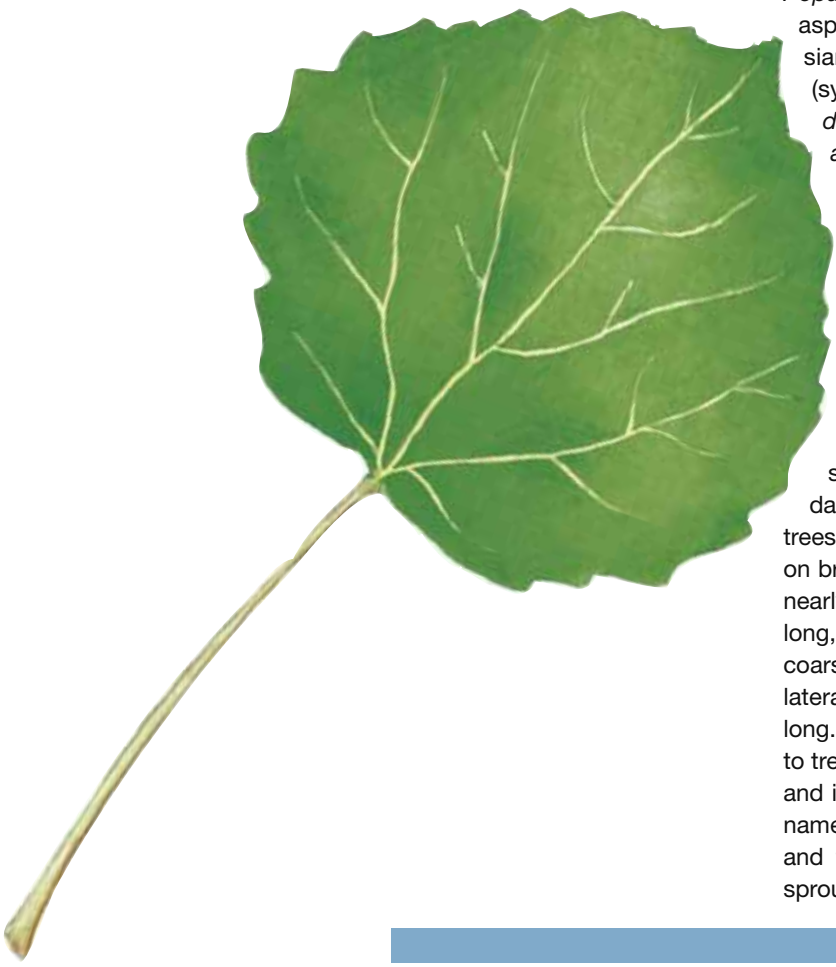
Eurasian aspen

Populus tremula

Georg von Wühlisch
Federal Research Institute for Rural Areas, Forestry, and Fisheries
Institute for Forest Genetics, Germany

These Technical Guidelines are intended to assist those who cherish the valuable Eurasian aspen genepool and its inheritance, through conserving valuable seed sources for 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 for 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

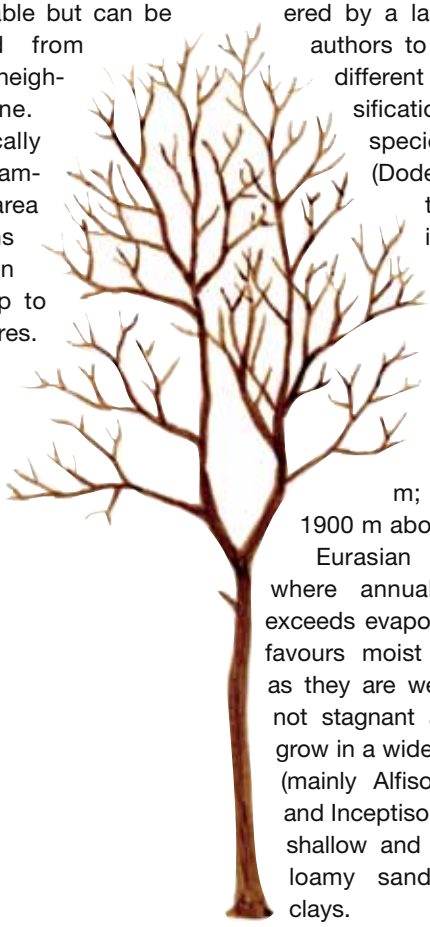
Populus tremula L. (European aspen, common aspen or Eurasian aspen; section *Populus* (syn. *Leuce*) (subsection *Trepidae* (Dode)); family *Salicaceae*) is a wide-spread colonising pioneer species. It is a medium-sized to tall deciduous tree growing to 40 m height with a trunk attaining over one meter in diameter. The bark is pale silvery-grey to green and smooth on young trees with dark grey diamond-shaped lenticels, becoming dark grey and fissured on older trees. The adult leaves, produced on branches of mature trees, are nearly round, slightly wider than long, 2–8 cm diameter, with a coarsely toothed margin and a laterally flattened petiole 4–8 cm long. The flat petiole allows them to tremble in even slight breezes, and is the source of its scientific name. The leaves on seedlings and fast-growing stems of root sprouts are very different, heart-

