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THE APPLICATION OF THE ECOSYSTEM APPROACH THROUGH SUSTAINABLE FOREST MANAGEMENT: AN ITALIAN CASE STUDY

During the last decades adapting silvicultural systems to a changed society, increasingly aware of the multifunctional role of forests, was a much debated issue in Italy. Stemming from this discussion is the systemic silviculture concept, an adaptive forest management tool aimed at cultivating the forest as a self-organizing system and focusing on sustaining its functional efficiency as the best way to enhance forest multi-functionality. This concept has much connection with the Ecosystem Approach defined by the Convention on Biological Diversity as a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. In the following a case study is presented where the principles of systemic silviculture are implemented in the management of private and common forest properties in the Serre mountains of the Calabria Region (Italy); relationships with the Ecosystem Approach principles are analyzed in order to evaluate to what extent systemic silviculture can be regarded as a means to bring the EA to the implementation level.

Keywords: Convention on Biological Diversity; Pan-European Biological and Landscape Diversity Strategy; forest management on a natural basis; systemic silviculture.
Parole chiave: Convenzione sulla Diversità Biologica; Strategia Pan-Europea su Diversità Biologica e Paesaggio; gestione forestale su basi naturali; selvicoltura sistemica.

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1. Global framework

Over the last decades, conservation and sustainable use of forest biodiversity have been some of the major issues of international high-level policy processes.

The term Sustainable Forest Management (SFM) can be traced back to the so-called Forest Principles deriving from UNCED (1992): "Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations" (Principle 2b). The concept of SFM has continued shaping up in the international forest policy dialogue (e.g., the United Nations Forum on Forests, UNFF) and in several country-led and eco-regional initiatives aimed at transferring it into practice, through the development of criteria and indicators of SFM.

The Convention on Biological Diversity (CBD) defined the Ecosystem Approach (EA) as "a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way"; accordingly 12 Principles (known as the Malawi principles) and five Operational Guidelines (Decision V/6 of the Conference of the Parties, 2000) have been identified as a guidance for assessing its practical implementation. In the last decade CBD also highlighted the importance of sustainable management of non-timber forest resources and wildlife to people and its implications for the current development of Ecosystems Services evaluation in forestry. On the other side, a rigorous analysis of the causes of unsustainable harvesting has been carried out, underlying the changes in socioeconomic factors as main drivers all over the world (CBD, 2001).

In the European context, the Ministerial Conference on the Protection of Forest in Europe (MCPFE) produced several declarations and resolutions, such as the "General Guidelines for Sustainable Management of Forest in Europe" (Helsinki Conference, 1993), contributing to the definition of SFM. Furthermore, within the ministerial process Environment for Europe (EfE), the Pan-European Biological and Landscape Diversity Strategy (PEBLDS) represents the coordinating political framework addressing the conservation of biological and landscape diversity, including forest biodiversity.

In order to promote the regional implementation to Decision VI/22 of the Sixth Conference of the Parties to the CBD and Resolution 3/4 of the third Session of the UNFF, the MCPFE and the PEBLDS adopted a Framework for Cooperation to clarify the relationship between the EA and SFM, and established an Ad Hoc Working Group in 2004.

Building on the recognition by Decision VII/11 of the Seventh Conference of the Parties to the CBD that SFM can be considered as a means of applying

the EA to forests and taking into account the FAO Forest Management Working Paper on "Sustainable Forest Management and the Ecosystem Approach: two concepts, one goal" (FAO, 2003), the Ad Hoc Working Group produced a "Joint position of the MCPFE and the EfE/PEBLDS on the Pan-European Understanding of the Linkage between the Ecosystem Approach and Sustainable Forest Management" (MCPFE/PEBLDS, 2006). The document discusses the relationships and linkages between SFM (as defined by the MCPFE) and the EA, and presents existing MCPFE tools and processes for implementing SFM and the EA in Europe. Indeed even the last MCPFE report on Sustainable Forest Management in Europe (KOHL and RAMETSTEINER, 2007) has largely benefited from the past discussion and has been strictly influenced by these approaches.

