SLOVAKIA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Note by FAO

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Table of contents

CHAPTER 1
Introduction to Country and Its Agricultural Sector

Slovak Republic has the area of 49,035 km^2 and is situated in Central Europe, number of inhabitants 5.3 millions. Territorially it is an integral part of the systems of Alps and Himalayas and Carpathian Mountains are a basic geological and geomorphological unit. Surface of the territory is mostly hilly, varying of mountains and basins being typical especially in Western Carpathian Mountains. In the south of Slovakia, there are lowlands: Záhorská, Podunajská, Vychodoslovenská. On the territory of Slovakia, there are great differences of elevation from 95 m above sea-level to 2,655 m above sea-level, about 80% of the territory is in the elevation 750 m above sea-level. Climate is moderately continental, with increasing elevation the temperature is decreasing and precipitations are increasing. Agricultural land is composed of 30.8% of arable land, 16.6% of pastures, and 40.5% of forests. Inhabitants are employed (data from 1992) in industry and building industry (44%), in agriculture (13.9%), and in other sectors (42.1%).

Slovakia is a country with limited sources of raw materials. The greatest natural wealth is its agricultural and forest soil. On January 1, 1994, its acreage has been as follows:

	Total thousand ha	Per 1 inhabitant in ha
Agricultural soil of it	2,446.0	0.45
Cultivated land	1,482.6	0.28
Forest land	1,904.3	0.37

Orchards, hop yards and vineyards cover approximately 51.0 thousand ha, meadows and pastures 835 thousand ha. In Slovakia, we have 5 national parks and 16 protected landscape areas, covering 387 thousand ha of agricultural soil. Besides that there are 10 protected areas of natural water accumulation, 58 protected streams and catchment areas and 24 protected zones of natural sources of mineral waters. On this agricultural soil, approximately 1,250 economic entities are working with 164 thousand workers, of which approximately:

	Number	Average acreage/ha
Cooperative farms	1,050	1,660
State enterprises	150	2,900
Private companies	50	750

Besides that roughly on 200 thousand ha of soil, 16,000 individual farmers work of which more than 7,100 farmers have the acreage larger than 2 ha.

Totally, about 7 workers work on 100 ha of the agricultural soil.

Crops belong to the main agricultural plants which are grown on more than 800 thousand ha. The average yearly production is within the range of 3,5-3,8 millions tons. Of other plants there are especially: oil plants (rape plant and sunflower), potatoes, sugar beet, pulses, vegetable and volume feed stuffs.

The competitiveness of plant production gradually increases in Slovakia. The acreage of grain crops on arable land increased from 53.9% to 56.3% in 1993 and to 58.9% in 1994.

Plant production was negatively influenced by a continuing decrease in agriculture inputs (fertilizers, pesticides). For example, in 1989 more than 238 kg of net nutrients per hectare was applied, compared to 128 kg in 1991 and merely 38.8 kg a year ago. The same is true for high-quality seed, planting material, pesticides and fertilizers. Investments into machinery were also minimal.

CHAPTER 2
Indigenous Plant Genetic Resources

2.1 OTHER WILD SPECIES AND WILD RELATIVES OF CROPS PLANTS

The study of plant populations of the natural vegetation of Slovakia results in twelve-volume work Flora of Slovakia [Flóra Slovenska] (volumes 1 to 7 will represent Flora of Vascular Plants of Slovakia and volumes 8 to 12 Flora of Lower Plants of Slovakia).

Flora of Slovakia, Vascular Plants, summarizes the knowledge about autochthonous, alochthonous, temporary (accidentally) introduced, often cultivated and expected species of the vascular plants in Slovakia.

This work provides the basic scientific data about genera, species and infraspecific taxa, it contains the identification keys, accepted Latin names and Slovak names of plants as well as the critical evaluation of the nomenclature. Description of all taxa, nomenclatural and taxonomic notes, actual distribution in Slovakia, the notes on the morphological variability and chromosome numbers are given, too. Information on: the utilization (use) of taxa, the provenance of crop plants, retreat of some species and proposals for their conservation are included.

The already published volumes of the Flora of Slovakia (Futák 1966, Futák et Bertová 1982, Bertová 1984-1992, Bertová et Golia ová 1993), include also the wild relatives of the crop plants and plants potentially important for agriculture, forestry, pasturage or medicine, occurring in the natural vegetation of Slovakia.

The attached list of species includes the taxa corresponding to the criteria and requirements of FAO project; the most important information concerning the majority of presented species had been published in Flora of Slovakia. Data about pharmaceutically important plant species, till now unpublished in the Flora of Slovakia, were acquired from "Atlas lieΦivych rastlín a lesnych plodov" (Kresánek *et al.*, 1977). The IUCN criteria were accepted according to Maglocky et Feráková (1993).

The following taxa are excluded from the list:

- old cultivated taxa (e.g. *Armeniaca vulgaris, Persica vulgaris, Pisum sativum, Beta maritima subsp. vulgaris, Lactuca sativa*);

- economically important plants (families *Poaceae, Cyperaceae* and *Juncaceae*) of woodland communities and pastures, which are investigated in "Vyskumny ústav lúk a pasienkov v Banskej Bystrici" and "Vyskumny ústav lesného hospodárstva vo Zvolene".

The following taxa are included in the list (a separate appendix):

- *neoindigenophytes*: established neophytes occurring in the natural biotopes of natural plant communities (e.g. some taxa of genera *Epilobium, Robinia* etc.);
- *epecophytes*: plants introduced to the secondary biotopes, where they occur permanently (e.g. *Prunus domestica, Cerasus avium, Malus domestica*).

2.2 LANDRACES (FARMERS' VARIETIES) AND OLD CULTIVARS

The programme has been initiated by the research staff of the Department of Genetics and Plant Breeding, University of Agriculture in Nitra, 1991. The main reason of the programme setting up was an adverse situation in the protection of the original indigenous genepool of cultivated plants in Slovakia what has been documented by the finding that from the total amount of the maintained genetic resources assortment in Slovakia, indigenous genepool represents only 5 to 10 percent. The given topic was at the margin of interest in the past, while in traditional regions of Slovakia in spite of collectivization period hundreds of traditional cultivars and landraces have been maintained. They prove the considerable variability as regards fruits, seeds, habitus, growth rate, earliness, chemical composition and tolerance to the biotic and abiotic harmful factors. On account of that it is necessary to maintain also these genotypes as an important part of the plant biodiversity.

The main goal of the programme is the reconnaissance of locations, searching, collecting, inventory, evaluation, propagation and long-term maintenance of unique accessions of the traditional varieties and landraces as well as of ecotypes of the wild populations spread in various regions of Slovakia and representing an important part of the natural wealth of our country and cultural heritage of our people. All above mentioned activities will result in the maintenance of this wealth for the next generations and practical utilization in research and breeding of new varieties, landscape formation, development of an alternative agriculture and production of health food products.

Reconnaissance and searching of valuable genetic forms within scope of individual rural communities are ensured by external collaborators - volunteers from the local inhabitants with positive relation to the nature, cultivation and propagation of plants. In the first stage these volunteers carry out harvest of fruits and seeds from individual plant forms according to determined method. In primary documentation they keep data in form of searching cards for each sample.

Gathering of samples from external collectors has been ensured by the workers of research staff in accordance with negotiated time schedule. Research staff runs the central registration of collected accessions and their detailed documentation which has been processed in the form of specialized database GENOTYPDATA with the image documentation.

The basic evaluation of samples has been secured by the research staff in collaboration with the expert group consisting of the prominent research workers and breeders being mostly retired so thus their long-term experience and knowledge have been used.

During last four years of programme implementation within 112 rural communities situated in the regions of Krupinská planina, tiavnické vrchy and Biele Karpaty (Protected landscape region) there have been gathered and evaluated about five thousand samples covering following species: *Malus spp., Prunus spp., Vitis spp., Juglans spp., Pyrus spp., Castanea sativa, Phaseolus spp., Lotus spp.* as well as certain Ornamental and Medicinal plants.

From the collected samples more than 60 percent have been selected for the long-term maintenance. They show also certain degree of originality in characteristics of fruits and seeds.

CHAPTER 3
National Conservation Activities

3.1 *IN SITU* CONSERVATION ACTIVITIES

Our country has no programmes or projects for *in situ* conservation of PGR.

3.2 *EX SITU* COLLECTIONS

Collections of plant genetic resources produced since 1951 in RIPP Pie tány, the central institute for plant production in agricultural section, can be considered as the national plant genetic resources collections. Similarly the collections of landraces, being established within the "Endangered Plant Genepool Conservation" programme at the University of Agriculture, Nitra (in 1995 this programme entered the 4th year of its existence).

Due to the separation of ESFR, in 1993 a specific situation in genetic resources storage arose in Slovakia. In RIPP Praha-RuzynN a Genebank was established (serving the needs of research and breeding centres) and put into operation in 1990. When dividing the property after the separation of ESFR it was not possible to claim material property of Genebank by Slovak side. The agreement with RIPP Praha-RuzynN was concluded, according which Slovakia pays for the stored samples 165 000 Ek every year.

In Slovakia the storage of plant genetic resources is decentralized on research and breeding centres, which are holders of collections, and in most cases it is a short- or a medium-term storage. Samples are mostly stored in some store-rooms or partially adapted rooms, built for this purpose. Several vegetatively propagated species (potato, strawberry, raspberry, hop) are stored *in vitro*.

