Implementation of a mandatory programme on Intensive Forest Monitoring in Slovenia

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ABSTRACT

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From May 1st 2004, Slovenia will have the obligation to follow the legislation that is in force in the EU. This includes the implementation of an Intensive Monitoring of its Forest Ecosystems. "Senter" contracted Alterra Green World Research to execute the project: "Implementation of the mandatory programme on Intensive Monitoring in Slovenia", from January 1st 2003 till 31 December 2004. During this project the following results have been achieved: (i) eleven plots have been selected in a careful way with clear aims and criteria., (ii) the infrastructure in the field and laboratory has been build-up successfully, (iii) a Quality Assurance and Quality Control (Q(A/QC) programme has been implemented, (iv) a database is being set up, (v) the organisational structure is in place, (vi) there is a clear international imbedding and (vii) there is a long term commitment of the Ministries of Agriculture and Environment. The mandatory programme on Intensive Forest Monitoring in Slovenia has a large potential to evaluate impacts of elevated nitrogen inputs, high ozone exposure and climate change.

Keywords: Intensive Monitoring, Forest, Deposition, Air quality, Crown condition, Ground vegetation, forest growth, foliar chemistry, soil chemistry, Slovenia.

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Preface

With the accession of Slovenia to the European Union a well designed and working Intensive Monitoring has to be in place from May 1 2004 onwards. In Slovenia an Intensive Monitoring Programme, as stated under the Regulation 3528/86, was not yet installed. With a grant from the Netherlands Ministry of Economic Affairs, through Senter International, a project was financed to develop the Intensive Monitoring programme In Slovenia. This project was executed by Alterra Green World Research in co-operation with FECO consult and started on January 1st 2003 for the duration of 2 years.

Here, we thankfully acknowledge the great support and good collaboration we received from the Slovenian counterpart, Senter International, the Royal Dutch Embassy, the project staff involved at Alterra and ECN and colleagues from International Institutes who provided support to the project. More specifically we like to thank:

- Mr Maksimilan Mohorič of the Slovenian Ministry of Agriculture, Mr Radovan Tavzes of the Ministry of Environment and Spatial Planning, Mr Andrej Kermavner, Živan Veselič and Dragan Matijasič of the Slovenian Forest Service and Ms Andreja Sušnik, Mr Filip Štucin, Mr Anton Planinšek and Mr Silvo Žlebir of the Environmental Agency (ARSO) and many others at these instutions for their support to the project.
- Mr Niko Torelli, Mr Tom Levanič, Mr Primož Simončič, Ms Polona Kalan, Mr Robert Mavsar, Mr Matej Rupel, Ms Nike Krajnc and all colleagues supporting the work in the field, laboratory and office at the Slovenian Forestry Institute for their involvement and enthusiasm in carrying out the project, specifically the field and laboratory work and data management.
- Ms Elien Groot, Ms Merel Jonker and Ms Gaby Hoof of Senter EVD for financing the project and for their critical review of the various progress reports.
- Mr Jan Henneman Mr Klaas Huisman of the Royal Dutch Embassy and the agriculture chancellor Mr Hein van Asperen for their continuous support of the project.
- Mr Steven Crum, Mr Jan Japenga, Mr Gert Jan Reinds, Mr Wobbe Schuurmans, Mr Antonie van den Toorn and Mr Rick Wieggers of Alterra and Mr JanWillem Erisman, Mr Marco Geusebroek and Mr Han Möls of ECN for their professional support during the project and their enthusiasm in providing guidance to the Slovenian colleagues and Ms Mieke Tusveld of Alterra for the administrative support.
- Last but not least, we are grateful for the support we received from the International community and especially to Ms Tracy Houston and Mr Dave Durrant of the Forest research Station in the UK and Mr Erwin Ulrich of the Office National des Forests in France
- Many staff members participating in Intensive Forest Monitoring in the neighbouring countries Italy, Austria Hungary and Croatia.

