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*Biodiversity conservation
in the Mediterranean
forest*



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- The concept of biodiversity projects the problem far beyond the protection of individual species or biotopes.
- It involves ecosystems and their functioning.

**Diverse ecosystems give rise to different life forms,
habitats and cultures.
This is particularly true in the Mediterranean area.**



forest ecosystems:

→ complex biological systems



Sustained production depends on the possibility of predicting the regeneration rate of the resource.

This is the principle behind the theory of the *regulated or normal forest*: a forest where everything is predictable and controlled

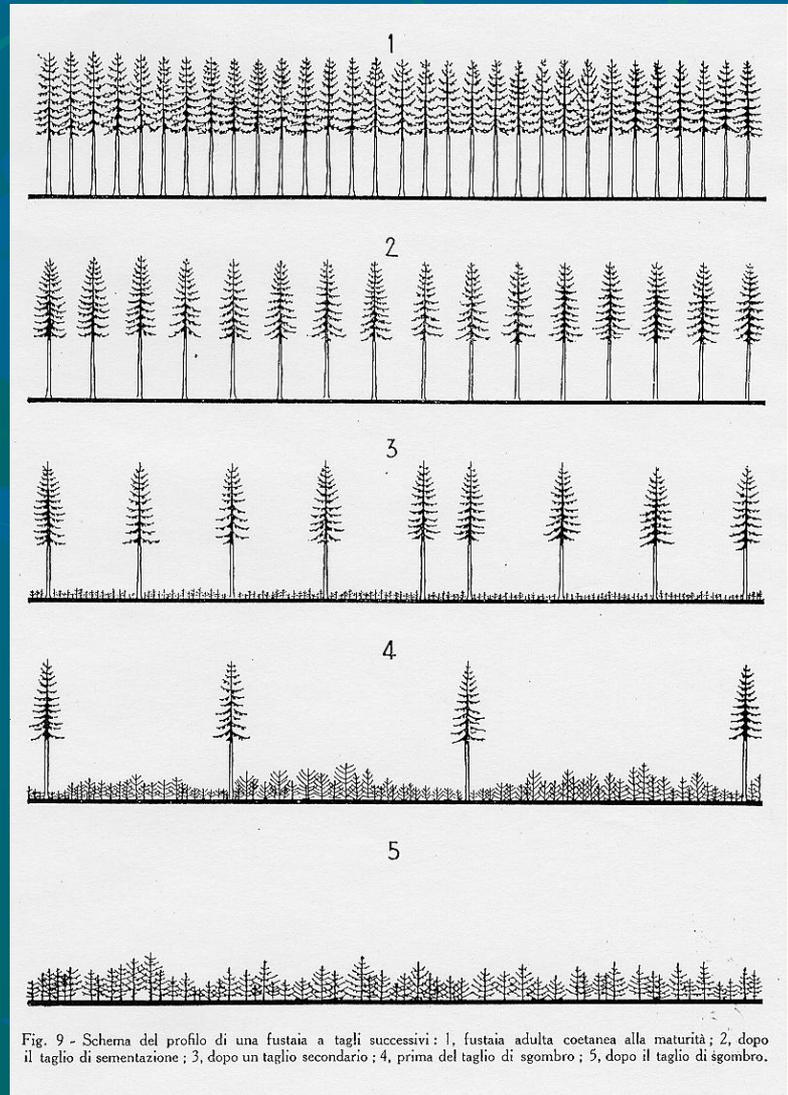
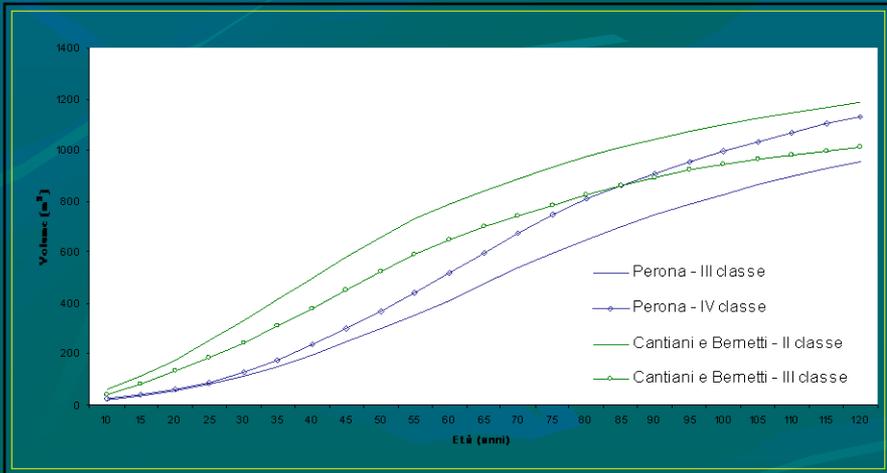


