

Chestnut Forests and Chestnut Cultivation in Switzerland

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ABSTRACT. Due to human activity, the European chestnut (*Castanea saliva*) became the dominant tree species in the colline and submontane (granite) regions south of the Alps. It is cultivated in orchards, sprout-forests and coppices with standards. In the rural areas, it was important as a producer of chestnuts for nutrition and forage, of litter, of timber, of stakes for vines, of firewood, of tannin, and also as an erosion-protector. The introduction of the potato in 1810, the drastic change of the economy in the middle of the present century and the occurrence and rapid spread of chestnut blight (caused by *Cryphonectria parasitica*), led to the neglect of the chestnut stands. Without silvicultural measures, the chestnut seemed doomed to gradually disappear.

In the 1950's, two programs were initiated: a) the selection and breeding of blight-resistant chestnut (*C. saliva* x *C. crenata*); and, b) the evaluation of the substitute tree species. The spontaneous arrival of hypovirulence, together with a new awareness of the tree's beauty and its value for the landscape, awakened a new interest in chestnut cultivation. The Forest Service and the "Chestnut Working Party" have recently taken the initiative to restore the chestnut stands by supporting tending operations, converting coppices to timber forest, and planting orchards with selected trees from Switzerland, Italy and France. Poor nut quality and ring shake need further research.

Small stands of chestnut also are found north of the Alps. Recently, several foci of chestnut blight were found, and sanitary fellings were undertaken and hypovirulent *C. parasitica* strains will be introduced.

The chestnut tree (*Castanea sativa* Mill.) accounts for only 1% of the forest trees in Switzerland (25). South of the Alps, however, this tree species represents 14.3 % of the growing stock or 21% of the trees. Chestnut stands also are found in the lower Valais and along the lakes of central Switzerland. Due to its beauty, the chestnut tree is a landscape forming element. Many chestnut stands are witness of the cultural and economic history of the growing region. Since the industrial revolution, chestnut cultivation has declined. Many authors (7, 13, 17, 18, 19, 21, 26) described the chestnut culture in the southern and northern regions of Switzerland not only for scientific reasons but also to increase interest in a beautiful but neglected tree species. This article describes the chestnut forests and the history of chestnut cultivation in Switzerland.

THE ORIGIN OF *CASTANEA SATIVA* IN SWITZERLAND

Fossil pollen maps indicate that *C. sativa* had glacial refuges in southern Europe from where it spread north. By 1000 BC, *C. saliva* reached the Alps, expanded rapidly during the Roman empire and by 1000 AD reached the present range (20). As *C. sativa* is missing in pollen profiles from the neolithic-bronze period in southern Switzerland, Zoller (27) concluded that *C. sativa* together with *Juglans regia* L was introduced by man after the onset of agriculture and settlement. Etymological studies find the origin of the word 'Castanea' in the Armenian chestnut 'kaskeni' and further back in the Persian 'kashtah' (thy fruit) (24). This also is an indication that the chestnut might have been introduced from the east. After the Roman period the pollen counts decreased and were low between 600 and 1000 AD. After the year 1000 AD they periodically increased to very high counts (28).

The dissemination of *C. saliva* north of the Alps also is attributed to the Romans. Kiister (22), however, reported several pollen findings along the Alps from pre-Roman times and recently found *C. sativa* remnants in layers of the late bronze period (personal communication) at Greifensee near Zürich. Wooden relics, however, were only found in the Middle Ages (Schweingruber, personal communication).

VEGETATION ASSOCIATIONS, CLIMATE AND SOIL

According to Ellenberg (15), *C. sativa* is an indicator of warm regions with oceanic climate on acidic to neutral soils. Its wide distribution in Switzerland is primarily due to human activity. Without silvicultural management *C. sativa* is doomed to gradually disappear as it does not withstand the competition of the trees of the original vegetation (i.e. *Quercus petraea* Liebl., *Q. robur* L., *Tilia cordata* Mill., *Prunus avium* L., *Betula pendula* Roth, *Fraxinus excelsior* L. in the south and *Fagus sylvatica* L. in the north).

Castanea saliva is the dominant tree species in the colline and submontane regions in the southern foothills of the Alps up to an elevation of 1000 m. It is found associated in the thy variation of the mixed oak forest '*Phyteuma betonicifoliae-Quercetum castanosum*' (16. No. 42) with *Monilia litoralis* Pers., an indicator of variable humidity. Only in abandoned stands is the original insubric oak-birch association found. On richer soils, *C. saliva* also grows in the association '*rruciato glabrae-Quercetum castanosum*' (No. 34). In the more humid, lower parts, it

is associated with mixed ash forest *Arunco-Fraxinetum castanosum*' (No. 33). In the northern pre-alpine stands, *C. saliva* is associated with the linden mixed forest *Asperulo taurinae-Tilletum*' (No. 25).

