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ManFor·C.BD.·"Managing·forests·for·multiple·purposes:·
carbon,·biodiversity·and·socio-economic·wellbeing".¶

Action 7 – ForBD

Report n. ~~2~~ 3 (2014-02)

(Action ForBD & ForBD-SI)

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1. Brief summary of contents

Into semi-natural forests concerned within ManForCBD, structural diversity is the outcome of silviculture applied over the previous and current stand life cycle. In cultivated forests, management practices are in fact the major determinant of trees' spatial arrangement and trees' density, individual social ranking, canopy structure, individual crown volumes and overlapping, gaps' size and occurrence. Data collection involved individual tree measurement of a series of qualitative/quantitative parameters, i.e.: tree position and species, vitality (alive, dead, damaged, withering), social rank, diameter at breast height (dbh), tree height, height of crown insertion, crown thickness and crown area. Structural diversity has been assessed both in Italy and Slovenia, using similar set of parameters. Data collection for the calculation of indexes of structural diversity has been fully performed at 5 out of 7 Italian designated sites and at all the 3 Slovenian sites.

Vertebrate aimed field surveys have been performed in all Manfor areas by hired personnel. Just a preliminary assessment has been made at Vallombrosa. In the "Pennataro" and "Chiarano" extended areas the 1st bird survey has been completed on 2013 along with a Summer-Autumn survey of arboreal rodent within hair tubes and nest boxes. After preliminary surveys in all sites - in addition to vertebrate standard monitoring procedures - we have identified 4 focus actions amphibians (yellow-bellied toad and spectacled salamander) and birds (reproductive biology and demography of sort-toed treecreeper. Further pilot studies for additional focus researches have been planned aimed at fire salamanders.

In Slovenia, the effects of small scale silvicultural practices was investigated on the following trophic levels for **invertebrates**: saproxylic beetles (bark beetles and longhorn beetles), pollinators (hoverflies) and low level predators (carabid beetles) and for **vertebrate** high level predators and seed-eaters (birds). Methods for invertebrate have been selected: the hoverflies will be investigated with plot counts, window traps and malaise traps; Carabid beetles will be caught with pitfall traps using salt and water; bark beetles are collected using Theyson trap with pheromone Trypowit® (partially applied). Cross vane funnel traps with pheromone GALLOPROTECT 2D® will be used to sample both bark beetles and longhorn beetles. The plot counts have started in all three Slovenian sites. Sampling on bird were realized in 2013.

Below ground biodiversity (ectomycorrhizal fungi) were assessed at site 8 (Kočevski Rog). At each plot a single sampling was used in 15 repetitions (soil core sampling; 275ml of soil/core). All roots and ectomycorrhizae were extracted and measured. The ectomycorrhiza biodiversity and root parameters were statistically evaluated.

2. Report on performed activities

2.1. *Activities performed in 2013*

2.1.1. Subaction 1 - Structural Diversity

Italy: Field work carried out in 2013 at the last two sites, Bosco Pennataro (Molise) and Vallombrosa (Toscana), made available the full data set of variables needed to the calculation of indexes of stand structure diversity. At Pennataro, tree structure is made up by a main deciduous species, Turkey oak, typical of intermediate vegetation belt in Central Apennines and secondary broadleaves, beech, hop-hornbeam and maple, scattered or grouped on the terrain depending on the aspect, slope, outcrops and past uses of the forest.

Vallombrosa is an evenaged grown-up beech forest, where beech is quite exclusive, other tree species (e.g. maple or silver fir) being rarely present per individuals (broadleaved sp.) and small cohorts (conifer sp.).

Structural diversity is considered both in terms of dendrological or specific diversity (spp. number or spp. richness) and spatial arrangement. Tree composition and presence (abundance) within a-priori defined main vegetation layers as well as the relative horizontal texture are being assessed, they defining together the spatial arrangement of stand structure by the suite of indexes already experienced at the other sites.

At the end of 2013, data collection for the calculation of parameters and indexes of structural diversity has been fully performed at all the designated sites:

(Site 1) - Cansiglio State Forest, UTB-Vittorio Veneto (Veneto Region)

(Site 2) - Chiarano-Sparvera Regional Forest, UTB-Castel Di Sangro (Abruzzo Region)

(Site 3) - Valdescura Community Forest, Town of Lorenzago di Cadore (Veneto Region)

(Site 4) - Marchesale State Forest, UTB-Mongiana (Calabria Region)

(Site 5) - Bosco Pennataro Regional Forest, UTB-Isernia (Molise Region)

(Site 6) - Rutte Tarvisio State Forest, UTB-Tarvisio (Friuli Region)

(Site 7) - Vallombrosa State Forest, UTB-Vallombrosa (Toscana Region)

Slovenia:

To obtain the indices of structural diversity, individual tree measurements were carried out between autumn 2011 and spring 2012. In each of the 3 locations (namely Kočevski Rog, Snežnik and Trnovo) we established altogether 27 (3 x 9) concentric permanent sample plots. In 2012 the previously marked trees were harvested and in the fall 2013 it was checked which trees were cut and logged. Based on this information it was possible to establish a comparison between the plots characterizing the time before and after management actions. To make the field work more efficient tree position maps for each research plot were prepared (Figure 1).

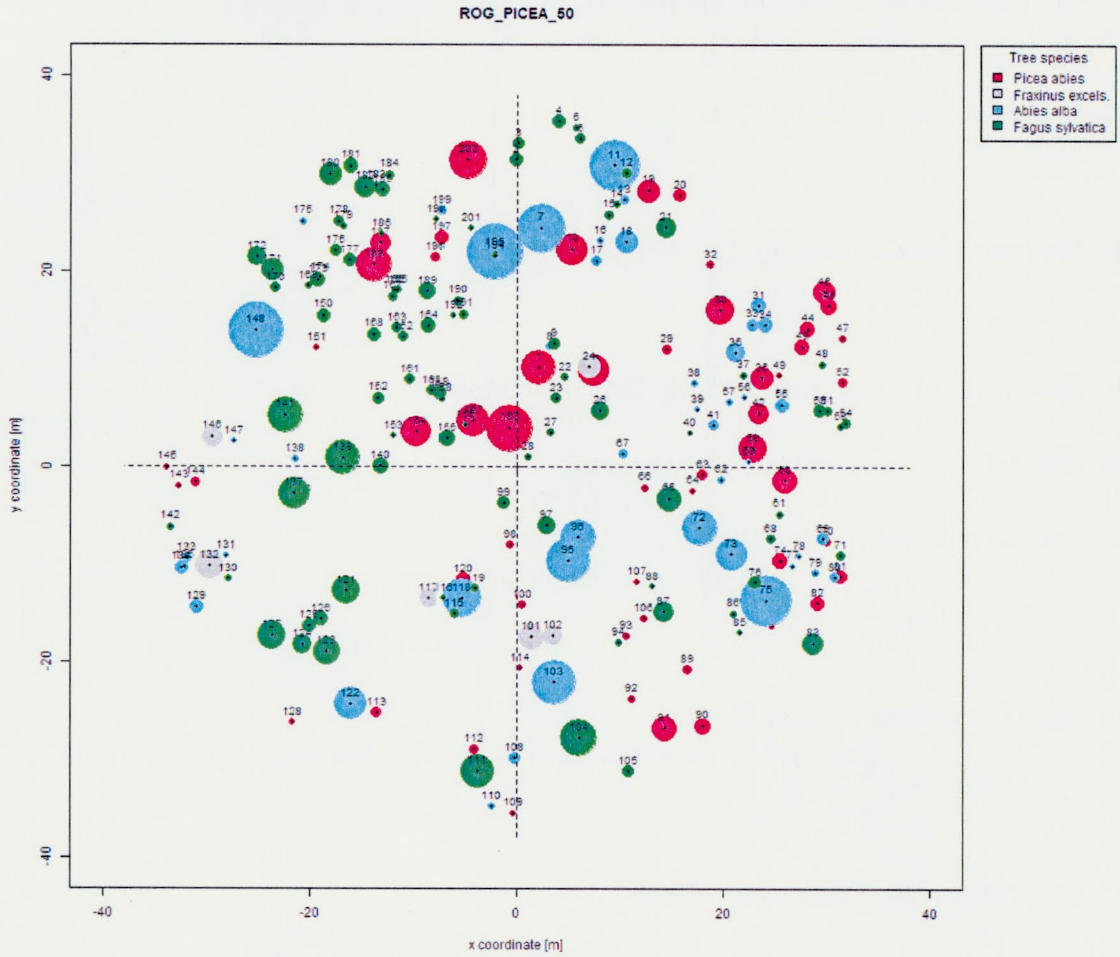


Figure 1. Example of map with locations of trees.

In 2013 we calculated the indicators important for structural diversity. All the calculations were done on the plot level. The indicators were divided to two groups, characterizing:

1. General features of the plots and
2. Diversity Indices

Ad 1: Each plot contained the information on the Number of trees (Num), Growing stock (GS), Basal area (BA), Number of trees per social class (vertical structure) (NumSoc), Number of veteran trees (dbh > 50 cm) (Vet), Number of trees with microhabitats and Number of trees with damages.

Ad 2: Diversity Indices were calculated with the support of the stem number, basal area, coverage volume or total biomass. Diversity indices were calculated to asses:

- species diversity (number of different tree species, Shannon Index of diversity, Simpson Index of diversity and Evenness) and
- structural diversity (Species mingling, Size differentiation and Contagation).

Species diversity indices were calculated with the following formulas:

1. Number of different tree species (*RI* = *N* (*N* is the number of species))

RI = N

2. Shannon Index of diversity (SH) (Shannon, 1948)

$$\mathrm{SH} = \sum_{k=i}^{N} (\log_2 \pi)\pi$$

3. Simpson Index of diversity (SI) (Simpson, 1949)

$$\mathrm{SI} = \sum_{k=i}^{N} (1 - \pi)\pi$$

4. Evenness (E) (Lloyd and Ghelardi, 1964; Magurran, 1988)

$$E = SH/\log_2 N$$

Used methodology for structural diversity indices:

1. Species mingling (Fuldner 1995)

$$Ming = \frac{1}{4}\sum_{j=1}^{4} v_j \left\{\begin{pmatrix} 1 & \cdots & neighbour\ j\ belongs\ to\ the\ same\ species\ as\ reference\ tree\ j \\ 0 & \cdots & otherwise \end{pmatrix}\right.$$

2. Size differentiation (Hiu et al. 1998)

$$SizDiff = \frac{1}{4}\sum_{j=1}^{4} v_j \left\{\begin{pmatrix} 1 & \cdots & neighbour\ j\ is\ smaller\ then\ reference\ tree\ j \\ 0 & \cdots & otherwise \end{pmatrix}\right.$$

3. Contagation (von Gadow et al. 1998)

$$Contag = \frac{1}{4}\sum_{j=1}^{4} v_j \left\{\begin{pmatrix} 1 & \cdots & \alpha_j < \alpha_0 \\ 0 & \cdots & otherwise \end{pmatrix}\right.$$

All the structural diversity indices were calculated for a selected tree in the plot and practically referred to the group of four nearest trees (Figure 2). The edge effect was considered. This means that the trees that were closer to the plot line then to the four (1^{th} - $4^{th)}$ nearest trees, were excluded from the calculation.

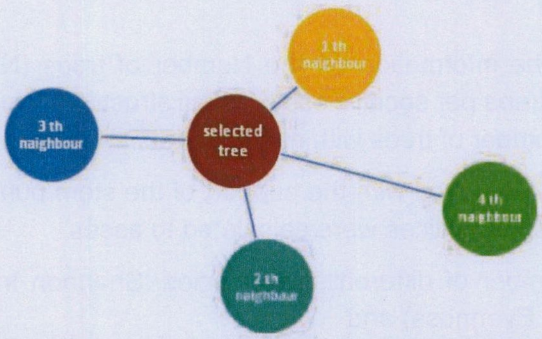


Figure 2. Example of selection of four nearest neighbours to the selected tree.

2.1.2. Sub-action 2 - Fauna Diversity

Sub-action 2a - Vertebrate diversity

Italy:

Data collection has been performed at 7 out of the 7 designated sites:

(1) - Chiarano-Sparvera Regional Forest, UTB-Castel Di Sangro (Abruzzo Region);

(2) - Cansiglio State Forest, UTB-Vittorio Veneto (Veneto Region);

(3) - Marchesale State Forest, UTB-Mongiana (Calabria Region);

(4) - Valdescura Community Forest, Town of Lorenzago di Cadore (Veneto Region);

(5) - Rutte Tarvisio State Forest, UTB-Tarvisio (Friuli Region);

(6) - Bosco Pennataro-Monte di Mezzo Regional Forest, UTB-Isernia (Molise Region)

(7) - Vallombrosa Forest (Tuscany Region)

Birds: aural/visual point count (replicated point count for abundance-based community model)

One research focuses has been identified: *Certhia brachydactyla* (site 6)

Short-toed treecreeper (*Certhia brachydatyla*)

- Population size (using Capture-Marking-Recapture methods
- Demographic parameters (i.e. sex ratio, adults/juveniles ratio)
- Influence of forest structure on density and distribution

Herps: VES (visual encountering survey, aimed at different life stages: adult, larvae, eggs); CS (Calling Surveys following the methods in Dorcas et al., 2009)

Two research focuses have been identified: *Bombina variegata* (site 5) and *Salamandrina perspicillata* (site 6):

yellow-bellied toad (*Bombina variegata*, species included in the Habitat Directive Annex II).

- Population size estimation,
- Demographic parameters (i.e. sex ratio, adults/juveniles ratio)
- Body condition Index
-

spectacled salamander (*Salamandrina perspicillata*; species included in the Habitat Directive Annex II as a part of *S. terdigitata*).

- Population size (using Capture-Marking-Recapture methods and Occupancy methods) and density
- Diet and food
- Demographic parameters (i.e. sex ratio, adults/juveniles ratio)
- Terrestrial Habitat use as shelter (i.e. different use of different tree typology and relationship with tree buttresses)
- Body condition index

The pilot studies on the feasibility of further researches on *Salamandra salamandra* (at site 2, 3 and 5) showed inapplicability on those additional focuses (small population size, breeding habitat on the border of the cutting plot and so on).

Chiroptera

In the 2013 field work session (July-August 2013), ultrasound bat surveys were carried out at all ManFor sites:

- Foresta Demaniale Regionale "Chiarano Sparvera" - Scanno (AQ), Abruzzo;
- Riserva Naturale "Marchesale" - Mongiana/Acquaro (VV), Calabria;
- Foresta Demaniale Regionale "Bosco Pennataro" - Vastogirardi (IS), Molise;
- "Riserva Naturale Campo di Mezzo-Pian Parrocchia" - Fregona (TV), Veneto;
- Bosco di "Lorenzago di Cadore" - Lorenzago di Cadore (BL), Veneto;
- "Foresta di Tarvisio" - Tarvisio (UD), Friuli Venezia Giulia;
- Riserva Naturale di "Vallombrosa" – Reggello (FI), Toscana.

Surveys were realized in late summer, when all bat species were much more active and detectable than in other months. This is due to both the flying activity of young bats and the warmer weather conditions, that determinates an higher suitability of insect prays[1] for bats during their foraging activity.

I used automatic bat detectors Pettersson D500X and manually operated Pettersson D1000X to record bat activity for long time intervals simultaneously at different recording points.

I used 4 Pettersson D500X units, 1-2 Pettersson D1000X units and also 2 mist nets to catch bats and obtain information on the occurrence of species otherwise not detectable or recognizable by acoustic analysis.

In order to improve the sampling effort with mist nets, during capture sessions a Sussex AutoBat was used as an acoustic lure.

[1] Russo D., Jones G., 2003. Use of foraging habitats by bats (Mammalia: chiroptera) in a Mediterranean area determined by acoustic surveys: conservation implications. Ecography 26: 197-209

D500X bat detectors were employed for at least 6 hours per night; D1000X for at least 4 hours per night; when possible, mistnetting was done for 4 hours per night or more.

The following Table 1 summarizes sampling efforts at all study sites.

Table 1. Sampling effort

SITE	SAMPLING EFFORT 2013 (h)	N. PASSES 2013	N. SPECIES 2013	ACTIVITY INDDEX (N. PASS./h)
CHIARANO	54	71	4	1,31
MONGIANA	56	490	8	8,75
PENNATARO	48	30	4	0,63
CANSIGLIO	51	404	8	7,92
LORENZAGO	52	56	5	1,08
TARVISIO	38	71	8	1,87
VALLOMBROSA	42	427	13	10,17

Table 2. Number of sampling points per site

Indicator	*Per Site*		*Total*
Number of D500X sampling points	1	8	56
	2	8	
	3	8	
	4	8	
	5	8	
	6	8	
	7	8	
	8		
	9		
	10		
Number of mist net sampling points	1	2	8
	2	2	
	3	1	
	4	0	
	5	0	
	6	1	
	7	2	
	8		
	9		
	10		
Number of D1000X sampling points (includes external circle round sampling points, wher made)	1	20	78
	2	6	
	3	7	
	4	8	
	5	0	
	6	19	
	7	18	
	8		
	9		
	10		

Site codes:

Site 1 – Cansiglio (IT)	Site 6 – Tarvisio (IT)
Site 2 – Chiarano Sparvera (IT)	Site 7 – Vallombrosa (IT)
Site 3 – Lorenzago di Cadore (IT)	Site 8 - Kočevski Rog (SI)
Site 4 – Mongiana (IT)	Site 9 - Snežnik (SI)
Site 5 – Monte di Mezzo – Pennataro (IT)	Site 10 - Trnovo (SI)

Sampling points (mist netting and ultrasound sampling site) were selected in plots not yet investigated according to the different treatment assigned to the latter (traditional, innovative, no practice). Inside the not yet logged sites, I investigated the plots assigned to traditional or innovative silvicultural thesis as well as plots assigned to "no practice".

Slovenia: Vertebrate diversity

For the Slovenian sites the birds were investigated. On all 27 plots of in total three sites (Kočevski Rog (site 8), Snežnik (site 9) and Trnovo (site 10), breeding bird abundances were counted using point counts with aural-visual point counts. Additionally, we conducted point counts in similar ecological and environmental conditions to account for the edge effect. A point count existed out of three buffers: 0-25m, 25-35m and < 35m. Every point count was visited twice: once in April and once in the end of May/beginning of June.

In addition, an update was made of the list of forest bird species listed on the Annex I of Directive 79/409/EEC was made for the selected sites. The approximated number of breeding individuals was extracted from the literature (Denac et al, 2011). A start was made with the literature review of the effect of forest management to the different bird species of the Bird directive.

Subaction 2b - Invertebrate diversity

Italy:

In 2013, for what concerns Italy, the sampling activities were focused on three sites: Cansiglio (site 1), Lorenzago di Cadore (site 3) and Vallombrosa (site 7) (see Figure 2). The field activities took place from May to October. According to the weather conditions, the positioning and activation of the traps was completed in Cansiglio and Vallombrosa in April, and in May for what concerns Lorenzago di Cadore. The traps were emptied every second week, with the collaboration of the local staff.

Figure 3. Map of the location of the sites where the field activities took place in 2013, showing the distribution of the traps: a) Lorenzago di Cadore, b) Cansiglio, c) Vallombrosa.

In Vallombrosa the aim of the survey was the description of pre-treatment conditions, and thus applying the sampling protocol already established, we placed nine window traps and three Malaise traps (Figure 4). The influence of the different experimental silvicultural practices on insect diversity has been studied in both in the Cansiglio and Lorenzago sites. In the Cansiglio site we placed a total of 18 window traps and 6 Malaise traps, equally distributed in six plots, to compare the innovative forestry treatment, the traditional treatment and a not-treated forest condition. In the Lorenzago site, we placed four types of traps: window, Malaise, emergence and pitfall traps. As in the other sites of the project, we placed 3 window traps and 1 Malaise trap per plot, for a total number of 9 and 3 respectively.

Figure 4. Traps positioned in Vallombrosa: a) window trap, b) Malaise trap.

In addition, further experiments were performed in this site, involving: emergence traps and pitfall traps. We used emergence traps to study the contribution of high stumps to sustain the saproxylic community. The sampling design took into account two diameter classes (32-42 and 54-64 cm) and two decay stages (2 and 3 cf Hunter's decay scale), with 7 traps for each combination, for a total of 28 emergency traps distributed inside the stand. These traps were specifically designed for this purpose, wrapping the stumps in a polypropylene net that had a 500 ml plastic bottle attached to the top and a pitfall trap inside (Figure 5). The two containers were filled with a solution of copper sulphate (1.5% $CuSO_4$) dissolved in water, with a few drops of detergent to lower the surface tension.

Figure 5. Emergency trap placed on a high stump in Lorenzago di Cadore.

In order to sample ground dwelling invertebrates we introduced in 2013 one further trapping method. In particular, we were interested in ground (carabid) beetles communities, which are known to be good indicators in forest ecosystems and have been widely studied in the past. With data on ground beetles we investigated the influence of forest management intensity on beetle community structure. For doing this, we placed pitfall traps in different forest stands with different intensity of management all across the municipality of Lorenzago di Cadore (Belluno). Twelve traps were positioned in the ManFor experimental site, with three traps per forest treatment (three treatments) and three traps in the untreated matrix (Figure 6). Further 80 traps were placed in 10 nearby stands for comparing different sites with different intensities of past management (Figure 7).

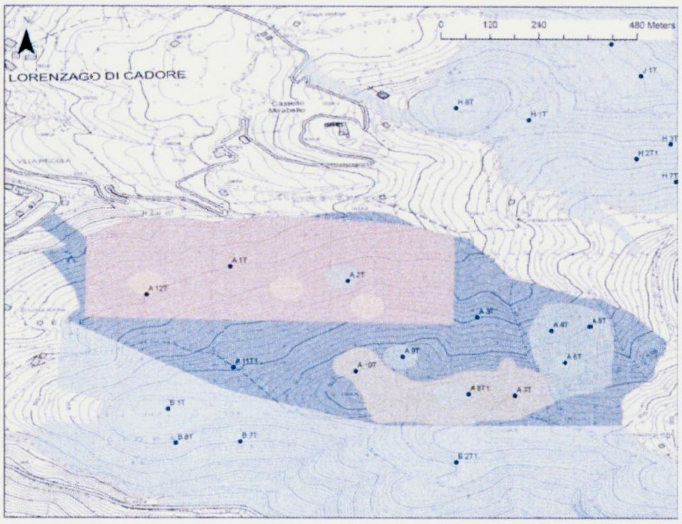


Figure 6. Location of the pitfall traps placed in the ManFor site at Lorenzago di Cadore.

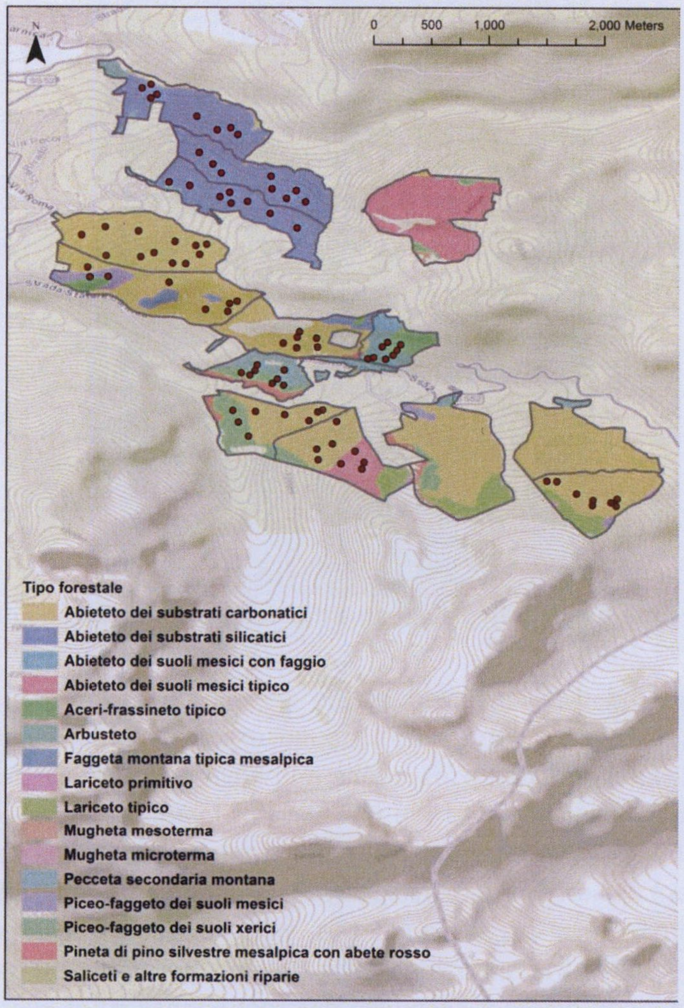


Figure 7. Location of the 92 pitfall traps placed in the forest stands of the Lorenzago di Cadore Municipality.

Each pitfall trap were 12 cm wide and covered with a funnel that channels falling insect in a 250 ml bottle, partially filled with a saturated solution of salt and vinegar (Figure 8). In comparison to simpler procedures, this trap design reduces the rate of accidental capture of non-target species on the one hand, limiting the entrance of small vertebrates, and increases the capture efficacy of ground beetles on the other, attracting them by mean of the vinegar smell.

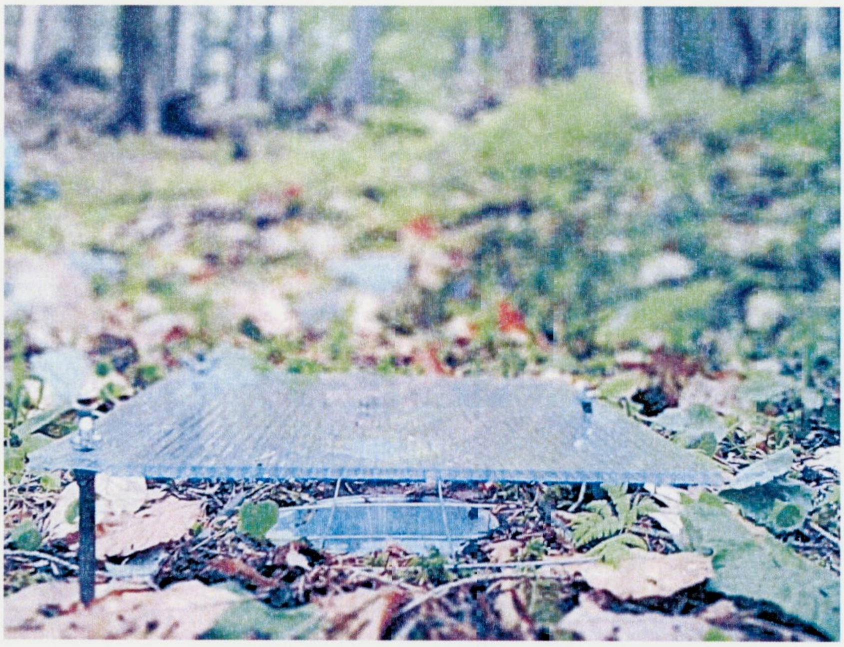


Figure 8. One of the 92 pitfall traps placed in the forests of Lorenzago di Cadore.

For the three sites we performed surveys to measure variables relevant for the target species. Around each trap, inside a circular sample plot with a radius of 11 meters and centered on the trap, we measured the amount of deadwood in terms of volume and decay class (minimum diameter 2 cm). Furthermore we took hemispherical photographs of the canopy (Figure 9) to derive metrics that will be used to analyse the effect of the canopy closure, in relation to the forest management options, on the richness and diversity of the saproxilic assemblages.

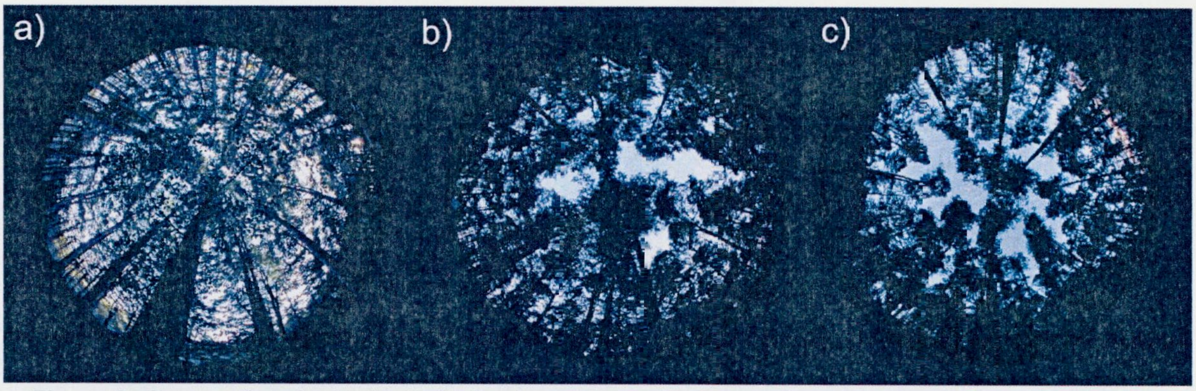


Figure 9. Canopy hemispherical photos took above the traps placed in the plots with different management options in the Cansiglio forest: a) Control, b) Traditional, c) Innovative.

Laboratory activities were performed from July 2013 to February 2014. We sorted all window trap samples from Cansiglio to Coleoptera family level with a stereomicroscope. We started the sorting of window and emergence trap samples from the other sites, as well as Malaise trap samples to family level, for both Coleoptera and Diptera target groups. For the pitfall, samples were sorted at the family level and each individual carabid were determined at the species level.

Slovenia:

Hoverflies

In total 2363 hoverflies were caught between April and October in the site Trnovo with the malaise traps. The catch of hoverflies fluctuated over the year (Figure 10). There was a large increase of hoverflies in the end of August. The main species caught here were aphid feeding species. The identification of some species is still in progress. With the sticky traps 58 species were caught. Kočevski rog had 27 species and 118 individuals. Snežnik had 32 species with 158 individuals. Trnovo had 35 species with 205 individuals. The individuals counted during the transects are not yet completely identified. Interesting saproxylic species caught in the areas were *Blera fallax, Brachypalpoides lentus, Brachypalpus laphriformis, Temnostoma vespiforme, Xylota caeruleiventris, Xylota ignava* and *Xylota jakutorum*.

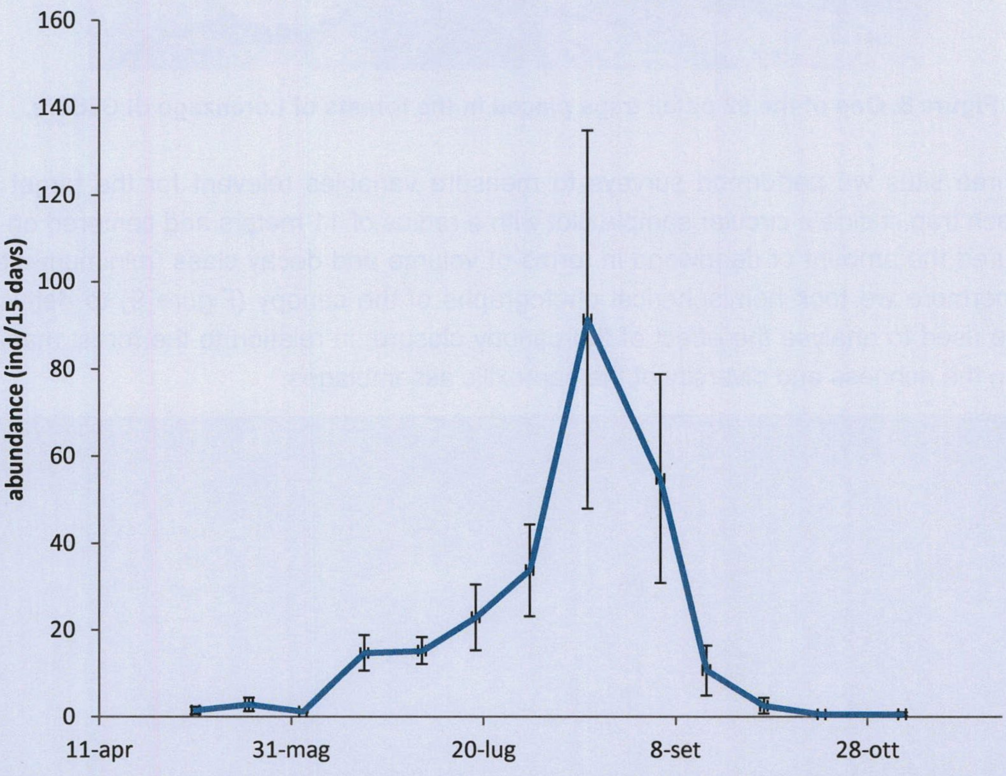


Figure10: The average relative abundance of hoverflies for all the plots caught by malaise trap in Trnovo.

Saproxylic beetles

In year 2013 we caught in the Slovenian sites 23 different species from family Cerambycidae. In total, the dominant species was *Rhagium inquisitor*, followed by *Monochamus sutor* and *Monochamus sartor.*

In Table 3 we present % of species from family Cerambycidae on each location.

Species name	*Kočevski Rog*	*Snežnik*	*Trnovo*
	%	%	%
Rhagium inquisitor (Linnaeus, 1758)	60,7	35,0	38,3
Rhagium mordax (De Geer, 1775)	3,4	2,8	1,8
Rhagium bifasciatum Fabricius, 1775	2,2	0,7	0,4
Monochamus sutor (Linnaeus, 1758)	0	8,2	28
Monochamus sartor (Fabricius, 1787)	0	24,3	18,5
Monochamus galloprovincialis (Olivier, 1795)	0	2,1	5,1
Leiopus nebulosus (Linnaeus, 1758)	1,1	0,4	0,2
Mesosa nebulosa (Fabricius, 1781)	0	0,4	0
Clytus lama Mulsant, 1847	1,1	1,1	2,3
Rutpela maculata (Poda, 1761)	0	0,4	0,2
Prionus coriarius (Linnaeus, 1758)	0	0,4	0
Acanthocinus reticulatus (Razoumowsky, 1789)	3,4	4,3	0
Etorufus pubescens (Fabricius, 1787)	0	0,7	0
Pachyta quadrimaculata (Linnaeus, 1758)	0	0,4	0
Sticoleptura rubra (Linnaeus, 1758)	3,4	5,7	0,6
Tetropium castaneum (Linnaeus, 1758)	4,5	2,8	0,6
Oxymirus cursor (Linnaeus, 1758)	16,8	10	2,7
Xylosteus spinolae Frivaldszky, 1838	0	0,4	0
Acanthocinus aedilis (Linnaeus, 1758)	1,1	0	0,2
Saphanus piceus (Laicharting, 1784)	0	0	0,2
Pachytodes cerambyciformis (Schrank, 1781)	1,1	0	0,2
Clytus arietis (Linnaeus, 1758)	1,1	0	0,2
Anaglyptus mysticus (Linnaeus, 1758)	0	0	0,2

Table 3. Percent (%) of families from family Cerambycidae caught in traps on each location.

In Kočevski Rog, the most dominant species was *Rhagium inquisitor*, followed by *Oxymirus cursor*. Even that we used the pheromone, we did not catch any species from genera *Monochamus*. On location Snežnik, the most dominant species was also *Rhagium inquisitor*, followed by *Monochamus sartor* and *Oxymirus cursor*. On location Trnovo, the most dominant species was *Rhagium inquisitor*, followed by *Monochamus sutor* and *Monochamus sartor*. The species reachnes was almost the same on location Snežnik and Trnovo, but it was lower on location Kočevski Rog.

In Table 4 we present the percent of founding's of the species *Morimus funereus* according to the main tree species in the stand and implemented forest measure.

