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IN SITU AND ON-FARM MANAGEMENT OF PLANT GENETIC RESOURCES

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SUMMARY

The history of plant genetic resources conservation in Poland is over 80 years old. During this time the aims and methods of conservation have been changing and developing. Since the Convention on Biological Diversity and its ratification in Poland in 1995, the main emphasis in crop plant biodiversity activities has been moved from protection of some special areas to sustainable use of the whole environment, from protection of wild species inclusively to protection of all species and from *ex situ* to *in situ* protection methods. Thereby the collaboration with freelance farmers and regional environmental organisations becomes of equal significance to the co-operation with national nature protection structures.

Rural areas form a very important part of nature and a landscape that surrounds human being. They are often crucial for protection of biodiversity and for this reason, nature conservation should take place on the agricultural land and farms as well. Rural areas create proper environment for native varieties of crop plants thereby forming the best place for conservation of their diversity and protection from extinction.

That peculiar way of protection of old or neglected plant varieties has been named "on-farm conservation" and has been executed by freelance farmers in co-operation with environmental organizations. Bigger parts of agricultural landscape and natural sites of wild crop relatives can be protected either through the new forms of actions and co-operation with national, already existing, nature protection structures.

Both methods have the same aim – to arouse interest in old landraces, to promote them and to introduce, to the largest possible extent, into cultivation.

The above mentioned goals are executed in numerous environmental and rural development programmes, in which the National Centre for Plant Genetic Resources of Plant Breeding and Acclimatization Institute is co-operating together with many governmental and non-governmental organizations for nature conservation purposes.

INTRODUCTION

The history of plant genetic resources conservation in Poland is over 80 years old. During this time the goals and methods of conservation have been changing and developing. The first efforts have been made to collect local Polish cultivars and ecotypes. Later activities were broadened with collecting their wild and weedy relatives, through collecting missions. Since 1979 the National Centre for Plant Genetic Resources, Radzików, Poland, has carried responsibility for statutory conservation and research tasks that are related to biodiversity and identity of crop plants and their wild and weedy relatives. The most relevant tasks are:

- collection and preservation of a crop plant germplazm, its documentation and analysis,
- maintenance of the gene bank and long-term storage facilities,
- supplying collected material to breeders and researchers,
- co-ordination of the governmental programme aimed at conservation and utilization of crop plant genetic resources.

Numerous collecting and evaluating missions in Poland and adjacent countries gave us the idea about regions especially rich in local landraces and crop plant diversity. In all the visited areas we observed strong genetic erosion, the number of cultivated varieties has decreased by 70% and more (Podyma 1998). That loss of genetic diversity resulted in change of priorities

in nature conservation and was expressed in the Convention on Biological Diversity (1992). The Convention considers biological diversity essential for human existence and well-being and assumes natural habitat as the most proper environment for threatened plant biodiversity conservation and its sustainable use. Nowadays, when the main emphasis in crop plant biodiversity protection has been moved from *ex situ* to *in situ* methods, collaboration with freelance farmers and regional environmental organizations becomes of greater significance. For that reason the new task has been included in the NCPGR statutory activities:

- integration of *ex situ* and *in situ* conservation approaches through participation (together with numerous non-governmental organizations [NGOs]) in on-farm conservation programmes.

The Agri-environmental Programmes or local ecological initiatives are the response to the growing need for balanced, sustainable use and protection of national and global nature diversity.

NATIONAL STRATEGY FOR CROP PLANT GENETIC RESOURCES CONSERVATION AND UTILIZATION

The **National Plant Genetic Resources Conservation Programme** in Poland was established in 1979. Its main goal is to preserve genetic material of major crop plants and their wild and weedy relatives for breeding and research. The Programme, financed by the Ministry of Agriculture, is based on multi-institutional input and co-operation of three universities, eight branch institutes, seven breeding stations, and the Botanical Garden of the Polish Academy of Sciences. The collaborating institutions carry the responsibility for evaluation, regeneration and multiplication of crop collections and undertake relevant research projects connected with the Programme goals (Bulińska et al. 1990).

The **National Centre for Plant Genetic Resources** (NCPGR) of Plant Breeding and Acclimatization Institute (PBAI) in Radzików serves as a national co-ordinator of collaborative activities and as a national genetic resources representative. Its main objectives are expressed in the title of the programme which states "Collection, characterization, evaluation and preservation of crop plant germplasm for plant breeding and genetic research." This means statutory conservation and research tasks that are related to biodiversity and identity of crop plants and their wild and weedy relatives.

As the coordinator, the NCPGR has the following responsibilities:

- to identify and include into the programme crop plants for which genetic resources have to be collected and preserved. This is done according to the two criteria: importance for the Polish economy and the danger of germplasm extinction,
- to identify and include into the programme institutions with technical capacity and crucial expertise for managing appropriate collections,
- to identify needs for research projects relevant to major issues of the programme and to employ appropriate institutions to carry out such research projects.

