PYRENEAN OAK FOREST OF IZKI

A Pyrenean oak forest is mainly composed of Pyrenean oaks (*Quercus pyrenaica* Willd.), also known as rebollo, roble almez or ametz. The Izki Natural Park (Alava) is located in the region of the Montaña Alavesa, in the east of the Historic Territory of Alava, located on an important sandy hollow scored by small watercourses defined by the many tributaries of the Izki river. This protected area has 3,850 ha of Pyrenean oak forests, which account for 43% of the park's total surface. It is estimated that there are 2.3 million trees in the Pyrenean oak forest, which represent a total of 624,000 cubic metres of wood.

GENERAL FEATURES OF THE IZKI PYRENEAN OAK FOREST DE IZKI

- Great diversity of plant species and a multitude of forest formation types.
- Good general state of health of the trees and good growth capacity.
- High tree density and high competition for light in the forest.
- Significant presence of formations with irregular structures (with trees of different ages).
- Presence of other species apart from the Pyrenean oak, such as beeches, Portuguese oaks, birches, etc.
- Little presence of standing dead trees, which is necessary from a biodiversity conservation point of view.
- High density of the ground vegetation in some of the Pyrenean oak forest areas, particularly of holly plants (*Ilex aquifolium* L.).
- Limited natural regeneration of the Pyrenean oak forest due to the high tree density and the abundance of ground vegetation.
- Low presence of big, well-shaped trees, since they were harvested in the past.
- Significant refuge for two emblematic animal species: the middle-spotted woodpecker (*Dendrocopos medius* L.), and the Bechstein Bat (*Myotis bechsteinii* Kuhl.)

FOREST TYPES

BY MAIN TREE SPECIES

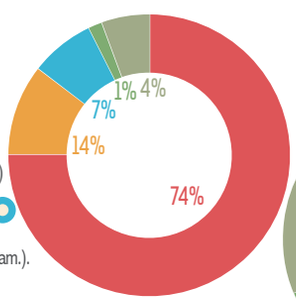
PURE PYRENEAN OAK FOREST
Forests whose main species is the Pyrenean Oak, and secondary species of little significance.

PYRENEAN OAK-BEECH FOREST
Forests whose main species is the Pyrenean Oak, and whose secondary species is the beech (*Fagus sylvatica* L.)

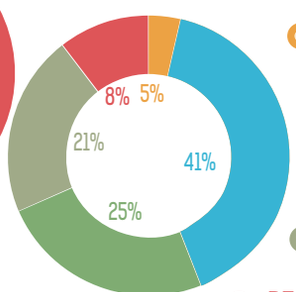
PYRENEAN-PORTUGUESE OAK FOREST
Forests whose main species is the Pyrenean Oak, and whose secondary species is the Portuguese oak (*Quercus faginea* Lam.).

PYRENEAN OAK-BIRCH FOREST
Forests whose main species is the Pyrenean Oak, and whose secondary species is the birch (*Betula pendula* Roth.).

BEECH-PYRENEAN OAK FOREST
Forest whose main species is the beech, and whose secondary species is the Pyrenean Oak.



BY TREE STRUCTURE



LOW-DENSITY FORESTS
Forests with low tree density (with open structure).

IRREGULAR FORESTS
Forests with trees of different ages, diameters and heights.

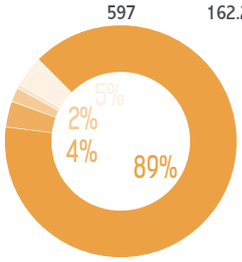
REGULAR YOUNG FOREST
Dominant presence of trees with diameters smaller than 20 cm.

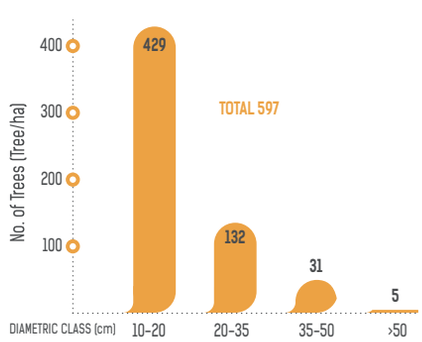
REGULAR DEVELOPED FOREST
Dominant presence of trees with diameters between 20 and 35 cm.

