

European black poplar

Populus nigra

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These Technical Guidelines are intended to assist those who cherish the valuable European black poplar genepool and its inheritance, through conserving valuable seed sources or use in practical forestry. The focus is on conserving the genetic diversity of the species at the European scale. The recommendations provided in this module should be regarded as a commonly agreed basis to be complemented and further developed in local, national or regional conditions. The Guidelines are based on the available knowledge of the species and on widely accepted methods for the conservation of forest genetic resources.

Biology and ecology



The European black poplar, *Populus nigra* L. (family *Salicaceae*), is a typical tree species of many alluvial forests of many European and Siberian rivers. Being heliophilous, black poplar usually forms local populations by colonizing open areas on alluvial soils through seeds, cuttings or root fragments. Black poplar is characterized by a great diversity of population types—from isolated trees to huge pure or mixed stands. Individual trees may live over 400 years.

As a dioecious species, black poplar trees are either male or female. They reach the reproductive stage when they are 10–15 years old. Approximately 1–3 weeks prior to leaf initiation in the early spring (March–April), during the flood peak period along rivers in temperate Europe, male and female trees produce flowers clustered in pendulous catkins. In common

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with many colonizer species, black poplar depends on the wind for pollination, is capable of vegetative regeneration and is characterized by rapid growth. Black poplar is affected at all stages of its life cycle by hydrological controls and is, in fact, reliant on them for regeneration. Seeds are disseminated through wind and water, have a short viability and need very specific soil-water conditions for germination. The production of large quantities of airborne seeds coincides with an immediate post-flood period when freshly deposited, moist, but well-drained sediments are available for colonization. Successful regeneration occurs in years when soil moisture remains high enough for roots to grow down at the same rate as water recedes from the saturated waterfront, but not so high that anoxic conditions prevail. It follows that in many years, successful regeneration does not occur, and that in naturally occurring stands a strong age structure frequently exists, reflecting the history of flooding. Regeneration is generally poor within old established stands; the riparian forest naturally evolves toward hardwood formations.

Distribution

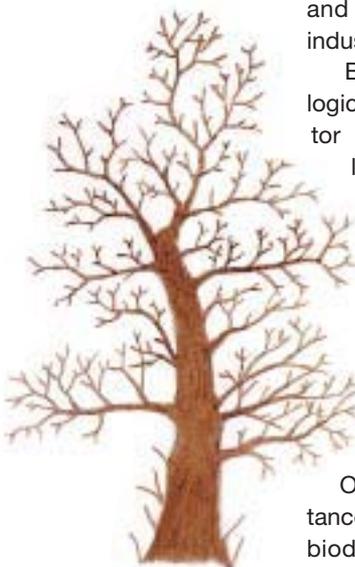
Black poplar has a large distribution area throughout Europe and is also found in northern Africa and central and west Asia. The distribution area extends from the Mediterranean in the south to approximately 64° latitude in the north and from the British Isles in the west to Kazakstan and China in the east. The distribution area also includes the Caucasus and large parts of the Middle East.

Importance and use

Black poplar is a tree of social and economic interest. It is predominantly used as a parent pool in breeding programmes in many parts of the world; 63% of the poplar cultivars descend from it, either as a pure species or from interspecific hybrids. Black poplar is hybridized with *P. deltoides* and other exotic *Populus* species, providing adaptability to various soil and climate conditions, rooting ability, high resistance to bacterial canker caused by *Xanthomonas populi*, fair resistance to *Marssonina brunnea* and to poplar mosaic virus. Black poplar is also of economic interest as a pure species. It is widely planted in East European countries for domestic use and, owing to its plasticity, is used as a pure species for soil protection and afforestation in polluted industrial zones.

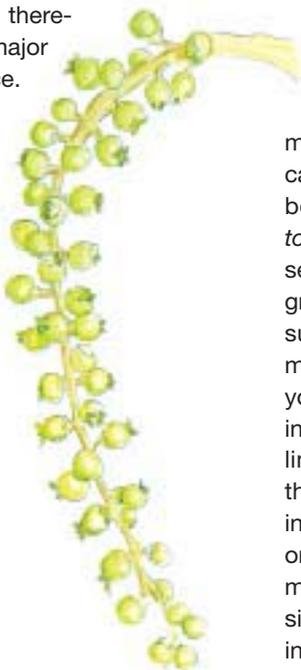
Black poplar is also of ecological importance as an indicator species of riparian woodlands. It dominates, together with other members of the *Salicaceae* family and *Alnus incana*, the early successional stage of floodplain woodlands in many temperate areas. Floodplain forests are among the most diverse ecosystems in Europe.

Only recently has the importance of poplars as centres for biodiversity been recognized.