Wim de Vries and Evert Vel

Summary

Background and approach

In 2003 and 2004 the project 'Implementation of the mandatory programme on Intensive Forest Monitoring in Slovenia' was executed under the Pre-accession projects programme. On May 1st Slovenia joined the European Union and EU-legislation had to be fulfilled. Alterra assisted Slovenia in the development, installation and start of the Intensive monitoring programme.

First a review was made of the forest ecosystems in Slovenia and the potential risks and threats. As a result 11 plots were selected that cover the most important forest ecosystems in Slovenia. In the summer of 2003 the plots were selected, installed and equipped with sampling equipment.

To ensure a high quality monitoring system, the laboratory of the Slovenian Forestry Institute was reviewed and new equipment was purchased for the laboratory. A complete QA/QC system from the field to laboratory and database was devised and implemented in 2004. Pre-audits for certification of the laboratory were carried out and training in the field was given to plotmanagers and project staff. Finally a database was installed and training in data management, data validation and evaluation was given.

Institutional aspects formed an integral part of the development of the Slovenian programme. Consequently, efforts were made to ensure close collaboration with the Ministries of Agriculture, Forestry and Food as well as the Ministry of Environment and Spatial Planning with their institutes in the field of forestry (SFS) and environment (ARSO). To enhance communications to the policymakers and the wider public, a number of events were organised to improve the public relations, including an international conference.

Results obtained and effects of the projects

During this project the following results have been achieved:

- Eleven plots have been selected in a careful way with clear aims and criteria.
- The infrastructure in the field and laboratory has been build-up successfully
- A Quality Assurance and Quality Control (QA/QC) program has been implemented
- The database is being set up
- Organisational structure is in place
- A good link with ministries is established
- There is a clear international imbedding
- There is a long term commitment of ministries

More specifically, the effects of the project can be summarized as follows:

1. Improved cooperation within the Slovenian Forestry Institute (SFI).
2. Improved institutional relationships with the Slovenian Forest Service, ARSO and university and with the ministries of agriculture and environment.
3. Improved image of SFI both in a national and international context and increased public awareness of the relevance of forestry research.
4. A large potential resource for future scientific and policy oriented research by the establishment of an infrastructure.

1 Improved internal co-operation at SFI: This included a better view on the need of chain management and quality aspects of each link. It has changed ideas on co-operation within SFI from individual research work to interdisciplinary research including various specialists in dendrology, soil science, phenology and ground vegetation.

2 Improved institutional relationships: Since the intensive monitoring (level II) is part of the Forest Focus programme, covering also crown condition assessment on a systematic grid (Level I) and monitoring related to forest fires and special studies, an overall programme had to be realized to be brought forward to the Ministry of Agriculture (MAFF) and Environment (MOPE) for submission to Brussels. This led to improved institutional relationships with both Ministries and SFI and to other institutes. At the moment, SFI works in this programme together with SFS, ARSO and several universities/faculties. The approach to work as team of scientists from different sections of SFI together with scientists from other institutes, faculties etc. implies a change from rather mono-disciplinary and mono-institutional research to interdisciplinary and inter-institutional research.

3 An improved image of SFI both in a national and international context: To increase the Public Relations of the Intensive Monitoring Programme and SFI as a whole, an annual report on the intensive monitoring programme in Slovenia has been made and published and a first step has been made with the development of a website (www.gozdis.si/monitoring). In the week with the final conference a lot of efforts have been given to reach the international community with the organisation of the Expert panel on deposition and the direct following of the international conference, which was well covered by the national press.

4 A large potential resource for future scientific and policy oriented research. The intensive monitoring programme has the potential impact to grow to a wide and extensive scientific basis for ecosystem research. The policy making bodies, MAFF and MOPE, are in need of good information on the status and development of ecosystems over time in response to environmental stresses since the expected increased of transport and industry will bring a number of negative consequences. The monitoring system of forest ecosystems can provide information on pollution effects (e.g. ozone) on forest ecosystems. The possibility of negative effects and potential threats has been accounted for in the development of the monitoring system. The results of this basic monitoring net will also provide the policymakers with information on how and where the research should continue. Especially in view

of the needs of international agreements, information is also needed on carbon sequestration (Kyoto), biodiversity (CBD) and sustainable management (MCPFE), that can partly be obtained form this monitoring system. This holds specifically for effects of climate change and nitrogen impacts on biodiversity.

