EUFORGEN

Italian alder

Alnus cordata

Fulvio Ducci[1] and Andrea Tani[2]
[1] CRA-ISSEL (Silviculture Research Centre), Arezzo, Italy
[2] Faculty of Forestry, University of Florence, Florence, Italy

These Technical Guidelines are intended to assist those who cherish the valuable Italian alder 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

Italian alder (*Alnus cordata* (Loisel) Desf.) is a monoecious, wind-pollinated tree. There are two recognized botanical varieties: *rotundifolia* and *genuina*. The species reaches reproductive maturity at about 10-12 years of age. Flower buds appear in early summer, just before leaf buds burst, and flowering starts the following winter. Male flowers contain 5-6 catkins. The female catkins are axillary to male catkins and develop into pseudo-cones. These ripen during the winter, turning from green to brown, and open the following spring. The seed is wind-dispersed.

Buds and pseudo-cones are the largest among alders. Leaves are typically heart-shaped. In spring, bud-burst occurs relatively late. Leaves

commonly remain green after the first frosts of winter and persist until the end of December.

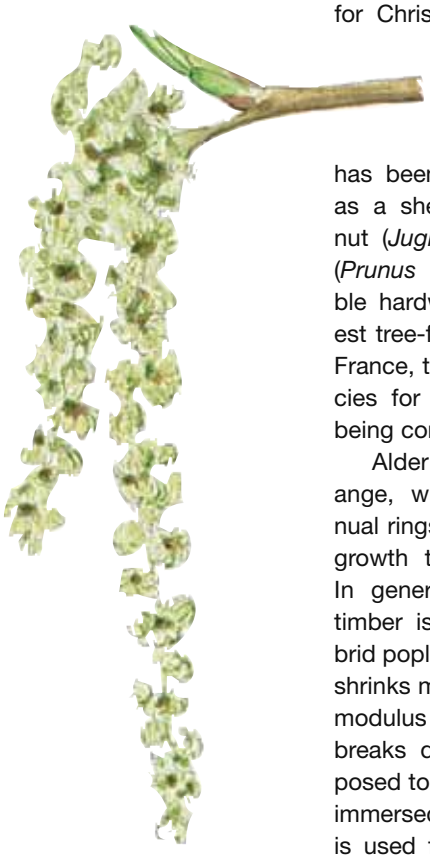
Italian alder grows at altitudes of 200 m (on northern slopes) to 1600 m, depending on rainfall and temperature. It can reach a height of 25 m or more in natural forests, with stem diameter of more than 65 cm at breast height. Italian alder is a heliophilous pioneer species and it can rapidly colonize gaps created by felling in beech (*Fagus sylvatica*) and chestnut (*Castanea sativa*) stands. This allows the species to develop pure stands. It is also able to invade black pine (*Pinus nigra*) stands in wet conditions.

Adventitious buds commonly survive on stumps after forest fires and are able to produce shoots very quickly.

Italian alder will grow on most soils, but planting in clay soils should be avoided.

Distribution

Italian alder is found in small areas of the southern Apennines (Basilicata, Calabria and Campania) and mountains in north-eastern Corsica. Both varieties (*rotundifolia* and *genuina*) grow in southern Italy whereas only *rotundifolia* is found in Corsica.



Importance and use

Italian alder is a fast-growing, multipurpose species that can also improve soil fertility though symbiotic nitrogen fixation with *Actinomyces alni* (*Frankia alni*). It is grown as an ornamental tree and also produces valuable wood. The dried flower industry uses the pseudo-cones for Christmas floral ornaments. In mountainous areas, it is planted for soil protection. In recent decades, Italian alder has been widely used, in Italy, as a shelter species with walnut (*Juglans regia*), wild cherry (*Prunus avium*) and other noble hardwoods in intensive forest tree-farming programmes. In France, the potential of this species for biomass production is being considered.

Alder timber is reddish-orange, with relatively wide annual rings resulting from the fast growth typical of the species. In general, the quality of the timber is similar to that of hybrid poplar, although it is heavier, shrinks much more and has high modulus of rupture. The timber breaks down rapidly when exposed to air, but is durable when immersed in water. The timber is used for turning and carving as well as for the production of moulding, furniture, panelling and plywood.