In 1994 (in October), construction of Genebank, which will serve the needs of conservation (all methods) of genetic resources in Slovakia, was started in RIPP Pie tány. Testing operation of this Genebank should begin in the 2nd half of 1996. Construction of genebank, at the cost of 31 mil. Sk, is financed from the state budget and at present it is the only capital construction in agricultural section. This fact fully reflects the government's support in national conservation activities.

From the view of composition, national collections represent economically important crops, which create for Slovakia preconditions of food security (wheat, barley, maize, forage crops, etc.), the resource of a high nutrition value (pulses, vegetable, fruit) and aesthetic worth (flowers, ornamental woody plants). Approximately 8% of collections represent indigenous genetic resources, the rest of material was obtained through the introduction from abroad. As the most important material in collections we consider regional populations, products of our new-breeding and locally selected material in some vegetatively propagated species. When starting the operation of the Genebank, these material will receive preferential treatment.

From individual collections of plant genetic resources a different number of samples (from 0 to 80% in sugar and fodder beet) is used for research and breeding purposes. The most intensively used are the collections established in the centres, where a given plant is bred. National institutions (research, schools) are the main users. At present, privatization of some breeding and research centres in Slovakia is not finished (or, better, is only at the beginning). Due to a short-term existence of National Programme of Plant Genetic Resources in Slovakia, contacts with other national programmes or international agricultural research centres are not sufficient. Foreign material is obtained especially from breeding and seed producing firms, from genebanks (according to catalogues, Index seminum) or by means of participation in international experiments organized by international agricultural research centres (CIMMYT, ICARDA) or international organizations (EUCARPIA).

Within the framework of National Programme, in no collection the analyses that would make possible to express whether the set represents diversity of particular species, genus, etc. were made. Collections were formed with regard to economic importance of characters and characteristics (yield, quality, resistance to biotic and abiotic factors of environment) and therefore they are fully adequate for research and breeding purposes in conservation according to recommended, acceptable standards.

In last years, collecting expeditions on the territory of Slovakia have been organized. The planned collecting expeditions to certain localities were preferred and always more species were the subject of collecting using random sampling techniques. Also a systematic collecting on selected territories of Slovakia (at present Krupinská planina, see Chapter 2) is worked out and realized, being aimed at preservation of indigenous landraces of grown crops, and/or their relatives.

In view of purposes preferred in existing programmes of collecting, evaluation, and maintenance of plant genetic resources, plant collections are not large and it is not necessary to discard material from them.

3.3 STORAGE FACILITIES

As we have already mentioned, at present no adequate facility for conservation is built in Slovakia. In RIPP Pies'any, the coordinating centre for the study of this task, for purposes of a medium-term storage, the rooms with the area of 18 m^2 have been adapted, where the temperature and humidity are maintained by means of cooling equipment. These conditions can be maintained during the whole year and they match up to the required standard. At present, 5,000 samples of cereals, forage crops, and pulses are stored in these conditions.

The part of collections created within the framework of Czechoslovak Programme is stored in Praha-RuzynN Genebank, where selected indigenous genetic resources are stored also in the "base collection". After finishing the construction of Genebank in RIPP Pie tány, the samples will be transferred into this Genebank.

Botanical gardens and arboreta maintain - first and foremost - living plant collections. Collections of seeds are maintained predominantly in short-term storage facilities, i.e. in conditions of room temperature and moisture content. Living collections are aimed at native plant species (autochthonous taxa), in the first place at threatened ones from endangered plant populations, not only of plant crops or other cultural plants wild relatives.

In several cases, unique plant collections for conservation of variability of indigenous woody plant species in the whole width are made from the whole territory of Slovakia (Arboretum Borová hora of the Technical University in Zvolen).

Another woody plant collections are aimed at collecting foreign shrub and tree species from different phytogeographic regions in great diversity for the use in garden designing or landscape planning. These collections are focused, e.g. in Arboretum Mly any, predominantly on evergreen trees and shrubs. At present, living collection of native woody plants from the whole territory of Slovakia is built in that arboretum on the base of natural woody plant communities.

In another case, predominantly seed material obtained from outside the country, particularly by international seed exchange via index seminum, is used for establishing living collections, e.g. of field and garden crops, medicinal plants etc., in some cases, of tropical useful plants and crops held under cover, too (e.g. University of Agriculture in Nitra Botanical Garden, Botanical Garden of the P.J. afárik University in Ko ice).

Living material is only exceptionally used for breeding purposes, as in the case of peaches in Botanical Garden of the Comenius University in Bratislava. In its workplace in Blatnica *ex situ* conservation by means of living collections of native plant species from Veœká Fatra Mts. is the main role.

3.4 DOCUMENTATION

Information system of genetic resources, built within the Czechoslovak Programme since the end of the sixties under the title EVIGEZ, is a basis for documentation system used at present. It is operated under the programme FOX PRO 2.0 multiuser. As to the collections, passport data are processed preferentially and then descriptive part including also agronomic evaluation information in many economically important plants. In National Programme of Genetic Resources, about 125 species are recorded at present. In the past, large data sets preferentially published in Final Research Reports have been obtained in important species. Only after 1989 (after velvet revolution) computers became available to many workplaces and also activities regarding genetic resources documentation became more intensive. Many descriptive data contain also breeders' records.

In 1993, the Catalogue of Genetic Resources of Cereals in Czech and Slovak Collections was published and now the publication of catalogue of other crops is being prepared from the joint programme. As to the many crops, the holders of collections work at the workplace, where a given plant is bred or they are breeders themselves, what means an ideal situation for direct utilization of genetic resources in breeding. In other cases information are available by letter or users can come and consult results on excursion within the field experiments.

From the historical point of view we cooperate the most intensively with the Czech Genebank in Praha-RuzynN (seed storage, exchange data). We develop contacts (on the basis of cooperation agreements) with the neighbouring countries (IHAR Radzikow, National Centre of Plant Genetic Resources of Ukraine, Kharkov, etc.). Through these contacts we endeavour to organize joint collecting expeditions as well as the exchange of information and seed material. We would consider the inclusion of SLOVAKIA into the network of similar centres with a regular information exchange to be suitable after finishing the construction of our Genebank.

In Botanical Garden we file data concerning taxa of collections in filing software. All the data are in the dbf size. We file basic taxonomical, chronological data, data on growing character as well as origin of taxa. In the case of partial collections, e.g. that ones collected for germplasm maintaining purposes according to the FAO programme, we can add other special data.

We can give outputs from this software as the print size, or, in case, the Botanical Garden will be connected to Internet, also on line. These outputs are in our dbf size, or in the size of the ITE (International Transfer Format - software of the Kew Gardens for filing rare or endangered plant species).

3.5 EVALUATION AND CHARACTERIZATION

Processes of characterization and evaluation of germplasm samples are carried out by holders of collections within the framework of the basic and the special evaluations. Within the former association of COMECON countries the descriptors were worked out and they were used in previous evaluation the most. Gradually we pass to IBPGRI/IPGRI descriptors, which became accessible to us only within the independent Slovak programme. Some holders of collections, working also as breeders, extend the set of studied characters from UPOV descriptors. From the set of evaluated plants, 35 crops, i.e. 28%, are evaluated at the locality of the future Genebank. In these collections in indigenous historical varieties up to the varieties grown at present, anatomically-morphological and agronomical characters are supplied with selected indices of quality, phytopathological, biochemical, and molecularly-biological evaluation. Also those genetic resources, which are included into the further research and breeding programmes are the subject of evaluation.

3.6 REGENERATION

The method of seed material regeneration depends on the method used for genetic resources storage at present, i.e. short- and medium-term (i.e. every year up to every 5 years depending on the species). In fruit crops, the regeneration goes in cycles in the interval from 3 to 10 up to 15 years, depending on the species (in almonds up to the 25th year and in common walnut up to the 50th year following the seeding). Regeneration depends also on the seedling stock and the level of treatment.

In regeneration, the holders of collections endeavour for sufficient regenerated samples to avoid genetic drift. At the same accessions, "fresh" and "old" material is not combined and only 1 generation is maintained.

CHAPTER 4
Use of Plant Genetic Resources Collections

4.1 CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

The function of National Plant Breeding Programme is different according to the crops, local varieties in combination with foreign donors of characters and characteristics being used in all of them. In economically important crops, e.g. cereals, specific characters - lodging resistance, disease resistance, quality, have been introduced. Until recently the objective of the breeding programme was to increase production, at present the aim is to maintain production, to meet the requirements of food security of the country. In several crops the production is aimed also at the export (barley, hop). At present, the exchange of generations in breeders community has appeared, the number of breeders is lower and the whole breeding is in the process of privatization. We find it useful to leave some breeding stations in the form of the state organization to ensure procedures, which regarding the level of knowledge and experience are risky and highly material demanding (biotechnologies).

Agricultural production (cooperative farms, state farms) is in the process of transformation. The farms have lack of finances, the banks do not grant credits to several subjects, what is the reason for limited seed purchase, but also the limited production. Cooperative farms and farmers were not in the past and are not even in the present interested in breeding process, though in the past (less at present) they participated in varieties evaluation in the form of semi-operation experiments.

From the national collections of genetic resources, genetic resources characterized in preliminary or basic evaluation by significant expression in selected characters and characteristics (agronomic characters, quality, tolerance to biotic and abiotic factors of environment, etc.) are used the most frequently. Breeding stations, research institutes, centres of basic research (i.e. Institutes of Slovak Academy of Sciences), schools (from Universities to Basic schools) are usually in-country users.

In following review we present species or groups of crops and their utilization in the past 3 years.