Fig. 9 - Schema del profilo di una fustaia a tagli successivi: 1, fustaia adulta coetanea alla maturità; 2, dopo il taglio di sementazione; 3, dopo un taglio secondario; 4, prima del taglio di sgombrò; 5, dopo il taglio di sgombrò.



Classic silviculture and management, with the aim of predicting regeneration rate and producing a constant yield of merchantable wood, have in practice transformed complex ecosystems into simplified systems.



Silviculture has usually favoured one or few species, depending on particular characters, such as productivity, growth rate, quality and quantity of wood production, sprouting capacity, etc.





The simplification of forest systems does not involve only the number of species, it also impacts the variety of structures and processes at different scales, from the stand to the landscape.

- The application of rotation ages sensibly shorter than natural tree longevity is one of the factors which causes the most evident difference between human impacted forest landscapes and natural landscapes
 - 53% of Italian forests are coppices, with an age averaging 20-25 years
 - almost 60% of high forest stands are even-aged with uniform structure over large areas
 - most of them do not reach 60 years of age, and less than 20% are over 100 years old.

(Temperate and Boreal Forest Resources Assessment - UN 2000).

When the role of biodiversity in the functioning of forest ecosystems is considered in relation to management, generally the analysis concentrates on the impact that the different cultivation techniques have on a few parameters or indicators, such as the variation in the number of species of particular interest



The forest: only a list of species?

- forest ecosystems are too **complex and unpredictable** to allow for an accurately deterministic management of all their components
- forest ecosystems are dominated by processes that cross **multiple space and time scales**
- the forest is not a closed system, but **interacts with other systems** such as the social system, the economic system, the cultural system . . .

the **reference models**
of classic silviculture and management are the real
cause of the **simplification** of forest ecosystems

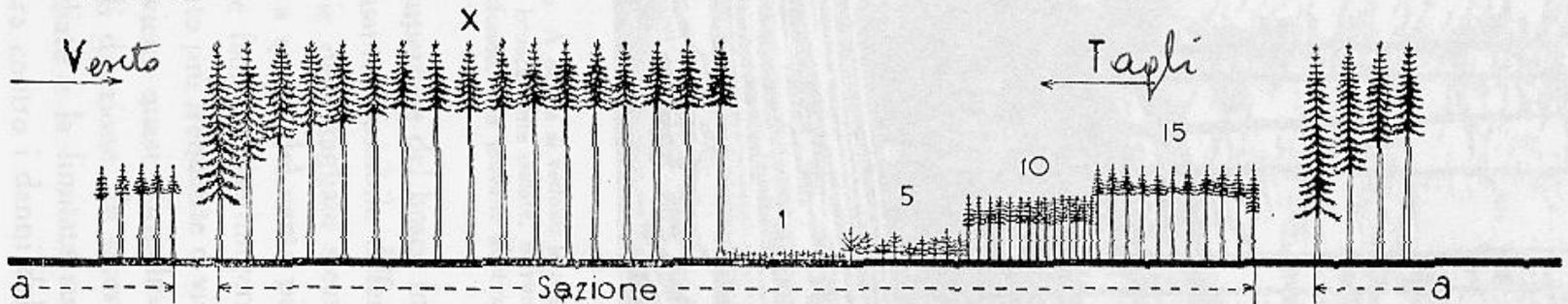


Fig. 4 - Rappresentazione schematica del profilo di una fustaia a taglio raso. V. direzione del vento dominante; T. direzione dei tagli.
Particelle di ogni sezione: x = matura. 1, 5, 10, 15... di anni 1, 5, 10, 15... a , a , sezioni adiacenti.

