

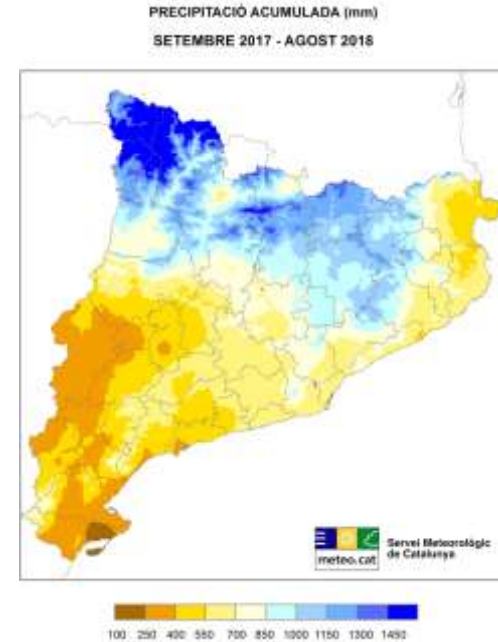
Some instances of Humid Catalonia forestry

Douglas fir in Guillerries
Close to nature forestry in Garrotxa

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What and where Humid Catalonia is

- Region with annual precipitation greater than 800 l/m²
- Pyrenees, Transverse mountains, and Montseny



