 the harmful alien species have increased 10 times, among which about 200 species are causing damage. It was considered that in the USA the alien species accounts for 39% of crop pests, 27% of forest pests, 7% of livestock diseases/pests, 41% of grass weeds and 73% of paddy soil weeds, respectively. In the USA, about 400 of the 958 species on the USA Threatened or Endangered Species List are considered at risk primarily because of competition with and predation by non-alien species.

Of the 27 515 total plant species identified in the UK, only 1 515 species are considered to be native and more than 80% of alien plant species in the UK are established in railway embankments, roadsides, and similar disturbed habitats.

Of the 55 000 known plant species in Brazil, an estimated 21.1% (11 605) are alien species. Introduced grass species are having significant negative impacts upon

Brazil's ecosystems because they displace native grasses and make the ecosystem more susceptible to fires than native grasses do.

And there is not a little of cases that alien invaders become host of pest. For instance, an avian malaria occurred in the birds reared by Hawaii people, but did not be spread because of the absence of its host. In 1826, tropical house mosquito was introduced through the ballast water of sailing ship and became host to disseminate avian malaria, resulting in the extinction of at least over 10 native species of bird susceptible to malaria.

In addition, the alien invaders induce the competition with native species in an way of producing individual superior to native ones and consequently pose a change and degradation of the composition of indigenous biodiversity.

Secondly, the invasive alien species generate adverse impact on the structure and function of invaded ecosystem.

Less damage are made when simply some bio-species are affected, but problems that are much more serious come through ecological transformation. Plants usually become such factors as called *ecological transformers*, which also change the physical nature of the habitat and therefore lead to the local extinction of dozens of species, and if they are very successful invaders, the adverse impact thereby are equally widespread.

False-acacia (*Robinia pseudoacacia*) is considered not only to be useful in that it protects soil erosion, has high value of fuel, and is used for wood, livestock feeds, nectar source, edible seeds, reforestation, crop nurse and reclamation of mine lands; but also to be notorious invader of plant in many countries, accounting for its rapid seed germination and growth and high capacity of photosynthesis and rebirth. For the first 10 years, growth of *R. pseudo-acacia* in height of the seedlings per year averages 0.46 to 1.22 meters or more and *R. pseudo-acacia* is therefore able to out-compete other pioneer species for light to suppress many understory plants. Besides, using the richness of NOx referring to the symbiosis with *Rhizobium*, it stretches radically about 300 m long into soil, so that it brings about damage to eco-environment.

The presence of alien aquatic plants, such water hyacinth *(Eichhornia crassipes)* native to South America and water lettuce *(Pistia stratiotes)* as significant aqua-ecological transformers, causing rapid deoxygenation in water, alter the habitats of fish and other aquatic species, choke waterways, alter nutrient cycles, and reduce recreational use of rivers and lakes. It forms thick and dense

masses of vegetation that slow down the water flow, leading the water to heat up, and by covering the surface limit gaseous exchange.

In South Africa, water hyacinth is reducing already scarce water resources. In Cape Town, invading woody species are estimated to reduce the total water supply by 30%. The economic investment of the work for water totals US$ 50 million per year. In addition, more than US$ 5 million per year is being spent to prevent future alien plant invasions in South Africa.

There is also the case where the alien invaders completely reconstruct other ecosystem. For example, after its introduction in 1937 from South America to Is. Taiti, the plant named “Miconia” of very high decorative value have rapidly spread to cover more than half of the whole island. Its shallow and tentacular root system brought about landslides and its predominant crowns covered whole lower and understory trees, resulting in the habitat destruction and native species under extinctive threat. And in the other country, kinds of alien species introduced from South America formed aggressive community of invaders to transform the forest vegetation rich in species biodiversity into pure forest.

In particular, island ecosystem under the isolated eco-geographical environment is affected more extensively than continental countries and/or regions, attributable to its high susceptibility.

Like this, the invasive alien species are considered to be one of the largest threat to the conservation and protection of wildlife.

2. Socio-economic Impacts of Alien Species

Alien invaders species pose adverse impact not only on biodiversity, but also on agriculture, forestry, fishery, tourism, human’s health, water resource management, electric power generation, maintenance of construction structure and the other social and economical fields.

Particularly, alien plants, as being harmful weeds, cause not a little of economic loss to agriculture and forestry. In crop systems, including forage crops, many intentionally introduced plant species have become weed pests. Most weeds are accidentally introduced with crop seeds from ship-ballast soil, or from various imported plant materials.

In USA agriculture, weeds cause a reduction of 12% in potential crop yields. In economic terms, this reduction represents about a US$ 33 billion loss in crop

production annually. Based on the estimate that about 73% of the weeds are non-indigenous, it is likely that about US$ 27.9 billion of these crop losses are due to introduced weeds. In USA pastures, since about 45% of the weeds are alien, the approximate forage losses due to non-indigenous weeds are nearly US$ 1 billion per year. About US$ 5 billion per year spend to control invasive alien weeds in pastures and rangelands, but these weeds continue to spread.

More than 80% of alien species are present in waste ground areas, urban sites, roadsides, and similar disturbed habitats. An estimated 63% of the alien plant species grow in hedges and scrub areas, and vegetation in rock walls and woodlands consist of about 40% alien species. UK croplands and gardens contain 43% alien weeds and it is likely that US$ 1.4 billion of the crop losses annually are caused by alien weeds

Table 1. Economic losses to introduced pests in crops, pastures, and forests in the United States, United Kingdom, Australia, South Africa, India, and Brazil

(x billion US$ per year)

Introduced organism	Damaged sufferer	US	UK	Australia	S. Africa	India	Brazil	Total
Weeds	Crops	27.9	1.4	1.8	1.5	37.8	17.0[a]	87.4
-	Pasture	6.0	-	0.6	-	0.92	-	7.52
Vertebrates	Crops	10[b]	1.2[c]	02	-		-	2.4
Arthropods	Crops	15.9	0.96	0,94	1.0	16.8	8.5	44.1
-	Forest	2.1	-	-	-	-	-	2.1
Plant pathogens	Crops	23.5	2.0	2.7	1.8	35.5	17.1	82.6
-	Forest	2.1	-	-	-	-	-	2.1
Total		78.5	5.56	6.24	4.3	91.02	42.6	28.72

a: Pasture losses included in crop losses; b: Losses due to English starlings and English sparrows; c: Calculated damage losses from the European rabbit;

Many of the alien plant species introduced into Australia have become weeds and have invaded a wide range of environments. These invasive plants are reducing

yields in crops and pastures and changing the natural environment. In Australia, some 60% of the weeds in crops are alien, based on a survey of major weeds in cereal crops. The introduced blackberry *(Rubus proceus)* from Asia is alone causing US$ 77 million per year of damage to crop production. A total of 463 exotic grasses and legumes were intentionally introduced for forage, but only four species proved beneficial for pasture. The losses due to pasture weeds are estimated to be US$ 970 million per year.

In South Africa, a reduction in crop production due to all weeds is 16.6% and cost about US$ 2.2 billion per year in value of potential crop production. Assuming that 67% of the weeds in crops are alien, they cause total crop losses of about US$ 1.5 billion per year.

In India, weeds are estimated to cause a 30% loss in potential crop production. Assuming that 42% of the weeds in crop production are alien, the total cost associated with them is about US$ 37.8 billion per year. *Lantana camara,* a major weed shrub in India was introduced from Australia as an ornamental plant has invaded the majority of Indian pasture lands (13.2 million ha) plus other areas and is toxic to cattle, and the cost of its control is US$ 70 per hectare. Since about 4% of India's land area is pasture, the damage from *Lantana* is estimated to be US$ 924 million per year.

In Brazil, alien weeds make up 75% of the weed species in crop production areas. Alien weeds are estimated to destroy about 13.4% of crop and pasture production, causing about US$ 17 billion per year in losses. These and other invasive plants change key natural ecosystems, alter fire regimes, and reduce the resources for native animals. In addition to alien animals and plants, the introduced pathogens like viruses cause vast damage to agriculture and human's health and radical socio-economical problems as well.

Potato blight (*Phytophtora infestans*) native to South America is not active, but massively develop and let potato decay once proper climatic condition has come. The damage by potato blight in Ireland in 1845 brought about the starvation of 1.5 million of people.

Since *Viteus vitifolii* invaded into France in 1860 through wine seedling from the USA, it has made damage to 1.01 million ha of winyard (1/3 of France's wineyard area at that time).

Ostrinia nubilalis invaded to the USA in 1921 has become the first insect pest of corn, damaging and expending annual worth of US$ 350 million.

And next, the alien invaders make the of water containing capacity of forest worse and consequently impact on water supply and power generation, and adhere construction structure to decrease its life time.

In the South Africa, as invasive alien plants are consumptive water-users, they may have reduced river flows in 4 main catchments river basins of the country by about 6.7%. if invasions are not controlled, they could potentially spread and occupy up to 70% of the river basins and spend the cost of US$ 92 million per year in future.

In a country, the biomass increase by invasive aquatic alien plant caused the largely decrease of area by 1.7 million ha and water consumption of 4.4 billion ㎥. The cutting of such an invasive alien costs about US$ 1.2 billion, but it is more effective for water conservation in the catchments than the construction of new dam.

Alien invaders either destroy the scenic beauty of native ecosystem and thus affect the spiritual and cultural life of local people or hinder the recreation and tourism. The hydrilla *(Hydrilla verticillata*) infestations in two Florida lakes have prevented their recreational use, causing an annual loss of US$ 10 million. In the USA, a total of US$ 100 million is invested annually in the control of alien aquatic weed species.

To prevent and control the alien species costs large economic losses beside the cost referring to the impact on biodiversity. Even China, which basically combats only the short-term economic costs of invasive species, spends about US$ 9 billion annually on control and mitigation measures. The real costs to China are considered to become larger in the mid-term future, through increased understanding of the true effects of species not currently being dealt with.

In addition, alien species affect adversely human's health and life environment. It is well known that some alien plants like *Ambrosia artemisifolia*, orchard grass (*Dactylis glomerata*), Japanese hop (*Humulus japonicus*) and eulalia (*Miscanthus sinensis*) damage human's health, causing such a by-pollen allergy and other diseases.

As shown, despite of the world-wide effort to remove or alleviate the adverse impacts of alien invaders, the issue of alien species today is still posed to be serious, and in case of the already established and/or naturalized alien invaders makes more and more threats to native ecosystem with regard to the higher adaptability of invaders.

Chapter 2. Inventory and Impact Assessments of Alien Plants in DPR Korea

Section 1. Inventory of Alien Plants in DPR Korea

The interest and study on the alien plants are recently increasing, thus, familiar plants for us as natives in our country known later as aliens, and some expand rapidly incrementing the number of new alien species. Therefore, it is very important to survey in detail on the alien plants introduced into our country and to control them sustainably.

This book treated mainly the alien plants introduced or naturalized in our country, its inventory based on different books/journals and spot-survey data up to now (the year 2008) are following.

1. ***Podocarpus chinensis*** (Podocarpaceae)

[Origin] China, Japan; introduced to Korea from China long ago

[Characters] Trees, evergreen, to 5 m tall, growing in shade forests. Leaves rather broad (8-12 cm wide), linear-lanceolate, acute at both apex. Dioecious, staminate cones spreading pollens in May; ovulate cones ripening red in autumn.

[Distribution/Impacts] Cultivated in gardens and parks, thus, no impact on native flora

2. ***Chamaecyparis obtusa*** (Cupressaceae)

[Origin] Japan

[Characters] Trees, evergreen, scaly, to 40 m tall and ca. 2 m in diameter. monoecious, spreading pollens in Apr., female cone ripening reddish-brown, in Sep., due to good for afforestation and usage, deeds to plat in proper soil of the mountains.

[Distribution/Impacts] Planting as afforestation species in southern parts, but cultivated in parks and gardens in Northern parts, grown normally without impact of temperature.

3. ***Chamaecyparis pisifera*** (Cupressaceae)

[Origin] Introduced to Korea from Japan long ago

[Characters] Trees, evergreen, scaly, ca. 30 m tall, ca. 1 m in diameter. Monoecious, staminate cones spreading pollens in Apr.; ovulate cones ripening brown in autumn. Propagation by seeds and cuttings. Soft timber useful for furnishes, good for urban greening because of tolerant to contamination.

[Distribution/Impacts] Planting at valleys in southern parts, but found in parks of northern parts. Thus, no impact on nature flora of the country.

4. ***Thujopsis dolabrata*** (Cupressaceae)

[Origin] S. Honshu of Japan; montane areas between 500-1 500 m above sea level; introduced to Korea long ago.

[Characters] Trees, evergreen, erect to 10 m-30 m tall, ca. 90 cm in diameter. Leaves tick, scale-like. High tolerant to shade; the timber very firm with beautiful patterns, thus, used as furnishes/building materials.

[Distribution/Impacts] Cultivated in southern parts of our country, but not planting in montane areas, only some parks and gardens of northern parts.

5. ***Metasequoia glyptostroboides*** (Taxodiaceae)

[Origin] This plant had been recognized as an extinctive species long ago, but it is known in China in 1943; cultivated in Korea since 1950’s.

[Characters] Trees, needle-leaved, deciduous, ca. 35 m tall, 2-3 m in diameter. Plants along roadsides usually with conical crown-like, or globose–shaped in case of a pure forest. Mostly grown in warm places with sufficient humidity (ca. 80%), but grown very slowly.

[Distribution/Impacts] Cultivated as roadside trees in parks of various localities of the country. Grown normally and rapidly, but not invaded into montane areas.

6. ***Taxodium distichum*** (Taxodiaceae)

[Origin] N. America; introduced to Korea long ago.

[Characters] Trees, needle-leaved, deciduous, ca. 50 m tall, ca. 4 m in diameter, with narrowly conical or globose crown, colored in yellowish brown and beautiful in shape. Staminate cones spreading pollens in Apr.-May; ovulate cones ripening brown in Sep. the timber soft, a little useful. Propagation by seeds, but in case by cuttings the rooting rates lower, growing 10-80 cm per year.

[Distribution/Impacts] Cultivated in some gardens, parks, resorts, thus, no impact on nature flora; forming a pure forest or mixed forests in marshy places.

7. ***Cedrus deodara*** (Abietaceae)

[Origin] India; at montane areas Western Himalaya (1 200-3 000 m by sea level); introduced to Korea long ago.

[Characters] Trees, evergreen, to ca. 30 m tall, with long and short branches; the crown usually conical. Monoecious, staminate cone spread pollens in Oct.; ovulate cone ripening in autumn of next year. Propagation by seeds or cuttings

[Distribution/Impacts] Cultivated in gardens, parks, thus, no impact on native flora.

8. ***Larix leptolepis*** (Abietaceae)

[Origin] Middle parts of Japan; cultivated in Korea since ca. 80 years ago, as a pure forest in low mountains

[Characters] Trees, needle-leaved, deciduous, ca. 30 m tall, ca. 1 m in diameter; the crown usually conical. Monoecious; staminate cone spread pollens in May; ovulate cone ripening brown in Oct.; Propagation by seeds and grown more rapidly than other species of same genus (*Larix*). The timber stout with many resins, thus, used as different building's materials.

[Distribution/Impacts] Cultivated as a major tree for afforestation in different parts of the country, but not expanded in distribution due to natural propagation lower than other species.

9. ***Picea abies*** (Abietaceae)

[Origin] Europe; under cultivation in Korea since ca. 80 years ago

[Characters] Trees, evergreen, needle-leaved, to ca. 50 m tall. Branches spreading widely with globose crown. Monoecious, staminate cones axillary in old branches; ovulate cones in terminal of branches. Early growth slow, but after 15 years grow rapidly as ca. 1m tall per year. The timber is not very useful.

[Distribution/Impacts] Cultivated in gardens, parks, thus, no impact on nature flora and with low capability of natural renovation by itself.

10. ***Pinus banksiana*** (Pinaceae)

[Origin] N. America; introduced to Korea long ago

[Characters] Trees, needle-leaved, evergreen, ca. 25 m tall, ca. 50 cm in diameter, Leaves 2 per fascicle. Monoecious, staminate cones spread pollens in spring; ovulate cones ripening in autumn, very hard, somniferous scale persistent. Propagation by seeds or cuttings, but the germination rate very low.

[Distribution/Impacts] High resistant to cold in original places, but not widely cultivated because the timber is soft no good quality, only concerned with gen bank conservation, thus, no impact on nature flora.

11. ***Pinus bungeana*** (Pinaceae)

[Origin] China; introduced to Korea in ca. 600 years ago; an unique native tree in Asia.

[Characters] Trees, needle-leaved, evergreen, ca. 15 m tall, ca. 1.7 m in diameter; with 3 leaves per fascicle. Stems not erect like others of Pinus, usually axillary buds growing more rapidly than terminal ones after 4-5 years covering the earth. Staminate cones spreading pollens in May; ovulate cones maturing in Oct. of next year, falling seeds. Propagation by seeds or cuttings. Comparatively resistant to cold and dry, also grown in shade places, used as furnishes materials.

[Distribution/Impacts] Planting mainly in parks or/and gardens, and no in mountain areas, thus, no impact on native flora.

12. ***Pinus rigida*** (Pinaceae)

[Origin] N. America; introduced to Korea long ago.

[Characters] Trees, needle-leaved, evergreen, 15-20 m tall, ca. 50 cm in diameter; leaves 3 per fascicle, often with ellipsoid crown. Staminate cones spreading pollens in May; ovulate cones maturing in Oct. of next year and exposing seeds. Grown even in dry and humid places, thus planting for landslip protection, also resistant to damage from pine-caterpillars; not valuable as timbers, but used as resin, railroad-tie and building materials.

[Distribution/Impacts] Afforested along seaside and some low mountains of various parts of the country. Grown normally, but not found either the invasion to other plant community and the competition with others species.

13. ***Pinus strobus*** (Pinaceae)

[Origin] N. America; introduced to Korea long ago.

[Characters] Trees, needle-leaved, evergreen, 40-50 m tall, 1.5 m in diameter, the crown usually conical, but globose. Leaves 5 per fascicle. Staminate cones spread pollens in May; ovulate cones ripening in Aug. of next year exposing seeds. Grown rapidly in fertile soils; the timber soft, light, beautiful, thus, widely used as building materials. Propagation by seeds and cuttings with high rates of germination/rooting; a bark with tannin (ca. 8%).

[Distribution/Impacts] Planting in parks or resort areas, also in mountains of Kosong and Wonsan in Kangwon Prov., Pukchang of South Phyongan Prov. and Hyesan of Ryanggang Prov. Normally grown; the natural renovation and expansion of areas, and the continuation in given community are observed. High resistant to cold and grown rapidly, also, high competition between needle-leaved trees.

14. ***Pinus sylvestris*** (Pinaceae)

[Origin] Europe

[Characters] Trees, evergreen, ca. 40 m tall, ca. 50 cm in diameter; the crown usually conical in forests, but changed in case of a single tree. Leaves 2 per fascicle.

Staminate cones spreading pollens in May; ovulate cones ripening in Sep.-Oct. of next year. Propagation by seeds; grown erect even in water places; valuable as good timber.

[Distribution/Impacts] It is distributed upwards the northern-west regions from a boundary line with *P. densiflora* of our country. Some taxonomists reports that found an community of *P. funebris* in boundary area between *P. densiflora* and *P. sylvestris*, but more research needs. Cultivated in Ryanggang Prov., but no impact on nature flora.

15. ***Pinus tabulaeformis*** (Pinaceae)

[Origin] N. and NE China; grown in montane areas in Korea since long ago.

[Characters] Trees, needle-leaved, evergreen, usually ca. 20 m tall, ca. 80 cm in diameter, the crown spreading in umbel. Leaves 2 per fascicled, alternate in branches. Staminate cones spreading pollens in May; ovulate cones ripening in Oct. of next year, with persistent strobilus. Propagation by seeds. Much larger than that of others of *Pinus*. The timber rather stout, remarkably with annual ring, useful as building's materials and for windbreak. Tolerant to damage from caterpillars.

[Distribution/Impacts] The plant grown in Maengsan county of South Phyongan Prov. It presumes ca. 22 m tall, ca. 110 cm in diameter with ca. 200 years of lifetime, and grows well naturally expanding their habitats. The plant less than 10 years is growing more rapidly than *P. densiflora* or *P. thunbergii*, thus, is possible to invade their habitats.

16. ***Pinus hakkodensis*** (Pinaceae)

[Origin] Japan; introduced firstly into Pujon county in 1920's, and then naturalized.

[Characters] Trees, evergreen, needle-leaved, 30-40 m tall.