The countries around the Mediterranean basin are characterized by a long history of heavy exploitation of natural resources.

- The forest has disappeared over vast areas or has been relegated on the poorest soils.
- In many areas, important reforestation projects carried out during the last century have produced even aged pure conifer stands.
- Very often the original forest has been transformed into coppices.
- On the best sites, where cultivation has maintained high forest stands, the application of silvicultural models oriented towards maximizing wood production has generally favoured even aged structures and the prevalence of one or few tree species

In the Mediterranean area there is also a diversity produced and sustained by human activity which has a relevant historical, cultural and landscape value



Biodiversity conservation in Mediterranean forests must therefore be based on a strong action aimed at:

- preserving the last, rare, remnants of the primeval forest;
- renaturalising forest systems that have been simplified by past management;
- maintaining traditional forms of forest use where these are truly a part of the local culture and traditional knowledge

It is especially in managing simplified forest systems that biodiversity conservation must be based on the coherence between theory and practice: here management must not be oriented towards recreating a supposed “natural” state, but should sustain natural evolutionary processes which tend to increase the system’s diversity and complexity.



the Vallombrosa Forest Management Plan



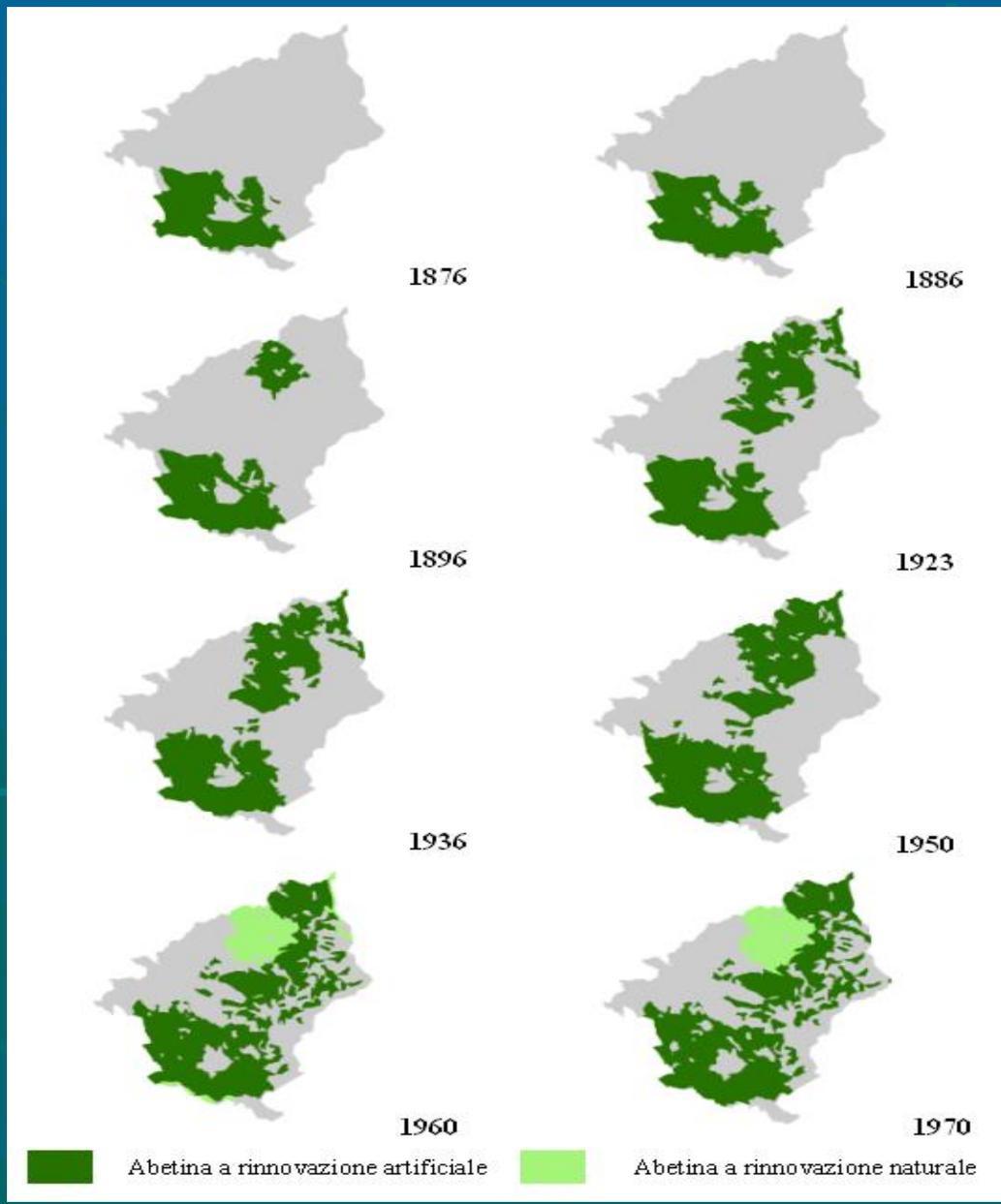
These even aged, pure silver fir stands are still today a characterizing element of the Vallombrosa forest landscape