Crop/group of crops	Number of used genetic resources	% of collection
Barley	550	72
Triticale	374	67
Soybean	238	51
Fruit trees		40
Potatoes	120	35
Wheat	739	28
Lucerne	51	23
Vegetable		20
Lentil	51	16
Termophile fruit trees	84	16
Grape	210	12
Vetch	11	12
Bean	10	3
Pea	22	3
Maize		1

Note: in other species the data are not known, or there is no utilization.

The number of professionals using plant genetic resources of individual species depends first of all on economic importance of given plant and on the extent of its growing. For example in wheat, the number of users of genetic resources will correspond minimally to the number of breeding centres in Slovakia engaged in variety production, i.e. 6 organizations. On the other hand, only 1 person in Slovakia, being at the same time the user of genetic resources, is engaged in the problems of faba bean from genetic resources up to growing technologies.

Because only national collections of genetic resources are formed in Slovakia, breeders have used in the breeding only genetic resources from these collections, or they have obtained genetic resources during their sporadic visits to foreign countries. Within the framework of COMECON, the research programmes were developed producing donors of characters and characteristics (e.g. in the GDR - resistance to powdery mildew of barley).

There are only several collections of plant genetic resources, which have not been intensively utilized in the past 3 years. Collection of tobacco is one of them, because research and breeding of this plant has been suspended. Breeding of fodder beet is more intensive compared to sugar beet. Better results have been obtained in silage maize than in grain types of maize. These facts have been reflected in the work with genetic resources. This state cannot

be considered permanent, further changes resulting from privatization can appear in the future.

Farmers have access to information concerning genetic resources, which have been published. They are interested especially in comparison of indigenous varieties with introduced ones. We expect better cooperation in the future, mainly in the crops, which will be grown for the purposes of improved nutrition and in alternative management systems in general.

4.2 BENEFITS DERIVED FROM THE USE OF PLANT GENETIC RESOURCES

In the temporary built facility for a medium-term storage, RIPP ensures the storage of tobacco collection for foreign users. From this activity no benefits are derived, only the costs are covered. From the point of view of National Programme we are interested above all "mentally" in conservation of gene pool of this plant, formed in Slovakia.

In all plants, which are bred (or were bred), indigenous landraces were used in combination with introduced donors of characters and characteristics. Within the former research programmes of COMECON, indigenous plant genetic resources were provided, particularly those of cereals and fodder crops. The exchange was not subject to files and contracted conditions, therefore it is difficult to conclude as to the benefits deriving from this collaboration, but they will be certainly expressed in characteristics of new released varieties in former states of COMECON. Benefits are only indirect.

4.3 IMPROVING PGR UTILIZATION

The main achievements of plant genetic resources activities are in improving traditional plant production, in improving varieties of the plants grown historically on the territory of Slovakia. Plant genetic resources research activities in the past also helped to the fast expansion of growing some foreign varieties having outstanding characters and characteristics that were not present in the assortment grown at that time. Swiss red clover variety Temara, Swedish soybean variety Fiskeby, and many winter wheat varieties (Mironovská, Jubilejná, Kaukaz, Aurora, etc.) from the former states of Soviet Union can be an example.

In many collections of genetic resources of plants, which are also the subject of breeding in Slovakia, commercial varieties prevail. In the fifties, and/or sixties in collectivization, no sufficient and systematic attention was paid to collecting and particularly to conservation of indigenous historical landraces and the importance of this biological material for the future was not understood. Wild forms, donors of characters and characteristics (mainly quality, tolerance to biotic and abiotic factors of environment, etc.) are insufficiently or hardly at all represented in collections. More effective connection to research programmmes, where germplasm is produced for a certain purpose, seems to be a way out. For a better use of the resources a better collaboration between the sections of agriculture, environment, and schools, and between basic and applied research is necessary. Different ways of financing in schools, academic institutions and research institutes create barriers in the development of National Programme. Full acceptance of National Programme of plant genetic resources at the factual but also the financial level is the way out.

Depending on the species, diversity collected in collections is different. Some collections have been systematically created since 1951 (wheat, barley, fodder crops, maize, etc.), collections of other species began to be created only after the separation of ESFR (rye, oilseed rape, etc.). Insufficient attention was paid also to collecting and conservation of plants for the alternative management systems. Importance of these collections will be higher in the future than now.

At present we consider as priorities:

- to ensure the method of systematic collecting of indigenous gene pool,
- documentation,
- evaluation of genetic resources at least at the level of the basic ensurance of long-term programme from the view of finances,
- finishing construction of Genebank and its operating,
- improving international collaboration.

For improving the use of plant genetic resources we consider necessary:

- technical assistance in finishing construction of Genebank and in starting its operation,
- trainings, study stays in selected institutions.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

Activities concerning plant genetic resources are organized into the "National Programme", financed in different ways. We want to stress that the financial means are not provided from the state budget regularly throughout the year. Several ministries - the Ministry of Agriculture, the Ministry of Education, and the Ministry of Environment participate financially in ensuring the Programme (without above-sectional coordination) and partially make use of a special financial chapter of Constitution of Slovak Academy of Sciences.

In agricultural section, genetic resources were the integral part of research projects investigation in research and breeding centres. From the state budget, endowments are provided also for:

- conservation of basic genetic resources,
- conservation of rare gene pool of historical and regional varieties.

Since 1994 the problems of plant genetic resources are studied within the state scientific and technical project "Collecting, Study and Protection of Cultural Plants Gene Pool" (No 05-514-31). National Programme partially covers also the use of genetic resources. No commercial firms, NGOs, nor farmers s organizations are involved in this Programme. When collecting genetic resources, voluntary workers (students, pensioners, housewives) are involved.

The present goals and objectives of the National Programme are:

- integration of Slovakia into the project "Global System of Conservation and Utilization of Plant Genetic Resources for Nutrition and Agriculture";
- to continue in collecting all available genetic resources of indigenous origin;
- collecting and conservation of genetic resources from the localities, which will be used for different purposes due to industrial activity (water basins, atomic power stations, etc.);
- to gather within collections genetic diversity as wide as possible, as a safety protection for the needs of unforeseeable future (at present the need of genetic resources for low-input systems, etc.);

- to ensure initial material about characters and characteristics necessary for breeding or research.

Convention on Biological Diversity was ratified by Slovak Parliament in 1994. At present a commission for working out the Convention in conditions of Slovakia is being formed.

Coordinator of National Programme of Plant Genetic Resources is employee of RIPP Pie ′any and is appointed by the director of RIPP. The Ministry of Agriculture has entrusted RIPP, as the central national research organization in agricultural section, with this activity.

Annual budget for programme depends on the state budget and on the amount of finances granted to research .

Plant genetic resources collections are not protected by legislation neither by a national decree. All organizations, the holders of genetic resources collection, were the state organizations till the present and therefore all collections were the state property. In the process of privatization, it is necessary to declare the state ownership of collections, what is probably the task of founder of these organizations, i.e. the Ministry of Agriculture. Coordinating workplace of National Programme cooperates very closely in this matter with the Ministry.

National food security is also one of the important objectives in our National Programme.

5.1 TRAINING

Personnel involved in realization of National Programme is adequately educated and trained (Universities, Secondary Schools), mainly in Slovakia. At present, there is a great exchange of generations in research and breeding. Some of younger scientific workers have not a lot of experience. Neither younger generation working in research institutes and breeding centres has obtained experience and knowledge in a given area through training in foreign institutions. The reason is also insufficient knowledge of languages. In our National Programme following skills are available: statistical sampling, agronomic evaluation (in some crops), taxonomy, programme management, data management, germplasm health, plant breeding, policy. At present no plant genetic resources training is available in Slovakia. Department of Genetics and Plant Breeding, University of Agriculture, Nitra, within the framework of TEMPUS project, submitted proposal for establishment of the Institute for Plant Biodiversity Protection, where courses within the country

should be organized. With international assistance our country could offer regional courses.
User community has the opportunity to learn something about genetic resources by the means of Annual report - Plant Genetic Resources, scientific and professional papers published in different journals and newspapers. Slovak Gene Bank Newsletter and edition of non periodical publications "Plant Genetic Resources" are prepared for publishing. National policy-makers understand importance of plant genetic resources programme and pay adequate attention to it.

Staff turnover is not too rapid and genetic resources programme can fully benefit from the investment in staff training.

5.2 NATIONAL LEGISLATION

It is not possible to import to Slovakia plant genetic resources subjected to quarantine laws. Other genetic resources including *in vitro* can be imported to Slovakia after fulfilling conditions of seed import and export (phyto certificates). There are no delays in the passage of genetic resources materials, therefore no injury (or loss) occurs. In vitro materials must be thoroughly ensured (drying, damaged packing).

We think that more stringent quarantine controls than those that already exist are not necessary.

National laws do not restrict the planting out of imported genetic resources, provided that these serve only the needs of breeding process.

The Government of Slovakia and the Ministry of Agriculture provide endowments for genetic resources and endowments for propagation material produced in Slovakia, i.e. also propagation material of foreign varieties produced in Slovakia.

The use of varieties (sale, growing) is allowed in accordance with regulations in force only for varieties registered (released) in the State Varietal Book - specified in the List of Released Varieties. The seed of these varieties, which is used in practice, must be certified.

For the exercise of property right to variety, in Slovakia the law No 132/89 Zb. and regulation No 133/89 concerning legal protection of agricultural plant varieties and farm animal races are in force. Applications and certificates are accepted and issued by the Ministry of Agriculture of Slovakia. Property right to the variety, cannot affect the programme of collecting, verification, and conservation of genetic resources in Slovakia, if the law is kept.