1 Introduction

The programme on Intensive Forest Monitoring and need for implementation in Slovenia

In May 2004, ten countries joined the European Union (EU). Slovenia was among these acceding countries. From that moment onwards, Slovenia has to comply with the rules and regulations of the EU. The implementation of an Intensive Monitoring of the Forest Ecosystems is one of these obligations. It was therefore important that a Slovenian Intensive Monitoring has been set-up by the beginning of 2004.

In order to gain a better understanding of the effects of air pollution and other stress factors on forest ecosystems, the Pan-European Programme for Intensive and Continuous Monitoring of Forest Ecosystems was established in 1995. The Programme is based on both the European Scheme on the Protection of Forests against Atmospheric Pollution and the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) under the Convention of Long-Range Transboundary Air Pollution (UN/ECE). In 1994, the Intensive Monitoring Programme was established by the EC with the aims to (ICP Forest, 2000):

- Monitor effects of anthropogenic (in particular air pollution) and natural stress factors on the condition and development of forest ecosystems in Europe.
- Contribute to a better understanding of cause-effect relationships in forest ecosystems functioning in various parts of Europe.

At present 862 permanent observation plots for Intensive Monitoring of forest ecosystems have been selected.

The Intensive Monitoring Programme includes the assessment of crown condition, forest growth (increment) and the chemical composition of foliage and soil on all plots. Additional measurements on selected plots include atmospheric deposition, meteorological parameters, soil solution chemistry and ground vegetation. Within each of these surveys, a number of mandatory and optional parameters has been defined. The temporal resolution of the present surveys is scheduled as follows:

- Crown condition (at least once a year)
- Chemical composition of the concentrations of needles and leaves (at least every 2 years)
- Soil chemistry (every 10 years)
- Increment / forest growth (every 5 years)
- Atmospheric deposition (continuous)
- Soil solution chemistry (continuous)
- Meteorology and phenology (continuous)
- Ground vegetation (every 5 years)
- Remote sensing/aerial photography (once)
- Ambient air quality and ozone injury (continuous)

A major objective of the 'Pan-European Programme for the Intensive Monitoring of Forest Ecosystems' is to gain a European wide overview of the impacts of air pollution and other stress factors on forest ecosystems. The results should be useful for the evaluation of (protocols on) air pollution control strategies used within the UN/ECE Convention of Long-Range Transboundary Air Pollution and the EC. Specific objectives in the context of air pollution are the assessment of:

- The fate of atmospheric pollutants in the ecosystem in terms of accumulation, release and leaching.
- Critical loads and critical levels of atmospheric pollutants (SO_2, NO_x, NH_3, metals) in view of ecosystem effects in relation to present loads.
- Responses of forest ecosystems to (changes in) air pollution by deriving relationships between (trends in) stress factors and ecosystem condition.
- Influences of future scenarios of air pollution on the (chemical) ecosystem condition.

Recently, the aims of the Pan-European Programme have been widened towards the topics of biodiversity and climate change. In this context, the Programme aims to contribute to the development and monitoring of 'criteria and indicators for sustainable forest management'. Objectives of the Pan-European Programme related to this topic are the:

- Assessment of net carbon sequestration in European forests, to improve the assessment of the global carbon balance and to evaluate the influence of changes in the climate due to atmospheric greenhouse gasses on the forest ecosystem.
- Further development and monitoring of indicators related to the various functions of forest ecosystems to assess its long-term sustainability, such as forest ecosystem health, forest production, species composition of ground vegetation and protective functions of soil and water resources.

Objectives

With the accession of Slovenia to the European Union a well designed and working Intensive Monitoring had to be in place. In Slovenia an Intensive Monitoring Programme, as stated under the Regulation 3528/86, was not yet installed. With a grant from the Netherlands Ministry of Economic Affairs, through Senter International, a project was financed to develop the Intensive Monitoring programme In Slovenia. This project was executed by Alterra Green World Research in co-operation with FECO consult and started on January 1st 2003 for a duration of 2 years. To pursue this objective, activities in 3 fields had to be carried out.