shaped to nearly triangular, and often much larger, up to 20 cm long; their petiole is also less flattened. The flowers are wind-pollinated catkins produced in early spring before the new leaves appear. The species is dioecious, with male and female catkins on different trees. The male catkins are patterned green and brown, 5–10 cm long when shedding pollen; the female catkins are green, 5-6 cm at pollination, extending 10-12 cm long at maturity in early summer to bear 50–80 capsules each containing numerous tiny seeds embedded in downy fluff. The fluff assists wind dispersal of the seeds when the capsules split open at maturity.

Eurasian aspen is a disturbance-adapted species and is often a principal coloniser of areas after fire or clear cutting, either by seeding or root suckers. It is capable of rapid growth under conditions favoured by this light and water demanding species. Fast growth continues until the age of about 20 years when crown competition increases. After that, growth increment is slower and culminates at about 30 years of age. Aspen can reach an age of 200 years. Root suckers are produced abundantly on the shallow lateral roots after an individual has been damaged or destroyed, e.g. by cutting, fire or diseases leaving an open space exposed to sunlight. The trees growing from the suckers form clones and mature stands reproduce vigorously by this vegetative means. Aspen clones vary widely in many characteristics, members of a clone being indistinguishable but can be distinguished from those of a neighbouring clone. Clones typically have many ramets over an area of a few tenths of a hectare, in rare cases up to several hectares.

Distribution

Eurasian aspen has a large distribution range. It is native to cool temperate and boreal regions of Europe and Asia, extending from the British Isles and Iceland eastwards to Kamchatka, and from north of the Arctic Circle in Scandinavia and northern Russia, south to central Spain, Turkey, the Tian Shan, North Korea, and northern Japan. The aspen in the latter regions of East Asia is considered by a large number of authors to be sufficiently different to justify classification as different species; *P. davidiana* (Dode) Schneider. In the south of its range, aspen occurs at high altitudes in mountains (Alps: 1300-2000 m, Pyrenees: to about 1600 m; Caucasus: to 1900 m above sea level).



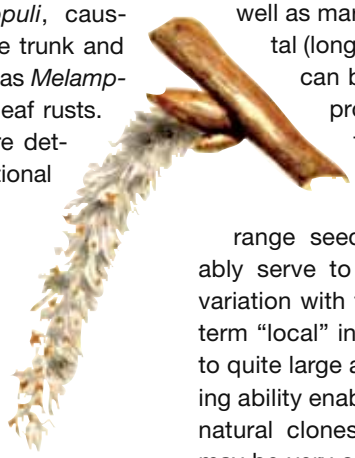
Eurasian aspen occurs where annual precipitation exceeds evapotranspiration. It favours moist soils so long as they are well aerated and not stagnant and is able to grow in a wide variety of soils (mainly Alfisols, Spodosols, and Inceptisols) ranging from shallow and rocky to deep loamy sands and heavy clays.

Populus tremula L.

Importance and use

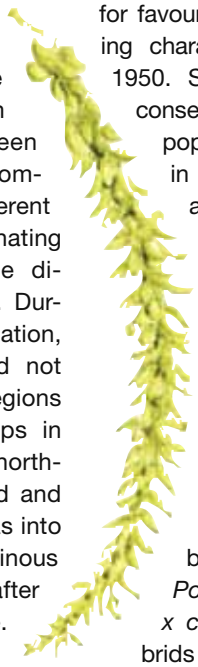
The light, soft wood has very little shrinkage and high grades are used for lumber and matches. Aspen wood is used for pulp and paper, where it is favoured for its easy delignification, easy bleaching and characteristics especially favourable for writing paper. It is also used for plywood and different types of particle and flake boards. It plays an important role in production of wood for renewable energy.