At the end of the XIXth century, with the birth and development of the Italian Forestry School at Vallombrosa, the silver fir stands became the scientific and didactic model of classic forest management based on the “normal” or “regulated” forest

Forest regulation plans

Year	Author	Silver fir total surface	Silver fir clear felling	Rotation age	Forest regulation method
		ha	ha	years	
1876	Giacomelli	217,40	217,40	80	age class area regulation
1886	Perona	229,31	229,31	90	age class area regulation
1896	Perona	292,34	292,34	90	age class area regulation
1923	Di Tella	482,39	482,39	100	age class area regulation
1935	Patrone	493,45	493,45	100	felling series
1950	Patrone	517,56	517,56	100	age class area regulation
1960	Patrone	680,01	554,98	100	age class area regulation
1970	Patrone	664,45	445,02	100	age class area regulation



The new management plan aims at the gradual evolution of the fir stands towards mixed stands with a more complex structure based on natural regeneration

- management tends towards the increase of forest complexity and diversity instead of trying to maintain regular, homogeneous structures which were aimed at maximizing yield;
- management is based on a type of silviculture that is not tied to prefixed schemes but is instead free to follow the natural self-organizing processes of each stand;
- the aim is to favour natural evolution towards mixed, self-regenerating stands; criteria such as rotation age or allowable cut are abandoned;
- monitoring and control are the basis for the evaluation of management

The Vallombrosa Forest

State Natural
Forest Reserve



NATURA 2000 Site

- The analysis of the ecological requirements of the species and the characters and distribution of the habitats within the Vallombrosa Forest showed that most of the species depend on an increase of structural diversity at different space and time scales
 - The management approach proposed by the new plan is perfectly coherent with this aim.
- Thus biodiversity conservation is not in conflict with forest management but is, instead, a direct consequence of the systemic approach.

This management approach will produce, in the long run, a change in the landscape characters of the Vallombrosa Forest