The potency of cutting according to the growing stock	*Location and main tree species*								
	Trnovo			*Snežnik*			*Kočevski Rog*		
	spruce	*fir*	*beech*	*spruce*	*fir*	*beech*	*spruce*	*fir*	*beech*
0	0	0	0	0	0	0	0	0	0
50	6,25	18,75	0	0	0	0	0	0	0
100	9,37	50	0	9,37	0	6,25	0	0	0
Σ	15,62	68,75	0	9,37	0	6,25	0	0	0

Table 4. Percent (%) of founding's of the species *Morimus funereus* according to the main tree species

In pitfall traps we caught just one specimen of *Rosalia alpina*, on the location Kočevski Rog in spruce stand, where the potency of cutting was 50% according to the growing stock.
Determination of *Trypodendron* species is in progress.

In Slovenia, we sampled hoverflies with transect, window trap and malaise traps. The transects and the window traps were established in all 27 plots. The transects were done for 20 minutes three times a year. The window traps were hanged for one week. Every window trap had two sticky bands on them. The counts and the window traps were done in the beginning of June, beginning of July and the beginning of August. The nine malaise traps were set in Trnovo (site 10). The traps were emptied every two weeks. During the winter period, the specimens of the transects and the window traps were identified in the laboratory.

The carabid beetles were surveyed with pitfall traps. Five pitfall traps were set in the northern, southern, western and eastern side (10 m of the centre) and in the centre of a plot. In total 27 plots of 3 sites were surveyed. The traps were set three times during the season for a week: once in the beginning of June, once in the beginning of July and once in the beginning of August. The identification of the species was started during the winter season and are still ongoing.

In 2013 we put Theyshon and Cross vane funnel traps in all three research areas (Snežnik, Kočevski Rog and Trnovo) with the aim to research the influence of small scale silviculture on saproxylic beetle diversity. The target groups are bark beetles (Coleoptera, Curculionidae: subfam. *Scolytinae*), which are primary saproxylic beetles, and longhorn beetles (Coleoptera, Cerambycidae) which are secondary saproxylic beetles. We also put five pitfall traps on each research plot with the aim to investigate the effect of small scale silviculture on edaphic insects and two NATURA 2000 species.
The Theyson trap with pheromone Trypowit® were used to sample the bark beetles. These traps catch mainly the bark beetle species such as *Trypodendron lineatum* (Olivier, 1795) and other species from those genera. The traps were set on plots where silviculture intensity treatment was

0% and 100% of logging with beech as dominant species. One Theyson trap served us as a control and was without pheromone and was placed 300 – 400 meters from pheromone traps. The traps were set at the beginning of May till the middle of October 2013 and emptied every four weeks. The specimens in the samples were identified in the laboratory of Department of Forestry and Renewable Forest Resources, Biotechnical Faculty (LEŠ – entomology).
Cross vane funnel traps with pheromone Galloprotect 2D®, set 2 meters from the ground, were used to sample longhorn beetles and also bark beetles. This pheromone primarily catches the species from the genera *Monochamus* and also many bark beetles (Curculionidae: subfam. *Scolytinae*), because it contains chemical components which are also in most of the bark beetles pheromones. On the location Kočevski Rog, Trnovo and Snežnik, eight Cross vane funnel traps (per location) were set on spruce and fi· dominated plots where silviculture intensity treatment was 0%, 50% and 100% of logging. Two traps were set without pheromone and served us as a control. The traps were set from the beginning of May till the middle of October 2013 and emptied in one month interval. Catch was identified in the laboratory of Department of Forestry and Renewable Forest Resources (LEŠ – entomology).
Pitfall traps were used to sample the selected NATURA 2000 species *Rosalia alpine* (Linnaeus, 1758) and *Morimus funereus* (Mulsant, 1863), both from family Cerambycidae and other edaphic insects. At each plot we established five traps (3 X 45 = 135 traps). One trap was established in the centre of the plot and four traps around it on a distance approximately 15 meters (in direction: N, S, W, E) and traps were located near stump/tree. Traps were set on all locations and all plots after 20th day in month from May to October 2013. Emptying was done after three days and the NATURA 2000 beetles were released a live.

2.1.3. Subaction 3 - Plant Diversity

Italy:

In Italy, two study sites have been investigated: Pennataro and Lorenzago di Cadore. Plant species and vegetation diversity were investigated using Braun-Blanquet (1932) methodology and, in order to have more precise information about the presence and the spatial distribution of plant species in each forest stand, a list of vascular flora and the percentage cover for each forest layer were recorded within a plot square of 20mx20m, divided in 4 subplots. The sample plots coincide with the deadwood and forest structure plot, in order to make comparable floristic data with the structural data collected. In the 2013, 24 plots were investigated for Pennataro forest and 9 plots for Lorenzago di Cadore. In 2013, vegetation and flora surveys were completed in all the study areas before silvicultural treatments (Chiarano, Pennataro, Mongiana, Tarvisio, Cansiglio, Lorenzago di Cadore) for a total of 124 plots of 400 square meters.

Slovenia:

In area of Dinaric fir-beech forests (ass. *Omphalodo-Fagetum*) in Slovenia, plant diversity have been studied at three sites; site 8 - Kočevski Rog, site 9 - Snežnik, and site 10 - Trnovo. In each site, the vegetation plots were established in 9 randomly selected sinkholes (Karst relief depression). In total, 27 medium vegetation plots (SVPs) with sampling area of 400 m^2 have been surveyed. Additionally, 135 small vegetation plots (MVPs) with radius of 2.0 meters have been systematically distributed in sinkholes and assessed.

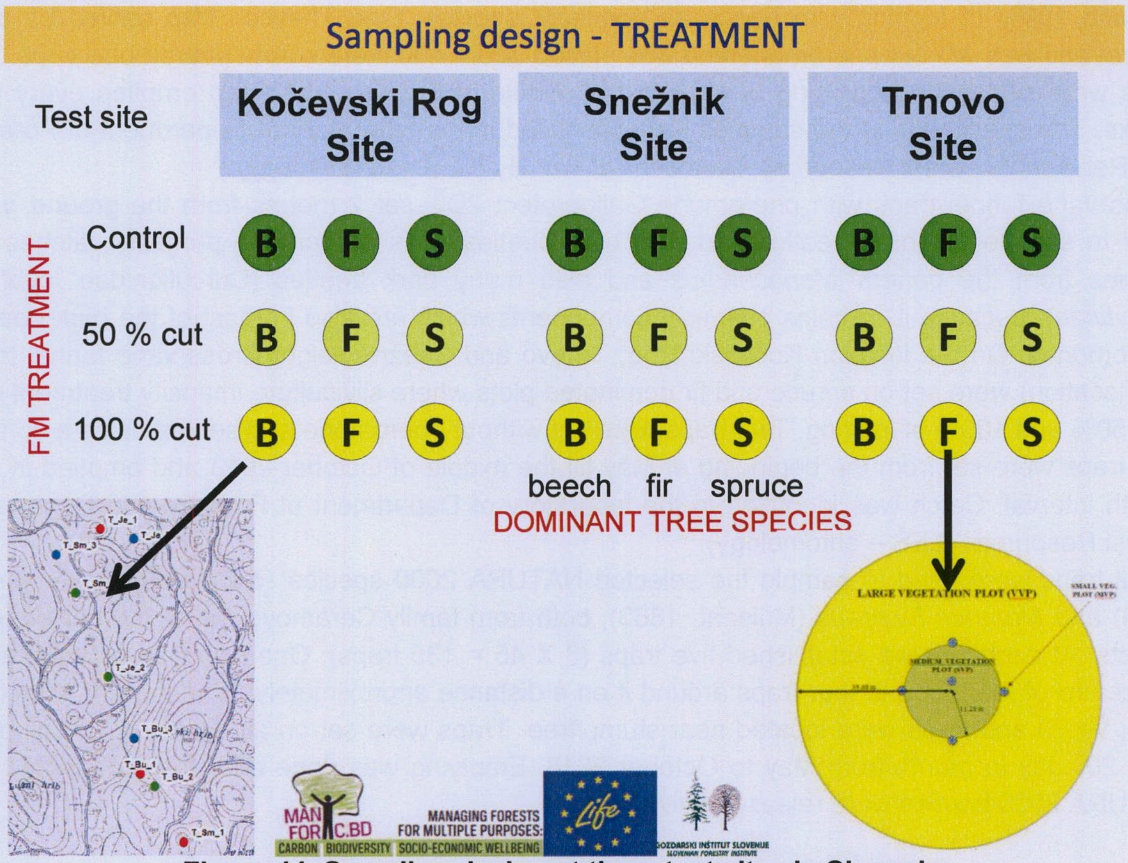


Figure 11. Sampling design at three test sites in Slovenia.

The indicator species and other indicator parameters were studied for all groups of similar plots. Using three key factors as main criteria and species composition in all vertical vegetation layers of plots, DCA ordination were performed and the medium vegetation plots were displayed in DCA ordination space.

Values of the indicators species were calculated as percentage of the perfect indication. Combining relative abundance and relative frequency, the indicator values were calculated by PC-ORD package program using Dufręne & Legendre method (source: Dufręne M., Legendre. P. 1997: Species assemblages and indicator species: the need for a flexible asymmetrical approach. Ecological Monographs 67:345-366.)

Using three grouping factors; planned treatment, dominant tree species and location, analysis of variance (ANOVA) were done to test differences among mean values of parameters related to site conditions, stand characteristics and species diversity.

Result of species diversity assessment of ManFor C.BD plots and testing of three grouping factors were presented at three scientific conferences; i) 56th Symposium of the International Association for Vegetation Science, 26-30 June, 2013, Tartu, Estonia; ii) 35th Meeting of Eastern Alpine and Dinaric Society for Vegetation Ecology, 3-6 July, 2013, Ohrid, Republic of Macedonia; iii) 4th Croatian Botanical Symposium with International Participation, 27-29 September, 2013, Split, Croatia.

In year 2013, the preliminary analysis of species diversity at 135 small vegetation plots has been done.
Based on three key factors, the groups of similar medium vegetation plots were assembled, and plant species diversity status before implementation of forest management measures among different groups have been tested.
Three grouping factors were as follows (Figure): i) Planned treatment; control without forest management action (without removing of trees), felling of 50 % growing stock, felling of 100 % growing stock; ii) Dominant (co-dominant) tree species; beech (*Fagus sylvatica*), fir (*Abies alba*), spruce (*Picea abies*); iii) Location; site 8 – Kočevski Rog, site 9 – Snežnik, site 10 – Trnovo

2.1.4. Subaction 4 - Deadwood

Italy:

Deadwood before the intervention was measured on all the 6 study sites (Chiarano, Pennataro, Mongiana, Tarvisio, Cansiglio, Lorenzago), on a total of 141 plots of 500 square meters. Particularly, 27 plots were sampled in the following sites: Chiarano, Cansiglio, Tarvisio and Mongiana, for a total of 108 plots; 24 plots were sampled in the Pennataro site and 9 in Lorenzago. So, 141 plots were sampled in the ex-ante sampling phase (108+24+9). Deadwood was classified considering dead downed trees, coarse woody debris and stumps, while snags and standing dead trees data were derived from the structural data sets. Decay levels were also assigned to each element sampled, using a five-grade scale (Hunter decay system).

Slovenia:

In the Slovenian sites, deadwood was measured on all 27 plots between autumn 2011 and spring 2012. Deadwood was classified according to the thickness (coarse CWD and fine woody debris FWD) and to the type (e.g. standing dead trees, lying dead trees, snags, stumps, other pieces of deadwood). In 2013 more detailed calculations were performed. The volume of deadwood was calculated at the plot and tree species levels, decay classes, types of deadwood, etc.
In the Slovenian sites, deadwood was measured on all 27 plots between autumn 2011 and spring 2012. Deadwood was classified according to the thickness (coarse CWD and fine woody debris FWD) and to the type (e.g. standing dead trees, lying dead trees, snags, stumps, other pieces of deadwood). In 2013 more detailed calculations were performed. The volume of deadwood was calculated at the plot and tree species levels, decay classes, types of deadwood, etc.

2.2. *Results obtained in 2013*

2.2.1. Subaction 1 - Structural Diversity

Italy:

At the end of 2013, field data collection for the calculation of mensurational parameters has been completed at 7 out of 7 sites.

Calculation of compositional/ structural diversity indexes has been fully performed at the following designated sites:

(Site 1) - Cansiglio State Forest, UTB-Vittorio Veneto (Veneto Region)

(Site 2) - Chiarano-Sparvera Regional Forest, UTB-Castel Di Sangro (Abruzzo Region)

(Site 4) - Marchesale State Forest, UTB-Mongiana (Calabria Region)

Calculation of compositional/structural diversity indexes is in progress at the following designated sites:

(Site 3) - Valdescura Community Forest, Town of Lorenzago di Cadore (Veneto Region)

(Site 5) - Bosco Pennataro Regional Forest, UTB-Isernia (Molise Region)

(Site 6) - Rutte Tarvisio State Forest, UTB-Tarvisio (Friuli Region)

(Site 7) - Vallombrosa State Forest, UTB-Vallombrosa (Toscana Region)

Slovenia:

A) General characteristics of plots

The average number of trees on all research plots was 409 trees/ha with the highest average in Rog (435 trees per ha) and the lowest in Snežnik (377 trees per ha) (Figure 12). Beech is the most common tree species in all Slovenian research sites. Out of the measured 2.756 beech trees, the highest number of this species has been found at the site of Trnovo where we measured 1.081 trees. The number of fir and spruce trees was much lower (855 spruce and 870 fir trees). Other species, presented with more than 10 trees on research plots, are maple (*Acer pseudoplatanus;* 72 trees) and ash (*Fraxinus excelsior:* 16 trees).

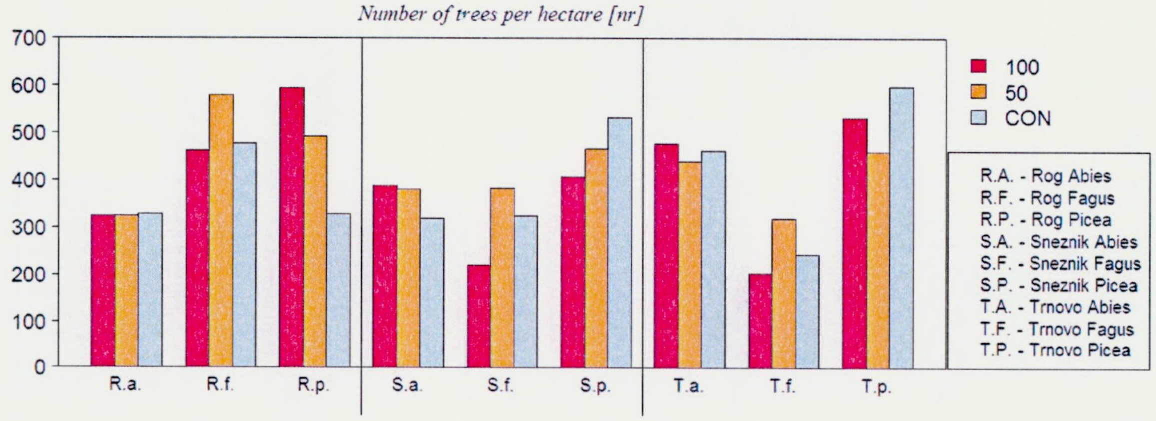


Figure 12. Number of measured trees on research plots at all three sites. Colour of the bar show the planned intensity of management

The plot with the highest growing stock with spruce as the main tree species is located at the site of Trnovo. The growing stock is estimated to 797.10 m^3/ha. The lowest growing stock was measured at the site of Rog on the plot with the main tree species of fir (Figure 13). The average growing stock for all research plots is 541.39 m^3/ha. Similar to the results of growing stock are the results of the basal area (highest on plot Trnovo Picea 50 with 58.03 m^2/ha and lowest at plot Rog Abies 50 with 24.39 m^2/ha) (Figure 14).

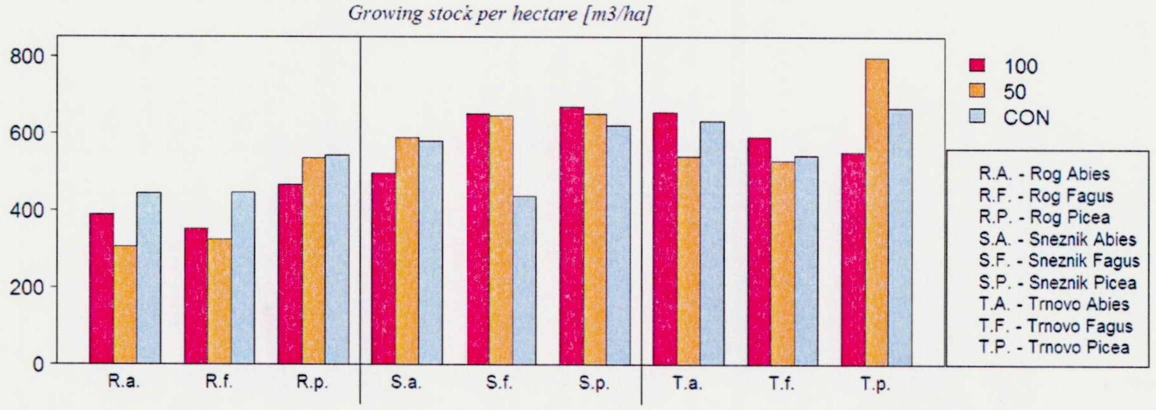


Figure 13. Growing stock on research plots. Colour of the bar show the planned intensity of management.

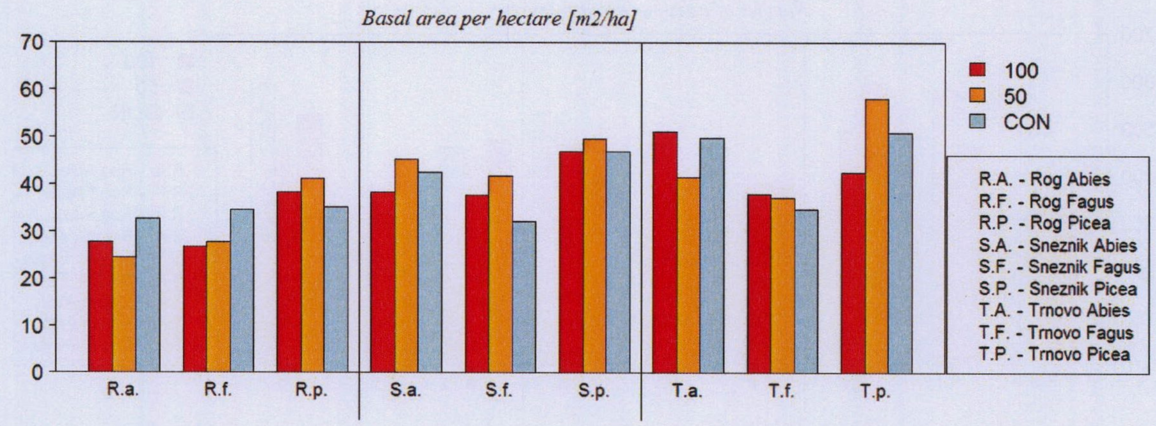


Figure 14. Basal area of research plots. Colour of the bar show the planned intensity of management.

In the view of vertical positions of trees, a comparison of the sites shows that the highest number of dominant trees is at the sites of Snežnik (711) and Trnovo (579). In Kočevski Rog (or Rog) co-dominant trees prevailed (481). This plot has also the highest number of pre-dominat trees (98) and supressed trees (244) (Figure 15).

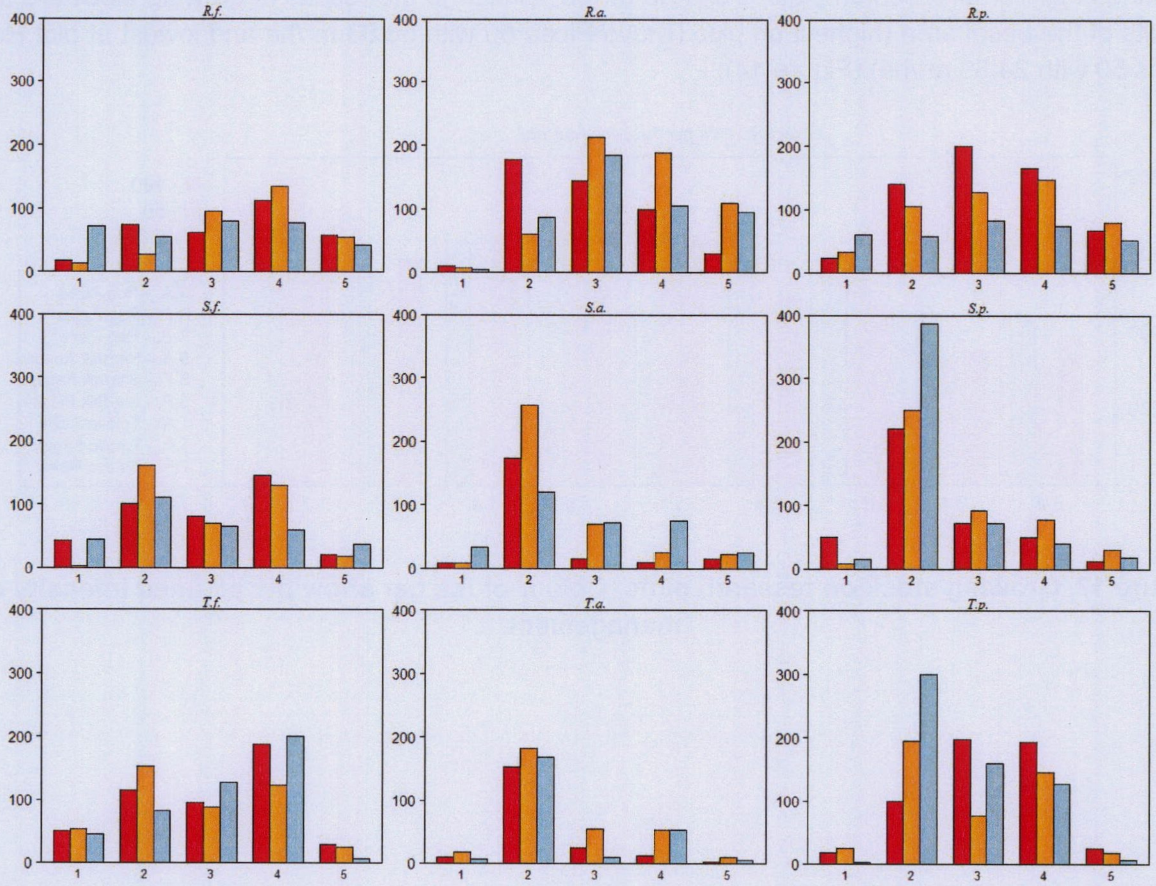


Figure 15. Number of trees in different social classes (1 - predominant, 2 - dominant, 3 - codominant, 4 - dominated, 5 - suppressed).

At the sites of Trnovo and Kočevski Rog the thickest trees are fir; in the site Snežnik beech. Beech with DBH 131 cm was measured at site Snežnik (Table 5).

max DBH				
Resarch area	*11- Picea abies*	*21 - Abies alba*	*41 - Fagus sylvatica*	99 - Other
KOČEVSKI ROG	82	97	83	60
SNEŽNIK	81	89	131	79
TRNOVO	103	109	76	52

Table 5. Maximal DBH of measured trees.

Veteran trees (habitat trees) are important because they provide an important refuge for certain animals and plant species. As veteran trees we considered all trees with a diameter larger than 50 cm. Beech plots in Rog had the lowest number of veteran trees and fir plots in Snežnik and Trnovo the highest (Figure 16).

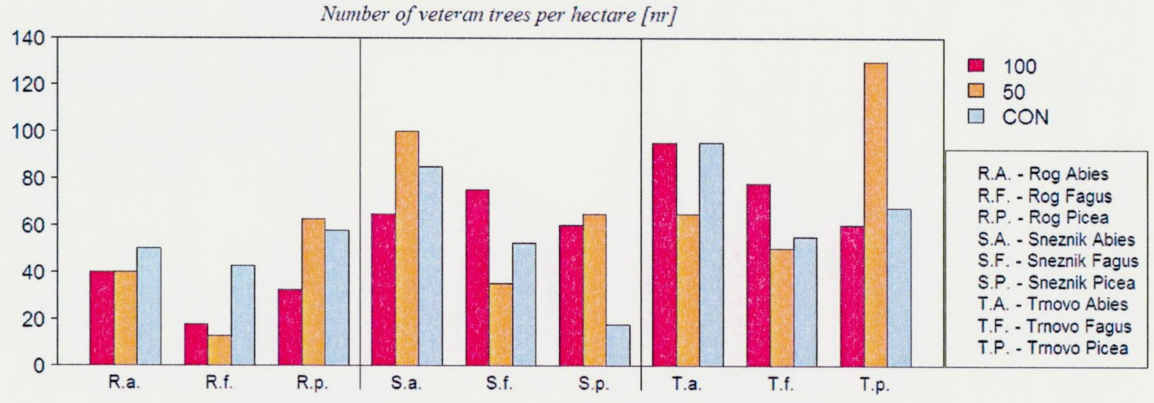


Figure 16. Number of veteran trees (dbh > 50 cm) for 27 research plots.

An important indicator of sustainable forest management is also the distribution of trees classified to the 5 cm dbh classes. Figure 17, Figure 18 and Figure 19 show the differences in the dbh structure between the sites. A low number of trees with the dbh < 25 cm has the site of Snežnik while the site Rog has a small number of trees with DBH > 45. Concerning the regeneration of fir (red colour) the site of Rog appears to be the most optimistic as it has a relatively high number of young trees. The site of Trnovo shows that most of the fir growing stock is in the DBH class of 10-15cm, with small number of young trees. As assumed, the regeneration of fir on this plot is the most problematic. At the same site spruce also seem to be replaced with beech.

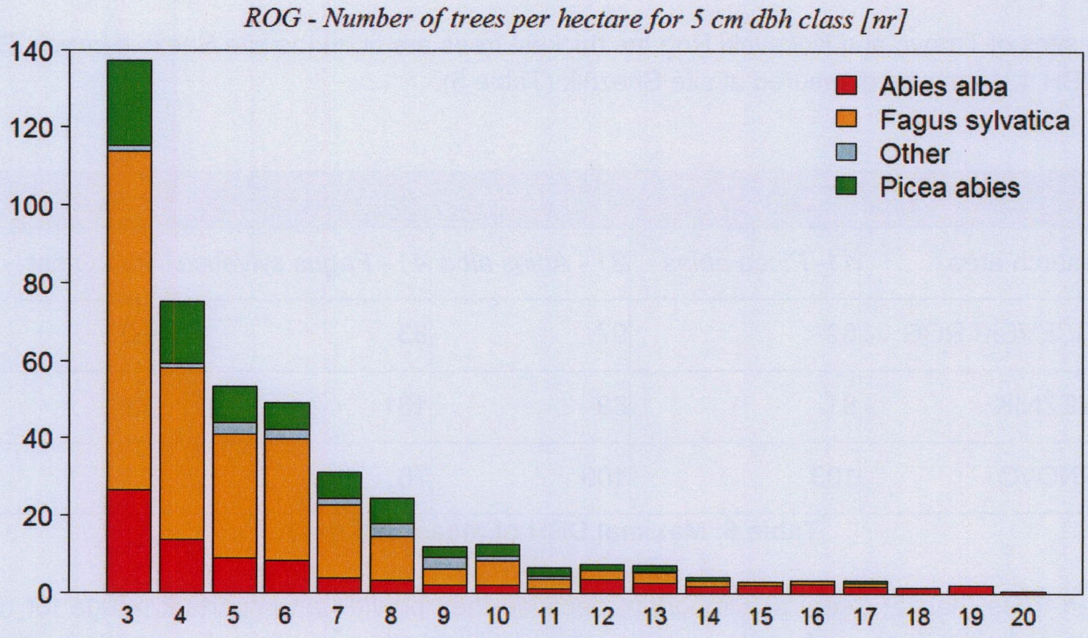


Figure 17. Site Rog - Number of trees for main tree species and 5 cm DBH class.

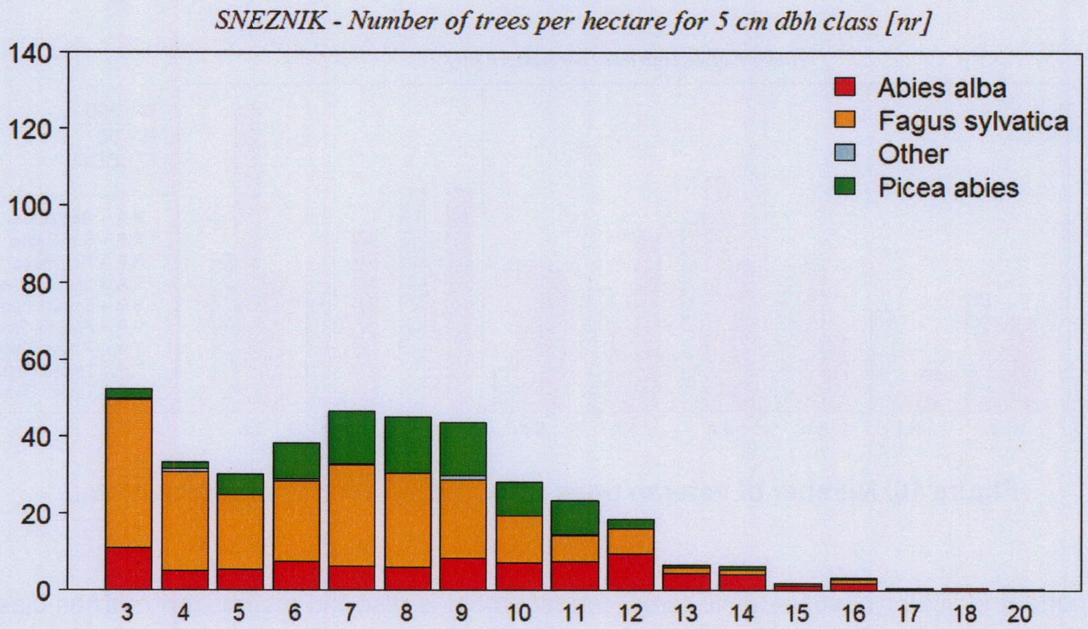


Figure 18. Site Snežnik - Number of trees for main tree species and 5 cm DBH class.

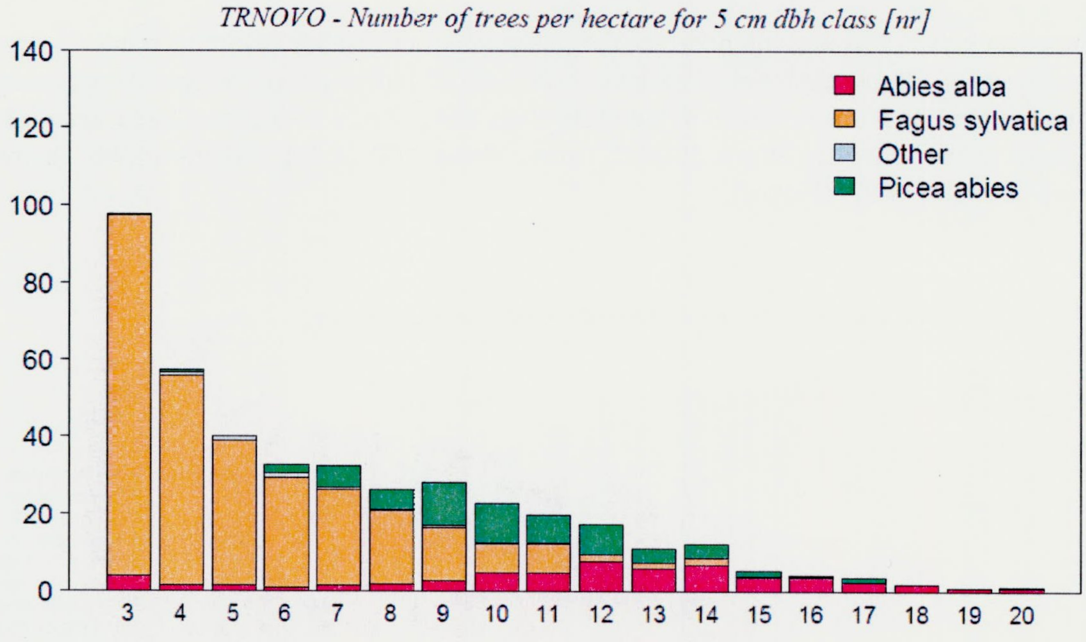


Figure 19. Site Trnovo - Number of trees for main tree species and 5 cm DBH class.

B) Diversity indexes

B.1) Species diversity

The richness index describe the number of different tree species found at the research plot. The highest number of different tree species was at the site of Rog with beech as the main tree species (nr.. = 6) and the lowest at the sites of Snežnik and Trnovo with fir as the dominant tree species (nr. = 2) (Figure20).

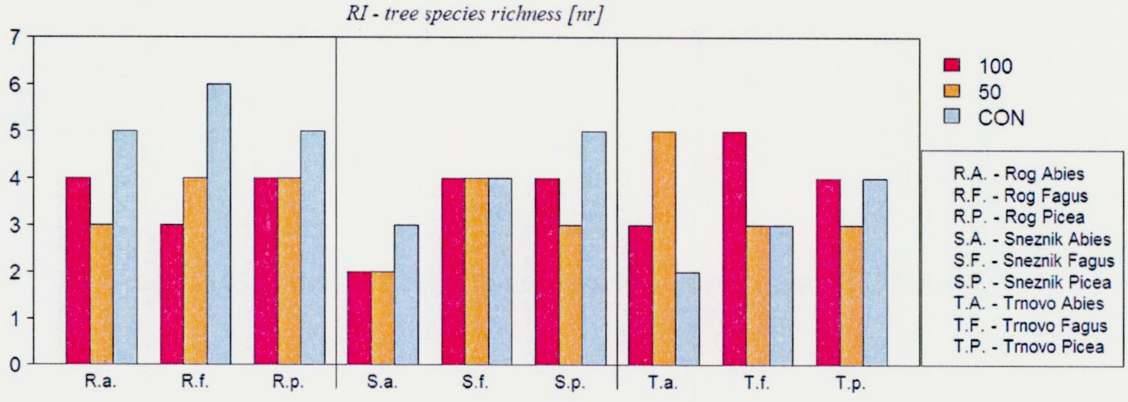


Figure 20. Site Snežnik - Number of trees for main tree species and 5 cm DBH class.

The Shannon index (SH) was intended for the assessment of species diversity, but it was used by many authors for the assessment of structural diversity of forest stands as well. Pi represent the proportion of the basal area of trees in the DBH class compared with the total basal area. SH was the highest at the plot Rog Picea 50 and Trnovo Picea 100 (2.79) and the lowest at the plot Snežnik Picea Con (1.99) (Figure).

