

Annex D

(informative)

Guidelines for the application of the Pan-European criteria and of indicators of sustainable forest management at the regional level

Criterion 1. - Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles

Table D.1 - Indicator 1.1: Total volume

Justification	The volume of forest stands is one of the principal decision-making tools of the forest manager. It defines, for the majority of forestry systems, the quantity of raw material that exists, at a given moment, in the forest.
Objective / Goal	Positive evolution (no reduction) in total volume (taken as the sum of the principal volume and the secondary volume).
Unit	m ³ (Total in the region)
Method of Evaluation / Measurement	Estimation of the total volume of the trunk or stem by plot sampling compatible with the national forest inventory.
Density of Evaluation	In conformity with the national forest inventory.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	The suggested presentation of results is in the form of volume (m ³ /ha) per age class and volume per diameter class (or perimeter class), for each species.
Access to Information	Public.

Table D.2 - Indicator 1.2: Structure

Justification	The structural variability of forest stands has a great influence on forestry and on the characteristics of the forest ecosystem. Both the variability of vertical structure (hierarchical distribution of the crowns – dominant, codominant, subdominated and dominated tree classes) and the variability of horizontal structure (distribution in diameter classes) are considered. Simplified structures (monocultural and/or regular stands) optimise forest harvesting, while complex structures (mixed and/or irregular stands) provide more frequent supplies of goods and services and, generally, greater levels of biological diversity.
Objective / Goal	Enhancement or maintenance of structural complexity at the regional level.
Unit	% of each species in the region; % of each diameter class per species; % of crowns by hierarchical class.
Method of Evaluation / Measurement	Description of the composition, horizontal structure and vertical structure, by plot sampling compatible with the national forest inventory.
Density of Evaluation	In conformity with the national forest inventory.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Suggested presentation: table and histogram showing distribution of the trees by species and, for each species, by diameter class and crown classification.
Access to Information	Public.

Table D.3 - Indicator 1.3: Carbon storage

Justification	One of the principal functions associated with forest ecosystems has to do with their capacity to fix carbon and thereby constitute a sink or reserve of that element. The increase in volume of the stands has positive consequences for the results of this indicator, although the effectiveness of this retention is greatly conditioned by the utilisation of products extracted from the forest.
Objective / Goal	Maintenance or positive evolution
Unit	ton C (total in the region)
Method of Evaluation / Measurement	Estimation of the biomass of the tree based on the total volume of the trunk, by sampling compatible with the national forest inventory. The components of the crown (branches and leaves), root system and cork (in the case of the cork oak) are evaluated whenever possible. The biomass is expressed in dry weight, total tons / region.
Density of Evaluation	In conformity with the national forest inventory.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Suggested presentation: table showing the carbon fixed in the region or, in case of impossibility of this calculation, the total biomass in the region.
Access to Information	Public.

Criterion 2. - Maintenance of forest ecosystem health and vitality

Table D.4 - Indicator 2.1: Fire hazard

Justification	The severity of a fire (or the vulnerability of the stand) is a result of the interaction between combustibility and the structure of the stand and permits a description of both the degree of difficulty in extinguishing a fire and the extent of damage to the forest cover. Decision-making in matters of fuel management and of preventive silviculture should preferably be based on the potential severity of fire and not on combustibility. One should therefore attempt to manage forest areas with the goal of reducing fire severity in the forest management unit (region), while seeking a compromise with the need for plant cover of the soil, both for purposes of soil and water conservation and for the conservation of biological diversity.
Objective / Goal	Reduction of the severity of fire in the region.
Unit	Scale of the regional severity of fire with 5 levels.
Method of Evaluation / Measurement	Table of severity of fire with the following input variables: Average size of forest fires, expressed in hectares, % of the number of occurrences that originated from forest fires, number of forest fires, % of forest fires investigated, density of human resources integrated in Groups of First Intervention, % of the area covered by plans foreseeing intervention, relation between the forest area burned annually and the total forest area of the region.
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	Annual
Presentation of Results	Table showing the quantification of the evaluations effected by sub-indicator and the value on the regional severity scale.
Access to Information	Public.

Table D.5 - Indicator 2.2: Density of the network of roads and trails

Justification	Deficient access to forest areas has been indicated as one of the main causes for the extent of damages caused by forest fires. The development of a network of well-maintained road and divisional infrastructures will allow a contribution to minimising fire hazard in many forest areas.
Objective / Goal	Ensure good regional coverage by the road network and conservation of the divisional network.
Unit	m/ha
Method of Evaluation / Measurement	Division of the sums of the length of roads (National and Municipal roads and forestry trails) and of the length of the divisional network (electrical distribution, roads and cutlines of more than 20 metres) by the area of the region. (Urban areas are excluded.)
Density of Evaluation	1 evaluation for the region.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Suggested presentation: table and/or map containing the observed values of density of the road and divisional network.
Access to Information	Public.