Genetic knowledge

Studies on intra-specific variation have pointed out that genetic diversity at individual level is very high. However, comparing Italian populations, variation in morphological traits, such as leaf size and leaf shape, is small. Comparisons of growth rate have never shown large differences in more than 30 years of observations in provenance trials.

In spite of the small species range area in Italy, the absence of natural barriers allows the pollen and the seeds to maintain sufficient gene flow to prevent differentiation among populations. Studies, including Corsican populations, show considerable differences compared to Italian alder: these populations are more resistant to drought than the Italians ones.

Self-pollination proved to be very low in controlled pollination experiments carried out in plantations aimed at obtaining full-sib progenies. This should be taken into account in the design of the seed orchards; ramets from the same clone must be planted as far apart as possible.

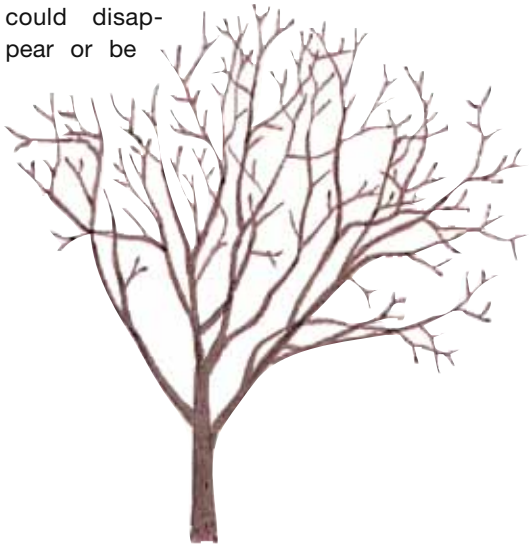
.

Threats to genetic diversity

Despite its limited natural range, Italian alder is not considered an endangered species. It has experienced little human intervention, largely because it grows over a wide range of elevations and can spread very rapidly. Natural regeneration occurs readily and seedling growth is rapid in clear cuts or gaps in forests. Moreover, most of its natural range occurs within protected areas.

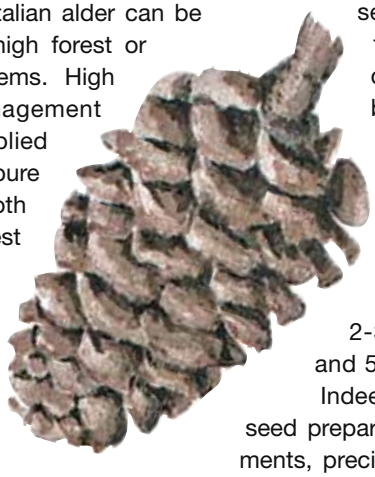
The most important threats to Italian alder diversity are the tree's limited natural range, the reduction of clear cutting in mixed forests and in protected areas, unauthorized grazing in forests and the isotherm shift in the Mediterranean region due to climate change. The increase in temperature may force beech–alder ecosystems to shift to higher elevations. As a result, large parts of populations could disappear or be severely damaged near their lower altitude limits. Climate change could also result in a reduction in genetic diversity through loss of suitable habitats. Other threats are connected with competition with beech and other species and the isolation due to reduction and/or absence of geneflow between populations.

The nursery system may also contribute to the reduction of diversity variability in new plantations, if seed collection activities are based on only a very few mother trees.



Guidelines for genetic conservation and use

The first long-term action is to ensure the *in situ* conservation of existing populations according to dynamic gene conservation criteria. Italian alder can be managed in high forest or coppice systems. High forest management can be applied to mixed or pure stands. In both cases the best regeneration method for Italian alder is the creation of small clear cuts or strips (e.g. 20 x 200 m). The best results for regeneration are achieved where mineral soil is exposed, i.e. when top soil layers are for some reason disturbed by erosion or 'ploughed' by animals or by humans. A typical situation is represented on slopes along roads where light is plentiful and mineral soil is accessible. Especially in mixed stands, small subpopulations or 10-20 trees should be used as seed trees on clear cuts and strips.

