

ACTION ForBD: Assessment of indicators related to forest biodiversity**Description**

Biodiversity will be assessed in its different aspects & scales: **structural diversity** (both at forest patch and at landscape scale), **plant and fauna** diversity. Some of the test areas are in Natura 2000 sites, where the conservation of biodiversity may have priority with respect to other objectives of forest management.

Forest ecosystems managed according to SFM principles provide a broad range of goods and services. Biodiversity is a key factor allowing or limiting the provision of these goods and services and the loss of biodiversity due to human and environmental factors is a potential threat to the ecosystem functioning and to its capacity to provide the expected goods and services. Biodiversity associated to trees improves the ecological and socio-economic significance of forest ecosystems. Manifold functions are concerned: these include hydrology, soil protection, filtering of gaseous pollutants, carbon balance, wood production, non-wood products, recreation and amenities, landscape values.

Forest management is a robust driver of diversity; according to the applied criteria, it may act as a factor of depletion, conservation or enhancement both in terms of types/scales and of related processes.

Structural Diversity.

Structural diversity at the stand scale (i.e. at the size of silvicultural intervention) is the attribute directly linked to the practice of forest management. The spatial repetition of cultivation practices over the forest area determines the achievement of structural diversity at higher scales by the spatial arrangement of patches of different age, each of them with its own structural and functional characteristics. These patches, and the connections with the other neighbouring or intercropped ecosystems, set up and develop the texture of the landscape matrix. The close relationship between structure and function is well explained by the use of the ecosystem space and resources (light, nutrients, water, ...) made available under different tree densities and spatial arrangements, canopies, dominant ages that are able to create and maintain suited habitats and ecological niches for a number of communities living inside the forest environment.

Diversity of fauna.

Invertebrates. In order to verify in the field the effectiveness of forest management options biodiversity of invertebrates will be monitored, focusing on a number of beetle families (e.g. *Scolytidae*, *Cerambycidae*, *Buprestidae*, *Lucanidae*), identified to the species level. The species belonging to these families are to a large part saproxylic and thus very important for the carbon cycle of the forests. Many saproxylic species, have become rare or even locally extinct in the past as a consequence of forest management. In order to validate the effects of different management options and to assess the biodiversity variation under different ecological conditions (deadwood amount, clearings, opening of gaps, etc.), sections under different management options will be compared into the same forest.

Vertebrates. It is widely acknowledged that to a certain extent several vertebrate *taxa* do act as indicators of forest conditions (in terms of several parameters) and could be employed to assess the effect on biodiversity of forest habitat changes due to different silvicultural practices. Given the multipurpose use of forests and multiple role of forest ecosystems, it is of paramount importance to study the relationships and assess the effect of forestry practices on vertebrates.

The most feasible indicator *taxa* (which comprise several species of bats, birds and amphibians classified as priority species by EU regulations) will be selected to assess the effects of forestry operations on species, population and community parameters. Through periodical surveys and monitoring of the study sites delineated in the previous actions, presence, distribution, abundance, reproductive output and habitat relationships of selected bat, birds and amphibian species will be measured. *Taxa* will be selected according to their *indicator* potential (based on a literature review) as well as according to local habitat characteristics and sampled repeatedly in relevant periods through the years of project duration. First sampling will take place in the experimental intervention sites, to provide a clear and full account of relevant parameters and in the control areas.

Plant diversity

In order to assess and monitoring the impact of forest management on flora, plant biodiversity will be assessed. Plant diversity will be identified at species level sampling all present species belonging to vascular plants. It is intended not only as the number of species, but also as their relative abundance (in terms of surface coverage). Different diversity indices will be calculated for each management option in each area identified in PA Action (Species Richness, Shannon's Diversity, Simpson Diversity and Evenness). During the project two survey will be realised. The first before the intervention and the second one after some month from the intervention.

Dead wood

Deadwood is an important component of forest ecosystems because it provides habitat, shelter and food source to many species, particularly invertebrates. For instance, woody debris on forest floor provide nursery site for seedling establishment favouring the natural regeneration of the forest. In managed forests, the amount of deadwood is usually much lower than in forests left to evolve naturally.