Aspen is of high ecological value. Many insect species benefit from aspen and it provides habitat for a wide variety of mammals and birds requiring young forests. Numerous leaf, bark and wood inhabiting insects and fungi exist on aspen, among them *Melasoma sp.* an ectoparasitic mite feeding the leaves, *Saperda sp.*, boring the trunk, fungi like *Phellinus tremulae*, causing heart rot, *Pollaccia radiosa,* causing shoot blight, bacterial canker, *Xanthomonas populi*, causing damage to the trunk and branches, as well as *Melampsora sp.* causing leaf rusts. Some of these are detrimental to operational plantations.



Genetic knowledge

The genetic diversity of Eurasian aspen is generally high. Much of the diversity is found within stands and less between them. However, when comparing populations of different geographic regions originating from different refugia the diversity may be very high. During the most recent glaciation, refugia may have existed not only in Mediterranean regions but also north of the Alps in mild micro habitats. The northward migration to England and into Scandinavia, as well as into higher altitudes in mountainous regions, took place early after the end of the last ice age. Since systematic provenance trials are lacking, it can only be assumed that aspen has undergone selection for adaptation to local environments. Clinal variation in adaptive traits along latitudinal, altitudinal as well as maritime to continental (longitudinal) gradients can be expected to be pronounced across the whole range. Wind pollination and long range seed dispersal probably serve to enhance genetic variation with the result that the term “local” in this case applies to quite large areas. The suckering ability enables aspen to form natural clones, some of which may be very old.



For aspen breeding programmes, parent trees have been selected phenotypically mainly for favourable stem and branching characteristics since about 1950. Such trees are usually conserved in the collections of poplar breeding institutes in Scandinavian, Baltic and other states, among them Germany. Fast growth, good stem forms and disease resistance was found in sources from the Kaliningradskaya Oblast region and is available under the name ‘Tapiau’.

Eurasian aspen hybridises naturally with *Populus alba* forming *P. x canescens*. Artificial hybrids have been produced with a number of other poplar species (e.g. *P. tremuloides, P. grandidentata, P. davidiana*, a.o.). Some hybrid progenies, especially those of *P. tremula* by *P. tremuloides* as well as *P. davidiana* and *vice versa* demonstrate heterosis effects and are significantly faster growing and less susceptible to diseases than the parental species. Also some triploid aspen clones of pure and hybrid aspen are faster growing. Like other poplar species, aspen has been subject of a variety of research, especially in tree improvement including genetic modification since 1990.

Populus tremula

Threats to genetic diversity

Aspen is a minor forest tree species. Therefore it is restricted to marginal or abandoned sites. As a pioneer species it is light demanding and requires bare soils devoid of competing vegetation for natural regeneration. Therefore, in silvicultural systems favouring closed cover forests, natural regeneration of aspen is nearly impossible. However, in regions of extensive land use it plays an important role as a coloniser species after fire, storm or other disturbance. In regions of intensive agricultural and silvicultural land use aspen has been removed over centuries. In such regions it is now considered to be a threatened species and the genetic variation is reduced. In regions where aspen is actively grown, improved hybrids are being used, which pose a potential threat to the genetic integrity of the autochthonous populations. Little information is available on the abundance, distribution, and history of aspen populations. Such information would aid in evaluating threats to the species and its genetic resources in different regions.

Guidelines for genetic conservation and use

As a colonising species, aspen has under unmanaged conditions only infrequent and unpredictable availability of spaces to spread into, where the prevailing forest vegetation has been destroyed by disturbances from storm, fire and flood. Under managed conditions the *ex situ* conservation of aspen populations would depend on deliberately creating open areas for new colonisations or actively planting or seeding this area.

As a general objective, the conservation of genetic resources should maintain the long term adaptive potential of populations, e.g. by *in situ* conservation of autochthonous stands or long term breeding programmes. Successful *in situ* conservation of Eurasian aspen would require active management. Removal of late successional tree species and clear cutting of small areas of the aspen stand at intervals of about 20-30 years would provide suitable conditions. Natural seeding from adjacent, dispersed parts of the population would then be successful.

