

MANAGING PLANT GENETIC DIVERSITY FOR OPTIMAL PRODUCTIVITY IN DIVERSE AGRICULTURAL LANDSCAPES

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As human needs are modulated by cultural, social and economic factors, so is the biodiversity in both natural and agricultural ecosystems. There is ample evidence that the conversion of natural ecosystems to human-managed agroecosystems has destroyed or degraded natural habitats of plants and animals, and adversely affected biodiversity. Although agriculture has led to a diverse array of agroecosystems around the world, it has also led to the aggressive expansion of a few crop species. Despite the fact that crop yield, rather than conservation, was the main priority of farmers through the history of agriculture, there remained abundant genetic diversity in agricultural plants and animals. The situation changed rapidly with the introduction of modern plant breeding at the beginning of the last century. We witnessed massive loss of genetic and species diversity in modern agroecosystems.

The predominant factors contributing to the accelerated genetic erosion are the never-ending emphasis on higher yield, better quality and greater genetic uniformity. Human societies have become increasingly dependent on the high productivity of a few selected species, and thus become vulnerable to ecological and genetic instability. For this reason, sustainable management of genetic diversity in the agricultural landscape has become a conservation imperative. Here we describe a simple and inexpensive scheme for sustainable management of genetic diversity in annual crop species.

Select a genetically diverse set of *ex situ* preserved crop genetic resources (CGR) of a target species with widest possible genetic diversity. In the absence of genetic information on CGR, choose accessions from a wide range of agroecological conditions. Synthesize a genetically heterogeneous population of the selected CGR and maintain parts of this population (subpopulations) in farmlands representing diverse agroecosystems with distinctive physical and ecological characteristics. Allow adaptive genetic changes to occur within and between these subpopulations. Genetic diversity will increase as the spatial genetic differentiation between subpopulations increase.

Evidence from genetic surveys of plant populations indicates that populations maintained in contrasting agroecological conditions develop distinctive multi-character associations due to adaptive multigenic organization. This is a powerful evolutionary process capable of enhancing genetic differentiation between subpopulations and increasing spatial genetic diversity. Natural selection may be complemented by conscious selection of crop genotypes for specific niches, as has been practiced by peasant farmers in traditional

agroecosystems through millennia. These then would be the modern equivalent of landraces that thrive in traditional agroecosystems and serve as rich reservoirs of genetic diversity. This dynamic conservation scheme can be modified to conserve perennial species, as well as a multitude of agricultural species to meet diverse human needs.

In recent years, participatory plant breeding or involving producers in breeding and selection of crop varieties for specific farming conditions has been emphasized. Focusing on niche-specific adaptation these practices would rapidly increase biodiversity in agroecosystems, as has been found in participatory rice improvement in Nepal (Sthapit et al. 1996 and later).