2. RECENT APPROACH TO FOREST MANAGEMENT IN ITALY

In the last decades much discussion in Italy has been devoted to the issue of reconsidering the meaning of silviculture in relation to a changed society which acknowledges forests as complex multi-functional systems.

Traditional silvicultural schemes aiming at prefiguring and implementing a specific forest structure, in the search of an optimized timber yield, have been criticized as regarded unacceptable, inappropriate and out of date to deal with the complex and not linear nature of ecosystems. Forest normalization has been also seen as a limitation to forest management credibility also from the point of view of external perception (CIANCIO *et al.*, 1999).

A new approach to silviculture, referred to as *systemic silviculture,* has stemmed from this discussion. The key concept of systemic silviculture is the respect of the self-organizing ability of forest systems, which can be achieved increasing their complexity and biodiversity without predetermining the stand structure (CIANCIO and NOCENTINI, 1997; CIANCIO *et al.*, 2003). This approach emphasizes the need to cultivate the forest as a dynamic system, being aware that the responses to disturbances, including silvicultural treatments, are non-linear and unpredictable. Management is adaptive in that aims and methods are adjusted to conditions of forest. All that implies, from an operational viewpoint, that the action of silviculture must depend on the forest ecosystem conditions and respect and promote the heterogeneity of stand structure (CIANCIO, 2009). Non intervention is regarded as the most applicable active management choice for forest ecosystems suffering from a high level of degradation or, conversely, characterized by a very high functional efficiency. In the other cases, the goal of cultivation is triggering processes of self-organisation, until the forest acquires the necessary stability or, otherwise

said, a state of bioecological efficiency. From our standpoint, this silvicultural approach is consistent with many key points of the EA as formulated and assessed by the 12 Malawi principles.

In the following, the case study of the Serre Calabresi forests (Southern Italy) is presented where the principles of systemic silviculture are implemented in the management of both private and common forest properties covering about 7000 ha. Aim of the paper is to show to what extent forest management in that area is able to put into practice the EA, although it is mostly the result of unwritten rules of silviculture and planning applied for the last decades rather than the consequence of formal decisions made by the local forest authority or the owners.

3. Case study: the mixed silver fir-beech forests of the Serre Calabresi mountains

3.1. The environment and past management

On the basis of pollinic analyses, historical documentation and phytogeografic and ecological studies, it has been proved that the mixed beech (*Fagus silvatica* L.) and silver fir (*Abies alba* Mill.) forest had a wider distribution in the past than now. On the Appennine mountains, such forests were subjected to simplification of stand structure and composition due to the decrease or disappearance of silver fir. Too frequent and intensive harvesting on wide areas, illegal cutting and overgrazing determined harsh environmental conditions for natural regeneration of silver fir and caused the contraction of the natural range of the species. Consequently, those which were once mixed forests have became pure beech forests and the presence of fir remained significant only in some areas (Iovino and Menguzzato, 1997). Furthermore, altering the composition reduced the stability, functionality and biodiversity of the ecosystem.

The original physiognomy of the mixed fir-beech forest formation still remains in the southern part of the Appennines, specifically on the Serre Calabresi mountains. Particular climatic conditions (up to 1800 mm per year of annual rainfall, high humidity, presence of mists even on summer) and soil fertility allow the fir to grow in this southernmost part of its natural range and return to spread in beech forests. The mixed fir-beech stands guarantee the natural regeneration to both species, the permanent covering of the soil, and the conservation of the biological functionality of the forest ecosystem, in addition to high levels of wood production.

The most representative forests of that district are the Communal property forests of Serra San Bruno, Spadola and Brognaturo which altogether

are named *Abetine delle Serre* (Serre silver fir forest) and cover an area of about 2600 ha, as well as some private forests like the Ferdinandea and the Santa Maria forests.