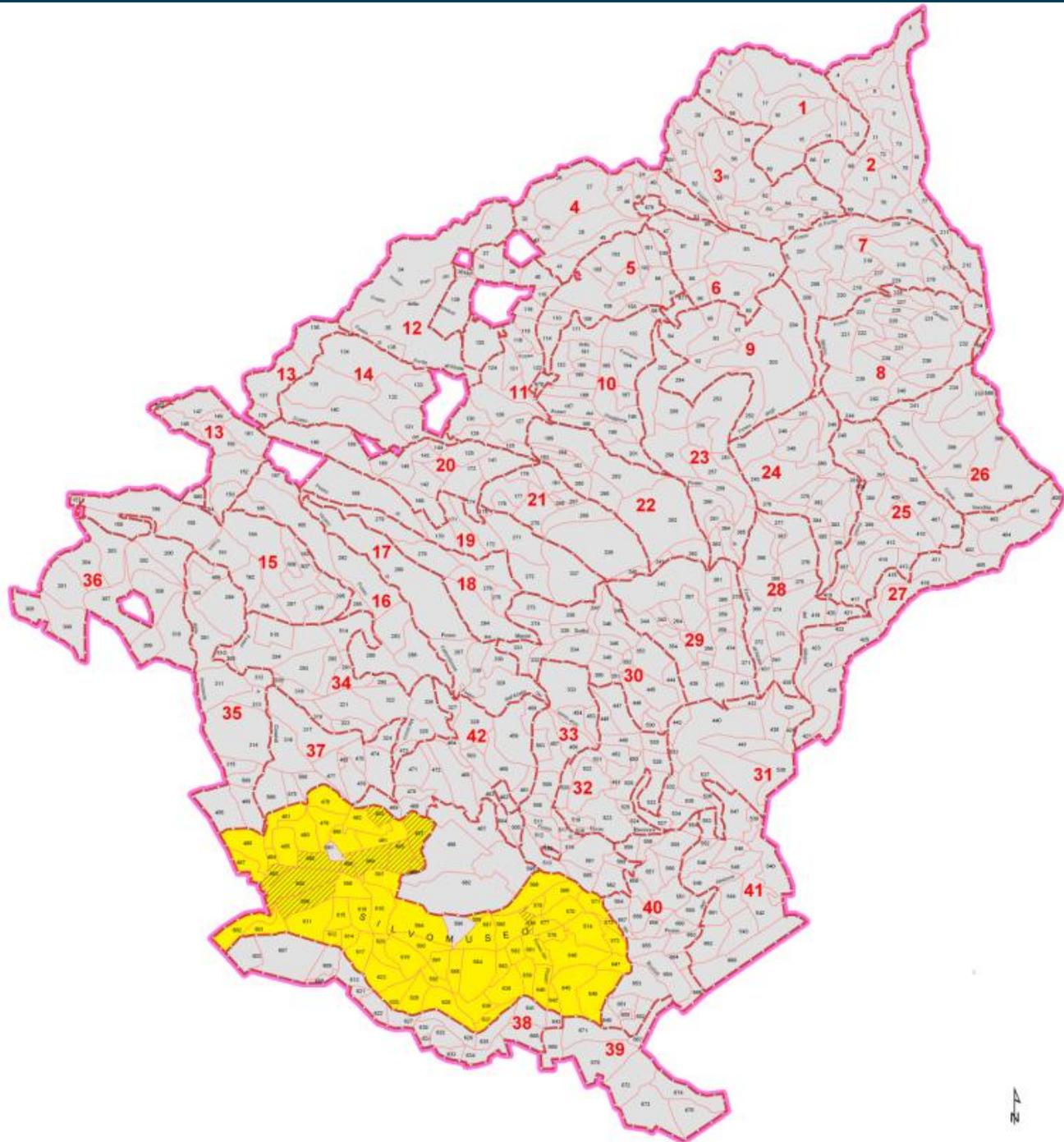
The idea of a “Silvomuseum” in Vallombrosa

- conserve the historic, cultural and landscape values of the fir stands by conserving the cultivation and management system started by the Vallombrosan Monks
- The aim is to conserve a dynamic mosaic of pure, even aged silver fir stands

Forest plan of the Natural Forest Reserve of Vallombrosa



Silvomuseum



Il Silvomuseo di Vallombrosa

Total surface = 105 hectares

Clear felling and artificial regeneration with silver fir

Rotation age → 150 years

Allowable cut = 0,6 hectares/year (=18 hectares/30 year period)