The insubric climate south of the Alps is influenced by the upper Italian lakes. This is an oceanic climate, characterized by over 2100 hr of sunshine per year, abundant rainfall (1800 mm/year), mainly during the growing season and mild winters with rare late frosts (2).

Additional chestnut stands also are found in the warm continental climate of the lower alpine valley Valais, where they are planted in selvas (orchards) and naturalized in the forest. In the oceanic climate zone along the pre-alpine lakes (lakes of Lucerne, Zoug, Walen and Geneva), the chestnut is not able to compete with the natural tree vegetation and it needs intensive tending. There the föhn (warm fall wind) and lake reflections influence the climate and chestnut fruits will ripen. Additionally scattered chestnut trees are found everywhere in the lower regions of the Swiss plateau. However, long warm fall seasons are essential for fruit ripening and survival of the trees is threatened during extreme cold winters (i.e. in 1956, 10-15% of the chestnut trees in Central Switzerland were destroyed (18)). *C. saliva* prefers acidic, fairly moist soils. On calcareous (lime stone) sites *C. saliva* is always found on a layer of moraine (18).

CHESTNUT DISEASES AND PESTS: CHESTNUT BLIGHT, INK DISEASE AND OTHER DISEASES AND PESTS

Chestnut blight, caused by *Cryphonectria parasitica* (Murr.) Barr, was observed for the first time at Soresina (Mt. Ceneri, Ticino) in 1948. The blight then spread rapidly; in 1952, many disease foci were found along the main valley and by 1963 almost all chestnut stands were infected, with the exception of the highest chestnut stands (3). In 1988, no chestnut stand was free of chestnut blight (14). Out of concern for the chestnut tree, with its value as erosion protection and important landscape element, sanitary fellings were carried out and a selection program was started for blight resistant chestnut trees (6). In addition, a project was initiated to find substitute trees. In an experimental plot, 71 indigenous and exotic tree species were planted and their silvicultural performance was evaluated (11).

Fortunately, the European chestnut blight epidemic turned out to be much less severe than in North America. This is attributed to the lower susceptibility of the host tree and the natural spread of transmissible hypovirulence. Probably due to the limited number of vegetative compatibility (v-c) groups (5), non-lethal cankers and hypovirulent *C. parasitica* strains are now found in all the chestnut stands. There was the great fear that the blight fungus would spread to the chestnut stands north of the Alps. A Federal Ordinance of 1952 forbid transportation of chestnut plants or parts of it from southern to northern Switzerland. This act was prompted by the uncertainty of

whether oak (*Q. petraea* and *Q. robur*) and the dominant beech (*F. sylvatica*) might be threatened by the disease. In 1989, chestnut blight was found in several stands north of the Alps. Today, these stands are of no economic value but they are a beautiful landscape element and they are witness of old agricultural practices. All *C. parasitica* isolates from north of the Alps, with one exception, belong to four known Swiss v-c groups. Although hypovirulent strains are widespread in the southern area, none have been found yet in the north. It is questionable whether hypovirulence will spread because of the limited extension of the northern chestnut stands (8).

Ink disease, caused by *Phytophthora cambivora* (Petri) Buism., is rarely found in Swiss chestnut stands. A chestnut stand, about 50 yr old in the region of Geneva, is heavily affected. Presumably, adverse climatic conditions have weakened the trees.

Other fungal pathogens. *Pseudovalsa modonia* (Tul.) Höhn. is found in all regions, mainly attacking old branches, possibly acting as a natural pruning agent. An outbreak of *Cryptodiaporthe castanea* (Tul.) Wehm. in an experimental plot in the Bregalia has not been diagnosed fully yet.

Insects. Economically important are the insects that develop in the nuts. Bovey et al. (9) stated that in the Ticino, in 1956, a yield loss of 52% had to be attributed to the activity of *Pammene fasciana* L., *Laspeyresia splendana* Hb. and *Curculio elephas* Gyll. Only proper management of the selvas will reduce the loss.

SILVICULTURAL MANAGEMENT OF CHESTNUT STANDS

Selva (orchard). Selvas are found around the settlements in the southern alpine valleys. The huge chestnut trees planted in a wide-spaced orchard dominate the landscape. The selvas produce nuts, litter and grass. Side products are mushrooms, berries and chestnut honey. Traditionally, the trees were grafted with local varieties. Bettelini (7) mentions 16 varieties for the region Sottoceneri. In the Bregalia, with its famous selvas, Geiger (19) noted 5 local varieties that still exist today. As the chestnuts were grown for domestic requirements, a mixture of varieties produced early and late chestnuts, as well as chestnuts for forage.

The selvas are gradually disappearing. In 1943, 9,000 ha were present (1); in 1986 it had dropped to 1,400 ha (25). With the closing down of the tannin factories, the arrival of the chestnut blight and the shrinking profitability of forestry, many stands were neglected. Due to reduced management, the selvas were overgrown by bushes and trees, as is shown by a comparison of aerial photographs in the Bregalia (4).