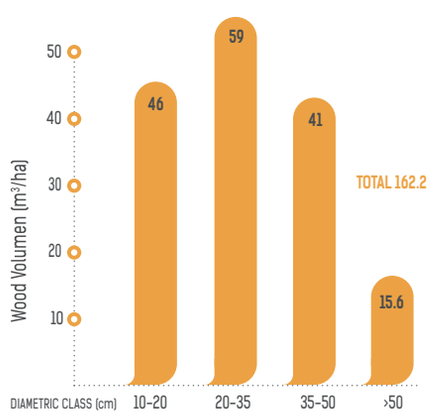
REGULAR MATURE FOREST
Dominant presence of large trees, with diameters greater than 35 cm.

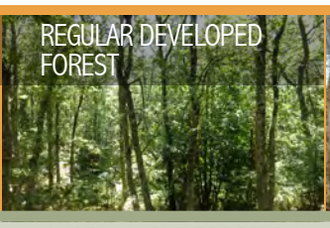
TREE DATA OF THE PYRENEAN OAK FOREST OF IZKI

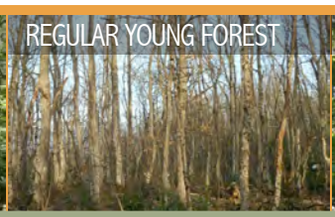
Species	No. of Trees (tree/ha)	Wood Volumen (m^3/ha)
Pyrenean Oaks	530	144.6
Beeches	21	7.5
Portuguese Oaks	15	2.3
Birches	1	0.4
Others	30	7.4
Total	597	162.2











INTRODUCTION TO FOREST MANAGEMENT

It is the organisation, management, and use of forests in a way and intensity that allows them to maintain their biodiversity, productivity, potential, and regeneration capacity, so they can fulfill, now and in the future, the ecological, economic, and social functions that are locally, nationally, and globally relevant, and without damaging other ecosystems (Forestry Law 43/2003).

HOW IS FOREST MANAGEMENT PLANNED

By using a forest planning document drafted under the directives of the discipline known as Forest Management. The document includes the analysis of the situation in the forest, the management objectives to be reached, and the planning of actions that must be executed within a determined time period.

DID YOU KNOW... ... that almost 72,000 ha of forests in the Basque Country have a Forest Management Plan, which accounts for 14.6% of the total forest area? In Spain, the total managed forest area reaches 4.06 million ha, which also represents 14.6 % of all forestry extension (MAGRAMA, 2013).

DID YOU KNOW... ... that the Forest Management Plan of the Izki Pyrenean Oak Forest has included measures to improve the habitats of the middle-spotted woodpecker and the Bechstein bat, such as increasing the number of standing dead trees and favouring the presence of large trees, with the aim of ensuring a greater number of feeding and rearing grounds for these species?

WHAT ARE THE OBJECTIVES OF FOREST PLANNING

Forestry management objectives can be very varied depending on the ecological, economical and social environment in which they are found. The conservation of natural values such as biodiversity, water and soil, the CO_2 fixation, the sustainable production of raw materials, and social activities are some of the management objectives that must be considered from a multifunctional perspective.

WHAT IS SILVICULTURE

It is the appropriate use of forests aimed at optimising all their functions, ensuring their correct development, which includes their stability and resistance. A silviculture that is flexible and well-adapted to the forest's ecological features constitutes the essential tool to achieve all the management objectives proposed.

Management plans include the silviculture that must be applied to the different forest masses via forest itineraries, which determine the necessary tasks to ensure the improvement and regeneration of the forest, as well as its distribution over time.

DID YOU KNOW... ... that, in order to understand a forest, it is necessary to know its history and the impact that man's intervention and natural disasters, such as fires and plagues, have had on it?

And that the forest characteristics can be modelled by silviculture? By fomenting, for example, a determined structure, thus orientating its regeneration, priorising the presence of some species over others...

DID YOU KNOW... ... that the wood obtained from sustainable forests is a construction material and an energy source with low negative impact on climate change. This is because forests act as CO_2 sinks and because wood has a low-emission manufacturing process. It is estimated that a tonne of wood stores the equivalent of a tonne of CO_2.

