

Evolution in future forests

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When the UK signed up to the Rio Biodiversity Convention in 1992, we signed up not just to conserve species and ecosystems, but also to conserve genetic diversity. This third strand has often been overlooked, but in many ways genetic conservation is the most exciting concept of all: it's about survival of the fittest, the very underpinning of biodiversity.

The Anthropocene is causing climate change, sea level change, and the rapid spread of new pests and diseases, so humans now have a moral duty to help protect the ability of species and ecosystems to adapt to those changing conditions. Pessimists may point out that we are changing the climate faster than most species can evolve. But there is still an argument over the rights of species to exist, the chance for species to find for themselves the most appropriate genes for the future.

In a future adapted world, we will need trees that can survive future wild pathogens. Most tree saplings being planted today have been grown from limited seed sources or cloned material, nursed in commercial nurseries, carefully dosed with fungicides, insecticides and fertilisers as necessary. Natural regeneration of wild trees provides a wild alternative to nursery saplings, and woodland gene conservation involves creating spaces for woodland ecosystems to adapt, managing specific areas with the intention of allowing the full cycle of natural processes to occur. This is wonderful.

There is now a Europe-wide network of forest sites, called Gene Conservation Units, and in Scotland the wild genetics of our best-known trees (pine, birch, oak and rowan) have been protected since 2019 (starting at the Beinn Eighe National Nature Reserve in Wester Ross).

In Galloway, aware of the slow disappearance of wild apples from the landscape, we have registered a gene conservation unit for Scotland's wild apple tree. Usually called the crab apple, the wild apple is native to Scotland, and is one of the genetic parents of the whole world's orchard apples, our beloved eating apples, cooking and cider apples. Clearly, wild apples have an inherent right to exist, but there's a commercial angle too, for if the £80 billion value of the world apple crop is to thrive, and if our commercial orchards are to stay healthy in the future, we should preserve genes from their wild cousins.

Most trees use wind for pollination and seed dispersal, but some rely on third parties to help out. Jays, squirrels and voles famously plant acorns and hazelnuts, but many of the northern hemisphere's fruit trees rely on mammals. Badgers, foxes and boar eat fruit, but being

omnivores, seem able to digest apple pips. Sheep and deer eat fruit, but their droppings seem too small to safeguard apple pips. Bears, horses and bison/cattle eat fruit, and their dung is the perfect size to act as plant pots for wild apple seedlings to develop. Clearly, we no longer have bears in the UK, but cow pats are a perfect place for wild apples to germinate, thus creating beautiful wild-apple wood pastures for the future. Since cattle and ponies try to avoid eating around their own dung, wild apple seedlings can emerge and survive in lightly grazed wood pasture.

There are also potential feedback loops, which we are beginning to understand thanks to DNA testing. Apples are insect-pollinated, and most trees require cross-pollination: pollen from a different tree. Apples therefore contain pips with genes from various other trees. Wild and orchard apples freely hybridise (which is why orchard apples are usually grafted). In Galloway, it seems that our purest wild apple seedlings are able to survive better in the wild than domestic seedlings. We think this is because domestic apple seedlings are soft and leafy, and need protection from a plastic tube, whereas wild apples are spiky and tough. This creates a positive feedback loop, in a wild and remote situation, favouring the wild apple genes. It is not clear just how important ruminants are in wild apple reproduction, but it is possible that in the UK, out-wintering cattle and perhaps ponies may be essential for the wild apple's reproductive strategy.

This is great news: healthy and beautiful 'future forests' will require a wide variety of silvicultural, agricultural and ethno-cultural practices, and a geographical mindset!

"Wild apple seedlings can emerge and survive in lightly grazed wood pasture."



Wild apple tree on a farm in Galloway. © Mas Smyth

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