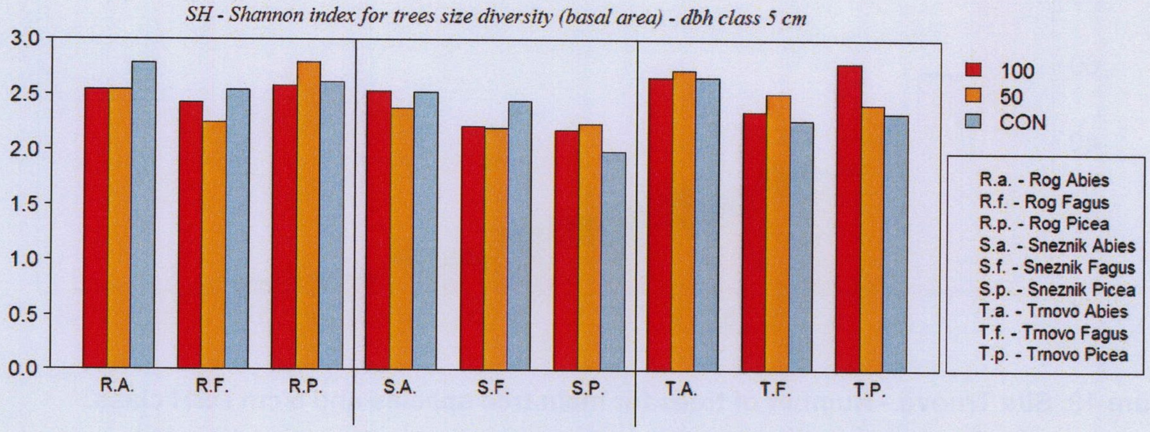


Figure 21. Shannon index- basal area of trees for 5 cm DBH class.

Simpson index (similar to Shannon's index) is used for assessing species diversity (Figure22). Likewise Shannon's (SH) and Simpson's Index (SI) it integrates both species number and the relative abundance of the different species. In Evenness (E) the influence of species number is removed by standardisation. Results for Evenness are presented in Figure23.

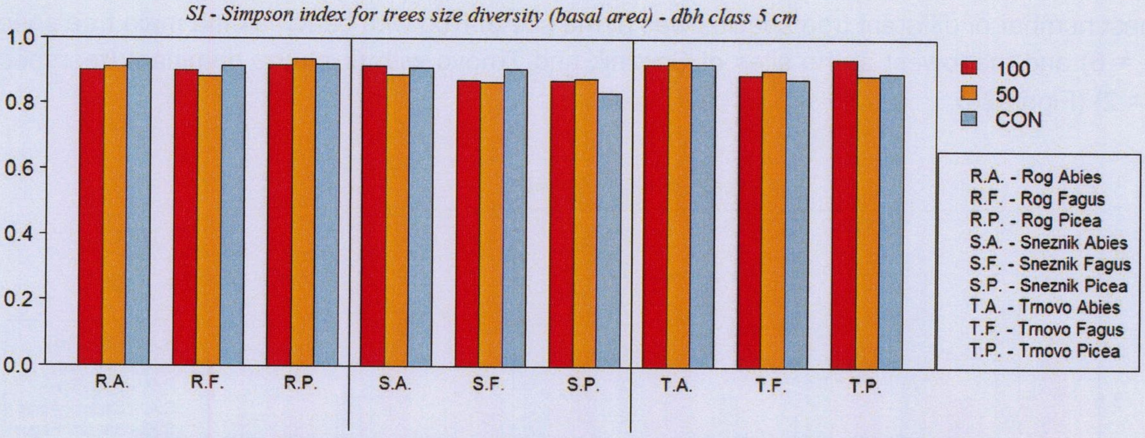


Figure 22. Simpson index- basal area of trees for 5 cm DBH class.

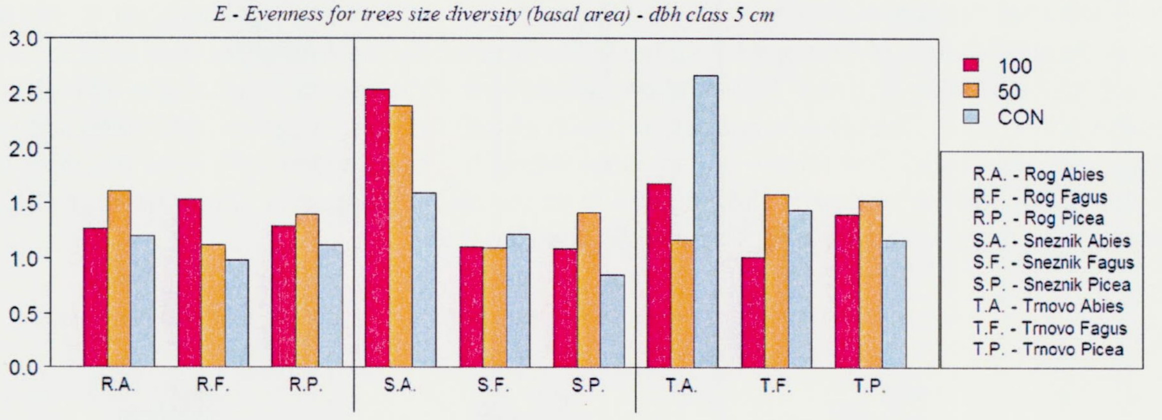


Figure 23. Evenness- basal area of trees for 20 cm DBH class.

B.2) Structural diversity

Structural diversity indices describe the structure of forest stands by the spatial distribution of tree positions, by the spatial mingling of different tree species and by the spatial arrangement of tree dimensions (size differentiation) and contagion.

Within this analysis number of used tree pairs (selected tree and four nearest neighbours) was:

- all tree species: 3241
- Picea abies: 587
- Abies alba: 595
- Fagus sylvatica: 1979

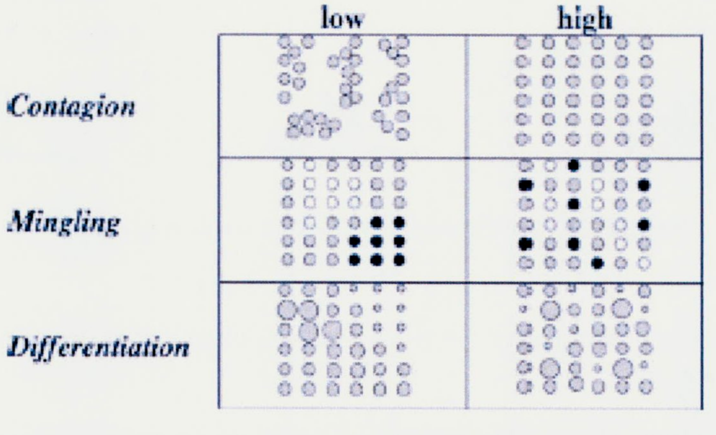


Figure 3. Schematic presentation of structural diversity indexes (author of the picture is von Aguirre et al. 2003).

The contagion index (Contag) concept is based on the classification of the angles between neighbouring trees. The index shows f the trees are aggregated or regularly distributed (Figure

325 – top row). Values of Contag close to 1 correspond to a regular neighbourhood of selected tree, while small values of Contag correspond to the case where the 4 neighbours of selected trees appear in the cluster of trees. Figure show calculations for selected plots at the site of Rog, Snežnik and Trnovo. Calculations are performed on all tree species. Together 3241 trees and their neighbours were used. The lowest Conag index was at the site Snežnik with fir as the main tree species (0.54) and the highest at site Rog with fir as the main tree species (0.63). Average Contag indexes were for site Snežnik 0.57, Trnovo 0.58 and Rog 0.61.

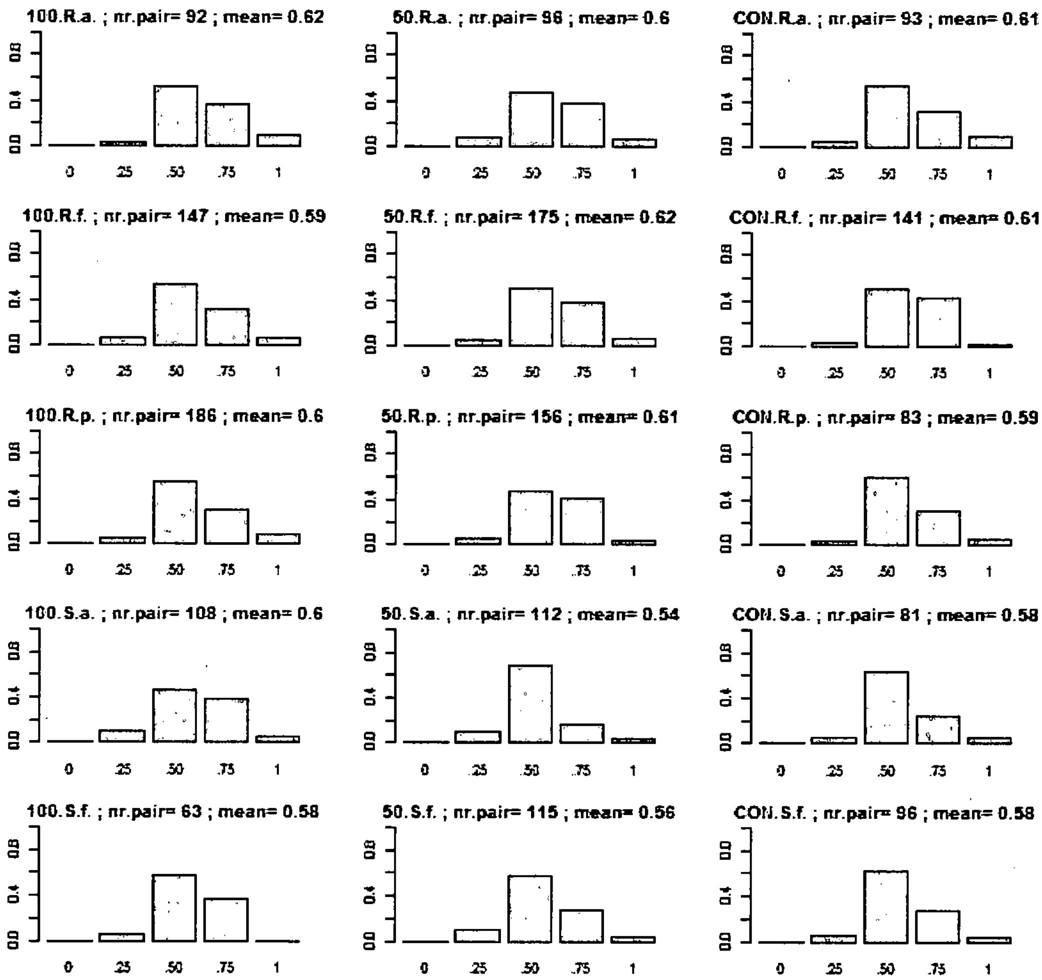


Figure 25. Contagio for selected research plots.

Mingling is defined as the proportion of the n nearest neighbours that do not belong to the same species as the reference tree.

The parameter mingling (Ming) has 5 values:

- 0.00 – all five trees (the reference tree and the four neighbours) are of the same tree species,
- 0.25 – three neighbours are of the same tree species,
- 0.50 – two neighbours are of the same tree species,
- 0.75 – one of the neighbouring trees is of the same tree species,

1.00 – none of the neighbouring trees are of the same tree species.

Figure26 show Ming calculations for selected plots at the site of Rog, Snežnik and Trnovo. Calculations are performed separately for three main tree species (fir, spruce and beech). In this report only the results for fir are presented. Altogether 595 fir trees and their neighbours were used. The lowest Ming index was at the site of Snežnik with fir as the main tree species (0.32). Average Ming indices were for the site of Rog 0.73, Trnovo 0.74 and Snežnik 0.75.

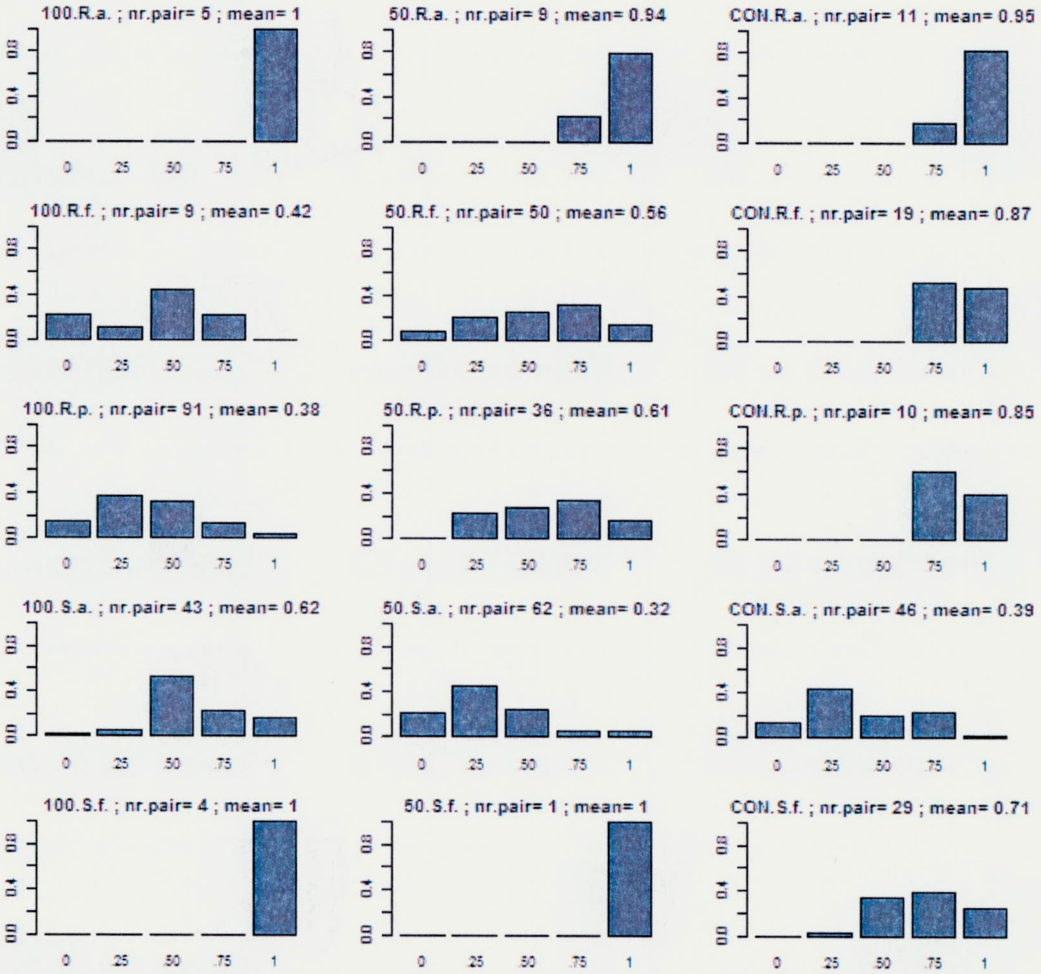


Figure 26. Species mingling for *Abies alba* on selected research plots.

The variable size differentiation (SizDiff) is a spatially explicit measure of the relative dominance of the reference tree within a neighbouring n-tree.

The parameter size differentiation (SizDiff) has 5 values:

0.00 – all the neighbouring trees are thicker than the reference tree,

0.25 – one of the neighbouring trees is thinner than the reference tree,

0.50 – two neighbours are thinner than the reference tree,

0.75 – three neighbours are thinner as the reference tree,

1.00 – all four neighbouring trees are thinner than the reference tree.

Figure show SizDiff calculations for selected plots at the sites of Rog, Snežnik and Trnovo. Calculations are performed for three main tree species (fir, spruce and beech). For this index also, only the results for fir are presented. Together 595 fir trees and their neighbours were used. The lowest SizDiff index was at the of site Snežnik with spruce as the main tree species (0.21). Average SizDiff indexes were for site Snežnik 0.43, Rog 0.67 and Trnovo 0.74.

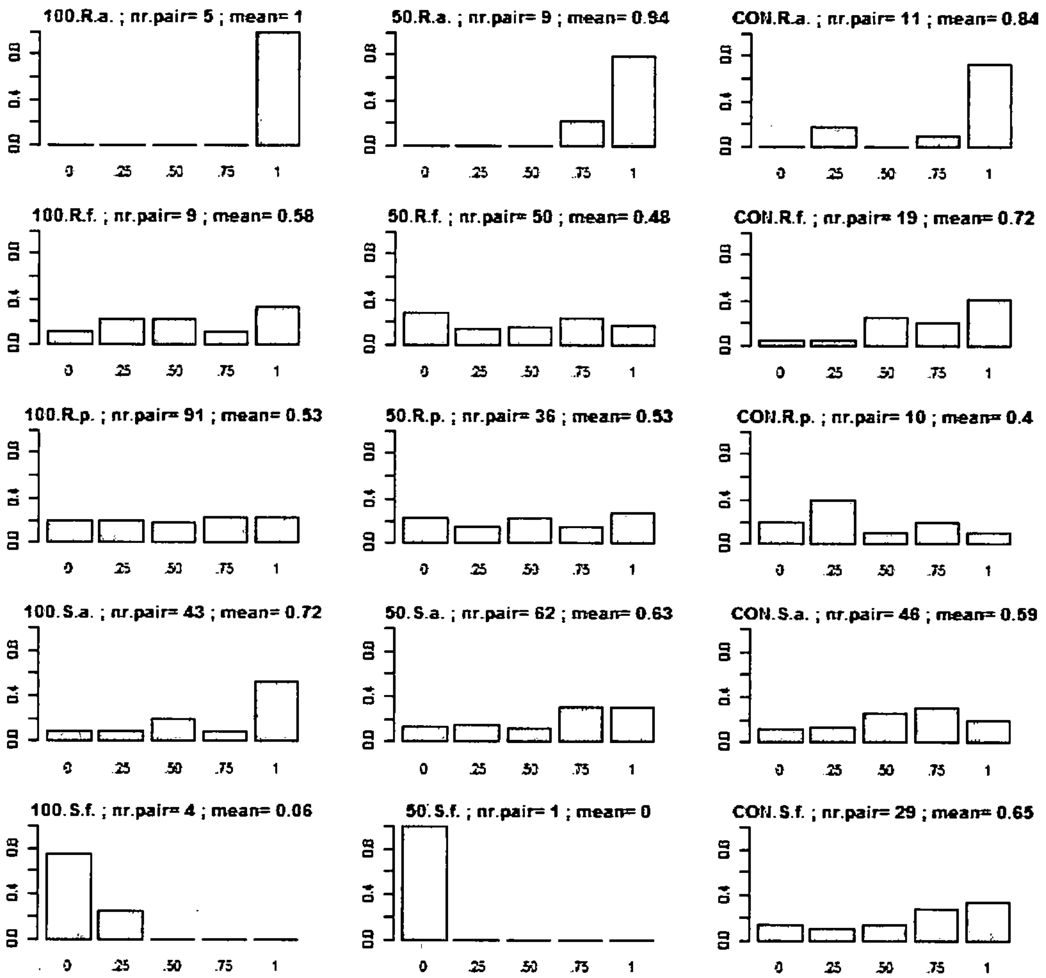


Figure 27. Size differentiation for *Abies alba* on selected research plots.

2.2.2. Sub-action 2 – Fauna Diversity

Sub-action 2a - Vertebrate diversity

Italy:

Checklist may be considered exhaus:ive. Herps species list reveals great differences among areas, Tarvisio forest holding the highest species richness. Herps surveys have been carried on in all 7 Manfor sites. In Pennataro and Tarvisio areas two research focuses have been already established and performed and will be carried out for all subsequent years. The abundance of some species' population allows detailed and quantitative studies (i.e. demography, diet and so on). Indeed, detection of presence/abs=nce is not a useful and exhaustive tool to disclose herps response to different forest management options at least when effects should be measured in a short time frame.

Tarvisio	Lorenzago	Cansiglio	Vallombrosa	Chiarano	Pennataro	Mongiana
				Ficedule albicollis		
Sylvia borin						
Sylvia atricapilla	*Sylvia atricapilla*	*Sylvia atricapilla*	*Sylvia atricapilla*	*Sylvia atricapilla*	*Sylvia atricapilla*	*Sylvia atricapilla*
Poecile palustris	*Poecile palustris*	*Poecile palustris*	*Poecile palustris*	*Poecile palustris*	*Poecile palustris*	*Poecile palustris*
Lophophanes cristatus	*Lophophanes cristatus*					
Periparus ater	*Periparus ater*	*Periparus ater*	*Periparus ater*	*Periparus ater*	*Periparus ater*	*Periparus ater*
Parus major	*Parus major*	*Parus major*	*Parus major*	*Parus major*	*Parus major*	*Parus major*
Cyanistes caeruleus	*Cyanistes caeruleus*	*Cyanistes caeruleus*	*Cyanistes caeruleus*	*Cyanistes caeruleus*	*Cyanistes caeruleus*	*Cyanistes caeruleus*
Pyrrhula pyrrhula	*Pyrrhula pyrrhula*	*Pyrrhula pyrrhula*	*Pyrrhula pyrrhula*		*Pyrrhula pyrrhula*	
Aegithalos caudatus	*Aegithalos caudatus*	*Aegithalos caudatus*	*Aegithalos caudatus*			*Aegithalos caudatus*
Phoenicurus phoenicurus	*Phoenicurus phoenicurus*		*Phoenicurus phoenicurus*	*Phoenicurus phoenicurus*		
Columba palumbus	*Columba palumbus*	*Columba palumbus*	*Columba palumbus*	*Columba palumbus*	*Columba palumbus*	*Columba palumbus*
Loxia curvirostra	*Loxia curvirostra*					
Cuculus canorus	*Cuculus canorus*		*Cuculus canorus*	*Cuculus canorus*		*Cuculus canorus*
Regulus ignicapillus	*Regulus ignicapillus*	*Regulus ignicapillus*			*Regulus ignicapillus*	*Regulus ignicapillus*
Tetrastes bonasia						
Fringilla coelebs	*Fringilla coelebs*	*Fringilla coelebs*	*Fringilla coelebs*	*Fringilla coelebs*	*Fringilla coelebs*	*Fringilla coelebs*
		Coccothraustes coccothraustes			*Coccothraustes coccothraustes*	
Garrulus	*Garrulus*	*Garrulus*	*Garrulus*	*Garrulus*	*Garrulus*	*Garrulus*

glandarius	*glandarius*	*glandarius*	*glandarius*	*glandarius*	*glandarius*	*glandarius*
	Carduelis spinus	*Carduelis spinus*				
Phylloscopus collybita	*Phylloscopus collybita*	*Phylloscopus collybita*	*Phylloscopus collybita*	*Phylloscopus collybita*	*Phylloscopus collybita*	*Phylloscopus collybita*
	Phylloscopus sibilatrix	*Phylloscopus sibilatrix*	*Phylloscopus sibilatrix*	*Phylloscopus sibilatrix*	*Phylloscopus sibilatrix*	*Phylloscopus sibilatrix*
Turdus merula	*Turdus merula*	*Turdus merula*	*Turdus merula*	*Turdus merula*	*Turdus merula*	*Turdus merula*
Nucifraga caryocatactes	*Nucifraga caryocatactes*					
Erithacus rubecula	*Erithacus rubecula*	*Erithacus rubecula*	*Erithacus rubecula*	*Erithacus rubecula*	*Erithacus rubecula*	*Erithacus rubecula*
Sitta europaea	*Sitta europaea*	*Sitta europaea*	*Sitta europaea*	*Sitta europaea*	*Sitta europaea*	*Sitta europaea*
	Dryocopus martius					
Dendrocopos major	*Dendrocopos major*		*Dendrocopos major*	*Dendrocopos major*	*Dendrocopos major*	*Dendrocopos major*
				Dendrocopos minor		
	Picus viridis					
Certhia brachydactyla	*Certhia brachydactyla*	*Certhia brachydactyla*	*Certhia brachydactyla*	*Certhia brachydactyla*	*Certhia brachydactyla*	*Certhia brachydactyla*
Certhia familiaris	*Certhia familiaris*	*Certhia familiaris*	*Certhia familiaris*	*Certhia familiaris*		
	Regulus regulus					
Troglodytes troglodytes	*Troglodytes troglodytes*	*Troglodytes troglodytes*	*Troglodytes troglodytes*	*Troglodytes troglodytes*	*Troglodytes troglodytes*	*Troglodytes troglodytes*
Turdus viscivorus	*Turdus viscivorus*	*Turdus viscivorus*		*Turdus viscivorus*		
Turdus philomelos	*Turdus philomelos*	*Turdus philomelos*	*Turdus philomelos*	*Turdus philomelos*	*Turdus philomelos*	*Turdus philomelos*

Table 6. Amphibians and Reptiles checklist in Manfor CBD sites in Italy. Data collected on 2013.

ORNITHOLOGICAL FOCUSES:

***Certhia brachydactyla* in the site 6**. At Pennataro Forest (site 6) a focus on the short-toed treecreeper (*Certhia brachydactyla*) will attempt at estimating population size and the influence of forest structure on the distribution of the species. The study will be accomplished in a Capture Mark Recapture (CMR) frame and capturing session have been held from April to August (6 consecutive day, repeated four times). Birds have been aged, sexed and measured (weight, biometric measures). Individual recognition is assured due to individual alphanumeric rings, applied on the bird leg. In the whole, we marked, measured and weighted 26 short-toed treecreeper (15 adults and 11 juveniles).

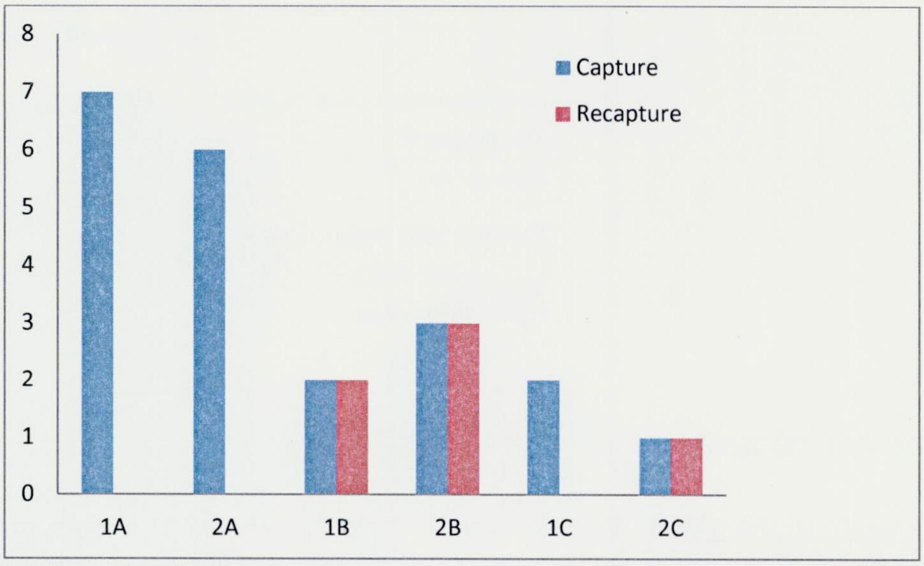


Figure 28. Number of individuals captured and recaptured in the two days of each sessions (A, B, C).

HERPS

SITE	***AMPHIBIA (* in Dir. 92/43/CEE)***	***REPTILIA (* in Dir. 92/43/CEE)***
FORESTA DI TARVISIO	*Salamandra salamandra*	*Natrix natrix*
	Ichtyosaura alpestris	*Iberolacerta horvati**
	Lissotriton vulgaris	*Zootoca vivipara*
	Bufo bufo	*Anguis fragilis*
	*Bombina variegata**	*Vipera berus*
	Rana temporaria	
LORENZAGO	*Salamandra salamandra*	
	Rana temporaria	
CANSIGLIO	*Ichtyosaura alpestris*	
VALLOMBROSA	*Speleomantes italicus*	*Anguis fragilis*
N.B. *Data from locality "Vallombrosa" collected at the Museo di Firenze "La Specola"*	*Salamandra salamandra* (***B***)	*Chalcides chalcides*
	Triturus carnifex	*Lacerta bilineata*
	Lissotriton vulgaris	*Podarcis muralis* (***P***)
	Bufo bufo (***B***)	*Podarcis sicula*
(P) = Confirmed within the plots during our sampling	*Bombina pachypus*	*Coronella austriaca*
	Hyla intermedia	*Elaphe quoatuorlineata*
	Rana dalmatina (***B***)	*Hierophi viridiflavus*
(B)= Confirmed near or on the border of the plots (no more than 200 m away)	*Rana italica* (***B***)	*Natrix natrix*
	Rana temporaria	*Zamenis longissimus*
	Pelophylax esculentus	*Vipera aspis* (***P***)

CHIARANO		*Podarcis muralis**
PENNATARO	*Salamandrina perspicillata** *Rana italica** *Bufo bufo*	*Podarcis muralis**
MONGIANA	*Salamandra salamandra* *Lissotriton italicus** *Hyla intermedia*	

HERPETOLOGICAL FOCUSES:

***Bombina variegata* in the site 5.** At Rutte Tarvisio State Forest (site 5) a focus on the yellow-bellied toad (*Bombina variegata*) will attempt at estimating population size, phenology in 3 reproductive pools. The study will be accomplished in a Capture Mark Recapture (CMR) frame and capturing session have been held from May to October (three consecutive day each month). Toads have been aged, sexed and measured (weigh, length). Individual recognition is performed based on individual ventral pattern. In the whole, we marked, measured and weighted 138 yellow bellied toads, differently distributed among sexes and pools (see Figure 29).

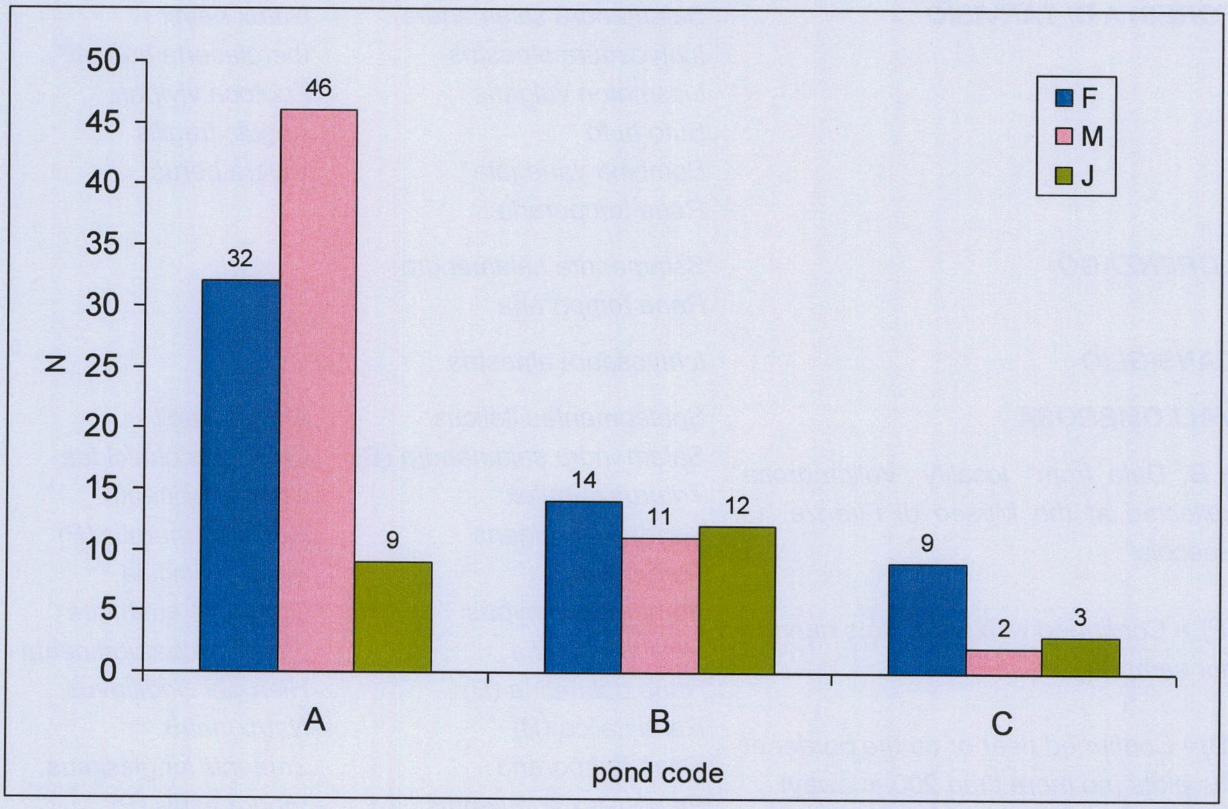
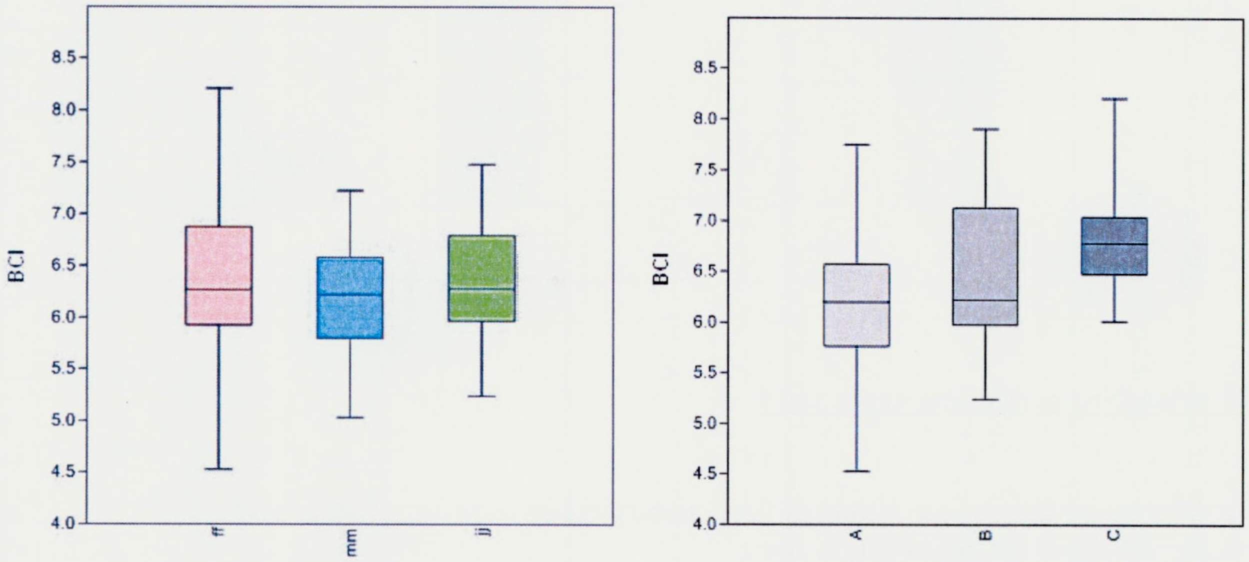


Figure 29. Marked, measured and weighted yellow bellied toads, differently distributed among sexes and pools.

Body condition Index (BCI) measured as the Scaled Mass Index (Peig & Green, 2009) before the forest cutting showed that there was no differences among BCI of females, males and juveniles (all site pooled, fig. XX) but in the pond C is significantly higher than in the other two ponds (Figure 29). Those BCI will be used to compare stress level of the population after forest cutting.