Gene conservation units should be spread throughout the distribution range of the species, preferably including more than one per ecological basic unit. A preliminary assessment of the genetic diversity of the candidate populations is recommended to ensure a high amount of diversity and a low number of clones. Particular attention must be paid to all practices that have an impact on flowering habit and the regeneration process, which determines the effective population size. Conditions for self-seeding and seedling establishment should be improved by completely exposing the mineral soil within or close to aspen stands.

For restored populations, introgression can be limited by creating buffer zones around the population by keeping a distance of several hundred meters from possible hybrid aspen plantations. Active management and evaluation of restored populations including possible clone compositions are necessary. Regeneration by root suckers should be minimised as repetitive vegetative regeneration will reduce genetic diversity.

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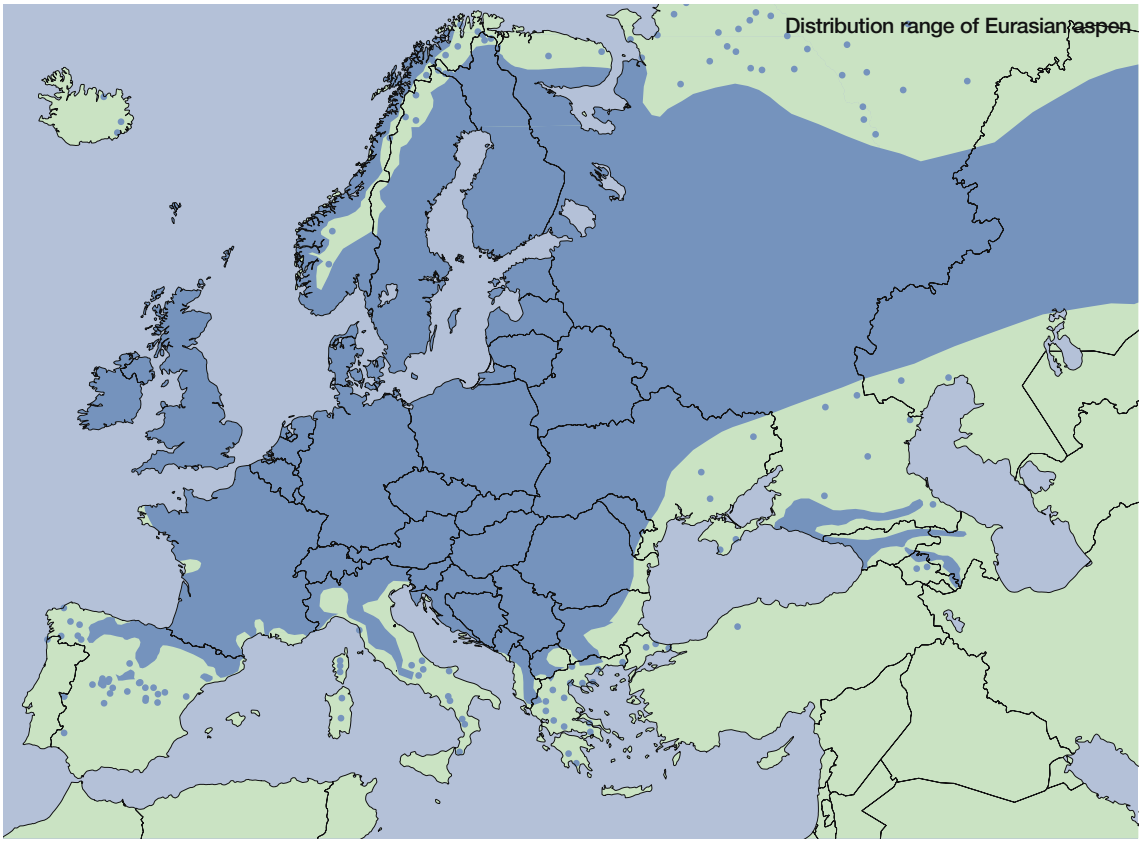

This series of Technical Guidelines and distribution maps were produced by members of the EUFORGEN Networks. The objective is to identify minimum requirements for long-term genetic conservation in Europe, in order to reduce the overall conservation cost and to improve quality standards in each country.

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EUFORGEN Secretariat
c/o Bioversity International
Via dei Tre Denari, 472/a
00057 Maccarese (Fiumicino)
Rome, Italy
Tel. (+39)0661181
Fax: (+39)0661979661
euforgen@cgiar.org

More information

www.euforgen.org