The Serra San Bruno forest covers an area of over 1350 hectares, between an altitude of about 750 and 1400 m a.s.l. It is prevailingly composed of beech, fir and chestnut (*Castanea sativa* Mill.). The pure or mixed fir and beech forests cover approximately 64% of the whole forest area. They are represented by four forest types: pure fir stands, pure beech stands, mixed fir-beech stands with prevalence of fir and mixed beech-fir stands with prevalence of beech. Chestnut coppices, reforestations (mainly with *Pinus nigra* Arn. var. *calabrica*) and mixed broad-leaved stands own the rest of the forest area. The present structure and composition of the forest derive from the silvicultural treatment applied for over a century on the basis of the management plans. The first plan (1902) reports that the silver fir trees were 58,1% of the total and those of beech 41,9% and an annual cutting of 1388 trees, then reduced to 1000, equally divided between the two species. The management goal was to limit gradually the presence of beech. Since the second (1961) and the third (1974) plan, management has been oriented to the constitution of mixed stands with prevalence of fir through the application of the small group selection system.

The Brognaturo and Spadola forest covers over 1200 hectares, between an altitude of about 800 and 1250 m a.s.l.. The pure beech stands and the mixed fir-beech stands cover approximately 61% of the whole forest area. The structure of the forest results from the shelterwood system.

The Ferdinandea forest is contiguous to the public forests of Serra San Bruno, Spadola e Brognaturo and currently is a private property which owns about 4000 hectares. The forest is almost all composed by beech and fir. Between the years 1700 and 1860 the Ferdinandea was a hunting reserve of the family of the Bourbons (the kings of Naples) and supplied coal to the nearby factory of weapons in Mongiana. After the Unification of Italy, the estate was for a short time a state property, then sold to private. The present structure and composition of the forest derive from the management followed during the Bourbons period. In the past beech was by far the prevailing species and the silvicultural system applied was clear-cutting with standards with a rotation of 24 years. As a consequence, the high forest was converted into coppices. Since the second half of the twentieth century, a reduced human influence and a management oriented to the conversion of coppice into high-forest have contributed to improve the health of the forest and the spread of fir into the beech stands. At present the Ferdinandea forest has a growing stock of 400-500 m^3/ha. Selection cutting by small groups is the treatment applied in the pure beech stands and in the mixed beech-fir stands.

The Santa Maria forest is a private property that covers an area of 800 ha near the village of Serra San Bruno, between 820 and 1090 m a.s.l. The stands, fairly young – the mean age of the trees does not exceed 50-60 years – are composed of beech, fir and chestnut. Only a small surface is covered by pure old fir stands (about 100 years old). Over the last fifty years the forest management has been based on the shelterwood system.

3.2. Ecosystem approach and the management on the Serre Calabresi forests

The silvicultural systems adopted in both private and public forests fall within the concept of Continuous Cover Forestry. That kind of stand management can guarantee the important social functions of mountain forests such as soil conservation, protection from natural hazards like landslides and floods, water conservation and landscape. Limited areas in the lower parts of some valleys are still covered by oak (*Quercus* spp) and chestnut coppices, where clearcutting on small surfaces with release of standards is applied. Nevertheless, thanks to the fast growing of the sprouts from stumps, the crown cover is restored in few years limiting soil erosion and only summer fires can start serious degradation processes of forest stands.

The main relationships between actions connected to the EA (MCPFE/PEBLDS, 2006) and their implementation into forest management in the considered territory are reported in Table 1.

3.2.1. Management framework

According to the Italian forest law, planning is compulsory for public forest owners. Until some decades ago, the Brognaturo and Serra San Bruno forests had formal management plans based on traditional silvicultural systems, mainly shelterwood. But, the prescribed treatments were rarely applied because they have been considered too rigid, and not suitable to the actual stand characteristics and market conditions. Today, in the considered area, formal updated management plans at forest management unit level are not effective anymore. Conversely, traditional stand-wise management plans are surrogated by extensive planning of large territories for multiple uses and integration of forest, rural and landscape planning procedures, such as the regional Forest Regulation prescriptions set up on a regional or provincial level.