The project will identify within the study areas a set of survey areas on ground (test areas) distributed in areas identified in PA Action. The position of each test area will be located with GPS equipment and afterwards will be included in the geographic information system of project. The measurements on dead wood will performed in the test areas in accordance with a common protocol defined in the Action PA. Decomposition classes and, where possible, time from death as well as single piece size will be measured/estimated in order to assess and monitoring the presence of different habitats for animals (insects, micro-mammals, birds etc.) and fungi. Even for this biodiversity component two survey will be performed in order to assess the its condition before and after intervention.

Number of surveys

Structural diversity:

A survey before and a survey immediately after management operations and at control plots. All dendro-structural parameters will be assessed (number of plants, diameter, height on selected cases, social class). Monitoring of those parameters expected to vary on annual basis

Diversity of Fauna:

Invertebrates:

Invertebrates will be monitored, focusing on a number of beetle families (e.g. Scolytidae, Cerambycidae, Buprestidae, Lucanidae), identified to the species level, using 8 traps for each site. Each year a minimum of 2 sites will be surveyed.

Vertebrates

On average, 0.5-1 point/ ha will be repeated 3-4 times per year but the exact number of sampling points and replicates will be precisely set after pilot studies (Preparatory Action). The exact number of survey will vary in relation to target families.

Plant diversity

For each test area, circular 15 meters-radius sample plots will be measured. Approximately a sample plot every at least 3-5 ha will be realised according to heterogeneity of test area.

Deadwood

Sampling scheme similar to plant diversity. Results will be compared to line intercept approach (Action ForC)

Action ForBD will start at month 4 and will finish at month 54

Methods employed

Structural diversity

- Definition of technical criteria, consistent with site potential, able to maintain or enhance the tree structural/compositional diversity at stand level in different phases of the forest life-span;
- Assessment of the economic viability of the proposed practice;

- Analysis of the improved quality of stand structure with respect to the baseline condition;
- Assessment of the design and choice of suited solutions in the field as for the demonstrative/innovative side;
- Itemizing of timing and parameters to be surveyed within the length of the project;
- Definition of a reliable set of quantitative indicators on structural diversity, easy to be surveyed and of the monitoring protocol;
- Determination of the quantum change from the baseline;
- Definition of the dissemination procedures (targets, level/type and communication means).

Diversity of fauna

- collection of the saproxylic beetle fauna by means of selective intercepting methods (i.e. Window traps/Malaise traps; basically 8 traps for each site). The traps will be activated and surveyed during the invertebrate activity season by the local personnel of the CFS-UTBs and by experienced grant-holders
 - sorting of the collected invertebrates in the Coleoptera and division in families
 - taxonomic studies of the specimens at the Laboratory of the National Centre for the Study and Conservation of Biodiversity at Verona (CNBF-VR) and statistically analyzed.
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- collection of information on study sites and on previous studies on local vertebrates
 - building capacity and attitude testing of personnel, calibration courses, pilot study, testing and definitive assessment of sampling methods
 - data collection (according to different standard methodologies as to bats, birds, amphibians)
 - database construction and implementation
 - exploratory data analysis and first draft report

Plant diversity

- Definition of sample size and design according to the amount of test areas to be managed.
- Field survey to collect information species presence and abundance (in terms of surface coverage) at each site.
- Identification of each species through latest system of nomenclature.
- Calculation of Species Richness, Shannon's Diversity, Simpson's Diversity and Evenness indices.
- Comparison of diversity indices before and after intervention.

Dead wood

- Definition of sample size and design according to the amount of test areas to be managed.
- Field survey to collect information on each deadwood element (size, decomposition class, species or genus/family/ order where decomposition doesn't allow more specific identification)
- Collecting core bores or wood sections (where possible and only at selected sites) in order to assess time from death through dendrochronological analysis.

Constraints and assumptions

The Action will rely on the timely setting up of experimental plots and execution of surveys. Part of these duties will be performed with the cooperation of the personnel of the UTB responsible for managing and control the forest areas where the project will be carried on. Several local offices were previously involved in biodiversity assessment. The personnel will be helped by grant-holders hired for the project. Possible delays in the hiring procedure could result in slight delay of surveys but it is not expected that this will cause major problems to the project.