- Institutional aspects. To ensure that the programme would be sustainable, an institutional embedding in the Ministry of Agriculture, Forestry and Food (MAFF) and the Ministry of Environment, Spatial Planning and Energy (MOPE) with a proper financial budget was needed. On execution level, efforts were needed to ensure intensive cooperation with the Slovenian Forest Service (SFS), the Environmental Agency (ARSO) and the University of Ljubljana.
- Building of the network of Intensive monitoring plots. To ensure a relevant monitoring system, plots should be selected that provide essential information on forest ecosystems for the next 10-15 years in response to stress, should be

well equipped and an organisation needs to be developed that can handle this in a proper way.
- Monitoring, Quality and data management issues. To ensure a high quality monitoring system, the assessments in the field, transport to the laboratory, laboratory analyses and database management require quality control on all aspects.

Contents of the report

In the following chapters an overview is given of the approach to the project (Chapter 2) followed by the results of the project, divided in institutional aspects (Chapter 3), building of the network of Intensive monitoring plots (Chapter 4), monitoring, quality and data management issues (Chapter 5), and public relations (Chapter 6), ending with a chapter on the spin off of the project and recommendations for the future (Chapter 7). Detailed information of the selected 11 plots is given in Annex 1.

2 Approach of the project

General approach

Institutional aspects
To ensure that the programme would be sustainable, efforts were carried out to ensure an institutional embedding in the Ministry of Agriculture, Forestry and Food (MAFF) and the Ministry of Environment, Spatial Planning and Energy (MOPE) with a proper financial budget. On execution level, efforts were made to ensure intensive cooperation with the Slovenian Forest Service (SFS), the Environmental Agency (ARSO) and the University of Ljubljana. On international level researchers of the Slovenian Forestry Institute (SFI) were encouraged to participate in International meetings. In November 2004 an international meeting of the experts on deposition took place in Slovenia. Finally, communication aspects were included related to the presentation of obtained results and contacts with press and public

Building of the network of Intensive monitoring plots
Under the building of the network of Intensive monitoring plots a number of activities took place. Plots should be selected that provide essential information on forest ecosystems for the next 10-15 years, should be well equipped and an organisation needs to be developed that can handle this in a proper way. Before plots could be selected an inventory of the existing situation was made and the potential risks and threats were identified, using available knowledge.

One of the first steps was the execution of a practical inventory of the actually existing forest ecosystems in Slovenia and its potential threats. Slovenia is a country rich of forests. Approximately 60% of the total land area is covered with forests. Slovenia is very diverse and ranges from wet and cool Alpine climate to hot and dry Mediterranean Climate, from calcareous Karst soils to acid sandy soil and from homogene spruce forests to mixed abietum-fagetum ecosystems. Potential risks range from acidification and eutrophication in response to nitrogen and sulphur input to ozone exposure and climate change effects (e.g. drought). Based on these results 30 potential plots were selected. Finally, 11 potential plots were identified. With these 11 plots, a long-term monitoring of forest ecosystems is considered feasible and the effects of the identified risks and threats can be assessed. The results of this inventory phase are described in a report called Intensive Monitoring in Slovenia (IMP-SI), Basic Structural Document printed in July 2003 (Cater et al., 2003). A summary of the results of the first year, including the building of the network but also several other aspects was given in Simoncic et al. (2004).

In the field over 100 potential sites were visited, documented and evaluated. In the end 11 plots locations were selected and here the plots were laid out according the manuals of the European Union and ICP Forests. On a selection of these plots the equipment for deposition, soil solution and ozone assessment was installed. Where needed, fences were erected to protect the installed equipment.

For meteorological information use was made of the stations run by the Meteorological office of the MOPE. For the regular execution of the work on the plots, regional foresters of the SFS were appointed and trained. Staff of the SFI was appointed to carry out the (bi-)annual surveys (crown condition, ground vegetation, foliar, growth).

