



GENETIC DIVERSITY IN AGRICULTURE

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EXECUTIVE SUMMARY

- The world's plant genetic resources hold great value for world food security, but they are under considerable threat. Crop improvement depends on the genetic diversity existing in our plant genetic resources, which are arguably inadequately conserved and used. Biodiversity is at risk from multiple threats including climate change.

Introduction

Dr Nigel Maxted's work on genetic conservation of crop wild relatives and landraces (traditional farmer-bred crop varieties) is providing a template for the conservation of agrobiodiversity and other plant species in the UK, Europe and many countries around the globe.

Food security is one of the major global challenges of the 21st century. It is now widely recognised that the remaining genetic diversity found in the wild species related to domesticated crops is an important reservoir of genes and alleles that are required to develop new varieties suited to meet the challenges of the future.

Feeding a growing human population is one of these challenges. In 2018, the human population stood at 7.65 billion, with 78% living in developing countries. By 2050, the world population is expected to reach 9.8 billion, with 86% living in developing countries (UN, 2018). If we are to address this challenge, then we will need to develop new varieties of high-yield crops.

To feed the human population in 2050 we will need to increase food supplies by 60% globally – and 100% in developing countries (FAO, 2011). However, climate change may reduce agricultural production by 2% each decade this century (IPCC,

2014). There is therefore an urgent need to develop new crops that can sustain production in a changing environment.

Crop wild relatives are being increasingly mined for and providing novel resistance to pests and diseases, and drought and soil salinity. While traditional crop landraces, often disregarded as inferior to modern cultivars, are now recognized for their role sustaining production in marginal environments and meeting the needs of niche markets.

Both crop wild relative and landrace diversity is threatened by mismanagement of the environment and unsustainable changes in agricultural practices, and so the conservation of both are directly linked to human future well-being. The conservation of agrobiodiversity has historically been largely *ad hoc* and thus not fit for purpose in underpinning current and future farmers' and consumers' demands.

The importance of biodiversity in agriculture

Plant genetic resources offer a means to sustainably increase food production by providing the breadth of genetic traits (pest, disease and environmental constraint reduction, agronomic quality and even yield improvement). Without such diversity, we are limiting the ability of crop breeders to develop improved varieties that can adapt to climate change and other challenges.

The majority of plant genetic resources are found in crop landraces, which are the product of traditional seed saving systems rather than modern plant breeding, and crop wild relatives, which are wild species that are relatively closely related to a crop and can be cross-bred to introduce desirable traits.

PwC have estimated global value of crop wild relatives for the purposes of crop breeding at [\\$115 billion per annum](#). No similar valuation is available for crop landraces, but it is thought to be even higher.

Given their value, it might be assumed that plant genetic resources are carefully preserved. However, a study in 2012 found that, of 572 native European crop wild relatives, 16% were assessed as 'threatened' or 'near threatened' and 4% were considered to be critically endangered and close to extinction.

Only a handful of crop wild relatives are actively conserved in protected areas, while the UK has no formally recognised conservation area to conserve crop wild relative diversity.

About the author

Dr Nigel Maxted is a Senior Lecturer in Plant Genetic Conservation at the University of Birmingham. Through his role as Chair of the Defra Plant Genetic Resources Group, together with his Chairing of European and global committees for the Species Survival Commission and Biodiversity International, he has helped secure the implementation of agrobiodiversity policy and conservation in the UK, Europe, Africa, Far East and South America.

An important recent outcome is the establishment of the first global priority inventory of crop wild relative species based on their value as trait donors for breeding and climate change mitigation, it is now being used internationally to plan *in situ* and *ex situ* conservation action and guide sustainable exploitation by plant breeders.

Lead academic

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Find out more

- <https://www.birmingham.ac.uk/research/activity/food-security/research/index.aspx>
- <http://ukpgrg.org/>

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