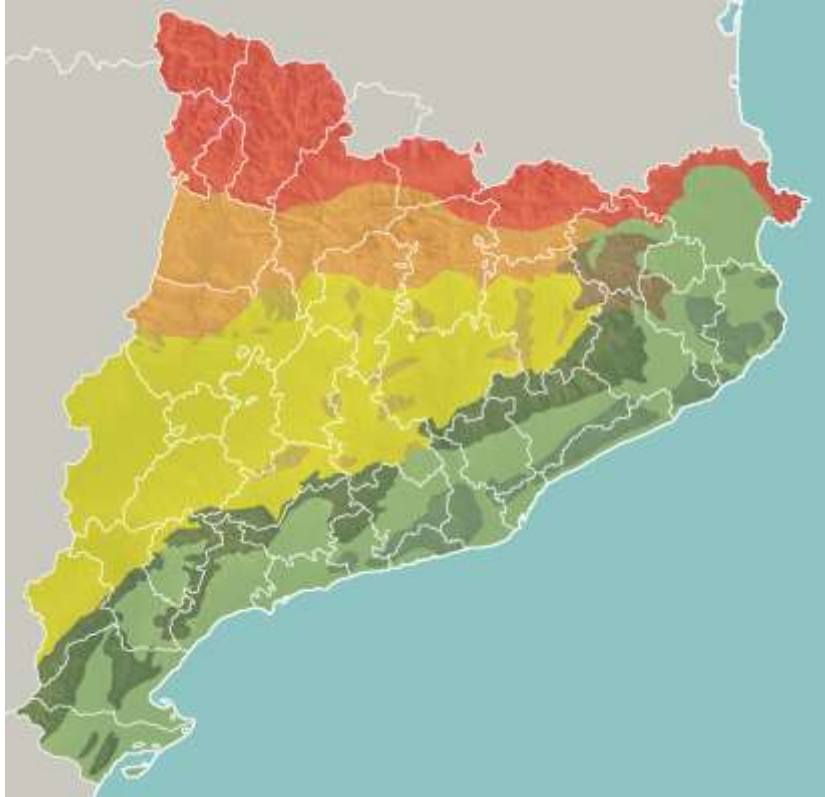
Douglas fir in Guilleries



A wood for structural use



Guilleries



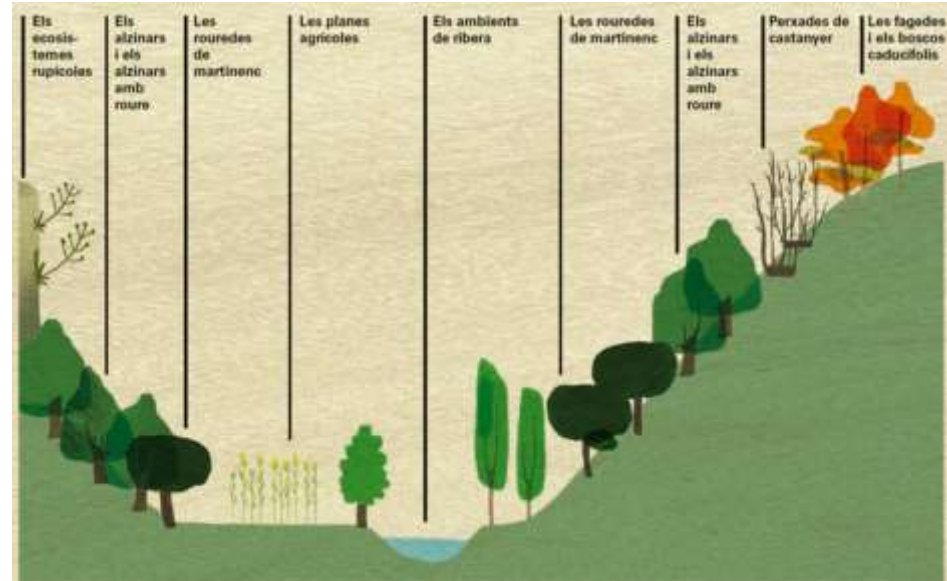
Relevant facts of Guilleries

- Maximum altitude 1.204 m
- Serralada Transversal
- Main town : Sant Hilari



Main natural tree species

- Evergreen oak (*Quercus Ilex*)
- Oak (*Quercus pubescens*)
- Oak (natural hybrids)
- Beech (*Fagus sylvatica*)
- Alder (*Alnus glutinosa*)



Main introduced tree species

- Chestnut (*Castanea sativa*)
- *Pinus radiata*
- Douglas fir (*Pseudotsuga*
Menziesii)
- Cedar



Stand environment

- Name: *Mas Carbó*
- Surface: 270 Ha
- Altitude: 750 - 1115 m
- Average slope: 35%
- Maximum slope: 60%
- Pluviometry: 805 mm/year
- Mean temp more calid month: 30°C
- Mean temp more cold month: 1,4°C



Soil conditions

- Mother rock: Granite
- Texture: Loam - gravel
- Rocks: None
- Reaction: acidic
- Soil depth: 30 - 50 cm



Main tree species

- Douglas Fir
- Cedrus atlantica and deodara
- Pinus sylvestris
- Castanea sativa
- Fagus sylvatica
- Quercus suber
- Quercus petraea
- Quercus ilex



Secondary tree species

- *Pinus nigra*
- *Pinus radiata*
- *Pinus pinaster*
- *Quercus humilis*
- *Prunus avium*
- *Acer opalus*
- *Tilia platyphyllos*



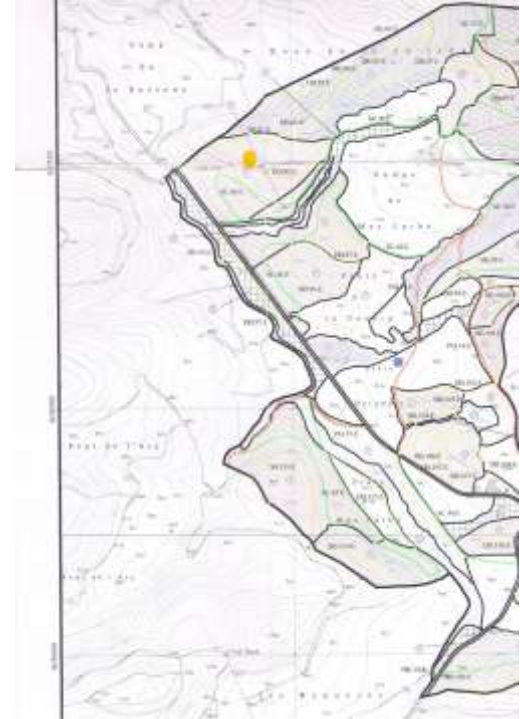
Plan for conifer planting

- Higher than 700 m
 - Best stations: Douglas fir
 - Rest : *Pinus nigra*
- Lower than 700 m
 - Best stations: *Pinus insignis*
 - Rest: *Pinus radiata*