Harvesting is scheduled when it is more convenient from ecological and economical point of view. The main management goal is to maintain forest composition, density, structure and growing stock stable over time (IOVINO and MENGUZZATO, 1997).

This management approach complies with specific suggestions for systems complies at different functional and efficiency levels. It is, therefore, pos-

Table 1 – Actions connected to forest management implementation of the EA in the Serre forests, according to the scheme by MCPFE/PEBLDS (2006).

EA principle	*Action*	*Implementation*
1	Partnership in implementation of forest management, cooperation with other stakeholders	Yes, through unwritten negotiation with breeders to limit cattle load in forest and establish rotation
1	Forest certification	Not yet implemented
2	Decentralization of forest management decision making	Forest planning is carried out at the property level; silvicultural prescriptions are decided on a stand level
3	Is the nature inventory conducted at the plot before deciding afforestation?	Yes
3	Check of indicator species	Specifically, within the two Natura 2000 sites
3	Is soil analysis carried out and potential vegetation assessed?	Not in a conventional way
3	Is the principle of not-using non-native species for afforestation applied?	Yes
3	Is the spontaneous natural forest regeneration promoted?	Silvicultural treatments are based only on natural regeneration
3	Are the natural ponds and flooding excluded from afforestation?	Yes
3	Is the boundary between forest and open land ecosystem shaped within its ecological function?	Specific prescriptions are given in windy areas to use the forest boundary as windbreaks protecting the lying behind stands
3	Are native species used for afforestation?	Yes
4	Shift from clear-cutting to selective cutting	The treatments applied are unconventional shelterwood and selective cutting by small groups; clearcutting is not allowed, except for oak and chestnut coppices
4	Designating and leaving for natural development and natural tree death some of the forest sections "bio groups" within one management unit	State forests are generally left for natural development for long time
4	Existence of specific regulations to promote ecological approach in forest management	Yes: Regional silvicultural guidelines, Regional guidelines for planning of public forests, Regional Forest Plan
4	Economic evaluation of full range of non-wood forest services	Partially. The main issue is related to the picking of undergrowth mushrooms as an important source of revenue for local people
4	Use of incentives to promote biodiversity conservation and sustainable use at the forest unit level	Incentives come from specific measures of the EU Rural Development Plan and Regional Forest Plan

(continued)

Continued Table 1

EA principle	*Action*	*Implementation*
4	Conservation of forest ecosystem resilience	Mixed fir-beech forest with multicoorths stand structure has a high level of diversity and stability which guarantee ecosystem resilience
5	Conservation of all the functions of forest ecosystem, including threatened species conservation, cultural sites, etc. (multifunctional forestry)	Protection against erosion and natural hazards, water conservation and landscape amenity are important goals of current management
5	Dead wood volume estimation	Implemented only on National Forest Inventory plots; picking of deadwood in public forets is a still asserted right for local communities
5	Monitoring conservation of threatened species and habitat	Specifically, within the two Natura 2000 sites
6	Proper age of trees harvested	Generally, yes; in private forests maximum diameter rarely exceeds 50 cm; in public forests larger (and older) trees are more common
6	Harvesting less than 100% of annual increment	Yes
7	Use of temporal scale in forest management	Yes
7	Cooperation with neighbourhood forest units in specific management problems resolution, particularly those which need proper temporal scale	Not yet implemented
7	Landscape planning approach in afforestation	Yes
7	Proper zooning of forest unit according to their functions	In some public forests, protective compartments are somewhat distinguished from productive ones, but sharp spatial distinction of management targets is overcome
8	Long term objectives set in forest management plan, including temporal scale	Yes, by both Regional Forest Plan and recent local plans
8	Genes conservation	Regional silvicultural guidelines aim at conserving forest biodiversity and habitats within Natura 2000 sites
8	Leaving specific trees for seeding while harvesting	Not required by the silvicultural treatments applied to obtain natural regeneration of stands
8	Monitoring of slow-changing variables in forest ecosystem	Several permanent plots were established by local scientific institutions for experimental purposes
8	National Forest Programmes long-term objectives	Not yet implemented