[Distribution/Impacts] Distributed only in Pujon Plateau (more than 1 000 m of altitude) of northern parts in Korea. It is normally grown and gradually expanded. The planting of a great number of the plant is very valuable in this region where theren't found *P. densiflora*.

17. ***Platanus occidentalis*** (Platanaceae)

[Origin] N. America; cultivated along road and gardens in Korea since long ago.

[Characters] Trees, deciduous, broad-leaved, 40-50 m tall, a bark peeling in small plates. Leaves widely ovate, shallowly 3-5 lobed. monoecious, unisexual, male inflorescence axillary, female ones usually solitary in terminal. Ripened fruits falling in next spring, seeds hairy basally. Grown rather in wet fertile soils, valuable as fiber materials, but no as timbers. Weak tolerant to insect damage.

[Distribution/Impacts] Widely cultivated as roadside trees or in parks in our country, its growth rapid, but no direct impact on native flora

18. ***Platanus orientalis*** (Platanaceae)

[Origin] Western region of Asia Minor; cultivated as roadside trees since long ago

[Characters] Trees, deciduous, broad-leaved, to ca. 30 m tall, a bark separating into large plates. Leaves widely ovate; deeply 5-7 lobed. Monoecious, unisexual, inflorescences in globose head, male one axillary, female ones several in terminal of short branchlets. Flowers in May-Jun. Fruits falling at maturity in spring of next year. Propagation by seeds or cuttings, grown very rapidly.

[Distribution/Impacts] Widely cultivated as roadside trees in the past, but currently are changing other trees for afforestation, therefore, no invasion to mountains and no impacts on native flora.

19. ***Liriodendron tulipiferum*** (Magnoliaceae)

[Origin] N. America; cultivated as ornamental along parks and gardens in Korea since long ago.

[Characters] Trees, deciduous, broad-leaved, to ca. 50 m tall. Stems erect, producing many branchlets with ellipsoid crown. Flowers solitary in terminal, greenish yellow, in May-Jun. Propagation by seeds or cuttings. Grown rapidly, in loamy soils with good drainage; the timber soft thus widely used as furniture materials.

[Distribution/Impacts] Grown normally, but a few in some parks of Southern and northern parts. Their's a plant (ca. 25 m tall and ca. 40 m in diam.) planted ca. 100 years ago in Wonsan, Kangwon Prov.

20. ***Magnolia denudata*** (Magnoliaceae)

[Origin] Middle parts of China; cultivated as ornamental in Korea since long ago.

[Characters] Trees, deciduous, broad-leaved, 5-10 m tall. Stems erect with many branchlets; bark light gray. Leaves thick-coriaceous, 10-15 cm long, 5-8 cm wide; greenish. Flowers bisexual, whitish, ca. 12 cm in diameter, precocious in Apr.-May before leaves. Fruits ripening brown in Sep.-Oct. Propagation by seeds or cuttings. Flowerets used as traditional medicine

[Distribution/Impacts] Cultivated as ornamentals in gardens, parks or resort areas of some places in South Phyongan Prov., but no impacts on native flora.

21. ***Magnolia grandiflora*** (Magnoliaceae)

[Origin] North America: introduced as ornamentals to Korea long ago.

[Characters] Trees, evergreen, broad-leaved, 20-30 m tall. Leaves large, elliptic or obovate, thick-coriaceous. Flowers precocious in May-Jun, white, in terminal, strongly fragrant. Fruits ripening in autumn, greenish white, densely pubescent. Propagation by seeds.

[Distribution/Impacts] Cultivated as ornamentals in some places of southern parts of the country, but no impacts on native flora.

22. ***Magnolia liliflora*** (Magnoliaceae)

[Origin] Introduced as ornamentals to Korea from China 100 year's ago.

[Characters] Trees, deciduous, broad-leaved, to ca. 15 m tall. Leaves obovate, 8-18 cm long, 4-11 cm wide, densely pubescent on upper/lower surfaces and nerves. Flowers precocious in Apr.-May, deep-purplish, bisexual. Fruits ripening brown in

Sep.-Oct. Seeds exposed out at maturity. Propagation by seeds or cuttings; flowerets used as traditional medicine. Rather weak to cold.

[Distribution/Impacts] Cultivated as ornamentals in gardens, parks or resort areas of some places of the country, but no impacts on native flora.

23. ***Magnolia obovata*** (Magnoliaceae)

[Origin] Japan: introduced to Korea long ago..

[Characters] Trees, deciduous, broad-leaved, 20-25 m tall, 60-70 cm in diameter, with globose crown; bark grayish, stems erect. Leaves obovate or oblong, large (20-40 cm long, 15-25 cm wide), entire. Flowers in May-Jun. yellowish white, beautiful, fragrant. large (12-16 cm in diameter). Fruits ripening in Sep.-Oct. Propagation by seeds. Grown rather rapidly in fertile or/and good drainage soils. The timber light, soft, white, clean, thus, used as furniture materials; bark as traditional medicine, but relatively not resistant to cold.

[Distribution/Impacts] Cultivated as ornamentals in gardens, parks or resort areas of some places in Phyongan Prov. and grown normally, but no impacts on native flora.

24. ***Magnolia stellata*** (Magnoliaceae)

[Origin] China, Japan; introduced from China long ago.

[Characters] Trees, deciduous, broad-leaved, to ca. 8 m tall, with globose crown. Leaves 5-8 cm long, 1-3 cm wide. Flowers precocious in Apr.-May, reddish white. Fruits ripening in Sep. Propagation by seeds or cuttings

[Distribution/Impacts] Cultivated as ornamentals in Pyongyang City and others parts of the country, but no impact on native flora

25. ***Cercidiphyllum japonicum*** (Cercidiphyllaceae)

[Origin] Japan; introduced to Korea long ago.

[Characters] Trees, broad-leaved, deciduous, to 40 m tall, ca. 1.5 m in diameter; much branched, with ellipsoid crown. Leaves opposite, widely ovate; upper surfaces green, shiny, lower surfaces whitish, with beautiful colored in autumn. Dioecious, Flowers fragrant, in Apr. Fruits ripening in Sep.-Oct. Propagation by seeds.

[Distribution/Impacts] Cultivated as ornamentals in some places including the Central Botanical Garden, Kaesong City or southern parts, their growth and fruition are normal, but no impacts on native flora.

26. ***Clematis florida*** (Ranunculaceae)

[Origin] China; cultivated as medicine to Korea long ago.

[Characters] Herbs, perennial, climbing. Leaves oppossite, compound, bipinnate with 3-lobed. Flowers solitary, axillary in Jun.-Jul., white, bisexual. Fruit ripening in Sep. to Oct.

[Distribution/Impacts] Cultivated as medicinal or ornamentals in the past, but a little currently, thus no impacts on native flora.

27. ***Paeonia lactiflora*** var**.** ***trichocarpa*** (Paeoniaceae)

[Origin] Northeastern of China; introduced as ornamentals to Korea long ago.

[Characters] Similar to Paeonia lactiflora, but differs from dense pubescent on surfaces of fruit. Flowers pink, large, in May to Jun. Fruits ripening in Jul. to Aug.

[Distribution/Impacts] Cultivated as ornamentals in pots, thus, no impacts on nature flora.

28. ***Paeonia delavayi*** (Paeoniaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Shrubs, deciduous, 30-80 cm tall. Leaves alternate, bipinnate with 3-lobed. Flowers red or reddish violet, large(6-8 cm in diameter) in May, Fruits

ripening in Jul.-Aug. Roots usually used as traditional medicine. Propagation by seeds.

[Distribution/Impacts] Grown normally, but no impacts on nature flora.

29. ***Paeonia anomala*** (Paeoniaceae)

[Origin] China, Russia, Mongolia; introduced to Korea from China long ago.

[Characters] Shrubs, perennial, to 50-70 cm tall. Roots thick, fusiform. Leaves tripinnate with slender leaflets. Flower solitary in terminal, reddish violet, 5.5-7 cm long, in May to Jun. Fruits ripening in Aug. Propagation by seeds. Roots used as traditional medicine.

[Distribution/Impacts] Cultivated in parks, gardens or resort area as ornamentals with others of Paeonia. No propagate by itself, thus, no impacts on nature flora.

30. ***Paeonia suffruticosa*** (Paeoniaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Shrubs, deciduous, 1-1.5m tall, with fusiform roots. Leaves alternate, bi- or tri-pinnate. Flowers in terminal of stems or branches, bisexual, white or reddish, flowering in May, Fruits densely yellowish-brown hairy on surface, ripening in Jun. Propagation by seeds or sometimes by separating the roots. Roots used as traditional medicine.

[Distribution/Impacts] Cultivated in parks, gardens or resort area as ornamentals, sometimes in house-pots. No propagate by itself, thus, no impacts on nature flora.

31. ***Paeonia veitchii*** (Paeoniaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Shrubs, perennial, to 30-80 cm tall. Roots conical, fusiform. Flowers in terminal, sometimes axillary, reddish violet, ca. 10 cm in diameter, flowering in May to Jun. Fruits densely yellowish hairy on surface, ripening in July.

Propagation by seeds or sometimes by separating the roots. Roots used as traditional medicine.

[Distribution/Impacts] Cultivated in parks, gardens or resort area as ornamentals, sometimes in house-pots. Grown normally, but no propagate by itself, thus, no impacts on nature flora.

32. ***Papaver orientale*** (Papaveraceae)

[Origin] Mediterranean: introduced to Korea long ago.

[Characters] Herbs, perennial, 40-100 cm tall, densely whitish hairy. Flower solitary in terminal, deep reddish, flowering in May to Jun. Fruits ripening in Jun.-Jul. Propagation by seeds.

[Distribution/Impacts] Cultivated in parks or resort area as ornamentals, sometimes in house-pots. thus, no impacts on nature flora.

33. ***Papaver rhosea*** (Papaveraceae)

[Origin] Europe; introduced to Korea long ago.

[Characters] Herbs, biennial, 30-80 cm tall. Leaves slender, pinnate, covering the stem at base. Flower solitary in terminal, deep reddish, violet or whitish, flowering in May. Fruit ripening in Jun. Propagation by seeds. The medicinal component or the pigment of petals are useful.

[Distribution/Impacts] Cultivated as ornamentals in house-pots. thus, no impacts on nature flora.

34. ***Thea sinensis*** (Theaceae)

[Origin] China; cultivated in Southern parts of Korea since long ago.

[Characters] Shrubs, evergreen. Leaves alternate. Flowering in Oct. to Nov.; ripening in autumn of next year. Tea leaves used for drinking. Propagation by seeds.

[Distribution/Impacts] Cultivated in southern parts (Jolla Prov. and Kyongsang Prov.). No report the inter-relationship with other plants.

35. ***Firniana platanifolia*** (Sterculiaceae)

[Origin] China; under cultivation in Korea since long ago

[Characters] Trees deciduous, broad-leaved, ca. 15 m tall, The bark greenish, smooth, very clean. Leaves often fascicled in terminal of branches, widely globular, shallowly 3-5 forked. Monoecious, flowers unisexual, flowering in Jun.-Jul., ripening in Oct. Propagation by seeds.

[Distribution/Impacts] Cultivated as ornamentals in middle and southern parts of the country, and one year after planting found growing and flowering normally, but no impacts on native flora.

36. ***Abutilon theophrastii*** (Malvaceae)

[Origin] Southeastern Asia; cultivated as fibers crops to Korea long ago

[Characters] Herbs, annual, to 1.5 m tall, densely white hairy. Leaves alternate, circular, obtusely crenate at margins. Flowers in inflorescence by leaves in Aug.-Sep. Fruit an achene, ripening in Sep. to Oct. Seeds hairy. Propagation by seeds. A bark used as fibers.

[Distribution/Impacts] Cultivated as fiber crops since long ago, but now nearly cultivating, only found in somewhere as naturalized plants, in particular around houses or non-farming land. Thus, no impacts on nature flora.

37. ***Gossypium arboreum*** (Malvaceae)

[Origin] East Asia; under cultivation in India or China; introduced to Korea in A.D. 16^{th} century from China.

[Characters] Herbs, annual, 1-1.5 m tall. Leaves alternate, shallowly 3-5 lobed. Flowers solitary, axillary, yellowish white or white or light pink, flowering in

Aug.-Sep.; ripening in Sep. to Oct. exposing out seeds with white puberlant. The harvest is continuous untill nearly spring. Propagation by seeds. The seeds used as oil materials.

[Distribution/Impacts] Cultivated as a major fiber-crop in all provinces of the country in the past, and its growth and fructification were sufficient with high productivity. However, with the increase of chemical and synthetical fibers, the production of cottons in limited farming lands and its demands have decreased, thus no impacts on native flora.

38. ***Hibiscus mutabilis*** (Malvaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Shrubs, deciduous, 1-3 m tall, often with stellate hairy. Leaves alternate, broad. Flowers bright pink, in summer to autumn; ripening in autumn. Seeds reniform, pilose dorsally. Propagation by seeds or cuttings. Flowers used as folk-medicinal. Weak to cold.

[Distribution/Impacts] Cultivated as ornamentals only in gardens or greenhouses.

39. ***Hibiscus trionum*** (Malvaceae)

[Origin] Middle parts of Africa; introduced to Korea from neighbor countries long ago.

[Characters] Herbs, annual, 30-60 cm tall, densely hairy. Stems much branched, erect or sometimes ascending. Leaves alternate, deeply lobed. Flowers axillary, 4-5 cm in diameter, flowering in Aug.-Sep.; ripening in Sep. to Oct.. Seeds black. Propagation by seeds. Growing in fertile wetlands, also in dryland.

[Distribution/Impacts] Growing in group along grasslands and fields, involving some community areas(100-1 000㎡) with 3-5 individuals per ㎡, but no impacts on native flora.

40. ***Malva verticillcota*** (Malvaceae)

[Origin] East Asia; also distributed in temperate or subtropical of Northern Europe; introduced to Korea as vegetables long ago.

[Characters] Herbs, biennials, 60-90 cm tall. Leaves alternate, globose, shallowly 5-7 lobed. Flowers axillary, several, reddish in Jul.-Sep., flowering 35-40 days after sowing. Fruits ripening in Sep.-Oct. Seeds blackish brown. Propagation by seeds. Young shoot/leaf used as vegetables and fruits as traditional medicine. Resistant to cold, in any soils.

[Distribution/Impacts] It is firstly used as traditional medicine, and then cultivated as vegetables and/or green manure, but now in some locations as hobby-vegetables. No impacts on native flora because of no natural propagation.

41. ***Corchorus capsularis*** (Tiliaceae)

[Origin] India, China, Pakistan; cultivated in different parts of Asia; introduced from India as fiber materials long ago.

[Characters] Herbs, annual, usually ca. 1 m tall, to 3 m tall in fertile soils. Leaves alternate, glabrous. Flowers in Aug.-Sep., axillary, yellowish; ripening in Sep. to Oct. Fruits 5-valved, exposing out black seeds. Propagation by seeds. Recently not cultivated this plant, due to it should be sown every year. Bark used as fibers, which are grayish-brown, lustrous, usually for producing a jute bags.

[Distribution/Impacts] Cultivated as gibers in different parts of the country in the past, but a little currently, and some found in wild state, but no impacts on native flora.

42. ***Brassica cernus*** (Brassicaceae)

[Origin] China; cultivated in some others of Asia

[Characters] Herbs, biennials, 1-1.5 m tall. Roots erect, with many fibrous or adventitious rootlets. Flowering stems elongate, flowers in spring and ripenning in summer. Propagation by seeds. Used as flavoring in Korea.

[Distribution/Impacts] Widely cultivated serving as spice and antiseptic in middle and southern parts of our country. The flowering/fruition in cultivating areas is enough, but no inter-relationship with other plants because there aren't individuals grown naturally.

43. ***Brassica napus*** (Brassicaceae)

[Origin] China; cultivated as vegetables in Korea since long ago.

[Characters] Herbs, annual or biennials, 60-140 cm tall. Roots without sour taste. Flowers bisexual, yellow. Seeds blackish brown. Propagation by seeds. Rootstock edible and leaves used as animal's feeds.

[Distribution/Impacts] It is cultivated as vegetables in alpine zones including Hamgyong, Ryanggang and Jagang Provinces where not grown *Raphanus sativus*. The flowering/fruition and its production in cultivating areas are enough, but no impacts on native flora due to there aren't individuals grown naturally.

44. ***Brassica oleracea*** (Brassicaceae)

[Origin] Mediterranean; cultivated as vegetables in Korea since long ago

[Characters] Herbs, biennials, radical leaves forming a globose "head" in 1st year and exposing upwards the stem (60-100 cm long) from root in May-Jun. of next year. Flowers yellow, in terminal or axillary inflorescence. Fruit a caryopsis; seeds blackish brown. The head of cabbage used for several kind of cookery by its high nutritive value. Propagation by seeds. There are different cultivars as vegetables and ornamentals.

[Distribution/Impacts] It is currently cultivated as vegetables in various locations of our country, particularly in alpine zones where not planting *B. pekinensis*. The flowering/fruition and its production in cultivating areas are enough, but no impacts on native flora due to there aren't individuals grown naturally.

45. ***Brassica rapa*** (Brassicaceae)

[Origin] Europe; cultivated as vegetables in Korea since long ago

[Characters] Hers, biennial, to ca. 1 m tall. Rootstock fusiform or glososе or conical, used as vegetables. Stems from roots in next year, and then flowering in terminal and fruiting. It is very soft, with sweet and hot tastes, thus used as hobby vegetable. Propagation by seeds. Germinated relatively in low temperature(even at 2-3°c), therefore should be cultivated since early spring to autumn.

[Distribution/Impacts] Cultivated as hobby vegetables, no popular, and thus not expanded its cultivating areas and no impact on native flora

46 ***Citrullus vulgaris*** (Cucurbitaceae)

[Origin] Africa, India or Afghanistan; cultivated since ca. 4 000 years ago in Egypt; widely used as edible fruits in our country.

[Characters] Herbs, annual, climbing, usually ca. 1.5 m long, sometimes to ca. 3 m long; sowing in spring, Flower solitary, yellow, in Jul.-Aug.; fruits ripening in Aug.-Sep., usually with reddish inside; edible by its sweet taste and essential ingredients. Seeds black, flat. Propagation by seeds. Germinated at 20 °c, in rather fertile wetland(soil humidity 50-60％).

[Distribution/Impacts] Widely cultivated in all provinces of the country, but no impact on native flora.

47. ***Cucumis melo*** (Cucurbitaceae)

[Origin] China, Africa; suggested its introduction through middle parts of Asia and Europe by early B. C. and naturalized in our country.

[Characters] Herbs, annual, climbing to 1-4 m long with tendrils. Flower solitary, yellow, in Jun.-Jul.; fruits ripening in Jul.-Aug.; edible by its special flavor and sweet taste. Propagation by seeds or transplanting seedling. Grown rather in warm places, also drylands.

[Distribution/Impacts] Widely cultivated as fruits and vegetables in all provinces of

the country and its productivity rather high, but no impact on native flora.

48. ***Cucurbita moschata*** (Cucurbitaceae)

[Origin] Tropical regions of Asia or America.

[Characters] Herbs, annual, twining to 8-10 m long; dense with hard and transparent hairy. Flower unisexual, axillary in Jul.-Aug.; fruits ripening in Aug.-Sep.; edible, sometimes used as medicinal or feeds. Propagation by seeds. Their's a lot of cultivars.

[Distribution/Impacts] It is a major green and fruit with high productivity, but not propagate by itself and no impact on native flora.

49. ***Cucurbita maxima*** (Cucurbitaceae)

[Origin] Asia; under cultivated in Korea since long ago.

[Characters] Herbs, annual, twining to 1.5-5 m long. Flowering in Jul.-Aug.; ripening in Aug.-Sep. Propagation by seeds.

[Distribution/Impacts] Cultivated as fruits and vegetables in northern parts of the country.

50. ***Tamarix juniperina*** (Tamaricaceae)

[Origin] China; cultivated in Korea since long ago.

[Characters] Trees, deciduous, broad-leaved, to ca. 5 m tall, much branched. Branches pendulous. Flowering two times (in spring and summer), flowers in spring , in old branches, not fruiting, but ones in summer in new branches and fruiting in Oct. Seeds hairy. Propagation by seeds or by cuttings. High tolerant to cold and dry.

[Distribution/Impacts] Cultivated as ornamentals in gardens, parks or resort area, in particular, planting as a windbreak along seaside, but no in mountains, thus no impact on native flora.

51. ***Populus balsamifera*** (Salicaceae)

[Origin] Europe; introduced to Korea long ago..