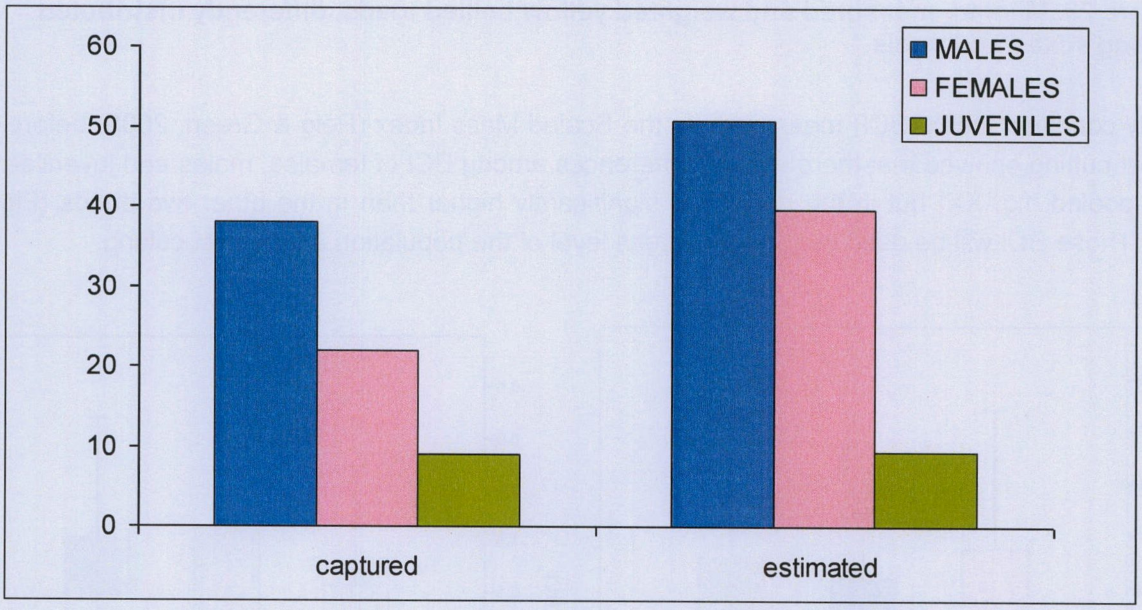
CMR analyses: The main result using the "Robust Design" method (only on the pond A, where there is a sufficiently large population) was that

- young toads have a lower survival probability in comparison with adults
- toads enter and leave the ponds randomly with no differences between ages or sexes
- capture probability is the same among toad groups (i.e. ages and sexes)

Survival probability will be compared between pre (years 2012 and 2013) and post forest treatments.

The original Jolly-Seber model was primarily interested in estimating abundance. We used the

The Burnham Jolly Seber (BJS) formulation (which includes a parameter for the population size at the start of the experiment). Our experiment started in June 2012 and we captured a total of 69 toads. BJS estimate 100 toads (see fig.XX) Estimation where the population in the pond A was composed as:



***Salamandrina persicillata* at the site 6.**

For Spectacled salamander at the site Pennataro-Montedimezzo we aimed to collecting demographic and ecological data to relate
their variations to forestry interventions. Four main focal points are under scrutiny:

1. Demographic study
2. A study of the realized trophic niche with possible seasonal variations in the experimental area and in a control area.
3. A study about environmental preferences related to different typology of forest trees used as terrestrial shelter.

1. Demographic study: first analyses using CMR data and using the Cormak Jollys Seber model suggest that the density of *Salamandrina* in the study forest is about 2700 salamanders/ha (range 1500-300).
2. Realized trophic niche. we compared the outcome of two methods (stomach contents and faecal contents) in interpreting prey selectivity when the available prey community in the environment is known. The interpretation of the population prey selection strategy varied in relation to the method used. Stomach content analysis suggested that salamanders were highly specialized on springtails, while faecal contents indicated a generalist trophic

strategy. Prey selectivity indexes were also highly divergent: the analysis of stomach contents indicated a significant positive selection upon springtails, while exactly the opposite conclusion was obtained when faecal contents were analyzed. The results confirm that in amphibians, stomach analysis provides more reliable dietary data in comparison to faecal analysis. This is related to the fact that soft-bodied prey items tend to be more fully digested, disappearing in faeces while highly chitinized and less digestible prey taxa tend to increase their relative abundances in faeces. *Salamandrina perspicillata* is a highly specialised predator of springtails and probably play an indirect role in letter decomposition and in the carbon cycling.

3. We sampled salamander on tree buttresses and we collected data on each tree (392 tree in the experimental area): tree species, DBH, number of buttresses, number of holes. Georeferentiation of each tree I still in progress. On the 2014 we will finish the data collection and we will analyse them: results will have practical application in forest management.

Chiroptera

Chiroptera

A first comparison between data collected in 2012 and 2013 shows what follows:

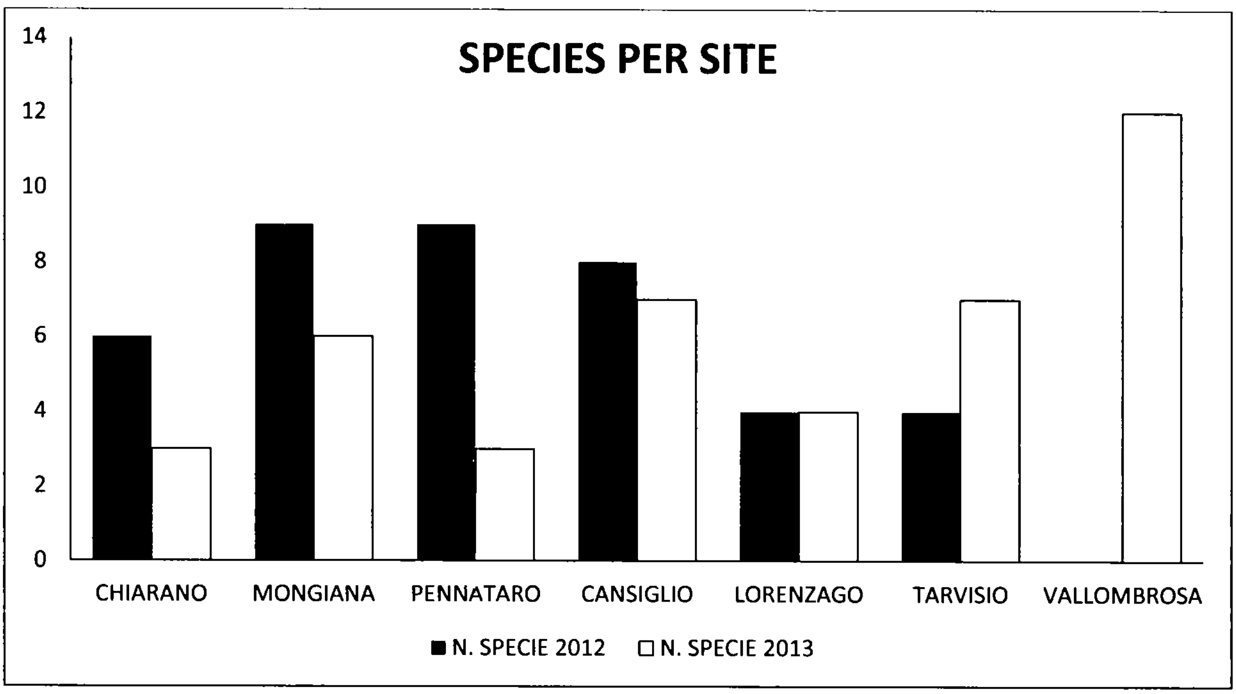


Figure 30. Number of species per site

The comparison has been carried out considering all the species registered inside the ManFor study areas and inside the external circle round (where investigated), in order to obtain a much more representative informations about bat activity and their species composition for the different ManFor sites.

Table 7. Number of species per site

SITE	N. SPECIES 2012	N. SPECIES 2013
CHIARANO	6	3
MONGIANA	9	6
PENNATARO	9	3
CANSIGLIO	8	7
LORENZAGO	4	4
TARVISIO	4	7
VALLOMBROSA	0	12

At Chiarano, Mongiana e Pennataro sites, the number of bat species decreased from 2012 to 2013, then at Lorenzago we had no changes. At Tarvisio the number of bat species increased. As Vallombrosa was only designated as a study site in spring 2013 no comparison with 2012 was possible.

This variability is probably due to multiple causes. First of all, the logging operations may have disturbed bats during their day roosting and may have dispersed them in the adjacent areas; furthermore, the different weather conditions in different years may have influenced the bat activity as well as their detectability.

This is the reason because these preliminary results need to be implemented with sampling sessions to be made when all logging operations will be completed and after a "quiet" period inside the area to permit an "assessment" of local bat community.

The variability among years could be statistically controlled only having a wide enough multi-year data series, but the difference between two years is less controllable when even the environmental conditions have changed, due to logging operations.

In order to manage the variability due to these factors, a synoptic sampling protocol among plots logged with different treatment thesis is needed. This sampling protocol needs to be applied after a "quiet" period as long as we can assume that local bat community is assessed to the new environmental conditions.

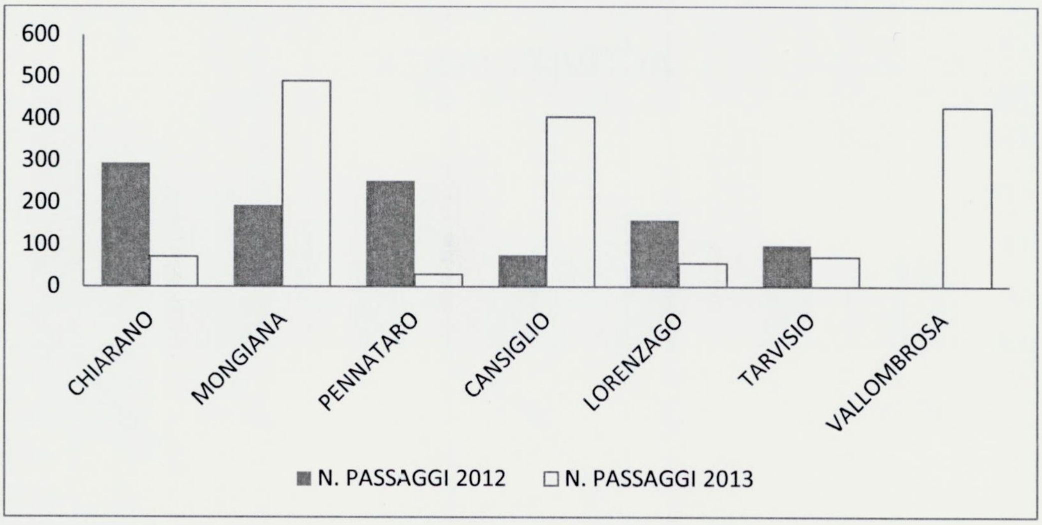


Figure 30. Number of passes per site.

Table 8. Number of passes per site.

SITE	N. PASSES 2012	N. PASSES 2013
CHIARANO	294	71
MONGIANA	193	490
PENNATARO	252	30
CANSIGLIO	76	404
LORENZAGO	159	56
TARVISIO	99	71
VALLOMBROSA	0	427

The comparison has been made only considering ultrasound data recorded inside ManFor sites. At Mongiana and Cansigio sites we noticed that bat activity increased, then at other sites we noticed a decreasing trend. At Vallombrosa, we have no data for 2012.

Table 9. Activity index per site.

SITE	ACTIVITY INDEX 2012	ACTIVITY INDEX 2013
CHIARANO	3,50	1,31
MONGIANA	4,02	8,75
PENNATARO	5,25	0,63
CANSIGLIO	2,53	7,92
LORENZAGO	2,65	1,08
TARVISIO	1,83	1,87
VALLOMBROSA	0,00	10,17

The comparison among activity index for all sites shows the same pattern as the number of passes.

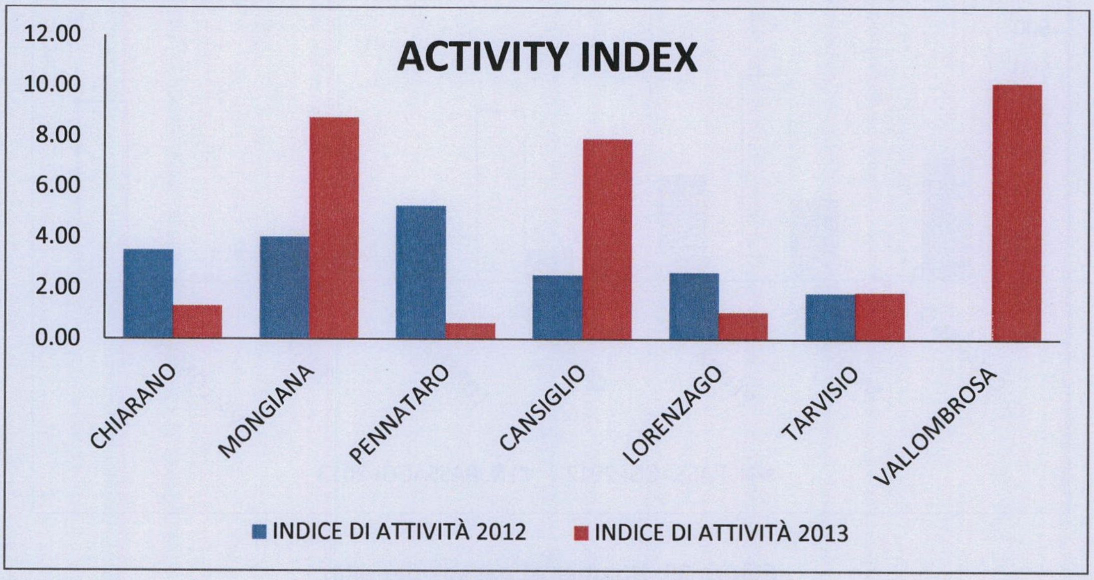


Figure 31. Activity index per site.

For 3 sites (Chiarano, Mongiana and Cansiglio) we could carry out a first comparison between "ex ante" and "ex post" bat activity and species richness in species according to the different treatment applied. The significance of association between treatment, phase and activity was tested with a Chi-square test.

Foresta Demaniale Regionale "Chiarano Sparvera"

At Chiarano site I carried out, during 2012 and 2013 field work, ultrasound bat surveys and mistnetting capture sessions inside plots assigned to different treatment thesis.

During the 2012 surveys I was able to identify the following species:

1) *Plecotus auritus* (Brown Big-eared Bat);
2) *Myotis nattereri* (Natterer's bat);
3) *Hypsugo savii* (Savi's pipistrelle);
4) *Miniopterus schreibersii* (Schreiber's Bent-winged Bat, Annex II and IV of Directive 92/43 CEE – Habitat Directive);
5) *Nyctalus leisleri* (Lesser noctule);
6) *Pipistrellus pipistrellus* (Common pipistrelle).

During the 2013 surveys I was able to identify the following taxa:

1) *Pipistrellus pipistrellus* (Common pipistrelle);
2) *Myotis cfr. mystacinus* (Whiskered bat);
3) *Hypsugo savii* (Savi's pipistrelle);
4) *Myotis sp.*

For this site, it was possible to carry out a comparison between "ex ante" and "ex post" bat activity and species richness in species according to the different treatment applied. The significance of association between treatment, phase and activity was tested with a Chi-square test

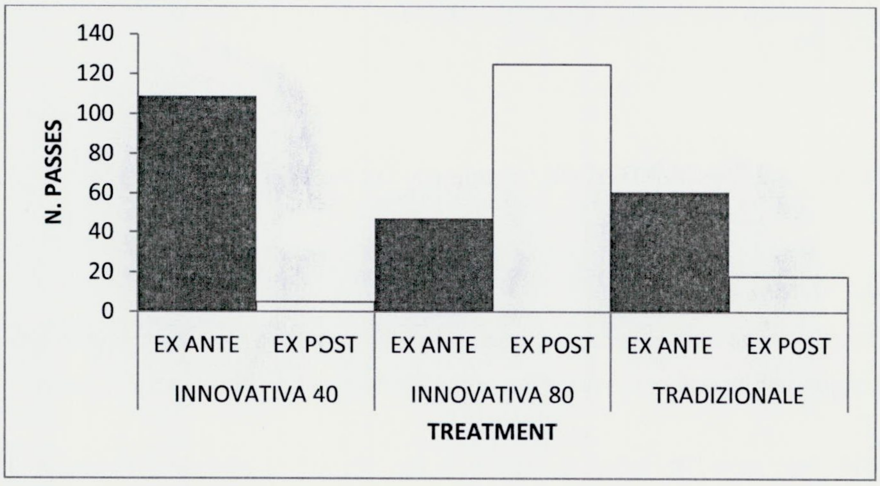


Figure 32. Comparison between bat activity.

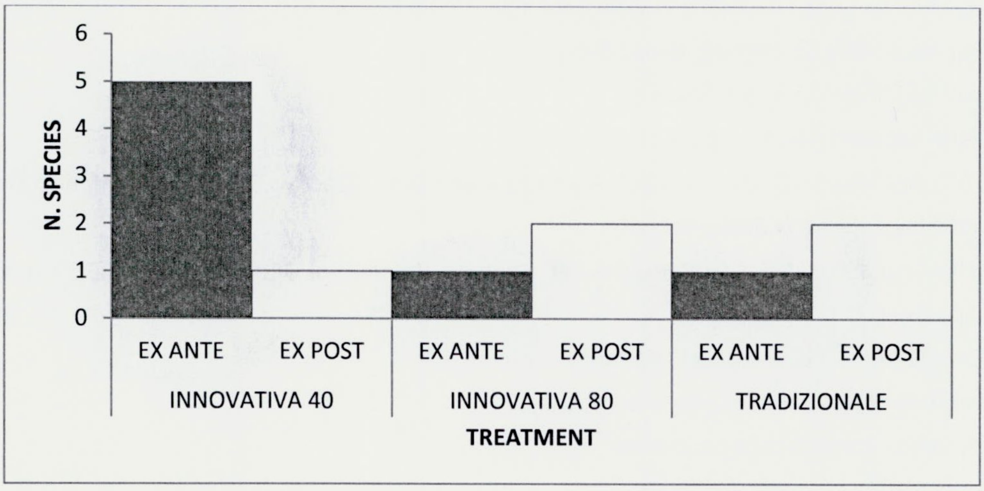


Figure 33. Comparison between species richness.

Table 10. Comparison between bat activity and species richness according to treatment association.

THESIS	STATUS	TOT. PASSES	N. SPECIES
INNOVATIVA 40	EX ANTE	109	5
INNOVATIVA 40	EX POST	5	1
INNOVATIVA 80	EX ANTE	47	1
INNOVATIVA 80	EX POST	125	2
TRADIZIONALE	EX ANTE	61	1
TRADIZIONALE	EX POST	18	2

According to the Chi-square the activity level (n. passes) was non-randomly associated to treatment and phase:

χ^2 (df=2) = 145,81

P < 0,0001

No significant pattern was found for species richness:

χ^2 (df=2) = 3,086

P = n.s.

So, at Chiarano, the "INNOVATIVA 40" treatment led to increased bat activity.

Riserva Naturale "Marchesale"

At Mongiana site I was able to replicate the surveys inside all the plots assigned to different treatment theses. At this site, logging operations have been completed when I carried out bat surveys.

During 2013 field work, in order to minimize the impact of sampling sessions, I haven't made mistnetting capture sessions.

During 2012 surveys I was able to detect the following species:

1) *Plecotus auritus* (Brown Big-eared Bat);
2) *Nyctalus leisleri* (Lesser noctule);
3) *Myotis nattereri* (Natterer's bat);
4) *Myotis bechsteinii* (Bechstein's bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
5) *Myotis mystacinus* (Whiskered bat);
6) *Barbastella barbastellus* (Barbastelle bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
7) *Tadarida teniotis* (European Free-tailed Bat);
8) *Pipistrellus pygmaeus* (Soprano pipistrelle);
9) *Pipistrellus kuhlii* (Kuhl's pipistrelle).

During 2013 surveys I was able to detect the following taxa:

1) *Nyctalus leisleri* (Lesser noctule);
2) *Barbastella barbastellus* (Barbastelle bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
3) *Tadarida teniotis* (European Free-tailed Bat);
4) *Pipistrellus pygmaeus* (Soprano pipistrelle);
5) *Pipistrellus kuhlii* (Kuhl's pipistrelle);
6) *Pipistrellus pipistrellus* (Common pipistrelle)
7) *Myotis sp.*

Even at this site we could carry out a first comparison between "ex ante" and "ex post" bat activity and species richness in species according to the different treatment applied. The significance of association between treatment, phase and activity was tested with a Chi-square test.

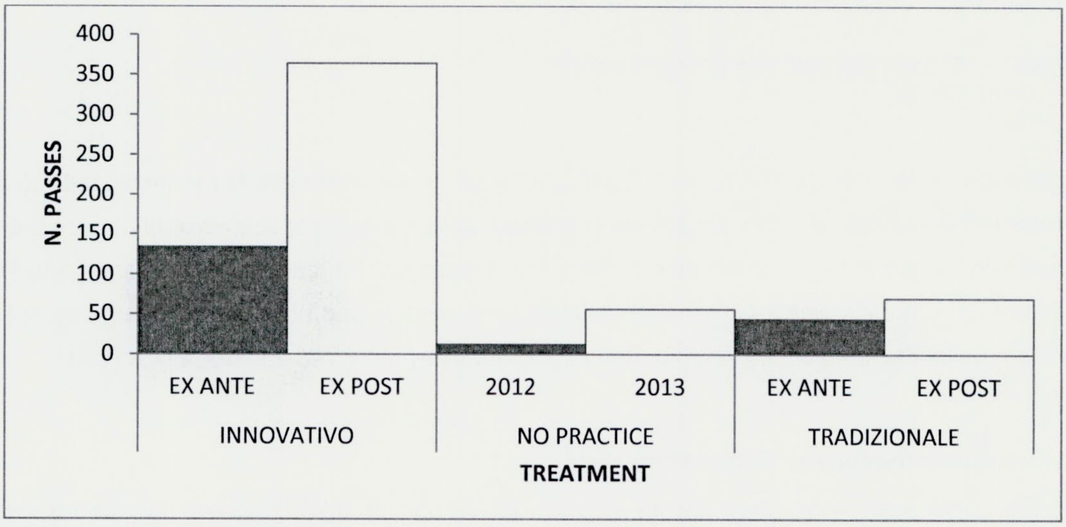


Figure 34. Comparison between bat activity level.

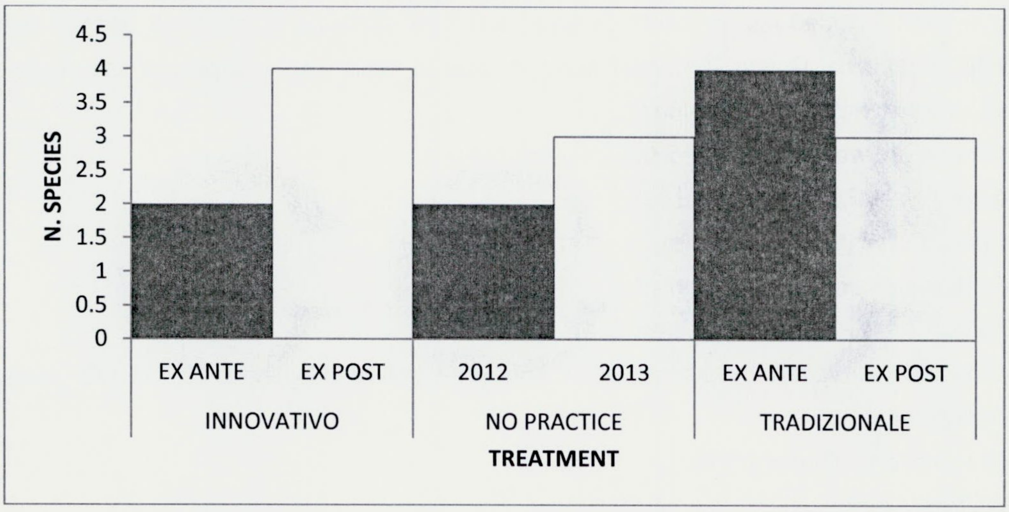


Figure 35. Comparison between species richness.

Table 11. Comparison between bat activity level and species richness.

THESIS	STATUS	TOT. PASSES	N. SPECIES
INNOVATIVO	EX ANTE	135	2
INNOVATIVO	EX POST	364	4
NO PRACTICE	2012	13	2
NO PRACTICE	2013	56	3
TRADIZIONALE	EX ANTE	45	4

TRADIZIONALE	EX POST	70	3

Bat activity was non-randomly associated to phase and treatment:
χ^2 (df=2) = 10,081
P < 0,001

Species richness showed no significant pattern:
χ^2 (df=2) = 0,797
P = n.s.

At Mongiana site, both "INNOVATIVA" and "TRADIZIONALE" treatments have led to increased bat activity. In fact, even within non-logged plots bat activity increased, possibly as a consequence of contiguity between logged and non-logged plots. I noticed that inside a non logged plot the bat activity increased and this may be due to both a non controllable interannual variability phenomena and an influence of logging operations that modified the landscape pattern, accentuated by the contiguity of logged and non logged plots.

Foresta Demaniale Regionale "Bosco Pennataro"

This ManFor Area was designated during autumn 2012. During 2012 summer monitoring session I investigated the whole "Bosco Pennataro" area, in order to collect data about bat activity and bat species richness of the entire area. Once the ManFor area was designated, I have noticed that n. 6 sampling points of 2012 have been included inside the study area, and n. 8 sampling points have been included in the external circle round area. During 2013 field work, in order to minimize the impact of sampling sessions, I haven't made mistnetting capture sessions.

During 2012 surveys I was able to detect the following species:

1) *Myotis mystacinus* (Whiskered bat);
2) *Hypsugo savii* (Savi's ppistrelle);
3) *Myotis daubentonii* (Daubenton's bat);
4) *Plecotus auritus* (Brown Big-eared Bat);
5) *Barbastella barbastellus* (Barbastelle bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
6) *Myotis nattereri* (Natterer's bat);
7) *Pipistrellus pipistrellus* (Common pipistrelle);
8) *Rhinolophus ferrumequinum* (Greater Horseshoe Bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
9) *Nyctalus leisleri* (Lesser noctule).

During 2013 surveys I was able to detect the following taxa:

1) *Hypsugo savii* (Savi's pipistrelle);
2) *Barbastella barbastellus* (Barbastelle bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);

3) *Myotis sp.*;

4) *Pipistrellus pipistrellus* (Common pipistrelle).

At this site it was not possible to carry our a comparison between "ex ante" and "ex post" because the site was still not logged in 2013.

"Riserva Naturale Campo di Mezzo-Pian Parrocchia"

During 2013 surveys the entire ManFor area have already been logged. I investigated all plots assigned to different theses. Mistnetting capture sessions have been made both in 2012 and 2013 field work sessions.

During 2012 surveys I was able to detect the following species:

1) *Myotis emarginatus* (Geoffroy's Bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
2) *Myotis mystacinus* (Whiskered bat);
3) *Nyctalus leisleri* (Lesser noctule);
4) *Pipistrellus pipistrellus* (Common pipistrelle);
5) *Rhinolophus hipposideros* (Lesser Horseshoe Bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
6) *Hypsugo savii* (Savi's pipistrelle);
7) *Barbastella barbastellus* (Barbastelle bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
8) *Tadarida teniotis* (European Free-tailed Bat).

During 2013 surveys I was able to detect the following taxa:

1) *Rhinolophus hipposideros* (Lesser Horseshoe Bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
2) *Hypsugo savii* (Savi's pipistrelle);
3) *Nyctalus leisleri* (Lesser noctule);
4) *Tadarida teniotis* (European Free-tailed Bat).
5) *Pipistrellus pipistrellus* (Common pipistrelle);
6) *Pipistrellus kuhlii* (Kuhl's pipistrelle);
7) *Eptesicus serotinus* (Serotine);
8) *Myotis sp.*

Some species detected in 2012 haven't been detected in 2013, as well as some species have been detected only in 2013. This may be due to both the elusivity and the low density of recurrence of forest bat species inside woodlands. Furthermore, three-dweeling bats frequently change roost (even once a day) doing a "roost switch", so their detectability is strongly influenced by the proximity of the bat detector to a colony.At this site we could carry out a first comparison between "ex ante" and "ex post" bat activity and species richness in species according to the different treatment applied. The significance of association between treatment, phase and activity was tested with a Chi-square test.

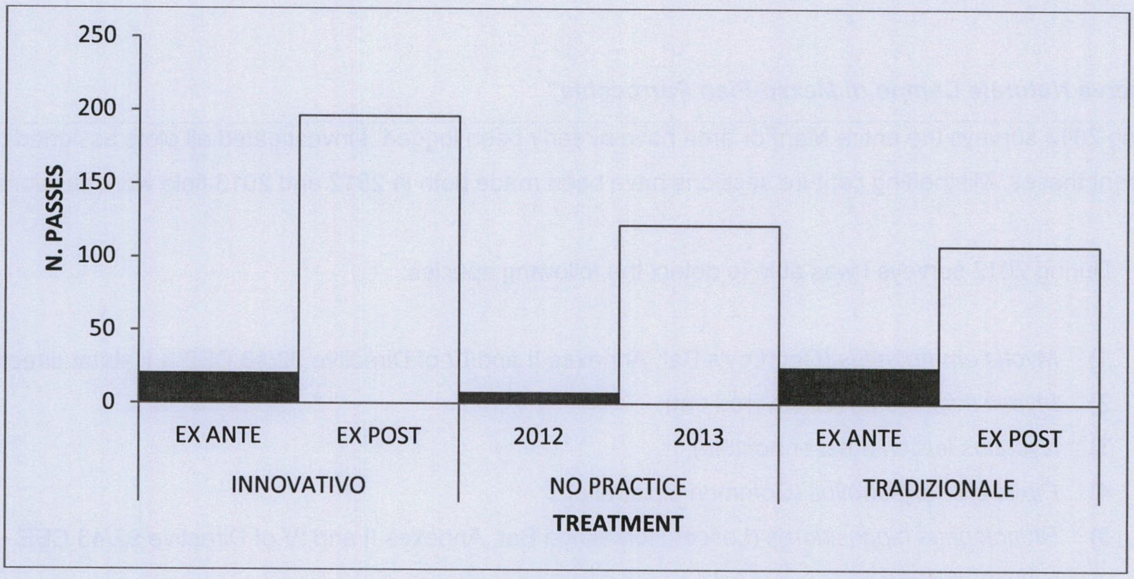


Figure 36. Comparison between bat activity level.

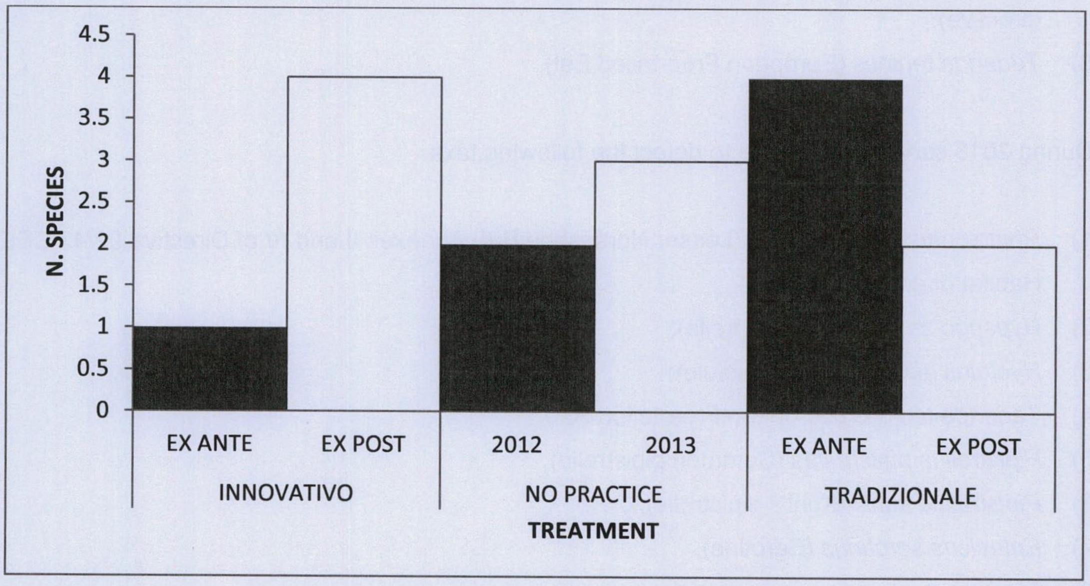


Figure 37. Comparison between species richness.

Table 12. Comparison between bat activity level and species richness.

THESIS	STATUS	TOT. PASSES	N. SPECIES
INNOVATIVO	EX ANTE	21	1

INNOVATIVO	EX POST	196	4
NO PRACTICE	2012	8	2
NO PRACTICE	2013	122	3
TRADIZIONALE	EX ANTE	25	4
TRADIZIONALE	EX POST	108	2

We found a non-random association between activity and treatment/phase:
χ^2 (df=2) = 11,506
P < 0,001

No effect for species richness:
χ^2 (df=2) = 2,455
P = n.s.

At Cansiglio, both "INNOVATIVA" and "TRADIZIONALE" treatments led to increased bat activity.

Bosco di "Lorenzago di Cadore"

As well as Cansiglio site, in 2013 even this site have been logged. I investigated logged and non logged plots inside the whole study area. Mistnetting capture sessions have been carried out in 2012 and 2013.

During 2012 surveys I was able to detect the following species:

1) *Plecotus auritus* (Orecchione bruno);
2) *Pipistrellus pipistrellus* (Brown Big-eared Bat);
3) *Pipistrellus pygmaeus* (Soprano pipistrelle);
4) *Myotis mystacinus* (Whiskered bat);

During 2013 surveys I was able to detect the following taxa:

1) *Tadarida teniotis* (European Free-tailed Bat);
2) *Nyctalus leisleri* (Lesser Noctule):
3) *Pipistrellus pipistrellus* (Common pipistrelle);
4) *Pipistrellus pygmaeus* (Soprano pipistrelle);
5) *Myotis sp.*

It wasn't possible to carry out comparison between "ex ante" and "ex post" at this site, because logging operations were not completed.

"Foresta di Tarvisio"

As well as in 2012, even in 2013 this site was not yet logged. This site is characterized by a young forest stands with a dense dominated vegetating layer. This situation didn't permit to investigate some internal areas with bat detector or mist nets. I tried to access to much more dense areas and set up bat detectors inside little "hollows" with less vegetation.The fire corridors allowed the investigation of different plots. During

2013 field work I even investigated a vaste external circle round, in order to implement informations about the local bat community.

During 2012 surveys I was able to detect the following bat species:

1) *Myotis mystacinus* (Whiskered bat);
2) *Pipistrellus pipistrellus* (Common pipistrelle);
3) *Barbastella barbastellus* (Barbastelle bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
4) *Hypsugo savii* (Savi's pipistrelle).

During 2013 surveys I was able to detect the following taxa:

1) *Myotis mystacinus* (Whiskered bat);
2) *Pipistrellus pipistrellus* (Common pipistrelle);
3) *Barbastella barbastellus* (Barbastelle bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
4) *Hypsugo savii* (Savi's pipistrelle);
5) *Myotis sp.;*
6) *Pipistrellus kuhlii* (Kuhl's pipistrelle);
7) *Plecotus auritus* (Brown Big-eared Bat);
8) *Nyctalus leisleri* (Lesser noctule).

The species richness recorded inside the external round circle is comparable with the species richness recorded inside the experimental ManFor area. The *Plecotus auritus* recorded only in 2013 and only inside the external circle round represent a forest bat species strongly related to mature forest stands.
It wasn't possible to carry out comparison between "ex ante" and "ex post" at this site, because logging operations were not started.

Riserva Naturale "Vallombrosa"

Vallombrosa site has been designated during autumn 2012, so we have no data for 2012. During monitoring session, the site was not yet logged.Sampling points distribution covered all the plots of the study area.
During 2013 surveys I was able to detect the following taxa:

1) *Myotis emarginatus* (Geoffroy's Bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
2) *Pipistrellus pipistrellus* (Common pipistrelle);
3) *Hypsugo savii* (Savi's pipistrelle);
4) *Pipistrellus kuhlii* (Kuhl's pipistrelle);

5) *Plecotus auritus* (Brown Big-eared Bat);
6) *Barbastella barbastellus* (Barbastelle bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
7) *Myotis myotis* (Greater Mouse-eared Bat);
8) *Tadarida teniotis* (European Free-tailed Bat);
9) *Rhinolophus ferrumequinum* (Greater Horseshoe Bat, Annexes II and IV of Directive 92/43 CEE – Habitat directive);
10) *Nyctalus leisleri* (Lesser Noctule);
11) *Eptesicus serotinus* (Serotine);
12) *Myotis nattereri* (Natterer's Bat);
13) *Myotis sp.;*

The entire ManFor site represent an important foraging area for *Barbastella barbastellus*. The particular species richness recorded at this site indicates an high conservation value of the woodland, despite the silvicultural treatments applied in the past. The woodland structure is complex enough to permit the presence of strictly related forest bat species, such as *Barbastella barbastellus, Plecotus auritus*, *Myotis myotis* and *Rhinolophus ferrumequinum*.