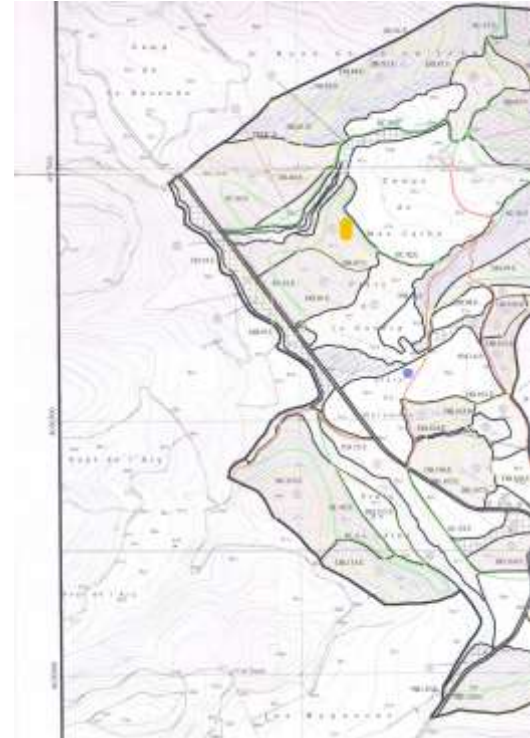
Douglas fir stand # 59

- Surface: 3,6 Ha
- Altitude: 970 m
- Slope: 20%
- Orientation: South-West



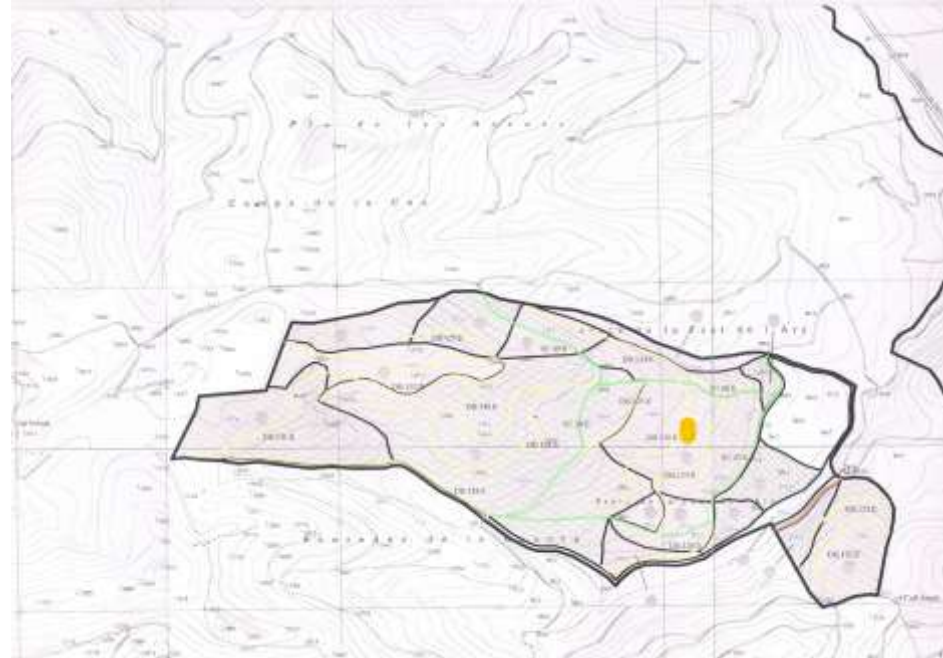
Douglas fir stand # 65

- Surface: 1,91 Ha
- Altitude: 970 m
- Slope: 15%
- Orientation: West



Douglas fir stand # 118

- Surface: 4,2 ha
- Altitude: 1030 m
- Slope: 25%
- Orientation: East



Planting

- Origin
 - Washington 412 - 422
 - La Luzette PME-UG-002
- Age
 - 2+1 (roots pruned at 2 years)



Planting system

- Manually in places with slope
- Mechanically in quite flat places
- Since 2014, use of mechanical excavators adapted for slope work.



Establishing



Picture at year 2007

| stand | age years | mean d cm | mean height m | units/Ha | basal A m ³ /Ha | m ³ /Ha/year |
|-------|-----------|-----------|---------------|----------|----------------------------|-------------------------|
| 59 | 42 | 39 | 20 | 350 | 42,2 | 14,2 |
| 65 | 45 | 35 | 22 | 319 | 31,3 | 6,32 |
| 118 | 44 | 43 | 26 | 415 | 63 | 15,32 |

Thinning and final cutting plan

| unit | initial | 1st 25 years | 2nd 35 years | 3rd 45 years | final 65 years |
|-------------|----------------|-------------------------|-------------------------|-------------------------|---------------------------|
| 59 | 1.000 | 700 | 400 | 275 | 200 |
| 65 | 1.000 | 700 | 400 | 275 | 200 |
| 118 | 1.000 | 700 | 400 | 275 | 200 |