In mutual exchange of genetic resources it is necessary to keep the law No 132/89 Zb. Considerable exchange of genetic resources is made on the basis of international agreements on cooperation in testing varieties for legal protection. Slovakia entered into agreements on exchange of varieties and tests of varieties according to UPOV with Czech Republic, Hungary, and Poland. The signing of agreement with Slovenia is supposed. Further exchange of genetic resources is made on the basis of breeding programme of individual teams in breeding stations.

5.3 OTHER POLICIES

Endowment policy is applied in all the seeds of released varieties, certified, produced, and finished in Slovakia.

The choice of planting material by growers is limited by representation of varieties in the List of Released Varieties. The Ministry of Agriculture has a possibility in case of need (natural calamity) to grant the exception on the import of seeds (genetic resources) of non registered varieties. National Programme enables also to multiplicate in advance those varieties, which have carried out 2 years of the State Tests and pass to the 3rd year of the State Tests.

Our Institute in implementing the State Tests and DUS tests doesn need at present any immediate international assistance. The tests are carried out in international collaboration according to the significance of plants and the extent of plants.

CHAPTER 6
International Collaboration

Our country adopted Agenda 21, and Commission for its elaboration and implementation is established at present in the Ministry of Environment.

6.1 FAO GLOBAL SYSTEM

Slovakia is not the member of FAO Commission so far, its representatives attended sessions in 1993 and 1994 as observers. We cooperate with FAO on ESCORENA programme (flax, soybean).

6.2 INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

Previous collaboration with CGIAR centres is only at the level of participation of Slovakia in international experiments (ICARDA, CIMMYT). Slovakia does not receive any support from CGIAR centres, neither National Programme staff received training from CGIAR centres.

In the past we were looking for the possibility of short visits of our staff to CGIAR centres, but we did not succeed. We apparently do not know well the mechanisms making possible these visits.

Since we do not know all functions and the responsibility of CGIAR centres we cannot make comment on new initiatives in plant genetic resources.

We have no mechanisms for communications between our National Programme and the CGIAR centres. Any scientist did not station in our country.

We would like to start close cooperation in following areas:

- exchange of biological material
- clarification of National Programme objectives

- mutual exchange of personnel for short visits
- co-organization of collecting expeditions

We suppose that IPGRI, as one of CGIAR centres, has for the next decade a new important function, to help realization of national programmes in Central and Eastern Europe. To create the same possibilities (programme, finances, material) also for the countries that are not members of EU.

6.3 REGIONAL RESEARCH CENTRES

Our country has no special relationship with the regional research centres.

6.4 REGIONAL INTERGOVERNMENTAL INITIATIVES

Slovakia participates in ECP/GR Programme in working groups Forrages, Small Grain Legumes, Barley as attending member and in other working groups as corresponding member. Slovakia as a newly formed state is a new member of the Programme. We expect that participation in these working groups will bring better communication and collaboration with European institutions.

6.5 BILATERAL INTERGOVERNMENTAL INITIATIVES

Slovakia has the following bilateral agreements on plant genetic resources:

- IHAR Radzikow.
- National Centre of Plant Genetic Resources of Ukraine, Kharkov.

CHAPTER 7
National Needs and Opportunities

- To finish construction of Genebank for the needs of medium- and long-term storage of plant genetic resources in Slovakia.
- To start operation of Genebank, particularly in the following activities:
  - conservation of genetic resources, which are at present stored at Genebank Praha-RuzynN and decentralized on research and breeding centres in Slovakia;
  - working out information system into the storage file;
  - inclusion of Genebank into the network of international institutions, namely by the exchange of seeds, information, and published documentation. (Index seminum, Slovak Gene Bank Newsletter, etc.).
- To develop and realize gradually the programme of centralization of collections of genetic resources endangered due to privatization or liquidation of some institutions.
- To ensure systematic collection of genetic resources on the territory of Slovakia, within the framework of expeditions to offer participation also to foreign countries, and on the contrary, to accept participation in expeditions on the territory of foreign countries.
- To collect and maintain genetic resources from the localities that will be due to industrial activities changed for different purposes (dams, surrounding of atomic power station, etc.).
- To collect, within the scope of maintained plant genetic collections, genetic diversity as wide as possible as a safety protection for the needs of unforeseeable future.
- To set up and operate the laboratory for characterization and identification of genetic resources by the means of biochemical and DNA markers.
- To ensure, in accordance with the programmes of the government of Slovakia, a permanent source of financial means for collecting, storage, and conservation of genetic resources in the form of state endowments.
- In conditions of Slovakia to initiate elaboration of national programme of genetic resources, where biodiversity of everything what is living would be included.

- To built repositories for preservation of fruit-tree species.
- To use protected territories for *in situ* conservation, to make agreements with administrators of these territories.
- To complete and verify dynamic system of genetic resources conservation.
- To complete the system of maintenance of cross-pollinated plants.
- In agreement with ECP/GR objectives, to participate in creation of core collection within the scope of working groups.
- In collaboration with Botanical Institute of SAS and Botanical Gardens to save and maintain endangered plant species from the territory of Slovakia.

CHAPTER 8
Proposals for a Global Plan of Action

At the national level:

- To ensure conservation and free accessibility of genetic resources for their use.
- To concentrate preferentially on collecting old historical varieties and wild relatives of grown plants.

At the international level:

- To develop international coordinated collaboration.
- To create the same conditions within the scope of international collaboration irrespective of the membership of EU.
- To look for the forms of active integration of the states from former "socialistic block" into international collaboration.
- To look for the possibilities of material and mental support of National Programmes development in the states of Central and Eastern Europe.

ANNEX 1
Forest Genetic Resources

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CHAPTER1 INTRODUCTION TO SLOVAKIA AND ITS FORESTRY SECTOR

The total area of Slovakia represents 49,035 km^2, out of which the forest cover represents the area of 1,985,600 ha (forest stand cover 1,904,339 ha), i.e. 40.6% of the country's territory is covered by forests (January 1, 1993). 1,389.6 thousand ha (72.2%) represent the commercial forests with the prevailing productive function and 263.3 thousand ha (13.6%) represent protection forests with prevailing protective functions and the remaining 272.9 thousand ha (14.2%) represent special purpose forests. 660,493 ha i.e. 13.47% of Slovakia are subject of the Nature Conservancy Act (national parks and the protected landscape regions). Of the total forested area the 42.2% of the forests are under the state ownership, 16.4% belong to private owners, 38.3% belong to communities, 3.1% to church etc. The reprivatization process in the forestry sector is almost finished and the target figure should correspond to the forest ownership proportions in the year 1948.

In comparison with several neighboring countries the tree species composition of the Slovakia's forests is indigenous and only a small proportion represents

non-indigenous and artificial forest stands. The tree species proportion almost corresponds to the original proportions of the main stand forming tree species. 42.7% of forests is covered by conifers and 56.0% by broadleaves (the remaining 1.3% are clear areas).

The highest proportion have the economically most important tree species as Norway spruce (27.5%), Scots pine (7.8%), silver fir (5.0%) and beech (29.4%) oaks (13.7%) and hornbeam (5.5%). Within the last century only the proportion of the silver fir and oaks decreased dramatically. In 1920 the proportion of silver fir represented 15% and that of oaks 20%. In contrast the proportion of Norway spruce slightly increased. The proportion of other broadleaves remained the same.

CHAPTER 2 INDIGENOUS PLANT GENETIC RESOURCES

The Slovakia's forests are a part of the Carpathians and more than 90% of the forested area belong to the Carpathians. Only the riverain forests in the South of the country belong to the Pannonian basin (riverain forests along the rivers Danube and Ipel and lowland forests in the Western and Eastern Slovakian Lowland).

As mentioned in the previous paragraph the present tree species composition corresponds more or less to the original tree species composition of the Carpathian forests and only in few cases the larger utilization of non-indigenous material and conversions of indigenous tree species composition to one-species man-made forest are known. There are several estimates known and about 10–15% of forest of man-made origin are expected.

Slovakia belongs to the countries with the oldest legal regulations of seed procurement and utilization of the forest reproductive material. In Slovakia since 1938 (in the Czech part of former Czechoslovakia since 1939) the regulations on the seed procurement from approved coniferous stands and utilization of reproductive material from such stands have been valid. These regulations were several times updated and the present regulations have been valid in Slovakia since 1985. Due to these legal regulations, the utilization of reproductive material from indigenous and approved stands resulted in the high standard of gene pool conservation and prevented the gene pool deteriorization. In the first half of this century the broadleaves were regenerated mostly naturally and it was not necessary to include also the broadleaves in this regulations. Along with the conifers the present

regulations, however, include also the beech and oaks among the tree species the seed procurement of which is allowed only in approved stands.

Status of important species or groups of species which are mainly or totally harvested, and managed, in natural forests

From among the conifers the highest degree of indigenousness is expected in silver fir. In this tree species the natural regeneration was almost exclusively the most common forest management practice. The other tree species could have been the subject of seed transfer, but mostly within the country, for in Slovakia there was also active the Seed Extractory Plant. The seed of Norway spruce, Scots pine and European larch has been collected, processed and stored in the Seed Extractory Plant, Liptovsky Hrádok, but mostly the indigenous seed sources have been utilized. This fact is also important for good preservation of indigenous tree species composition.

The most important broadleaves (beech and oak) were regenerated naturally and there was no need to make collection of seed for artificial reforestation. The proportion of these two species on afforestation of non-forest land is also negligible.