(continued)

Continued Table 1

EA principle	*Action*	*Implementation*
9	Adaptive management	Yes, cutting intensity is adapted to site characteristics, stand structure and timber demand from market
9	Climate change	Not specifically addressed
11	Scientific research, application of its results in forest management	Yes
11	Initiation of new research	Permanent research plots established by local scientific institutions
11	Use of traditional knowledge	Yes, management of private forest is highly based on local traditional knowledge
11	Use of information from stakeholders	Yes, management of private forest is highly based on local traditional knowledge
11	Cultural and social dimension of SFM	Not specifically addressed
12	Promoting partnership and transparency in forest management	Not specifically addressed
12	Educational activities, raising awarness	Yes, especially through visits by primary and secondary schools

sible to define a general framework of technical guidelines for a wide range of intervention levels. Adjustments to the specific requirements of each level are implemented by modifying intervention parameter values (intensity, frequency, etc.) within the given framework. The following are the most relevant aspects of the general framework:

– identification of the specific values of each forest complex;
– overcoming sharp spatial distinction of management targets (e.g. absolute preservation on one side and intensive wood production on the other). Protection of forest complexity and biodiversity is a prominent requirement throughout the entire area, under a so-called "integrative" approach;
– overcoming *a priori* yield determination and aiming instead at a planning approach that relies on periodic monitoring of yield levels as the mean of verification;
– search for impact-reducing cultivation methods that preserve existing values and promote others (e.g., adoption of a modular cutting system, favouring natural mixture of species, grazing control, releasing particularly large trees and, to some extent, standing deadwood and large woody debris, etc.).

3.2.2. Silvicultural approach

Silvicultural common rules adopted on an operational level provide for:

– avoiding rigid silvicultural schemes. Different, specific objectives need to be adopted for each stand, adapted to each particular structure and site conditions instead of necessarily trying to converge on predetermined, so-called normal structures by means of a sequence of predetermined treatments. The interventions are based on detailed comparative evaluations of the effects of previous actions;
– following and sustaining natural regeneration processes. This is done by enhancing the structural complexity of forest, favouring irregularities in the spatial and temporal distribution of the natural regeneration;
– linking tree felling criteria, in very general terms, to conditions of single trees or tree groups. The risk of reducing diversity, inherent to all artificial interventions, is minimised avoiding and uniform treatments that alter natural selection processes Heterogeneity is favoured, maintaining rare species, trees with cavities that are potential nesting sites, etc.;
– minimising alterations in nutrient cycles, only removing what is truly important to remove, leaving dead or decaying trees and decomposing branches, which may offer suitable habitats for woodpeckers, birds of prey, insects and many lower plants.

In private forests, managed without formal planning based on traditional silvicultural systems, a kind of small group selective cutting is usually implemented whose scientific basis were showed by CIANCIO *et al.* (2006) . The treatment is repeated at short time interval (8-10 years in beech forests or mixed silver fir-beech forests, but it can be longer according to the actual stand composition). About 60-80 m^3 per hectare on average are harvested (70-100 trees per hectare with 35-50 cm of mean dbh) corresponding to the periodic increment of volume (IOVINO and MENGUZZATO, 2004). After harvesting growing stock should not be lower than 300/350 m^3 per hectare (CIANCIO *et al.*, 2008). In such a way, by means of low impact interventions, it is possible to obtain the natural regeneration in small gaps favouring heterogeneity and diversification of forest structure with positive effects on biodiversity. On the whole, the forest has a mixed, unevenaged structure by groups with a rather fine texture and high degree of diversity. The percentage of fir and beech is variable in the different forest compartments according to site conditions and past treatment (Photo 1 e 2).