Thinning



Pruning

| Year | height m | units |
|------|-------------|----------|
| 10 | 2 | all |
| 15 | 4 | best 400 |
| 20 | 6 | best 200 |



Elemental costs

| operation | units | €/unit |
|---|--------------|---------------|
| plantation | Ha | 2.500 |
| Cutting and extraction 1st thinning | Tn | 21 |
| Cutting and extraction 2nd thinning | Tn | 19 |
| Cutting and extraction 3rd thinning | Tn | 16 |
| Cutting and extraction final cutting | Tn | 11 |
| Direct transport to mill (up to 120 km) | Tn | 12 |
| extraction + transport (long distance) | Tn | 22 |

Production

| operation | biomass, Tn/Ha | packing, Tn/Ha | wood 20 cm, Tn/Ha | wood >30, Tn/Ha | total, Tn/Ha |
|------------------|---------------------------|---------------------------|------------------------------|-------------------------------|-------------------------|
| 1st thinning | 25 | 25 | - | - | 50 |
| 2nd thinning | 40 | 24 | 16 | - | 80 |
| 3rd thinning | 18 | 40 | 26 | 26 | 110 |
| final cutting | 80 | 110 | 135 | 225 | 550 |

Selling prices (at destination)

| product | unit price, €/Tn |
|-----------------------------------|---------------------|
| Biomass | 30 |
| Pallets, packing | 60 |
| Wood for plank milling, d 20 mm | 76 |
| Wood for plank milling, d > 30 mm | 95 |