Table D.6 - Indicator 2.3: Density of water sources

Justification	On a par with access, the existence of water sources in forest areas is one of the most important factors in the combat against forest fires. The presence of easily accessible water sources, of medium to large size, reduces the reloading time for firefighting vehicles (land and airborne), thus increasing their efficiency. Bodies of water, even on a small or very small scale, also play an important role in the diversification of the landscape (<i>cf</i> Criterion 4).
Objective / Goal	Ensure an adequate network of water sources in the region.
Unit	% of hectares
Method of Evaluation / Measurement	Distribution by municipal council (territorial division) of the relation between the surface area of water bodies (evaluated in hectares) and the forest area.
Density of Evaluation	1 evaluation for the region.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Histogram with the distribution of the indicator by council. Map of existing water bodies.
Access to Information	Public.

Table D.7 - Indicator 2.4: Defoliation

Justification	Defoliation is an indicator of the state of health of plants, being a response to different types of stress. Some of these factors, in particular air pollution and drought, are beyond the control of forestry practice. However, whatever the cause, it is important to intervene in the sense of counteracting eventual causes of defoliation acting on a given forest area.
Objective / Goal	Reduction of the proportion of crowns showing signs of defoliation.
Unit	Relative scale of defoliation classes (0 - without defoliation to 4 - without leaves).
Method of Evaluation / Measurement	Visual evaluation of defoliation models ("ICP-Forests" methods and relative scale)
Density of Evaluation	According to "ICP-Forests".
Frequency of Evaluation	Annual.
Presentation of Results	Table showing the proportion of trees in each defoliation class, by species in the region. Identification of the cause whenever possible. The results should be expressed by calculation of the average class of defoliation per species, pondered by the area occupied in the region.
Access to Information	Public.

Table D.8 - Indicator 2.5: Nutritional deficiencies

Justification	Plant nutrition is a dynamic process, influenced by different factors, which cannot be estimated by a simple laboratory evaluation of soil fertility. The growth rhythm and the symptoms of known deficiencies are important indicators of site quality and important auxiliaries in the correction of eventual nutrient deficiencies.
Objective / Goal	Increase or maintenance of the area monitored for nutritional deficiencies.
Unit	Area of the forest management units monitored for nutritional deficiencies.
Method of Evaluation / Measurement	Evaluation of the number of forest management units monitored for nutritional deficiencies.
Density of Evaluation	1 evaluation for the region.
Frequency of Evaluation	Annual.
Presentation of Results	Area monitored for nutritional deficiencies in relation to the forest area of the region.
Access to Information	Public.

Table D.9 - Indicator 2.6: Pests and diseases

Justification	Biotic agents, provoking damage to different plant organs or tissues, are among the principal causes of forest degradation. The timely control of pests and diseases, making use of direct measures (biological control, sanitary cuts, traps, etc.) or indirect measures (resistant plants, adequate forestry practices, etc.) allied with an attitude of vigilance and frequent monitoring, are indispensable elements in the maintenance of adequate sanitary conditions.
Objective / Goal	Increase or maintenance of the area monitored for pests and diseases.
Unit	Area of the forest management units monitored for pests and diseases.
Method of Evaluation / Measurement	Evaluation of the number of forest management units monitored for pests and diseases.
Density of Evaluation	1 evaluation for the region.
Frequency of Evaluation	Annual.
Presentation of Results	Area monitored for the incidence of pests and diseases in relation to the forest area of the region.
Access to Information	Public.

Criterion 3. - Maintenance and enhancement of productive functions of forests (wood and non-wood)

Table D.10 - Indicator 3.1: Principal forest production

Justification	The majority of forest areas are oriented toward maximising a given product (in Portugal, wood, cork or fruit). This product constitutes the basis of the forest management system used and is the object of most of the cultural treatments.
Objective / Goal	Maintenance or enhancement of the productions identified in the region as principal productions.
Unit	Ton or m ³ / region.
Method of Evaluation / Measurement	Record of outputs in physical units and value of the principal product or products.
Density of Evaluation	1 evaluation for the region.
Frequency of Evaluation	Annual.
Presentation of Results	Table showing the principal forest production(s) and respective quantification (in physical terms and value).
Access to Information	Public.