A significant proportion of Slovakia's forests is covered by exotic tree species, e.g. black locust, Euroamerican poplars, Douglas-fir. Black locust and Austrian black pine populations are fully acclimatized and are considered to be a part of domestic flora.

Programmes and measures aimed at sustainable management of these natural forests, thus contributing to the conservation of the genetic resources they contain

As has already been mentioned, the seed procurement in approved stands of conifers and later also in broadleaves has been the legally based common forestry practice since the end of 1930'. The approved stands of the A category were regenerated only naturally, thus the best genetic resources have guaranteed reproduction by natural regeneration. In several cases where the natural regeneration is not possible, the artificial regeneration from the same seed source is recommended.

According to the recent legal regulation the regeneration of the approved stands of the A category is allowed only by natural regeneration, while in these stands the rotation period could be prolonged by two to four decennia. In mixed stands, such forest management practices should be applied to enable the regeneration of all stand-forming tree species.

In the recent decade, except the approved stands the gene reserves are the main measures which are contributing to the sustainable management of the genetic resources of the main tree species. The aim of the gene reserves is to establish larger units (usually more than 100 ha, exceptionally less), in which the dynamic aspect of gene pool conservation could be secured. The gene reserves are usually established in the region with the most valuable ecotypes of the given tree species. In mixed stands, the gene reserves could be declared for all tree species occurring in the reserve.

Recently a new regulation has been approved according to which the gene reserves are declared as special purpose forests and thus specific measures should be applied in their management (exclusive application of natural regeneration and in case of need of artificial regeneration only the utilization of local reproductive material is allowed, support of mixed stands etc.).

Important species or groups of species which are endangered at a species or provenance level in the country

From among the native tree species the silver fir (*Abies alba*), the elms (*Ulmus* sp.) and the English yew (*Taxus baccata*) are considered to be the threatened species on the entire territory of Slovakia. The proportion of silver fir has decreased since 1920 from 20% to 5%. The English yew does not belong to the tree species of economical importance. Even in the case that the English yew population in Slovakia is the largest one, it belongs to the endangered tree species.

The decline of oaks was recorded in Slovakia in the beginning of 1980's. It was supposed to be due to tracheomycoses (*Ophiostoma* sp.) which appeared after dry summers and due to improper forest management practices (summer cutting of oaks improved the reproduction of bark beetles which are vector of tracheomycoses). The decline process seems to be stabilized at present.

Some local populations of Norway spruce and silver fir are endangered in the industrial regions (e.g. Spis, Beskydy). The gene conservation practices and breeding programs aimed at the selection of tolerant genotypes started 10 years ago. Unfortunately, the breeding programs are interrupted due to the lack of financial funding.

The noble hardwoods are not endangered to such a high degree. The trend of their withdrawal from the forest stands with prevailing beech occurrence is however alarming. At the application of natural regeneration these tree species are frequently damaged by grazing of ungulates (red deer, roe deer).

Last but not least, 4 the riverain forests along the main Slovak rivers (Danube, Váh, Ipel, Bodrog) are endangered by the recultivation of the riverbanks. Many broadleaves, e.g. *Populus nigra, Salix* sp., *Alnus* sp., and also *Quercus* sp. disappeared due to recultivation and were frequently replaced by the Euro-American poplars.

CHAPTER 3 NATIONAL CONSERVATION ACTIVITIES

Exploration of the natural distribution of the main native forest species

The exploration of the natural distribution of woody species (trees and shrubs) was done in this century twice and was a subject of the two principal publications:

- Fekete, L. & Blattny, T.: Die Verbreitung der forstlich wichtigen Bäume im ungarischen Staate. [The distribution of forestry important trees and shrubs in the Hungary]. Schemnitz, 1914
- Blattny, T. & tastny, T., 1956: Prirodzené roz írenie drevín na Slovensku. [Natural distribution of tree species in Slovakia]. SVPL, Bratislava.

Since that time several smaller publications or data published in individual volumes of Flora Slovenska (Flora of Slovakia) have been published. The two above mentioned books are considered the basic comparative sources of the original natural distribution of woody plants on the territory of present Slovakia. A more comprehensive chapter is given in the national report.

Description and documentation of populations/stands representing the different eco-geographic zones in which each main species occurs, with identification of threats, *in situ* conservation possibilities and *ex situ* conservation needs

Individual populations were subject of the numerous provenance experiments (see following paragraphs). Based on these provenance trials as well as on those being established with Slovak provenances in foreign countries it was possible to establish the regions in Slovakia with valuable ecotypes and to define the seed zones and the directions and the limits of seed transfer.

At present there are defined the seed zones for the following tree species: Norway spruce, silver fir, Scots pine, European larch, European beech and oaks. The seed zones are defined for the natural range of these tree species as

well as outside their natural range. There were defined the following numbers of seed zones for the above mentioned tree species (in brackets the number of seed zones within the natural range):

Norway spruce	7 (5) seed zones
Silver fir	8 (5) seed zones
Scots pine	10 (7) seed zones
European larch	6 (3) seed zones
European beech	7 (5) seed zones
Oaks	5 (5) seed zones

There are following rules for seed transfer in principle: The seed transfer is allowed within individual seed zone, exceptionally also among the seed zones in directions which are stated implicitly in the law regulation. Vertical seed transfer is also implicitly stated in the law regulation and in general (when not other stated) it represents ± 200 m from the place of the seed procurement.

Genetic conservation through combined *in situ* conservation area network and *ex situ* conservation measures, such as *ex situ* conservation stands (long term seed storage - more than 5 years)

One of the advantages of tree species is their longevity. It enables the *in situ* conservation activities without greater complications for longer periods. The main principle of the *in situ* conservation practices which are applied in the forestry practices of Slovakia is the natural regeneration of the approved stands for seed procurement. In general the approved stands are used for seed procurement for artificial regeneration, but from the gene conservation point of view their natural regeneration is of highest priority. The size of approved stands is usually identical with the size of all forest stands (as forest management units) i.e. 10 – 20 ha. The transition step toward the larger units was the establishment of seed bases (later gene bases) which were, in the first period, a set of adjacent approved stands for seed procurement.

Gene Reserves

Later, the gene reserves (bases) became a tool of gene conservation practices. A gene reserve (base) is defined according to the regulations as a larger unit usually of the size of several hundreds of hectare including the forest stands already approved for seed procurement (older than 60 years) or those naturally regenerated younger stands.

The great attention of gene reserves is paid to the dynamic aspect of the gene conservation, i.e. the gene reserves should have approximately the equal

proportion of stands of all age classes to maintain the aspect of sustainability in gene conservation. The core zone of the gene reserves represent usually the zones with the most valuable gene pool of individual tree species or the best preserved original gene pool (natural stands, reserves etc.). In case, the subject of gene reserves are mixed stands, the gene reserves are declared for all species creating the mixed stands. The great attention is paid to the tree species occurring in low proportions, as for example the noble hardwoods (maple, ash, elm, wild cherry etc.). In case the gene reserves could not be established in one compact unit from any reason, they are exceptionally divided in smaller parts. The parts not belonging to the gene reserves are managed in a similar way as gene reserves (utilization of seed material exclusively from gene reserves).

At present there are established 45 gene reserves of 14,000 ha. The largest and the most important gene reserves are following ones:

Norway spruce: Liptovsky Hrádok (800 ha), Be u (2,000 ha), Zakammené (1,100 ha), Ru≡omberok ha) and High Tatras (500 ha);

Silver fir: Be u (200 ha), Margecany (300 ha), Medzilaborce (200 ha), Plavnica (200 ha);

Scots pine: Lipt. Hrádok (100 ha), Mní ek (100 ha), LevoΦa (600 ha), PartizánskaLupΦa (80 ha), Presov (40 ha), Pohorelá (50 ha), Luboch a (70 ha);

European larch: High Tatras (50 ha), Eierny Váh (60 ha), Eervená Skala (100 ha); Murá (50 ha)

European beech: Medzilaborce (300 ha) Krajná Polana (90 ha), Murá (350 ha), Tisovec (150 ha), Zvolen (500 ha), Krupina (360 ha), Sobrance (120 ha);

Oaks: Krupina (750 ha), Presov (230 ha), Krásnohorské Podhradie (60 ha), ≠itavany (150 ha), Sobrance (50 ha)

Except those gene reserves established for the economically most important tree species there were also established gene reserves for black alder in Sobrance (30 ha) and noble hardwoods in Tisovec (30 ha) and Murá (10 ha).

It has been decided to increase the number and acreage of gene reserves by 2,000 on 35,000 ha.

Seed Stands

In forestry practice of Slovakia there is also another unit aimed at gene conservation – seed stands (not identical with the seed stands according to the OECD scheme). Seed stand in this respect represents the open-pollinated progeny of the approved stand of the A-category which was established (1) to produce the seed of higher quality and (2) to conserve the original approved stand of high quality. Those seed stands may be reproduced both naturally and artificially. The may be established *in situ* and also *ex situ*.

The program of establishing seed stands has been running since 1980, while the priority was given mainly to the overaged stands and the rests of the local populations. In the recent period the priority of the establishment of seed stands was given to the populations under air pollution stress.

At present there are established in total 138 seed stands with a total area of 665 ha. 433 ha of seed stands were established from the natural regeneration and 232 ha by artificial regeneration from the seed material originating from native and indigenous stands. Seed stands of beech, oak, silver fir, and preferably also of Norway spruce are established by natural regeneration, while those of European larch and Scots pine originate mostly from artificial regeneration.