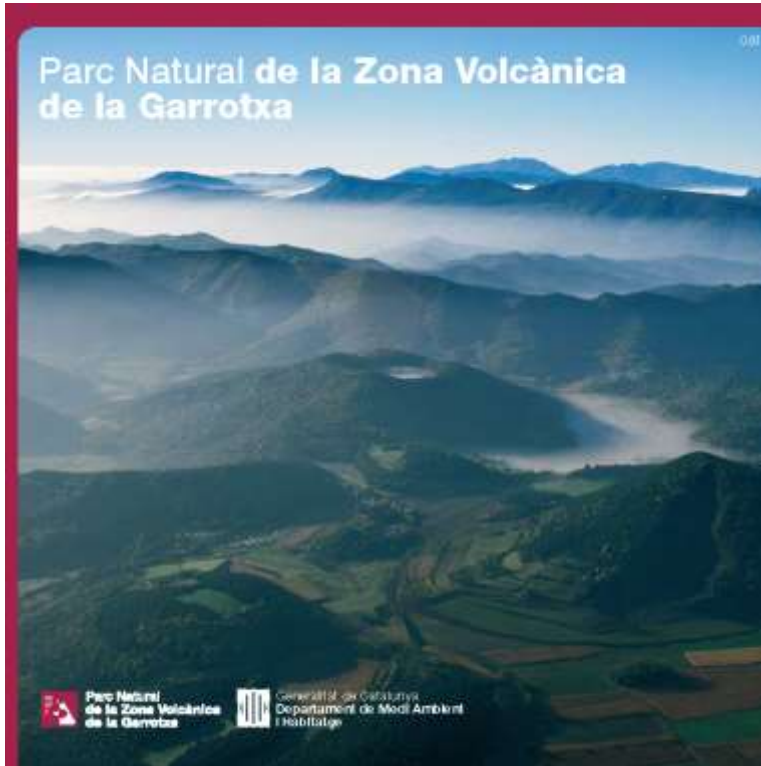
Close to nature forestry in Garrotxa

Some examples

Garrotxa location



Garrotxa Volcanic Zone Parc



Santa Pau

Holy Peace



Baron of Santa Pau castle and town

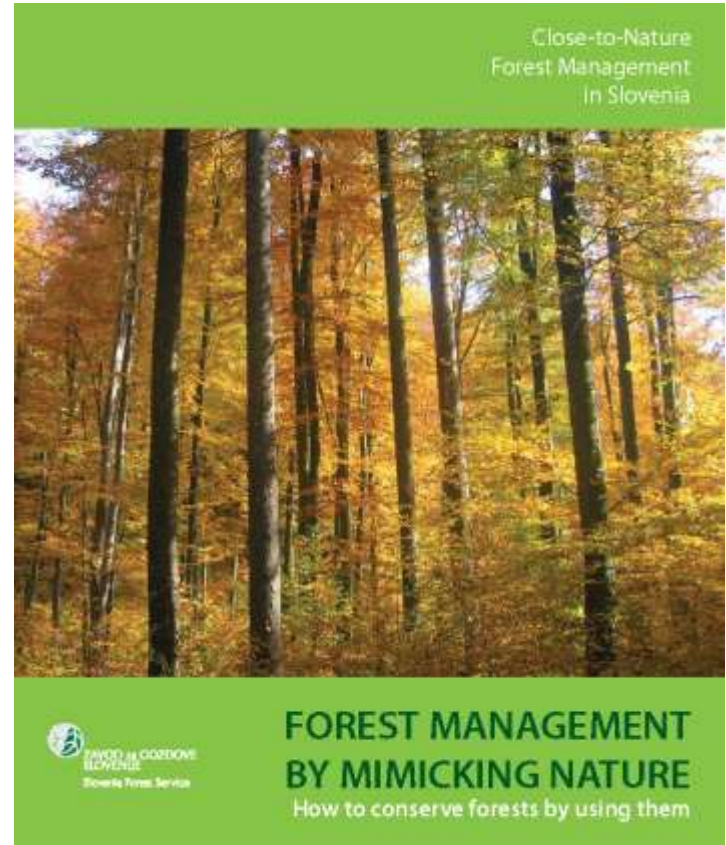


Main square



Close to nature forestry

- It requires strict adherence to long term goals.
- Flexible continually developing approach.
- Constant monitoring and learning.
- Ecosystem approach.
- Adaptive management.



Oak and evergreen oak mixed forest

Historical use

- Historically used for.
 - Charcoal
 - Firewood
 - Pasture
 - Structural wood
 - Floor and roof wood



Charcoal



Firewood



Pasture



Structural wood



Floor and roof wood



Oak wood is resistant to termites

- In Santa Pau there are termites. They destroy any wood element that is in contact with ground, except if it is made of oak.
- Nevertheless, traditional houses have the structural walls made of stones....



Multiple purpose management

- Close to nature management of this forest means:
 - To look at it as an ecosystem, and manage as such.
 - To seek wood production, environmental services, biodiversity, and landscape



Forest management

- **Goal: to establish and consolidate a forest:**
 - Mixed oak and evergreen oak
 - With other tree species (*Acer campestre*, *Prunus avium*, *Fraxinus excelsior*...)
 - Trees from seed (not coppice).
 - Over 50 cm diameter.
 - Mainly for structural and sawn planks production.



Part A forest dynamics

- **A part of the forest** was pastured till 1960. It had a very open structure, so that oaks grew with many extended arms.
- When pasture ended, oak and evergreen oak seedlings were established, under the protection of the big oaks.



Young and old trees dynamics

- Under the big old oaks there are young trees.
- As old oaks are debilitating and losing leaves and branches, young trees climb and pass through them, so that they progressively will reach the top canopy.
- Also some big trees will fall and produce a clear area.



Big trees functions

- Biodiversity support, as arboreal fauna love them.
- Microhabitats
- Epiphytes
- Contribution to the structural resistance of the forest to winds.
- Very good contribution to landscape.
- Source of dead wood



Part B forest dynamics

- This part was not pastured.
- It is quite regular
- Part of trees come from vegetative reproduction(coppice)and some from seed.
- Cover tends to be good.