→ The fully regulated forest will have 1/3 of fir stands with age > 100 years

→ High conservation value

ETI • Birds of Europe™



F. J. Maas

Common Treecreeper
(*Certhia familiaris*)



The conservation of traditional management in Calabrian pine forests

- The description of traditional silvicultural systems, which have developed in different environments and with different techniques and often in contrast with established silvicultural methods, can offer an important contribution to the search for ecologically, economically and socially sustainable ways of managing forests

Calabrian pine (*Pinus laricio poiret*) in Italy



	<i>Calabria</i>	<i>Sicily</i>
<i>Extension (ha)</i>	57000	4000
<i>Altitude range (m asl)</i>	1250 - 1600	1000 - 2000
<i>Localization</i>	Sila mountain and Aspromonte mountain	Etna volcano
<i>Mean annual temperature (°C)</i>	6.9 – 11.9	
<i>Coldest month mean temperature (°C)</i>	2.0 – 3.3	
<i>Average of yearly minimum temperatures (°C)</i>	(- 6.9) – (-13)	
<i>Mean annual rainfall (mm)</i>	1100 - 1500	
<i>Soil association</i>	Lithosoils and acid brown soils	

The structure of Calabrian pine stands on the Sila Plateau is the result of the management history, which depends on land ownership, as well as the economic and social changes that have taken place in the area.



- Strip and patch clear cutting, considered the most appropriate silvicultural methods for a light demanding species, have been usually applied in public properties producing even-aged stands over vast areas (Anzillotti 1950; Meschini e Longhi, 1956).

- Recently, in State owned forests that are now part of the Sila National Park, management has been limited to felling only dead or dying trees.
- This extremely conservative type of management is often the cause of widespread and vigorous natural regeneration of beech under the older pine stands.



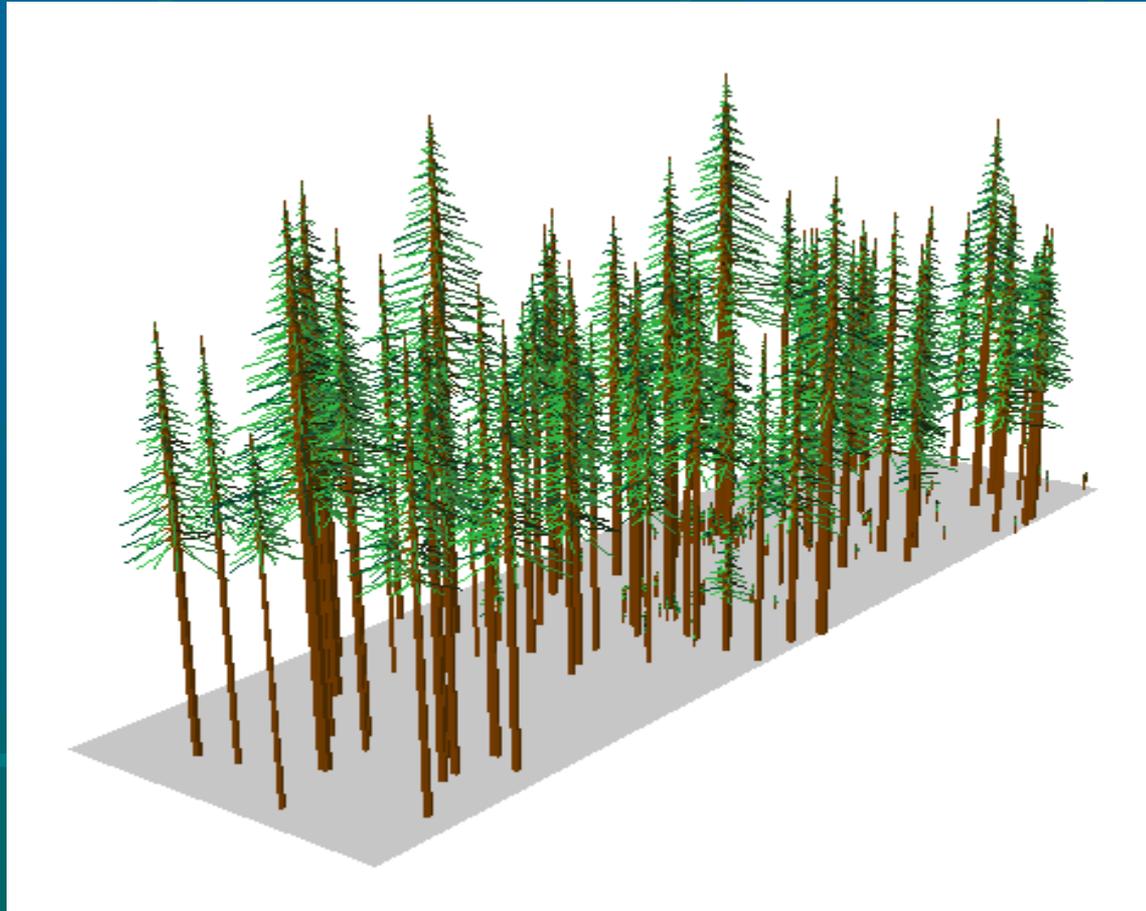
- **In private properties, selection cutting was widely applied to the Sila pine stands until the middle of the XXth century.**
- **This type of management has been generally discouraged by forest technicians because**
 - **it is not considered adequate to the light requirements of Calabrian pine and to its supposed “natural tendency” to create pure, dense, even-aged stands**
 - **selection cutting was considered a means of exploiting only the best trees on exclusively commercial grounds**
- **“Normalization”, i.e. the transformation into regular, even-aged stands, with a balanced age class distribution, was usually prescribed for stands with “irregular” structures (Meschini and Longhi, 1955).**