See also Action AnDeFM.

Beneficiary responsible for implementation

UniMOL

Other Beneficiaries involved in the Action: CRA, CNR

Expected results

Structural diversity

- analysis of structural diversity of managed forests;

- setting up and monitoring of “good management practices” complementary and/or alternative to the traditional management techniques, enforceable within the examined and similar forest contexts, providing dynamic conditions of structural-functional diversity at level of forest patch;
- Increased knowledge acquisition rates by suited actions of dissemination;
- Enhanced information flow between stakeholders (managers, policy makers, public);
- Established link between monitoring outcomes and ongoing regulatory activity.

Diversity of fauna

- data and information on abundance, distribution and habitat selection according to different experimental sites for the different selected taxa;
- changes of the beetle community (qualitative and quantitative) in forest areas managed with different options
- Integration of several biodiversity indices to depict a synergic and multifaceted biodiversity indicator
- Peer reviewed reports and scientific papers
- Guidelines for the conservation of selected vertebrate taxa in managed forest ecosystems
- Dissemination of guidelines

Plant diversity

- Data and information on presence and relative abundance of vascular plants species.
- Assessment of pre and post management plant diversity.
- Identification of species favoured or disadvantaged by forest management.
- Identification and definition of best forest practices that are able to balance production and plant diversity.

Dead wood

- Data and information on presence and relative abundance of different component of deadwood and different class of decomposition.
- Assessment of pre and post management deadwood amount (for each of its components).
- Assessment of different decomposition classes present on test areas.
- Identification and definition of best forest practices that allow the conservation of an acceptable amount and decomposition variability of deadwood.

Indicators of progress

Number of areas characterised as for forest structure

Number of sites equipped with invertebrate traps

Number of sites visited for the assessment of vertebrate taxa

Number of invertebrate species identified

Number of sites with birds and bats nest boxes and number of nest boxes

Number of sites visited for assessment of plant diversity

Number of sites visited for assessment of deadwood

Structural diversity

Three steps: july 2012 (33% of exp. sites); december 2013 (66% of exp. sites); april 2015 (completion).

Plant Diversity and Deadwood:

By December 2011, 50% of I phase survey plots will be measured. By December 2012 100% of I phase survey plots will be measured. By December 2013 50% of II phase survey plots will be measured. By December 2014 100% of II phase survey plots will be measured.

Diversity of fauna

Number of sites for the assessment of vertebrate taxa: June 2011

Number of sites with birds and bats nest boxes and number of nest boxes: December 2011

ACTION ForBD-SI: Assessment of indicators related to forest biodiversity

Description

The detail description of action ForBD-SI correspond to the action ForBD.

Plant diversity SFI & external experts

Dead wood SFI & external experts

Action ForBD will start at month 7 and will finish at month 56

Methods employed

Structural diversity, diversity of fauna, plant diversity and dead wood - see Action ForBD

Constraints and assumptions

The Action will rely on the timely setting up of experimental plots and execution of surveys. Part of these duties will be performed with the cooperation of the personnel of the SFI and external experts (SFS) responsible for managing and control the forest areas where the project will be carried on.

Beneficiary responsible for implementation

SFI with external collaborator (SFS, BF)

The Associated Beneficiary SFI planned cooperation with SFS (Slovenian Forest Service) and BF (Biotechnical Faculty, Department of Forestry and Renewable Forest Resources) experts to carry out action activities that are expressed in the breakdown of costs, allocating a portion of budget as external assistance costs (close to 10% of the budget).

In this respect, external costs will cover payment for the expected/agreed work with defined hourly rate/ fee, travel costs, needed to cover daily allowances according to the national legislation Specific work: help on the field for measurements. Assistance in data entry, technical support in the field. Support for sampling. All the external assistance will be awarded in agreement with existing regulation for public tendering.

Expected results

see Action ForBD

Indicators of progress

see Action ForBD