Clonal Archives

The selection of plus trees started in 1950's mainly in Scots pine and European larch, i.e. in those tree species which were used for establishment of the first seed orchards. In 1970's the selection was aimed at Norway spruce and later also at other species.

In Slovakia 3,171 plus trees are selected and protected *in situ*. Most of them represent the plus trees of Scots pine and European larch, the tree species which are used for the establishment of seed orchards. At present there are 202.82 ha of seed orchards, 104.92 ha of them represent European larch and 66.69 ha Scots pine and 11.91 ha Austrian black pine. The proportion of broadleaved seed orchards is negligible (8 ha only). The attention is paid to noble hardwoods e.g. ash, maple, curly birch and linden.

Due to the fact that the life expectancy of the plus trees is rather limited, the clonal archives play an important role. The central clonal archive was established in 1986 in Ostrá Lúka and has a size of 10.50 ha. In this archive only the plus trees of European larch and Scots pine are archived. At present 786 plus trees of these two tree species are archived in this clonal archive. They represent about 45% of selected plus trees of these both tree species.

Smaller clonal archives are established to conserve *ex situ* plus trees of curly birch and linden.

Although, the seed orchards themselves do not represent the best tool for gene conservation, the numerous seed orchards could be considered the *ex situ* measures for plus tree conservation, mainly of those genotypes which do not live any more.

Ex situ gene conservation in forestry practice of Slovakia is aimed at (1) the establishment of seed stands and other reproductive plantations *ex situ*, and (2) the establishment of seed orchards and clonal archives.

The significant contribution to *ex situ* gene conservation present the specialized arboreta:

1. The Forestry Arboretum Kysihybel (Banská tiavnica), established in 1911–1914 as a collection of exotics potentially significant for forestry. The size of this arboretum is 7.78 ha, it is managed by the Forestry Research Institute, Research Station in Banská tiavnica.
2. The Arboretum Borová Hora of the Technical University, Zvolen, (size 47.84 ha) was established in 1965 for the purposes of gene pool conservation mainly of indigenous tree species native to Slovakia in their diversity. Under the management of the arboretum staff there are numerous provenance tests (in total 8.9 ha) outside the arboretum, e.g. stone pine, maple, and a clonal archive and seed orchard of curly birch etc.
3. The Arboretum Mly any is a park with important collection of evergreen and exotic woody plants. It belongs to the Slovak Academy of Sciences
4. Smaller arboreta and botanical gardens are of local importance, but they contribute to the gene pool conservation of woody plants

Characterization, evaluation, study of intra-specific diversity through provenance and progeny trials and genetic marker studies. National information system on forest genetic resources (list and characteristics of *in situ* and *ex situ* conservation stands, seed lots in long term storage

Individual populations were subject of the numerous provenance experiments. Until now there have been established following provenance experiments in Slovakia:

Norway spruce	11 provenance trials
Silver fir	8 provenance trials
European larch	3 provenance trials
European beech	2 provenance trials
Oaks	4 provenance trials
Maple	1 provenance trial

These provenance trials as well as the results with Slovak provenances in foreign provenance trials allowed a characterization of the genetic variation and identification of valuable ecotypes. They were used for definition of the seed zones, the directions and the limits of seed transfer as well.

Several progeny test were established in Slovakia, e.g. with Norway spruce and silver fir, with the aim to investigate the variation of given populations as well as to conserve their gene pool. Special attention is paid to progeny tests (open-pollinated progenies) of tolerant Norway spruce from air polluted areas of Beskydy and Spis.

Exploration of the genetic resources of tree species using the genetic markers started in Slovakia in early 1980's. Several research organizations are involved in these investigations: Faculty of Forestry of the Technical University in Zvolen, Institute of Dendrobiology in Mly any and later the Institute of Plant Genetics of the Slovak Academy of Sciences, Nitra, and Research Station of the Forestry Research Institute, Banská tiavnica. Following studies, aimed at the investigation of natural populations as well as on processes in breeding populations employing genetic markers were performed:

	Faculty of Forestry	Institute of Plant Genetics	Forestry Research Institute
Monoterpenes	silver fir		
Isozymes	Norway spruce	silver fir	silver fir
	European beech	Scots pine	Scots pine
	European larch	mountain pine	
	Scots pine		
DNA/RFLP		silver fir	

Seed Bank was established in 1987 with the financial aid of the Ministry of Forestry. The aim of the seed bank is to cover the need for seed in the period of low seed crop. It should serve for gene conservation and scientific and tree breeding purposes. The seed bank is in reconstruction at present and its status has been newly formulated in accordance to the law on protected varieties. In the seed bank there are stored 255 samples of five coniferous tree species in total amount of 713.94 kg.

Tree species	Number of units	Amount
Norway spruce	75	363.65 kg
European larch	35	44.25 kg
Mountain pine	14	19.43 kg
Black pine	27	42.21 kg
Scots pine	104	244.40 kg
Total	**255**	**713.94 kg**

Documentation

The central documentation data base on forest gene resources of Slovakia is created at the Research Station of the Forest Research Institute in Liptovsky Hrádok. The component of this data base are the information on approved stands, gene reserves, plus trees, seed stands. Recently, the Central Register of Forest Genetic Resources was transformed into information system with a set of compatible computer data bases. This information data base is a part of Forestry Oriented System and is at present in the stage of its forming. It is expected that parts of this information system will be linked between forest offices and the central database in Liptovsky Hrádok.

Evaluation and Characterization

In the forestry practice of Slovakia there are few examples of the utilization of the varieties being a product of breeding programs. The only exception constitute the poplars.

There is, however, a need to deal with the problem of evaluation and characterization of bred material (e.g. hybrids of firs, clonally propagated reproductive material, etc.).

CHAPTER 4 IN-COUNTRY USES OF PLANT GENETIC RESOURCES

The national system of the genetic resources utilization is based on the valid regulations on the approval of the forest stands for seed procurement and transfer. The last version of this document has been valid since 1985 (for beech and oak since 1988) and all users of the forest reproductive material are obliged to follow this law regulation.

This legal regulation, practically seen, is an application of mass selection principles in forestry practice. Two categories of approved stands are defined in this regulation: A and B category. A-category represents protected forest stands of high phenotypic quality (they can only be reproduced by natural regeneration and the rotation period will be automatically prolonged by 20 - 40 years) and the B-category is a forest stand of high phenotypic quality (they may be reproduced also by artificial regeneration from the same material).

All organizations (forest owners) are obliged to follow the rules on the approval of forest stands for seed procurement as well as to procure the seed only from the approved stands. All reproductive material (seed and plants) has to be labeled with a 10-digit code (showing the origin - tree species, seed zone, altitude, type of the approved stand, region etc.), so the transfer of the reproductive material can be followed.

At present, there exist a monopoly with seed processing and trade in Slovakia. The Seed Extractory Plant in Liptovsky Hrádok is at present the only organization which process the cones of conifers and has facilities for medium- and long-term seed storage. It is the only organization which is responsible for seed trade.

In the central storage of the Semenoles .p., Liptovsky Hrádok there are commercially stored for trade purposes the following amounts of seed from approved stands:

Tree species	Number of units	Amount
Norway spruce	332 units	8,996.65 kg
European larch	223 units	5,090.60 kg
Mountain pine	28 units	88.85 kg
Black pine	74 units	752.16 kg
Scots pine	318 units	3,731.55 kg
Total	**975 units**	**18,659.81 kg**

There is no obligation to procure the seed of those tree species which are not implicitly given by the law regulation in approved stands, although for many of them there are also approved stands (see Table 1). Seed transfer for these tree species is usually carried out within the climatic zone.

The same seed zones are applied for the utilization of seed reproductive material originating not from the native stands but from the seed orchards. According to the same rules, reproductive material originating from the seed orchards is classified into seed zones according to the origin of plus trees which were used for the establishment of seed orchards. (In case, plus trees

from two or more seed zones were used to establish the seed orchard, the seed originating from such a seed orchard is classified to seed zones from which the most plus trees originated).

The best controlled utilization of gene resources in the forestry practice is in conifers where the centralized seed procurement, processing and trade is guaranteed. The worse situation is in tree species of minor importance where there are no rules of seed transfer as well as no specific gene conservation programs.

The export and import of forestry reproductive material (seed, plants) is licensed and it is under the control of the Ministry of Agriculture, and the Forestry Research Institute gives recommendations regarding the species origin etc.

CHAPTER 5 NATIONAL GOALS, POLICIES, PROGRAMMES AND LEGISLATION

Activities concerning the forest genetic resources are organized mainly within the research grants granted for the Forestry Research Institute from the Ministry of Agriculture. The Forestry Research Institute deals mainly with the commercial tree species for which the gene conservation measures (approved stands, gene reserves, plus trees etc.) are carried out, as well as it controls (Seed Control Authority) the trade with seed and reproductive material in Slovakia.

The minor species are subject of gene conservation by other institutions, e.g. Arboretum Borová Hora in Zvolen (curly birch, maple, wild cherry etc.) or University of Agriculture in Nitra.

The staff of the Faculty of Forestry, Technical University in Zvolen is dealing with the theoretical issues of gene conservation, population and evolutionary genetics, as well as with the characterization of genetic resources using the gene markers (isozyme studies on populations of European beech, Norway spruce, Scots pine). Partial results in this respect were obtained by the co-workers of the Institute of Plant Genetics of the Slovak Academy of Sciences in Nitra.

A national program on forest genetic resources was elaborated and it is followed-up, but there still exist discrepancies in financing of individual institutions (research institutes, universities and Slovak Academy of Sciences).