The presence of four bat species in annexes II and IV of Habitat Directive 92/43/CEE indicates the high naturalistic value of this site.

Table 13. Bats captured – year 2012.

SITE	D	M	Y	PROV	DATUM	UTM X	UTM Y	ELEV. (m)	SPECIES	SEX	AGE	STATUS	WEIGHT (g)	FOREARM (mm)
Posta Chiarano	12	July	2012	AQ	WGS84 Fuso 33	413840	4634197,2	1688	*Plecotus auritus*	F	AD	non reproductive	7,6	40,6
Posta Chiarano	12	july	2012	AQ	WGS84 Fuso 33	413840	4634197,2	1688	*Plecotus auritus*	F	AD	LACTATING	7,6	39,7
Posta Chiarano	12	july	2012	AQ	WGS84 Fuso 33	413840	4634197,2	1688	*Myotis nattereri*	F	AD	non reproductive	5,7	39,2
Il Faggio del Re	19	july	2012	VV	WGS84 Fuso 33	608330	4262088	1075	*Plecotus auritus*	F	AD	LACTATING	7,5	38,7
Il Faggio del Re	19	july	2012	VV	WGS84 Fuso 33	608330	4262088	1075	*Plecotus auritus*	F	AD	LACTATING	7,9	34,1
Il Faggio del Re	19	july	2012	VV	WGS84 Fuso 33	608330	4262088	1075	*Nyctalus leisleri*	M	AD	NOT VISIBLE TESTICLES	13,2	44,1
Il Faggio del Re	19	july	2012	VV	WGS84 Fuso 33	608330	4262088	1075	*Myotis nattereri*	F	AD	non reproductive	6,4	38,4
Il Faggio del Re	20	july	2012	VV	WGS84 Fuso 33	608216	4262187	1060	*Myotis bechsteinii*	M	AD	NOT VISIBLE TESTICLES	7,9	39,5
Il Faggio del Re	20	july	2012	VV	WGS84 Fuso 33	608216	4262187	1060	*Myotis mystacinus*	M	AD	NOT VISIBLE TESTICLES	4,1	32,2
Il Faggio del Re	20	july	2012	VV	WGS84 Fuso 33	608216	4262187	1060	*Myotis nattereri*	M	AD	NOT VISIBLE TESTICLES	6,6	39,5
Torrente Vandra/Colle S. Biagio	27	july	2012	IS	WGS84 Fuso 33	433036	4622727	900	*Myotis mystacinus*	M	AD	NOT VISIBLE TESTICLES	4,7	33,6
Fonte S. Antonio	28	july	2012	IS	WGS84 Fuso 33	433440	4621643	879	*Hypsugo savii*	M	AD	NOT VISIBLE TESTICLES	7,0	33,5
Fonte S. Antonio	28	july	2012	IS	WGS84 Fuso 33	433440	4621643	879	*Myotis daubentonii*	M	AD	NOT VISIBLE TESTICLES	7,0	36,4
Bosco Pennataro	29	july	2012	IS	WGS84 Fuso 33	433797	4621046	980	*Plecotus auritus*	M	AD	NOT VISIBLE TESTICLES	7,4	38,4
Bosco Pennataro	29	july	2012	IS	WGS84 Fuso 33	433797	4621046	980	*Barbastella barbastellus*	M	AD	NOT VISIBLE TESTICLES	7,5	38,5
Bosco Pennataro	29	july	2012	IS	WGS84 Fuso 33	433797	4621046	980	*Barbastella barbastellus*	F	AD	non reproductive	-	39,6
Costa Campo di Sopra	7	august	2012	BL	WGS84 Fuso 33	297440	5101992	1290	*Myotis emarginatus*	M	AD	NOT WELL VISIBLE TESTICLES	7,6	38,7
Ciopa	8	august	2012	BL	WGS84 Fuso 33	305678	5149509	1130	*Plecotus auritus*	M	AD	NOT VISIBLE TESTICLES	7,5	42,0
Ciopa	8	august	2012	BL	WGS84 Fuso 33	305678	5149509	1130	*Plecotus auritus*	M	AD	NOT VISIBLE TESTICLES	6,7	39,9
Rutte Piccolo	10	August	2012	UD	WGS84 Fuso 33	392695	5149303	875	*Myotis mystacinus*	M	AD	NOT VISIBLE TESTICLES	4,5	33,9
Rutte Piccolo	10	August	2012	UD	WGS84 Fuso 33	392695	5149303	875	*Myotis mystacinus*	M	AD	NOT VISIBLE TESTICLES	4,2	34,0

Table 14. Bats captured – year 2013.

SITE	D	M	Y	PROV	DATUM	UTM X	UTM Y	ELEV. (m)	SPECIES	SEX	AGE	STATUS	WEIGHT (g)	FOREARM (mm)
Vallombrosa	16	July	2013	FI	WGS84 Fuso 33	223903,4706	4848476,314	1.300	*Plecotus auritus*	M	AD	NOT VISIBLE TESTICLES	7,8	39,2
Vallombrosa	16	July	2013	FI	WGS84 Fuso 33	223903,4706	4848476,314	1.300	*Plecotus auritus*	F	AD	LACTATING	8,3	39,7
Vallombrosa	16	July	2013	FI	WGS84 Fuso 33	223903,4706	4848476,314	1.300	*Plecotus auritus*	F	AD	LACTATING	8,3	38,5
Vallombrosa	17	July	2013	FI	WGS84 Fuso 33	224944,4081	4849138,227	1.198	*Plecotus auritus*	M	AD	NOT VISIBLE TESTICLES	-	-
Costa Campo di Sopra	26	August	2013	BL	WGS84 Fuso 33	297440	5101992	1290	*Pipistrellus pipistrellus*	F	AD	non reproductive	4,7	32,9
Rutte Piccolo	31	August	2013	UD	WGS84 Fuso 33	392380,51	5149407,08	870	*Plecotus auritus*	M	AD	NOT VISIBLE TESTICLES	6,0	39,2

Slovenia: Vertebrate diversity

In total 103 individuals of 25 birds were found on all of the ManFor sites (Table 16, Table 17). Overall the number of species do not seem to differ between each other (Kočevski Rog: 31; Snežnik: 32; Trnovo: 38). On plot level the number of individuals showed approximately the same trend as with the number of species. There were differences in assemblages observed between the sites. Each site contained more than one bird directive species. In the Kočevski Rog we found Ural owl, Grey headed woodpecker and Black woodpecker. In Snežnik we found the Ural owl, Black woodpecker and Three-toed woodpecker. In Trnovo, we found pygmy owl, Ural owl, Grey headed woodpecker and Black woodpecker.

For the review of effects of forest management of forest species on the bird directive, the final densities of all selected species for the selected areas are shown in Table . At the moment, literature is being reviewed for every single selected species.

Species name	Kočevski Rog	Snežnik	Trnovo
Accipiter nisus		1	1
Buteo buteo	1		
Columba palumbus	1	1	1
Cuculus canorus	1	1	1
Glaucidium passerinum			1
Strix aluco			1
Strix uralensis	1	1	1
Apus apus		1	
Picus canus	1		1
Dryocopus martius	1	1	1
Dendrocopos major	1	1	1
Picoides tridactylus		1	
Hirundo rustica		1	
Delichon urbica	1		
Troglodytes troglodytes	1	1	1
Prunella modularis	1		1
Erithacus rubecula	1	1	1
Saxicola rubetra			1
Turdus merula	1		1

Turdus philomelos	1		1
Turdus viscivorus	1	1	1
Sylvia atricapilla	1	1	1
Phylloscopus sibilatrix	1		1
Phylloscopus collybita	1		1
Regulus regulus	1	1	1
Regulus ignicapillus	1	1	1
Muscicapa striata	1	1	1
Aegithalos caudatus			1
Parus palustris	1		1
Parus montanus		1	
Parus cristatus	1	1	1
Parus ater	1	1	1
Parus caeruleus		1	1
Parus major		1	1
Sitta europaea		1	1
Certhia familiaris	1	1	1
Certhia brachydactyla			1
Oriolus oriolus		1	
Garrulus glandarius	1	1	1
Nucifraga caryocatactes	1	1	
Corvus corax		1	
Fringilla coelebs	1	1	1
Carduelis chloris		1	1
Carduelis carduelis		1	1
Carduelis spinus	1	1	
Loxia curvirostra	1		1
Pyrrhula pyrrhula	1	1	1
Coccothraustes coccothraustes	1		1

Table 16. Observed bird species on the different ManFor sites.

	Kočevski Rog	Snežnik	Trnovo	TOTAL
N° Points	9	9	9	27
Total of maximum n. of individuals found in the plots	32	25	46	103
Average of maximum n. of individuals found in the plots	3.55	2.78	5.11	3.81
Standard Dev.	2.46	2.05	3.76	2.91
Min	0	0	0	
Max	8	6	11	

Table 17. Statistics of bird counts for the different ManFor sites.

Species name	Kočevsko-Kolpa	Snežnik-Pivka	Trnovski gozd
Ciconia nigra		2	
Pemis apivorus	15-20	150-500[1]	
Haliaeetus albicilla	1		
Gyps fulvus		90-100[1]	
Circaetus gallicus		1-3	
Circus aeruginosus		60-600[1]	
Circus pygargus		20-50[1]	
Aquila chrysaetos	1-2	1	
Falco peregrinus	6-7	3-4	
Bonasa bonasia	100-300	30-60	60-110
Tetrao urogallus	20-50[2]	10-20[2]	10-20[2]
Cotumix cotumix		50-100	
Porzana parva		2-5	
Crex crex		17-25	
Otus scops		40-50	

Bubo bubo		2-3	
Glaucidium passerinum	20-30	10-20	5-15
Strix uralensis	150-170	140-200	30-40
Aegolius funereus	50-80	40-70	20-50
Caprimulgus europaeus		100-200	
Upupa epops		30-50	
Jynx torquilla	150-200		
Picus canus	80-100	30-50	
Dryocopus martius	80-150	50-80	40-60
Dendrocopos leucotos	10-15	15-25	10-15
Picoides tridactylus	30-40	30-40	20-30
Lullula arborea		350-460	
Alauda arvensis		500-1000	
Anthus campestris		5-10	
Saxicola rubetra		100-200	
Monticola saxatilis		40-50	
Sylvia nisoria		530-890	
Ficedula parva	20-50		
Lanius collurio	1000-1500	1000-1700	
Miliaria calandra		100-200	
Alectoris graeca saxatilis		10-20	

Table 18. Birds species with number of breeding birds listed in the Annex I present in SPA Trnovo (SI5000025), SPA Snežnik-Pivka (SI5000002), SPA Kočevsko-Kolpa (SI5000013). Data are taken from Denac et al 2011.

Subaction 2b - Invertebrate diversity

Italy:

During the field season of 2013, a total of 1512 samples were collected in the three sites where the traps were positioned. These samples were sorted identifying the different families of the target groups (Coleoptera and Diptera) with a stereomicroscope. The beetle families determination has been completed for Cansiglio, whereas it is still in progress for Vallombrosa and Lorenzago.

For the Cansiglio we sorted 6601 beetle specimens to the family level. Of the 44 families that we caught in this site (Table 19), the most abundant were Byturidae, Curculionidae and Salpingidae (Figure 38).

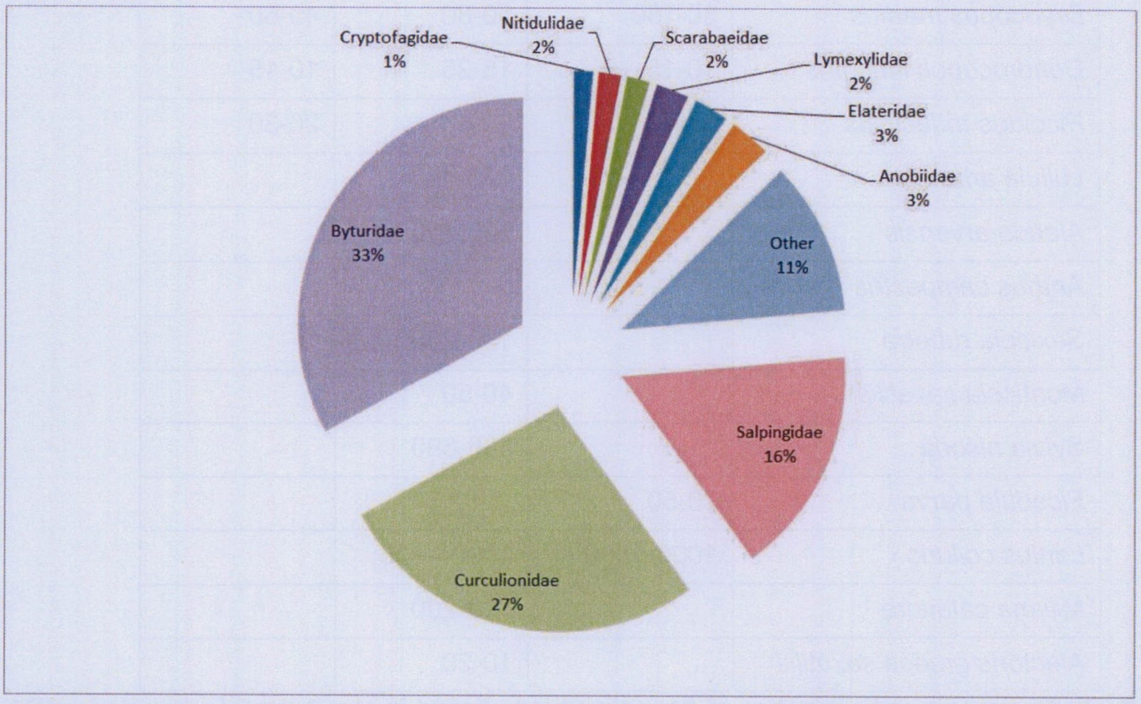


Figure 38. Number of beetle specimens caught in the Cansiglio forest, subdivided per family (showing only families with N>90).

Considering the whole assemblage, the phenology that we observed in the plots where the different experimental management options took place was similar (Figure 39), with the highest abundance of specimens always in the 4^{th} shift, from the 11^{th} to the 24^{th} of June.

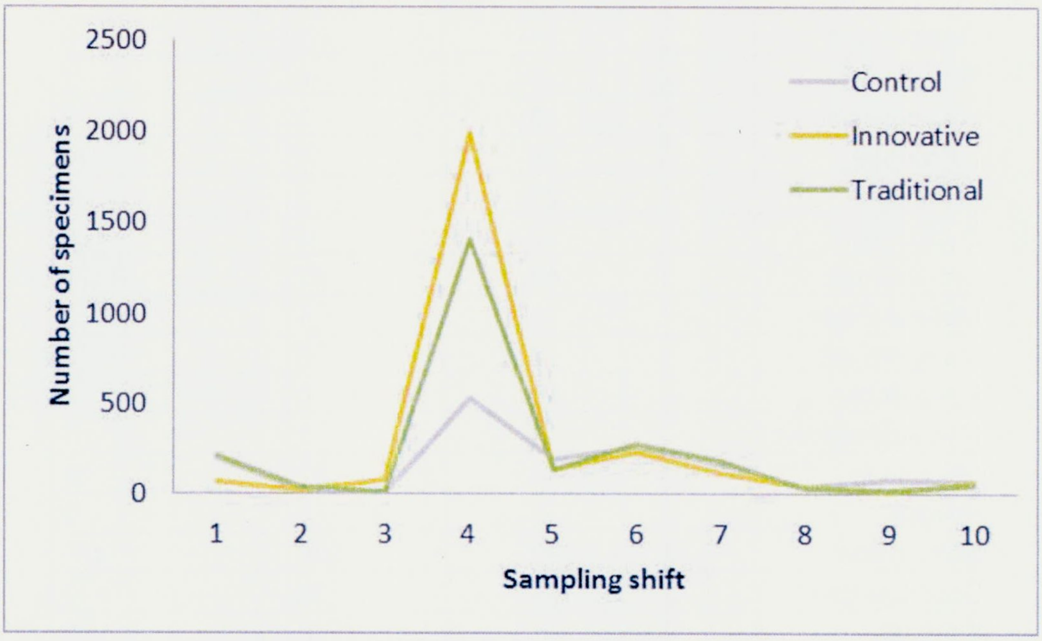


Figure 39. Phenology of the beetles trapped in the Cansiglio forest, considering the different experimental treatments.

The highest percentage of specimens (41%) was caught in the plots where the innovative management option was tested (Table 19) and the difference between the frequency distribution of caught specimens in the three options was statically significant (X^2 = 680.345, df = 2, p-value < $2.2e^{-16}$).

Family name	Control	Innovative	Traditional
Anobiidae	46	61	89
Anthribidae	0	2	1
Bostrichidae	1	0	0
Byturidae	114	1335	730
Cantharidae	3	12	3
Carabidae	2	2	4
Cerambycidae	2	14	5
Cerylonidae	1	2	1
Chrysomelidae	1	4	5
Ciidae	5	5	9
Coccinellidae	1	2	2
Colydiidae	0	1	1
Cryptofagidae	42	29	21
Curculionidae	496	627	659
Dasytidae	1	2	0
Dytiscidae	0	2	3
Elateridae	23	78	63
Endomichidae	0	1	0

Geotrupidae	1	2	3
Histeridae	0	0	1
Hydrophilidae	0	2	2
Latridiidae	15	11	10
Leiodidae	25	3	4
Lucanidae	2	1	0
Lymexylidae	40	47	72
Melandryidae	0	1	0
Monotomidae	7	3	3
Mordellidae	0	0	1
Mycetophagidae	0	1	1
Nitidulidae	46	32	31
Ptilidae	5	4	2
Salpingidae	390	236	459
Scarabaeidae	34	33	42
Scirtidae	1	0	0
Scraptidae	2	0	2
Scydmaenidae	2	2	0
Silphidae	0	2	0
Silvanidae	1	0	0
Sphaeritidae	0	1	0
Sphindidae	0	1	0
Staphylinidae	205	155	106
Tenebrionidae	0	0	1
Tetratomidae	10	2	9
Trogossitidae	2	7	5
Total	1526	2725	2350

Table 19. Number of individuals caught in the plots with the different treatments in the Cansiglio, subdivided per family.

The highest specimen abundance that we observed in the innovative management plots was mainly driven by one family, Byturidae, that represented the 49% of the caught individuals for the innovative plots (Figure 40). In the innovative plots we registered the highest number of families as well, with the 84% of the total number of observed families, compared to the 75% of the traditional plots and 70% of the control plots.

More exhaustive analyses will be performed once we obtain the species determination.

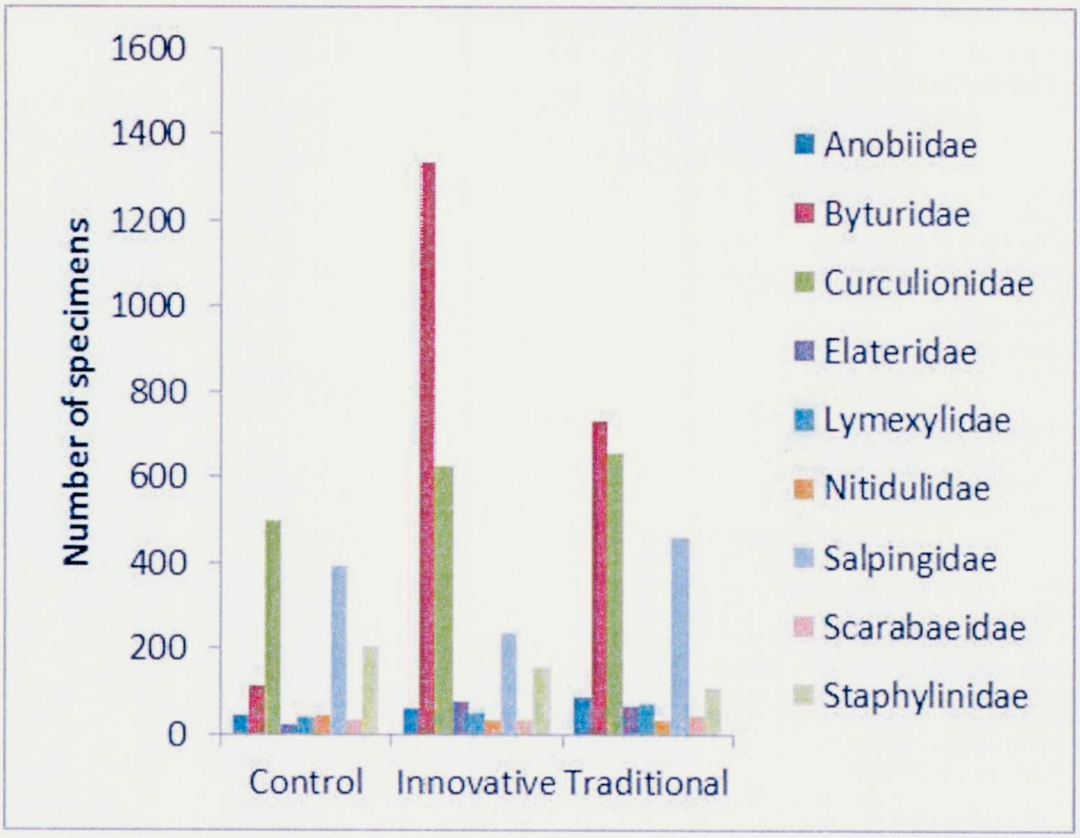


Figure 40. Number of beetle specimens trapped in the Cansiglio in the plots where the different management options took place, subdivided according to the family (for families with N>100).

For what concerns ground beetles, a total of 7420 carabid beetles were collected in the Lorenzago di Cadore forests, where the pitfall traps were positioned. Samples from the individual traps were sorted selecting carabid beetles, which were identified at the species level by an expert taxonomist. Overall, we observed 22 species of ground beetles, listed in the general checklist of carabids occurring in the area (Table 20).

Table 20. Checklist e corotipi delle specie di Carabidae di Lorenzago di Cadore (det. Augusto Vigna Taglianti 2014).

Carabinae Carabini Carabina					
Gen. ***Carabus*** Linnaeus, 1758					
Subg. ***Eucarabus*** Géhin, 1876					
1.	*arcensis* Herbst, 1784				SIE
	a. venetianus Bernau, 1914	N			
Subg. ***Tachypus*** Weber, 1801					
2.	*cancellatus* Illiger, 1798				SIE
	c. emarginatus Duftschmid, 1812		N S		
Subg. ***Tomocarabus*** Reitter, 1896					
3.	*convexus* Fabricius, 1775			SIE	
	c. dilatatus Dejean, 1826		N		
Subg. ***Platycarabus*** A. Morawitz, 1886					
4.	*creutzeri* Fabricius, 1801			CEU(ALDI)	
	c. creutzeri Fabricius, 1801	N			
Subg. ***Megodontus*** Solier, 1848					
5.	*germarii* Sturm, 1815				SEU

g. germarii Sturm, 1815		N		
Carabinae Cychrini				
Gen. ***Cychrus*** Fabricius, 1794				
6. *angustatus* Hoppe & Hornschuch, 1825	N		CEU	
7. *attenuatus* (Fabricius, 1792)			CEU	
a. attenuatus (Fabricius, 1792)	N S			
Nebriinae Nebriini				
Gen. ***Leistus*** Frölich, 1799				
Subg. ***Leistus*** Frölich, 1799				
8. *nitidus* (Duftschmid, 1812)	N		CEU	
Nebriinae Notiophilini				
Gen. ***Notiophilus*** Duméril, 1806				
9. *biguttatus* (Fabricius, 1779)	N S Si Sa OLA			
Trechinae Bembidiini Bembidiina				
Gen. ***Ocydromus*** Clairville, 1806				
Subg. ***Peryphanes*** Jeannel, 1941				
10. *deletus* (Audinet-Serville, 1821)				EUR
d. deletus (Audinet-Serville, 1821)	N S			
Pterostichinae Pterostichini Pterostichina				
Gen. ***Pterostichus*** Bonelli, 1810				
Subg. ***Bothriopterus*** Chaudoir, 1835				
11. *oblongopunctatus* (Fabricius, 1787)	N S		ASE	
Subg. ***Haptoderus*** Chaudoir, 1838				
12. *unctulatus* (Duftschmid, 1812)		N		CEU
Subg. ***Cheporus*** Latreille, 1829				
13. *burmeisteri* Heer, 1838				CEU
b. burmeisteri Heer, 1838		N		
Subg. ***Pterostichus*** Bonelli, 1810				
14. *fasciatopunctatus* (Creutzer, 1799)	N		CEU	
Pterostichinae Pterostichini Molopina				
Gen. ***Molops*** Bonelli, 1810				
15. *piceus* (Panzer, 1793)				EUR
p. austriacus Ganglbauer, 1889	N			
Gen. ***Abax*** Bonelli, 1810				
Subg. ***Abax*** Bonelli, 1810				
16. *parallelepipedus* (Piller & Mitterpacher, 1783)			EUR	
(= *ater* Villers, 1789)				
p. inferior (Seidlitz, 1887)		N		
17. *pilleri* Csiki, 1916	N		SEU(ALPE)	
(= *parallelepipedus* Dejean, 1828)				
Harpalinae Harpalini Harpalina				
Gen. ***Harpalus*** Latreille, 1802				
Subg. ***Harpalus*** Latreille, 1802				
18. *laevipes* Zetterstedt, 1828	N S		ASE	
(= *quadripunctatus* Dejean, 1829)				
Gen. ***Trichotichnus*** Morawitz, 1863				
Subg. ***Trichotichnus*** Morawitz, 1863				
19. *laevicollis* (Duftschmid, 1812)		N		CEU
Platyninae Sphodrini Synuchina				
Gen. ***Synuchus*** Gyllenhal, 1810				
20. *vivalis* (Illiger, 1798)				ASE
v. vivalis (Illiger, 1798)		N S Si		
Platyninae Sphodrini Sphodrina				
Gen. ***Laemostenus*** Bonelli, 1810				
Subg. ***Actenipus*** Jeannel, 1937				
21. *elegans* (Dejean, 1828)		N	**E**	WME(ALPE)
Platyninae Platynini				

Gen. ***Limodromus*** Motschulsky, 1864		
22. *assimilis* (Paykull, 1790)	N S	SIE

The relative species abundance changed along the activity season (Figure 41). Most of the species grew in abundance until early/mid-July (III/IV sampling sessions). Few species showed later peaks of abundance and one of them (*Cychrus attenuatus*) a full autumnal phenology, which grew until the end of the season. All but one species showed unimodal phenologies. The unique exception is *Pterostichus burmeisteri*, which was the most abundant species all across the year and showed two different peaks of activity.

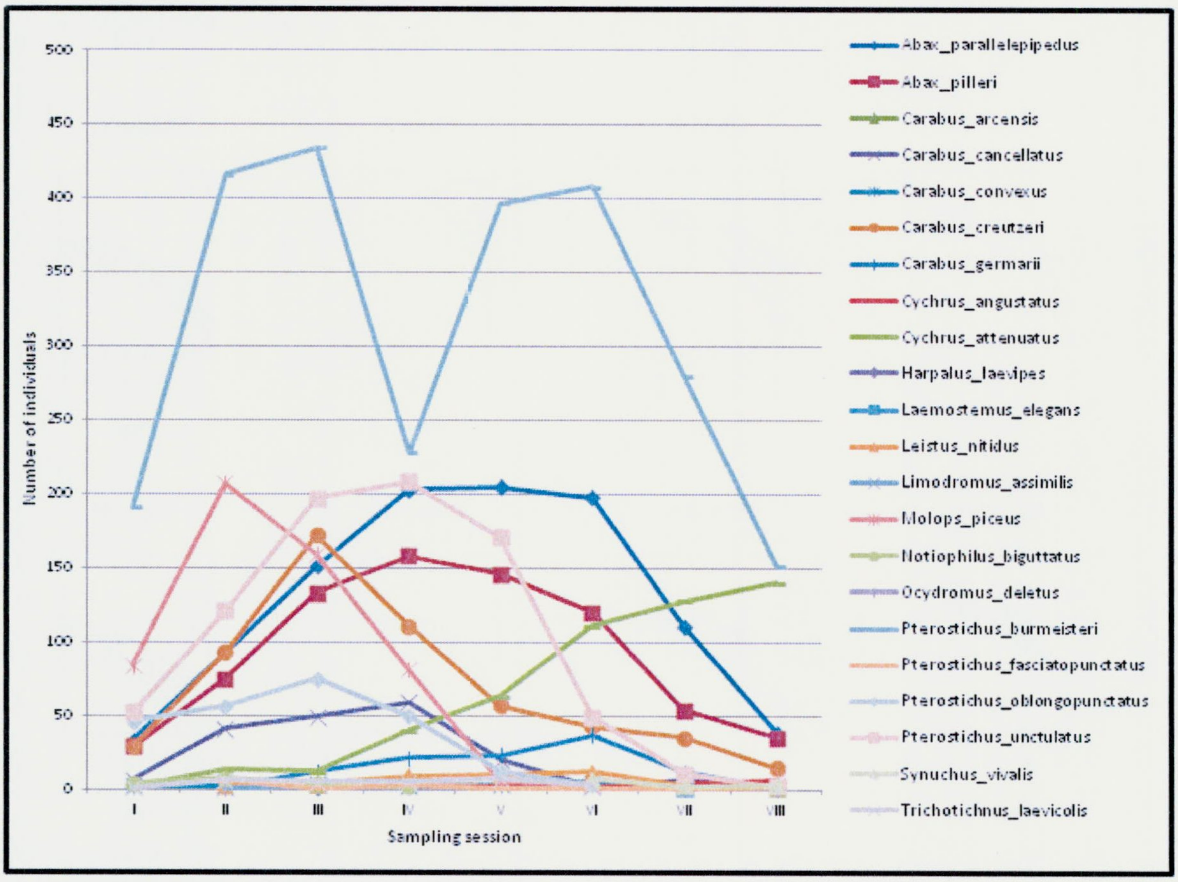


Figure 41. Abundance of carabid species during the activity season. Sampling sessions occurred between the end of May (session I) and the beginning of September (session VIII).

The collected data were abundant enough for obtaining a rather good figure of the structure of ground beetle communities in almost all the considered forest stands (Figure 42). The total dataset (first plot in the figure) was almost completely represented by our data, which arrives very close to the horizontal asymptote of the accumulation curve and the expected species richness of the entire carabid community (93.62% of the expected richness). For the individual stands, the percentage of saturation of the expected species richness range from 71.81% and 99.99%. This range of values guarantees that the communities of the different stands are represented adequately by our data. In the ManFor experimental site (second plot in the figure), 14 species have been collected, which represent the 84.79% of the expected species richness for the same site.

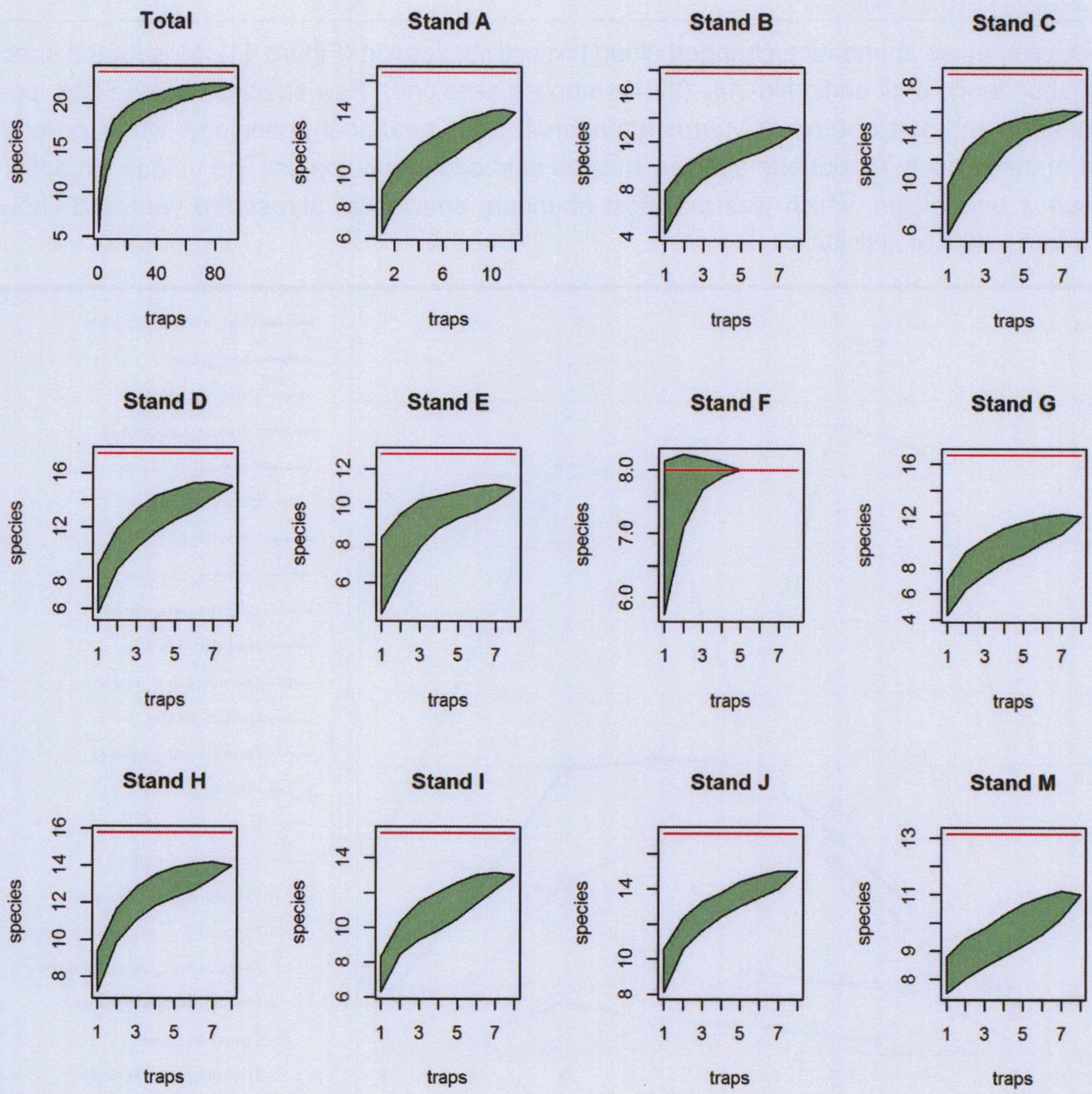


Figure 42. Accumulation curves for carabid beetles in the considered forest stands. Stand A corresponds to the ManFor experimental site. The red lines represent the expected species richness for each stand.

The temporal variation along the season of species richness and diversity indices followed similar trends in all the considered stands (Figure 43). The main peaks of species richness and diversity indices occurred between mid-June and mid-July. After this period the mean values of species richness and diversity indices decreased with similar trends. Nevertheless, the relative species abundances changed after the peak with different trends in different stands, influencing the total temporal trends of the diversity indices, which showed the main peak in mid-July, and the inter-stand variation in diversity indices, which grew from mid-August to the end of the season.