[Characters] Trees broad-leaved, deciduous, 25-35 m tall. Young branches with longitudinally edges, ones from the base of the tree more distinct. Dioecious; spreading pollens from male flower in Apr.; Fruit ripening in late May to early Jun, dehiscent into 2 vales at apex. Propagation by seeds, or easily by cuttings. Used as artificial silk, staple fiber or paper materials by high fiber components. Grown rapidly.

[Distribution/Impacts] Not cultivated currently, only found some individuals around villages and along roadsides of cities, thus, no impact on native flora.

52. ***Populus euroamericana*** (Salicaceae)

[Origin] Italy; introduced to Korea long ago.

[Characters] Trees broad-leaved, deciduous, to ca. 30 m tall. Young branch broadly edged; young leaf reddish. Dioecious; spreading pollens from male flowers in Apr.; ripening in May to Jun., then let fly the seeds with whitish hairs causing a great inconvenience to human health and urban sanitation. Propagation by seeds or cuttings; grown very rapidly, useful as fibers, but limited the proper soil for cultivation, thus widely planting as roadside trees of cities.

[Distribution/Impacts] Currently, grown widely anywhere including parks, resort areas, roadside, riversides through country, and sufficient their fruition and natural renovation and abundant in species, thus found some impacts on the formation of urban flora, particularly, other plants difficult to grow in areas with high density of this specie, but no impact on native flora of montane areas.

53. ***Populus italica*** (Salicaceae)

[Origin] Europe; introduced to Korea long ago.

[Characters] Trees, broad-leaved, deciduous, to 35-40 m tall; with narrowly conical crown; branchlets recorved. Dioecious; spreading pollens from male flowers in Apr.; ripening in late May, then let fly the seeds. Propagation by seeds or cuttings;

useful as fibers, but limited the proper soil for cultivation.

[Distribution/Impacts] Found as roadside trees in different parts of the country, but not invaded to mountainous community and no impact on native flora.

54. ***Salix matsudana*** for**.** ***tortuosa*** (Salicaceae)

[Origin] China; introduced to Korea long ago and naturalized..

[Characters] Trees, broad-leaved, deciduous, to ca. 10 m tall; branches erect backward, but slender branchlets pendulous or snarled. Dioecious; flowers precocious, spreading pollens from male flowers in Apr.; ripening in late May, then let fly the seeds. Propagation by seeds or cuttings; timber useful as furniture materials. fibers, but limited the proper soil for cultivation..

[Distribution/Impacts] Cultivated as roadside trees in gardens, also in wet places with good drainage along rivers and valley, currently some individuals naturalized, but not invaded to mountainous community and no impact on native flora.

55. ***Fragaria chiloensis*** var**.** ***ananassa*** (Rosaceae)

[Origin] South America; introduced to Korea from neighbor countries long ago.

[Characters] Shrubs, perennial, 10-20 cm tall. Branches long-creeping after anthesis, sometimes forming a new individual. Flowering in May-Jun. and ripening soon. Fruits an achene, within receptacle. Propagation by seeds. Propagation by seeds or artificially by cuttings. Fruits edible with sweet taste because of large amount of sugar and organic acid.

[Distribution/Impacts] Widely cultivated as fruit trees, but little beyond cultivating areas, thus no impact on native flora.

56. ***Kerria japonica*** (Rosaceae)

[Origin] Japan

[Characters] Shrubs, deciduous, broad-leaved, ca. 2 m tall, much branched from

base. Leaves alternate. Flower solitary in terminal of young branch, flowering in May. Fruits ripening blackish brown in Sep. Propagation by seeds.

[Distribution/Impacts] Firstly cultivated as ornamentals, now grown naturally in wetlands around houses and low mountains, also some individuals in parks, resort areas, no impacts on others species.

57. ***Rosa chinensis*** (Rosaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Shrubs, evergreen, 1-2 m tall. Stems with triangulate branches. Leaves alternate, pinnate. Flowers solitary or several in terminal of young branches, usually flowering in May. Fruits ripening reddish in Jun.-Jul. propagation by seeds or cuttings. Evergreen shrubs in original places, but deciduous in autumn.

[Distribution/Impacts] Cultivated as ornamentals mainly in parks and resort areas, but little beyond cultivating areas, thus no impact on native flora.

58. ***Rosa xanthinoides*** (Rosaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Shrubs, broad-leaved, 1-3 m tall. Stems covered with hooked and erect spines. Flower solitary in terminal of short branches, bisexual, yellow, with ovoid receptacle, flowering in May. Fruits lustrous, ripening yellowish in Aug., with persistent receptacle. Propagation by cuttings. Grown normally in any soils.

[Distribution/Impacts] Cultivated as ornamentals mainly in parks and resort areas, but little beyond cultivating areas, thus no impact on native flora.

59. ***Prunus salicina*** (Amygdalaceae)

[Origin] SE Asia, NW China; under cultivation in Korea since long ago.

[Characters] Trees, broad-leaved, deciduous, 10-15 m tall. Bark blackish gray, young branches reddish gray. Flowers precocious, white, in Apr. Propagation by

seeds . Fruit a drupe, maturing in Jul., edible. Seeds used as medicines.

[Distribution/Impacts] Cultivated mainly around houses, but found some naturalized in Jagang and Kangwon Provinces. Normally grown in cultivating area, no impact on native flora.

60. ***Prunus mume*** (Amygdalaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Trees, broad-leaved, deciduous, 6-10 m tall. Bark grayish, rather greenish gray, with small spines. Flowers precocious from old branches, in Mar.-Apr. Fruits ripening yellowish in Jun. Propagation by seeds. Fruits edible or as medicinal.

[Distribution/Impacts] Cultivated as ornamentals in rather warm regions, mainly in parks and resort areas, recently little beyond cultivating areas, thus no impact on native flora.

61. ***Prunus ansu*** (Amygdalaceae)

[Origin] China, Mongolia; introduced to Korea long ago.

[Characters] Trees, broad-leaved, deciduous, 5-7 m tall. Bark very stout, blackish gray or brown, usually with globose crown. Flowers in old branches, pink in Apr. Fruits ripening yellowish red in Jun.-Jul., harvested five years after planting, and contains a large amount of sugar and organic acid. Propagation by seeds or cuttings. Well growing in moist places.

[Distribution/Impacts] Cultivated mainly around houses since long ago, but now widely in large areas, some naturalized, but no impacts on native flora.

62. ***Prunus armenica*** (Amygdalaceae)

[Origin] Europe; cultivated in northern Korea long ago.

[Characters] Trees, broad-leaved, deciduous, to ca. 10 m tall. Bark blackish brown,

longitudinally with irregular grooves. Flowers white or light pink, precocious in Apr. Ripening yellow in Jul. Propagation by joining. Valuable fruits due to relatively large and sweet. Resistant to cold.

[Distribution/Impacts] Widely cultivated in northern parts, primarily grown in gardens, parks and resort areas, but little beyond cultivating areas, thus no impact on native flora.

63. ***Prunus persica*** (Amygdalaceae)

[Origin] Northwest of China; introduced to Korea long ago.

[Characters] Small trees, deciduous, 3-8 m tall. Flowering precocious in Apr.-May. Fruiting in Jul.-Aug. Propagation by seeds.

[Distribution/Impacts] Cultivated in all provinces except to some cold parts and other grown naturally, but no impact on native flora

64. ***Cassia occidentalis*** (Caesalpiniaceae)

[Origin] N. America (Mexico)

[Characters] Herbs, annual, 50-150 cm tall, erect. Leaves even-pinnate. Flowers a few in group, terminal from elongate rachis, yellow, in Aug.-Sep. Fruiting in Oct. Seeds compressed. Grown in any soils, but low productive in dry and sterile. Fruits as medicinal, Seeds as teas for drinking.

[Distribution/Impacts] Cultivated as medicinal in different parts of the country, normally grown, but little beyond cultivating areas, thus no impact on native flora.

65. ***Cassia tora*** (Caesalpiniaceae)

[Origin] N. America; introduced to Korea long ago.

[Characters] Herbs, annual, to ca. 1 m tall. Stems usually unbranched, erect, sparsely pubescent. Leaves even-pinnate. Flowers 1-2, in branches from axillary rachis, yellow, in Jul.-Sep. Fruiting black in Sep.-Oct. Seeds quadriangulate,

lustrous, brown. Seeds as medicinal.

[Distribution/Impacts] Cultivated as medicinal in different parts of the country, normally grown, but little beyond cultivating areas, thus no impact on native flora.

66. ***Cercis chinensis*** (Caesalpiniaceae)

[Origin] China; cultivated in some countries of East Asia.

[Characters] Small shrubs, deciduous, 3-4 m tall, tufted. Leaves alternate, circular. Flowers precocious in Apr.-May, reddish purple, densely fascicled at base of branches. Pods ripening in Sep.-Oct. Seeds compressed, dark brown. Propagation by seeds or cuttings.

[Distribution/Impacts] Cultivated as ornamentals in parks or resort area, sometimes as medicinal, no impact on native flora..

67. ***Gleditschia offieinalis*** (Caesalpiniaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Trees, broad-leaved, deciduous, 20-30 m tall, spinous. Flowering in June and fruiting in Oct. with whitish waxy, falcate, compressed-linear. Propagation by seeds.

[Distribution/Impacts] Cultivated as medicinal in village along seasides, no impact on native flora

68. ***Amorpha fruticosa*** (Fabaceae)

[Origin] N. America; introduced to Korea long ago.

[Characters] Shrubs, deciduous, broad-leaved, 1-3 m tall. Stems tufted, sufficient to renovate when cutting. Leaves odd-pinnate, compound. Flowers dense in terminal raceme, bluish purple, in May-Jun. Fruits 7-10 mm long, in Aug.-Sep. Seeds as oil materials, and stems as different glassworks and agricultural materials, sometimes as firewood or a bee plant.

[Distribution/Impacts] At present being cultivated in every part of the country as well as growing naturally, but most of them are wild-growing, mainly in dykes, margins of field or mountain where are relatively rich in moisture and well-drained; cultivation mainly around railway; normally flowering and fruiting in all part of the country, well renewed naturally; for its diverse utility, be estimated to affect the species composition of plant community in field or dyke herbs to a certain scale, but not.

69. ***Arachis hypogaea*** (Fabaceae)

[Origin] South America: introduced to Korea long ago.

[Characters] Herbs, annual, 30-90 cm tall. Stems usually erect, much branched at base. Leaves even-pinnate, compound with 2-paired leaflets. Flower solitary in Jun.-Sep., yellowish. Fruits ripening in subterranean. Propagation by seeds . Well-harvesting in sandy soils. Seeds as a major oil material, widely cultivated by light-industrial purposes from seeds oils.

[Distribution/Impacts] Being cultivated as oil plant in sseveral parts of the country, in relatively large scale of cultivation mainly in the sandy watershed area; normally flowering and fruiting with relatively high yield in all part of the country; for its being cultivated species, no relation to natural flora.

70. ***Trifolium repens*** (Fabaceae)

[Origin] Europe; introduced to Korea long ago.

[Characters] Herbs, perennial, 30-60 cm tall. Stems creeping, nodding; young bud in terminal of stem erect, thus, surpressing small plants below. Flowering in May-Aug. And ripening in Jul.-Sep. Propagation by seeds. The plant and seeds used as feeds because of high proteins.

[Distribution/Impacts] Growing in the grassland or margins of hills, forming dense communities and expelling native species so as to expand its habitat; its growth is somewhat restrained in the rainly period of the middle of Jul.~the middle of Aug., but after rainly season recovered and aggressive; particularly expelling lawns in greeneries, accompanying with other species such as *Artemisia asiatica*, *Erigeron*

annus and E. *canadensis*; thus degrading greenery and expelling native plants when less concern thereon.

71. ***Astragalus chinensis*** (Fabaceae)

[Origin] China; introduced as traditional medicines to Korea from China at Koryo periods.

[Characters] Herbs, perennial, 30-90 cm tall. Stems usually single, shallowly grooved. Flowers sparse in terminal rachis, yellow, in Jun.-Jul. Pod ripening in Jul.-Sep. Propagation by seeds. Seeds as medicinal.

[Distribution/Impacts] In the past cultivated in somewhat large scale, but only in the extremely limited parts of the country at present; normally flowering and fruiting in cultivation, but no anticipation of the expansion of its cultivation area, little of impact on natural flora.

72. ***Astragalus sinicus*** (Fabaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Herbs, biennial, 10-30 cm tall. Stems much branched at base, spreading. Flowers reddish purple or white in Apr.-May. Fruiting black in Aug.-Sep. Seeds yellow. Propagation by seeds.

[Distribution/Impacts] Being cultivated as green manure in some parts of the country, as medicinal herb for diuresis and antipyretic; little of cultivation at present, only in the extremely limited areas; normally flowering and fruiting in cultivation, but little of natural spread over beyond cultivation, thus no impact observed on natural flora.

73. ***Canavalia gladiata*** (Fabaceae)

[Origin] South-east Asia; introduced to Korea from China long ago

[Characters] Herbs, annual, climbing, twining. Leaves compound with 3 leaflets. Flowers in raceme, in axillary rachis, bright purple, in Jul.-Aug. Fruiting in Sep.-Oct. Seeds compressed, reddish brown or black brown. Propagation by seeds. Edible.

[Distribution/Impacts] Be cultivated for the use of its pods as food, mainly in the M. and southward of the country, normally flowering and fruiting in cultivation, no spread over nature beyond cultivation, thus no impact on native flora

74. ***Dolichos lablab*** (Fabaceae)

[Origin] Tropical regions of Asia; introduced to Korea long ago

[Characters] Herbs, annual, clambering, twining. Leaves compound with 3 leaflets. Flowers in raceme, in axillary rachis, white or bright purple in Jul.-Aug. Fruiting in Sep.-Oct. Seeds with white flowers as medicinal.

[Distribution/Impacts] Be cultivated for the use of its fruit and seed as food, in the small scale of cultivation area in some parts of the country; normally flowering and fruiting in cultivation; no spread over nature beyond cultivation, thus little impact on native flora.

75. ***Glycyrrhiza uralensis*** (Fabaceae)

[Origin] China(northeast), Mongolia, Russia(Siberia); introduced to Korea from China long ago.

[Characters] Herbs, perennial, 40-100 cm tall, with thick and elongate roots. Rhizomes reddish brown or black brown, yellow, with sweet taste. Stems woody at base, seems to small-shrubs. Flowers purplish red in Jul. Fruiting in Sep.-Oct. Propagation by seeds or rhizomes. Well grown in cold region or proper in sandy loamy of weak alkalinity; high demand to moisture, but need to dried condition after 3 years.

[Distribution/Impacts] Be cultivated as sweetener for traditional medicines in the N. of the country, in a large scale of cultivation area, normally flowering and fruiting with adequate amount of root yield; though distributed nearly to the flora

of the country, but no spread over nature beyond cultivation, thus no impact observed on native flora.

76. ***Medicago sativa*** (Fabaceae)

[Origin] The Mediterranean of Europe; introduced to Korea at the middle of 20th century.

[Characters] Herbs, perennial, 50-60 cm tall. Stems much branched, spreading horizontally. Flowers in terminal head from axillary rachis, purple in Jun.-Aug. Fruits twisting like a snail, ripening in Aug.-Sep. Propagation by seeds. Usually along roadside, field, rivers, streams; resistant to cold and moisture. Cultivated as foods or medicinal because of high protein (ca. 4.2%) and fibers (ca. 6%) before anthesis.

[Distribution/Impacts] At the first be cultivated as forage plant, but now so completely naturalized as to grow naturally in the grassland of every part of the country, forming community in some areas as well as mixing with *Lotus corniculatus, Trifolium lupinaster, Polygonum aviculare, Rumex crispus, Setaria glauca* and *Eragrostis multicaluis*, in a higher density than other species in the soil somewhat rich in fertility and moisture; but no observation of displacing other plants species, rather appreciated to be valuable forage, thus not assessed to be invasive.

77. ***Phaseolus angularis*** (Fabaceae)

[Origin] India; introduced to Korea from China long ago.

[Characters] Herbs, annual, 30-70 cm tall. Stems with recurved pilose. Leaves opposite, compound with 3 leaflets. Flowers in raceme from axillary rachis, bright yellow in Aug. Fruits in Sep.-Oct. Seeds ellipsoid or globose. Propagation by seeds. Seeds as food by high protein (ca. 20%) and carbohydrate (ca. 55%).

[Distribution/Impacts] Be cultivated as one of staple crops in Korea since long ago in nearly the whole country, in a adequate scale of cultivation area, but no spread over nature beyond cultivation.

78. ***Phaseolus coccineus*** (Fabaceae)

[Origin] Mexico; introduced to Korea long ago.

[Characters] Herbs, annual, climbing, twining. Leaves compound with 3 leaflets. Flowers in raceme from axillary rachis, reddish in Jul.-Aug. Fruits ripening black brown in Sep.-Oct. Seeds various colored. Pods used as foods and dried stems as feed for animals.

[Distribution/Impacts] Being cultivated for the use of seed and fruit as food in every part of the country, no spread over nature beyond cultivation, thus no impact on native flora, no impact on native flora

79. ***Phaseolus lunatus*** (Fabaceae)

[Origin] S. America; introduced to Korea long ago.

[Characters] Herbs, annual, usually climbing to 2-3 m long, sometimes erect. Leaves alternate, compound with 3 leaflets. Flowers in raceme from axillary rachis, bright yellow or white, in Jul.-Aug. Fruits in Sep.-Oct. Propagation by seeds. Seeds as food by large amount of different nutrients.

[Distribution/Impacts] Be cultivated for the use of its seed and green pods as food in some parts of the country, in less area of cultivation at present, only by private farmers; no spread over nature beyond cultivation, thus no impact observed on native flora.

80. ***Phaseolus nanus*** (Fabaceae)

[Origin] S. America; introduced to Korea long ago.

[Characters] Herbs, annual, ca. 60 cm tall, with erect and hairy stems. Leaves compound with 3 leaflets. Flowers in axillary raceme, white or purple in June. Fruiting in Jul.-Aug. Propagation by seeds.

[Distribution/Impacts] Being cultivated as one of staple crops in nearly the whole country since long ago, in a large scale of cultivation area and production amount for its high call; but no spread over nature beyond cultivation.

81. ***Phaseolus radiatus*** (Fabaceae)

[Origin] India; introduced to Korea from China long ago

[Characters] Herbs, annual, 50 cm tall, with brown hairs. Stems erect. Leaves opposite, compound with 3-leaflets. Flowers in raceme, from axillary rachis, yellow, in Jun.-Sep. Fruits blackish green or greenish brown in Sep.-Oct.. Propagation by seeds.

[Distribution/Impacts] Being cultivated in nearly the whole country since long ago, for the use of seed as special basic food material and traditional medicines, in the increasing cultivation area and production amount, but no spread over nature beyond cultivation, thus little impact on native species.

82. ***Phaseolus vulgaris*** (Fabaceae)

[Origin] S. America; introduced to Korea long ago.

[Characters] Herbs, annual, twining to 2-3 m long. Leaves compound with 3-leaflets. Flowers in raceme, from axillary rachis, bright red or purple, in Jul.-Aug. Fruiting in Aug.-Sep. Propagation by seeds. Seeds with various colored per cultivars.

[Distribution/Impacts] Being cultivated in nearly the whole part, excepting for highland of the country, in the adequate and gradually increasing scale of cultivation area and production amount, but not in the main farmland, mainly in the margin of field or around house; no spread over nature beyond cultivation, thus no impact on native flora.

83. ***Pisum arvense*** (Fabaceae)

[Origin] Europe; introduced to Korea long ago.

[Characters] Herbs, annual, ca. 1 m tall, twining, with tendrils. Flowers a few in clusters, from elongate axillary rachis, reddish purple, in Apr.-May. Fruiting in June. Propagation by seeds.

[Distribution/Impacts] Be cultivated as food in several parts of the country, in not

a little of production amount; normally flowering and fruiting in cultivation, but little impact on native flora

84. ***Pisum sativum*** (Fabaceae)

[Origin] Europe; introduced to Korea long ago.

[Characters] Herbs, annual, not climbing, but twining with tendrils, 1-2 m tall. Flowers a few in group, from elongate axillary rachis, white or light purple, in May. Fruiting in Jun. Seeds globose (4-8 mm in diameter), light yellow. Propagation by seeds. Cultivating as early-ripening crops.

[Distribution/Impacts] Being cultivated as food in nearly the whole part of the country, in not a little of production amount, normally flowering and fruiting in cultivation, but no spread over nature beyond cultivation, thus no impact on native flora.