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Poplars are host to a large number of threatened and common insects and animals that are associated with or depend on poplars. Today, there is a real interest in the restoration of riparian ecosystems not only for natural flood control but also because the river borders serve as corridors through which larger forest areas are connected. Monitoring and conservation of black poplar genetic resources in this dynamic ecosystems are therefore of major importance.



Genetic knowledge

Most of the genetic diversity is found within black poplar stands or river systems and very little genetic differentiation is found between the stands or rivers. Mating within a population does not occur at random and a female tree preferentially mates with a restricted number of males. The gene flow along rivers is found to be bidirectional, which means that the main factor of dispersal for pollen and seeds is the wind.

Introgression (i.e. movement of genes between genetically distinguishable populations) between *P. nigra* and *P. deltoides* has been detected at the seedling stage, but older introgressed individuals are rare. This suggests that introgression might be counterselected in the young seedling stage, but further investigations are needed. Preliminary results suggest that there is a large difference in introgression levels depending on the presence of competing males of black poplar. Introgression is more frequently detected in offspring of isolated females surrounded by only males of hybrid poplars, and in the absence of black poplar males. The male cultivar *P. nigra* cv. 'Italica' (Lombardy poplar) can hybridize with local resources, but non-synchrony of flowering can, in some cases (Belgium, U.K.), reduce this threat.

Threats to genetic diversity

Black poplar is one of the most threatened tree species in Europe and there are three major threats to its genetic resources. The first one is the alteration of riparian ecosystems throughout the species' distribution area by human activities. With hydraulic engineering, native poplar stands were displaced by agriculture and floodplain areas were subject to urbanization. Moreover, regulation of floods has altered the regeneration capacities of the species and favoured the succession of poplar stands by hardwood forests. Although the species may demonstrate locally highly successful regeneration, some regions of Europe have witnessed significant reductions in populations or the complete disappearance of black poplar.

Second, the autochthonous black poplar resources have been over-exploited and faster-growing hybrid poplars have been planted to replace those populations.

Finally, introgression from cultivated clones and other *Populus* species is a potential threat to black poplar. Very few



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clones are extensively cultivated and these contribute to a large extent to the pollen and seed pools. It is not only exotic hybrids that are creating a threat but also pure *P. nigra* varieties like the Lombardy poplar, which is distributed all over Europe.

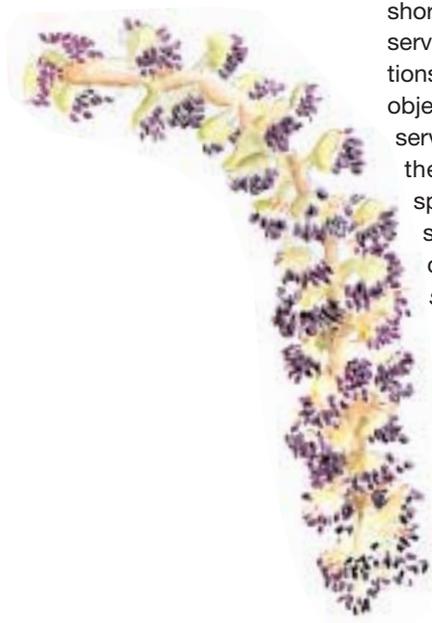
Guidelines for genetic conservation and use

As a general objective, the conservation of genetic resources should maintain the adaptation potential of species and populations. Static *ex situ* conservation is a widely applied strategy for short-term conservation to preserve genotypes in *ex situ* collections or genebanks. When the objective is long-term gene conservation and maximization of the adaptive potential of a species, dynamic *in situ* conservation is preferable. This can be achieved through *in situ* conservation of native stands (including restoration of stands), long-term breeding programmes or both. Successful *in situ* conservation of black poplar in Europe primarily depends on the location and protection of its natural habitats.