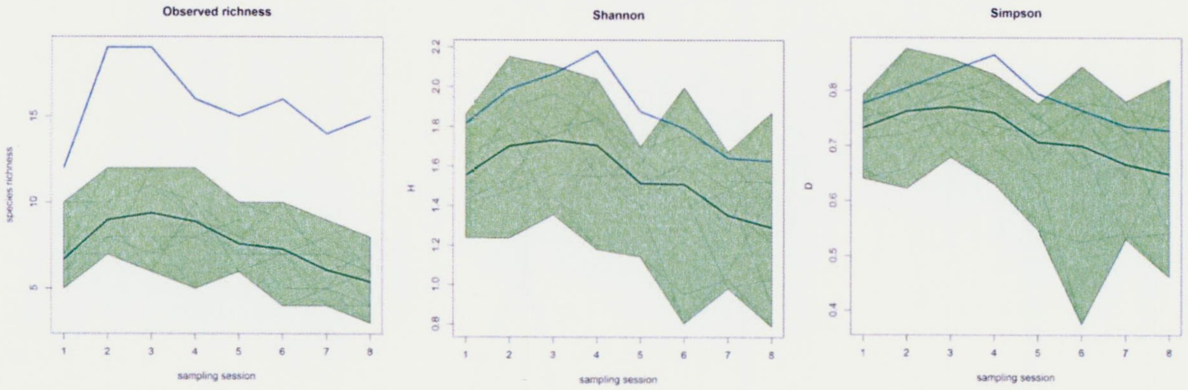


Figure 43. Temporal trends of species richness and Shannon and Simpson diversity indices for carabid beetle communities in Lorenzago. The blue lines is the temporal trend for the total area, the green bands are the range of trends for the individual stands (represented by the grey lines), and the black lines are the mean trends of the stands.

Slovenia: Invertebrate diversity

<u>Hoverflies</u>

In total 2363 hoverflies were caught between April and October in the site Trnovo with the malaise traps. The catch of hoverflies fluctuated over the year (Figure 44). There was a large increase of hoverflies in the end of August. The main species caught here were aphid feeding species. The identification of some species is still in progress. With the sticky traps 58 species were caught. Kočevski rog had 27 species and 118 individuals. Snežnik had 32 species with 158 individuals. Trnovo had 35 species with 205 individuals. The individuals counted during the transects are not yet completely identified. Interesting saproxylic species caught in the areas were *Blera fallax, Brachypalpoides lentus, Brachypalpus laphriformis, Temnostoma vespiforme, Xylota caeruleiventris, Xylota ignava* and *Xylota jakutorum*.

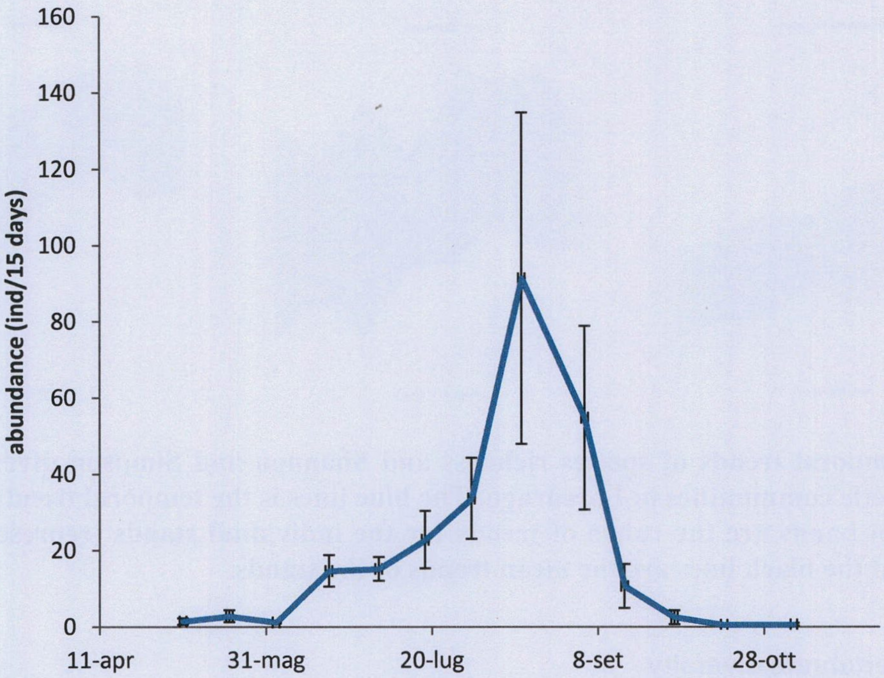


Figure 44. The average relative abundance of hoverflies for all the plots caught by malaise trap in Trnovo.

Saproxylic beetles

In year 2013 we caught in the Slovenian sites 23 different species from family Cerambycidae. In total, the dominant species was *Rhagium inquisitor*, followed by *Monochamus sutor* and *Monochamus sartor*.

In Table 21 we present % of species from family Cerambycidae on each location.

Species name	*Kočevski Rog*	*Snežnik*	*Trnovo*
	%	%	%
Rhagium inquisitor (Linnaeus, 1758)	60,7	35,0	38,3
Rhagium mordax (De Geer, 1775)	3,4	2,8	1,8
Rhagium bifasciatum Fabricius, 1775	2,2	0,7	0,4
Monochamus sutor (Linnaeus, 1758)	0	8,2	28
Monochamus sartor (Fabricius, 1787)	0	24,3	18,5
Monochamus galloprovincialis (Olivier, 1795)	0	2,1	5,1
Leiopus nebulosus (Linnaeus, 1758)	1,1	0,4	0,2
Mesosa nebulosa (Fabricius, 1781)	0	0,4	0
Clytus lama Mulsant, 1847	1,1	1,1	2,3
Rutpela maculata (Poda, 1761)	0	0,4	0,2

Prionus coriarius (Linnaeus, 1758)	0	0,4	0
Acanthocinus reticulatus (Razoumowsky, 1789)	3,4	4,3	0
Etorufus pubescens (Fabricius, 1787)	0	0,7	0
Pachyta quadrimaculata (Linnaeus, 1758)	0	0,4	0
Sticoleptura rubra (Linnaeus, 1758)	3,4	5,7	0,6
Tetropium castaneum (Linnaeus, 1758)	4,5	2,8	0,6
Oxymirus cursor (Linnaeus, 1758)	16,8	10	2,7
Xylosteus spinolae Frivaldszky, 1838	0	0,4	0
Acanthocinus aedilis (Linnaeus, 1758)	1,1	0	0,2
Saphanus piceus (Laicharting, 1784)	0	0	0,2
Pachytodes cerambyciformis (Schrank, 1781)	1,1	0	0,2
Clytus arietis (Linnaeus, 1758)	1,1	0	0,2
Anaglyptus mysticus (Linnaeus, 1758)	0	0	0,2

Table 21. Percent (%) of families from family Cerambycidae caught in traps on each location.

In Kočevski Rog, the most dominant species was *Rhagium inquisitor*, followed by *Oxymirus cursor*. Even that we used the pheromone, we did not catch any species from genera *Monochamus*. On location Snežnik, the most dominant species was also *Rhagium inquisitor*, followed by *Monochamus sartor* and *Oxymirus cursor*. On location Trnovo, the most dominant species was *Rhagium inquisitor,* followed by *Monochamus sutor* and *Monochamus sartor*. The species reachnes was almost the same on location Snežnik and Trnovo, but it was lower on location Kočevski Rog.

In Table 22 we present the percent (%) of founding's of the species *Morimus funereus* according to the main tree species in the stand and implemented forest measure.

The potency of cutting according to the growing stock	Location and main tree species								
	Trnovo			Snežnik			Kočevski Rog		
	spruce	fir	beech	spruce	fir	beech	spruce	fir	beech
0	0	0	0	0	0	0	0	0	0
50	6,25	18,75	0	0	0	0	0	0	0
100	9,37	50	0	9,37	0	6,25	0	0	0
∑	15,62	68,75	0	9,37	0	6,25	0	0	0

Table 22. Percent (%) of founding's of the species *Morimus funereus* according to the main tree species.

In pitfall traps we caught just one specimen of *Rosalia alpina*, on the location Kočevski Rog in spruce stand, where the potency of cutting was 50% according to the growing stock.
Determination of *Trypodendron* species is in progress.

2.2.3. Subaction 3 - Plant Diversity

Italy: Plant diversity

In the floristic analyses carried out in 2013, 57 species occurred in Lorenzago di Cadore forest and 75 in Pennataro forest. All the species recorded were defined (according to Pignatti, 1982 and update according to Conti et. al, 2005); Ellenberg indicators were calculated considering the list species and chorological spectrum (sensu Pignatti, 1982) and biological spectrum (sensu Raunkier, 1934) were also estimated.

Both the investigated areas are characterized by an high number of species because of heterogeneous forest structure, especially in Pennataro forest. Referring to Lorenzago di Cadore forest, investigated plots with presence of Larch are quite similar to those investigated in 2011. Biological and chorological Spectrum, and Ellenberg indicator are shown below.

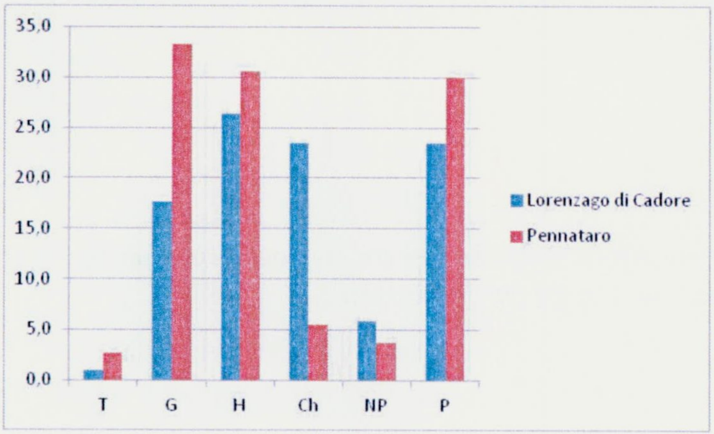


Figure 45. Biological spectrum

Both the forest stands are characterized by an high presence of geophytes, hemicriptophytes and phanerophytes. The first two groups are typical of mesophylous forest of mountain belt; the third groups highlights the heterogeneous forestry structures resulting first of all from forest management.

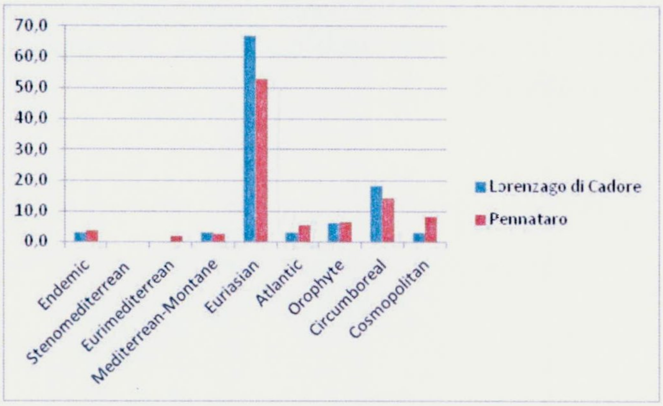


Figure 46. Chorological spectrum

The forest type investigated are typical of the central Europe, characterized from Eurasian chorotype; as expected, Pennataro forest is distinguished by the presence of Eurimediterrean and Mediterrean-Montane chorotypes.

The presence of endemic species, even with a low occurrence, is very important for both of forest, according to their role in Natura 2000 too.

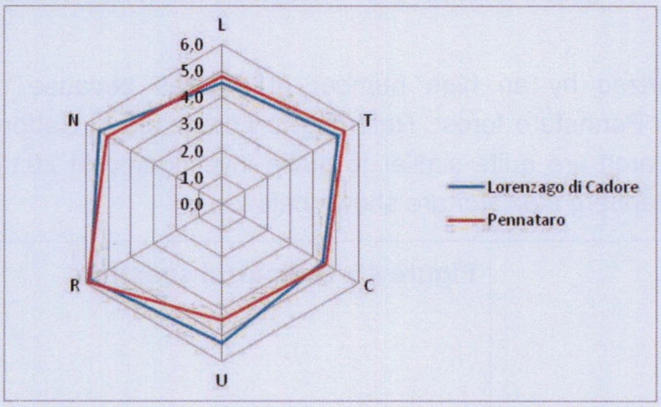


Figure 47. Ellenberg indicators

The concurrence of values is typical of mesophilous Eurasian forests: a conspicuous presence of species requiring full shade, deep, basic soils and lightly rich in nitrogen.

Slovenia. Plant Diversity

In Slovenia, the mean species richness per medium vegetation plots (27 plots with area of 400 m^2) is 48.8. The number of vascular plants species per medium vegetation plots varies between 29 and 68.

The mean species richness per small vegetation plots (135 plots with area of 12.6 m^2) is 18.0. The number of vascular plants species per small vegetation plots varies between 6 and 39.

For all 27 medium vegetation plots and for groups of plots assembled by three key factors, planned forest management treatment, dominant tree species and location, the mean values of parameters related to site conditions and stand characteristics of studied plots were calculated. The species richness and diversity indexes were calculated too (Table 23).

	All plots	Planned treatment			Dominant tree species			Location (site)		
		cont.	50% cut	100% cut.	beech	fir	spruce	Kočevski R.	Snežnik	Trnovo
	N=27	N=9	N=9	N=9	N=9	N=9	N=9	N=9	N=9	N=9
SURFACE ROCK COVER (%)	28.6	33.3	31.1	21.4	23.1	30.3	32.4	38.3	30.9	16.7
DEADWOOD COVER (%)	8.9	7.7	9.4	9.4	10.2	9.0	7.3	12.1	6.7	7.8
COVER OF ALL VERTICAL VEG. LAYERS (%)	97.9	99.0	96.9	97.8	99.0	97.7	97.0	98.8	95.7	99.2
COVER OF GROUND VEG. LAYERS (without tree) (%)	33.1	30.6	36.7	32.2	32.2	28.9	38.3	31.1	27.8	40.6
BARE SOIL (%)	34.1	36.1	26.1	40.0	43.9	30.0	28.3	28.9	36.1	37.2
TREE LAYER COVER (%)	95.4	97.9	92.8	95.4	96.7	97.2	92.2	96.1	93.8	96.2
SHRUB LAYER COVER (%)	7.1	7.2	3.7	10.3	8.2	7.4	5.6	8.3	7.8	5.1
HERB LAYER COVER (%)	27.5	25.0	33.3	24.1	25.8	22.2	34.4	23.6	21.7	37.2
MOSS LAYER COVER (%) on all substrates	24.9	27.6	30.1	17.0	17.8	30.0	26.9	33.1	28.1	13.4
MEAN SPECIES RICHNESS	48.8	50.7	49.3	46.4	44.3	52.9	49.2	47.6	55.8	43.1
SPECIES FREQUENCY IN ALL VERTICAL LAYERS	58.2	61.0	58.8	54.9	52.8	62.4	59.4	57.1	66.2	51.3
TOTAL NUMBER OF VASCULAR SPECIES	151	113	123	121	110	130	117	97	109	84
N. TREE LAYER SPECIES	15	11	13	14	11	12	13	9	14	11
N. SHRUB LAYER SPECIES	16	16	13	12	13	16	14	11	16	7
N. HERB LAYER SPECIES	120	86	97	95	86	102	90	77	79	66
PHANEROPHYTES (%)	20.5	22.1	19.5	20.7	20.9	20.0	21.4	20.6	25.7	20.2
CHAMAEPHYTES (%)	6.0	6.2	5.7	5.0	4.5	6.9	6.0	6.2	7.3	4.8
HEMICRYPTOPHYTES (%)	52.3	48.7	52.8	53.7	52.7	50.8	49.6	50.5	50.5	50.0
GEOPHYTES (%)	18.5	20.4	19.5	18.2	19.1	19.2	21.4	20.6	15.6	21.4
THEROPHYTES (%)	2.6	2.7	2.4	2.5	2.7	3.1	1.7	2.1	0.9	3.6
SHANNON INDEX H	2.413	2.486	2.476	2.278	2.188	2.421	2.631	2.528	2.397	2.315
SIMPSON INDEX D`	0.801	0.811	0.811	0.782	0.730	0.820	0.854	0.825	0.780	0.799
EVENNESS	0.595	0.605	0.608	0.571	0.552	0.587	0.646	0.625	0.571	0.589
Fagus sylvatica - UPPER TREE LAYER	38.9	39.9	30.4	46.4	73.6	23.5	19.5	43.3	40.8	32.5
Fagus sylvatica - LOWER TREE LAYER	29.2	25.6	33.1	29.0	15.1	38.5	34.1	28.2	21.9	37.5
Fagus sylvatica - SHRUB LAYER	6.5	6.4	2.9	10.1	7.5	5.8	6.2	6.6	7.7	5.2
Fagus sylvatica - HERB LAYER	2.5	2.9	1.9	2.6	3.7	2.2	1.6	2.3	2.6	2.5
Abies alba - UPPER TREE LAYER	14.5	9.0	21.2	13.3	2.6	38.3	2.5	5.7	18.5	19.2
Abies alba - LOWER TREE LAYER	3.5	2.8	3.0	4.6	0.5	6.3	3.6	3.2	4.7	2.5
Abies alba - SHRUB LAYER	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.4	0.0	0.0
Abies alba - HERB LAYER	0.6	0.8	0.6	0.5	0.5	0.6	0.8	0.6	0.7	0.7
Picea abies - UPPER TREE LAYER	10.1	13.4	13.2	3.6	0.1	0.2	29.9	4.8	13.2	12.1
Picea abies - LOWER TREE LAYER	1.6	1.9	2.4	0.5	0.2	0.7	3.9	2.1	1.3	1.4
Picea abies - SHRUB TREE LAYER	0.4	0.6	0.4	0.1	0.2	0.6	0.3	1.0	0.1	0.0
Picea abies - HERB LAYER	0.3	0.4	0.2	0.3	0.2	0.3	0.4	0.3	0.4	0.1

Table 23. Mean values of parameters related to site conditions and stand characteristics on plots, and species diversity at 27 medium vegetation plots.

Planned forest management treatment

Before implementation of the forest management measures, there were no significant difference among the groups of median vegetation plots of different planned forest management treatment. Thus, the groups with different planned treatment are overlapping in DCA ordination space (Figure48).

Among 188 vascular plant species occurring in all vertical vegetation layers, e.g. upper tree and lower tree, shrub, herb, there were no significant species indicating differences among three groups of planned forest management treatment.

Beside the indicators species, the differences among these three groups have been tested by ANOVA. The mean values of parameters related to forest site conditions, stand characteristics and species diversity were tested. Before the implementation of forest management measures, there were no significant indicators explaining differences among the groups of three planned forest management treatment (Table 24). Based on test of indicators species and indicators parameters, we assumed that there were no significant differences among these groups, and that they are similar to each other.

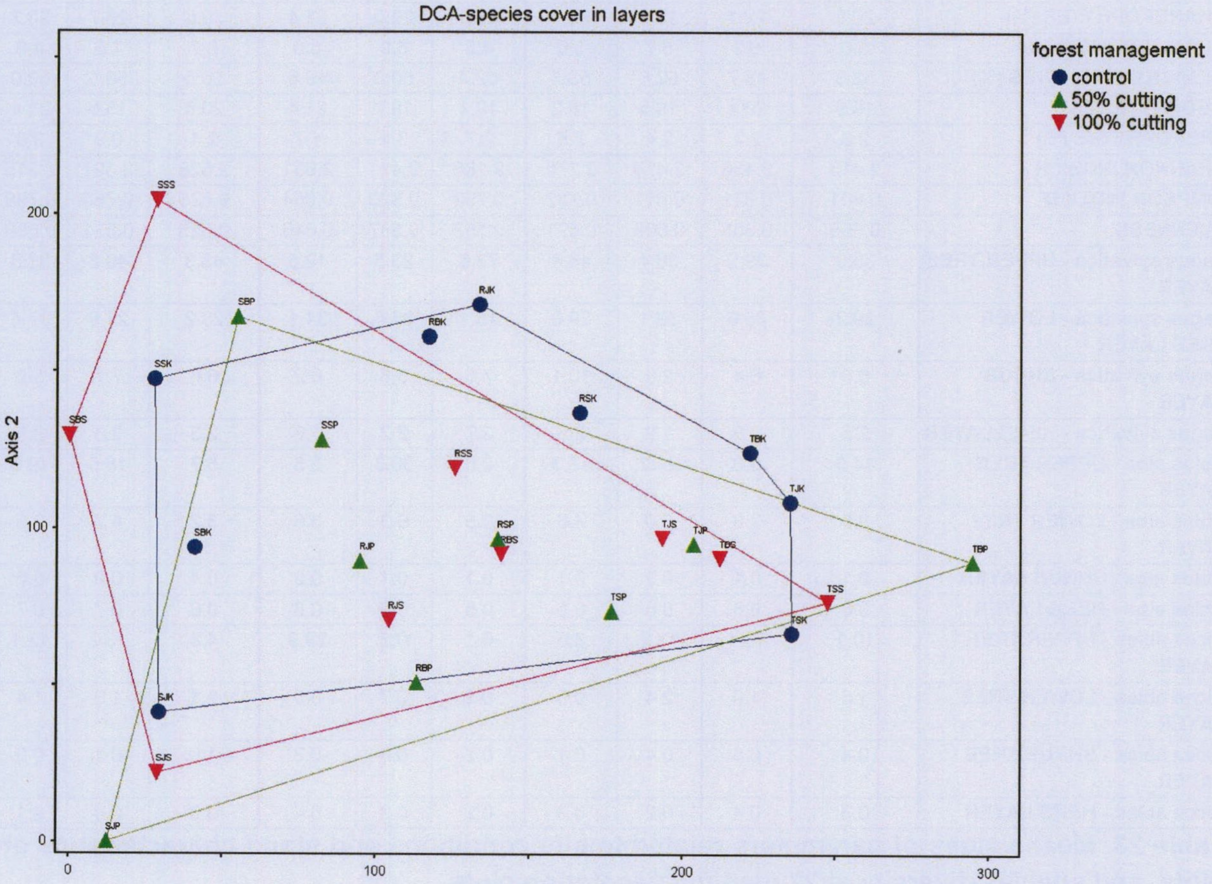


Figure 48. DCA ordination of the medium vegetation plots grouped on planned forest management action (pre-treatment status).

Name of parameter	Parameter	F	p	Signif.
SURFACE ROCK COVER (%)	ROCK	0.127	0.882	ns
DEADWOOD COVER (%)	DEADWOOD	0.902	0.419	ns
COVER OF ALL VERTICAL VEG. LAYERS (%)	ALL_LAYC	0.068	0.935	ns
COVER GROUND VEG. LAYERS (%)	GRO_LAYC	0.794	0.464	ns
BARE SOIL (%)	BARE_SOIL	1.143	0.336	ns
TREE LAYER COVER (%)	TREE_COV	3.086	0.065	ns
SHRUB LAYER COVER (%)	SHRUB_CO	1.523	0.239	ns
HERB LAYER COVER (%)	HERB_COV	1.808	0.187	ns
MOSS LAYER COVER (%)	MOSS_COV	2.633	0.093	ns
NUMBER OF SPECIES OCCURENC IN ALL LAYERS	N_OCCUR	1.578	0.228	ns
TOTAL NUMBER OF VASCULAR PLANT SPECIES	N_TOTAL	0.429	0.656	ns
N. TREE LAYER SPECIES	N_TREE	0.282	0.757	ns
N. SHRUB LAYER SPECIES	N_SHRUB	0.468	0.632	ns
N. HERB LAYER SPECIES	N_HERB	0.251	0.780	ns
SHANNON INDEX H	SHANN_H	0.593	0.561	ns
SIMPSON INDEX D`	SIMPS_D`	0.821	0.453	ns
EVENNESS	EVENNESS	0.429	0.656	ns
PHANEROPHYTES (%)	LF%_PHAN	0.689	0.512	ns
CHAMAEPHYTES (%)	LF%_CHAM	1.352	0.278	ns
HEMICRYPTOPHYTES (%)	LF%_HEMI	0.148	0.864	ns
GEOPHYTES (%)	LF%_GEOP	0.680	0.517	ns
THEROPHYTES (%)	LF%_THER	0.153	0.859	ns
Fagus sylvatica - UPPER TREE LAYER	FAGSYL_T1	0.820	0.453	ns
Fagus sylvatica - LOWER TREE LAYER	FAGSYL_T2	0.884	0.427	ns
Fagus sylvatica - SHRUB LAYER	FAGSYL_S	0.497	0.615	ns
Fagus sylvatica - HERB LAYER	FAGSYL_H	2.139	0.141	ns
Abies alba - UPPER TREE LAYER	ABIALB_T1	0.680	0.516	ns
Abies alba - LOWER TREE LAYER	ABIALB_T2	0.583	0.566	ns
Abies alba - SHRUB LAYER	ABIALB_S	0.305	0.740	ns
Abies alba - HERB LAYER	ABIALB_H	0.325	0.726	ns
Picea abies - UPPER TREE LAYER	PICABI_T1	0.968	0.395	ns
Picea abies - LOWER TREE LAYER	PICABI_T2	0.816	0.455	ns
Picea abies - SHRUB TREE LAYER	PICABI_S	0.868	0.433	ns
Picea abies - HERB LAYER	PICABI_H	1.055	0.365	ns

Table 24. Test of differences among the groups of different planned forest management treatment by ANOVA of parameters related to forest site conditions, stand characteristics and species diversity.

Dominant tree species

Based on ordination of median vegetation plots, some differences among groups with different dominant tree species may be observed in the DCA ordination space (Figure49). In the ordination space some of fir dominated plots differ from rest of the plots.

Using Dufręne & Legendre method (1997) only two plant species among 188 species occurring in all vertical layers have been recognised as indicator species of the groups with different dominate tree species (Table 25).

The differences among the mean values of parameters related to forest site conditions, stand characteristics and species diversity were tested by analysis of variances (ANOVA). In total, 7 parameters indicate the significant differences among the groups of different tree species (Table 26).

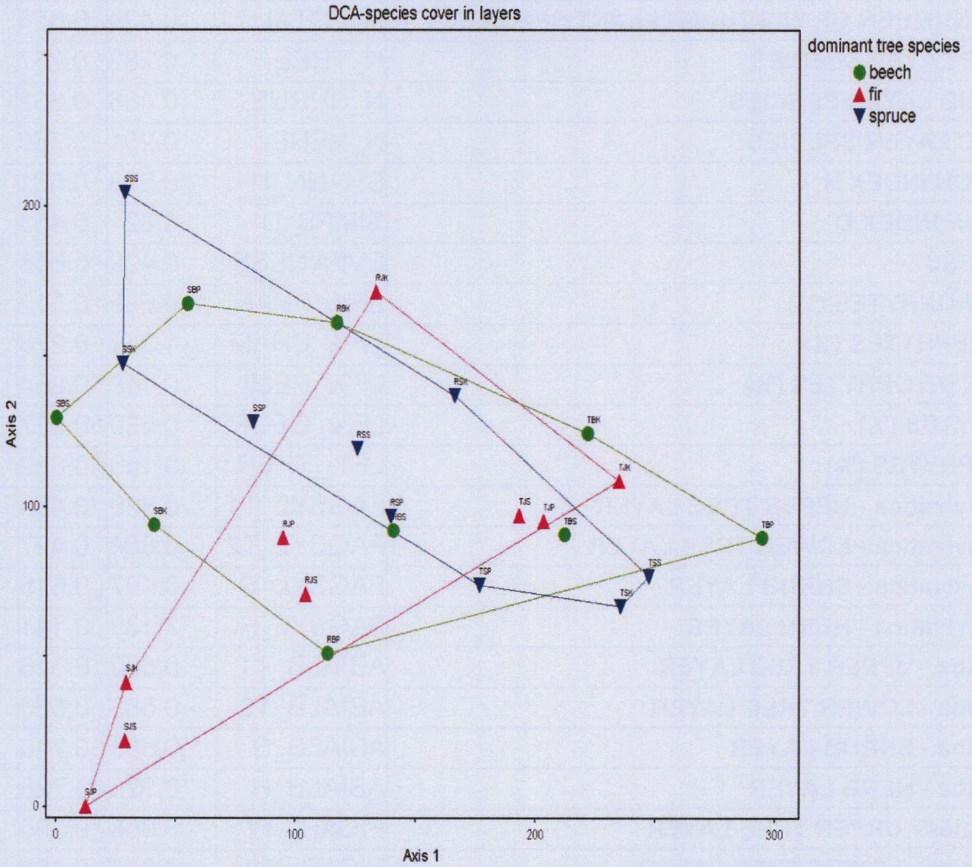


Figure 49. DCA ordination of groups of medium vegetation plots with the same dominant tree species.

	Beech	*Fir*	*Spruce*	*p **	*Signif.*
Species	**N=9**	**N=9**	**N=9**		

Picea abies - upper tree layer	1	1	82	0.0002	***
Mycelis muralis	15	50	10	0.0336	*

Table 25. Indicator species of the groups of median vegetation plots with the same dominate tree species.

Parameter	*F*	*p*	*Signif.*
ROCK	1.1603	0.3311	ns
DEADWOOD	0.1689	0.8457	ns
ALL_LAYC	0.8460	0.4421	ns
GRO_LAYC	0.3745	0.6917	ns
BARE_SOIL	2.6167	0.0946	ns
TREE_COV	0.5816	0.5670	ns
SHRUB_CO	0.7173	0.4987	ns
HERB_COV	0.9914	0.3864	ns
MOSS_COV	2.0443	0.1523	ns
N_OCCUR	1.5340	0.2369	ns
N_TOTAL	1.7375	0.1983	ns
N_TREE	0.5642	0.5765	ns
N_SHRUB	0.6021	0.5561	ns
N_HERB	2.2990	0.1230	ns
SHANN_H	2.1585	0.1383	ns
SIMPS_D`	4.7372	0.0189	*
EVENNESS	2.1289	0.1418	ns
LF%_PHAN	0.1953	0.8240	ns
LF%_CHAM	0.5617	0.5779	ns
LF%_HEMI	0.1497	0.8618	ns
LF%_GEOP	0.1744	0.8411	ns
LF%_THER	0.8891	0.4247	ns
FAGSYL_T1	17.9285	0.0000	***
FAGSYL_T2	4.5864	0.0211	*
FAGSYL_S	0.4376	0.6509	ns
FAGSYL_H	3.5082	0.0468	*
ABIALB_T1	13.0100	0.0002	***
ABIALB_T2	1.7681	0.1931	ns
ABIALB_S	0.4682	0.6320	ns
ABIALB_H	1.2394	0.3082	ns
PICABI_T1	20.7208	0.0000	***
PICABI_T2	7.4327	0.0032	**
PICABI_S	0.4803	0.6247	ns
PICABI_H	0.8527	0.4393	ns

Table 26. Test of differences among the groups of different dominant tree species by ANOVA. Different parameters related to forest site conditions, stand characteristics and species diversity were tested.

Location (site)

In the DCA ordination space, the plots belonging to three sites, Kočevski Rog, Snežnik and Trnovo are separated evidently from each other (Figure50). Irrespective of the fact that all Slovenian sites belong to the same forest type – Dinaric fir-beech forests, it seems that plots from different test sites are significant different in terms of plant species composition. On average, the species diversity increases from right to left side of the ordination space, from Trnovo to Snežnik site.
Among 188 vascular plant species occurring in all vertical vegetation layers, upper tree and lower tree, shrub, herb, 36 species were recognised as indicator species which indicate significant differences among the groups from three locations (Table).
The differences among these three groups have been tested by ANOVA to indicate the differences in mean values of the parameters related to forest site conditions, stand characteristics and species diversity. In total, 10 of all 35 parameters tested by ANOVA were significant (Table28).

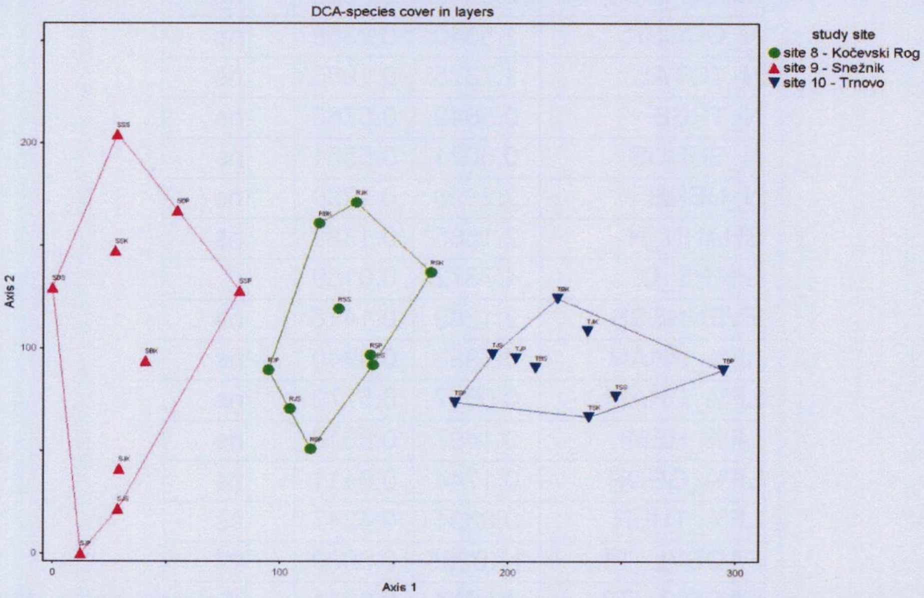


Figure 50. DCA ordination of groups of medium vegetation plots from three test sites, Kočevski Rog, Snežnik and Trnovo.

