

Alnus viridis in Europe: distribution, habitat, usage and threats

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Alnus viridis (Chaix.) D.C., known as green alder, is a native deciduous shrub or small tree that grows up to 6 m, occasionally taller, distributed widely across the cooler parts of the Northern Hemisphere, from north-west America to Japan through Central Europe. It is a light-demanding, fast-growing shrub that grows well on poorer soils. The species is well known for soil enrichment through atmospheric nitrogen fixation, soil stabilisation by forming a highly fibrous system, and for producing abundant leaf litter. The species went through a considerable expansion during the last decades as a result of land abandonment. More recently a deterioration of *Alnus viridis* is occurring in the Alps as a consequence of pest damage and fungal disease.

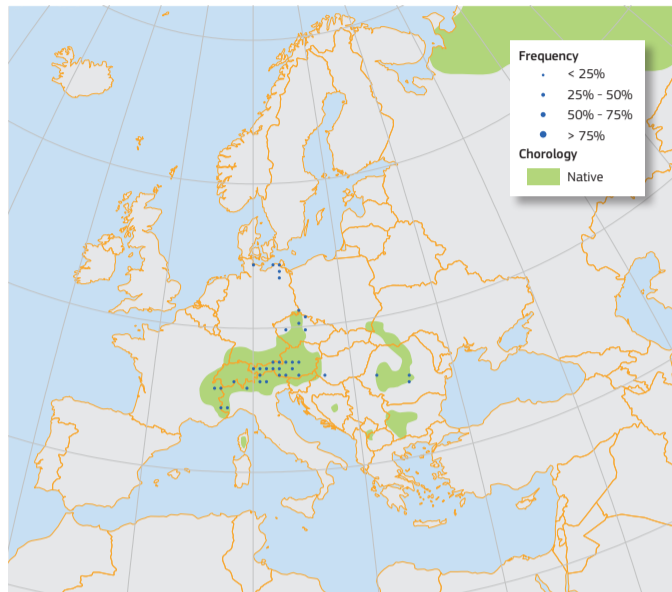
The green alder (*Alnus viridis* (Chaix.) D.C.) is a deciduous shrub or small tree. It forms many prostrate to ascending stems, and normally reaches a height of between 0.5 to 3 m. In ideal conditions it can live more than 50 years. The bark is thin and from grey to blue-grey colour. The leaves are alternate, sticky when young, from 7 to 14 cm long and from 3 to 10 cm wide. The flowers are **monoecious** with separate male and female catkins on the same plant. Flowering occurs in early or later spring depending on the elevation and latitude, while seeds mature between mid-September and December. Pollination occurs mainly by wind. The seeds are small, 1-2 mm long, light brown with a narrow encircling wing. The roots form a highly fibrous root system, which make this plant very suitable for preventing soil erosion¹. The roots also host a symbiosis with fungi enabling fixation of atmospheric nitrogen².

Distribution

Green alder is distributed widely across the cooler parts of the Northern Hemisphere in form of different subspecies. The subsp. *viridis* is found in Europe mainly in the Alps, Balkans and Carpathians, but also in the Pyrenees, Apennines, Dinaric mountains and Norwegian mountains³⁻⁵. The subsp. *suaveolens* is endemic in Corsica⁶. The subsp. *fruticosa* occurs in Northeast Europe, northern Asia and northwestern North America⁷. The subsp. *crispa* is present in Northeastern North America and Greenland. The subsp. *sinuata* is found in Western North America and far northeastern Siberia⁸, and the subsp. *maximowiczii* is constrained in Japan⁹. In Europe its altitudinal range varies between 1600m and 2300 m, although scattered individuals can be observed up to 2500m¹⁰.