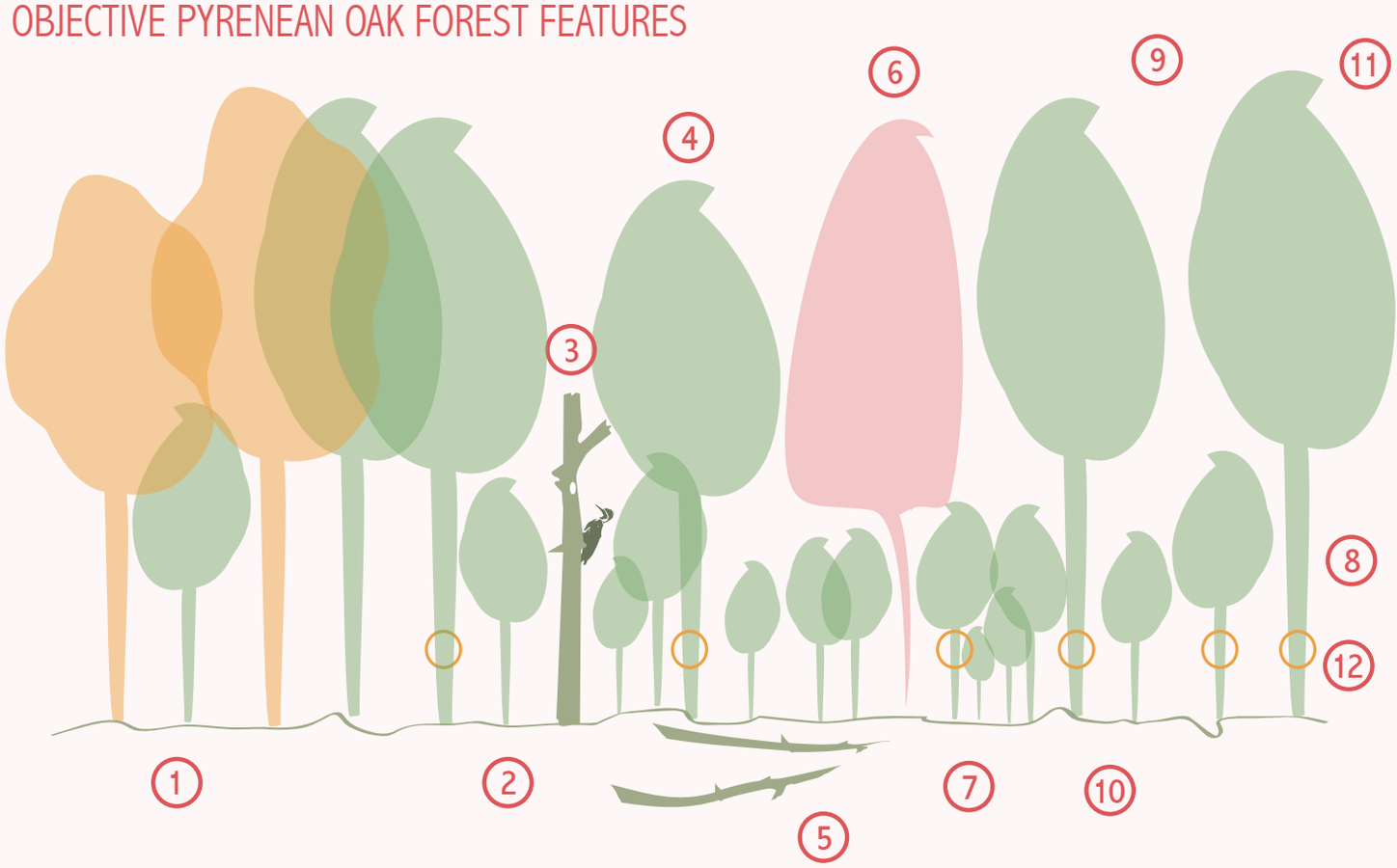
WHAT IS FORESTRY LAND-USE

It is an organised, sensible management of the forest's natural resources, to provide society with high-value products.
Among the main forest resources wood, pasturage and hunting stand out. Many products are obtained from wood, including firewood, structural timber, and wood for barrels or for joinery and carpentry, among others. Mushrooms, fruits, and medicinal plants are also resources of great interest.

OBJECTIVE PYRENEAN OAK FOREST

With the sustainable forest management in the Pyrenean Oak Forest of Izki, our aim is to improve forest masses and reach certain features to achieve what we know as an objective (Pyrenean Oak) forest.