	Kočevski Rog	Snežnik	Trnovo	p *	Signif.
Species	N=9	N=9	N=9		
Abies alba - shrub layer	56	0	0	0.005	**
Picea abies - shrub layer	57	2	0	0.004	**
Fraxinus excelsior - shrub layer	0	0	44	0.026	*
Fraxinus excelsior - herb layer	0	2	57	0.0052	**
Ulmus glabra - herb layer	2	57	0	0.0056	**
Daphne laureola - shrub layer	56	0	0	0.0038	**
Daphne laureola - herb layer	89	0	0	0.0002	***
Euonymus europaea - herb layer	0	44	0	0.022	*
Lonicera alpigena - herb layer	1	54	4	0.01	*
Lonicera nigra - herb layer	4	54	1	0.0112	*
Lonicera xylosteum - shrub layer	1	60	1	0.0026	**
Lonicera xylosteum - herb layer	6	50	0	0.0218	*
Rubus hirtus - herb layer	60	27	0	0.0046	**
Adoxa moschatellina	17	3	56	0.01	**
Ajuga reptans	1	79	0	0.0004	***
Aposeris foetida	0	67	0	0.0032	**
Asarum europaeum	9	49	1	0.0266	*
Carex pilosa	0	56	0	0.0036	**
Carex sylvatica	50	15	10	0.0298	*
Cyclamen purpurascens	1	68	0	0.0014	**
Epipactis helleborine	0	0	44	0.0244	*
Festuca altissima	1	0	79	0.0004	***
Galeopsis speciosa	0	0	56	0.0044	**
Gymnocarpium dryopteris	1	1	50	0.0166	*
Impatiens noli-tangere	0	0	44	0.0194	*
Luzula luzuloides	0	0	56	0.0062	**
Mercurialis perennis	20	64	0	0.001	***
Milium effusum subs. effusum	0	0	78	0.0008	***
Moehringia muscosa	0	56	0	0.0044	**
Omphalodes verna	50	50	0	0.031	*
Petasites albus	44	0	0	0.0202	*
Phyllitis scolopendrium	78	0	0	0.0002	***
Polystichum aculeatum	47	27	1	0.0484	*
Pulmonaria officinalis	0	89	0	0.0002	***
Scopolia carniolica	89	0	0	0.0002	***
Stellaria montana	27	0	60	0.0038	**

Table 27. Indicator species of the groups of median vegetation plots from three test sites

Figure 51. ***Pulmonaria officinalis*** **was found only on plots of Snežnik site (Photo: L. Kutnar).**

Figure 52. ***Scopolia carniolica*** **is indicator species for the plots of Kočevski Rog site (Photo: L. Kutnar).**

Figure 53. ***Festuca altissima*** **is more frequent on the Trnovo plots (Photo: L. Kutnar).**

Parameter	F	p	Signif.
ROCK	4.2314	0.0272	*
DEADWOOD	0.6030	0.5556	ns
ALL_LAYC	3.0143	0.0688	ns
GRO_LAYC	1.0792	0.3565	ns
BARE_SOI	1.1263	0.3415	ns
TREE_HEI	0.5347	0.5929	ns
TREE_COV	0.8745	0.4305	ns
SHRUB_CO	1.0490	0.3665	ns
HERB_COV	2.4983	0.1043	ns
MOSS_COV	4.7819	0.0183	*
N_OCCUR	3.7888	0.0378	*
N_TOTAL	4.3266	0.0254	*
N_TREE	9.4248	0.0010	***
N_SHRUB	8.6588	0.0016	**
N_HERB	2.0462	0.1521	ns
SHANN_H	0.6485	0.5321	ns
SIMPS_D`	0.4879	0.6201	ns
EVENNESS	0.8463	0.4419	ns
LF%_PHAN	3.3307	0.0537	ns
LF%_CHAM	2.0010	0.1581	ns
LF%_HEMI	8.6395	0.0016	**
LF%_GEOP	13.4137	0.0001	*
LF%_THER	9.5406	0.0010	***
FAGSYL_T1	0.1230	0.8848	ns
FAGSYL_T2	0.9256	0.4106	ns
FAGSYL_S	0.9862	0.3882	ns
FAGSYL_H	0.0438	0.9572	ns
ABIALB_T1	1.1049	0.3482	ns
ABIALB_T2	0.1671	0.8471	ns
ABIALB_S	3.0442	0.0672	ns
ABIALB_H	0.0474	0.9538	ns
PICABI_T1	0.5092	0.6076	ns
PICABI_T2	0.1952	0.8240	ns
PICABI_S	8.2750	0.0020	**
PICABI_H	1.8976	0.1727	ns

Table 28. Test of differences among the groups from different test sites by ANOVA. Different parameters related to forest site conditions, stand characteristics and species diversity were tested.

2.2.4. Subaction 4 - Deadwood

Italy: Deadwood is an important component of forest ecosystems because it provides habitat, shelter and food source to many species. For instance, woody debris on forest floor provide nursery site for seedling establishment favouring the natural regeneration of the forest. Deadwood amounts were estimated, calculating its abundance in relation to different components and decay classes. Moreover, in order to integrate the evaluation of the levels of naturalness ante and post the intervention, the occurrence of microhabitats was also measured in the Italian sites. We focused on microhabitats which are common (e.g. bark loss, canker) or easy to observe (e.g. splintered stem, broken fork) and generally known for their relevant relationship with the natural biocoenosis of forests. Twenty-three different types of microhabitats were distinguished. Within the project, a set of survey areas on ground (test areas) was identified in the test sites selected in PA Action, where deadwood and microhabitats were sampled.

In order to achieve the parameters relative to the ante-intervention stand structure, in Italy all the study sites have been sampled. In each plot, deadwood was assessed within one plot of 13 meters of radius, concentric within the plot established for structural measurements. Particularly, coarse woody pieces were measured when more than half base of their thicker end lied within the plot. A threshold height of 1.3 m was used to distinguish stumps (less than 1.3 m) from snags (higher than 1.3 m). Deadwood components and attributes surveyed are detailed in Table 29.

Deadwood component	Dimensional limits	Parameter recorded
Standing dead trees	$D_{1.30m} \geq 5cm$ $H \geq 130cm$	species, $D_{1.30m}$, height, decay class
Snags	$D_{1.30}m \geq 5cm$ $H \geq 130cm$	species, D_{base}, D_{top}, height, decay class
Dead downed trees	$D_{1.30}m \geq 5cm$ $L \geq 130cm$	species, $D_{1.30m}$, length (L), decay class
Coarse woody debris	$D_{min} \geq 5cm$ $L \geq 100cm$	species, D_{min}, D_{max}, length (L), decay class
Stumps	$D_{top} \geq 5cm$ $H < 130cm$	species, D_{base}, D_{top}, height, origin (natural or from cutting), decay class

Table 29. Parameter recorded for each deadwood component.

Decay level classification of each deadwood piece was carried out visually by the system proposed by Hunter (1990). Such classification system is based on decay levels with a five-grade scale, in which morphological features of deadwood, presence of bark, integrity of wood structure, and wood colour are considered. Considering how the stage of decay could vary in different parts of the deadwood components, when more than one class of decay was present on the same sample, with the most widespread decay class was assigned.

Results on deadwood aomunts obtained are reported below (Table 30).

Table 30. Deadwood amounts in the sampled sites.

Study Site	*Thesis*	*Stumps (mc/ha)*	*Coarse woody debris (mc/ha)*	*Dead downed trees (mc/ha)*	*Total Amounts (mc/ha)*
Mongiana	Innovative	4.3 ± 3.2	1.3 ± 0.7	-	5.6 ± 3.3
	Traditional	3.3 ± 2.8	1.8 ± 1.2	-	5.1 ± 3.1
	No practice	4.2 ± 3.1	1.2 ± 0.7	-	5.4 ± 3.2
Tarvisio	i	58.0 ± 27.5	12.9 ± 10.2	1.6 ± 2.2	72.5 ± 29.4
	i2	62.3 ± 23.9	4.5 ± 6.4	2.6 ± 3.2	69.4 ± 24.9
	t	59.3 ± 17.3	6.9 ± 3.7	7.8 ± 15.5	74.0 ± 23.5
Cansiglio	A	5.4 ± 2.5	1.9 ± 1.4	-	7.3 ± 2.9
	B	5.2 ± 3.6	6.0 ± 4.2	0.01 ± 0.04	11.2 ± 5.5
	C	7.1 ± 4.8	10.1 ± 19.3	-	17.2 ± 19.9
Chiarano	T	10.2 ± 9.4	1.4 ± 1.6	-	11.3 ± 9.5
	40	8.5 ± 2.2	2.4 ± 2.3	1.3 ± 2.6	14.1 ± 4.1
	80	7.0 ± 2.8	4.68 ± 5.2	0.4 ± 1.3	10.1 ± 6.0
Lorenzago	1	65.5 ± 30.5	11.0 ± 1.8	-	76.5 ± 30.6
	2	23.1 ± 12.3	10.8 ± 9.5	-	33.9 ± 15.5
	4	66.9 ± 14.5	20.4 ± 17.7	2.7 ± 3.0	90.0 ± 23.1
Pennataro	T1	0.47 ± 0.4	6.79 ± 6.5	0.85 ± 1.2	8.1 ± 6.6
	T2	0.76 ± 0.6	10.2 ± 7.4	0.29 ± 0.6	11.2 ± 7.4

Moreover, occurring microhabitats, which are common or easy to observe and generally known for the evaluation of level of forest naturalness, were assessed. The following 23 microhabitats (Table 31) were identified in the study plots.

Microhabitat ID	Microhabitat description
M1	Living trees with fruiting bodies of *Fomes fomentarius*
M2	Living trees with fruiting bodies of *Fomitopsis pinicola* (Swartz ex Fr.) Karst.;
M3	Other fungal infections: living trees with fruiting bodies. Fruiting bodies were >5 cm in diameter or occur in 10 cm long cascades of smaller fruiting bodies;
M4	<50% of the crown broken: significant loss of a part or parts of the crown. One or more main branches are lost. The remaining crown seems to be 50% of the former crown;
M5	50% of the crown broken: several main branches are broken. The remaining crown seems to be <50% of the former crown;
M6	Broken fork: complete fracture of one of the two forking branches. The loss of one forking branch results in a severe damage of the main stem;
M7	Broken stem: the crown is totally absent. Underneath the fracture, some very small living twigs have remained. This microhabitat type can develop into a substitute crown (M8);
M8	Substitute or secondary crown: after the loss of the primary crown (M7), a tree with a broken stem has developed a secondary crown.
M9	Lightning scar: a crack caused by lightning; at least 3 m long and reaching the sapwood;
M10	Crack: cleft into the sapwood >50 cm long along the stem and at least 2 cm deep in the sapwood:
M11	Splintered stem: the split-up results in numerous scales (minimum 5) of wood > 50 cm long;
M12	Cavities with >5 cm aperture: (A) entrance of a Black Woodpecker cavity, (B) entrance of a Green Woodpecker cavity and (C) entrance at hollowed branch forms cavity in stem
M13	Cavity string: at least three woodpecker cavities in a stem with a maximum distance of two meters between two cavity entrances.
M14	Deep stem cavities: a tubular cavity with little or without mould, whose development may take decades;
M15	Cavities with mould of at least 8000 cm3 volume
M16	Mould pockets: space between loose bark and the sapwood with a minimum extension of 5 cm;
M17	Bark pockets: same structure and size as M16 but without mould
M18	Canker: proliferation of cell growth; irregular cellular growth on stems or branches, which is caused by bark inhabiting fungi, viruses and bacteria. At least 10 cm in diameter;
M19	Bark loss: patches with bark loss of at least 5 cm 5 cm mainly caused by felling or natural falling of trees.
M20	Uprooted stumps: were recorded with a minimum height of 1.2 m of the vertical root plate.
M21	System of galleries on deadwood (Scolytid activities)
M22	Woody debris and/or stumps with saproxylic insects holes
M23	Water-filled rot hole on stumps

Table 31. A list of the microhabitats measured in the study plots

The same number of plots assessed for deadwood was also surveyed for microhabitats occurrence. The total number of microhabitats per hectare observed in the Italian study sites is presented in Table 32, while a detailed repartition of each microhabitat per hectare is reported in Table 33.

Total number of microhabitats per hectare			
Chiarano			
Thesis	**T**	**40**	**80**
Number of microhabitats	148,7	203,1	289,0
St. dev.	16,4	14,9	24,4
Cansiglio			
Thesis	**A**	**B**	**C**
Number of microhabitats	119,3	111,0	115,2
St. dev.	13,5	10,2	10,4
Lorenzago			
Thesis	**1**	**2**	**4**
Number of microhabitats	31,4	69,2	44,0
St. dev.	5,3	8,5	5,2
Mongiana			
Thesis	**Inn.**	**Trad.**	**No P.**
Number of microhabitats	169,6	236,6	129,8
dev. St.	16,4	25,1	12,4
Tarvisio			
Thesis	**i**	**i2**	**t**
Number of microhabitats	228,2	134,0	326,6
dev. St.	17,6	9,7	22,7
Pennataro			
Thesis	**t1**	**t2**	
Number of microhabitats	196,30	216,7	
dev. St.	20,1	22,2	

Table 32. Total number of microhabitats per hectare (average) in the study sites, shared

Number of each microhabitat per hectare									
Type of microhabitats	Chiarano			Cansiglio			Lorenzago		
Thesis	T	40	80	A	B	C	1	2	4
M1 tree with *F. fomentarius*									
M2 tree with *F. pinicola*									
M3 tree with other fungi		6,3	20,9						
M4 broken crown < 50%	39,8	29,3	46,1	52,3	37,7	39,8			
M5 broken crown > 50%									
M6 broken fork				2,1					
M7 broken stem	4,2	10,5	2,1				25,2	25,2	18,9
M8 substitute crown	2,1	6,3	2,1						
M9 lighting scar		4,2		2,1	2,1	4,2			
M10 crack	2,1	8,4	27,2		2,1	4,2			
M11 splintered stem		6,3	8,4						
M12 woodpecker and br.cavities								31,5	
M13 cavity string									
M14 deepened stem cavities		2,1	12,6		2,1				
M15 cavity with mould									
M16 pocket with mould		6,3	10,5			2,1			
M17 bark pocket	2,1	4,2	2,1			2,1			
M18 canker					8,4	4,2			
M19 bark loss	8,4	4,2	8,4			4,2			
M20 uprooted stumps		4,2			2,1	2,1			12,6
M21 Galleries on deadwood	0,0	10,5	20,9	2,1	12,6	2,1		12,6	
M22 Saproxylics insects holes	69,1	60,7	111,0	33,5	12,6	20,9	6,3		12,6
M23 Water-filled root on stumps	20,9	39,8	16,8	27,2	31,4	29,3			

Number of each microhabitat per hectare								
Type of microhabitats	Mongiana			Tarvisio			Pennatar o	
Thesis	Inn.	Trad.	No P.	i	i2	t	t1	t2
M1 tree with *F. fomentarius*				2,1	2,1	2,1		
M2 tree with *F. pinicola*								

M3 tree with other fungi				16,8	12,6	14,7	1,6	3,1
M4 broken crown < 50%	4,2			2,1	6,3	8,4	70,7	64,4
M5 broken crown > 50%			2,1		10,5	4,2		
M6 broken fork	2,1	2,1		16,8	6,3	25,1		
M7 broken stem						33,5		
M8 substitute crown		2,1	2,1					
M9 lighting scar				8,4	2,1	2,1		
M10 crack				10,5	2,1			
M11 splintered stem		2,1						
M12 woodpecker and br. cavities	25,1	20,9	20,9		2,1		3,1	4,7
M13 cavity string			6,3		4,2			
M14 deepened stem cavities	8,4	14,7	2,1	4,2		2,1		
M15 cavity with mould	2,1	4,2						
M16 pocket with mould			2,1	33,5		31,4	1,6	
M17 bark pocket							34,5	29,8
M18 canker		2,1		2,1		8,4	3,1	14,1
M19 bark loss	4,2	4,2	2,1	18,8	37,7	23,0		
M20 uprooted stumps						10,5		
M21 Galleries on deadwood	12,6	16,8	10,5	71,2	29,3	100,5	14,1	12,6
M22 Saproxylics insects holes	48,2	108,9	50,3	41,9	8,4	41,9	64,4	86,4
M23 Water-filled root on stumps	62,8	58,6	31,4		10,5	18,8	3,1	1,6

Table 33. Occurrence of each microhabitat in the study sites (average of number per hectare), shared among the different thesis.

Slovenia. Deadwood

The average volume of deadwood of the Slovenian research plots amounts to 26.96 m3/ha (FWD + CWD). Fine woody debris represents 27% of total deadwood. The highest volume at site of Snežnik amounts to 31.94 m3/ha (26.13 m3/ha of CWD and 5.81 m3/ha of FWD). In contrast, the lowest volume is found at the site of Trnovo (23.44 m3/ha) (Figure 54, Figure 55).

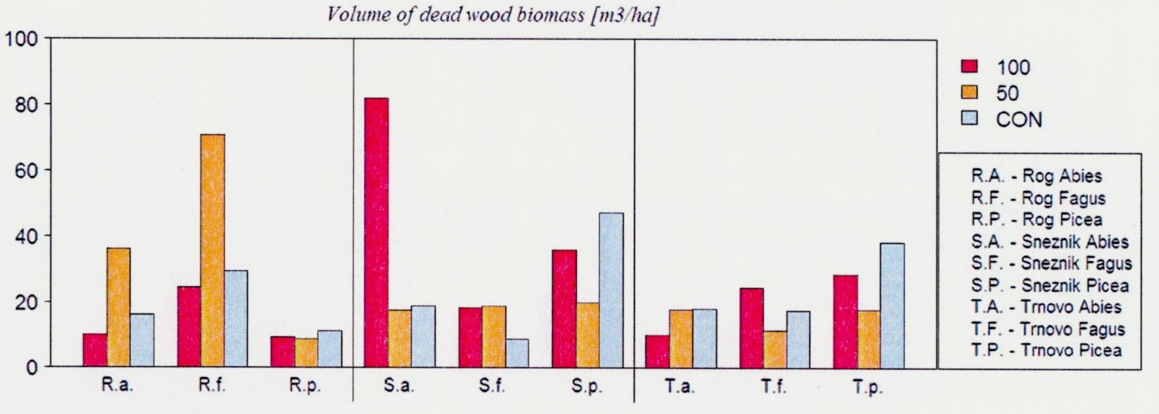


Figure 54. Volume of deadwood for plots.

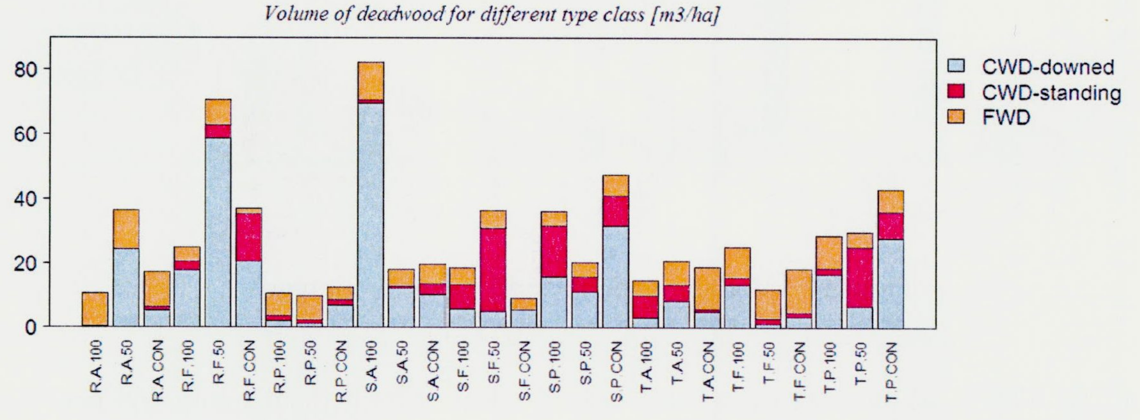


Figure 55. Volume of CWD and FWD for plots.

The amount of deadwood is mainly due to the stumps, coarse woody debris and accumulations, while the standing dead trees and dead downed trees are scarce and often totally absent.

Table summarizes the deadwood volumes (1 - dead standing tree, 2 - downed (lying) dead tree, 3 – stump, 4 – snag, 5 - coarse woody debris and 6 - logging accumulation) per ha for each plot (Figure56).

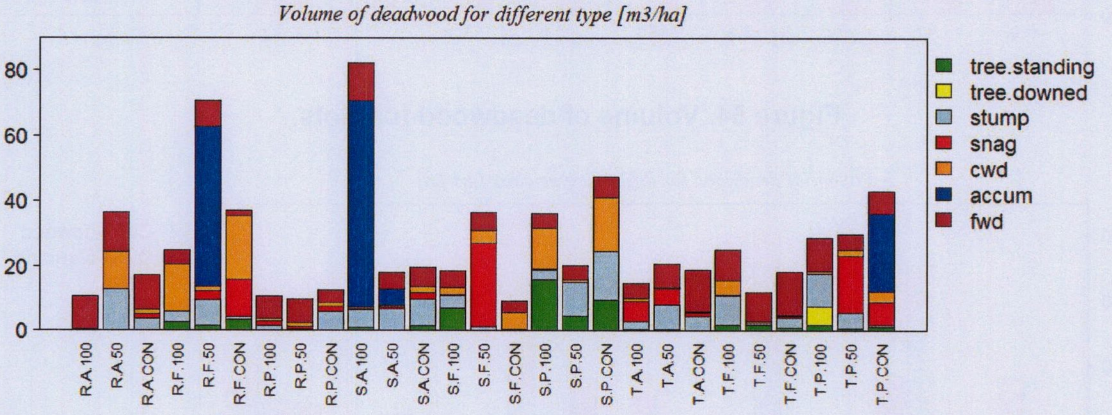


Figure 56. Volume of deadwood for different types.

More than 60% of all measured deadwood was in decay class 1 (hard wood) and only 7% of deadwood was completely decayed (decay class 4) (Figure57).

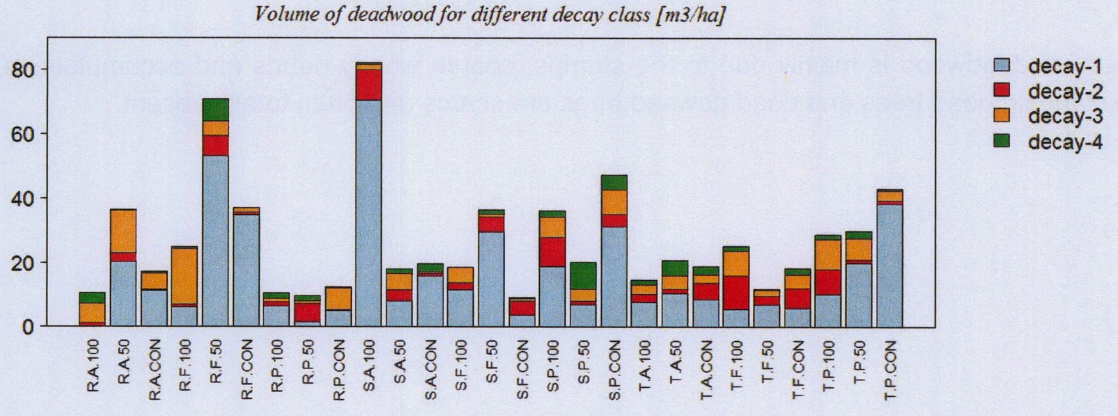


Figure 57. Volume of deadwood for different decay classes.

									type of dead wood							decay class					microhabitats for standing dead trees and snags					
Site	Dominant tree	FM treatment	CWD [N/ha]	FWD [N/ha]	SUM [N/ha]	CWD [m3/ha]	FWD [m3/ha]	SUM [m3/ha]	tree-standing [m3/ha]	tree-downed [m3/ha]	stump [m3/ha]	snag [m3/ha]	cwd [m3/ha]	logging accum. [m3/ha]	fwd [m3/ha]	decay-1 [m3/ha]	decay-2 [m3/ha]	decay-3 [m3/ha]	decay-4 [m3/ha]	SUM [m3/ha]	M4 [N/ha]	M7 [N/ha]	M10 [N/ha]	M17 [N/ha]	M19 [N/ha]	Without [N/ha]
Kočevski Rog	Fir	100% cut	44	10186	10230	0.26	10.19	10.45	0.00	0.00	0.26	0.00	0.00	0.00	10.19	0.13	0.93	6.29	3.1	10.45	0	0	0	0	0	0
		50% cut	663	17348	18011	24.23	12.2	36.43	0.00	0.00	12.65	0.00	11.58	0.00	12.20	20.04	2.83	13.13	0.42	36.42	0	0	0	0	0	0
		Control	143	19417	19560	6.45	10.71	17.16	0.00	0.00	3.78	1.26	1.41	0.00	10.71	11.36	0.31	4.82	0.66	17.15	0	0	0	0	0	10
	Fagus	100% cut	121	17348	17468	20.56	4.32	24.88	2.49	0.00	3.24	0.24	14.59	0.00	4.32	6.1	0.95	17.32	0.52	24.89	0	0	0	0	3	8
		50% cut	430	17666	18096	62.92	7.99	70.91	1.44	0.00	7.96	2.73	1.56	49.23	7.99	53.17	6.42	4.4	6.92	70.91	0	0	0	0	0	10
		Control	180	11300	11480	35.25	1.67	36.92	3.47	0.00	0.84	11.39	19.53	0.00	1.67	34.7	0.84	1.31	0.06	36.91	0	0	0	0	0	25
	Picea	100% cut	116	30717	30832	3.58	7.01	10.59	0.08	0.00	1.32	1.40	0.77	0.00	7.01	6.31	1.57	1.06	1.65	10.59	0	0	0	0	0	5
		50% cut	54	23873	23927	2.35	7.33	9.68	0.23	0.00	0.06	1.01	1.05	0.00	7.33	1.54	5.68	0.75	1.71	9.68	0	0	0	0	0	10
		Control	121	8435	8556	8.57	3.84	12.41	0.00	0.00	5.90	1.52	1.15	0.00	3.84	5.06	0.31	6.94	0.12	12.43	0	0	0	0	0	10
Snežnik	Fir	100% cut	165	17348	17513	70.68	11.53	82.21	0.81	0.00	5.66	0.26	0.40	63.55	11.53	70.62	9.56	1.48	0.54	82.20	0	0	0	0	0	10
		50% cut	179	12573	12753	12.7	5.28	17.98	0.00	0.00	6.57	0.58	0.52	5.03	5.28	8.12	3.4	5.2	1.25	17.97	0	0	0	0	0	3
		Control	300	11937	12236	13.56	5.97	19.53	1.38	0.00	8.45	1.93	1.81	0.00	5.97	15.75	0.82	0.61	2.36	19.54	0	0	0	0	0	13
	Fagus	100% cut	229	6048	6276	13.21	5.32	18.53	6.97	0.00	3.73	0.26	2.25	0.00	5.32	11.7	2.14	4.65	0.05	18.54	0	0	0	0	0	8
		50% cut	288	6207	6495	30.79	5.54	36.33	0.10	0.00	1.18	25.73	3.78	0.00	5.54	29.64	4.64	0.77	1.26	36.31	0	3	0	0	0	20
		Control	155	5411	5566	5.52	3.66	9.18	0.00	0.00	0.45	0.00	5.06	0.00	3.66	3.62	4.33	1.01	0.21	9.17	0	0	0	0	0	0
	Picea	100% cut	497	10345	10842	31.65	4.43	36.08	15.64	0.00	3.18	0.22	12.61	0.00	4.43	18.87	8.98	6.36	1.88	36.09	0	0	0	0	0	33
		50% cut	216	10504	10721	15.86	4.35	20.21	4.56	0.00	10.26	0.19	0.84	0.00	4.35	6.94	1.18	3.71	8.39	20.22	0	0	0	0	0	18
		Control	339	10663	11003	41.2	6.21	47.41	9.44	0.00	15.18	0.00	16.58	0.00	6.21	31.1	4.01	7.68	4.62	47.41	0	0	0	0	0	30
Trnovo	Fir	100% cut	189	14324	14513	9.87	4.77	14.64	0.27	0.00	2.58	6.44	0.59	0.00	4.77	7.82	2.32	3.1	1.4	14.64	0	0	0	0	0	13
		50% cut	221	16075	16296	13.38	7.24	20.62	0.43	0.00	7.76	4.70	0.49	0.00	7.24	10.43	1.35	4.19	4.66	20.63	3	0	3	3	0	15
		Control	103	18303	18406	5.85	13.03	18.88	0.00	0.00	4.57	0.90	0.38	0.00	13.03	8.66	5.04	2.65	2.53	18.88	0	0	0	0	0	15
	Fagus	100% cut	189	11300	11489	15.5	9.56	25.06	1.77	0.00	8.98	0.39	4.35	0.00	9.56	5.5	10.5	7.68	1.37	25.05	0	0	0	0	0	13
		50% cut	113	12732	12845	2.94	8.91	11.85	1.65	0.00	0.53	0.00	0.76	0.00	8.91	7.01	2.78	1.94	0.12	11.85	0	0	0	0	5	3
		Control	126	14006	14131	4.76	13.46	18.22	0.89	0.00	3.02	0.61	0.24	0.00	13.46	5.95	6.11	4.2	1.96	18.22	0	0	0	0	0	15
	Picea	100% cut	251	10663	10914	18.51	10.31	28.82	1.61	6.01	9.94	0.19	0.75	0.00	10.31	10.37	7.47	9.6	1.37	28.81	0	0	0	0	0	8
		50% cut	415	9868	10283	25.06	4.79	29.85	0.70	0.00	4.95	17.65	1.76	0.00	4.79	19.83	1.22	6.54	2.25	29.84	0	0	0	0	3	15
		Control	305	13051	13356	36.01	7.03	43.04	1.29	0.00	0.54	6.98	3.44	23.76	7.03	38.33	0.96	3.24	0.51	43.04	0	0	0	0	0	18
					average	19.67	7.28		2.05	0.22	4.95	3.21	4.01	5.24	7.28											

Table 34. Total deadwood volume

2.3. *Activities planned for 2014*

2.3.1. Sub-action 1 - Structural Diversity

Italy: The Action is in progress at:

Completion of calculation of compositional/structural diversity indexes at the following designated sites:

(Site 3) - Valdescura Community Forest, Town of Lorenzago di Cadore (Veneto Region)

(Site 5) - Bosco Pennataro Regional Forest, UTB-Isernia (Molise Region)

(Site 6) - Rutte Tarvisio State Forest, UTB-Tarvisio (Friuli Region)

(Site 7) - Vallombrosa State Forest, UTB-Vallombrosa (Toscana Region)

Slovenia:

In the year 2014 we plan to elaborate the diversity indexes for plots that were managed in 2013. Additionally we are planning to evaluate the statistical model so as to explore the relationships between the diversity indexes and the volumes and the types of deadwood and to relate the deadwood amounts to the results of the other sub-actions such as flora and fauna.

Data processing, analysis and results

Data processing uses software especially designed for computing descriptive statistics and indexes. This phase provides knowledge of the following attributes:

- actual spatial tree layer structure and distance from the canonical cultivation types (i.e. from the parameters of standing crops managed according to traditional practices);

- canopy density (crown cover and crown overlapping), canopy thickness, size, area/perimeter ratio and distributive pattern of canopy gaps (Figure 58);

- set of indexes descriptive of the "α" or stand diversity: (i) compositional diversity i.e. tree species richness and relative abundance (total and per layer distribution); (ii) type of mixture and its distributive pattern; (iii) tree size diversity and its distributive pattern; (iv) spatial arrangement of trees in the growing space, i.e. horizontal and vertical distributive pattern; (v) stand complexity.

Other parameters and related statistics i.e. tree density, average, and dominant dbh and tree height, stem size frequency distribution, provide supplementary knowledge on the arrangement of stand structure. The assessment of growth allocation per layer determines finally the amount of carbon stock allocated and allows some inference about figures and the progress of current sequestration ability (also of relevance for Action ForC).

The analysis compares the structural diversity of stands managed according to different management options, i.e. traditional vs. innovative/s practices and no-intervention (where present). It started since October 2012 and is in progress in 2014 according to the availability of field data from designated sites.

Fig. 58. Dynamics of canopy following thinning implementation and a few years later

Dissemination within ManForCBD: Two abstracts on "innovative vs. traditional management practices" and "indexing of stand structure" have been submitted and accepted as oral communication and poster respectively to the 9th Congress of the Italian Society of Silviculture and Forest Ecology (SISEF), Bolzano: September 16th-19th.

The paper "Early impact of alternative thinning approaches on structure diversity and complexity at stand level in two beech forests in Italy" has been issued on the *Annals of Silvicultural Research* in 37 (1), 2013: 55-63. http://ojs-cra.cilea.it/index.php/asr

2.3.2. Sub-action 2 - Fauna Diversity

Sub-action 2a - Vertebrate diversity

Italy:

Data processing and lab analyses have been performed during 2013 and 2014.

Two posters (and their abstracts) have been presented at the 9th Italian Ornithological Congress Trento: September 11th-15th 2013.

Two posters (and their abstracts) have been presented at the 9th Congress of the Italian Society of Silviculture and Forest Ecology (SISEF), Bolzano: September 16th-19th 2013.

Two papers on herps are in press on two journal with ISI Impact factor.

Birds

Point count surveys in Manfor Italian sites will be carried out from May to June (according to birds phenology) in all 7 sites.

An intensive CMR study (24 traps) on short-toed treecreeper will be carried out at Pennataro site from April to August. We will install in many Manfor sites ca. 200 nest boxes during the field season.

Data from nationwide bird monitoring projects will be acquired to both implement selected indicators (e.g. n. of specialist bird species vs. total number of species in a certain area at different area extensions) or to tentatively control bird abundance data recorded in Manfor site taking into account trend that could be locally undetected

Herps

Sampling through above mentioned methods (section 1.2.2. subaction 2a) to confirm and monitoring checklists will be carried out in all sites (N=7) year-round with the exception of the warmer months.

Yellow-bellied toad focus research will be carried out from April or May to October at Tarvisio. Spectacled salamander focus research will be carried out at Pennataro site and Monte di Mezzo control site from March to November.

The planned pilot study on fire salamander habitat use was carried out in spring-and summer 2013. It showed that this research was inapplicable to the situation.

Birds

For the Slovene sites, the data obtained during the point counts will be analysed. Furthermore, a review of the species mentioned in the results will be made regarding the impact of forest management.

Chiroptera

For the 2014/2015 working session the aim is to replicate the monitoring of bat activity inside all ManFor sites and to proceed analyzing the collected data, in order to write the conclusive report containing the results of the entire monitoring work.

As in some ManFor sites logging operations have been completed, it is possible to apply a different sampling protocol, which consider to monitor bat activity simultaneously in all plots logged with different thesis. In this way, we will have a synoptic picture of bat activity in all logged and non logged plots.

Inside the selected ManFor areas it will be possible to do even a mistnetting sessions, useful to refine the species richness data recorded with bat detectors.

This different sampling design could not be used at all ManFor sites because almost three plots assigned to every treatment are needed and logging operations must be already completed. So, we can consider only Mongiana, Chiarano and Cansiglio sites.

The new sampling design provide for:

- Only one ultracoustic sampling point set up at the center of the investigated plot, in order to reduce the risk of data replication;
- Eight hours of ultracoustic recording sessions, starting from an 30 min. after sunset;
- Random selection of plots to investigate during the same night;
- Two sampling session: the first one in early summer (end of june-july) and the secondo ne during late summer (end of august-september);
- Environmental variables, such as air temperature and wind speed, will be measured at the start and at the end of every sampling session;

The entire dataset will be statistically analysed with an ANCOVA, considering the silvicultural theses as the treatments and the air temperature, wind speed and plot dimensions as covariates.

In according with this new sampling design, all plots of a single ManFor area will be investigated in a narrow temporal windcw (max two days).

Slovenia:

Subaction 2b - Invertebrate diversity

Italy:

To verify the effect of the different management options on the saproxylic assemblages, we will focus our field activity in three sites: Chiarano-Sparvera, Mongiana and Tarvisio. The influence of different silvicultural practices on insect diversity will be studied, in Chiarano-Sparvera and Mongiana placing a total of 18 window traps and 6 Malaise traps (equally distributed in six plots). The effection of the experimental interventions in Tarvisio will be studied with direct catches performing standardised transects.

In order to sample ground (carabid) beetles communities, we will place pitfall traps in the ManFor experimental site in Cansiglio as well as in different forest stands with different intensity of management nearby. Twelve traps will be positioned in the ManFor experimental site, with three traps per forest treatment (three treatments) and three traps in the aging islet. Further 80 traps will be placed in 10 nearby stands for comparing different site with different intensities of past management. Traps will be emptied every second week from May to September 2014. Samples will be sorted at the family level and each individual of Carabidae will be determined at the species level.

Slovenia:

Regarding hoverflies and carabid beetles in the Slovenian sites, the identification will be finished this year. Furthermore the data will be analysed with multivariate and univariate statistical methods.

2.3.3. Subaction 3 - Plant Diversity

Italy:

For 2014, the repetition of field assessment of plant species diversity at all plots will be repeated in allthe sites where silvicultural treatments are completed, in order to have data of the state of the art post-intervention. The data will be organized in a database, and appropriate matrix of species related to their presence/abundance values ante and post treatment will be realized and elaborated with multivariate analysis software (CANOCO, R).