- On some private properties, Calabrian pine stands are still managed according to the traditional, locally developed selection cutting method that essentially goes against the tenets of regulated silviculture.
- This type of management has maintained the typical forest landscape by maintaining a continuous forest cover.



- private property of approximately 600 hectares where the pine stands have been managed by the same family since at least the end of the eighteenth century according to silvicultural criteria passed on from father to son and which have been applied consistently for over the last hundred years

Stand structure



The stands are formed by small groups of trees of different age and size

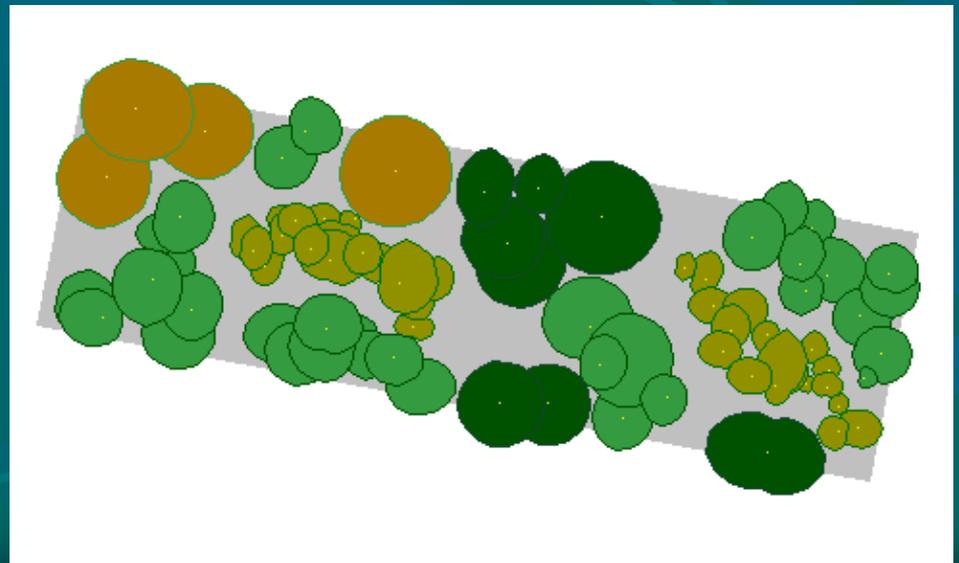
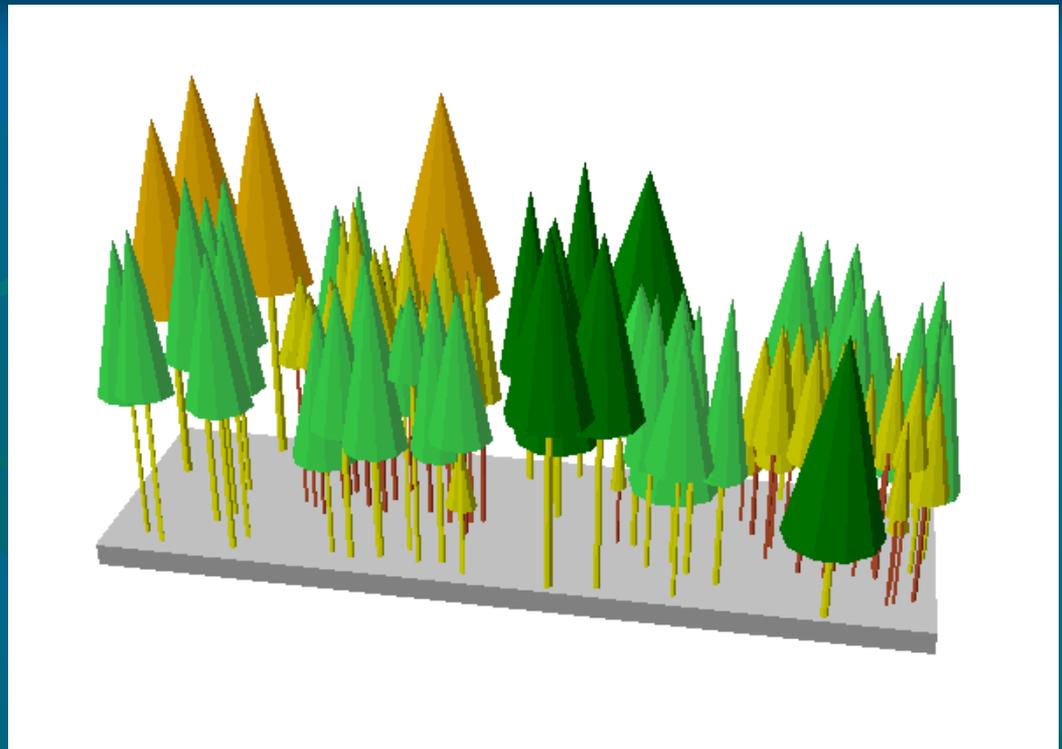
Each small group is even-aged and tree age is approximately one, two, three or four times the cutting cycle (approx. 20 years).

I. 2-3 big trees, age 80 - 90 years, dbh > 40 cm, height 23-25 m

II. 5-6 trees, age 60-70 years, dbh 31 - 40 cm height 21-23 m

III. 9-10 trees, age 40-50 years, dbh 21-30 cm, heights 17-20 m

IV. 14-15 trees, ages around 20 years, dbh < 20 cm, height < 15 m



- The type of empirical silviculture applied by the owner on the basis of century long experience and tradition can be considered sustainable because:
 - it adopts a type of felling that favours prompt and fast growing pine regeneration;
 - it utilizes no more than the annual volume increment, adjusting cutting levels to the effective growth reaction of the stands;
 - it is implemented by a flexible planning scheme that adapts to market variability.

- it guarantees the conservation of the traditional forest landscape of the area.

A strategy for the conservation of the diversity and complexity of forest ecosystems in the Mediterranean area

- diversify structures and processes in space and time
 - favour the presence of all those elements that can function as connection between different space and time scales
- take into account not only the natural history of each forest but also its cultural history

Conclusions

- forests are complex biological systems interacting with the environment and with social and economic systems
- preserving forest biodiversity often means conflicting with other uses and interests
- forest management strategies must be based on solid theoretical assumptions



Thank you!