Table D.11 - Indicator 3.2: : Productivity of the principal forest production

Justification	<p>An estimate should be made of the productivity of the forest management unit for three predefined situations:</p> <p>a) Systems in which the principal forest product is wood and the species are installed at definitive spacing (mean annual increment – between the moment of installation and the moment of the analysis).</p> <p>b) Systems in which the principal forest product is wood and the stands are subject to thinning (mean periodic or current increment – between two moments, taking into account the volumes removed during thinnings between those moments).</p> <p>c) Systems in which the principal forest product is not wood and that are supposed to tend toward an annual or periodic revenue (mean periodic or current increment – between two moments, taking into account the quantities produced between those moments).</p> <p>The mean annual increment and the mean periodic or current increment are measures for evaluating the average rate of growth of the principal forest product. They greatly influence the definition of the optimum moment of harvest of forest products.</p>
Objective / Goal	Superior performance, or in agreement with the growth and production patterns most adequate to the region, the species and the cultural system being used.
Unit	m ³ /ha/year or ton/ha/year, depending on the principal forest product.
Method of Evaluation / Measurement	Comparison of the mean annual increments or the mean periodic or current increments with values of production growth adequate to the region, species and silvicultural system observed. When models of reference do not exist, construction of the tendency of the mean annual increments or the mean periodic or current increments over time.
Density of Evaluation	In conformity with the national forest inventory.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Suggested presentation: table with the mean annual increments or the mean periodic or current increments.
Access to Information	Public.

Table D.12 - Indicator 3.3: Other productions

Justification	Forest areas can, in most cases, produce a wide spectrum of goods and services, besides the principal product. Although many of these goods and services do not have a market (or have one in an unstructured or inefficient way), there are others for which the market is properly established and organised. In these cases the diversification of production is desirable, since it creates added value from the forest areas, reducing dependence in the face of fluctuations of the market associated with the principal forest product and significantly increasing the total revenues of the forest management unit.
Objective / Goal	Maintenance or increase in the volume of other productions identified in the region.
Unit	ton/ha, m ³ /ha, head/ha.
Method of Evaluation / Measurement	Record of outputs, in physical units and value, of the secondary products..
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	Annual.
Presentation of Results	Suggested presentation: table showing the secondary production(s) and respective quantification.
Access to Information	Public.

Criterion 4. – Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems

Table D.13 - Indicator 4.1: Understorey shrub diversity

Justification	Structural diversity is strongly correlated with biological diversity. The study of shrub diversity under forest cover constitutes a simplification of the study of diversity at reduced scales, since it does not consider all the life forms that exist on a given forest management unit. This simplification is, however, necessary in order to guarantee the feasibility of the indicator on a large scale, and is based on the premise that there is a high positive correlation between understorey plant diversity and community diversity in general. This indicator is complementary to the indicator Structure.
Objective / Goal	Enhancement or maintenance of diversity in the region.
Unit	Variable.
Method of Evaluation / Measurement	In conformity with the national forest inventory.
Density of Evaluation	In conformity with the national forest inventory.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Suggested presentation: table showing the values of the diversity index.
Access to Information	Public.

Table D.14 - Indicator 4.2: Relevant natural or semi-natural plant communities

Justification	The conservation of relevant natural or semi-natural plant communities is important not only to guarantee maintenance of the plant species they are composed of, but also as they are habitats for species of fauna, some of which are classified as threatened or endangered.
Objective / Goal	Conservation of the relevant natural or semi-natural plant communities in the region.
Unit	Hectares.
Method of Evaluation / Measurement	Identification and mapping of the areas classified for nature conservation (National network of protected areas and Natura 2000 network).
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Suggested presentation: list and map of the classified areas, distinguishing those that have a management plan.
Access to Information	Public.

Table D.15 - Indicator 4.3. Ancient and cavernous trees

Justification	Most forestry systems determine the final cut of the trees at an age that is often under the natural longevity of the species. As a consequence of this practice, forest areas generally have very few trees of an advanced age and large diameter. It is normally in trees of large diameter and advanced age that natural cavities are formed, fundamental as shelter for an important group of animals, particularly birds and some mammals, as well as supporting epiphyte communities. These functions are also assured by dead standing trees.
Objective / Goal	Conservation of long-lived and / or cavernous trees when applicable. The conservation of very old dead trees should be contemplated insofar as they do not constitute points of dissemination of sanitary problems. The region should increase or maintain the total number of classified trees.
Unit	Number of ancient trees, living or dead / ha; number of cavernous trees / ha.
Method of Evaluation / Measurement	Record of ancient and cavernous trees (previously classified or not).
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Suggested presentation: mapping and record of these trees, by forest species.
Access to Information	Public.

Criterion 5. – Maintenance and appropriate enhancement of protective functions in forest management
(principally soil and water)

Table D.16 - Indicator 5.1: Evidence of erosion

Justification	The quantity of soil is directly affected by the silviculture practised on a given forest management unit. Certain practices lead to a physical loss of soil and situations of erosion, while others permit an adequate conservation of this resource.
Objective / Goal	Minimisation of silvicultural practices that tend to increase erosion.
Unit	Number of subscribers to the code of good practices.
Method of Evaluation / Measurement	Verification of a list of subscribers to the code of good practices.
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	Annual
Presentation of Results	Report with commentaries and analysis of the situation.
Access to Information	Public.