Slovenia: In the 2014, the repetition of field assessment of plant species diversity at all plots (27 medium vegetation plots and 135 small vegetation plots) and at all 3 sites (Kočevski Rog, Snežnik, Trnovo) is planned. Approximately after 2 years from the time when the forest management actions had been completed, the field vegetation survey will be carried out for a second time (post-management status).

The species diversity data obtained in field vegetation relevés will be stored into computer database. The preliminary analysis of plant species diversity status before and after management actions will be performed by using different indicators related to plants and habitats.
Selected indicators of plant species/vegetation diversity and indicators species will be tested after forest management actions. Their status before and after will be evaluated.

2.3.4. Subaction 4 - Deadwood

Italy: During the 2014 year, post-treatments sampling of deadwood and microhabitats sampling will be carried out in the sites managed in the previous year: Cansiglio, Mongiana, Chiarano, Tarvisio Lorenzago and Pennataro, for a total of 141 plots.
Particularly, 27 plots will be sampled in the following sites: Chiarano, Cansiglio, Tarvisio and Mongiana, for a total of 108 plots; 24 plots will be sampled in the Pennataro site and 9 in Lorenzago. So, 141 plots will be analysed in the ex-ante sampling phase (108+24+9).

Slovenia: In 2014, we are planning to repeat the field measurement of CWD on all plots that were managed in year 2013. Additionally we intend to evaluate the statistical model and to explore the relationships between the volume and the type of deadwood with the results acquired by other sub-action like flora and fauna.

3. Comparison of achieved vs. expected results

3.1. Expected results in the reporting period

3.1.1. Subaction 1 - Structural diversity

Italy: Collection and processing of quantitative/qualitative parameters referred to the condition *ex ante* and *ex post* intervention. The resulting datasets provide the basis for a detailed description of standing crop and crown layer structural attributes.

Field data collection

scheduled activity (total)	July 2012 = 33%	December 2013 = 66%	March 2015 = 100%
actual/foreseen progress (total of project)	April 2012 = 70% (7 sites)	July 2012 = 80% (8 sites)	October 2013 = 100% (10 sites)

Table 35. Field data collection.

Field data collection has been completed on all the designated sites (7) in Italy.

Slovenia: The collection of field data has been completed at all 27 research plots (3 Slovenian sites). For the collected data the basic analyses were performed and different diversity indexes were calculated. The evaluation of the statistical design will be made in the year 2014.

Data processing

scheduled activity (total)	July 2012 = 33%	December 2013 = 66%	March 2015 = 100%
actual/foreseen progress (total of project)	July 2012 = 60% (6 sites)	October 2012 = 60% (6 sites)	July 2014 = 100% (10 sites)

Table 36. Data processing.

Data processing will be completed at all sites within July 2014.

Data analysis and results

scheduled activity (total)	July 2012 = 33%	December 2013 = 66%	March 2015 = 100%
actual/foreseen progress (total of project)	October 2012 = start (6 sites) 60%	March 2014 = in progress (6 sites) 60%	December 2014 = 100% (10 sites)

Table 37. Data analysis and results.

Data analysis and results will be available at all sites within December 2014.

3.1.2. Subaction 2 - Fauna Diversity

Subaction 2a - Vertebrate diversity

Italy:

Birds. In the spring-summer first post treatment data in few sites will be collected and in autumn they will be analysed.

Herps. In the spring-summer first post treatment data in few sites will be collected and in autumn they will be analysed

Chiroptera.

Bat surveys in pre-treatment conditions was completed at Vallombrosa site in 2013. During the same field work session we also repeated the sampling at all ManFor sites. Ultrasound analyses and the species identification was completed in the scheduled timeframe.

Scheduled activity	*Site*	*Status*	*Actual/foreseen progress*
Bat surveys and ultrasound analysis	Vallombrosa	Completed	April 2014=100%
Bat surveys and ultrasound analysis	Cansiglio	Completed	April 2014=100%
Bat surveys and ultrasound analysis	Lorenzago di Cadore	Completed	April 2014=100%
Bat surveys and ultrasound analysis	Tarvisio	Completed	April 2014=100%
Bat surveys and ultrasound analysis	Chiarano	Completed	April 2014=100%
Bat surveys and ultrasound analysis	Mongiana	Completed	April 2014=100%
Bat surveys and ultrasound analysis	Pennataro	Completed	April 2014=100%

Table 38. Sheduled activity and foreseen progress for vertebrate diversity.

Slovenia:
As foreseen the fieldwork for the birds was completed during the reporting period. The analysis is still in progress

Subaction 2b - Invertebrate diversity

Italy:

Field data collection of the pre-treatment conditions was completed in Vallombrosa in 2013, whereas in the same period we completed the sampling of post-treatment conditions in Cansiglio and Lorenzago di Cadore (Table y). Fieldwork concerning the collection of carabid beetles was carried out at the Lorenzago site as expected. The lab work for the sorting and identification of the ground beetle material was completed in the scheduled timeframe.

Scheduled activity	Site	Status	Actual/foreseen progress
Sampling of communities of pre-treatment conditions	Vallombrosa	Completed	October 2013=100%
Sampling of communities after experimental treatment	Cansiglio	Completed	October 2013=100%
Sampling of communities after experimental treatment	Lorenzago di Cadore	Completed	October 2013=100%
Experiment on carabid beetle	Lorenzago di Cadore	Completed	September 2013=100%
Sampling of communities after experimental treatment	Chiarano-Sparvera	In progress	October 2014=100%
Sampling of communities after experimental treatment	Mongiana	In progress	October 2014=100%
Sampling of communities after experimental treatment	Tarvisio	In progress	October 2014=100%

Table 39. Sampling of invertebrate assemblages in Italy.

Slovenia:

For what concerns Slovenia the data of the hoverflies was sampled as expected. Malaise traps and window traps were set and sampled and transect were conducted in 2013.

The data of the Cerambycidae was sampled as expected. We only had problems with the findings of the species *Rosalia alpina*, because we found just one specimen.Cross vane funnel traps and Theyshon traps were set and sampled in 2013.

3.1.3. Subaction 3 - Plant Diversity

Italy:

The methodology used was easy and expeditious, at the same time it's efficacy to have enough information to define the expected data. Floristic and vegetation relevés carried out with the visual estimate of cover percentage for every species in the plot of 20mx20m divided in 4 plots, was preferred, because more accurate. Moreover, as expected all sites were investigated before silvicultural treatment in July 2013, as the table below.

Scheduled activity	*Site*	*Status*	*Actual/foreseen progress*
Flora and vegetation amounts pre-treatment conditions	Chiarano	Completed	October 2011= 100%
Flora and vegetation amounts pre-treatment conditions	Cansiglio	Completed	October 2011= 100%
Flora and vegetation amounts pre-treatment conditions	Lorenzago	Completed	October 2011 October 2013 = 100%
Flora and vegetation amounts pre-treatment conditions	Mongiana	Completed	October 2012= 100%
Flora and vegetation amounts pre-treatment conditions	Tarvisio	Completed	October 2012= 100%
Flora and vegetation amounts pre-treatment conditions	Pennataro	Completed	October 2013= 100%

Table 40. Sheduled activity and foreseen progress for flora and vegetation.

Slovenia.

As the activities in subaction were planned for this reporting period, field data from all 3 Slovenian sites including vegetation relevés of 27 medium vegetation and 135 small vegetation plots were stored into computer database. Using three key factors, planned forest management treatment, dominant tree species, location as the main grouping criterion, the species diversity, species indicators and other parameters related to site conditions and stand characteristics were evaluated. In the pre-treatment conditions, the groups of plots assembled by three key factors were analysed.

3.1.4. Subaction 4 - Deadwood

Italy. In the Italian sites, the comparison is reported in the Table 41 below.

Scheduled activity	*Site*	*Status*	*Actual/foreseen progress*
Deadwood amounts pre-treatment conditions	Mongiana	Completed	October 2012= 100%
Deadwood amounts pre-treatment conditions	Tarvisio	Completed	October 2012= 100%
Deadwood amounts pre-treatment conditions	Chiarano	Completed	October 2013= 100%
Deadwood amounts pre-treatment conditions	Pennataro	Completed	October 2013= 100%
Deadwood amounts pre-treatment conditions	Lorenzago	Completed	October 2013= 100%
Deadwood amounts pre-treatment conditions	Cansiglio	Completed	October 2013= 100%

Table 41. Sheduled activity and foreseen progress for deadwood sampling.

Slovenia: The collection of field data has been completed at all Slovenian research sites and the basic analyses were already performec. A more detailed data processing was performed in 2013 when the structure of deadwood was calculated for different deadwood types.

3.2. *Evaluation of performance during the reporting period*

3.2.1. Sub-action 1 - Structural Diversity

Italy: the work accomplished so far in the phases of (i) data collection, main phase in terms of field work and time dedicated to surveying the variables of concern and (ii) data processing is in accordance with the overall scheduled progress of the Action-topic. Some delays occurred for field work and tree marking operations at the sites of Lorenzago, Pennataro, Vallombrosa and Tarvisio due to local organization of forest managers and unfavourable climate conditions. The fulfilment of the sub-action will occur anyway in advance to the scheduled end.

Slovenia: At the Slovenian sites there are no critical delays. The work accomplished so far was: (i) the data collection, (ii) basic data processing and (iii) advance data processing. The work is in accordance with the overall scheduled progress of the Action-topic.

3.2.2. Sub-action 2 - Fauna Diversity

Sub-action 2a - Vertebrate diversity

Italy: All activities have been successfully performed, and further focus activities have been foreseen.
Slovenia: there are no delays in the bird assessment. All activities in this subaction are carried out in accordance with the project plans.

Subaction 2b - Invertebrate diversity

Italy: The sampling activities planned for 2013 were successfully completed, allowing the characterization of the communities of the pre-treatment conditions for Vallombrosa, and the first experimental test of the different management options in Cansiglio and Lorenzago di Cadore. Activities for carabid beetles have been completed for one site (Lorenzago di Cadore) in the expected time. Data elaboration is still in progress but there are no expected delays.

Slovenia: there are no delays in Carabidae, hoverfly and Cerambycidae assessment. All activities in this subaction are carried out in accordance with the project plans. In year 2014, we will just repeat monitoring of *M. funereus* and *R. alpina*.

3.2.3. Subaction 3 - Plant Diversity

Italy:

There are no critical delay. The monitoring post silvicultural treatment will be successfully completed by the end of October 2014 in all sites.

Slovenia: there are no delays in plant diversity assessment. All activities in this subaction have been carried out on time and in accordance with the project plans. The plant diversity status of the pre-treatment conditions for all three Slovenian sites was evaluated. Taking into account the impact of three main factors, set of different indicators and indicator species were tested.

3.2.4. Subaction 4 - Deadwood

Italy: No critical delays. The work accomplished so far was (i) data collection and (ii) basic data processing. The work is in accordance with the overall scheduled progress of the Action-topic.

Slovenia: No critical delays. The work accomplished so far was (i) the data collection, (ii) basic data processing and (iii) advance data processing. The work is in accordance with the overall scheduled progress of the Action-topic.

3.3. *Overall future estimation of planned Action's objectives*

3.3.1. Subaction 1 - Structural Diversity

Italy: we estimate to achieve all the planned objectives of the Action-topic within the scheduled time. The availability of a wide series of indexes descriptive of stand structure, of its specific composition and spatial arrangement, will provide the basis for the comparative evaluation of types of diversity at stand level among the tested forestry practices. The dataset will allow monitoring and detecting possible changes and their direction in the follow-up of the project.

Slovenia: In 2014 we intend to calculate the diversity indexes for all managed research plots. The results of those calculations will allow comparing the diversity of stands treated with different forestry regimes. We also intend to continue more detailed data analyses and evaluation of the statistical design and exploring the correlations with other measured variables and indicators.

3.3.2. Subaction 2 - Fauna Diversity

Subaction 2a - Vertebrate diversity

Italy: in spring 2013 not all sites have been treated, so conclusive comparison will be completed in the 2014 field seasons available after treatment.

Slovenia: for the Slovenian sites, the data obtained for birds in 2013 will be analysed regarding the effect of forest management on bird territory data. Furthermore, the review of the impact of forest management on the selected bird directive species will be finished till the end of 2014.

Subaction 2b - Invertebrate diversity

Italy: For invertebrate biodiversity, the effect of the different forestry treatments will be assessed comparing the data collected in 2012 (Cansiglio, Chiarano-Sparvera, Mongiana) and 2013 (Vallombrosa) with the sampling activities that will take place in the third and fourth year of the project, after the implementation of the treatments. In 2014 we will start analyzing the effect of the treatments on the insect communities in Chiarano-Sparvera, Mongiana and Tarvisio. In order to clarify the environmental drivers of carabid community structure we will utilize both data from Lorenzago and Cansiglio sites. Using two different sites will allow us to take into account a larger range of environmental variation, drawing a more complete picture of the processes behind community structure.

Slovenia: In 2014, we will finish the identification of the carabid and hoverfly species in the Slovenian sites. The data will be analysed in regard of the effect of forest management on invertebrates.

3.3.3. Subaction 3 - Plant Diversity

Italy: as planned, for all 124 plots vegetation and flora surveys will repeated to evaluate the effects of silvicultural treatment on those biodiversity indicators. The data recorded in the first field survey will be compared and analysed with all data that are going to be recorded in field surveys during 2014.

Slovenia: We estimate to achieve all the planned objectives of the subaction within the planned time. The second field survey of species diversity of 27 medium vegetation plots and 135 small vegetation plots is foreseen. The dataset on plant species diversity data after implementation of forest management actions will allow evaluating the effects of different forest management regimes.

3.3.4. Subaction 4 - Deadwood

Italy: In 2014, for deadwood and microhabitats, all the pre-treatments data analyses will be completed. Moreover, starting from may 2014, a complete deadwood and microhabitats occurrence evaluation will be carried cut in all the study sites after the forest interventions. The effect of the different forestry treatments will be then evaluated, comparing the data obtained with those that will be collected in third and fourth years of the project.

Slovenia: In 2014 deadwood (only coarse woody debris) will be re-measured on all managed research plots in all three sites. The effects of different forestry treatments will then be assessed by comparing the already collected data with the data that will be collected in third and fourth years of the project. We also plan to continue with more detailed data analyses and evaluations of the statistical design and with the explorations of correlations with other measured variables and indicators.

4. Indicators of progress

4.1. Planned indicators

4.1.1. Subaction 1 - Structural Diversity

Italy:

The total number of permanent sampling plots already established and surveyed at the 7 designated Italian sites is equal to 168.

Indicator	2013
Number of sites	7
Number of research plots A	168

Table 42. Planned indicators of progress for the study of the structural diversity

Slovenia:

The total number of permanent sampling plots already established and surveyed in Slovenia is 27 plots in three sites. In the year 2013 all the plots were rechecked after logging. Information on all harvested trees was acquired. In 2013 different structural diversity indices were calculated.

Indicator	*2012*	*2013*
Number of sites	3	3
Number of research plots A	27	27
Number of research plots C	135	/

Table 43. Planned indicators of progress for the study of the structural diversity.

4.1.2. Sub-action 2 – Fauna Diversity

Sub-action 2a - Vertebrate diversity

Italy:

For birds and herps the indicators of progress are showed in Table 44, while Table 45 reports the indicators for Chiroptera.

Indicator	*2012*	*2013*	*(planned+alreadycarried out)*
Number of sites visited for the assessment of birds and herps community	7	7	7

Table 44. Planned indicators of progress for the study of the vertebrate fauna diversity.

Indicator	Per Site		Total
Number of D500X sampling points	1	8	56
	2	8	
	3	8	
	4	8	
	5	8	
	6	8	
	7	8	
	8		
	9		
	10		
Number of mist net sampling points	1	2	8
	2	2	
	3	1	
	4	0	
	5	0	
	6	1	
	7	2	
	8		
	9		
	10		
Number of D1000X sampling points (includes external circle round sampling points, when made)	1	20	78
	2	6	
	3	7	
	4	8	
	5	0	
	6	19	
	7	18	
	8		
	9		
	10		

Table 45. Planned indicators of progress for Chiroptera.

No survey has been done for the birds in Slovenia. However there was already a planning done for 2013. A list of NATURA 2000 species, which are occurring in the selected sites was prepared.

Slovenia:

For vertebrates the indicators of progress are showed in

Table .

Indicator	2013
Number of sites visited for the assessment of bird community	27

Table 46. Planned indicators of progress for the study of the vertebrate fauna diversity.

Subaction 2b - Invertebrate diversity

Italy:

For the invertebrate fauna in Italy, the indicators of progress are showed in Table 47.

Indicator	2013	2014
Number of sites equipped with invertebrate traps	3	4 (in progress)
Number of invertebrate species identified	In progress	In progress

Table 47. Planned indicators of progress for the study of the invertebrate fauna diversity.

For invertebrate fauna in Slovenia, the indicators of progress are showed in Table 48.

Indicators	Hoverflies	Carabid beetles	Saproxylic beetles
Number of sites equipped with invertebrate traps	3	3	3
Number of species identified	25	19	In progress
Number of positioned invertebrate traps/transects	54	127	19
Number of collected samples	90	651	57

Table 48. Planned indicators of progress for the study of the invertebrate fauna diversity.

Slovenia:

The indicators of progress are showed in

Table49.

Indicators	Hoverflies	Carabid beetles	Saproxylic beetles
Number of sites equipped with invertebrate traps	3	3	3
Number of species identified	82	In progress	In progress
Number of positioned invertebrate traps/transects	54	135	33
Number of collected samples	162	405	840

Table 49. Planned indicators of progress for the study of the invertebrate fauna diversity.

4.1.3. Subaction 3 - Plant Diversity

Italy:

For the Italian sites, the indicators of progress are showed in Table 50.

Indicator	2013
Number of Italian sites	6
Number of vegetation and flora plots evaluated before silvicultural treatment	124

Table 50. Planned indicators of progress for the study of plant diversity.

Slovenia:

For plant diversity in Slovenia, the indicators of progress are showed in

Table 151.

Indicator	2013
Number of Slovenian sites evaluated	3
Number of vegetation plots where detailed evaluation of plant species diversity and indicators was done	27 medium vegetation plots

Number of vegetation plots where preliminary evaluation of plant species diversity was done	135 small vegetation plots
Number of key factors tested	3 forest management treatment, dominant tree species, location
Number of indicator species (from all 188 vascular plant species in all vertical vegetation layers of medium vegetation plots)	0 (forest management treatment groups) 2 (dominant tree species) 36 (location)
Number of indicators related to forest site conditions, stand characteristics and species diversity (from 35 tested parameters)	0 (forest management treatment groups) 7 (dominant tree species) 10 (location)

Table 1. Indicators of progress for the plant species diversity in Slovenia.

4.1.4. Subaction 4 - Deadwood

Italy and Slovenia: The total number of permanent sample plots established and surveyed in 2013 in Italy and Slovenia is reported in Table 52. In the year 2013 the database was prepared and the amount of deadwood was calculated for different categories. Those calculations are input numbers for different diversity indices.

Indicator	*2013*	
	Slovenia	*Italy*
Number of sites	3	6
Number of research plots A	27	141
Number of research plots B	27	
Number of research plots C	135	

Table 52. Planned indicators of progress for the study of deadwood.

4.2. Additional indicators

4.2.1. Sub-action 1 - Structural Diversity

Italy: the analysis of more recent literature has made possible to include in the list further, promising descriptors of stand structure. The available dataset allows their calculation and they will be included in the analysis. As soon as the practices are being implemented at each site, plots are being visited again to verify the respect of all guidelines and possible damages to the standing crop, due to tree fellings. An "old-growth/ageing island" has been bounded at Cansiglio, Chiarano and Tarvisio test sites.

Slovenia: On the basis of the literature review a list of structural diversity indices was designed and different diversity indices were calculated for each of the 27 research plots. The database on measured alive trees was used for all calculations. The database contains information about the tree species, DBH, social class, presence of microhabitats, damages of trees and spatial position of each tree. After having implemented the practices (harvesting marked trees), the plots were revisited again (the harvested trees were recorded). The calculation of all diversity indices will be performed with the new datasets and the differences will be explored.

4.2.2. Sub-action 2 – Fauna Diversity

Sub-action 2a - Vertebrate diversity

Italy: For birds and herps, the additional indicators not originally/formally described in the project are showed in Table 53.

Indicator	*2012*	*2013*	*(planned+already carried out)*
Number of sites with birds focus	1	1	4
Number of sites with herps focus	1	2	2

Table 53. Planned indicators of progress for the study of the vertebrate fauna diversity.

Subaction 2b - Invertebrate diversity

Italy: Regarding the invertebrate fauna, the additional indicators are listed in Table 54.

Indicator	*2013*	*2014*
Number of plots equipped with invertebrate traps	12	15 (In progress)
Number of positioned invertebrate traps	168	140 (In progress)
Number of collected samples	1512	In progress

Table 54. Additional indicators for the study of invertebrate fauna diversity.

Slovenia:

EARTHWORMS

Methodology

Earthworms are an important and biologically very active part of the forest soil biota. We have decided to analyse them in terms of their diversity and as a potential indicator organisms for assessing the influence of the forest management on forest soils.

Earthworms were analysed on two research plots in Slovenia, namely at site 8 (Kočevski Rog) and at site 10 (Trnovo). Only beech plots were analysed (100% of present growing stock, 50% of present growing stock and cleared site – all after the feeling. Sampling was performed once at all selected plots in May 2013, all within one-week time to avoid differences in earthworm activities at the beginning of their activity season. The sampling approaches included four different methodologies:

- time limited purposive sampling over entire plot
- 50 x 50 cm subplots with sieving the soil (5 subplots) (Figure59-left)
- 25 x 25 cm subplots with formalin extraction (5 subplots) (Figure59-right)
- 25 x 25 cm subplots with mustard powder extraction (5 subplots) (Figure59-right)

Figure 59. Sampling approaches in earthworm studies used at site 8 (Kočevski Rog) and at site 10 (Trnovo) using a 50 x 50 cm subplots with sieving the soil (left) or 25 x 25 cm subplots with formalin or mustard powder extraction (right).

All earthworms collected by any of the sampling approaches were grouped per subplot and kept in 70% ethanol. Samples preserved in such way retain all the necessary taxonomic characters needed for their identification to the species level and the DNA remains in the condition suitable for a subsequent extraction and molecular identifications. For the analysis and plot comparison we have used a literature based identification (including microscopy of key identification characters), pooling records from various approaches to site and plot level and calculate the Haydeman dominance index (Mršić 1983).

Results

Using the four named sampling approaches, namely purposive sampling, sieving the soil, formalin extraction and mustard powder extraction, the first three were successful and yield in at least one earthworm extracted from the volume of the soil while the mustard powder extraction, despite used in parallel to other methods, yield no earthworms.In total we have extracted 140 samples of earthworms (

Table55).

	No cutting (intact forest)	*50% of growing stock felled*	*100% of growing stock felled*	*Total*
Aporrectodea caliginosa caliginosa	**18**	**10**	**7**	**35**
Allolobophora chlorotic	3	0	0	3
Aporrectodea (A.) rosea	4	0	0	4
Aporrectodea (A.) smaragdina	3	2	0	5
Panonia leoni	5	4	1	10
Lumbricus rubellus	**12**	**7**	**5**	**24**
unidentified	8	6	4	18
juvenile	20	12	9	41
Total	26	41	73	140

Table 55. The list of number of dominant earthworms species recorded at site 8 (Kočevski Rog) and at site 10 (Trnovo) (pooled data) in relation to the management system 0%, 50% or 100% cut. In bold are given the dominant species after the Haydeman dominance index and total numbers.

Based on the literature data and our observations, for the analysed areas there were recorded or published about 70 different species of earthworms. Among the methodological approaches the most successful method for the earthworm extraction was the formalin extraction, and is suggested for its further use despite its negative influence to the environment and the rest of the site biota.

Results indicate relative low number of earthworms per unit of surface. In 0% cut areas we have recorded 13 individuals per meter square. The number dropped to average 5,2 individuals in 50% cut and 6,8 in 100% cut. Relative low number of individuals is explained by a sampling in a relative early season (ca 3 weeks following the complete melting of the snow cover), relative homogeneous soil structure and a high abundance of the litter decomposing fungi. The latter are an indicator of a particular site conditions that favour a decomposition lead by decomposing fungi and less by decomposing fauna (earthworms).

Applying the Haydeman dominance index modified by Mršić (1983) for a particular use in assessing the earthworms diversity, we have identified two species, that were dominant at the analysed sites and are generally regarded as a common species in the altimontane Dinaric Alps or comparable climatic and soil-types areas. The two species identified as dominant were *Aporrectodea caliginosa caliginosa* and *Lumbricus rubellus*.

Indicator	*2012*	*2013*
Earthworms - number of sites analysed	0	2 (all three felling regimes)
Number of individuals – 0% cut	0	26
Number of individuals – 50% cut	0	41
Number of individuals – 100% cut	0	73
Haydeman dominance index	0	2 dominant species (*Aporrectodea caliginosa caliginosa* and *Lumbricus rubellus*)

Table 56. Indicators of progress for the earthworms analysis in Slovenian sites.

4.2.3. Sub-action 3 - Plant Diversity

Slovenia:

ECTOMYCORRHIZAL FUNGI

The below ground biodiversity (ectomycorrhizal fungi) was selected as an additional parameter for assessing site's biodiversity, in particular facing the ectomycorrhizal fungi as one of key factors in connecting nutrient and water sources with plants in symbiosis. The sampling and methodology activities were described in previous reports. No further development of the methodology was done after the last reporting period. The ectomycorrhiza diversity was statistically assessed by counting and (if required) normalisation of the number of each individual ectomycorrhiza type number (presence/absence, number of species, number of ectomycorrhizal species) for a subsequent testing of the normal distribution of the data and calculation of the Shannon diversity index.

Results

The analysis of ectomycorrhiza diversity and fine root parameters resulted in outcomes that are in concordance with the past studies. The number of fine roots and ectomycorrhizal species diversity was reduced at 50% cut subplots insignificantly and at 100% cut area at significant level. The number of different ECM types per soil core sample ranged from 5-12 in 0% cut to 1-5 in 100% cut. Accordingly the diversity indices (per soil core) ranged from 0,78-2,28 (0% cut), 0,00-1,62 (50% cut) and 0,00-0,71 (100%) the presence of vital ECM in 100% cut sites is explained either by the fact that sampling was done only a few months after the cutting or by the ECM network, connection old roots with still standing neighbouring trees through the common mycelia networks.The ECM species recorded at any of the named subplots and identified to the species level level were: *Byssocorticium atrovirens, Clavulina cinerea, Cenococcum geophilum, Entoloma rhodopolium,* *Genea hispidula, Hebeloma sinapizans, Laccaria amethystine, Lactarius acris, L. blennius, L. camphoratus, L. pallidus, L. rubrocinctus, L. salmonicolor, L. subdulcis, L. subsericatus, Russula cyanoxantha, R. fellea, R. illota, R. lepida, R. mairei, R. ochroleuca, Tomentella terrestris, Tricholoma sciodes* in *Xerocomus chrysenteron*. Several types of ECM remained unidentified. Most of named types of ECM types are specific or were found on beech. In particular types *C. geophilum, R. ochroleuca, L. pallidus* in *L subdulis* were commonly present also on 100% plots and may be regarded as a stress-tolerant types of ECM.

Indicator	2012	2013
Ectomycorrhiza - number of sites analysed	1 (site 8 – in total 45 soil cores and 3 beech subplots; 45 per subplot at S, W, N, E and the centre of the subplot	0
Number of species	In progress	36 types of ECM
Ectomycorrhiza diversity indices (Shannon-Weaver, eveness)	0	0.00 – 1.82
Fine root parameters (total number of non ECM fine roots)	0	11-844 (per soil core sample)

Table 57. Indicators of progress for the ectomycorrhiza fungi study.

4.2.4. Subaction 4 - Deadwood

Italy: In order to integrate the evaluation of the levels of naturalness ante and post the intervention, the occurrence of microhabitats was also measured as additional indicator. This choice is linked to an increasing interest, emerging in the recent literature, to integrate the traditional structural parameters measured in forest inventory. These new parameters and indicators, such as microhabitats, are useful to evaluate the level of naturalness, giving precious suggestions in the silvicultural management options. For this reason, we focused on microhabitats which are common (e.g. bark loss, canker) or easy to observe (e.g. splintered stem, broken fork) and generally known for their relevant relationship with the natural biocoenosis of forests.

Slovenia: A literature review was the basis that assisted in gaining the information about which kind of deadwood is important for the diversity of fauna and flora. Based on this knowledge different aggregation of deadwood volumes and numbers were performed. After the logging of trees on all research plots coarse woody debris will be re-measured and comparisons will be made

5. Envisaged progress until next report

5.1. *Sub action 1 - Structural Diversity*

Italy:

scheduled activity (total)	**February 2014 ➔February 2015**
foreseen progress	- completion of data processing, analysis and results made available at all designated sites (7 in Italy and 3 in Slovenia)

Slovenia:

scheduled activity (total)	**February 2014 ➔February 2015**
foreseen progress	- the second measurement of small trees on the 3 Slovenian sites - data processing and evaluation of the statistical model

5.2. *Sub-action 2 – Fauna Diversity*

Sub-action 2a - Vertebrate diversity

Italy

Birds. As to vertebrate diversity first months of the year will be devoted to the analysis of the results obtained in the 2013 sampling season. From March to June spcies survey in all sites; from March to August sampling of *Certhia brachydactyla* at the site 6.

Herps. As to vertebrate diversity first months of the year will be devoted to the analysis of the results obtained in the 2013 sampling season. From March to June spcies survey in all sites; from March to October/November sampling of *Salamandrina* at the site 6; froma Aprile to September/October sampling of *Bombina variegata* at the site 5.

Year	Month	Activities	Milestones	Sub-action
Birds 2014	March-August	Field Sampling		Vertebrate diversity
Birds 2014	May-December	Data analyses		Vertebrate diversity
Herps 2014	March-October/November	Field Sampling		Vertebrate diversity
Herps 2014	May-December	Data analyses		Vertebrate diversity

Table 58. Progress of activities for the sub-action on vertebrate diversity in Italy (2014).

Year	Month	Activities	Milestones	Sub-action #
HERPS 2013	February – June Sept.-February (2014)	Data and sample analysis		Vertebrate diversity
HERPS 2013	April – October	Field sampling		Vertebrate diversity
BIRDS 2013	February-May August- Feb. (2014)	Data analysis		Vertebrate diversity
BIRDS 2013	February-June July-August August-November	Field work Field work (treecreeper netting) Deployment of nest boxes		Vertebrate diversity
BATS 2013	February-May October-Feb. (2014)	Data analysis		Vertebrate diversity
BATS 2013	June-September	Field work		Vertebrate diversity
2013	May-June	Bird counts in Slovenian sites	Sampling will be finished	vertebrates
2013	August-	Literature study effects of management on birds in Slovenian sites	Starting	vertebrates

Table 59. Progress of activities for the sub-action on vertebrate diversity in Italy (2013).

Chiroptera.

As described in Chapter 1 (paraghaph 1.3.2), for the 2014 working session, the aim is to replicate the monitoring of bat activity inside all ManFor sites and to proceed analyzing the collected data, in order to write the conclusive report containing the results of the entire monitoring work. In some sites will apply a different sampling protocol, which consider to monitor bat activity simultaneously in all plots logged with different thesis. In this way, we will have a synoptic picture of bat activity in all logged and non logged plots.

Year	Month	Activities	Milestones	Sub-action #
2014	February - March	2013 ultrasound data analysis		Bat diversity
2014	April - May	Planning of 2014 field work		Bat diversity
2014	June - September	Field work		Bat diversity
2014	October - December	2014 ultrasound data analysis		Bat diversity

Table 60. Progress of activities for the Chiroptera (vertebrate diversity) in Italy (2014).

Slovenia:

During the next period, the bird counts will be processed and analysed. Furthermore, the literature study on the effects of forest management on the different NATURA 2000 bird species will be finished.

Year	Month	Activities	Milestones	Sub-action #
2014	February-December	Analysis bird data of the Slovenian sites	Sampling will be finished	vertebrates
2014	February-December	Literature study effects of management on birds in Slovenian sites	It will be finished	vertebrates

Table 61. Progress of activities for the sub-action vertebrate diversity.

Subaction 2b - Invertebrate diversity

Italy:

For what concerns the analysis of invertebrate biodiversity, the following months will be devoted to the analysis of the samples obtained during the 2013 field work. In May 2014 we will start the field work, installing 24 traps in Chiarano-Sparvera and 24 traps in Mongiana, and we will perform standardised transects in Tarvisio From July 2014 to February 2015 we will be sorting the samples to identify the target groups. The obtained results will be used to build a dataset, that will be used in the subsequent elaborations and statistical analyses.

Until next report, the same activities for carabid beetles carried out in Lorenzago di Cadore will be repeated in one more site (Cansiglio) in order to improve data and enlarging the range of environmental conditions considered. From May to September pitfall traps will be active in forest stands in the Cansiglio area. At the same time, or immediately after, material sorting will be carried out in lab and carabid beetles will be selected for future specific identification. Specific identification will be carried out during next winter with the consultancy of an expert taxonomist.

Year	Month	Activities	Milestones	Sub-action #
2014	February - March	2013 sample analysis		Invertebrate diversity
2014	February - March	Planning of sampling activities		Invertebrate diversity
2014	April - October	Field work		Invertebrate diversity
2014	June - December	2014 sample analysis		Invertebrate diversity

Table 62. Progress of activities for the sub-action Invertebrate diversity.

Slovenia:

Year	Month	Activities	Sub-action #
2014	February – June	Finish identification hoverflies and carabid beetles	Invertebrate diversity
2014	July – December	Data analysis	Invertebrate diversity
2014	February - June	Finish identification *(Trypodendron lineatum)*	Invertebrate diversity
2014	May - October	Monitoring *R. alpina* and *M. Funereus*	Invertebrate diversity
2014	July – December	Data analysis (Cerambycidae)	Invertebrate diversity

Table 63. Progress of activities for the sub-action invertebrate diversity.

5.3. *Subaction 3 - Plant Diversity*

Italy:

Year	*Month*	*Activities*	*Sub-action #*
2014	May – August	2nd Field assessment of flora species diversity	Plant diversity
2014	September – December	Additional checking of plant species determination Set of the database flora species Data Elaboration and Analysis of results Evaluation of silvicultural treatments' effects on plant species diversity	Plant diversity
2015	January-February	Assessment of indicators for plant diverisity	Plant diversity

Table 64. Progress of activities for the sub-action plant diversity (Italy).

Slovenia:

Year	*Month*	*Activities*	*Sub-action #*
2014	May – August	2nd Field assessment of species diversity	Plant diversity
2014	September – December	Additional checking of plant species determination and preparing of raw data for the computer database	Plant diversity
2015	January-February	Evaluation of plant species diversity and indicators after forest management action	Plant diversity

Table 2. Progress of activities for the sub-action plant diversity (Slovenia).

5.4. *Subaction 4 - Deadwood*

Italy:

Year	Month	Activities	Sub-action #
2014	May – August	deadwood sampling post-intervention	Deadwood
2014	September – December	Set of the deadwood database Data Elaboration and Analysis of results Evaluation of silvicultural treatments' effects on deadwood abundance and distribution	Deadwood
2015	January-February	Assessment of indicators for deadwood	Deadwood

Table 66. Progress of activities for the sub-action deadwood (Italy).

Slovenia:

scheduled activity (total)	**February 2014 ➔February 2015**
foreseen progress	- the second measurement of deadwood on the 3 Slovenian sites - data processing and evaluation of the statistical model

Table 67. Progress of activities for the sub-action deadwood (Slovenia).