SECTION B. LANDRACES

B.1. Introduction

What is a 'landrace'?

Is definition of landraces possible?

There has been extensive discussion on what constitutes a landrace (LR), and even whether it is possible to define them[113], however although it may be difficult to precisely define LR, practically they are widely recognised by farmers and scientists alike and are key components of PGRFA. As such they exist and if we wish to study them practically we need a working definition, two such definitions are:

"Dynamic population(s) of a cultivated plant that has historical origin, distinct identity and lacks formal crop improvement, as well as often being genetically diverse, locally adapted and associated with traditional farming systems". [114]

"A landrace of a seed-propagated crop can be defined as a variable population, which is identifiable and usually has a local name. It lacks "formal" crop improvement, is characterized by a specific adaptation to the environmental conditions of the area of cultivation (tolerant to the biotic and abiotic stresses of that area) and is closely associated with the traditional uses, knowledge, habits, dialects, and celebrations of the people who developed and continue to grow it". [115]

Within LR two types are distinguished[116]:

- ***Primary landrace***: a crop that has developed its unique characteristics through repeated *in situ* grower selection and that has never been subjected to formal plant breeding (as opposed to selection / breeding undertaken by independent LR maintainers). These can be divided into ***autochthonous*** (a crop that is grown in the original location where it developed its unique characteristics through grower selection; its genetic and socio-economic characteristics are associated specifically with this location) and ***allochthonous*** (an introduced

[113] Zeven (1998)
[114] Camacho Villa *et al.* (2005)
[115] Negri (2007) who took into account the discussions presented by Anderson and Cutler (1942), Harlan (1975), Brush (1992, 1995), Papa (1996, 1999), Zeven (1998), Asfaw (2000), Friis-Hansen and Sthapit (2000), Negri (2003, 2005a), Camacho Villa *et al.* (2005), Saxena and Singh (2006).
[116] Kell *et al.* (2009)

crop that is locally adapted but that has developed its unique characteristics through grower selection in another region)[117].

- ***Secondary landrace***: a crop that has been developed in the formal plant breeding sector but which is now maintained through repeated *in situ* grower selection and seed saving, which is likely to be genetically distinct from the original bred material.

Some authors question whether locally adapted '*allochthonous landraces*' fit within the above definitions of LR because they lack a historical origin among farmers. However, these LR do have local economic importance, are likely to contribute increase crop diversity availability to farmers and breeders, and many were introduced a significant time ago so that they have passed through numerous sowing, cultivation, harvesting cycles since introduction so may not be regarded as distinct from the original introduction.

Example of a primary allochthonous landrace: *Phaseolus coccineus* from Romenia. The species originates from America and it was introduced to Romenia probably between the 16th and the 17th, this landrace is well adapted to the locations where it is grown (photo: Tsvetelina Stoilova)

[117] Zeven (1998) after Mayr (1937)

Example of a secondary landrace of *Zea mays* L. in the Chiapas region, Mexico (photo: Carolina Camacho).

Box 62. Farmers, growers, gardeners or maintainers

The literature on LR and on-farm conservation almost always assumes that the person planting, cultivating and harvesting LR are farmers, but a farmer may be defined as "a person cultivates a tract of land cultivated for the purpose of agricultural production" and this would exclude cultivation associated with home-consumption. As such there is a distinction between farmers and gardeners growing crops for sale and home-consumption on the basis of scale of production, cultivation techniques used, crops grown, economic valuation, marketing and end-consumer. So farmers and gardeners (and growers) are not synonyms, they each maintain distinct LR diversity that should form part of the national LR checklist / inventory; it would be more accurate to refer to them as maintainers. But given the wide use of farmers in the literature, the term farmer is here used to include, unless otherwise stated, anyone cultivating LR diversity.

Genetic erosion is the main threat to landraces. What is genetic erosion?[118]

Genetic erosion is the main threat to LR and has been referred to in the literature as:

- the loss of a crop, variety or allele diversity[119,120,121,122];
- the reduction in richness (in the total number of crops, varieties or alleles)[123,124,125,126];

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[118] See Maxted and Guarino (2006) and Van de Wouw *et al.* (2009) for reviews on the concept of genetic erosion in crops.

[119] Peroni and Hanazaki (2002)
[120] Gao (2003)
[121] Tsegaye and Berg (2007)
[122] Willemen *et al.* (2007)
[123] Hammer *et al.* (1996)

- the reduction in evenness (i.e. of genetic diversity)[127,128].

Why are landraces threatened?

There are numerous factors that negatively impact plant species and their populations which will result in taxonomic (species, subspecies, and varietal) and genetic diversity erosion, and eventually extinction.