85. ***Robinia hispida*** (Fabaceae)

[Origin] North America; introduced to Korea long ago.

[Characters] Shrubs, broad-leaved, deciduous, ca. 3 m tall; branches densely with reddish brown. Flowers in short raceme, roseous in May-Jun. Fruiting in Aug.-Sep. Propagation by seeds.

[Distribution/Impacts] Only rare cultivation in some parts of the country, little of spread over nature beyond cultivation.

86. ***Robinia pseudoacacia*** (Fabaceae)

[Origin] N. America; introduced to Korea from Japan at early 20th century.

[Characters] Trees broad-leaved, deciduous, to ca. 20 m tall. Flowers in raceme, white in May-Jun. Fruits ripening in Aug.-Sep., persistent even in hibernation. Roots long-creeping, germinating new plant from aerial parts. Well grown in montane areas till 10-15 years, but after then grown slowly putrefacting lignified

portion. (* So does *R. pseudoacacia* var. *benssoniana*)

[Distribution/Impacts] At present be so naturalized under the Korean natural environment as to grow naturally in hills and the margins of mountains in many parts of the country, as well as forming simple community in some areas; for its habitat similar to that of pine tree, expelling lots of element species of low mountain flora such as *P. densiflora*, *Lespedeza bicolor* var. *japonica*, *Symplocos chinensis* and of accompanying species like *Atractylodes koreana*, *Festuca ovina*, *Carex lanceolata*, *Peucedanum terebinthaceum* according to the soil fertility; lower impact where lower fertility of soil.

87. ***Sophora japonica*** (Fabaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Trees broad-leaved, deciduous, ca. 20 m tall. Bark grayish brown or black brown. Leaves compound with several leaflets. Flowers in compound inflorescences, yellowish white in Jul.-Aug. Fruits in Sep.-Oct. Seeds black brown. Propagation by seeds. Flowers as traditional medicines, timber as building or furniture materials.

[Distribution/Impacts] Generally be cultivated in the surroundings of village; normally flowering and fruiting under the Korean environment, lots of natural growing plants of it; being used for afforestation and medicines, but little of cultivation for that purpose; only individual plants of growing naturally in low mountains; no observation of competition with other species.

88. ***Vicia faba*** (Fabaceae)

[Origin] SW Asia and N Africa; introduced to Korea long ago.

[Characters] Herbs, annual, 60-70 cm tall, Stems single, unbranched, with filiform tendril in terminal. Flowers a few in fascicle, white or light purple in Jun.-Jul. Fruiting in Jul.-Sep. Propagation by seeds. Seeds valuable nutritious as food materials because of high protein (22-35%).

[Distribution/Impacts] Being one of the crops of high resistance to cold,

cultivated as one of staple crop in the Paektu and Kaema Plateaus in the N. of the country; in not a little scale of cultivation area and production amount; no spread over nature beyond cultivation, thus no impact on native flora.

89. ***Vigna sinensis*** (Fabaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Herbs, climbing, often twining, glabrous. Flowers bluish purplish blue in long axillary rachis in Jul.-Aug. Fruiting in Sep.-Oct. Propagation by seeds. Seeds valuable nutritious as food materials because of high protein(30-32%) and starch(50-60%).

[Distribution/Impacts] Cultivated through the country except to some alpine zones and its cultivating area relatively large with high productivity, but recently decreased by low demand on this plant, thus, no expanding to native flora.

90. ***Punica granatum*** (Punicaceae)

[Origin] The Mediterranean; introduced to Korea long ago.

[Characters] Trees broad-leaved, deciduous, to ca. 7 m tall. Leaves opposite, but fascicled at apex of branches. Flowers reddish in Jun.-Jul., with 6 sepals and 6 petals. Fruits globose, ripening reddish in Sep.-Oct. 3 years after sowing. Seeds edible and pericarp as medicinal. Propagation by seeds or cuttings. Well grown in loamy drylands with good drainage.

[Distribution/Impacts] Cultivated as ornamentals in gardens or parks, even in greenhouse, no impact on native flora.

91. ***Lagestroemia indica*** (Lythraceae)

[Origin] China; introduced to Korea long ago.

[Characters] Trees, deciduous, 3-7 m tall, with brown bark. Flowers several in terminal of branches, light purple or white, in Jul.-Aug. Fruits dehiscent in 6 valves

ripening in Sep. Seeds winged. Propagation by seeds. Cultivated as ornamentals due to flowers for long time and leaves tinted beautiful colors in autumn.

[Distribution/Impacts] Cultivated in southern parts, but in greenhouse of N. Parts, thus no impact on native flora

92. ***Daphne odora*** (Thymelaeaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Shrubs, evergreen, broad-leaved, ca. 1 m tall. Bark brownish, valuable as fiber material. Dioecious. Flowers white or reddish purple, in Mar.-Apr. Fruits reddish, ripening in May-Jun, but usually not maturing in southern parts. Propagation by seeds .

[Distribution/Impacts] Cultivated as ornamental in southern parts of the country.

93. ***Citrus aurantium*** (Rutaceae)

[Origin] India; introduced to Korea long ago.

[Characters] Trees, evergreen, broad-leaved, to ca. 7 m tall, much branched, with spines. Flowers solitary or several in axis, whitish in May. Fruits yellowish brown in Oct., persistent until next summer. Propagation by seeds or joining the cuttings. The seedlings fruiting 8-10 years after sowing and the jointed cuttings ripening 4-5 years after joining.

[Distribution/Impacts] Cultivated as ornamentals in Jeju Isl., no impact on native flora. Similar to *Citrus aurantium* ssp. *nobilis, C. deliciosa, C. junos, C. sinensis*.

94. ***Toona sinensis*** (Meliaceae)

[Origin] China; introduced to Korea in the mid. of A.D.18th century.

[Characters] Trees, deciduous, broad-leaved, ca. 20 m tall. Leaves even-pinnate, 30-60 cm long. Flowers in terminal panicle, white in middle of June. Fruits ripening in Sep. exposing seeds. Propagation by seeds

[Distribution/Impacts] Cultivated around houses, recently in parks and resort areas or some individuals found in margins of lowlands, but no impact on native flora.

95. ***Ailanthus altissima*** (Simaroubaceae)

[Origin] China; introduced to Korea long ago.

[Characters] Trees, broad-leaved, deciduous, to ca. 20 m tall. Leaves alternate, odd-pinnate. Dioecious. Flowers in terminal panicle, white, in June. Fruits ripening yellowish in Sep. Propagation naturally by seeds. Cultivated as ornamentals in parks and resort areas.

[Distribution/Impacts] Firstly was cultivated, now naturalized in all provinces of the country, but no impact on native flora.

96. ***Acer negundo*** (Aceraceae)

[Origin] N. America; cultivated in Korea since long ago

[Characters] Trees, broad-leaved, deciduous, to ca. 20 m tall. Leaves opposite, compound with 3-7 leaflets. Dioecious. Flowers precocious in Apr.-May. Ripening in Sep. Propagation by seeds. Cultivated as ornamentals in parks, resort areas.

[Distribution/Impacts] Cultivated as ornamentals throughout the country and normally grown, but no expanded beyond cultivating areas and no germinating naturally, thus, no impact on native flora

97. ***Acer saccharinum*** (Aceraceae)

[Origin] North America; cultivated in Korea since long ago

[Characters] Trees, broad-leaved, deciduous, ca. 30 m tall. Bark grayish brown, beautiful in shape. Dioecious. Flowers precocious, small, greenish, in terminal of short branches in late Mar.-early Apr. Fruits a samara, ripening in Jun.-Jul. The seeds germinate soon and grow rapidly. Propagation by seeds.

[Distribution/Impacts] Cultivated as ornamentals in different parts of the country, but no impact on native flora.

98. ***Xanthoceras sorbifolia*** (Sapindaceae)

[Origin] China; cultivated as oil plants since 1970's in Korea.

[Characters] Trees broad-leaved, deciduous, ca. 8 m tall. Bark grayish brown, longitudinally separating. Leaves odd-pinnate, opposite. Flowers in raceme, white, in May. Fruits ripening in Jul.-Aug., dehiscent by 3 valves at apex when mature exposing out black-brown seeds. Propagation by seeds. Seeds as oil material with 57-66% of oils or as ornamental as well.

[Distribution/Impacts] Cultivated some regions in northern parts and normally grown, but no expanded beyond cultivating areas and no impact on native flora

99. ***Tropaeolum majus*** (Tropaeolaceae)

[Origin] Peru; under cultivation as ornamental in Korea since long ago.

[Characters] Herbs, annuals, climbing, to 1.5 m tall. Leaves urceolate, alternate. Flowers in terminal, from elongate and axillary rachis, yellow in Jun.-Aug. Fruits ripening in Aug.-Sep. Seeds nephroid. Propagation by seeds.

[Distribution/impacts] Under cultivation since long ago as ornamental in park and resort area in every part of Korea; but little of wild growth in nature.

100. ***Vitis vinifera*** (Vitaceae)

[Origin] W. Asia; under cultivation in Korea since long ago.

[Characters] Trees, broad-leaved, deciduous, twining with tendrils. Leaves alternate, shallowly palmate. Flowers small in fascicle, yellowish green, flowering in May to Jun. Fruit ripening blackish violet or violet in Sep.-Oct. (variable by each cultivar), edible with sugar components (10-30%). Propagation by seeds, cuttings or grafting.

[Distribution/impacts] Under cultivation in vineyard or private house garden in every part of the country, in fairly large area and yield; but no wild growth in nature beyond cultivation, thus no impact on native flora.

101. ***Impatiens balsamina*** (Balsaminaceae)

[Origin] India, Malaysia, China; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 40-100 cm tall. Stems soft, fleshy, glabrous, shiny, with thick nodes. Flowers axillary, red, pink or violet, flowering in Jul. to Aug. Fruits ripening in Aug, to Oct. Seeds exposing out at maturity. Propagation by seeds. Used flowers as dying materials and seeds as traditional medicine.

[Distribution/impacts] Under cultivation as ornamental in flower garden in every part of the country; seed germinating everywhere after dropped, but little of invasion to natural flora, thus no impact on native flora.

102. ***Ricinus communis*** (Euphorbiaceae)

[Origin] Africa; under cultivation in Korea since long ago.

[Characters] Herbs, annual, to ca. 2 m tall or shrubs with many branches in original places. Flowering in Jun.-Aug. and fruiting in Aug.-Sep. Propagation by seeds. Well growing in sandy loamy wetlands.

[Distribution/impacts] As one of oil plants, Under cultivation in every part of the country since long ago, but in very less area and volume of production at present; but no invasion to natural flora, thus no impact on native flora.

103. ***Tetrapanax papyriferum*** (Araliaceae)

[Origin] Southern China; under cultivation in the southern parts of the country.

[Characters] Small trees, evergreen, to ca. 3 m tall. Bark deep yellow, split in big plates. Flowering in Sep.-Oct. and fruiting in Nov.-Des. or Jan.-Feb of next year. Propagation by seeds.

[Distribution/impacts] Under cultivation in the S. of the country; fully wintering, flowering and fruiting in Jeju Is.; considered to have no impact on native flora.

104. ***Carum carvi*** (Apiaceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Herbs, annual sometimes perennial, 60-70 cm tall. Leaves often radical and rarely cauline. Flower bisexual, sometimes unisexual, flowering in Jun. to Jul. Fruit ripening brown in Aug.-Sep., with especial aroma used as oil material or in food industrial as a spice or flavoring, and sometimes as a digestive or carminative.

[Distribution/impacts] Mainly as spice plant, under cultivation in some parts of the country, in a small scale of area; at present in diminishing area due to the decreased need and low prosperity of utility; thus little of impact on native flora.

105. ***Coriandrum sativum*** (Apiaceae)

[Origin] Eastern coast of the Mediterranean in Europe; cultivated in Korea since long ago

[Characters] Herbs, annual, 30-60 cm tall. Stems follow. Leaves alternate, usually radical. Flowers in terminal of stems or branches, whitish, in umbels, in Jun.-Jul. Fruits fragrant, ripening in Jun.-Aug. Propagation by seeds. Young individuals used as vegetables and Fruits traditional medicines or a perfume.

[Distribution/impacts] Under cultivation as vegetable or spice plant in Korea since long ago, but not in public use, only in private houses due to diverse and a little of fancy of people to it; thus in a small scale of area and yield; no wild growth in nature beyond cultivation , thus no impact on native flora observed.

106. ***Ammi visnaga*** (Apiaceae)

[Origin] Asia; under cultivation in Korea since long ago.

[Characters] Herbs, annual or biennial, to ca. 1 m tall. Flowers in umbels, white, in Jun.-Aug. Fruits ripening in Sep.-Oct. Propagation by seeds. Fruits and plants used as traditional medicines or flavoring.

[Distribution/impacts] Under cultivation as ornamental or spice in several M. part of the country, only in private houses, in a small scale of area and yield; normally growing, flowering and fruiting in cultivation to give proper yield; but no impact on native flora observed.

107. ***Apium graveolens*** (Apiaceae)

[Origin] Mediterranean coast; under cultivation in Korea since long ago.

[Characters] Herbs, annual or biennial, 30-100 cm tall, follow, lustrous, with especial aroma. Flowering white in Jun.-Jul.; ripening in Aug.-Sep. Propagation by seeds or by separating the roots. Roots often woody next year after sowing, but in case of the cultivation get pulp like radish, thus, used as vegetables. Fruits usually as medicines.

[Distribution/impacts] Being used for additive taste of dish and other purpose of its components, occasional natural proliferation; but no clear impact on native flora.

108. ***Daucus carota*** (Apiaceae)

[Origin] Likely to be Mediterranean coast, appearing some wild plants of it or its resemblances; *Daucus littoralis* var. *koreana* growing in Korea is known to resemble to *D. carota* or its variety, thus the origin of *D. carota* needs furthermore correct estimation.

[Characters] Herbs, biennial, to ca. 1 m tall, follow. Roots fleshy, yellowish, orange or reddish. Flowering white or bright pink in Jun.-Jul.; ripening in Aug.-Sep. Propagation by seeds.

[Distribution/impacts] As one of favorite vegetables, being cultivated in a large area in every part of Korea, with fairly high amount of production, with increasing

cultivation area for increasing need in recent years; no wild growth in nature beyond cultivation , thus no impact on native flora.

109. ***Foeniculum vulgare*** (Apiaceae)

[Origin] The Mediterranean coast; under cultivation in Korea since long ago.

[Characters] Herbs, annual or biennial, 90-200 cm tall, strongly aromatic. Flowering yellow in Jun.-Aug.; ripening in Aug.-Sep. Propagation by seeds.

[Distribution/impacts] As vegetable, spice or traditional medicines, being cultivated in every part of the country; in recent years some individual plants of naturally spreading and growing beyond cultivation observed, mixed with shrubs and herb species of *Sium, Sanguisorba* and *Peucedanum* in low mountains, but in a very low density and thus no competition between species therein.

110. ***Pastinaca sativa*** (Apiaceae)

[Origin] Mediterranean coast; under cultivation in Korea since long ago.

[Characters] Herbs, biennial, 1-2 m tall, with thick and flesh roots. Stems sharply angulate. Flowers in umbels, yellow, in Jun.-Jul., and ripening in Jun.-Aug. Propagation by seeds or by separating the roots. Used usually as medicines for nervous system. .

[Distribution/impacts] As vegetable or traditional medicines, being cultivated in some parts of the country; no impact on native flora observed.

111. ***Petroselinum crispum*** (Apiaceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Herbs, biennial, 40-60 cm tall, with especial aroma, with thick and flesh roots. Flowering yellow in Jun.-Jul., and ripening in Jun.-Aug. Propagation by seeds or by transplanting the seedling. Growing in wet places.

[Distribution/impacts] As vegetable, being cultivated in some parts of the country; but in a little of area for low need due to its being fancy item; normally growing, flowering and fruiting in cultivation; but not naturally spreading and growing beyond cultivation , thus no competition observed between species therein.

112. ***Eucommia ulmoides*** (Eucommiaceae)

[Origin] China

[Characters] Trees, broad-leaved, deciduous, to ca. 20 m tall. Bark grayish brown or rough. Flowering in late spring and ripening in late autumn. Propagation by seeds or cuttings. Growing in wet places and rather resistant to cold.

[Distribution/impacts] As medicines, being cultivated in our country, recently in the gradually increasing area of cultivation referring to additional value of plantation, transplanted mainly in the park, resort area or around house; normally growing, flowering and fruiting in cultivation; some seeds occasionally germinating in nature, but not still observed its invasion into and direct impact on natural flora.

113. ***Ficus carica*** (Moraceae)

[Origin] From the W. of Asia to Mediterranean; under cultivation in the S. of Korea since long ago.

[Characters] Trees, broad-leaved, deciduous, small to 2-4 m tall. Bark brown, whitish juice when damaged. Flowering from the axillary sac with many male and female flowers in May-Jun.; this flowering sac becomes a blackish violet or yellowish green fruit maturing in Aug.-Oct. Propagation by seeds. Weak resistant to cold (young branches freeze at -12 °c and die at -18 °c).

[Distribution/impacts] Being cultivated in the S. of the country, as ornamental or food of fruit; only in the flowerpot as ornamental in other parts of the country.

114. ***Humulus lupulus*** (Cannabinaceae)

[Origin] Europe; started cultivation in Korea in the early 20th century.

[Characters] Herbs, perennial, climbing and twining. Dioecious, flowering in summer and ripening in Aug. Propagation by seeds, or by vegetative multiplication of cutting stems foe massive production.

[Distribution/impacts] Being cultivated in the N. part of the country, i.e. Ryanggang Prov. for beer production; cultivation in limited area due to its limited use, thus little of impact on natural flora.

115. ***Juglans regia*** (Juglandaceae)

[Origin] China; under cultivation in Korea since long ago.

[Characters] Trees, broad-leaved, deciduous, to ca. 15 m tall. Bark grayish brown. Monoecious, unisexual, flowering in Apr.-May and ripening in Sep.-Oct. Fruits edible or as oil materials. Propagation by seeds.

[Distribution/impacts] As oil plant, being cultivated in several parts of the country; little of wild growth in nature beyond cultivation, thus no impact on the species composition of native flora.

116. ***Pterocaria stenoptera*** (Juglandaceae)

[Origin] China; under cultivation in Korea since long ago.

[Characters] Trees, broad-leaved, deciduous, to ca. 10 m tall. Bark grayish brown, smooth when young, and then changing into dark grayish, split. Monoecious, unisexual, flowering in May and ripening in Jun-Sep. Propagation by seeds..

[Distribution/impacts] As plantation species, being cultivated in several parts of the country, but with low need of cultivation and only in some cultivation park or resort areas because of its low value of plantation; not naturally spreading and growing beyond cultivation, thus no impact on natural flora.

117. ***Portulaca grandiflora*** (Portulacaceae)

[Origin] South America; under cultivation in Korea since long ago.

[Characters] Herbs, annual, to 15-20 cm tall, procumbent or ascending. Stems and leaves fleshy, juicy. Flowers in terminal of branches, red, pink or yellow, flowering in Jun.-Aug. and ripening in Aug.-Sep. Fruit with numerous black seeds. Propagation by seeds.

[Distribution/impacts] As ornamental, being cultivated in the flower garden of park and resort area in nearly the whole country; but not naturally spreading and growing beyond cultivation.

118. ***Mirabilis jalapa*** (Nyctaginaceae)

[Origin] Central America; under cultivation in Korea as ornamental since long ago.

[Characters] Herbs, annual or perennial (annual in Korea), 50-100 cm tall. Flowering in Aug.-Sep. and ripening in Sep.-Oct.. Fruit blackish. Propagation by seeds.

[Distribution/impacts] As ornamental, being cultivated in flower garden in several parts of the country; with the additional use of medicines, i.e. starch of seed and medicinal compounds, but in limited area of cultivation for its low demand; no impact on natural flora observed.

119. ***Beta vulgaris*** (Chenopodiaceae)

[Origin] S. Europe; under cultivation in Korea since long ago.

[Characters] Herbs, annual or biennial, ca. 1 m tall. Rootstock thick, downward to subterranean. Flowering in May-Jun. and ripening in Jun.-Aug. Propagation by seeds.

[Distribution/impacts] As one of main vegetable, being cultivated in every part of the country since long ago; but only in the field of vegetable, thus not naturally spreading and growing beyond cultivation.

120. ***Beta vulgaris*** var**. *altissima*** (Chenopodiaceae)

[Origin] Central Asia; introduced fro Russia and started in Korea in the early 20th century.