In public forests, silvicultural prescriptions of expired management plans are adjusted to stand structure, which is very variable also within the same compartments. The silvicultural treatment implemented can be defined as a sort of "irregular shelterwood" because the selection of the trees to harvest tries to

Photo 1 – Both beech and fir regenerate by small groups under the canopy cover after the cutting of one or few trees which allows more light to reach the forest floor.

Photo 2 – Regeneration of beech within small gaps. In pure beech forest, far away from fir stands, the mixed forest cannot develop but the stand structure shows a high degree of diversity.

follow the general rules of shelterwood. However, cutting characteristics and intensity vary a lot according to site conditions, stand density and the presence of advanced natural regeneration under the cover of mature trees. In the latter case, the gradual canopy opening favours the natural regeneration of fir under the beech cover and vice-versa. As a result, the stands have a two storied structure with the overstorey prevailingly composed of only one of the two species (Photo 3). Thinnings do not give any revenue to the owner and can be carried out only using resources coming from the sale of the harvested mature trees, which have to be used also for the maintenance of forest roads.

In the forest compartments where the cost of harvesting is too high because of the low density of roads and severe site conditions, the stands are released to natural evolution for a long time. That is a good opportunity for biodiversity enhancement.

Photo 3 – Natural regeneration of beech under the cover of fir before the final cutting. The unconventional shelterwood applied in mixed fir-beech public forests create a two storey stand structure where each layer is comprised by only one of the two species.

3.2.3. Wood harvesting and marketing

The level of mechanization is low in both public and private forests. Skidding is generally made by traditional systems which are based on oxen and mules. The use of winches adapted to agricultural tractors is limited to the forest compartments where the road network is sufficiently dense. The labor productivity is not very high but the impact on the forest environment, particularly on the soil and the natural regeneration, is low. Furthermore, suitable timing and localization of harvesting operations are respected in order to prevent both interference with the reproductive season of wildlife and disturbance of rare or threatened species within the two Natura 2000 sites (see 3.2.5).

The stumpage value of roundwood ranges usually between 20 and 70 euro/m^3 according to different site conditions and stem quality, with average values around 40 euro/m^3.

Logs are sold to forest industries outside the region Calabria. Forest owners often directly contact wood processing companies to offer timber and harvesting is made on demand. For that a flexible management planning is applied more suitable to a very variable demand.

The harvesting of coppices produces poles of different sizes (from chestnut coppices) for fences and agricultural uses and firewood (from oak coppices). The demand of such products is very high in the local market. The forests on the Serre Calabresi are located in a rural context where agriculture is still very important for local economy. Average stumpage value of firewood is about 30 euro/m^3.

3.2.4. Non timber forest products and services

In pure beech and mixed silver fir-beech high forests it is very difficult to limit grazing and the picking of dead wood, mushrooms and other fruits in the underwood from which many families can get some revenue. If uncontrolled, these activities may have a negative impact on natural regeneration of stands, especially in public forests burdened by ancient grazing rights, and on biodiversity. Even in such a case the EA to management is implemented empirically. Forest owners look for unwritten compromises with local breeders which aim to limit the load per hectare and to keep the cattle far from the stands where the natural regeneration is in a critical stage. The estimated financial benefits from sustainable grazing and mushroom picking average approximatively about 10 euro/ha and 15 euro/ha, respectively.

Forest-related services includes hunting licences, renting of huts and houses as well as forest-based leisure, like sport, eco-tourism and outdoor adventure activities, and educational services that are not free of cost to con-

sumers (turists, pupils, children). Most services are not directly marketed by the forest owners, and no reliable data can be provided on this subject.

3.2.5. Biodiversity conservation

The silvicultural systems applied to the forests on the Serre Calabresi mountains has determinated a high degree of stand structural diversity. As well known, stand structure complexity is often positively related to other aspects of forest biodiversity like the richness of animal species. Ungulates and big predators like wolf and bear, as well as many birds species, were cancelled from the Serre forests. Hunting had no limitations until some decades ago because it was considered necessary for the existence of local communities and to protect cattle. The good conservation of the forest habitat is an essential premise so that many wildlife species could be introduced again.