Monitoring, quality control and data management issues
This aspect includes the assessments in the field, transport to the laboratory, laboratory analyses and database management including quality control on all aspects. A line of quality issues and control was identified from the field to laboratory and to the database. On all aspects, attention was given and where applicable additional training was done.

The Laboratory of Forest Ecology had to be improved on several points. Equipment had to be purchased and installed, staffing problems had to be solved and the way of working and cost calculations had to be adjusted to fulfil requirements of co-financing and accreditation. Data management issues included validation methods and the development of a proper database with feed-back to field and laboratory and with a link to evaluation.

Practical approach
The period January 1 - March 31st, 2003, the inception phase, was used to investigate the actual situation in Slovenia and especially that of the beneficiary, the Slovenian Forest Institute. In that period, the organisation and implementation building, including staffing of the project from the Slovenian side, started and a first set-up was made of the building of the Intensive monitoring network. An inception report, describing the results was made. This report was followed by six quarterly progress reports, describing the progress in the period April 1st 2003 – October 1st 2004, mainly focusing on the organisation and implementation building, (Result 1), the set-up of the Intensive monitoring network (Result 2) and in the last reports the main focus was on monitoring, quality control and data management (Result 3).

From the side of Alterra the project was headed by a project manager (Dr Wim de Vries) and an operational project leader (Evert Vel, from Forest Ecosystems Consult B.V.). In addition a number of specialists were appointed for specific aspects:

<u>Assessments</u>	
Soil solution	Mr A. van den Toorn
Deposition (fieldwork)	Mr H. Mols
Deposition/Air quality	Mr JW Erisman
<u>Laboratory</u>	
Cost calculation/Analytical chem.	Mr J. Japenga
QA/QC and accreditation	Mr R. Wieggers, Mr W. Schuurmans, Mr S. Crum, Mr M. Geusebroek

Data management

Data validation and evaluation	Mr G.J. Reinds
National Database management	Ms T. Houston

National Focal Centres

NFC France and deposition	Mr Erwin Ulrich
NFC United Kingdom and crown	Mr Dave Durrant

The development of the project in Slovenia was closely monitored and specialists were brought in at moments that their input was most effective. Also travel to international meetings was used to meet and talk with other experts. In this context, the expert panel meeting on deposition was organized in Slovenia in 2004 and an intensive exchange of views with the international experts could be realized.

3 Organisation and implementation building

In Figure 1 an organisation scheme is given of the relevant Ministries and institutes in Slovenia that collaborate in the Intensive Monitoring of Forest Ecosystems. The central coordination lies at with the SFI that is financed by MAFF. Staff of the SFS is engaged as plotmanagers, while scientists of the Biotechnical Faculty and ARSO (financed by MOPE) are working together in the Ozone assessment and evaluation and the ARSO provides information on Meteorology. In the meantime the collaboration is extending to more integrated projects on carbon sequestration, ozone and others. In Figure 2 , the internal organisation of the project is presented.