The other important role is to act as a centre providing the following services and facilities:

- germplasm introduction service,
- central documentation facilities and service,
- controlled storage facilities and service,
- training to provide updates on genetic resources problems.

The core activity of the gene bank is the long-term storage service and all research related to this issue. The germplasm is collected in the form of seeds (79%), tissue cultures (2% – mainly potato varieties) or living plant collections (19% – mainly fruit plants and to some extent hop, garlic or asparagus plantations). Altogether there are over 70,000 accessions of 57 genera collected under the auspices of the national genetic preservation programme (Podyma 1998). Every year about 600 new accessions are collected. The structure of Polish collection meets the needs of private breeders as well as crop-related breeding and scientific centres. The broad range of plant seeds (cereals, forages, root and tuber crops, horticulture, vegetable, industrial, medicinal and herbal plants) serve as an initial material for new varieties. NCPGR conducts molecular analysis concerning the collected germplasm, in order to determine diversity and affinity between the populations.

The third role performed by the National Centre for Plant Genetic Resources in Radzików involves representation of Polish genetic resources interests in organizations, networks and undertakings abroad such as the Gene Bank Technical Advisory Committee for Eastern European Countries, European Cooperative Programme for the Conservation and Exchange of Crop Genetic Resources (ECP/GR) and the EUCARPIA Gene Bank Committee.

IN SITU CONSERVATION ASSUMPTIONS AND ORIGIN

Contemporary modern breeding being induced by economic considerations and pressure, is oriented mainly towards an overproduction and a high profit and this leads to a dramatic biodiversity reduction of domesticated animals and cultivated plants.

The most promising or rich in species areas in Europe have been already identified and evaluated, and without doubt, genetic erosion of crop plants, which has been observed in Poland and all over the world during the last few decades, still continues. We observed an extinction of old varieties that are replaced by the new, modern ones. Threatened plants can be collected from farms or wild (natural) sites of occurrence and conserved as collections of seeds, tissue cultures or living plants in *ex situ* collections. But even with very sophisticated methods of storage, samples get old and lose their vigour, and the main goal still remains to keep the biodiversity as broad as possible in nature. Crops should grow where they belong, where they evolved and are most useful – on agricultural land. Natural habitat and in the case of crop plants – traditional breeding and selection – seem to be the most proper environment for germplazm conservation. Only sustainable and effective use of crops can guarantee their survival. That is why the increasing emphasis is put on *in situ* and on-farm protection actions.

The activities for *in situ* preservation of genetic resources fulfil the following goals:

- biodiversity conservation in rural ecosystems,
- *in situ* preservation of wild crop relatives,
- maintenance of traditional activities of local rural communities, reflecting traditional attitudes towards biodiversity,
- restitution and renovation of devastated ecosystems, natural habitats and species in their natural sites of occurrence.

There are some specific economic-geographical conditions that support preservation of crop plant genetic resources in their habitat.

- Fragmentation of land holdings allows farmers to manage several fields and this favours keeping several local landraces.
- Marginal agronomic conditions, especially steep slopes and heterogeneous soils of mountain agriculture, make local landraces competitive with improved cultivars, at least in part of the farming system.
- Economic isolation creates imperfection of the market and thereby decreases the competitive advantages of improved cultivars.
- Strong attachment to traditional farming and type of cultivars causes conservation of local landraces.

The afore-mentioned conditions often appear together in marginal, poor agricultural zones, e.g. in mountainous areas. These kinds of external conditions together with an internal need of possession or usage of old landraces, e.g. for decorative reasons, home use or for the final product commercialisation, support the formation of local refugial areas rich in diversity. In such areas *in situ* protection activities are undertaken and have the biggest chance to succeed.

But, at the same time, in marginal, poor rural communities a few constraints to the landraces conservation and use can occur, and these are: farmers' age, unawareness of landrace importance, lack of incentives for farmers to keep the old varieties or finally, forced legislation.

Therefore, to conserve the genetic diversity within the rural ecosystems, all possible options and methods available should be considered and implemented. Through a better understanding of the role of farmers and their families as the producers of garden and orchard products, it will be possible to improve the management of genetic diversity around farm houses, resulting in a better and more sustainable production combined with the maintenance of a high level of genetic diversity. Targeted and well planned 'interventions' from the outside, e.g. the introduction of new crops, improved varieties or of specific characteristics that are missing in a given farm can further strengthen the importance of this production system and allow a nat-

ural link between conservation and development (IPGRI 2002).