Tree oriented thinning

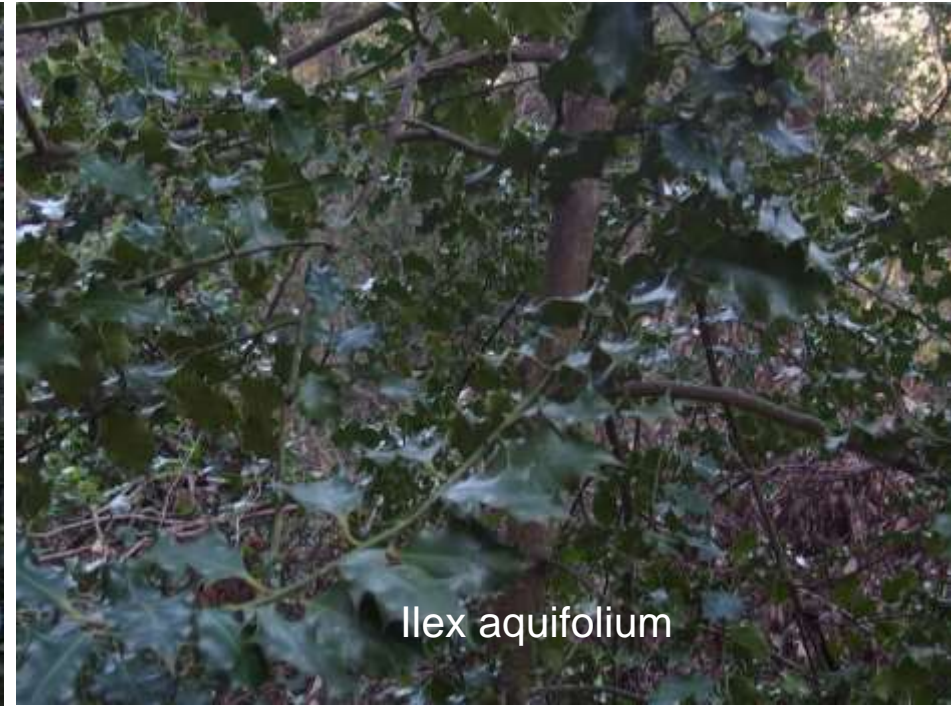
- Selection and green marking of best trees (future trees).
- Red marking of one (or two) trees that compete with them
- Cut out red marked trees
- Repete thinnings every 8 years approx.



Understory



Understory



Mosses and epiphytes



Fauna

- Fauna is an important part of the system, often forgotten.
- A closer look at fauna composition and population can help to understand forest dynamics
- We use a trail camera to record fauna



Wild boar

- He is the king of Santa Pau forests
- He has an estimated population of 4 per 10 Ha.
- They are useful, but not at these high levels of population
- They help in keeping the forest transitable.



Roe deer action on understory

- Roe deer have a limited action on understory volume. Sometimes prefer nearby agricultural products.
- The effect on regeneration has also to be considered.
- Sometimes they keep grazing areas free of bush.



Birds

- Birds are basic to control insect population.
- They are also very important for seeds dispersal
- The work of Jay regarding oak seeds dispersal is well known and documented



Some trail camera pictures









32 C 28 InHg

C1

06/13/2020 05:05PM



32 C 28 InHg

C1

12/11/2019 08:29PM



Badger



14 C 28 inHg

C1

12/20/2019 02:02AM



Nobel hardwood plantations

Species (hardwood)

- *Quercus robur*
- *Quercus petraea*
- *Quercus rubra*
- *Juglans regia*
- *Juglans nigra*
- *Fraxinus excelsior*
- *Acer pseudoplatanus*
- *Prunus avium*
- *Sorbus torminalis*



Main information

- Started in 1992
- Objective product: veneer
- Final cutting diameter: 60 cm
- Annual diameter increment: 1 cm
- Planting spacing: 6 x 6, 4 x 3
- In left over agricultural land
- Surface: 5 Ha
- Quality pruning
- Formative pruning
- Progressive thinnings



Cultural works

- They are kept to a minimum
- The main work is pruning
- Understory suppression avoided as much as possible
- Thinning continuous and progressive.
- Fauna shelter monitored to avoid excessive pressure
- Individual tree protection from fauna in first years



Tips to obtain quality wood (veneer)

- Plantation spacing not higher than 4 x 3 m
- Good quality seedlings. They can be tested by means of an own intermediate nursery.
- Pruning branches when thin.
- Favoring terminal bud, by pruning competition.
- Favor “forest ambiance” (ambiance forestière)



Ways to favor fauna presence

- Use species that produce food for them (Juglans, Quercus, Castanea sativa)
- Animals are propagators of fruit trees. Do not suppress them!
- Keep shelter trees and shrubs.
- Keep eventual nearby tall trees.



Ways to keep fauna pressure at a reasonable level

- Favor the presence of spontaneous bushes and young trees (not objective trees)
- After thinning keep sufficient regrowth shoots to have roe deer busy.
- Use individual tree protections when they are young.



Gallery

Branches were too thick at pruning



This ones were better



Formative pruning



Quercus rubra and Ebonimus



Dogwood



Oaks, with pruning marks



Juglans nigra



Quercus rubra

