

## Agroforestry in central, northern, and eastern Europe

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**Abstract.** Integrated management of natural resources and the multiple use of trees and forests have prevailed in most European societies since prehistoric times. In the Middle Ages, expanding and intensified agriculture resulted in the separation of trees from agricultural fields. During the last century, with the introduction of sustainable and highly productive forest management, the goal of increased wood production has been achieved in most parts of central, northern, and eastern Europe. Today, agroforestry is not considered to be an important land-use option within the region; however, there are many practices that could rightfully be classified as agroforestry. These include tree/crop systems in which trees provide products and/or environmental benefits, and tree/animal systems in which animals are grazed in forests or open woodlands.

The future seems to offer some prospects for agroforestry. Large areas, hitherto used for food production, are either marginally suited to agriculture, or will probably be taken out of production due to agricultural policy considerations. Agroforestry may, at least in part, offer alternatives for the use of such lands. The availability of (surplus) fertile soils, capital, and labor may provide incentives for site-adapted forms of agroforestry, including improved fallow management. The focus of such systems would be on maintenance of biodiversity in the landscape, environmental protection, recreation, and product diversification.

There are numerous expectations as to what agroforestry might provide for the land holder and for society as a whole. These expectations should be carefully analyzed and evaluated prior to political decisions on future land use. The promotion of agroforestry requires overall investment; agroforestry does not 'happen by itself'. A set of integrated actions – not isolated efforts – must be implemented if agroforestry is to become a successful land-use option.

### Historical review

Integrated management of natural resources – originating from the prehistoric practices of hunting and gathering, and from early attempts at animal and crop domestication – has been documented almost everywhere in central, northern, and eastern Europe [Devillez, 1984; Diechtl, 1992]. However, as compared to the tropics and even to southern (Mediterranean) Europe, there was less potential for developing efficient agroforestry systems in this region because of the prevailing natural conditions and socioeconomic structures.

In central Europe, expansion of intensified agriculture resulted in the Middle Ages in a splitting of land into forests, agricultural fields, and pastures. From the time of Charles the Great (around 800 AD), increasing demand for food, armed conflicts, missionary work, and strategic settlement policies of the kings and high ecclesiastical dignitaries, led to the clearing of forests and to permanent land cultivation. Cultivation was considered a synonym for

culture; forest for backwardness. Until the 19th century, mercantilistic policies, which were designed to maximize state revenues, further promoted agriculture at the expense of forestry. Forests and trees/shrubs were gradually displaced to marginal areas that could barely support profitable agroforestry. In the subsistence economies of those times, these areas were widely used for community-based grazing and litter collection. Both uses, however, were detrimental to the production of wood, which was increasingly needed for energy supply, construction and mining activities, and naval uses. Foresters, therefore, believed that competition from agriculture and livestock should be reduced to a minimum.

In some regions, a rotation of agricultural crop production (after slash-and-burn), fallow pastoral use, and/or coppice forestry (yielding, for example, fuelwood, poles, and tanning bark) was common for a long period. The still abundant coppice forests in parts of France (as compared to Germany, where an almost complete conversion to high forest was achieved more than a century ago), indicate the former regional importance of agriculture (including wine-growing) in close combination with coppice forestry [Kapp, 1984]. During the past two centuries, agriculture developed rapidly with the use of mechanization, chemical fertilizers and crop breeding; forestry focused almost exclusively on wood production through the use of specialized silvicultural practices and the principle of sustainable yields.

Silvopastoralism is another activity with a long history. Throughout the Middle Ages, it was the dominant forest use in large areas of the deciduous oak and beech forests of the central European lowlands and hillsides. Fattening of pigs was an especially characteristic activity in many local forest policies. This practice was subject to many laws and concession arrangements, as well as to continuous conflicts, typically between feudal lords and rural people. Some of the concessions were hereditary and have been maintained until the present time. Seasonal transhumant alpine pasture also remained common for centuries and was usually regulated at the community level.

In northern and eastern Europe, agroforestry has never been of great importance except for the practices of local swidden agriculture, occasional silvopastoralism, and reindeer management in the transition zone between forest and tundra. This region is either continental-temperate or boreal and, thus, offers mainly harsh site conditions with short growing seasons and, often, poor soils. Population densities are low as compared to central Europe, and the vast tracts of available land do not encourage labor-intensive management. Instead, agriculture has been concentrated on the few appropriate sites.

### **Present status**

Under the prevailing conditions in central, northern, and eastern Europe, agroforestry is not considered to be an important land-use option. However, subject

to definition, several practices may be classified as agroforestry, or as related to agroforestry.