In many countries farmers constantly use diversity to improve their existing varieties, consciously bringing in new material or simply by selecting from their harvests. Gene banks and researchers work with them, helping, encouraging, providing with new, interesting materials. A new approach is participatory plant breeding, in which farmers, breeders and other experts work together to develop the kinds of variety that directly meets farmers' needs, often with an additional genetic diversity 'injection' from gene banks. That means organizing many training courses and meetings, asking what is most wanted and next, promoting chosen genotypes and landraces, taken from available pool of accessions (IPGRI 2004). The other incentive for old or improved varieties usage in farming could be the law regulations, as it takes place in Switzerland (PGR Forum 2003).

Thanks to the extensive farming and use of local seeds it would be possible to conserve the local weeds communities. Herbich (1986) claims that establishing of natural weeds reserves is absolutely necessary to protect endangered weeds diversity and their habitats.

IN SITU PROTECTION IN EUROPE

The *in situ* protection actions in Europe are conducted or supported by some international ecological organizations. Through thematic networks, 'ad hoc' formed workgroups or financing of local eco-initiatives they can guide and integrate efforts on plant genetic resources conservation.

PGR Forum, a Thematic Network funded under the European Community Framework 5 Programme for Research, provides a unique opportunity to enhance dialogue between national and regional crop wild relative conservationists, policy makers and users, and to promote discourse with the broader international stakeholder communities.

Monitoring Institute for Rare Breeds and Seeds in Europe together with SAVE, a European umbrella organization for the promotion and co-ordination of activities for the conservation of endangered breeds of domestic animals and plant varieties in the form of live populations, take care of coordination and integration of conservation activities in the Carpathian region.

The Global Environment Facility (GEF) and its Small Grant Programme – is a very special assistance program that in a simple, uncomplicated way supports local organizations and societies in implementation of environment-friendly solutions and technologies. GEF/SGP aims to promote the cheaper resolutions connected with the use of the local workforce but its sustainability and environmental friendliness is always a crucial point.

IN SITU PROTECTION IN POLAND

As it was mentioned before, biodiversity protection in Poland has very strong foundations in collaboration inside the National Plant Genetic Resources Conservation Programme, with input of national nature protection structures (which possess proper infrastructure and experience) and ecological organizations (which have better access to the local communities). The Conservation Programme has a very promising experience in on-farm conservation of old fruit trees, in co-operation with non-governmental organizations and landscape parks. Wide-spread efforts to conserve old fruit trees and establish new orchards are taken throughout Poland in close cooperation with Vistulan and Brodnicki Landscape Parks and with a big contribution from Orcharding Institute in Skierniewice and Botanical Garden of PAS in Powsin. These activities are supported by series of educational and practical workshops, organized in the operation area.

The first *in situ* conservation project of old fruit trees landraces in Poland has taken place on the Vistulan Landscape Park, where very old orcharding traditions, big variability and traditional fruit processing methods survived.

Nowadays many non-governmental ecological organizations carry out on-farm protection projects. They are working to protect and increase the biodiversity in agricultural land, through introduction of old breeds and crop plant varieties, helping to develop eco-tourism or local fruit processing sustainable activities. The location of the most relevant NGOs projects is shown in Fig. 1.

More complicated is on-farm conservation of the less spectacular species, but for them there is