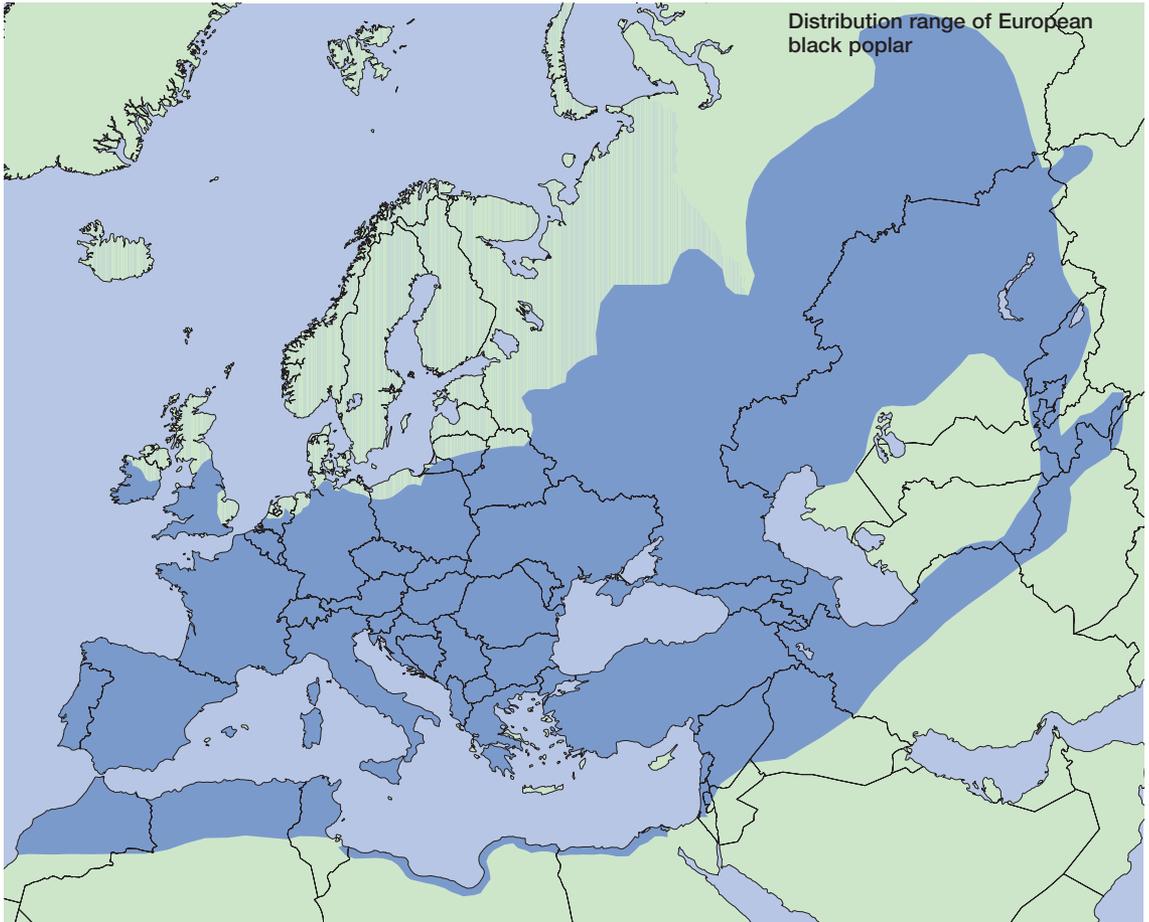
The conservation units should be distributed throughout the distribution range of the species, preferably including more than one conservation site per river system. A preliminary assessment of the genetic diversity among adult trees in the candidate populations is recommended to conserve a high amount of diversity and a low number of clonal duplicates. Particular attention must be paid to all practices that have an impact on flowering habit and the regeneration process, which determine the

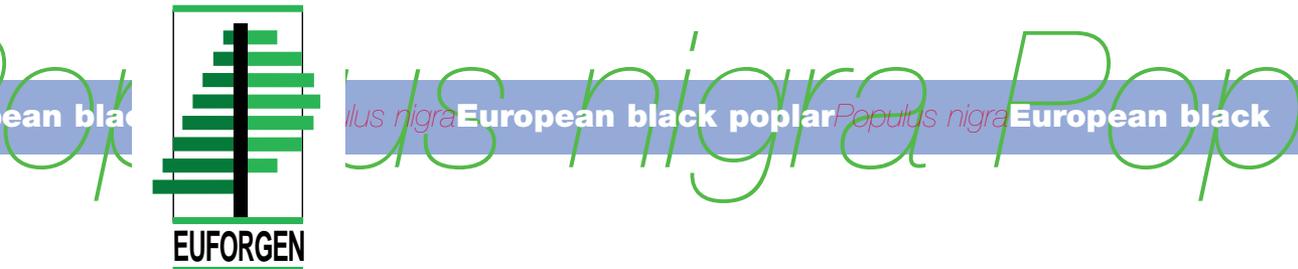
effective population size. Conditions for seed-set and seedling establishment should be optimized.

For restored populations, introgression can be limited by creating a “buffer zone” around the population consisting of local male trees. Active management and evaluation of the restored populations are highly recommended and should include replacement of poorly flowering individuals, corrective thinning, new additions to and from the genebanks, and removal of unsuitable individuals to avert the threat of introgression or poor adaptation.



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These Technical Guidelines were produced by members of the EUFORGEN Populus nigra Network. The objective of the Network is to identify minimum genetic conservation requirements in the long term in Europe, in order to reduce the overall conservation cost and to improve the quality of standards in each country.

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