A Comparative Review of Coppice and High Forest Protective Functions in a Romanian and European Prospective

Victor Dan PACURAR, Ph.D
Associate Professor
Transilvania University of Brașov
A Comparative Review of Coppice and High Forest Protective Functions in a Romanian and European Prospective

Victor Dan PACURAR, Ph.D
Associate Professor
Transilvania University of Brașov
The protective services provided by forest vegetation are presently gaining an increasing recognition, being worldwide considered at least as important as the wood production function.

increasing recognition .... and hopefully adequate payments
FORESTS

PROTECTIVE FUNCTIONS

Ecosystem Processes

PROTECTIVE SERVICES

Society Benefits

Hazards Control

and/or

Damage Risk Decrease
Ecosystem functions are integrated in the biophysical processes specific to a certain ecosystem. “They can be characterized apart from any human context, though they are generally affected by human activities” (DAILY, 1997).

“Ecosystem services cannot be characterized apart from the human context and require some interactions with humans. Functions become services only to such an extent to what humans acknowledge them within their social systems of the value generation. However, unlike forest products, most forest service values are not paid for” (Constanza et al. 1997).
PROTECTIVE FUNCTIONS  PROTECTIVE SERVICES

➢ WATER REGULATION

➢ EROSION AND LANDSLIDES CONTROL

➢ CLIMATE FUNCTION

AIR QUALITY – CARBON STORAGE
Forest Structure

- LAI
- Litter Amount
- Root System

- WATER REGULATION
- EROSION AND LANDSLIDES CONTROL
- CLIMATE FUNCTION (including carbon storage)

Among the factors affecting the protective efficiency one could mention:

- canopy closure and leaf area (affecting interception etc.),
- ground status and litter amount (influencing infiltration and runoff),
- root system structure (important for the water budget and landslide stability, by anchoring and physiological “drainage”) etc.
Forest Structure

- LAI
- Litter Amount
- Root System

- Species
- Age
- Site Conditions and others
- but not least
- The management system:
  - High forest
  - or
  - Coppice
Coppicing is one of the oldest forestry systems known from many countries worldwide (Fujimori 2001).

Coppices were usually used as a source of firewood until the second half of the 19th century (Buckley 1992).

Afterwards, the conversion of coppices to high forests has been the principal trend especially in central and northwestern Europe (Matthews 1991; Peterken 1992)
### Area and share of coppice forests in some Mediterranean and SEE countries (Stajic et al, 2009)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total forested area (ha)</th>
<th>Coppice forests</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Area (ha)</td>
<td>Share (%)</td>
<td></td>
</tr>
<tr>
<td>Albania</td>
<td>942 000</td>
<td>405 000</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>3 992 000</td>
<td>70 000</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td>3 700 000</td>
<td>1 750 000</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Croatia</td>
<td>2 403 000</td>
<td>512 000</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>14 470 000</td>
<td>6 822 000</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Macedonia</td>
<td>948 000</td>
<td>557 000</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td>2 512 000</td>
<td>1 640 000</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>1 702 000</td>
<td>501 000</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>6 013 000</td>
<td>3 397 000</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Montenegro</td>
<td>543 000</td>
<td>298 000</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Romania</td>
<td>5 617 000</td>
<td>369 000</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Serbia (without Kosovo)</td>
<td>2 252 000</td>
<td>1 456 000</td>
<td>65</td>
<td></td>
</tr>
</tbody>
</table>

Sources: SFA (2005); Bankovic et al. (2008); Toromani, Jupe (2007); Barbu, Barbu (2005); UN–ECE/FAO (2000); Chatziphilippidis, Spyroglou (2004); Glavonjic et al. (2005)
In addition to the effects of the structure peculiarities, the protective functions are considerably affected by the disturbances related to the specific management operations.

As regards coppices, the harvesting process could be less “invasive” (the transport of small wood pieces requiring light machinery or only horse power) but the more frequent interventions and the subsequent reductions of protective efficiency only allow a comparison with the clear-cuttings system.

There is no doubt about the superior protective services provided by the continuous cover systems.

But as it will result in further analyses, traditional coppice is more efficient than SRC, which are generally better than most agricultural crops.
The negative effects of coppicing on soil properties (less degradation control and reduced fertility) are considered to affect not only the environmental services but even timber production, (Hansen, Baker 1979; Ranger, Bonneau 1986; Ranger, Nys 1996).