Habitat and Ecology

Green alder requires moist soil and is a colonist of screes and shallow stony slopes. It prefers moist and open areas, including avalanche tracks, edges of wet meadows, stream-banks and/or other disturbed sites. It is usually found at medium to subalpine elevations. The abundant leaf litter is an important source of organic matter for soil building and nutrient cycling⁸. This species plays an important role in primary successions, successfully colonising areas after strong disturbances such as glacial retreat or avalanches¹¹. This is because it recovers quickly from avalanches by being able to regrow from roots and broken stumps, while larger trees are killed. However, in European mountain areas, secondary succession is also important. The land abandonment occurring during the last decades at the upper tree line¹² was the main trigger for the colonisation of green alder at



Map 1: Plot distribution and simplified chorology map for *Alnus viridis*. Frequency of *Alnus viridis* occurrences within the field observations as reported by the National Forest Inventories. The chorology of the native spatial range for *A. viridis* is derived after Jalas and Suominen²².

the expense of subalpine grassland¹³. This success is due to its strong ability to spread under a high disturbance regime¹⁴.

Importance and Usage

Green alder can be used for soil enrichment, for slope and stream bank stabilisation and more generally to prevent erosion on disturbed, nutrient poor soils^{15, 16}, although one recent study considers this species neither to protect against avalanches nor to secure slopes from erosion¹⁷.

In the western Alps the rapid expansion of green alder on subalpine grasslands causes considerable environmental changes which have a mostly negative effect on the conservation of vascular plant diversity (particularly concerning conifer species) when it reaches more than 50% cover. Below this level, it appears to contribute to the increasing floristic diversity of the subalpine belt^{18, 19}. The economic importance of this species is very low. Only in the past was it partly used as fuel wood¹⁶.

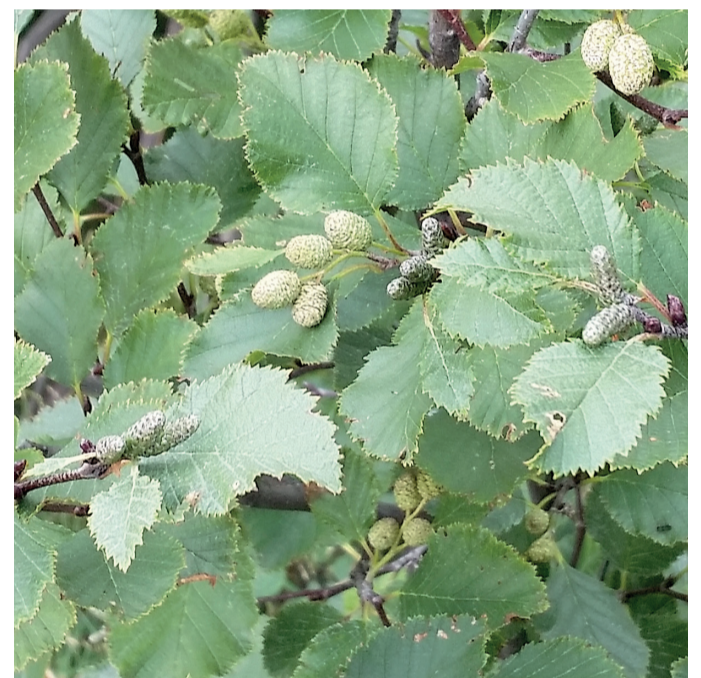
Threats and Diseases

During the last decades, the populations of green alder in the Alps went through a considerable deterioration, mainly as a result of pest damage and fungal disease, where *Cryptodiaporthe oxystoma* was considered to be the primary fungus involved.



Isolated young alder in an alpine field at Col Vesco (Arabba, North-East Italy). (Copyright Aldo De Bastiani, www.actaplantarum.org; AP)

This phenomenon usually takes place after winters with low snow amounts, which reduce the alder vitality and makes it more sensitive to parasite attacks. This could develop into a widespread problem as a consequence of climatic changes^{16, 20}. Green alder is considered an invasive species in New Zealand, especially in South Island where it has been widely planted²¹.



Clusters of maturing green fruits which look like small coniferous cones. (Copyright Giovanni Caudullo; CC-BY)

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Green alder scrub vegetation on the flanks of the Pizzo Nero (Monte Rosa Group, North Italy). (Copyright Giovanni Caudullo; CC-BY)

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