Convention on Biological Diversity was ratified by the Parliament of Slovakia in 1994. At present a commission for elaborating the implementation of Convention issues for Slovakia is formed.

Training

Forestry specialists (undergraduate and postgraduate) are educated at the Faculty of Forestry, Technical University in Zvolen. Within the postgraduate studies a specialization Forest phytology (including genetics and breeding) is opened. At present 5 Ph.D. students are dealing directly or indirectly with the issues of gene conservation.

The active international exchange of education and research experience in the field of genetics and breeding exists.

National Legislation

The forest gene conservation issues are a part of the legal regulations issued by the Ministry of Forestry (1985) on the approval of stands for seed procurement, further regulation on gene reserves (bases) (1991) and will be a part of the law on varieties.

The exchange of forest genetic resources for scientific and breeding purposes is allowed following the valid phytosanitary regulations.

CHAPTER 6 INTERNATIONAL COLLABORATION

There have not been numerous contacts between the Slovakia or former Czecho-Slovakia in the field of the gene resources conservation with West European countries. The former COMECON countries had in the past a board of forestry cooperation including tree breeding and gene conservation. This has also not helped significantly to the creation of compatible rules and legislation. The results of this situation is the fact that the legislation in Slovakia is not fully compatible with the rules applied in the EC countries. The new legislation on the approval of the reproduction which is in preparation will be compatible with the OECD terminology and legislation.

More lively contacts to the West European countries were established after 1989 when the previous isolation of the Central and East European countries was removed. Slovakia has been one of the signatory countries of both ministerial conferences on the forest conservation which were held in Strasbourg (1990) and Helsinki (1993). Two of the resolutions are aimed at the gene and biodiversity conservation.

Slovakia is also a member of the EUFORGEN Programme aimed at the implementation of the S2 resolution of the Strasbourg ministerial conference dealing with gene conservation and is actively participating in the Working party on Norway spruce gene conservation. There exists intention to participate also in working party especially aimed at the conservation of genetic resources of noble hardwoods and black poplars.

Numerous bilateral activities were aimed at the exchange of the experimental material and at the establishment of the provenance experiments and progeny tests (silver fir – Germany, Slovenia, Norway spruce – Germany, European beech – Germany etc.) Some of these international activities led to the establishment of the broader international provenance experiments (beech, silver fir and Norway spruce). There were also numerous direct or indirect bilateral activities aimed at the gene conservation of rare species e.g. English yew, noble hardwoods, wild fruit-trees etc. (cooperation between the Technical University in Zvolen and the Lower Saxonian Forestry Research Institute in Staufenberg, Germany).

The publication of the international journal Forest Genetics (which also covers gene conservation) improves significantly the exchange of information and active international collaboration.

CHAPTER 7 NATIONAL NEEDS AND OPPORTUNITIES

There are several needs and opportunities on national level:

- To continue in the establishment of the gene reserves on the territory of Slovakia to cover all species and seed zones.
- To optimize the financial resources allocation for research and conservation of genetic resources among individual organizations (research institute, university, Slovak Academy of Sciences).
- To utilize the genetic markers for identification of genetics resources (populations, seed orchards etc.) more efficiently.

- To update the law regulations on approval of forest stands and gene conservation regarding the new ownership circumstances.
- To finish the reconstruction of the forest seed bank in Liptovsky Hrádok and make a new proposal of selection of stored seed samples.
- To incorporate the gene conservation and biodiversity issues into the national program on sustainable forestry.

CHAPTER 8 PROPOSALS FOR A GLOBAL PLAN OF ACTION

A topical issue on the national level is the ownership problem within the forestry sector. During the previous regime, the state ownership of forest land was most common. The application of the legislative was rather simple and well controlled. Due to the changes of the ownership of the forest land the gene conservation became more complicated and due to the ownership changes some of the most valuable genetic resources are endangered. As a consequence of the ownership changes the trade with seed and reproductive material is also endangered. Although this item could be solved on the national level, its international significance should not be ignored and must also be solved on the international level.

The proposals for Global Plan of Actions could be summarized as follows:

- to make necessary political decisions aimed at the conservation of genetic resources regardless the ownership (in case of need by financial subsidies);
- to continue the EUFORGEN program of the IPGRI for chosen tree species (Norway spruce, cork oak, black poplar and noble hardwoods) and to make necessary steps for including further tree species (or groups of species), e.g. silver fir, rare species;
- to make necessary decisions to support (organizationally, technically, financially and personally) the forest gene conservation.

Table 1: Survey of approved stands, plus tees, seed orchards and seed stands of principal tree species in Slovakia (by December 31, 1994)

Tree species	Approved stands		Plus trees	Seed orchards	Seed stands
	A	B			
Scots pine	635	2,858	982	66.69	64.0
Silver fir	734	3,521	160	–	81.0
Norway spruce	6,075	16,329	345	5.00	224.0
European larch	304	618	898	104.92	41.0
Black pine	–	170	98	11.91	–
Mountain pine	–	1	–	–	–
Stone pine	–	4	80	6.30	–
Conifers	7,748	23,501	2,563	194.82	410.0

Tree species	Approved stands		Plus trees	Seed orchards	Seed stands
	A	B			
European beech	2,871	15,699	38	–	145.5
Oaks	690	4,598	262	7.0	110.0
Ash	28	77	92	–	–
Elms	24	–	5	–	–
Maple	33	77	3	–	–
Alder	41	3	134	1.0	–
Poplars	–	10	196	–	–
Willows	–	–	36	–	–
Black locust	–	18	42	–	–
Linden	1	20	80	1.0	–
Birch	–	–	–	1.0	–
Broadleaves	3,688	20,502	888	10.0	255.5
Total	**11,436**	**44,003**	**3,451**	**204.82**	**635.5**

List of Forestry Organizations Involved in Forest Genetic Resources Conservation

Organization	Conservation activity
Lesnícky vyskumny ústav Forestry Research Institute] T.G. Masaryka 20 SK-96092 Zvolen Slovakia	research programs in forest genetic conservation
Lesnícky vyskumny ústav of exotic tree species [Forestry Research Institute] [Research Station] SK-96092 Banská tiavnica Slovakia	Arboretum Kysihybel, gene pool conservation Vyskumná stanica
Lesnícky vyskumny ústav seed control, seed bank [Forestry Research Institute] [Research Station] SK-03301 Liptovsky Hrádok Slovakia	central register of forest genetic resources, Vyskumná stanica
Lesnícka fakulta of forest tree species [Faculty of Forestry] [Technical University] SK-96053 Zvolen Slovakia	research program on population genetics Technická univerzita
Arboretum Borová Hora Technical University SK-96053 Zvolen Slovakia	gene pool conservation of native tree species
Slovenská akadémia vied tree species [Slovak Academy of Sciences] [Institute of Plant Genetics] SK-94901 Nitra Slovakia	research program on population genetics of forest Ústav genetiky rastlín
Arboretum Mly any SK-95152 SlepΦany Slovakia	collection of evergreen and ornamental plants

List of English and Latin Names of Tree Species Mentioned in Text

English names	Latin names
Norway spruce	*Picea abies*
Scots pine	*Pinus sylvestris*
Silver fir	*Abies alba*
European larch	*Larix decidua*
Austrian black pine	*Pinus nigra*
Mountain pine	*Pinus mugo*
Swiss stone pine	*Pinus cembra*
English yew	*Taxus baccata*
European beech	*Fagus sylvatica*
Oaks	*Quercus petraea, Q. robur*
Ash	*Farxinus excelsior*
Elms	*Ulmus carpinifolia, U. minor*
Maple	*Acer platanoides, A. pseudoplatanus*
Alder	*Alnus glutinosa*
Poplar	*Populus* sp.
Willow	*Salix* sp.
Black locust	*Robinia pseudoacacia*
Linden	*Tilia parvifolia*
Birch	*Betula verrucosa*

(List of endangered tree species: see Appendix 1 of the report.)

APPENDIX 1
List of Species

Explanations of abbreviations:

+ - *epecophytes*
x - wild progenitor of cultivated races
E - taxa in danger of extinction
Vm - most vulnerable taxa
V - threatened taxa with decreasing number of localities
R - rare taxa, which they have been always rare or became rare recently
Ed - endemic
I - taxa potentially threatened, with uncertain status
II - data published in Futák 1966
III - data published in Futák et Bertová 1982
IV/1 - data published in Bertová 1984
IV/2 - data published in Bertová 1985
IV/3 - data published in Bertová 1992
IV/4 - data published in Bertová 1988
V/1 - data published in Bertová et Golia ová 1993
V/2 - publication is being prepared for print [Golia ová (ed.)]