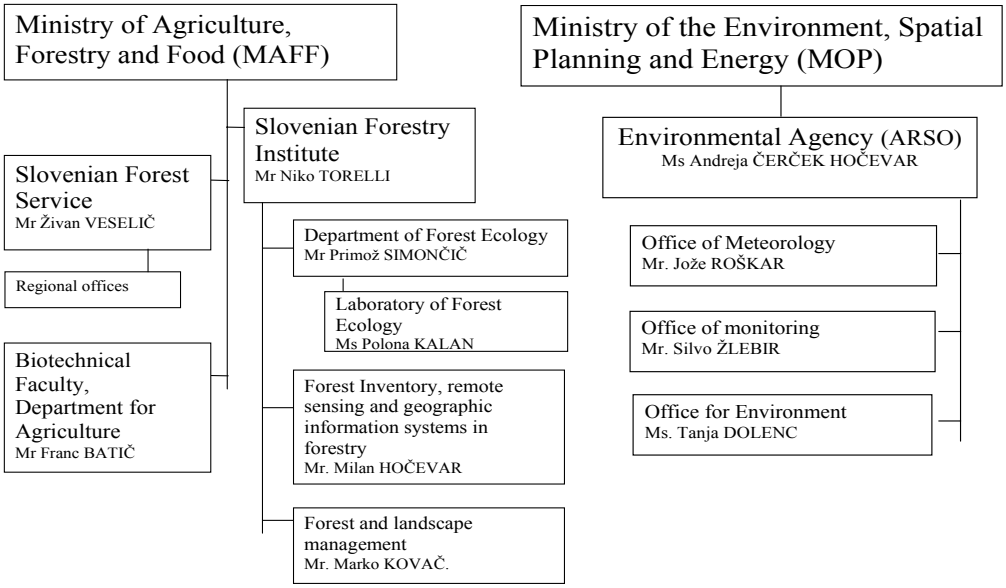


Figure 1 Organisation scheme of relevant Ministries and institutes in Slovenia (circumstances in 2003)

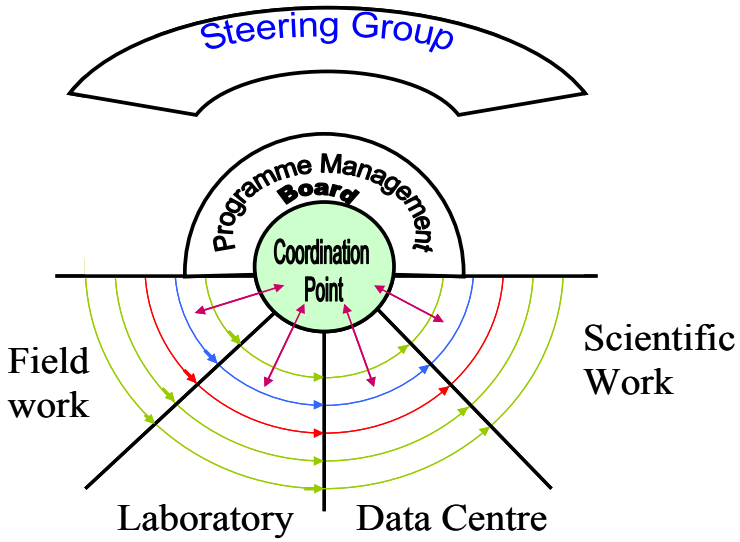


Figure 2 Internal organisation of the project

A steering group is in place that has the responsibility to make the decisions on the direction, funding and development of the Monitoring programme and other activities under Forest Focus. In the Steering Group, all stake holders are present. For the regular management a Programme Management Board (PMB) is in place. The daily management is carried out by the coordination point (CP). The CP coordinates the day-to-day business and keeps track of the work as well as the financial expenditures. The CP has intensive contact with the field manager (Mr M Rupel), the head of laboratory (Ms P. Kalan), the data centre (Mr P Orginc) and project manager (Mr P. Simončič).

The staff working on the plots in the field (SFS) are trained and supervised by the field manager. He is responsible for the provision of clean and well marked sample collectors, the over all quality of the sampling and the collection of samples and submission to the laboratory, including the relevant paperwork.

The laboratory is adequately fitted and laboratory staff is trained. The work is organised in batch process. Every 4 weeks a new set of samples comes in and has to be analysed. This ensures a continuous stream of work and enables the laboratory to plan the workload in advance.

The data centre is in place and the database manager received training. Validation protocols have been developed and are in place, first loading scripts have been made. The further development of the database will have to continue in the next two years. In the last months of the project the laboratory started with the building of database as well. This database will be linked to the central database, but will also include all control data of quality tests carried out in the laboratory (such as results from daily control samples, ring tests and instrument control readings).

The scientific input for the validation has been completed and a start has been made with the evaluation. An evaluation strategy for the short term medium and long-term evaluation has to be completed. At the moment only limited data are available for evaluation. Some first evaluations have been made but for integrated evaluations more time and data is needed. The scientists involved in the various field are familiar with the work and participate actively in the European scientific community.