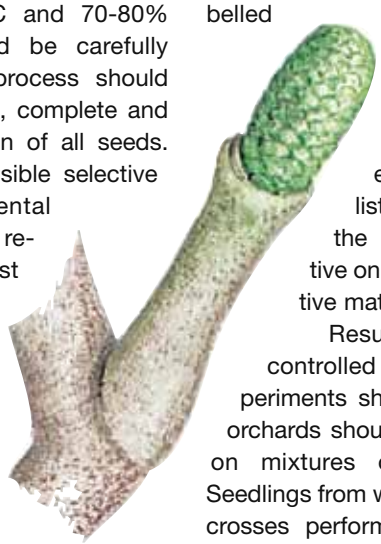


In mixed beech-alder coppices, standards of Italian alder are usually allowed to develop to provide seed for growing natural regenaration, by taking advantage of suitable light conditions, of the more rapid partial mineralization of the litter and of the soil mineral layers made accessible by harvesting.

Seed should be collected from 30-40 well scattered trees per seed stand. Nearly ripe pseudo-cones should be collected in mid-October and early November to ensure that viable seeds material is obtained. The pseudo-cones should be dried at 38-40°C for 15-18 hours and between 5 and 6% air humidity.

Seeds can be stored up to about 2-3 years at 5-7°C and 5-6% air humidity.

Indeed, concerning the seed preparation and pre-treatments, precise temperature and moisture requirements during the seed extraction and conservation should be met (temperature between -3° and +3°C and moisture of the seed-bed between 5 and 7%), as well as chilling conditions (±5°C and 70-80% moisture) should be carefully supplied. This process should induce a prompt, complete and quick germination of all seeds. In this way, possible selective micro-environmental effects will be reduced and most of the genetic variation present in the seed lots will be maintained. A similar strategy should be followed in the nursery, where the micro-site factors should be appropriate for maximum seedling survival and development. Extreme conditions for the range required by seedlings should be avoided (pH, minerals, temperatures, light, water supply, etc.) as these may impose selection pressures which only allow those that are best adapted to these conditions to survive.



Seed collection should be regularly rotated among several stands, so that different populations or subpopulations are sampled. Similarly, different groups of trees within a stand should be used for successive collections. Stands should be selected across a range of altitudes to ensure that the full range of genetic variation is captured.

Seedlings should be planted on a site that matches the requirements of the species. This will help ensure seedling survival. Seedlings should be carefully labelled to ensure that their origin can be traced, and should be the species included in the official list of species of the European directive on forest reproductive material trade.

Results of several controlled pollination experiments showed that seed orchards should not be based on mixtures of populations. Seedlings from within-population crosses performed better than

those from between-population crosses. Possible problems of inbreeding can be reduced in single-population seed orchards by the inclusion of adequate numbers of clones.

EUFORGEN

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.

*Citation: Ducci F. and A. Tani 2009. EUFORGEN Technical Guidelines for genetic conservation and use of Italian alder (*Alnus cordata*). Bioversity International, Rome, Italy. 6 pages.*

Drawings: Alnus cordata*, Giovanna Bernetti.*

ISBN 978-92-9043-786-4

Selected bibliography

Magini, E. and M. Paci 1988. Comportamento al 12 anno di popolazioni diverse di ontano napoletano (*Alnus cordata* Loisel.). L'Italia Forestale e Montana LXIII (5): 111–127.

Mannucci, M. 1995. Il legno di ontano. Sherwood 7: 21-24.

Paci, M. and A. Tani 1995. La ricerca sull'ontano napoletano: il punto della situazione dopo oltre vent'anni di osservazioni. Sherwood 6: 15–21.

Paci, M. and A. Tani 1995. La ricerca sull'ontano napoletano: il punto della situazione dopo oltre vent'anni di osservazioni (seconda parte). Sherwood 7: 13–20.

Gamisans, J. 1983. L'aulne à feuilles en coeur (*Alnus cordata* Loisel.) dans son milieu naturel en Corse. Revue Forestiere Francaise 30 (6): 445–442.

Prat, D. 1998. *Alnus cordata* – Aulne à feuilles en cœur. *En*: Les ressources génétiques forestières en France. Tome 2: les feuillus (M. Arbez et J.F. Lacaze, eds.). Bureau des ressources genetiques, INRA, Paris, France. pp 33–36.

Bioversity International

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