OBJECTIVE PYRENEAN OAK FOREST FEATURES



1. There are areas whose main tree species are different to the Pyrenean oak, such as beeches, with the Pyrenean oak as a secondary species.
2. The forest is irregular, with trees of different diameters and heights.
3. There are standing dead trees of great diameter (greater than 35 cm) which serve to improve the middle-spotted woodpecker's habitat.
4. There are gaps for the Pyrenean oak's natural regeneration.
5. There are dead trees on the ground that serve as refuge, nourishment, etc. for the animal wildlife.
6. There are other species that enrich the Pyrenean oak forest (beeches, birches, portuguese oaks, etc.)
7. Young trees compete for the sunlight, they grow in height, and prevent the development of branches in their trunks.
8. Trees with high technological quality, straight trunks, with neither branches nor knots, and with good crowns, are predominant among the forest's trees - they are known as 'future trees'.
9. The crowns of adult trees have space to develop and concentrate a large proportion of the forest's growth.
10. The Pyrenean oak (*Quercus pyrenaica*) is the main species, representing between 50 and 90 % of the trees.
11. There is a great presence of large trees (at least 30% are trees with a diameter greater than 50 cm and big crowns).
12. The average amount of wood is between 170-210 m^3/ha.

THE MANAGEMENT PLAN

The Izki Pyrenean oak forest has a Forestry Management Plan as a basic instrument for its correct management, which considers the following plans of actions:

FORESTRY PLAN. Silviculture based on selective, low-intensity cuts designed to improve the Pyrenean oak forest, favouring the Pyrenean oak as the main species and taking into account criteria to improve the habitat of the middle-spotted woodpecker.

LIVESTOCK MANAGEMENT PLAN. Regulation of the conditions of pasturage - intensity of livestock density, pasturing calendar, delineation of no-livestock zones, and improvement of livestock infrastructures.

FOREST RESEARCH & EXPERIMENTATION PLAN. Tests to study the regeneration of the Pyrenean oak forest, the habitat of the middle-spotted woodpecker, and the evolution of the ecological processes of the Pyrenean oak forest in the absence of human intervention.

SELF-PREVENTION OF FOREST FIRES PLAN. Actions to minimise fire risks and to facilitate fire-fighting tasks, such as improving the road network for a rapid access to the fire and the expansion of forest masses that are more resistent to fires.

DISSEMINATION PLAN. A programme of activities aimed at the population related to the management and use of the Izki Pyrenean Oak Forest, with the objective of disseminating the characteristics of the implemented forest management.

MONITORING PLAN. Monitoring and analysis of results of the execution of the management plan, with particular attention to the actions aimed at the improvement of the middle-spotted woodpecker's habitat and those aimed at the improvement of the Pyrenean oak forest.

Uses of the Pyrenean Oak Forest of Izki

SOCIAL AND TOURIST USE	SCIENTIFIC USE
HUNTING	PASTURAGE
WOOD PRODUCTS	OTHER FOREST RESOURCES

Expected Results of the Sustainable Forest Management of the Pyrenean Oak Forest for the next 15 years (2014-2028)

RESULT	DATA
Forest improvement with selective harvesting	2,313 ha
Sustainable wood production (wood and firewood)	130,000 m^3
Avoided Greenhouse Gas Emissions	52,000 t CO_2
Direct employment generation	650 months-person
Pyrenean oak forest regeneration tests	6.7 ha (4 parcels)
Studies of the interventions on the habitat of the middle-spotted woodpecker	45 ha (3 parcels)
Integral forest conservation studies (without human intervention)	122 ha
Fire prevention with the creation of natural firewalls	345 ha

INTRODUCTION TO FOREST MARKING

Marking consists in the selection, marking, and measurement of trees to be cut or preserved following a silvicultural objective.

PLANNING THE TASKS

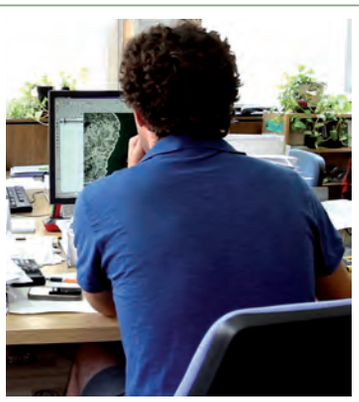
- Study the harvesting objectives and the marking criteria.
- Know the specific marking conditions (biodiversity, non-target species, etc.)
- Prepare the material and the equipment.
- Plan the access and the working methods.

DIAGNOSIS, SELECTION, MARKING AND MEASUREMENT

- Move through the woods while systematically observing all the trees.
- Select the trees according to the defined directives and objectives.
- Mark the trees to be harvested or preserved.
- Measurement and classification.

VERIFICATION AND ADJUSTMENT

- Verification of the compliance of the silvicultural objective (this is generally done using traditional sampling methods).
- Adjustment of the marking in case it does not comply with the established objectives.