The positive results which management has attained over the last decades in the Serre Calabresi forest habitat conservation have been certified by the creation of two wide Natura 2000 sites. The first one (Bosco di Stilo - Bosco di Archiforo, code IT9350121) covers an area of about 4000 hectares and comprises mainly public forests. The second one (Bosco di Santa Maria, code IT9350118) is 800 ha wide and includes only private forests. In both sites, the 80% of the total area is covered by mixed silver fir-beech forests.

It has to be stressed that forest management in the Serre Calabresi mountains is contributing to the conservation of the silver fir in the southernmost part of the natural range of that species which in Calabria presents peculiar genetic characteristics.

4. Outline

According to Ciancio *et al.* (2003) and Ciancio and Nocentini (2004), the conservation and enhancement of the Mediterranean forests must be based on strong actions aiming at:

– preserving the last remnants of the primeval forests;
– renaturalising ecosystems that have been simplified by past management;
– maintaining traditional forms of forest use where these are truly a part of the local culture and knowledge.

The silvicultural systems applied on the Serre Calabresi mountains in the recent years may represent an actual example of forest management aimed at meeting the right balance between social, economic, ecological, cultural and spiritual aspects, in accordance with the SFM principles within the EA.

According to the 2007-2013 Regional Forest Plan, this kind of approach can feasibly be introduced in the management of all the forest properties in Calabria (REGIONE CALABRIA, 2007). The application of EA to forest management can be even sustained by economic instruments (incentives, contractual agreements, etc.) and technical assistance, as recognition of the services rendered by the forest to society as a whole. Several European Union financing instruments can be exploited to this end, like Life+ or agricultural policy measures (e.g., see the measures n° 224, 225 and 229 under the EU Regulation 1698/2005).

Forest are complex, self-regulating, dynamically changing systems. For that, an adaptive management approach based on systemic silviculture is needed to frame operational practices in the primary search for forest functional efficiency. Such approach does not refer to the rigid and prearranged parameters of normal forest models (rotation, maximum diamer, growing stock, etc.) but aims at favouring the interactions between the components of the ecosystem (CIANCIO and NOCENTINI, 1997).

The continuation of economic activities in the form of Sustainable Forest Management, especially in forest systems that have a long history of use integrated into local traditions and culture, is fundamental for the implementation of a EA strategy that is really effective and widely accepted.

RIASSUNTO

Applicazione dell'approccio ecosistemico attraverso la gestione forestale sostenibile: un caso di studio in Italia

Negli ultimi decenni si è molto dibattuto in Italia circa la necessità di adattare approcci e sistemi selvicolturali alle aspettative di una società sempre più consapevole del ruolo multifunzionale delle foreste. In questo contesto è stato formulato il concetto di selvicoltura sistemica: un approccio adattivo alla coltivazione della foresta, intesa come un sistema complesso e dotato di capacità auto-organizzativa, finalizzato a supportarne l'efficienza bioecologica per garantirne la multifunzionalità. La selvicoltura sistemica presenta affinità con l'approccio ecosistemico (*Ecosystem Approach*) proposto all'interno della Convenzione sulla Biversità Biologica (CBD), una strategia integrata di gestione del territorio, acque e risorse biologiche basato su criteri di sostenibilità e equità (generazionale e intergenerazionale). Si presenta qui un caso di studio ove i princìpi della selvicoltura sistemica sono applicati alla gestione delle proprietà forestali, private e pubbliche, delle Serre Calabresi nella Regione Calabria; sono analizzate le relazioni con i principi dell'approccio ecosistemico (*sensu* CBD) al fine di valutare in che misura la selvicoltura sistemica possa essere considerata uno strumento di applicazione dell'approccio ecosistemico nella gestione forestale operativa.

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