In central Europe, trees grown outside of forests are found in many areas [Cotta, 1819; Hundeshagen, 1820; Hilf, 1958; Allison and Peterken, 1985]. Their importance for the environment and for the people involved may be very high [Joachim, 1992]. Fruit trees (e.g., apple, pear, cherry, plum) or nut trees (e.g., walnut, chestnut, hazelnut) may be grown in orchards which simultaneously provide land for agricultural crops or pasture. These trees can also be found in single rows alongside roads, boundaries, and water courses. Quite often these species can be classified as multipurpose trees in agroforestry systems. They are characteristic for many landscapes from France and the United Kingdom [Carruthers and Tranter, 1989], across Germany and eastward, and are generally typical of favorable site conditions and markets.

In addition, various forms of tree and shrub management on fields and pastoral land [Joachim and Schrödl, 1990], for diverse functions and services such as windbreaks, erosion control, shade and shelter, maintenance of biodiversity, and amenity, are very common from the Atlantic coast far into the Ukraine and the southern parts of Russia. Variations include individual specimens (oak and linden trees are quite common), single lines or narrow strips (e.g., poplars), hedgerows (common in the lowlands adjacent to the North Sea), and the Ukrainian and Russian multi-row and multi-story 'field-protecting forests' [Pavlovskij, 1984; Vomperskij and Olovjannikova, 1984; Pasternak, 1985; Miloserdov, 1985]. All of these may provide products like fuelwood, fencing material, and fodder, in addition to environmental benefits. Poplar plantations, located in parts of central Europe, deserve special consideration and can, if combined with crop production or pasture, be classified as an agroforestry system [Gathy and Evrard, 1982].

In contrast to the aforementioned examples in which woody perennials are preserved and maintained, or deliberately cultivated on agricultural lands, there are types of agroforestry in which agriculture penetrates the forest. These, however, are limited to silvopastoral management. Several trials in recent years have indicated that grazing on afforestation plots may have detrimental effects on tree growth [Holsteiner-Jorgensen and Møllergaard, 1984]; other trials have given more positive results [Dorward and Carruthers, 1980; Lewis, 1988; Korn, 1989].

In Austria, 350,000 ha are still in silvopastoral use, feeding more than 80,000 cattle and 55,000 sheep and goats. Transhumance in the alpine regions [Koch, 1986] and in parts of Southeast Europe [Bevermann, 1967] also plays a traditional role. Efforts to replace old grazing concessions in order to improve forest management in Bavaria revealed some interesting information [Lohner and Silbernagl, 1987]:

- Cattle are the main livestock species involved.
- Grazing rights include permission to maintain shelter and alm-stables, to

utilize a certain amount of fuelwood and timber for subsistence, and to drive the animals into lower elevation forests in case of emergency following unexpected snowfall.

In 1934, there were 823 *alms* in Bavaria with a total of 20,155 ha of open grassland and 112,194 ha of forest, and a total carrying capacity of 27,540 NCG (1 NCG = 'normal cattle-unit grass' for 100 days of pastoral use per year). In 1987, there were still 747 *alms* with a total of 17,300 ha of grassland and 76,500 ha of forest. Forests continue to provide 25% to 30% of the required fodder.

Because of the many negative effects of silvopastoral use on forest regeneration (especially with broadleaved species, and the involvement of goats or sheep), the following compensation options have been offered for the replacement of existing concessions:

- cash, ranging from DM 3,500 to 8,500 per NCG,
- allocation of adequate pasture lands in state forests, or
- allocation of former agricultural lands, to be purchased by the forestry departments.

The calculated value of these grazing rights may indicate the value of the remaining silvopastoral operations in adjacent regions.

By far, the most important form of integrated management of crop, pasture, and forest lands in Europe is a combination of the different types of land use at the enterprise level. In this system, however, the areas allocated to each land use remain clearly separated. Millions of farmers, most of them possessing fewer than 50 hectares, manage their land in a mosaic of small fields, pastures, and forest lots. The agricultural land-use policy in Western Europe explicitly supports small-scale farm forestry, quite often with substantial incentives through subsidies and extension. In the Nordic Countries (Sweden, Finland, Norway), as well as in central Europe, cooperatives of farm forest owners are encouraged and promoted so that they may play a role similar to, or even greater than, the state in providing community forests at a local or regional level.

In eastern Europe, privatization of state forest is progressing, and will lead to structures similar to those in the West. During the current transition period, the private landowners' lack of experience in managing forests (as well as agricultural lands) may prove to be a limiting factor. One of the major threats to the sustainable management of the forest resources in these countries is the possibility that forests allocated to farmers will be immediately clearcut to provide the money so urgently needed for investment in buildings, machinery, fertilizers, and livestock. This is, at present, the most controversial argument among forest services, and agricultural societies and administrations. In Estonia, for example, several hundred thousand hectares of former private agricultural land was abandoned during the fifty years of Soviet

rule. Now, these lands are covered by mixed stands of mainly small-sized broadleaved species like birch, aspen, alder, and willow. If the land is returned to its former proprietors or sold to new owners, there will inevitably be severe problems regarding future 'sustainable' management.