Aconitum moldavicum ˅ Ed III
Adonis aestivalis I III
Adonis vernalis ˅ III
Allium cepa +
Allium sativum +
Anethum graveolens + IV/1
Archangelica officinalis I IV/1
Arctostaphylos uva-ursi ˅ III
Armoracia rusticana +
Artemisia pontica ˅
Avena fatua ×
Avena sativa +
Bryonia alba +
Bryonia nigra +
Castanea sativa +
Cerasus avium + IV/3
Cerasus fruticosa + ˅ IV/3
Cerasus mahaleb + IV/3
Cerasus vulgaris + IV/3

Chenopodium ambrosoides [+]
Convallaria majalis [I]
Cyclamen fatrense [V Ed]
Cydonia oblonga [+] IV/4
Daphne cneorum [Vm] IV/4
Dictamnus albus [I] III
Drosera anglica [E R] IV/4
Drosera rotundifolia [Vm] IV/4
Ephedra distachya [E R] II
Epilobium nutans [E R] IV/4
Gratiola officinalis [Vm] V/2
Gypsophilla paniculata [Vm R]
Helleborus purpurascens [Vm R] III
Hippophae rhamnoides [+] IV/4
Hyssopus officinalis [+] V/1
Inula helenium [+]
Juglans nigra [+]
Juglans regia [+]
Lactuca seriola [x]
Lathyrus sativus [+] IV/4
Ledum palustre [E] III
Levisticum officinale [+] IV/1
Linum tenuifolium [x] III
Linum usitatissimum [+] III
Lycopodium annotinum [I] II
Lycopodium clavatum [I] II
Malus domestica [+] IV/3
Marrubium vulgare [V] V/1
Melilotus altissima [Vm] IV/4
Melissa officinalis [+] V/1
Mentha arvensis [x] V/1
Mentha x piperita [+] V/1
Menta spicata [x] V/1
Menyanthes trifoliata [Vm] IV/1
Mespilus germanica [+] IV/3
Morus alba [+]
Morus nigra [+]
Morus x trnaviensis (M. nigra x M. rubra) [+]
Nigela sativa [+] III
Orchis morio [V]
Oxycoccus palustris [E] III
Panicum miliaceum [+]
Papaver somniferum [+]
Phacelia tanacetifolia [+] V/1
Phyllitis scolopendrium [I] II

Pimpinella anisum +IV/1
Pinus mugo lII
Prunus domestica +IV/3
Pisum elatius xIV/4
Pulegium vulgare xV/1
Pyrus communis +IV/3
Raphanus sativum +
Ribes alpinum xIV/2
Ribes aureum xIV/2
Ribes nigrum xIV/2
Ribes petraeum xIV/2
Ribes uva-crispa xIV/2
Robinia pseudoacacia +IV/4
Salvia officinalis +V/1
Saxifraga granulata lIV/2
Scopolia carniolica lV/1
Scorzonera hispanica l
Silybum marianum +
Sinapsis alba +
Sinapsis nigra +
Solanum scabrum +V/1
Sorbus aria lIV/3
Stachys germanica +V/1
Teucrium scorodonia lV/1
Trapa natans vIV/4
Vaccinium uliginosum vIII
Veratrum album v
Vitis silvestris xERIV/1

Abies alba II
Acer campestre IV/1
Acer platanoides IV/1
Acer pseudoplatanum IV/1
Achillea millefolium
Aconitum napellus III
Acorus calamus
Actaea spicata III
Aegopodium podagraria IV/1
Agrimonia eupatioria IV/3
Agropyron repens
Ajuga reptans V/1
Alchemilla xanthochlora IV/3
Alliaria officinalis
Allium ursinum

Althaea officinalis III
Anagallis arvensis
Anchusa officinalis V/1
Anemone nemorosa III
Angelica silvestris IV/1
Anthyllis vulneraria IV/4
Aquilegia vulgaris III
Arctium lapa
Arctium minus
Aristolochia clematitis III
Artemisia absinthium
Artemisia vulgaris
Asarum europaeum III
Asparagus officinalis
Astragalus cicer IV/4
Astrantia major IV/1
Athyrium filix-femina II
Atropa bella-donna V/1
Ballota nigra V/1
Bellis perennis
Berberis vulgaris III
Betonica officinalis V/1
Betula pendula
Brassica nigra
Calystegia sepium IV/4
Calluna vulgaris III
Cannabis sativa
Capsella bursa-pastoris
Carlina acaulis
Carum carvi IV/1
Centaurium umbellatum IV/1
Chelidonium majus
Chenopodium bonus-henricus
Chimaphila umbellata III
Cichorium intybus
Cimicifuga europaea III
Colchicum autumnale
Conium maculatum IV/1
Consolida regalis III
Convolvulus arvensis IV/4
Cornus mas IV/1
Coronilla varia IV/4
Coryllus avelana
Corydalis cava
Crataegus monogyna IV/3

Crataegus oxyacantha IV/3
Cyanus segetum
Cynoglossum officinale V/1
Dalanum spec. div. V/1
Daphne mezereum IV/4
Datura stramonium V/1
Daucus carota IV/1
Delphinium elatum III
Dentaria bulbifera
Dentaria enneaphyllos
Digitalis lanata V/2
Dryopteris filix-mas II
Echium vulgare V/1
Epilobium alpestre IV/4
Epilobium alsinifolium IV/4
Epilobium anagallidifolium IV/4
Epilobium ciliatum IV/4
Epilobium collinum IV/4
Epilobium lamyi IV/4
Epilobium lanceolatum IV/4
Epilobium montanum IV/4
Epilobium obscurum IV/4
Epilobium palustre IV/4
Epilobium parviflorum IV/4
Epilobium roseum IV/4
Epilobium tetragonum IV/4
Equisetum arvense II
Erigeron canadense
Eryngium campestre
Euonymus europaea IV/1
Euonymus verrucosa IV/1
Euphrasia rostkoviana V/2
Fagus sylvatica
Ficaria verna III
Filipendula ulmaria IV/3
Fradaria elatior IV/3
Fragaria moschata IV/3
Fragaria vesca IV/3
Frangula alnus IV/1
Fraxinus excelsior IV/1
Fraxinus ornus IV/1
Fumaria officinalis
Galega officinalis IV/4
Galeopsis spec. div. V/1
Galium odoratum IV/2

Galium verum IV/2
Genista tinctoria IV/4
Geranium robertianum III
Geum urbanum IV/3
Glechoma hederacea V/1
Globularia punctata V/2
Glycyrrhiza glabra IV/4
Hedera helix IV/1
Helichrysum arenarium
Hepatica nobilis III
Herniaria glabra
Herniaria hirsuta
Hesperis nivea
Humulus lupulus
Huperzia selago II
Hyoscyamus niger V/1
Hypericum perforatum III
Impatiens noli-tangere
Imperatoria ostruthium IV/1
Juncus effusus
Juniperus communis II
Juniperus sibirica II
Lactuca virosa
Lamium album V/1
Larix decidua II
Lathyrus tuberosus IV/4
Leonurus cardiaca V/1
Linaria vulgaris V/2
Lycopus europaeus V/1
Lythrum salicaria IV/4
Malus sylvestris IV/3
Malva neglecta III
Malva silvestris III
Matricaria chamomilla
Medicago sativa IV/4
Melilotus alba IV/4
Melilotus dentata IV/4
Melilotus officinalis N/4
Mentha crispa V/1
Meum athamanticum IV/1
Nepeta cataria V/1
Ononis spinosa IV/4
Onopordon acanthium
Origanum vulgare V/1
Oxalis acetosella III

Oxycoccus microcarpus
Padus racemosa IV/3
Papaver rhoeas s. l.
Pastinaca sativa IV/1
Petasites hybridus
Physalis akekengi V/1
Picea abies II
Pimpinella major IV/1
Pimpinella saxifraga IV/1
Pinus cembra II
Pinus silvestris II
Plantago indica V/2
Plantago lanceolata V/2
Plantago psyllium V/2
Polygala amara III
Polygonatum multiflorum
Polygonatum odoratum
Polygonum aviculare
Polygonum bistorta
Polypodium hydropiper II
Polypodium vulgare II
Populus alba
Populus nigra
Potentilla anserina IV/3
Potentilla erecta IV/3
Primula elatior
Primula veris
Prunella grandiflora V/1
Prunella laciniata V/1
Prunella vulgaris V/1
Prunus spinosa IV/3
Pteridium aquilinium II
Pulmonaria officinalis V/1
Pyrus nivalis IV/3
Pyrus pyraster IV/3
Quercus pedunculiflora
Quercus petraea
Quercus robur
Raphanus raphanistrum
Rhamnus cathartica IV/1
Rosa spec. div. IV/3
Rubus caesius
Rubus fruticosus agg.
Rubus idaeus
Rumex acetosa

Salix alba
Salix fragilis
Salvia pratensis V/1
Sambucus ebulus IV/2
Sambucus nigra IV/2
Sambucus racemosa IV/2
Sanguisorba officinalis IV/3
Sanicula europaea IV/1
Saponaria officinalis
Sarothamnus scoparius IV/4
Scrophularia nodosa V/2
Senecio vulgaris
Solanum dulcamara V/1
Solidago virgaurea
Sorbus aucuparia IV/3
Sorbus torminalis IV/3
Stachys annua V/1
Stachys recta V/1
Stachys palustris V/1
Staphylea pinnata IV/1
Symphytum officinale V/1
Tanacetum vulgare
Taraxacum officinale
Taxus baccata II
Teucrium chamaedrys V/1
Thymus spec. div. V/1
Tilia cordata III
Tilia platyphyllos III
Tilia x vulgaris III
Trifolium hybridum IV/4
Trifolium pratense IV/4
Tussilago farfara
Ulmus carpinifolia
Urtica dioica
Urtica urens
Vaccinium gaultherioides III
Vaccinium myrtillus III
Vaccinium vitis-idaea III
Valeriana officinalis IV/2
Valerianella locusta IV/2
Verbascum phlomoides V/2
Verbascum thapsiforme V/2
Verbena officinalis V/1
Veronica beccabunga V/2
Veronica officinalis V/2

Viburnum opulus IV/2
Vicia pisiformis IV/4
Vicia sativa IV/4
Vicia sepium IV/4
Vinca minor IV/1
Vincentoxicum hirundinaria IV/1
Viola arvensis
Viola odorata
Viola tricolor
Viscum album IV/1

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