[Characters] Herbs, annual or biennial, to ca. 1 m tall. Rootstock thick, downward to 50-60 cm depth of subterranean, with sugar contents (14-26%). Flowering in May-Jun. and ripening in Jun.-Aug. Propagation by seeds. Comparatively resistant to cold (growing even in areas of N.L. 34-60') with high requirement on nutrients.

[Distribution/impacts] As sugar-alternative plant, being cultivated in the N. part of the country; but recent years in little area of cultivation and production referring to lowered need; normally growing, flowering and fruiting in cultivation; not naturally spreading and growing beyond cultivation.

121. ***Chenopodium ambrosioides*** (Chenopodiaceae)

[Origin] Tropical America; under cultivation in Korea since long ago.

[Characters] Herbs, annual, to 60-80 cm tall. Flowers axillary or terminal in panicles, with many flowerets, flowering in Aug.-Sep. and ripening in Sep.-Oct. Propagation by seeds.

[Distribution/impacts] As traditional medicines, cultivated in every part of the country; but now in the less scale of production, due to its character of annuals and low call; normally growing, flowering and fruiting in cultivation; but not naturally spreading and growing beyond cultivation, thus no impact on native flora.

122. ***Spinacia oleracea*** (Chenopodiaceae)

[Origin] Central Asia; as vegetable, under cultivation in Korea since long ago.

[Characters] Herbs, annual or biennial, 40-80 cm tall. Stems single or rarely branched, follow. Flowering in May-Jun. with many flowerets, and ripening in Jun. Propagation by seeds. Fruits with a few of horns.

[Distribution/impacts] As vegetables, being cultivated in nearly the whole country, in the fairly high amount of area and production; normally growing, flowering and

fruiting in cultivation every year; but not naturally spreading and growing beyond cultivation, thus no impact on native flora.

123. ***Amaranthus caudata*** (Amaranthaceae)

[Origin] Tropical America; under cultivation in Korea since long ago.

[Characters] Herbs, annual, ca. 1 m tall. Monoecious. Flowers in terminal panicles, reddish, very small, unisexual, flowering in Jun.-Aug. and ripening in Sep.-Oct. Seeds yellowish. Some individuals naturalized found growing usually as weeds. Others cultivated for feeds or as oil materials.

[Distribution/impacts] As ornamental flower plant, being cultivated in every part of the country; normally growing, flowering and fruiting in cultivation; seeds well germinate and lots of plants naturally spread to natural grassland in every part of the country, some of them even become naturalized; but still low impact found on natural grassland and its species composition.

124. ***Amaranthus tricolor*** (Amaranthaceae)

[Origin] India; as ornamental flower plant, under cultivation in Korea since long ago.

[Characters] Herbs, annual, 80-150 cm tall. Monoecious. Flowers axillary in globose inflorescences, unisexual, flowering in Jun.-Aug. ripening in Jul.-Sep. Seeds blackish brown, lustrous. Propagation by seeds.

[Distribution/impacts] As ornamental flower plant, being cultivated mainly in the flower garden in every part of the country; but not naturally spreading and growing beyond cultivation.

125. ***Amaranthus viridis*** (Amaranthaceae)

[Origin] Tropical America; established in Korea long ago.

[Characters] Herbs, annual, 40-90 cm tall. Leaves ovate or elliptic, alternate. Monoecious. Flowers axillary in spikes, greenish flowering in Jun.-Aug.; ripening in Aug.-Sep. Seeds black or dark brown, lustrous. Propagation by seeds.

[Distribution/impacts] Being used mainly as forage, sometimes used young leaves and stems as edible grass; normally growing in bush, wet place or around of field in every part of the country, mixed in balance with other plants in the relatively high density, but not forming community of intensively growing in a large area; when being as weed in the fields for vegetables, potato or corn, roots stretch deeply into soil to compete with crops for nutriments, affecting crop yield, its control or eradication being labor-expensive; be successfully established and naturalized as to be the element species of plant community of natural grassland, but no observation of inter-species competition thereby in the herb or weed communities of fields.

126. ***Celosia argentea*** (Amaranthaceae)

[Origin] India; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 40-80 cm tall. Stems longitudinally angulate. Leaves alternate. Flowers in terminal spikes, bright reddish, flowering in Jul.-Sep.; ripening in Sep.-Oct. Propagation by seeds.

[Distribution/impacts] Being under cultivation in Korea since long ago as ornamental or traditional medicines, even some individual plants naturally growing in the M. part and southward of the country; but little of far spread away from cultivation area, thus little of impact on natural flora.

127. ***Celosia cristata*** (Amaranthaceae)

[Origin] Tropical Asia; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 60-90 cm tall. Flowers in terminal spikes like a cockscomb, reddish, pink or yellowish, flowering in Jun.-Aug.; ripening in Aug.-Sep. Seeds black or dark brown, lustrous. Propagation by seeds. Fruits in Aug.-Sep., open at apex exposing out the black and lustrous seeds. Propagation by seeds.

[Distribution/impacts] As ornamental, being cultivated in flower garden, occasionally in park or resort area in every part of the country, seed being used as traditional medicines; normally growing, flowering and fruiting in cultivation; but no invasion into natural flora, thus no impact on natural flora.

128. ***Gomphrena globosa*** (Amaranthaceae)

[Origin] Tropical America estimated, but also the species being naturally distributed even in the tropical Asia and Australia; thus estimation that be introduced into Korea from Tropical.

[Characters] Herbs, annual, 40-60 cm tall, rough hairy.. Leaves opposite. Inflorescences in axillary or terminal of rachis, globose, Flowers in terminal inflorescences, deep reddish, violet or whitish in Jun.-Aug. Fruit ripening in Sep.-Oct., 1-seeded. Propagation by seeds.

[Distribution/impacts] As ornamental, being cultivated in flower garden in every part of the country, no invasion into natural flora.

129. ***Agrostemma githago*** (Caryophyllaceae)

[Origin] Europe, China; under cultivation in our country since long ago

[Characters] Herbs annual, 30-80 cm tall. Leaves opposite on nodes, linear-lanceolate. Flowers solitary in terminal of stem and branch, reddish purple, flowering in Jul.-Aug., ripening in Aug.-Sep. Seeds black, papillate. Propagation by seeds.

[Distribution/Impacts] introduced as ornamental; known now so completely naturalized as to grow occasionally in the bush or grassland in low mountains; though large amount of the plant, the plant rarely be observed in nature; thus no impact on native flora.

130. ***Fagopyrum esculentum*** (Polygonaceae)

[Origin] Central Asia; cultivated in our country since A.D. 13^{th}-17^{th} centuries.

[Characters] Herbs, annual, 50-80 cm tall. Flowering in Jun.-Jul., ripening in Jul.-Aug., planting as a late crop mainly in idle field or new grassland of low mountains, propagation by seeds. Seeds contain a lot of starch (67%), therefore, edible and as traditional medicines.

[Distribution/impacts] As food crop of being used seed starch, being cultivated in every part of the country, in a fair amount of area and production; lots of the plant naturally growing in roadsides, bush of low mountains or around fields; little impact on natural flora due to it being annual and not so forming community as the case of cultivation; in many cases being cultivated together with vegetables for its allelopathy in agriculture.

131. ***Persicaria tinctoria*** (Polygonaceae)

[Origin] China; introduced as dyestuff resource by people, successfully naturalized and now grows in nature.

[Characters] Herbs, annual, 50-80 cm tall. Stems often glabrous, smooth, reddish violet. Leaves lanceolate, alternate. Flowers pink, in spikes, flowering in Jul.-Sep. Fruits trigonous, brown, lustrous, ripening in Aug.-Oct. Propagation by seeds.

[Distribution/impacts] Growing together with *Cucubalus baccifer*, *Polygonum nodosa*, etc. in fields, margins of rivers and mountains in every part of the country, occasionally in the community of several individuals; obviously found in such places, but no competition with other species observed.

132. ***Jasminum nudiflorum*** (Oleaceae)

[Origin] China; introduced from China and being cultivated since long ago.

[Characters] Shrubs, usually ca. 60 cm tall, to 2 m tall (to 5 m tall in original places). Flowers precocious in Apr. yellowish in old branches. Fruits ripening in Sep. but not maturing in Korea, and branches pendulous downward to the earth, then rooting. Cultivated in gardens or pots by greenish stem and yellow flowers in early time attracting the human interests. Propagation by cutting of branches.

[Distribution/impacts] Being cultivated in park or flower port in some areas of the country; no found of fruit maturing in the environment of Korea, thus no spread into natural flora observed.

133. ***Fontanensia phyllyreoides*** (Oleaceae)

[Origin] W. Asia; being cultivated in Korea since long ago.

[Characters] Shrubs, deciduous, ca. 3 m tall. Stems much branched, with grayish bark. Leaves lanceolate, opposite. Inflorescences axillary, conical, forming step by step in May, with white flowerets. Fruits a samara, ripening in Sep.-Oct. Propagation by seeds.

[Distribution/impacts] Being used for afforestation or as live fence in park/resort area and around buildings in every part of the country; normally flowering, fruiting in cultivation, occasionally growing in nature; little of spread into nature, thus little impact on natural flora.

134. ***Fraxinus americana*** (Oleaceae)

[Origin] N. America; being cultivated in Korea since long ago.

[Characters] Trees, broad-leaved, usually to ca. 20 m tall (to ca. 40 m tall in original places), with widely ovoid crown. Dioecious. Flowers unisexual, precocious in May, and ripening in Jun. Propagation by seeds.

[Distribution/impacts] Being used for afforestation in every part of the country, but recently in a decreased scale; thus no impact on native flora observed.

135. ***Fraxinus excelsior*** (Oleaceae)

[Origin] Europe; being cultivated in Korea since long ago.

[Characters] Trees, broad-leaved, deciduous, 20-30 m tall. Bark blackish gray and young branches yellowish. Flowering in May and ripening in Aug. Propagation by seeds.

[Distribution/impacts] Being used for afforestation in several parts of the country; normally flowering and fruiting in cultivation; but not naturally spreading and growing beyond cultivation, thus no impact on natural flora.

136. ***Fraxinus chinensis*** (Oleaceae)

[Origin] China; being cultivated in Korea since long ago.

[Characters] Trees, broad-leaved, deciduous, ca. 15 m tall. Flowering in Apr. and ripening in Sep.-Oct. Propagation by seeds.

[Distribution/impacts] Being used for afforestation in several parts of the country, in a small scale of area and population.

137. ***Osmanthus fragrans*** (Oleaceae)

[Origin] China.

[Characters] Trees or large shrubs, evergreen, to ca. 3 m tall. Bark bright grayish-brown. Dioecious. Flowering in Apr. and ripening in autumn. Propagation by seeds.

[Distribution/impacts] Being used for afforestation in park and resort area in the S. of the country.

138. ***Vinca rosea*** (Apocynaceae)

[Origin] India; being cultivated in Korea since long ago.

[Characters] Herbs, annual (or semi-shrubs in original places). Flowering in Jun.-Aug. and ripening in Jun.-Aug. Alkaloid contained in plants used as inflammation treatment.. Propagation by seeds.

[Distribution/impacts] Mainly as ornamental or medicinal herbs, but recently in a diminished scale of cultivation, due to the lowered demand, occasionally in flower port only.

139. ***Ipomoea aquatica*** (Convolvulaceae)

[Origin] E. Asia; introduced to Korea from China in the middle of 20th century.

[Characters] Herbs, annual, climbing. Leaves narrowed, elongate, rooting from nodes. Flowering in Oct.-Nov., but difficult to maturing. Seeds pilose. Propagation by seeds..

[Distribution/impacts] Cultivated as summer vegetable in a large scale; but recently in less area and production amount; not normally flowering and fruiting in cultivation, but rather requiring special care of cultivation; not naturally spreading and growing beyond cultivation, thus no impact on natural flora.

140. ***Ipomoea batatas*** (Convolvulaceae)

[Origin] Tropical America; introduced from China and being cultivated in Korea since 1764.

[Characters] Herbs, annual (but perennial in original places), clambering, with fusiform roots. Flowering in Jun.-Aug. and ripening Aug.-Sep., but nearly fruiting. Transplanting by germination of the tuberous roots conserved during spring.

[Distribution/impacts] As its tuberous root being used for food, being cultivated in every part of the country, in the fairly large scale of area and production amount; occasionally flowering in cultivation in the N., but usually flowering in summer cultivation in the S. and Is. Jeju of the country; no case of normal growing beyond cultivation, thus no impact on natural flora.

141. ***Quamoclit angulata*** (Convolvulaceae)

[Origin] Tropical America; being cultivated in Korea since long ago.

[Characters] Herbs, annual, clambering. Leaves globose-cordate, alternate. Flowers 3-6 in terminal of axillary rachis, yellowish red. Fruits ripening in Sep.-Oct. with 2-4 seeds. Propagation by seeds.

[Distribution/impacts] Being used for afforestation or ornamentals in park and resort area in every part of the country; normally flowering, fruiting in cultivation;

but not naturally spreading and growing beyond cultivation, thus no impact on the formation of natural flora.

142. ***Quamoclit sloteri*** (Convolvulaceae)

[Origin] Tropical America; being cultivated in Korea since long ago.

[Characters] Herbs, annual, clambering, twining. Flowering reddish in summer and ripening in autumn. Propagation by seeds.

[Distribution/impacts] Being cultivated in some parts of Korea; but so rarely as not to see usually.

143. ***Quamoclit pennata*** (Convolvulaceae)

[Origin] Tropical America; being cultivated in Korea since long ago.

[Characters] Herbs, annual, clambering, twining to 3-6 m long. Flowers axillary, reddish in Jun.-Aug. and ripening in Sep.-Oct. Propagation by seeds.

[Distribution/impacts] As ornamental, being cultivated in every part of the country, in wide area in the past, but now in a fairly decreased amount of production for decreased call; not naturally spreading beyond cultivation, thus no impact on natural flora.

144. ***Capsicum annum*** (Solanaceae)

[Origin] S. America; cultivated in Korea since 15th century ago, even estimated to have spread from Korea to other countries since 16th century.

[Characters] Herbs, annual, 40-60 cm tall (perennial, to ca. 60 cm tall in tropical regions). Flowering in July and ripening red since September. Propagation by transplanting seedlings, and easy to grow in sandy loamy soil of moist places and rise yield applying fertilizers.

[Distribution/impacts] Mainly the very hot cultivars of the species are cultivated in Korea, in the very large scale of cultivation area and production amount for very

high call of people; not naturally spreading and growing beyond cultivation, thus no impact on the formation and species composition of natural flora.

145. ***Datura meteloides*** (Solanaceae)

[Origin] Tropical Asia; naturalized in Korea long ago.

[Characters] Herbs, annual, 60-150 cm tall, densely white and glandular hairy. Leaves widely ovate or oblong, entire at margins. Flowers white in Jun.-Sep. Fruits with spinose hairy, ripening in Aug.-Oct. Propagation by seeds.

[Distribution/impacts] Cultivated in several parts of the country as medicinal herb since long ago, recently little in cultivation; some individual plants naturally growing in roadsides and idle fields or around settlements, but in small population and separately, thus no impact on natural flora.

146. ***Datura stramonium*** (Solanaceae)

[Origin] Tropical America; cultivated in Korea long ago.

[Characters] Herbs, annual, 1-1.5 m tall. Flowers white in Aug.-Sep. Fruits spinose, ripening in Sep.-Oct. Propagation by seeds. Seeds, flowers and shell used as medicinal.

[Distribution/impacts] Cultivated in Korea long ago; but recently little in cultivation, occasionally growing in nature, rather in a small number of population and around field or settlements; playing tiny role in native flora.

147. ***Datura stramonium*** var**.** ***chalybea*** (Solanaceae)

[Origin] Tropical part of N. America; cultivated as medical herb in Korea since long ago, some individual plants growing naturally at present.

[Characters] Herbs, annual, 1-2 m tall, nearly glabrous, lustrous, often violet. Flower solitary in axis, bright violet in Jun.-Sep. Fruit ripening in Jun.-Aug. with black seeds. Propagation by seeds. Strongly poisonous, used as different medicines.

[Distribution/impacts] Cultivated as medical herb in Korea in the past, but at present in less amount of cultivation, referring to diminished need thereof, some occasions of wild-growing in community in roadsides, around settlements or idle field, particularly the place where ash of coal is scattered or in pile; thus no observation of impact on native flora.

148. ***Hyoscyamus bohemicus*** (Solanaceae)

[Origin] Europe; being cultivated in Korea since long ago.

[Characters] Herbs, annual, 50-100 cm tall, dense with glandular hairs or pubescent. Flowers axillary, yellowish in Jun.-Jul. Fruits ripening in Aug.-Sep. Seeds compressed, nephroid, grayish brown. Propagation by seeds. Photophilic. leaf used as medicinal..

[Distribution/impacts] Naturally growing in roadsides, fields and around settlements in every part of the country, occasionally being cultivated as medicinal herb; some individual plants going wild and spreading into grassland flora, but little in community, rather separately in 1-2 plants, thus no large impact on natural flora.

149. ***Lycopersicum esculentum*** (Solanaceae)

[Origin] S. America; started its cultivation in Korea since end of 19th century, introduced from China.

[Characters] Herb, perennial in tropic regions, nearly annual in temperate zone, 0.6-1 m tall, with special smell; flowering yellow in Jun.-Jul.; fruit ripening since Jul., orange and yellow and other colored. Propagation by seeds. Various cultivars during cultivation, cultivation in every places of the country.

[Distribution/impacts] As food, being cultivated in broad area with not a little production in every places of the country, some occasions of natural growing around houses and grass land referring to its good capacity of seed reproduction, but no impact on native flora.

150. ***Nicotiana rustica*** (Solanaceae)

[Origin] South America; expected to be introduced to Korea from China long ago

[Characters] Herbs, annual, ca. 1 m tall; flowering greenish yellow in Jul.-Sep.; fruits ripened in Sep.-Oct., with brown seeds. Propagation by seeds.

[Distribution/impacts] Cultivated in various parts of the country, for same purpose as N. tabacum; never grow naturally out of its cultivation area.

151. ***Nicotiana tabacum*** (Solanaceae)

[Origin] South America; started its cultivation in Korea since the early 17th century.

[Characters] Herbs, annual, 1-2 m tall, with dense glandular hairs secreting sticky material to feel gummily; flowers in spikes, pink, in Sep.-Oct.; fruits with numerous seeds; Propagation by seeds.

[Distribution/impacts] Cultivated in nearly whole parts of the country, but decreasing its cultivation area and production currently referring to the diminished need thereof; normally flowering and fruiting and well growing when cultivated, little of impact on native flora.

152. ***Physalis angulata*** (Solanaceae)

[Origin] Tropical America; cultivated in Korea since long ago.

[Characters] Herb, annual, 30-40 cm high; flowers yellow, axillary, in Jul.-Aug.; fruits ripen in Sep.-Oct., fully surrounded by calyx; Propagation by seeds.

[Distribution/impacts] Started its cultivation for antipyretic in the south part of Korea since long before, little cultivation now; some known to naturalized in the S. parts, including Jeju and Uleung Isls.

153. ***Solanum melongena*** (Solanaceae)

[Origin] India; under cultivation in Korea since the early 12th century.

[Characters] Herbs, annual, 60-90 cm high; stalk with trichomes; flowers purple in Jul.-Sep., fruits ripened to black purple in Aug.-Sep.; Propagation by seeds or often by transplanting seedlings, due to its property of high temperature and long time of growth.

[Distribution/impacts] As vegetable and medicines, being cultivated in every parts of the country, with increasing cultivation area for gradually increasing need; known limit of worldwide cultivation by N.L.50°; broad-scale cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

154. ***Solanum tuberosum*** (Solanaceae)

[Origin] South America and Peru; known to be started its cultivation in Korea since 16th century when was introducing to Asia by the Spanish.

[Characters] Herbs, annual, 50-90 cm high; harvested in the late spring in lowland, but transplanted in the late spring and harvested in autumn in alpine flowering in terminal of stalk in Jul.-Sep.; fruits ripen in Aug.-Sep., rarely normal mature; even so, little case of seed use for cultivation; Propagation mainly by tuber, with great concern to virus-free ones.

[Distribution/impacts] Principal food in Europe, spring crop in lowland and staple crop for principal in alpine in Korea, with increasing cultivation area and production for the increasing need; no invasion to natural flora out of cultivation, and thus no impact on native flora.

155. ***Antirrhinum majus*** (Scrophulariaceae)

[Origin] S. part of Europe and N. part of Africa; cultivated in Korea as ornamental flower since long ago.

[Characters] Herbs, perennial in native place, annual in the Korea’s cultivation; flowering in Jun.-Aug.; fruiting in Jul.-Sep.; Propagation by seeds or separating roots as well.