### **Future prospects**

The future seems to offer some limited prospects for agroforestry in central and eastern Europe [Carruthers, 1990; Willems, 1987]. Large areas of agricultural land will probably be reallocated to other uses because of excessive food production (both, from crop plants and livestock), low agricultural prices on the world market, lack of cheap labor in rural areas, and concern about the environmental impact of various modern practices. The question remains how to use these areas. Some policies aim to convert marginal lands to non-agricultural uses, and to concentrate agricultural production on optimal sites. This strategy strives for higher efficiency by increasing the pressure on sites with the best natural and economic conditions. Other policies would convert the most productive lands to other uses, primarily in order to reduce agricultural overproduction. This might increase the need for investment on poorer sites and stress the ecological carrying capacity of these areas.

With both options the question remains what is to be done with the newly available areas. More than a million hectares in central, northern, and eastern Europe may be suitable for forestry. However, many land owners are not attracted to forestry because of its low net revenues and the risk of damage to the forest from environmental pollution. Smaller areas may be used for nature reserves. Other sites will be occupied by settlements, tourism and sports activities, and infrastructure – and industrial development. The remaining hundreds of thousands of hectares could be allocated to extensive forms of land use, including various forms of agroforestry.

One option would be improved fallow management with a focus on either biodiversity of natural landscapes, or product diversification in conjunction with quality improvement by ecological, rather than chemical, production methods. Agroforestry would offer a higher degree of resilience with regard to legal restrictions on land use than would forestry, and would meet the emotional preference of many people for a more natural and diversified environment. Agroforestry might also play a role in the restoration of degraded or polluted lands, including military training areas in eastern Europe, as long as these areas are used to produce industrial crops (e.g. for bioenergy) instead of food.

Because of the adverse site conditions, agroforestry may have less potential in the boreal zone of northern and northeastern Europe than in the other zones. When considering the future cultivation of wetlands in northern Russia, after large-scale drainage of hitherto low-yielding swamp and peat forests, it

is probable that vast monocultures with crop plants would fail, whereas a diversified landscape including many trees and shrubs, and providing various products and benefits, could reduce risks.

The feasibility of agroforestry projects in the European areas being discussed in this paper will, obviously, depend on many factors, including adequate financial returns, labor input, environmental compatibility, and land tenure [Gutton, 1991]. Agroforestry may succeed in areas where private land management prevails or can be established, but in the remote, almost uninhabited areas of northern Scandinavia and Russia, there is little potential other than a continuation of reindeer management. Agroforestry may also have a chance if people can afford to search for alternatives to professional stress and environmental monotony.

### **The competitors**

In areas with high population density, a high degree of urbanization and industrialization, and thus a higher standard of living, agroforestry will encounter severe difficulties when competing with other land uses [Van der Meiden, 1988]. Among the main limiting factors will be labor and time, the availability of income to purchase imported products that are aggressively marketed by multinational enterprises, and last but not least, prevailing conditions under which there is no necessity to use limited rural resources to supply individual subsistence and income. Under such conditions, agroforestry may be regarded as merely a hobby or a nostalgic alternative to common professional stress. Competing for an adequate allocation of land, capital, labor, government subsidies, and general acceptance would be extremely difficult.

In areas with a low population density, as in the Nordic countries and large parts of eastern Europe and Russia, the natural site conditions are so unfavorable for agroforestry that the options to combine trees, crop plants and/or animals will remain limited. As only a few people live in these regions, and many of them (especially the active young and better qualified persons) move to the cities in search of more attractive living conditions, labor is generally scarce and expensive. Therefore, large-scale mechanization – a technology that is not easily applied to agroforestry systems – is common. In Russia, the almost exclusive policy of organizing land use through large-scale kolkhozes or sovkhoses has practically excluded agroforestry for about seven decades, leaving little space for individual diversified land management except in tiny vegetable gardens.

In all three sub-regions under consideration, professional foresters, almost traditionally, have had strong reservations against cooperation with agriculture. They would, by all means, try to prevent the penetration of agriculture into their 'domain'. This attitude is based on previous bad experiences. Forestry has, almost continuously, been displaced to marginal sites by a

dominating agricultural society and rural development policies. Now, agroforestry might try to occupy the remaining favorable sites (and certainly not the worst sites) because the decreasing productivity and vitality of the forests threatens their sustainability and competitiveness.