The main factors that contribute to the genetic erosion of LR diversity include:

- changes in agricultural practices and land use;
- use of pesticides and herbicides;
- replacement of traditional varieties with modern, uniform cultivars which lead to a genetic bottleneck; once LR have been replaced by modern cultivars, unless the LR is conserved *ex situ*, the unique combination of genetic diversity is unavailable to breeders; as a consequence, the total number of different varieties grown is reduced and/or cultivars grown by farmers become increasingly similar to each other;
- type of variety and seed certification system associated with the enforcement of plant breeders' rights, which limits the sale of crop seed unless the variety is included in the national or regional varietal list; LR growers do not usually register their varieties since this process is relatively expensive and generally returns limited value to individual farmers; therefore, as it is illegal to grow non-registered varieties in many countries, farmers are inadvertently encouraged to switch to registered varieties and their LR material is lost;
- simplification of silvi-agriculture productive processes due to high manpower costs;
- subsidy schemes that promote the use of uniform varieties;
- perverse incentives given by, for instance, government agricultural advisory services, such as the free distribution of modern cultivars;
- constant decrease of rural populations due to migration and emigration;
- research programmes that ignore LR and their associated knowledge and uses;
- ageing of farmers and the unsuccessful passage of LR and associated knowledge from one generation to the next;
- lack of education of the unique value of LR as a local, national and global resource;
- changes in consumption habits;
- food standards that limit entry of LR and products into markets;

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[124] Hammer and Laghetti (2005)
[125] Ford-Lloyd (2006)
[126] Nabhan (2007)
[127] Khlestkina *et al.* (2004)
[128] Ford-Lloyd (2006)

- political system such as in the ex-Soviet Union where agriculture was structured into a system of state (*sovkhozes*) and very large collective farms (*kolkhozes*) with centralized planning (what to cultivate and where) and relatively high mechanization, which have favoured the cultivation of introduced varieties rather than of local LR;
- war and political instability, as in Cambodia where nearly all traditional varieties were lost during civil unrest, though subsequently some Cambodian LR were repatriated from the International Rice Research Institute collection[129];
- climate change – changes in climate are expected to directly affect the cropping patterns and result in extinction of traditional varieties, particularly in drier regions where certain LR are already marginally being grown near their limits of minimum rainfall requirement.

Many of these threats are associated with external changes in fragile traditional agro-ecosystem, the introduction of various alien factors stressing the agro-ecosystem dynamic and results in change from traditional LR to modern cultivars. Like oceanic island vulnerable to alien species introduction, traditional agro-ecosystem have 'evolved' in isolation and demonstrate 'evolutionary innocence' often being out-competed by the more aggressive introductions, ultimately resulting in the loss of native diversity.

Traditional farmers in West Tatry (Zuberec, Slovakia) (photo: Pavol Hauptvogel).

[129] Hawkes *et al.* (2000)

Aerial view of cultivated land, Tatarstan Republic 2012 (Photo: ©FAO/Vasily Maksimov)

What are the practical consequences of LR genetic erosion?

- A decrease in genetic diversity availability means genes and alleles will not be available for breeders to develop improved varieties and meet:
  - changing consumer demands;
  - changing environmental conditions;
  - exploit new markets or environments;
  - provide food security
- Cultivars grown by farmers become increasingly genetically homogenous.
- Agro-ecosystem functioning and its provision of services (e.g., pest and disease control, pollination, soil processes, biomass cover, carbon sequestration, prevention of soil erosion, etc.), as well as potential innovation in sustainable agriculture are each likely to be seriously impacted.

What is landrace on-farm conservation?

Landrace on-farm conservation is the active management of LR diversity within the traditional agricultural systems where they have developed their unique characteristics. It implies that conservationists work closely together with farmers in order to manage and monitor their LR populations aiming at the long-term preservation of the dynamic of the agricultural systems while maintaining genetic richness and evenness of the included diversity.

Why do landraces need a National management plan?

Landraces are unique resources for food security but are becoming more threatened and suffering from genetic erosion. The systematic, coordinated and integrated *in situ* and *ex situ* conservation of LR diversity is thus fundamental and best implemented via a national management plan.

What are the general goals of a National management plan?

A *National management plan for LR conservation* aims at the long-term active conservation of the country's LR diversity, while at the same time promoting its use.

LR Diversity from a home garden in Griblje, Bela Krajina, Slovenia (photo: Pavol Hauptvogel).

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B.1.2. Additional materials and resources

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	Diverseeds Documentary Film. Plant Genetic Resources for Food and Agriculture: http://www.diverseeds.eu/index.php?page=video (shows the importance of agricultural biodiversity for food and agriculture, with astonishing pictures from Europe and Asia)
WWW	Agricultural Biodiversity Weblog: http://agro.biodiver.se/