“A specific effect on the soil environment is the frequent disturbance of the soil due to timber harvest and skidding” (Ranger, Nys 1996).
Average carbon storage (t/ha) in arable use, short rotation coppices and forests (Boman and Turnbull, 1997)

<table>
<thead>
<tr>
<th>Components</th>
<th>Arable use</th>
<th>Short rotation coppice</th>
<th>Forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves</td>
<td>4.0</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Trunks</td>
<td>0</td>
<td>21.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Weed</td>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Litter</td>
<td>0.5</td>
<td>5.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Roots</td>
<td>2.0</td>
<td>5.5</td>
<td>10.0</td>
</tr>
<tr>
<td>Soil</td>
<td>25.0</td>
<td>35.0</td>
<td>45.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32.0</strong></td>
<td><strong>69.5</strong></td>
<td><strong>144.5</strong></td>
</tr>
</tbody>
</table>
The fine root biomass under clones of the willows *S. viminalis* and *S. dasyclados* in a SRC on former arable soil in Estonia was vertically concentrated (39 to 54 % of the total fine root biomass) in the uppermost 10 cm of soil (Heinsono et al., 2009).

The fine root characteristics of poplar varied among clones (Al Alfas et al., 2008) and were affected by the management, like irrigation and coppicing (Dickmann et al., 1996).
Species

The species influence on the net production (SRC, on reclaimed sites in Lusatia, Germany) amounted to 64.5 Mg C ha\(^{-1}\) for \textit{R. pseudoacacia} and 8.9 Mg C ha\(^{-1}\) for poplar, over a period of 36 years (Quinkenstein, A.; Jochheim, H. 2016)
Italian studies in the Mount Etna region (Leonardi et al, 1996):

As regards the age influence on the aboveground biomass, its amount was between 22 and 24 t ha$^{-1}$ in 7-yr-old stands and 83 and 100 t ha$^{-1}$ in 12- and 22-year-old coppices.

Aboveground perennial biomass production: 2.4 to 5.4 t ha$^{-1}$ year$^{-1}$ and this was also correlated with stand age and altitude.

Litterfall, measured during 3 successive years, varied between 1.7 and 5.1 t ha$^{-1}$ year$^{-1}$ and was directly related to stand age.

Litter accumulation on the soil surface was 7.4 to 7.9 t ha$^{-1}$, Decomposition required more than 6 years.
Researches undertaken in Russia (Trashliev, Ninov, 1975) in a 40-year-old coppice composed of 84% of Quercus conferta and 16% of Q. cerris established that the aerial phytomass amounted 166 ton/ha and the subterranean phytomass 113.3 ton/ha.

Leaf fall was about 7.8 ton/ha.

Litter amounted to about 19 ton/ha; this decomposed over a period of 21/2 to 3 years.
A comparative study between Bialowieza Forest, Poland, and three English woods (two coppiced and a high forest, largely neglected for 100 years and promoted from coppice) indicate that in the English high forest fallen dead wood was only about a third of that in the undisturbed areas of Bialowieza Forest.

As regards age influence, two young stands (From Catania, Italy) had much lower leaf biomass values: (1600 and 1500 kg/ha) than the two older stands (3900 and 4100 kg/ha), located in Salamanca, Spain, and Montpellier, France (Santa Regina et al, 2001).
In Germany, three 20-year-old coppice woods (mainly Betula pendula, Quercus petraea and Corylus avellana) were compared to two nearby 140-year-old high forests of Fagus sylvatica (Hölscher et al, 2001):

The mean aboveground phytomass of the two high forests (31.2 kg dry mass m\(^{-2}\)) was 4 times larger than that of the coppice woods (7.3 kg m\(^{-2}\)) and stored 2 to 3 times larger amounts of Ca, K, Mg and N. The soil organic layers of the high forests were thicker and contained 6 times more organic matter than those of the coppice woods (6.8 vs. 1.1 kg m\(^{-2}\)) and stored 3 to 7 times more nutrients.
PRESENT OPPORTUNITIES AND CHALLENGES for coppice woods in Romania in relation to their potential ecological functions.
Black locust in Romania
(aprox. 250 000 ha)

Degraded lands  Restoration and Protection

- Coppiced?

> better than eroded pasture or bareland
Riparian Forest Vegetation
(willows and poplars)
Shelterbelts

- On erodable hillslopes with agricultural land use
- On sandy lands
- Around lakes and reservoirs
- On the river banks
Coppice woods could provide land and water protection services, not as a substitute but in addition to the high forests (managed for their protective services as a priority, being included in the first functional group, according to the Romanian zoning system), especially on the small farm estates in steep terrain regions and on riparian areas.
References


Branko Stajic, Tzvetan Zlatanov, Ivaylo Velichkov, Tomislav Dubravac, Pande Trajkov, 2009 - Past and recent coppice forest management in some regions of South eastern Europe, Silva Balcanica, 10(1).


Dickmann DI, Nguyen PV, Pregitzer KS, 1996 - Effects of irrigation and coppicing on above-ground growth, physiology and fine-root dynamics of two fieldgrown hybrid poplar clones. For Ecol Manage 80:163-174


Rytter R-M, 1999 - Fine-root production and turnover in a willow plantation estimated by different calculation methods. Scan J Forest Res 14:526-537
Thank you very much for your attention!