Sprout forest (coppice). South of the Alps, *C. saliva* is widely grown in short rotation coppice. Within a rotation of 15 to 25 yr, stakes and firewood are grown. In many areas, they are grown as 'capitozzi' (coppice with pollards) in order to protect the sprouts from goat grazing. Most of

these trees suffer from butt rot. South of the Alps, sprout forests form 14% of the forest area, i.e. 8,000 ha. Seven-thousand ha are coppiced with standards (25).

HISTORY

The distribution and importance of *C. sativa* during the centuries reflect the economic conditions of the population. Chestnut trees were grown not only in the poor valleys in the southern foothills of the Alps but also on the Swiss central plateau. Local names (i.e. Kastanienbaum, Kestenholz, Chestenrain, Chestenewald, La Châtaigne) indicate the former widespread distribution of the chestnut tree in the German, as well as in the French-speaking regions of Switzerland.

Merz (23) mentioned that chestnuts served as tribute in the middle ages. Chestnuts were sold on the markets of Locarno and Bellinzona, Ticino around 1200 AD. The chestnut growing regions in southern as well as in northern Switzerland are devoid of natural resources. The agricultural land is poor and steep and does not allow a rich crop of grain. In many regions chestnut served as the main food base. Its products also served as a cash crop.

The chestnuts were most important in human nutrition (roasted and cooked, and ground to flour for bread and porridge) and additionally served to raise pork. The durable wood was valued for outside constructions and slope stabilization works. Chestnut also provided stakes for the vine and telegraph poles and served as firewood and for charcoal production. The litter was used instead of straw for bedding of the cattle and was sometimes valued higher than the nuts (26).

In 1750, the potato was introduced in central Switzerland and in 1810 in the remote, mountainous chestnut growing regions of the Ticino. It gradually replaced the chestnut as the major food staple. With the construction of the railroad through the Alps (1882), the Ticino and central Switzerland were linked to the international trade, which allowed for cheap importation of rice and corn from the south; those grains supplanted the chestnuts. The selvas became obsolete and their management was abandoned.

With the conversion of the self-sustaining agricultural system to dairy production in the 19th century, many chestnut stands in central Switzerland were converted into grassland (18). Inventories in eastern Switzerland by Tanner (26), in central Switzerland by Furrer (18) and in the Valais by Closuit (13) stated the abandoned condition of many orchards. As the chestnut stands need management, many chestnut trees have disappeared from the forests due to their low competitive fitness.

A new interest for chestnut wood arose during World War I and World War II when the import of tannin was restricted and two new tannin factories were founded in Switzerland. Between 1925 and 1935, the three Swiss tannin factories consumed 20,000 t of chestnut wood annually (10) and during World War II this amounted to 50,000 t (1). We estimate the annual yield at 70,000 m³. The big demand for chestnut wood resulted in destructive

lumbering along the main roads and the railroad. At the same time the demand for chestnuts increased as importation of food was impaired by the war. In 1927, the Ticinese Forest Service tried to stabilize the chestnut wood market and improve chestnut quality for better salability. The foundation 'Pro Selve Castanili' supported the plantation and grafting of chestnut trees to restore the selvas and sprout forests in the Ticino (1). With the closing of the last tannin factory in 1965, the economic interest in this tree was extinguished. Chestnut blight has damaged many stands, the revenue from silvicultural management diminished gradually with the development of Switzerland to a high income country, and the indigenous chestnuts were replaced by cheaper imports from Italy and Portugal. (Roasted chestnuts and 'Vermicelles' (sweet chestnut paste) are welcomed in winter time; the importation of chestnuts amounts to 15 million SFr. annually.)

OUTLOOK

Today, the Forest Service of the Ticino in cooperation with the 'Gruppo di lavoro sul castagno' (Chestnut working party), instituted by the Ticinese government, takes action to establish new selvas with improved nut quality, to convert abandoned sprout forests into timber forests and to intensify silvicultural management. The 'Centrale del legno' (founded 1987) will support the marketing of the wood and the 'Station South of the Alps of the FSL' will propagate the scientific knowledge to the public. Improved chestnut quality together with a better marketing of nuts, vine stakes and wood for technical constructions will increase the interest for chestnut cultivation in the Ticino. It is hoped chestnut forests will be restored so that they keep their role as erosion protection on the steep valley slopes and as the characteristic element giving the landscape its mediterranean aspect. Poor fruit quality and ring shake of the timber will need future research efforts.

North of the Alps, chestnut stands are on the verge of disappearing. Silvicultural management will help to preserve the chestnut stands as a memory of former times and part of the cultivated landscape. Some of the stands are protected by nature conservation acts or are listed in the 'Federal Inventory of landscapes and natural monuments of national importance' (12).

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