Table D.17 - Indicator 5.2: Water quality

Justification	Water quality is directly affected by forestry practices that result in soil loss and nutrient inputs, contributing to an excess of suspended materials, impoverishment of habitats due to sedimentation of fine materials and eutrophication of watercourses. Riparian vegetation can constitute an efficient buffer to these practices, and riparian ecotones also constitute some of the environments with the greatest known biodiversity. In parallel, the present Watershed Plans and the Framework Directive for Water attribute special relevance to these communities due to their role in and great value for conservation.
Objective / Goal	Maintain or improve the quality of runoff water.
Unit	Burned areas over 100 ha; Areas subject to clearcuts over 100 ha; % of the forest area in relation to the region.
Method of Evaluation / Measurement	Information obtained from regional and national statistics.
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	Annual.
Presentation of Results	Report with comments and analysis of the situation.
Access to Information	Public.

Criterion 6. – Maintenance of other socio-economic functions and conditions

Table D.18 - Indicator 6.1: Forestry investment and operating costs

Justification	The characteristics of forestry investment often make it unattractive in comparison with alternative uses of capital. However, without a minimum investment the probability of quality (and quantity) forest production is reduced. Optimisation of the timing of intervention in the forest allows one to not only maximise the effects of forestry operations but also to minimise their cost.
Objective / Goal	Increase or maintenance of forestry investment in the region.
Unit	Euro
Method of Evaluation / Measurement	Information obtained from regional and national statistics.
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	Annual.
Presentation of Results	Suggested presentation: table showing the distribution of costs and investments in the forest area, including the principal and secondary activities.
Access to Information	Public.

Table D.19 - Indicator 6.2: Income

Justification	Diversification of sources of income (multiple use) and of the moments of their realisation (continuous production) make the income from forest areas more attractive financially.
Objective / Goal	Increase or maintenance of sources of income.
Unit	Euro
Method of Evaluation / Measurement	Information obtained from regional and national statistics.
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	Annual.
Presentation of Results	Suggested presentation: table containing the distribution of incomes as per principal and secondary activities.
Access to Information	Public.

Table D.20 - Indicator 6.3: Volume and qualification of employment

Justification	Forestry activity has been indicated as an employment solution of high potential in rural areas. It is therefore worthwhile to not only clarify the contribution of the forest areas to rural employment, but also to promote the well-being of forest workers (promoting, among other things, qualification, specialised training and equality between the sexes in forestry work).
Objective / Goal	Maintenance or increase of the volume of employment and of the qualification of professionals in the sector.
Unit	Number of workers. Scale of professional qualification of the European Union. EURO.
Method of Evaluation / Measurement	Information obtained from regional and national statistics.
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	Annual.
Presentation of Results	Suggested presentation: table showing the number of workers in the forestry sector and their degree of qualification. It is important to emphasize the specific aspects of this activity, which is frequently complementary to the principal activity.
Access to Information	Public.

Table D.21 - Indicator 6.4: Workplace accidents

Justification	Forestry activity, due to its intrinsic characteristics, involves a reasonably high degree of risk in comparison to that of other professions. There are, however, diverse codes of work safety that, when complied with by workers and contractors, permit a reduction or even annulment of the number of accidents and particularly the number of serious accidents.
Objective / Goal	Reduction of the number of workplace accidents in forestry activities; compliance with work safety codes.
Unit	Number of workplace accidents
Method of Evaluation / Measurement	Record of accidents during work in forestry activity occurred in the region.
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	Annual.
Presentation of Results	Suggested presentation: report on the accumulated record of accidents in the workplace. It would be convenient to present the regional costs of prevention of workplace accidents.
Access to Information	Public.

Table D.22 - Indicator 6.5: Conservation of sites of cultural value

Justification	Forest areas frequently contain archaeological and/or heritage values. As testimony of our past and history, it is extremely important that the forestry activities dedicate special care to these elements and the respective surroundings so as to avoid their degradation or disappearance.
Objective / Goal	Increase of the records of these sites and preservation (non-loss) of the cultural values that exist in the region.
Unit	Number of records of sites with cultural value.
Method of Evaluation / Measurement	Identification of heritage values, through national and regional records and local knowledge.
Density of Evaluation	1 evaluation for the whole region.
Frequency of Evaluation	A minimum of every 5 years.
Presentation of Results	Suggested presentation: Record of the elements with archaeological or heritage value that exist in the region and, whenever possible, the respective state of conservation.
Access to Information	Public.