[Distribution/impacts] Cultivated only in flower garden as ornamental, no spread to natural flora.

156. ***Digitalis lanata*** (Scrophulariaceae)

[Origin] Europe; cultivated as medicines in Korea since long ago.

[Characters] Herbs, biennial or sometimes perennial, 80-100 cm high; flowering in Jun.-Jul.; fruiting in Jul.-Sep.; Propagation by seeds.

[Distribution/impacts] Occasional cultivation in the S. of middle part and the lowland of N. part; normal flowering and maturing, but no impact on native flora.

157. ***Digitalis purpurea*** (Scrophulariaceae)

[Origin] Europe; cultivated in Korea since long ago.

[Characters] Herb, perennial or sometimes biennial, ca. 1 m high; aggressive growth of radical leaves of long leafstalk, somewhat small cauline leaf; flowers in terminal raceme of stalk, campanulate, red purple, in Jun.-Jul.; fruiting in Jul.-Aug.; Seeds small, numerous, brown. Propagation by seeds or often transplanting seedlings; a leaf used as medicines.

[Distribution/impacts] As medicines, cultivation in the south of M. part and the flat areas of N. part of the country; normal flowering and maturing; no invasion to natural flora out of cultivation, and thus no impact on native flora.

158. ***Rehmannia glutinosa*** (Scrophulariaceae)

[Origin] China; cultivated as traditional medicines in Korea since long before.

[Characters] Herbs, perennial, ca. 30 cm high; rootstalk yellow-colored and meat-like, stretching aside at long length, used as medicines; stalk with glandular hairs of purple red color and with aggressive radical leaves; flowers in terminal, red purple, in Apr.-May; fruiting in Jun.-Jul. Propagation by seeds and/or separating roots; well growing in sunny, well-drained and loamy soil.

[Distribution/impacts] As medicines, cultivated in every places of the country, with not a little of cultivation area and production; normal growing, flowering and maturing under cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

159. ***Campsis grandiflora*** (Bignoniaceae)

[Origin] China; introduced into Korea long ago

[Characters] Trees, deciduous, broad-leaved, creeping, twining; flowers in terminal panicle, yellow red, in Jul.-Aug.; fruiting in Sep.-Oct.; Propagation by seeds, cuttings or root splitting and others; medicinal use of flower in summer.

[Distribution/impacts] As one of garden tree, cultivated in several parts of the country, even occasions of naturally growing in some places but mainly in the South Phyongan Prov. referring to its low cold resistance, only individuals naturally growing but little in community, no observation of impact to species composition of natural flora.

160. ***Sesamum indicum*** (Pedaliaceae)

[Origin] Unclear, record of cultivation in Korea since 1,400 years ago.

[Characters] Herbs, annual, 50-80 cm high, with sticky glandular hairs and special smell; flowers white or light purple in Jul.-Aug.; fruits maturing in Aug.-Sep., dehiscent by 4 valves exposing out seeds; Propagation by seeds. Use of seed as oil/traditional medicines raw material or direct food; slightly soil-sensitive and preferring to neutral or slightly basic soil.

[Distribution/impacts] As one of the raw material of favorite edible oil of the Korean, cultivated in the large scale of area and with not a little production; normal growing, flowering and maturing under cultivation, but no invasion to natural flora out of cultivation.

161. ***Lavandula angustifolia*** (Lamiaceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Semi-shrub evergreen, ca. 60 cm high; flowers in Jun.-Jul., fruits maturing in Aug.-Sep.; Propagation by seeds.

[Distribution/impacts] Cultivated for the oil used in daily necessities industry but now in little area and production referring to little need, thus no impact on flora.

162. ***Melissa officinalis*** (Lamiaceae)

[Origin] The Mediterranean coast of S. Europe; cultivated in Korea since long ago.

[Characters] Herbs perennial, 50-120 cm high, with strong orange-like and sulphureous smells; underground rootstalk stretching at full length, from which budding out to grow new plant; flowers purple or white, in Jun.-Sep.; fruits maturing with grayish brown seed in Sep.-Oct.; Propagation by seeds or cutting.

[Distribution/impacts] was cultivated in several places of the country but now little and only in some places or botanical gardens; no impact on native flora.

163. ***Perilla frutescens*** (Lamiaceae)

[Origin] East Asia; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 60-150 cm high, with strong smell; flowers pink color, in Aug.-Sep.; fruits maturing in Oct., matured one splitting at apex to spill seeds; Propagation by seeds; seed oil of high dryness.

[Distribution/impacts] Under cultivation in every places of the country for seed oil, with considerable cultivation area and production for high need; some occasions of natural spread out of cultivation around houses and open field, but no further existence of individuals due to annularity, thus no impact on native flora.
(* China-native *P. frutescens* for. *viridis* is also cultivated, but much less than *P. frutescens* and no impact on native flora.)

164. ***Pogostemon patchouli*** (Lamiaceae)

[Origin] India; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 70-80 cm high (but evergreen sub-shrub or shrub in native places). Leaves usually opposite. Flowers light purple, in Jun.-Jul.; fruits maturing in Sep.-Oct.; harvested leaves for perfume when green before yellowed at the temperature under 10-12°c; Propagation by seeds.

[Distribution/impacts] Was under cultivation in various places of the country, but

now a little of cultivation area and product referring decreased need; normal growing, flowering and maturing under cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

165. ***Salvia miltiorrhiza*** (Lamiaceae)

[Origin] China; under cultivation in Korea since long ago.

[Characters] Herbs, annual (perennial in native place); roots long shuttle-like and red-colored, used as medicines, stem with dense trichomes; flowers in racemes, purple, in May-Jun.; fruits maturing to black in Aug.-Sep.; Propagation by seeds or transplanting roots of last autumn in next spring; germinating at 10°c, favorite temperature to growth 25-30 °c.

[Distribution/impacts] As medicinal herb, under cultivation in a wide area in every places of the country, normal growing, flowering and maturing under cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

166. ***Salvia officinalis*** (Lamiaceae)

[Origin] Europe

[Characters] Herbs, perennial, 40-90 cm high, stalk with dense white trichomes, generally lignified at the lower part; flowers purple or light purple, in Jul.-Aug.; fruits maturing in Aug.-Sep.; Propagation by seeds**,** cutting or separating roots as well.

[Distribution/impacts] As perfume and medicines raw material, was under cultivation, but now a little of cultivation area and product and only in some places; normal growing, flowering and maturing under cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

167. ***Salvia sclarea*** (Lamiaceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Herb perennial, 1-1.5 m high, stalk dense with white tomentose, flowers in spikes, roseous or purple, in Jun.-Aug.; fruits maturing in Aug.-Sep.; Propagation by seeds. High drought tolerance and wintering ability in the environment of Korea.

[Distribution/impacts] Being cultivated in the several parts of the country as one of perfume plants, but in the small scale of cultivation area and production because of lowered need and no invasion to natural flora out of cultivation, and thus no impact on native flora.

168. ***Salvia splendens*** (Lamiaceae)

[Origin] South America; under cultivation in Korea since long ago.

[Characters] Herbs, annual (Shrubs in native places), 60-90 cm tall. Leaves opposite. Flowers in terminal spikes, reddish in Aug.-Sep.; fruiting in Sep.-Oct. with blackish purple seeds. Propagation by seeds.

[Distribution/impacts] Being under cultivation in flowering garden as ornamentals; normally flowering and maturing in the areas of cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

169. ***Schizonepeta tenuifolia*** (Lamiaceae)

[Origin] China; under cultivation in Korea since long ago.

[Characters] Herbs, annual, fragrant, 60-100 cm tall, often with reddish purple stem. Leaves opposite. Flowers in terminal or axillary spikes, bright red-purple in Jun.-Aug.; fruiting black brown in Jul.-Sep. with white seeds. Propagation by seeds.

[Distribution/impacts] Was under cultivation in Korea since long ago as medicinal herbs; but currently only in some parts of the country in the extremely small scale of cultivation area and production because of lowered need and not invading to natural flora out of cultivation, and thus no impact on native flora.

170. ***Ambrosia artemisifolia*** (Asteraceae)

[Origin] America; introduced casually from America and naturalized in Korea in 20th century.

[Characters] Herbs, annual, 30-80 cm tall, sometimes to ca. 2 m tall, dense with whitish hairs. Flowering in Aug.-Sep. and fruiting in Sep.-Oct. Propagation by seeds.

[Distribution/impacts] Observed at the first in the southern of the country and then spread throughout whole country; widely growing in the roadsides, the edges of low hills, grasslands and around the crop fields; displacing lots of essential composition species of native flora of pertinent areas and gradually spread to wider areas forming simple community; even though annual, keeping its growth areas every year as same as perennial and invading to the other places, even to the edges of mountains where trees are growing; when sprouting in spring, covering densely the whole area by the plants of 5 cm tall in the density of more than 400-600 plants, then in summer keeping its growth to 15-20 cm tall, causing the condition under where other plants can not inhabit, resulting in the complete displace the element species of such as *Taraxacum officinale, Polygonum aviculare, P. caducifolium, Trifolium lupinaster, Capsela bursa, Descurainia spphia, Lepidium apetalum, Oxalis corniculata, Geranium nepalense, Leonurus sibiricus, Artemisia asiatica Plismenus undulatifolius, Setaria viridis, S. glauca, Agropyron ciliar* and *A. tsukushiense*; since causing kinds of allergy, being defined to be invasive species, under the eradication and control effort of the state but cost- and labor-expensive.

171. ***Anthemis arvensis*** (Asteraceae)

[Origin] Europe; introduced into Korea across China in early the 19th century.

[Characters] Herbs, annual or biennial, 20-50 cm tall, dense with whitish hairs. Head, 1-2, in terminal of stem in July., female flowers at margin, yellow, ligulate; male ones in the center, tubiform, bisexual. Fruiting in Aug. Propagation by seeds.

[Distribution/impacts] 1-2 plants are being extremely rarely distributed in the grassland of wet field or around creeks, but not in community; being constantly as element species in such places, but not observed its impact on the concerned flora formation for its very rare existence.

172. ***Artemisia maritima*** (Asteraceae)

[Origin] Europe; summer keeping; under cultivation in Korea since long ago as medicinal herbs.

[Characters] Herbs, perennial, 20-50 cm tall, dense with whitish hairs. Head, a lot in terminal, in Aug., with many whitish flowers. Fruiting in Sep. Propagation by seeds.

[Distribution/impacts] Introduced from Europe and under cultivation in several farms of medicinal plants for the raw material of santonin in Korea since long ago; normally flowering and maturing in the areas of cultivation, but now in the gradually decreasing area of cultivation and not invading to natural flora out of cultivation, and thus no impact on native flora.

173. ***Calendula officinalis*** (Asteraceae)

[Origin] The Mediterranean coast and the south of Europe; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 20-50 cm tall, dense with whitish hairs. Head, in terminal of stem in Jun.-Sep., female flowers at margin, reddish yellow, ligulate; male ones in the center, bright yellow, tubiform, bisexual. Fruiting in Aug. Propagation by seeds. Plant used as medicinal and producing edible pigments from flowers.

[Distribution/impacts] Being cultivated as ornamentals mainly in the flowering garden of parks resort areas; normally flowering and maturing in the areas of cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

174. ***Carthamus tinctorius*** (Asteraceae)

[Origin] Around Egypt; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 50-90 cm tall, stems much branched at upper parts, glabrous, smooth, lustrous. Leaves and compound bract with hard spines. Flowers in terminal head in Jun.-Jul. Fruits maturing in Jul.-Aug., used as seeds.

[Distribution/impacts] Was under cultivation for fruit as medicines in the several parts of Korea; but currently mainly in the farms of medicinal herbs and rarely for ornamentals in some parts of the country; normally flowering and maturing in the areas of cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

175. ***Centaurea cyanus*** (Asteraceae)

[Origin] Europe; under cultivation as ornamentals in Korea since long ago.

[Characters] Herbs, annual or biennial, 20-60 cm tall, usually dense with whitish hairs. Head, in terminal of stem in May-Oct, female flowers at margin, greenish, ligulate; male ones in the center, bisexual. Fruiting in Aug. Propagation by seeds. Extracting green pigments from flowers and oil from seeds.

[Distribution/impacts] As ornamentals under cultivation in the flower gardens of several parts of Korea; normally flowering and maturing in the areas of cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

176. ***Chrysanthemum coronarium*** (Asteraceae)

[Origin] The Mediterranean; cultivated as vegetables in Korea since long ago.

[Characters] Herbs, annual, 50-80 cm tall. Stems deep green, glabrous. Head, large, yellow or white, in terminal of stem in May, female flowers at margin, yellow, ligulate; male ones in the center, tubform, bisexual. Fruiting in July. Propagation by seeds. Grown in sandy or loamy soils sufficient with humidity.

[Distribution/impacts] Being under cultivation as vegetables in various parts of Korea in large scale of cultivation area for high need; normally growing, flowering and maturing in cultivation; being used aerial part thereof as vegetable before flowering, no invasion to natural flora out of cultivation, and thus no impact on native flora.

177. ***Chrysanthemum leucanthemum*** (Asteraceae)

[Origin] Asia; introduced with the introduction of forage plants from Japan in 1930s and established now.

[Characters] Herbs, perennial, 50-100 cm tall. Stems soft, herbaceous, nearly unbranched. The plants in lowlands flowering in May and ripening in June; naturalized ones in mountains flowering in Jul.-Aug. and ripening in Aug.-Sep. Propagation by seeds.

[Distribution/impacts] Being under cultivation as ornamentals in the flower gardens of every parts; its natural invasion is only in the flat grassland of highland in the Unhung County of Ryanggang Province, displacing all grass plants to form simple communities in an wide area. The community formation is not well observed, but rather in the expanding tendency, with very low speed expected. However, its kinetics in the area is considered to be of interest.

178. ***Coreopsis lanceolata*** (Asteraceae)

[Origin] North America; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, 30-70 cm tall, with fusiform or tuberous roots. Flowering in Jun.-Aug. and fruiting in Jul.-Sep. Propagation by seeds or transplanting tubers.

[Distribution/impacts] As ornamentals under cultivation in the flower gardens of every parts of Korea; normally growing in cultivation, flowering and maturing in the areas of cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

179. ***Coreopsis tinctoria*** (Asteraceae)

[Origin] N. America; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 40-100 cm tall. Leaves opposite, long lanceolate. Flowering in Jun.-Sep. and fruiting Jul.-Oct. Propagation by seeds or transplanting tubers.

[Distribution/impacts] As ornamentals under cultivation in the flower gardens of every parts of Korea; some spreading to grow naturally around streams or grassland of fields; naturally growing plants are scattered by one or two plants, but not y community; no impact to species composition of natural flora.

180. ***Cosmos bipinnatus*** (Asteraceae)

[Origin] Mexico; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 1-2 m tall. Leaves opposite, slender, pinnate. Flowering in Jun.-Oct. and fruiting to Nov. Propagation by seeds.

[Distribution/impacts] As ornamentals under cultivation in roadsides, parks and resort areas of every parts of Korea; some naturally growing in the pertinent place or grassland, but without continuous maintenance of its growth, and thus no impact on native flora. (* So does *C. sulpureus*.)

181. ***Dahlis pinnata*** (Asteraceae)

[Origin] Mexico; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, 1.5-2 m tall, with several fusiform roots. Flowers in heads in Aug.-Oct.; Female ones at margin, ligulate; male ones in the centre tubiform, bisexual, some individuals only with ligulate flowers. Propagation by tubers.

[Distribution/impacts] Being cultivated as ornamentals, mainly in flower gardens, in every parts of Korea; normally growing in cultivation, but no invasion to natural flora out of cultivation, and thus no impact on native flora.

182. ***Erigeron annus*** (Asteraceae)

[Origin]: N. America; growing in Korea since long ago.

[Characters] Herbs, annual or biennial, 30-50 cm tall. Stems densely pilose. Flowers in terminal and conical heads, yellowish white; female ones at margin,

ligulate; male ones in the centre tubiform, bisexual. Fruits ripening in Aug.-Oct. Propagation by tubers.

[Distribution/impacts] Widely growing in the roadsides, the edges of mountains and grasslands flat fields in every parts of the country, with high frequency of appearance in each place; forming communities especially in the stony loamy soil frequent to roadsides, causing great impact on the grass communities of flat fields.

183. ***Erigeron bonariensis*** (Asteraceae)

[Origin] Not clear; established and growing in Korea since long ago.

[Characters] Herbs, annual or biennial, 20-50 cm tall, densely with white hairs. Flowers in terminal and conical heads, in May-Oct.; female ones at margin, very short and slender ligulate; male ones in the centre, bisexual. Fruits ripening in Jul.-Nov. Propagation by seeds.

[Distribution/impacts] Established and growing, as one of element species of pertinent local flora, in the roadsides, the edges of mountains fields and grasslands of plane fields in every parts of the country, in community in some places; no observation of displacing other species with regard to inter-species relation, but existing in the grassland flora in high frequency.

184. ***Erigeron canadensis*** (Asteraceae)

[Origin] North America; naturalized in Korea long ago.

[Characters] Herbs, annual, 50-100 cm tall, densely with white hairs. Flowers in terminal and conical heads, in May-Sep. Fruits ripening in Jul.-Oct. Propagation by seeds.

[Distribution/impacts] Naturalized in Korea long ago, growing as one of the normal element species of grassland flora in Korea; mainly in the roadsides, around fields and the grasslands of mountain edges, sometimes forming simple community or with high density; no special relation observed between species.

185. ***Erechtites hieraciifolia*** (Asteraceae)

[Origin] N. America; naturalized and started to spread in the middle of 20th century; estimated to be spread by seed during the trade process with USA or other country of N. America referring to the observation at that time from in the S. of Korea as well.

[Characters] Herbs, annual, 60-100 cm tall. Radical leaves deciduous. And cauline leaves opposite, not petiolate, long-elliptic. Flowers in Aug.-Sep.. Fruits ripening in Sep.-Oct., with white umbellate hairs flying far away and falling down the earth; well-germinated. Propagation by seeds.

[Distribution/impacts] From the end of 20th century so far known only in the M. and S. of the country, but not in the N. of the country; growing accompanying with other element species of grassland flora of low hills and flat fields; keeping its growth land in very frequency of existence, but not forming community; no observation of detailed impact on native flora.

186. ***Gaillardia pulchella*** (Asteraceae)

[Origin] S. America; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 30-50 cm tall, densely with white hairs. Flowers in terminal and conical heads, in Jul.-Sep.; female ones at margin, ligulate; male ones in the centre, tubiform, bisexual. Fruits ripening in Aug.-Oct. Propagation by seeds.

[Distribution/impacts] Under cultivation in the flower gardens in every parts of the country, as ornamentals; no invasion to natural flora out of cultivation, and thus no impact on native flora.

187. ***Helianthus annus*** (Asteraceae)

[Origin] N. America; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 1-3 m tall (sometimes lees than ca. 1 m high). Flowers in terminal heads, in Aug.-Sep.; female ones at margin, ligulate; male ones in the centre, tubiform, bisexual. Fruits ripening in Sep.-Oct. Propagation by seeds useful as oil materials..

[Distribution/impacts] Under cultivation as one of oil plants or ornamentals in park, resort areas, around house, roadsides and idle lands, in small scale of area; no invasion to natural flora out of cultivation, and thus no impact on native flora.

188. ***Helianthus tuberosus*** (Asteraceae)

[Origin] N. America; cultivated in Korea since long ago, but changed nearly to be wild at present.

[Characters] Herbs, perennial, 2-3 m tall, densely with white hairs. Flowers in terminal heads, in Aug.-Sep.; female ones at margin, ligulate; male ones in the centre, tubiform, bisexual. Fruits ripening in Sep.-Oct. Propagation by seeds. In case of cultivation by tubers forming an community in nature.

[Distribution/impacts] The first cultivated for tuber as food or forage, but gradually changing to be wild and naturally growing throughout the whole country; no invasion to natural flora out of cultivation, and thus no impact on native flora.

189. ***Inula helenium*** (Asteraceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, usually 60-100 cm tall, sometimes to ca. 250 cm tall. Rhizomes fusiform. Radical and cauline leaves persistent. Flowers in terminal heads, in Jun.-Sep.; female ones at margin, ligulate; male ones in the centre, tubiform. Fruits ripening in Aug.-Sep. Propagation by seeds or tubers. Tubers and roots as medicinal.

[Distribution/impacts] Under cultivation as medicinal plant in several parts of the country, especially in the N. of the country; no natural growth out of cultivation, thus no impact on native flora.