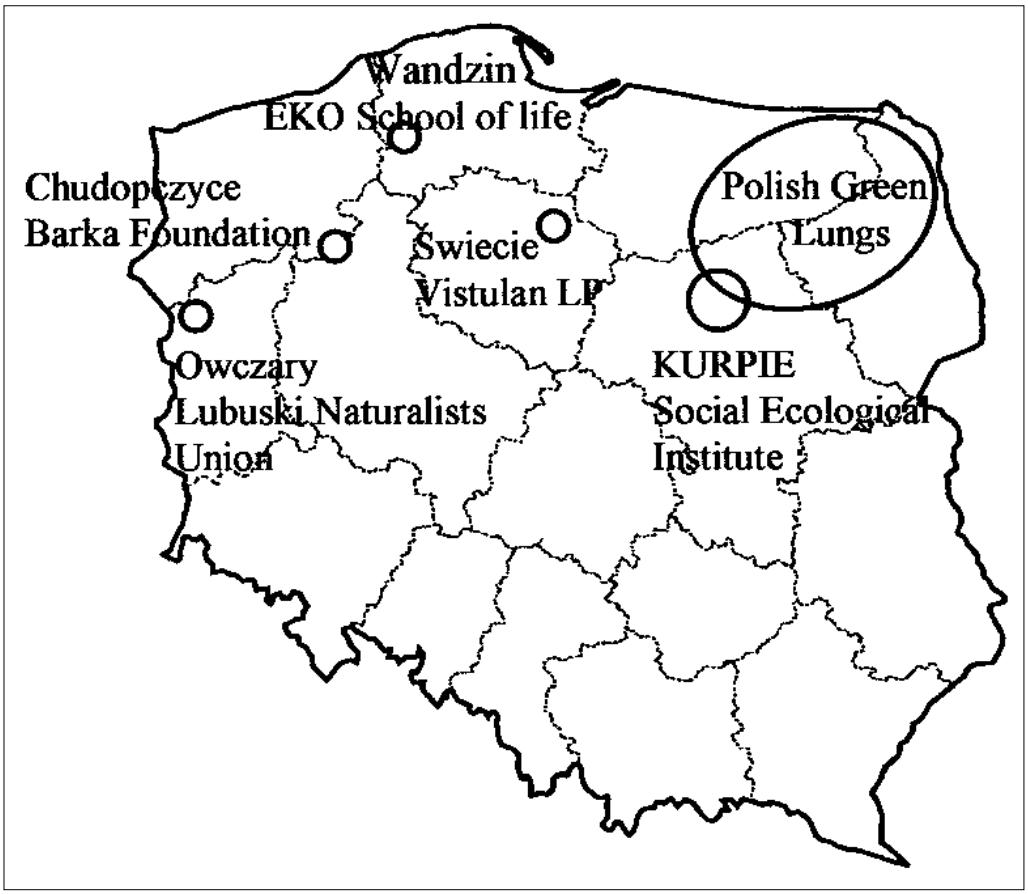

Fig. 1. Projects of plant *in situ* protection in Poland.
EKO "School of life", Wandzin – conservation of old varieties of fruit trees; **Barka Foundation**, Chudopczyce – conservation of old varieties of fruit trees; *Vistulan Landscape Parks*, Świecie – conservation of old varieties of truit trees; **Social Ekological Institute**, Kurpian model of biodiversity in agriculture; **Lubuski Naturalists Union**, Owczary – conservation of weeds communities; **Polish Green Lungs**, north-east Poland – biodiversity in agriculture.

also a growing chance in eco-farming or regions with cultivated local traditions. A good example is false flax (*Camelina sativa*), widely spread in the past and at present almost forgotten species of oil plant. Oil pressed from its seeds is characterised by high quality of taste and nice smell and is used as a component for traditional dishes served during Christmas by local farmers. Additionally, the plant stems are used for broom making. Thanks to constant traditional use some populations of false flax have been maintained in Pińczów and Lower Narew River regions (Nowosielska, Podyma 2000). Formal steps should be taken quickly to secure its survival.

Lately, many national structures in Poland contribute to the activities connected with crop plant protection on rural areas. One global action is undertaken by Polish government, under the auspices of EU, in order to improve economic and ecological conditions in the rural areas.

AGRI-ENVIRONMENTAL PROGRAMMES IN POLAND

Rural development programmes in Poland are based on two legal issues: *Council Regulation (EC) 1257/1999* regarding the assistance for rural development by EAGGF

and *Council Regulation (EC) 1750/1999* – including detailed rules of implementation 1257/1999. Thanks to implementation of the abovementioned legislation, since May 1 2004 Poland has got a system of subsidy of environmental protection in rural areas in the form of agri-environmental programmes.

Pilot Agri-Environmental Programmes are focused on two main aims, which are:
1) biodiversity protection in rural areas and
2) agricultural environment and landscape feature protection.

These extensive protection goals are supposed to be achieved through fulfilling specific steps on the way towards efficient, sustainable and environmentally friendly use of agricultural land. These are:

- Code of Good Agricultural Practice – which means development and implementation of environmentally friendly methods of agricultural production,
- Preservation of farmland with unique natural values (priority habitats), traditional crops and local breeds – it means collaboration between national or landscape parks,
- Maintenance of cultural heritage of rural areas – aided and promoted by local and national actions,
- Development of high quality agricultural production – conducted jointly by scientific, national and NGOs structures, with strong contribution of rural development advisory structures,
- Increase of ecological awareness of rural communities – realized through series of eco-educational workshops and financial incentives included into agri-environmental programme options.

The activities undertaken include subsidies for:

- organic farming and some aspects of extensive farming
- protection of genetic resources by maintenance of local breed
- development of advisory system concerning fertilizers, fertilization and pesticides.

CONCLUSION

A new philosophy tends to replace the traditional understanding of nature conservation. Simultaneous with *ex situ* protection programmes, concept and methodology of *in situ* protection have been developed. Our and other conservationists' experience suggests that gene banks should use every opportunity to join new environmental programmes. That means *ex situ* conservation in gene banks should support and improve complex environmental protection actions. An important and durable effect on the conservation of landraces and wild relatives of crops can be achieved only by combining *in situ* conservation with their sustainable, traditional use.

Agri-environmental and nature protection programmes or initiatives can get a new dimension, serving to create a national and European net of protected areas, crucial for diversity conservation all over Europe.

For that reason the European Strategy for Biodiversity Protection NATURA 2000 has been established.

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