REPORT PROCESSING AND ELABORATION

- Determine volume and classify: quantification of the volume of harvest, generally classified by species, diameter class, and product.
- Appraise following the market rate.
- Define prescriptions to be considered while cutting:
  - Harvesting method
  - Sales type and location
  - Harvesting dates
  - Conservation of habitats and species.

EVALUATION OF THE INDIVIDUAL TREE

- Locate defects and evaluate its current and future consequences depending on the end use.
- Identify their function in the forest mass.
- Identify values and evaluate its possibilities of improvement.

STUDY OF THE RELATIONSHIP OF THE INDIVIDUAL TREE WITH ITS NEIGHBOURS

- Competitive relationships.
- Dynamic in the forest mass.

SELECTION OF TREES TO BE CUT

The main selection criteria are:

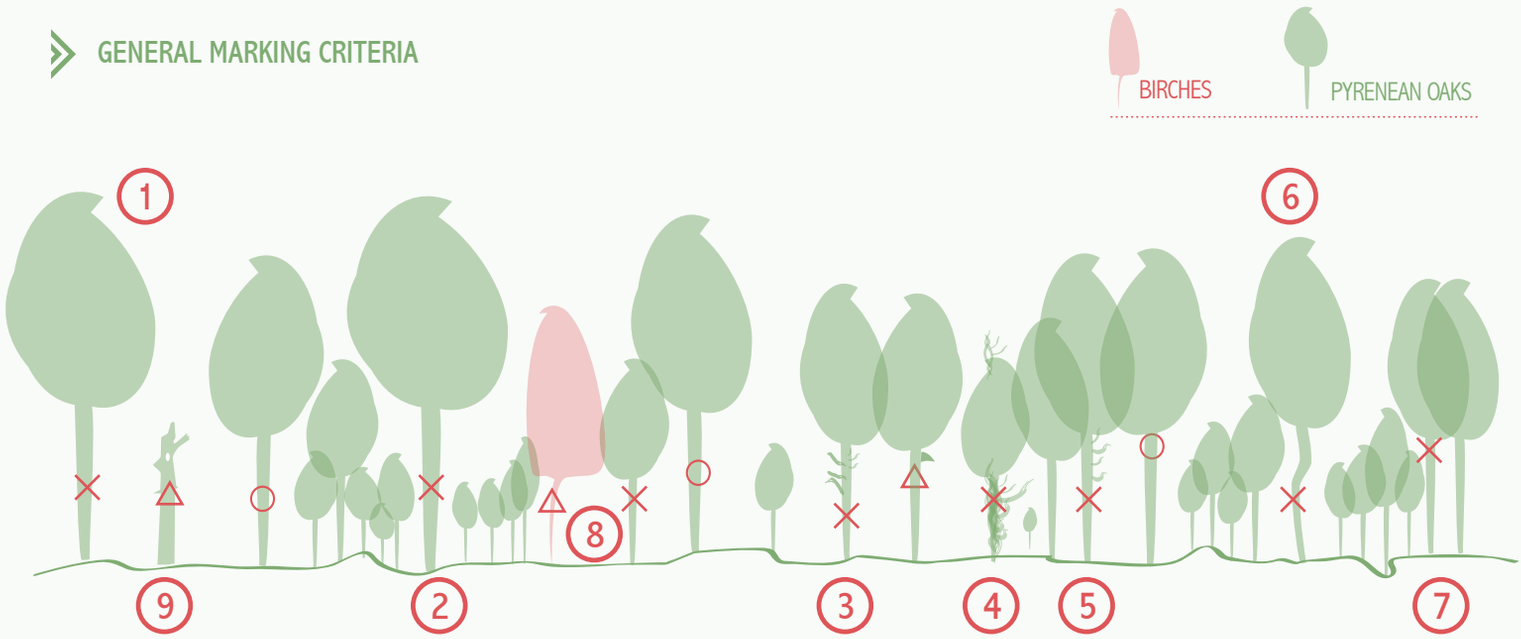
- Species
- Cut diameter
- Interference with neighbouring trees
- Competence with 'future trees'
- Technological quality
- Functions of the individual tree in the forest mass
- State of health

MARKING AND MEASURING

- Make a visible, long-lasting mark on the trees to be cut (with paint, seals,...) until the moment when the tree is cut: (i) At eye level for the correct progress of the marking and to facilitate the cutting work; (ii) On the stump, under the cutting line, to control lumbering.
- Mark the trees to be left uncut (either for being 'future trees', or due to its special conservation features) with a special mark that can be identified by the people responsible for the cutting.
- Measure the trees to be cut to determine its volume:
  - Materials: Callipers, hypsometer, GPS, and PDA
  - Variables to measure and/or identify of each tree to be cut:
    - Species
    - Diameter at 1.3 m
    - Total height (only for a sampled of marked tress for cutting)
    - Length by logs (only for good-quality wood)
    - Classification by products (per individual tree or logs)
    - Singular elements (presence of nests, state of health, etc.)