190. ***Lactuca sativa*** (Asteraceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Herbs, biennial, 40-70 cm tall, densely with white hairs. Flowers in terminal heads, yellowish, all ligulate, bisexual in Jul.-Aug.; Fruits ripening in Aug.-Sep., elongated to needle-like at apex. Propagation by seeds. Leaves as vegetables.

[Distribution/impacts] As vegetable under cultivation in fairly large area and production of the country, but no natural growth out of cultivation, thus no impact on native flora.

191. ***Rudbeckia hirta*** (Asteraceae)

[Origin] America: under cultivation in Korea since long ago.

[Characters] Herbs, annual, 30-60 cm tall, sometimes to ca. 100 tall, densely with white hairs. Flowering in Jun.-Oct. and fruiting in Aug.-Oct. Propagation by seeds.

[Distribution/impacts] As ornamentals under cultivation in the flower gardens, occasionally some plants naturally growing in the roadsides, but no impact on native flora.

192. ***Rudbeckia laciniata*** (Asteraceae)

[Origin] N. America; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, 50-200 cm tall. Flowering in Jul.-Oct. and in Aug.-Nov. Propagation by seeds.

[Distribution/impacts] As ornamentals, under cultivation in the flower gardens in the gardens in every parts of the country.

193. ***Silphium perfoliatum*** (Asteraceae)

[Origin] Europe; introduced directly from Europe and under cultivation in our country as forage plant since 20th century.

[Characters] Herbs, perennial, 1-2.5 m tall. Stems quadrangular, dense with hard tomenta, densely with white hairs. Flowers in terminal heads, yellowish in

Jul.-Aug,; ones ligulate at margins maturing in Aug.-Sep., but others tubiform not fruiting. Propagation by seeds.

[Distribution/impacts] Being under cultivation in the fields of some areas of the country, for the use of forage, some plants changed to be wild out of cultivation, but no any report on its impact on native flora..

194. ***Silybum marianum*** (Asteraceae)

[Origin] Europe; started its cultivation in our country directly from Europe since 20^{th} century.

[Characters] Herbs, annual, 1-2 m tall, with hard spines at margins of leaves and bracts of inflorescences. Leaves with whitish spots. Flowers in terminal heads, purple, in Jul.-Aug. Fruiting in Aug.-Sep. Propagation by seeds.

[Distribution/impacts] For the use of medicinal plant, being under cultivation in some areas of the country, in the early in large scale of area and production, but recent years in the smaller area due to the decreased need; normally growing, flowering and maturing in cultivation, but no natural invasion to nature and thus no impact on native flora.

195. ***Sonchus asper*** (Asteraceae)

[Origin] Europe; naturalized in Korea long ago.

[Characters] Herbs, annual, 30-100 cm tall. Leaves with hard spines at margins. Flowering in May-Jul. and ripening in Jun.-Aug. Propagation by seeds.

[Distribution/impacts] Naturalized in Korea long ago throughout nearly the whole country; growing in the grassland of field and roadsides; its control and eradication in the arable field of crop or vegetables are effort-expensive; distributing densely to a certain extent in field, but very sparsely in natural flora,; no observation of intensive competition between species, thus not considered to be of serious impact on native flora.

196. ***Tagetes erecta*** (Asteraceae)

[Origin] Mexico; started its cultivation in our country since long ago.

[Characters] Herbs, annual, 50-100 cm tall, with especial smell. Flowering in Jul.-Aug. and fruiting in Aug.-Sep.

[Distribution/impacts] As ornamentals, being cultivated in the flower garden in every parts of the country; no spread into natural flora. (* So is done *T. patula*.)

197. ***Zinnia elegans*** (Asteraceae)

[Origin] Mexico; under cultivation in our country since long ago.

[Characters] Herbs, annual, 30-100 cm tall. Flowering in Jul-Sep. and fruiting in Aug.-Oct. Propagation by seeds.

[Distribution/impacts] As ornamentals, being cultivated in every parts of the country; normally growing in cultivation; but no natural spread to nature and thus no impact on native flora.

198. ***Galinsoga parviflora*** (Asteraceae)

[Origin] America; known in the S. of Korea in 1976 and in the N. of Korea in 2001.

[Characters] Herbs, annual, 10-60 cm tall (ca. 10 cm tall in dry places and more than 60 cm tall in fertile soils, growing in high density suppressing others herbs. Flowering from May to Oct.; flowers early-blooming in spring grown even till Oct. Fruiting one month after flowering. High capability to propagate by seeds.

[Distribution/impacts] Spread to the S. for the first through the trading process with American countries, furthermore gradually up to N. including Pyongyang and its around; appearing nearly in everywhere of loamy soil, excepting for mountainous places, covering whole area in high density especially around dumping ground or areas of coal ash; from spring densely growing, displacing other field weeds, even until the late of autumn; thus consuming many nutritional elements to decrease seriously soil fertility, causing great damage to agriculture; requiring the

labour-expensive effort for eradication; no any utility thereof known so far; causing serious problem of displacing all over the other species of grassland; therefore being considered to be one of dangerous invaders.

199. ***Hosta plantaginea*** (Liliaceae)

[Origin] China; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, 40-60 cm tall. Rhizomes fusiform. Radical leaves fascicled. Flowers in raceme, whitish in Aug.-Sep. Fruiting in Sep.-Oct. Propagation by seeds.

[Distribution/impacts] As ornamentals, being cultivated in the flower garden of park or resort area; no spread into natural flora and thus no impact on native flora.

200. ***Asparagus officinalis*** (Asparagaceae)

[Origin] Europe

[Characters] Herbs, perennial, 1-1.5 m tall. Stems smooth, green, soft and thick when young. Dioecious; flowering in Jul.-Aug. and ripening red in Aug.-Sep. Propagation by seeds.

[Distribution/impacts] Introduced from Europe, being cultivated as vegetable in our country; no natural spread to nature.

201. ***Allium cepha*** (Alliaceae)

[Origin] Southwest of Asia; under cultivation in Korea since long ago.

[Characters] Herbs, biennial, 30-50 cm tall, with bulb of ca. 10 cm in diameter. Flowering stem elongate, follow, stout, between leaves in early spring. Fruiting in autumn. Propagation by seeds or bulbils. With hot taste and fragrant used as materials for cooking.

[Distribution/impacts] As vegetable being cultivated in every parts of the country, in not a little of area and production for high need; but no spread into natural flora

and thus no impact on native flora. (* So does *A. fistulosum*, native of China and *A. sativum*, native of W Asia)

202. ***Dioscorea bulbifera*** (Dioscoreaceae)

[Origin] China; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, climbing, 2-3 m long, with tubers of ca. 10 cm in diameters. Dioecious. Flowers male and female catkins in Aug.-Sep. Fruiting in Sep.-Oct. Propagation by seeds or tubers. Tubers edible or as medicinal..

[Distribution/impacts] As medicinal herb, being under cultivation in several parts of the country, where normally growing, flowering and fruiting; but no invasion to natural flora, thus no impact on native flora.

203. ***Narcissus tazetta*** (Amaryllidaceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, with ovoid bulb. Leaves several at base of stems, 20-40 cm long. Flowering stem elongate, between leaves, with 2-8 white flowers in terminal. Fruits not maturing. Propagation by separating bulbs.

[Distribution/impacts] As ornamentals, under cultivation mainly in the garden of several parts of Korea; normally growing, flowering, but not fruiting and not spreading, thus no impact on native flora.

204. ***Zephyranthes candida*** (Amaryllidaceae)

[Origin] South America; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, with globose bulb, with radical leaves of ca. 30 cm long. Flowers in terminal, white or bright pink, with 6 petals, in Jun.-Aug. between radical leaves, elongate. Fruiting in Aug.-Sep. Propagation by seeds.

[Distribution/impacts] As ornamentals, under cultivation mainly in the garden of several parts of Korea; normally growing, flowering and fruiting; but no invasion

to natural flora, thus no impact on native flora.

205. ***Zephyranthes carinata*** (Amaryllidaceae)

[Origin] Mexico; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, with globose bulb, with 5-6 radical leaves. Flower solitary in terminal, pink, with 6 petals, in Jun.-Aug. between radical leaves, elongate. Fruiting in Aug.-Sep. Propagation by seeds.

[Distribution/impacts] As ornamentals, under cultivation mainly in the garden of several parts of Korea; normally growing; but no invasion to natural flora, thus no impact on native flora.

206. ***Sisyrinchium angustifolium*** (Iridaceae)

[Origin] N. America; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, 10-20 cm tall. Leaves fascicled at base. Flowers in May-Jun. with purple or bright violet lines. Fruits brownish purple, lustrous, ripening in Jun.-Aug. Propagation by seeds or cuttings.

[Distribution/impacts] As ornamentals, being under cultivation in Korea, normally growing, flowering and fruiting; no invasion to natural flora out of flower garden, thus no impact on native flora.

207. ***Crocus sativus*** (Iridaceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, ca. 15 cm tall, with bulb of ca. 3 cm in diameter. Flowers purple, in rachis between leaves in Oct.-Nov. Dried pistil as medicinal.

[Distribution/impacts] As ornamentals, being cultivated in the flower garden of park or resort area; no spread into natural flora and thus no impact on native flora..

* As alien flower species, *Gladiolus gandavensis*, and *Freesia refracta* and *Iris*

tectorum are also cultivated in the glass house or flower garden; no impact on native flora.

208. ***Cyperus esculentus*** (Cyperaceae)

[Origin] The Mediterranean coast; started cultivation in our country directly from Europe since 20th century.

[Characters] Herbs, perennial, 80-130 cm tall, densely tufted. Rhizomes long-creeping, with tubers. Flowering in Jul.-Aug. Fruits ripening in Aug.-Sep., producing a little in amount. Tubers used for propagation or oil materials. Well-growing in sandy soils.

[Distribution/impacts] At first cultivated as soil plant in several parts of the country, recently in some sandy lands; normally growing in cultivation, but no spread to nature and thus no impact on native flora.

209. ***Arundo donax*** (Poaceae)

[Origin] Europe; started its cultivation in our country in 1960s.

[Characters] Herbs, perennial, 2-4 m tall. Stems very stout, in different purposes. Flowering in Aug.-Sep. Fruiting in Sep.-Oct., but not maturing in Korea. Propagation by seeds or cuttings.

[Distribution/impacts] As fiber plant, being cultivated in the middle of Korea, Hwanghae Province; growing normally, but fruit immature, main buds that generated in autumn and damaged by cold when wintering are sprouting in the late of next spring, thus less biomass as that in native place; no natural growth and thus no impact on native flora.

210. ***Briza minor*** (Poaceae)

[Origin] Europe; naturalized in Jeju. Isl.

[Characters] Herbs, annual, 30-40 cm tall. Flowering in Jun.-Aug. and fruiting in

Aug.-Sep.. Propagation by seeds.

[Distribution/impacts] Being spread in the natural flora of Jeju Isl., normally growing in cultivation, flowering and fruiting; no any data on competition between species.

211. ***Aegilops caudata*** (Poaceae)

[Origin] Europe; firstly known in 2003 and naturalized in Wonsan

[Characters] Herbs, annual, usually single, 40-50 cm tall. Flowering in Jun.-Jul. Fruiting in Jun.-Aug. Propagation by seeds.

[Distribution/impacts] Being distributed in Provinces Kangwon, South Phyongan Prov. and Pyongyang City, accompanying with *Setaria viridis, S. glauca, Agropyron tsukushiense, A. ciliare, Bromus japonicus* in the field grassland; being one of floral elements, but not forming simple community of high density, thus no observation of displacing other species.

212. ***Lolium perenne*** (Poaceae)

[Origin] Europe; under cultivation in Korea since long ago

[Characters] Herbs, perennial, 30-60cm tall, soft, often tufted. Flowering in Jun.-Aug. and fruiting in Aug.-Sep. Propagation by seeds. Well-grown relatively in cool and wetlands.

[Distribution/impacts] At first, cultivated for forage; now growing in nature, but rather in a low density, due to its low competition ability; no observation of competition between species.

213. ***Zea mays*** (Poaceae)

[Origin] S. America; under cultivation in Korea since the late of 17^{th} century.

[Characters] Herbs, annual, 1-2 m tall. Female inflorescences axillary, male ones in terminal of stems. Flowering in Jun.-Aug. and fruiting in Sep.-Oct.

[Distribution/impacts] Being cultivated in every parts of the country, as one of fundamental crop, in the fairly large amount of area and production; but no impact on native flora.

214. ***Coix lachryma-jobi*** var. ***mayuen*** (Poaceae)

[Origin] China; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 1-1.5 m tall. Flowering in Jul. and fruiting in Aug. Fruits edible or medicinal. Propagation by seeds..

[Distribution/impacts] Being cultivated in every parts of the country in normal growth; no impact on native flora.

215. ***Zerna inermis*** (Poaceae)

[Origin] N. America; naturalized species known in 2001.

[Characters] Herba, perennial, 80-90 cm tall. Known as feed for animals. Flowering in Jun.-Aug. and fruiting in Aug.-Sep.

[Distribution/impacts] Found in the Ryongsong District of Pyongyang City at first, but recently in almost whole around of Pyongyang City; normally growing, flowering and maturing in cultivation, but not forming independent community, but rather in density of 2~3 plants per 4㎡ or even rarer in general; thus no observation of displacing native plant species.

216. ***Brachypodium pinnatum*** (Poaceae)

[Origin] N. America; at first found in 2002 around Pyongyang City, but considered to be established before that time.

[Characters] Herbs, perennial, 80-100 cm tall, grown mixing with others weeds. Flowering in Jun.-Aug. and fruiting in Aug.-Sep. Propagation by seeds.

[Distribution/impacts] As being plant of recently established in Korea, spreading field and grassland in South Phyongan Province and Pyongyang City.

217. ***Panicum dichotomiflorum*** (Poaceae)

[Origin] N. America; in 1999 reported in the N., but fairly before that time in the S. of the country.

[Characters] Herbs, annual, 30-100 cm tall. Germinating in late spring or early summer, growing till October with soft stem. Flowering in Aug.-Sep. and fruiting in Sep.-Oct. Propagation by seeds..

[Distribution/impacts] Known to be accidentally introduced during the trade with N. American countries and spread up to and established in the N. of the country; normally growing in cultivation, flowering and maturing forming simple community in a fairly high density, thus clearly expelling native species in its habitat. Because it is sprouting in Jun.- early the Jul. in the Korean condition, being compressed in spring in the drought places improper to growth by the early growing species and having very low ability of keeping its habitat continuously next year, no impact on native flora be observed. Well growing in the loamy land rich in water and being distributed in wet lands around roadsides, fields and low hills.

218. ***Phleum pratense*** (Poaceae)

[Origin] Europe; under cultivation in Korea since long ago.

[Characters] Herbs, perennial, 40-120 cm tall. Stems several, tufted. Flowering in Jun.-Aug. and fruiting in Aug.-Sep. Used as feed. Propagation by seeds. Well grown in loamy wetlands.

[Distribution/impacts] At first, cultivated intensively in some parts of our country as forage plant, but at present lots of plants completely established to grow naturally in the grassland of field; in high rate particularly in the grassland of highland; found not to displace native species.

219. ***Holcus lanatus*** (Poaceae)

[Origin] Europe; established long ago.

[Characters] Herbs, perennial. Flowering in Jun.-Aug. and fruiting in Aug.-Sep.

Propagation by seeds.

[Distribution/impacts] Growing in the southern parts and Jeju Isl.

220. ***Arrhenatherum elatium*** (Poaceae)

[Origin] Europe; introduced into Korea long ago; being widely spread at present.

[Characters] Herbs, perennial, 0.7-1.5 m tall. Flowering in May-Jun. and fruiting in Jun.-Aug. Propagation by seeds..

[Distribution/impacts] At first, cultivated in our country as forage plant, but after that spread widely to nature in the N. and other parts of the country, little under cultivation for forage at present; very low frequency and density in natural flora, thus no great impact on native flora.

221. ***Avena sativa*** (Poaceae)

[Origin] Central Asia; under cultivation in Korea since long ago.

[Characters] Herbs, annual, ca. 1 m tall. Stems tufted. Flowering in Jun.-Jul. and fruiting in Jun.-Aug. It, as a crop, but now used as feed due to low quality and productivity. Resistant to cold and well-grown in wetlands.

[Distribution/impacts] Cultivated through the whole country in 7-8th century, but now only in some highland of N. of the country, in a fairly decreased area of cultivation for decreased need; some plants invaded into nature in some areas, but no impact on native flora.

222. ***Hordeum jubatum*** (Poaceae)

[Origin] Europe; introduced into and established in Korea long ago.

[Characters] Herbs, annual, 30-50 cm tall. Flowering in Jun.-Aug. and fruiting in Jul.-Sep.

[Distribution/impacts] Growing in the wet around of creek or fields of some areas including South Hwanghae Province in a fairly low frequency; in the past known to be widely distributed in the mountainous areas or fields of N. part of the country, but no its observation proved in the mountainous areas of the N.; thus no impact on native flora.

223. ***Secale cereale*** (Poaceae)

[Origin] Europe ; under cultivation in Korea since long ago.

[Characters] Herbs, annual, 1-1.5 m tall. Flowering in Jun.-Jul. and fruiting in Jun.-Aug. Propagation by seeds. Well-grown in acidic soils.

[Distribution/impacts] Being cultivated for food in several parts of Korea, but recent years in diminished area and production due to decreased need; but no spread into natural flora and thus no impact on native flora.

224. ***Dactylis glomerata*** (Poaceae)

[Origin] Europe; cultivated in our country since the middle of 20th century.

[Characters] Herbs, perennial, 50-120 cm tall, glabrous, whitish green. Flowers in terminal panicle in May-Aug. with many ears or spikes and fruiting in Jul.-Sep. Propagation by seeds.

[Distribution/impacts] For the first introduced for the use of forage in a large area, but recently decreasing in the area of cultivation; being successfully naturalized in Korea to spread everywhere in natural flora, in particular in high density in the grassland of mountain and field margins; no observation of its expelling or displacing other plants; in some areas, intentionally introduced to pasture comprising high percent of valueless weeds, in order to improve the species composition of forage grass.

225. ***Vulpia megalura*** (Poaceae)

[Origin] N. America; established in Korea long ago.

[Characters] Herbs, annual, 30-60 cm tall. Flowering in May-Jun. and fruiting in Jun.-Jul. Propagation by seeds.

[Distribution/impacts] Known to be accidentally introduced during the trade with N. American countries or neighbors and spread up to and established in some flora of the S. of the country; no its observation reported in the N. yet; normally growing in the invaded habitat, but no large impact on native flora observed.

* in addition, *V. myuros* introduced from Europe and established in the S. of the country, annual or biennial, being observed usually in the sunny margins of mountains.

226. ***Anthoxanthum odoratum*** (Poaceae)

[Origin] Europe, Russia(Siberia); introduced to Korea across NE China long ago.

[Characters] Herbs, perennial, 20-50 cm tall, with especial odor. Stems tufted, soft, pubescent. Flowering in May-Jun. an ear with three flowers, but two degenerated and only one flowering and maturing. Fruits ripening in Jun.-Jul.

[Distribution/impacts] Known to be distributed several parts of the N. and M. of the country; cultivated as forage plant in the past, but little at present and being found only in some alpine; no impact on native flora.

Section 2. Impacts Assessment of the Alien plants in DPR Korea

As alien plant species are those that have been both intentionally or casually, introduced from foreign countries or regions into a country by man, animal, carrier etc., and inhabited therein. In our country, their distribution has been expanded due to the booming international trade and tourism and accelerated urbanization, affecting natural ecosystem.

From ancient time, our ancestor introduced elite cultivars of different crops such as rice, maize, sweet potato, potato, beans, cucumber and watermelon from other countries for use in their dietary lives. It is a well-known fact that cotton crop, a source of cotton cloth which is a favorite of our people, were widely spread throughout our country by the patriotic activity of Mun Ik Jom in the period of RI dynasty. The introduction of such beneficial plant species needs to be continued in future as same as in the past.

Thus, not all of alien plant species give adverse effects, and it is rather difficult to anticipate what kinds of potential impacts on ecosystem and socio-economy may be produced even by the alien plants beneficial to human being. Hence, it is of great importance for the effective use of the country's limited resources to assess the impact and risk of alien plants.

By risk assessment, the ecological and economic impact of the invasive alien plants is assessed and the approaches to their management investigated. Because the invasion of alien plants takes place by artificial factors rather than natural ones in recent years, the ecological risk assessment focuses on the artificial factors and risks by human activities.

In the management of alien plant species, the targets are those plants with either known or potential risks. The choice of targets among numerous alien plant species is done by the method of ranking.