There are a number of other reasons for foresters' reluctance to cooperate with agriculture. Silvopastoral use has caused erosion in hilly areas, soil compaction, and substantial damage to forest regeneration, among other problems. To prevent these impacts it is necessary to accept high costs for fencing and supervision. Forestry, as part of agricultural enterprises, has generally been regarded as merely a service component within the system, often neglected or, in times of special financial need, overexploited. Farmers owning or managing forests may not always follow professional recommendations for optimal forest management. Finally, many (state) foresters still consider their role to be the established 'king' of the forest, a role which they protect against all others, rather than offering their services to overall, integrated, regional development.

Farmers may fear increased labor and reduced income from agroforestry as compared to monospecific crops or livestock management. In Europe, the restrictions on changing land uses or applying management practices are generally more limiting for forests than for agricultural lands. Farmers may also be concerned about marketing facilities and the prospects for a diversified 'basket' of unconventional products. Those who remain on their land and depend on low-risk income for their enterprise may resist 'experiments' with agroforestry unless substantial, long-term government subsidies are granted.

Environmentalists may anticipate undesirable changes in biodiversity and landscape pattern, and may compete for lands that they want preserved or converted to protected areas. Agroforestry, as with all land-use systems, selects plant and animal species as components of its management system and, therefore, has an impact on the structure, vitality, and performance of the affected area. Environmentalists have a strong lobby and will probably exert an influence not only on agriculture and forestry, but also on agroforestry.

The tax-paying citizen may be concerned about the prospect of higher rural subsidies. Thus, the political decision-makers will compete for the limited financial resources that are available in public budgets, and agroforestry as a tiny 'newcomer' would have a marginal chance of competing successfully. Funds for rural development within the European countries and the EU do not yet provide for agroforestry.

The long list of expectations as to what agroforestry could provide for the individual, for society, and for national development should, therefore, be carefully analyzed, and reliable information provided to all interested groups to prove that agroforestry is – in contrast with its present image within Europe – not a nostalgic return to 'stone-age' practices, but a land-use strategy with a real development potential.

## Policy and implementation

The critical (but constructive) assessment of agroforestry's potential role in European land use will have to originate from basic, applied, adaptive, and strategic research. So far, there has been very little enthusiasm for European agroforestry research, especially when compared with the achievements in tropical/subtropical regions, or even North America. In addition, education and training in European agroforestry is rather pitiful. Agroforestry is either a 'nobody' within the European rural sciences curricula or an 'exotic' that offers mainly non-transferable overseas experience and challenges.

To address this problem, an answer will be needed to the question of why agroforestry should be encouraged. Are there problems which need to be solved by agroforestry? In the tropical world, the foremost challenge for agroforestry is more and sustainable food production. This is not a target in large parts of central, northern and eastern Europe. The same applies to fuelwood supply. Fuelwood (from agroforestry) cannot be expected to gain importance in Europe. Yields of various raw materials, such as fibers, tanning materials, dyes, pharmaceutical components, and industrial wood may have local potential, but may suffer from massive competition from chemical industries or commercial forestry. There are few socioeconomic incentives except in cases of government subsidies. Although agroforestry is labor-intensive and could help solve problems of underemployment, agroforestry jobs are more likely to find only limited acceptance, as is true of other types of low-paying rural work. The only approach with promise may be environmental protection and improvement. Agroforestry, however, is not the only option for achieving such goals.

If agroforestry is to become desirable in research and education, the focus should be on its economic viability ('does it pay?') as evaluated from a holistic systems approach, and on the marketing of agroforestry products and services. This necessitates timely and adequate ex-ante and ex-post evaluations, and monitoring. Among the criteria to be considered, listed according to priority, are:

- effectiveness (i.e., whether and how far implementable whatever the cost),
- efficiency in terms of cost/benefits, productivity, profitability,
- competitiveness with other land uses, with regard to labor, capital, markets, etc.,
- sustainability at different (national, regional, local, farm) levels,
- risks (political, social, economic, technical, biological, climatic, etc.),
- environmental compatibility,
- acceptance by land owners, rural societies, governments,
- transferability to other land owners, other regions,
- multiplier effect, impact on other sections of the economy, and
- development prospects.



For each of these criteria, objective (measurable) indicators will be needed. Their identification and application may be more difficult in practice than anticipated in theory.

Agroforestry does not 'happen by itself', at least not under the conditions prevailing in central, northern or eastern Europe. Agroforestry, in common with other land uses, requires investment, and investment depends heavily on political decisions [Van Maaren, 1988], the overall economic situation, and – in democratic systems – on the acceptance and participation of the citizens. The latter will depend on comparative social, environmental, and economic advantages of agroforestry against other land uses. These advantages will have to be continuously supported by research, education, extension and, last but not least, mass-media, NGOs, and agro-industries, i.e., a powerful lobby. Agroforestry is more than a technology or a specific practice. It is the way in which people deal with their natural resources and their environment, a way that is based on tradition, present status, and future prospects. It is a dynamic process within the increasingly complex systems of society.

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