THE MARKING
OF THE PYRENEAN OAK FOREST

GENERAL MARKING CRITERIA



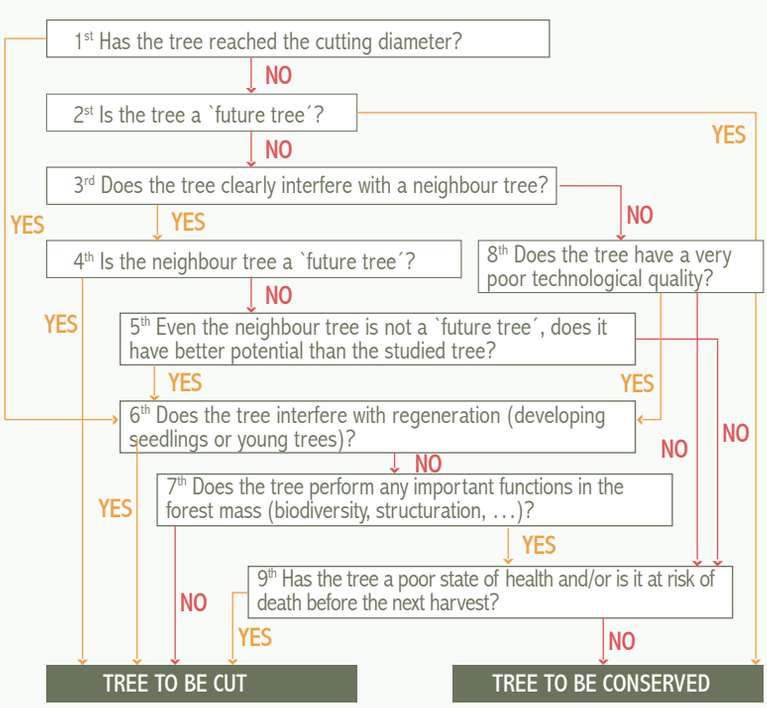
TREES TO BE CUT

1. For reaching its cutting diameter and not performing any important functions in the forest mass.
2. For reaching its cutting diameter and interfering with regeneration (developing seedlings or young trees).
3. For having a very poor technological quality and for not performing any important functions in the forest mass.
4. For having a poor state of health and being at risk of death before the next harvest.
5. For clearly interfering with a neighbouring tree that is a 'future tree', by competing for sunlight.
6. For having a very poor technological quality and for interfering with regeneration.
7. For interfering with the neighbouring tree with better potential and, either for not performing any important functions in the forest mass, or for interfering with regeneration.

TREES TO BE CONSERVED

8. For being a species with little representation.
9. For having unique values (trees with a nest on their tops, trees with polypore, etc.)

SELECTION OF TREES TO BE CUT



FUTURE TREES

Qualities to identify in the 'future trees':

- Essential qualities:
  - Straightness
  - Good state of health
  - No damage to the trunk
- Recommendable:
  - Thin branches
  - Thin bark
  - Balanced crown
  - Long trunk
  - Good upwards growth
  - Low risk to be damaged

SPECIFIC CRITERIA FOR MARKING IN IZKI

- Cutting diameter for the Pyrenean oak forest: established depending on the technological quality (80 cm for high-quality trees, 65 cm for medium-quality trees, and 50 cm for low-quality trees).
- Cutting Intensity: 25-50 m^3/ha and/or 15-25% of the volume with bark.
- Objective values for stocks in the mid to long-term: 170-210 m^3/ha in volume with bark, and 17 m^2/ha of the basal area.
- Frequency: 8 to 14 (8 years for the most capitalised forest masses - more than 200 m^3/ha - up to rotations of 14 years for forest masses located in poor quality areas).
- Integration of conservation criteria: respect trees for their unique values (e.g. conserving individual trees of special interest for the middle-spotted woodpecker and/or the Bechstein bat).