The ranking process offers a tool for the effective assessment on the potential impact of already-known alien plant species, and its objective is to foresee and understand the adverse effects brought about by the introduction of alien plants.

In other words, by way of ranking, the target alien plant species for priority management are ranked, and along with this the information on the beneficial plant species is offered and the plants with potential risks are warned beforehand, so that

we can get information for the anticipation of in-future potential damages or for the evaluation of possible effects which might come as a result of past causes.

For the ranking of alien plant species, above all, their characteristics and impact should be effectively evaluated through a long-term *in-situ* investigation.

What is important herein is to qualitatively and quantitatively assess each elements depending on the invasion/dispersion scale of alien plants, and to properly identify the ranking indices. In other words, the indices related to ecological impact of alien plants on ecosystem and those related to their response and impact should be considered. (Table2)

Table 2. Major assessment indices to be considered in the ranking of alien plants

Category	**Indices and elements of assessment**	
Possibility of Invasion and Dispersion	Phytological Characteristics	Type of reproduction (vegetative, reproduction, seeds)
		Type of dispersion (seed vitality, life span, germination rate, fertilization rate, bud formation)
		Use (food, drug, horticulture etc.)
	Properties of Habitat	Adaptability (similarity to place of origin, disturbed empty habitat)
Impact on Ecosystem	Phytological Characteristics	Ecological effect (layer structure, density, area, vegetation, diversity, nutrition, change of microclimate)
		Economic impact (crop yield, commercialization, change of market price)
		Others (human, leisure time, aesthetic enjoyment etc.)
	Properties of Habitat	Sensitive regions (invasiveness into protected and vulnerable areas, change of habitat)
Others	Control and introduction pathway (artificial, natural)	

As shown in table 2, the indices related to the invasion and dispersion should be chosen above all among the characteristics of alien plants, including seed productivity, germination rate, mode of reproduction, dispersive ability,

self-compatibility, and in addition, seed-setting period, wind, water, animal and other seed carriers, rate of dispersion etc. As for the properties of habitat, an importance should be attached to the analysis on the change in its habitat conditions, ecological structure and functions.

As for the impact of the invasion of alien plants, the effect on ecosystem should be first addressed and followed by economic and other effects. The parameters for the determination of ecosystem change include those relative to ecosystem structure and function, i.e., structural change (layers, density, canopy, diversity, abundance, vegetation etc) and functional change (change in the circulation of nutrients and in the microclimate). The abundance in plant species (relative rates of appearance of original and alien species in a specific region and its change with the lapse of time) and fertility (structure and composition of relative appearance of alien species and their change with the lapse of time) may also be the indices for estimating the invasiveness of alien plants.

In addition, the impact on environment such as rivers, lakes, chock of waterway, change in water quality etc., as well as the social and cultural effects including those on human health like asthma, allergy etc. should be evaluated.

As the impact of alien plant species differs with the lapse of time and according to place, the change in the habitats vulnerable to alien species and/or a region where a specific species inhabits is an important element with respect to the protection of indigenous species.

Next, the ranking form of alien plants (Table3) comprising such indices and elements is filled in, and the ranks are classified on the basis of assessment result. In view of the enormous expense of labor, cost and time, it is a very difficult task to survey all the elements included in the table. However, information on as many elements as possible should be collected, and scores be given to each of the elements prior to rank determination.

What is important herein is to give greater weight to the indices reflecting the characteristics of alien plant species itself, because final goal of the management of alien plants is to restrain the invasion/dispersion and to minimize the effect of invasion, and the prioritization should start from the viewpoint of species value.

Therefore, in preparing management plan, the alien plants with the most adverse impact on ecosystem should be ranked on a top priority for management and be under legal management and with proper management site.

Table 3. The ranking form of alien plant species in our country.

Plant name: (Scientific name)_____ Korean name_____

Origin:_____

Category	**Index**	**Element**
Invasion/ dispersion	Range of habitat	All Provinces, or regional (north, middle, south), or specific region.
	Abundance	Formation of individual or colony
	Mode of reproduction	Vegetative or seed reproduction
	Conditions for seed germination	No seeds or produce seeds
	Period of survival	Less than 1 year, 2-3 years, over 3 years
	Dispersive capacity	Long distance
Effect of invasion	Impact on native species	Competitiveness with endemic species
	Hybridization	Crossing species
	Effect of eco-environment	Toxic substance, damage to livestock, reduction of crop production, damage to human health, host of pathogens etc.

Table 4. Criteria for prioritization in managing alien plants in our country

Rank	Criterion for evaluation	Meaning
Ⅰ	Species for which a high invasion into natural habitat is anticipated and whose adverse effect is evident.	Urgent measures of management need to be taken through detailed survey and impact assessment.
Ⅱ	Species which is invasive but can be eliminated by an active management.	Needs for continued survey and data accumulation.
Ⅲ	Species which has a weak invasiveness into natural habitat, and therefore, can be spontaneously eliminated without any human's activity.	Re-assessment of the recently introduced plant species is required (at an interval of 15 years)
Ⅳ	Species which has no invasiveness, but requires sustainable introduction for its economic and other special use.	

In the past, the DPR Korea has also performed the impact assessment of the alien plant species which have already been or are being introduced and the sustainable management thereof by using the form ranking and prioritization criteria (Table 4), for example, the impact assessment of alien plant species in the Mt. Myohyang Nature Park under the sponsorship of the Government. (Table 5)

In the Mt. Myohyang Nature Park, there are many exotic plant species and in particular, exotic larch and acacia trees which were planted 60-70 years ago are thriving intensively in certain places, and cosmos, chrysanthemum and other alien flowers and ornamental plants give adverse impact on the unique natural landscape, forest and river ecosystems of concerned area.

Table 5. Management prioritization for the major alien plants in the Mt. Myohyang Nature Park.

No.	Plant Names	Invasiveness	Management Category
1	*Ambrosia artemisiifolia*	+++	I
2	*Galinsoga parviflora*	+++	I
3	*Erigeron canadiensis*	++	I
4	*Trifolium repens*	++	I or II
5	*Catalpa ovata*	+	I or II
6	*Larix leptolepis*	+	II
7	*Robinia pseudoacacia*	+	II
8	*Pinus banksiana*	-	II or III
9	*Magnolia obovata*	-	II or III
10	*Metasequoia glyptostroboides*	o	III
11	*Biota orientalis*	o	III
12	*Acer negundo*	o	III
13	*Zinnia elegans*	-	III
14	*Cosmos bipinnatus*	+	II or III
15	*Tagetes patula*	-	III
16	*Tagetes eresta*	-	III
17	*Celosia cristata*	-	III
18	*Phlox paniculata*	-	III
19	*Pharbitis ni*)	-	III
20	*Viburnum sargentii*	-	III
21	*Calendula officinalis*	-	III
22	*Gomphrena globosa*	-	III
23	*Salvia splendens*	-	III
24	*Hibiscus suriacus*	-	?

[Note] +++; strong: ++; medium: +; restrictive: -; indistinct: o; none
I, II, III; ranks of priority (1st, 2nd, 3rd categories)

Particularly, *Ambrosia artemisiifolia* and *Galinsoga parviflora* belonging to the family of *Asteraceae* bear a big adverse effect on the agricultural production in the local ecosystem as well as on human health.

Galinsoga parviflora grows in crop fields and orchards continually from May to the middle of November, leading to the waste of large amount of weeding labor and enormous loss of soil nutrients. If *G. parviflora*, which has a short history of

natural acclimatization on our country, is spread over the whole country at such a high rate, the damage it causes will not simply end in the loss of weeding labour and soil nutrients, but will further continue to expel completely some meadow plant species, resulting in a big loss of specific diversity.

Clover (*Trifolium repens*), one of leguminous species, has a high value as a forage plant and plays a positive role in improving soil fertility due to its symbiosis with *Rhizobium*, However, it is very likely to get rid of turf, which is normally planted for urban greening. Though *Ambrosia artemisiifolia* and *Galinsoga parviflora*, with their high reproduction, suppress the growth of other grass plants, they all have the disadvantage of annual plant species. But Clover, as a perennial species, is characterized by its persistency in preserving its habitat and by its ability to produce many branches and expand its growing area. While the tip of the stolon in clover, where there is growth primordial, is always held upwards, that of a lawn plant is directed either horizontally or downward. Hence, clover is always above turf plants, which is unfavorable for the latter in the competition for sunlight. In the end, turf will be removed from lawn plots.

As described above, it is very important to properly collect and handle the information on exotic plant species since they can produce unexpected result in the conservation of local flora.

As aforementioned (refer to Section l of Chapter 2), according to data reported in the country so far, there are approximately 240 species of relatively well known alien plants, except for those growing in specialized greenhouses, pots or other small flower plots.

Most of them belong to *Asteraceae* (31 species, about 13.6%), *Fabaceae* (22 species, 9%) and *Poaceae* (about 7%), respectively.

In these families, there are a lot of plants intentionally introduced for their economic benefit and not a little of species introduced by chance to be domesticated and considered as invasive species which has a negative impact.

Moreover, the alien invaders are included mainly in the species that introduced by chance into and domesticated in the natural flora.

Chrysanthemum leucanthemum, for example, was introduced by chance into Korea around 1930 and lives in the mountainous area of Unhung County. Almost all the forage plants introduced into this area at that time have been annihilated, but

only *Chrysanthemum leucanthemum* maintains and extends its habit in a large area and with high density. *Ambrosia artemisiifolia* and *Galinsoga parviflora* are also the invasive alien plants introduced by chance and domesticated.

Therefore, it is important in protecting the invasive alien species to conduct the plant quarantine more carefully and strictly in the exchange with other countries, especially with neighboring countries such as China, Russia and Japan which are near to our country.

That is because the biogeographical characters, one of the important factors of controlling the invasiveness of alien species are significant for the restoration of their invasion history while inhabitation scale of species is related to the phytogeographical and climatic compatibility of introduced areas. In other word, there is a logical hint that the alien species invasive in one place of the world may be also invasive elsewhere similar to the former place in climate and ecology.

For example, *Alternanthera philoxeroides* and *Solidago canadiensis*, belonging to the 12 most dangerous species in China, were introduced from South America and USA to Shanghai approximately in 1930 and now spread over the northeast and south of China due to their high reproduction and genetic mutation[14, 19] that gives us easy prediction of their potential impact on the local ecosystem of Korea geographically near to China.

According to the survey, most of the alien species in Korea are from our neighboring countries, among which there are 98 species originated from Asia, 59 species from Europe and 4 species from North America, respectively.

And there are few alien species growing in natural flora, whereas most of aliens were intentionally introduced.

The survey shows that in our country there are about 185 species restricted to cultivation, 22 species introduced by chance and domesticated in the nature and 20 species fully domesticated to natural flora beyond cultivation.

As shown in aforementioned fact, a certain range of introduction of exotic plant species is necessary for seeking the plants of economic value, but it is more important to collect and manage the specific information correctly.

Section 3. Recommendation to manage alien plants in DPR Korea

The restriction and management of alien species have been mentioned every time from the 4th to the 8th Conferences of Parties (CoP) to Convention on Biological Diversity. The 7th CoP recommended to make and distribute the practical list of alien invasive species, and to develop, extend and widely use the database on alien species, referring to the invasion risk of alien species.

The International Union for Conservation of Nature and Natural Resources (IUCN) requires to define the plants of practical or potential risk when preparing the national strategy for management of invasive alien plants, draw up the Global Invasive Species Plan (GISP) for the mutual cooperation of concerned units and develop the management program on invasive alien species for prevention identification, and control through the legal and institutional framework.

What is important in management of alien plants in our country is to prevent the introduction of invasive alien species in advance and to establish the legal and institutional framework.

Since the laws such as “the Quarantine Law on Animals and Plants at the Border” (1997), “Law on Prevention of Epidemics in Veterinary” (1997), “Law on Bio-safety of Transgenic Organism”(2004), “Law on Hygiene Quarantine” (1996) and “Law on International Trade” (1997) have been enacted in our county, these laws ought to be strictly kept.

Especially, Quarantine is the basic means for the prevention of spread of invasive alien species from the current status in which the international exchange becomes more activated. We have to give priority to plant quarantine service and enhance the execution ability of relevant laws and rules, so as to strictly control the specific goods with invasion risk of alien species and to permit deliberate introduction after the strict risk assessment thereon. The legislation is also needed in case of the introduction of natural enemies for the control of harmful alien invaders.

The goal of the prevention of invasive alien species is to protect and/or recover the sound ecosystem, where the priority should be given to the periodic survey and basic impact evaluation on both native and alien species, and thus create starting point and base for the work to control invasive alien species.

In the preparation of management plan, it is very important to rank and define the management priority of the invasive plant species harmful environmentally and socio-economically. This means that it should be fully identified if an alien plant is invasive or not.

With this view, it is necessary to collect all the available information including origin, taxonomic position, biological characteristics, productivity in the specific region and genetic potential and kinds of resistance of the specific exotic plant.

In case of cultivars, it is significant to collect the information such as the growth pattern, cultivated areas, method and rates of propagation and the ecological condition of its original place including latitude, altitude, temperature and humidity, soil and topographical condition.

It is, especially, important to set up the methodology of risk analysis and evaluation criteria proper to our condition and on the basis of it to evaluate comprehensively the alien species introduced into the country. By doing so, we could take scientific and effective measures for minimizing the negative impact of alien species.

Moreover, it is significant to establish and strengthen the effective system of monitoring and forecast. Because the later the prevention measures are taken, the greater is the damage by the alien species.

The damage by some alien species may take effect tens of years after its introduction. For example, an ornamental plant, *Buddleja daviii*, is said to be identified as a major weed in the forest 100 years after its introduction.

It is, therefore, necessary to carry out the systematic research on the invasion, formation of species groups and the cause of increase, and to develop and apply the indicators and methods of comprehensive risk assessment.

This means that measures should be taken to thoroughly eradicate the harmful invasive alien plants introduced in the past by the most rational method adopted in the specific condition based on the evaluation of the risk.

In case the eradication is impossible, the control measure is taken to minimize the density and population of invasive alien species below the tolerable level by the way of management. For this purpose, the mechanical, chemical and biological control may be applied.

In mechanical control, the target invasive alien plant is removed by hand and/or a machine, which is highly effective, but laborious in common.

The chemical control using herbicides, the current measures, takes a high effect, but it needs a high cost and generate the unforeseen aftereffects such as tolerance to herbicides, residual toxicity, and environmental pollution.

In recent years, biological control is widely investigated and applied to controlling alien plants in the world. Especially, Integrated Pest Management (IPM) is applicable to natural protection regions as it is practical to overcome the problems of chemical method.

The biological control is more cost-effective than other methods and favorable to environmental safety due to the sustainability of its effect, whereas it has the defects that its effect is slow and there are many indefinite factors. It is, therefore, necessary to intensify the research on population ecology depending on the condition of the specific region.

In addition, they are also applying the sustainable management of habit based on pasturage and firing and the high-technology to controlling alien species.

In recent years the *zelkova* variety with resistance to *Ceratocyctis ulnii* based on molecular and transgenic technology has been developed and the genetic means are applied to control insects.

There are significant achievements such as the application of the edge-technology including the economic evaluation on the composition and damage of population of species, Geographic Information System (GIS) and expert system.

Next, people’s enlightenment and education on alien species are prerequisite.

It is, especially, necessary to awaken the people on the harmful invasive alien species, actively involve them in controlling the spread and make them fully understand the economic, aesthetic, emotional significance and especially the value of environmental protection of biodiversity.

With this view, the knowledge on alien species should be widely distributed using the means of propaganda like newspapers, broadcast, books and journals, and various educations including the training for specialists should be strengthened and

this campaign should be a social movement participatory under the interest and support of the concerned officers and people.

The international cooperation plays an important role since the spread of alien species is the worldwide problem.

The 8th Article of the Convention on Biological diversity stipulates that the introduction of alien species that damage ecosystem, habitat or species should be prohibited and if any, they should be removed or controlled.

Since the prevention of spread and extension of alien species is a very important national and international duty, it is necessary to actively take part in the international (multi-lateral and bi-lateral) cooperation to prevent the damage by alien species.

An invasive alien species is the most dangerous enemy in the nature parks and the protected zones, which are the most important places to maintain and protect the biodiversity.

In other words, even if an alien species was introduced with the intended purpose of making the biological composition more diversified, the native species might be restricted or annihilated by its invasion on the contrary to the original intend.

Therefore, the officers involved in protection have to pay attention to the interception of invasion of alien species into the protection zone through the different channels and remove the introduced ones periodically.

We must also prevent the introduction of alien species to thoroughly depend on the native species in the activity for the rehabilitation of the degraded eco-system. And we have to be careful lest the restriction of alien species destruct the eco-system.

As mentioned above, the officers in the protection field, keeping in mind their mission responsibility; will have to make a contribution to maintenance and conservation of the beautiful landscape of our country by implementing the awareness and management activity to prevent the invasion of alien species.

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Appendix

1. List of crop cultivars in DPR Korea

Plant Name	Total Number of Cultivars	Plant Name	Total Number of Cultivars
Rice	224	Water shield	1
Maize	108	Commomn fennel	5
Indian millet	40	Sour sorrel	2
Foxtail millet	25	Coriander	4
Millet	6	Radish	83
Barnyard grass	13	Carrot	14
Wheat	53	Turnip	4
Burley	58	Rutabaga	2
Oats	11	Yam	12
Rye	2	Dasheen	5
buckwheat	10	Evening primrose	4
Potato	59	Indian lotus	3
Sweet potato	10	Garlic	62
Soybean	598	Welsh onion	25
Horse bean	7	Onion	15
Haricot	34	Aromatic parsley	4
Red bean	61	Beet	4
Mung bean	38	Leaf mustard	6
Common pea	19	Mustard	3
Whole cabbage	86	New Zealand spinach	2
Cabbage	48	Cucurbita maxima	12
Spinach	10	Acorn squash	9
Lettuce	18	Wax gourd	6
Crown daisy	4	Egg plant	15
Parsley	6	Tomato	28

Plant Name	Total Number of Cultivars	Plant Name	Total Number of Cultivars
Scallion	1	Water melon	13
Mallow	1	Common melon	17
Butterbur	3	White muskmelon	4
Asparagus	3	Legume	21
Vegetable lentil	2	Ramie plant	3
Red pepper	37	Indian mallow	1
Green perilla	32	Sugar beet	11
Sesame	13	Stevia	2
Sunflower	4	Tobacco plant	22
Bird rape	7	Hop	4
Gold of pleasure	3	Corn mint	5
peanut	8	Jujube	16
Safflower	4	Strawberry	7
Bush clover	2	Cherry	7
Cotton	4	Tara vine	6
Flax	6	Almond tree	2
Hemp plant	7	Dalmatian pyrethrum	1
Korean horseradish	3	Apple tree	109
Ginger	4	Pear	55
Giant garlic	1	Peach	33
Cucumber	74	Apricot	35
Korean pumpkin	24	Plum	22
Prickly comfrey	2	Cattail	3
Amaranth	5	Persimmon tree	48
Jerusalem artichoke	4	Chestnut	18
Santonica	2	Walnut	7
Insam(Panax gingseng)	9	Cherry tree	18

2. List for Quarantine of Weeds in DPR Korea

No.	Weeds Scientific name
1	*Iva axiltaris* Pursh
2	*Xanthium strumarium* Lin.
3	*Iva xanthifolia* Nutt.
4	*Lolium temulentum* L.
5	*Helianthus califurnicus* D.C.
6	*H. ciliaris* D. C.
7	*Solanum elaeagnifolium* Cav.
8	*S. carolinense* L.
9	*Orobanche ramose* L.
10	*O. aegyptiaca* Pers.
11	*Sorghum halepense*(L) Pers.
12	*Cenchrus pauciflorus* Benth.
13	*Solanum rostratum* Dun.
14	*S. triflorum* Nutt.
15	*Ambrossia psilostachya* D.C.
16	*A. trifida* L.
17	*Cuscuta appromata* Bab.
18	*C. europaea* L.
19	*C. monogyne* Vahl..
20	*C. appruximata* Bob.
21	*C. campestris* Juncker
22	*C. lupliformia* Knocker
23	*C. epilinum* Weiche
24	*C. chinensis* Lam.
25	*C. australis* R. Br.
26	*C. cupulate* Engelm
27	*C. pentagoma* Engelm
28	*C. reflexa* Roxb.
29	*C. japonica* Choisy
30	*Bidens pilosa* L.
31	*Ambrossia artemisifolia* L.
32	*Acroptilon picris* Pall.

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