

Short Term Scientific Mission (STSM)

Scientific Report – COST E42

Valentina Giuliatti

in Universität für Bodenkultur Wien- Institute of Silviculture (Vienna)

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▪ **Purpose of the visit**

Analysis of single tree oriented management held in Austrian eastern part (Weinviertel) in order to improve timber quality and value production. In the specific: coppice and coppice with standard oak and ash-maple forests. This experience will be compared to similar Italian studies.

▪ **Description of the work carried out during the visit**

The first phase of the STSM concerned indications about the management of broadleaved tree species in Austria, with information about research in BOKU University and related publications.

The STSM was focused on field surveys of experimental and demonstration plots, located in eastern Austria, dealing with different forest management systems:

Coppice with standards system

In dry Lower Austria forests (Weinviertel), annual precipitation (450-700 mm) and mean annual temperature (8-10 °C) characterize these sites. The coppice with standards system (CWS) and coppice system dominate. The STSM focused on the study of CWS. This silviculture system is characterized by an over wood devoted to the high-quality timber production and an under wood with coppice for firewood production. Several of these dry sites are suitable for oak and other species (maple, ash, cherry, wild service tree and service tree) timber production. The analysis of these areas has shown interesting results either in under wood or in over wood.

- UNDER WOOD: in the Weinviertel, the most important agriculture production area in Austria, land owners need coppice for its important biomass sink. The over wood density cannot be too high (<66% of crown cover) to maintain a good coppice vitality. The rotation in association with the site-specific conditions should not exceed 20-40 years for the maintenance of coppice shoot potential. In one of the experimental plot visited (45 years old) hornbeam dominates the under storey and the other species are replaced (Fig.1).



Figure 1 - Coppice with standards, coppice (hornbeam) 45 years old

- OVER WOOD: the origin of this population is both gamic and agamic. While the management aims to seed regeneration, in unfavourable years (dry season, pests, etc.) the under storey coppice is utilized to select individuals for the dominant layer. Since the over wood destination is timber production, the selection criteria are: species, stem and crown shape, spacing (if possible). A good explanation of this management is a mixed oak (*Quercus petraea* and *Quercus robur*) and wild service tree stand in Weinviertel region (Fig. 2-left). In order to produce valuable assortments (40 (50) cm and branch free bottom log of 5-7 m) a rotation of 100-120 years has been implemented. This goal is achieved with an age graduation of 4 different classes, that permits every 20-40 years the fells of the under storey coppice and the biggest classes (diameter classes) of the over storey. With special tending the valuable trees can be achieve a good development of the crowns and the periodical formation of water sprouts, after removal of the under wood, can be prevented. Additionally, frequent pruning (branches <3cm) was realized. The catastrophic infestation of oak-dieback (*Lorathus europaeus*) has led to the promotion of biodiversity: the more diverse is the forest, the less relevant is the economic loss in case of pest. For this reason in the demonstration plot an artificial enrichment of sycamore and cherry tree has been carried out (Fig. 2-right).



Figure 2 - Left: coppice with standards, *Sorbus* and *Quercus* in the over wood. **Right:** enrichment of valuable broadleaved

On the whole, the coppice with standards management in practice offers a broad setting for ecological and economic possibilities.

Target tree management system (in “high forest system character” stands)

In the Austrian broadleaved stands regeneration has been mainly carried out by artificial planting while natural regeneration has not played a major role (although the latest is favoured through silvicultural treatments). With the STSM both afforestations and natural forests were visited.

A major objective of this silvicultural system is the production of high-quality timber at the lowest cost. In order to achieve 50 (60) cm diameter of straight trunk and branch-free bottom logs, the system is based on the following phases:

- **SELECTION OF PLUS TREES:** individuals are selected using the same criteria of CWS method (over storey): market interest for the species, good development and vitality of the crown, good stem conformation and uniform spacing. Interesting experimental plots (thinning and control), in a natural stand, were examined. In both kind of plots oak, sycamore, cherry and ash (in order of Austrian market importance) were selected.

- EARLY INTERVENTIONS (THINNED PLOTS): the first thinning starts both when the natural pruning (due to high competition between individuals) produces free-branch bottom log (of 4-5 m) in plus trees and when their competitors have a negative crown development impact.
- THINNING: in thinned experimental plots (Fig.3-left) and all plants around plus trees with the radius of 1 m were cut in order to facilitate workers in their pruning activity. Additionally, variable distance between plus trees and its neighbours was experimented, cutting all competitors in dominant and co-dominant tree layer. With this system interventions are concentrated exclusively around plus trees, with therefore a consistent lowering of the silviculture management costs (Fig.3-right). In general, through frequent thinning (every 5-6 years) a well development of the crown and 10-14m final spacing can be reached.



Figure 3. Target tree management system in a natural “high forest”. *Left:* oak plus tree, in an experimental thinned plot, competitors-free around a radius of 2.5 m. *Right:* well developed crown of *Fraxinus excelsior*.

- PRUNING: in addition to natural pruning, plus trees need an artificial live branches pruning in order to reach a free-branch bottom logs of 6-7 m (for 60-75 trees/ha). Some experimental plots with artificial pruning of different species (oak, sycamore, ash, *sorbus* and *pyrus*) were visited. The more afforestation density is the less is the artificial green-pruning intensity. In the aim of cost reduction, is quite common in Austria to plant trees with a low density with insufficient pruning interventions.

The Target Tree Management System plays an important role to increase the value of forest production. More experimental information for each stand and each tree species about the potential sites and trees is however needed. Since the plots are only 10 years old, it is still too early to have some significant results.

Since the aim of both CWS and Target tree management system is the increase of high quality products, another aspect to be taken into account is the study of provenience of some valuable sporadic species.

In some Austrian afforestations with presence of *Sorbus domestica* and *S. torminalis*, considerable differences in terms of timber quality and yield among were observed depending on the provenience of the seedlings. These two species are interesting for timber production as the price of their good-quality wood is extremely high and its demand is increasing on the European market. Studies about Austrian provenience of *Sorbus sp.* and their behaviour need to be carried out as same as in Italy. The research activity must be focused on selection of best *Sorbus* individuals, collection of seeds, cultivation in controlled fields, monitoring and selection of best individuals in terms of growth performance, form and stem characteristics. Some information about this topic were given by Raphael Klumpp in BOKU University during the visit of the local nursery.

- **Description of the main results obtained**

- Better knowledge of coppice with standards system for high quality-timber production

- In the past, the CWS system in Italian Turkey oak stands has been used, even for firewood production, also for pasture and railroad sleepers production. Nowadays, these traditional products are no longer required. Furthermore, the high density of the overstorey depresses the coppice production. The Austrian experience may be applied to certain extends to the Italian situation.

- In such way, may be possible to improve the cultivation and the quality of valuable broadleaves with CWS management system.

- Better knowledge of target tree management system

- This selviculture system is not applied in Italy being only few experimental researches. The Research Institute of Selviculture in Arezzo and Firenze took part to the redaction of a manual “Silviculture of sporadic species in Tuscany” in order to promote this management system for the improvement of quality timber production. The STSM gave the opportunity to visit interesting Austrian experimental plots where target tree management system is applied.

- **Future collaboration with host institution**

The Austrian research in CWS and target tree management system is recent and this could be a good opportunity for both countries to develop collaboration during this early stage of experimentation. Furthermore, our research group is willing to find other European partners in order to share the experiences and create networks about these management systems.