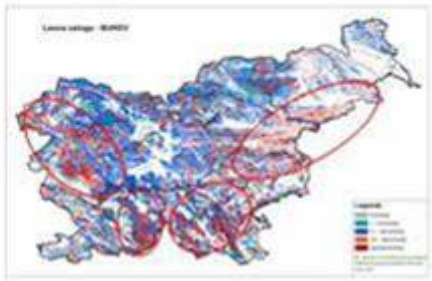
In view of the co-financing possibilities form the European Commission strict rules for (sub-)contracting, administration, archiving and processing exist. In November the representative of the European Commission visited Slovenia. He was so kind to look into the administrative arrangements between the MAFF, the SFI and the SFS, as well as the methods for the proper accounting of the costs of the work done. The methods used, turned out to be satisfactory to the legal rules that are applied at the moment.

4 Building the Intensive Monitoring Network in Slovenia

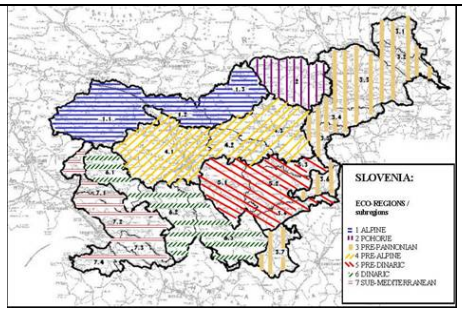
4.1 Plot selection and installation

Selection of plots

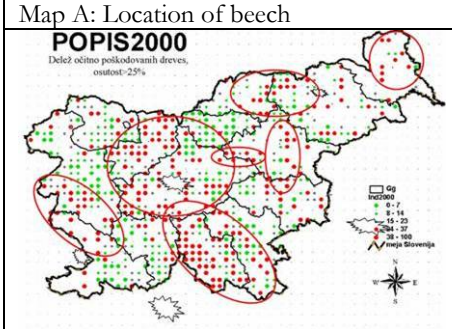
In first instance an inventory of the existing situation was carried out. Maps were obtained form the SFS showing the areas where the six main species are most frequent. These maps were combined with information on ecological climatic zones in view of different potential ecosystems, damage by defoliation and potential risks by air pollution (Fig. 3 with map A being an example for beech).



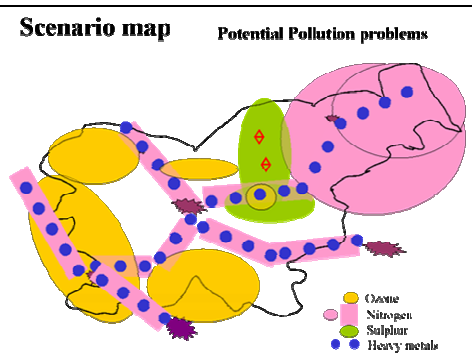
Map A: Location of beech



Map B: Ecological- climatic regions



Map C: Areas with high Defoliation scores



Map D: Potential pollution risks and threats

Figure 3 Maps of the location of beech (A) , the ecological and climatic regions (B), Crown condition in the year 2000 (C) and a map with potential pollution risks (D).

Map A shows the areas where beech is most frequent. Further the actual situation considering soil type, vegetation type and ecological climate regions (Fig 3, Map B) were collected and studied. From the national Level 1 network we obtained information on the defoliation score in the year 2000 (Fig 3, Map C) which shows several areas with high defoliation scores. Based on the information from the Environmental section we made a combination map with the various pollution aspects, such as Ozone, nitrogen, sulphur and heavy metals (Fig 3 Map D). Also studies with expected drought stresses in the near future and hydrology aspects were collected and used. All information was analyzed and integrated.

Due to financial constraints no complete cover of all combinations could be made Hence a selection had to be made and combinations of factors had to be found. For example in the Southern part of Slovenia (green part in Map B) Beech is abundant

(red circles in map A) and in the right corner more defoliated (map C). One of the potential risks is the ozone concentration (yellow circle in map D). This leads to the selection of a number of potential plot locations in the defoliated areas (numbers 10 – 13 in Figure 4), in beech, beech/fir, close to the ozone measuring station Iskrba. In this way a total of 30 potential plot locations were identified in first instance.

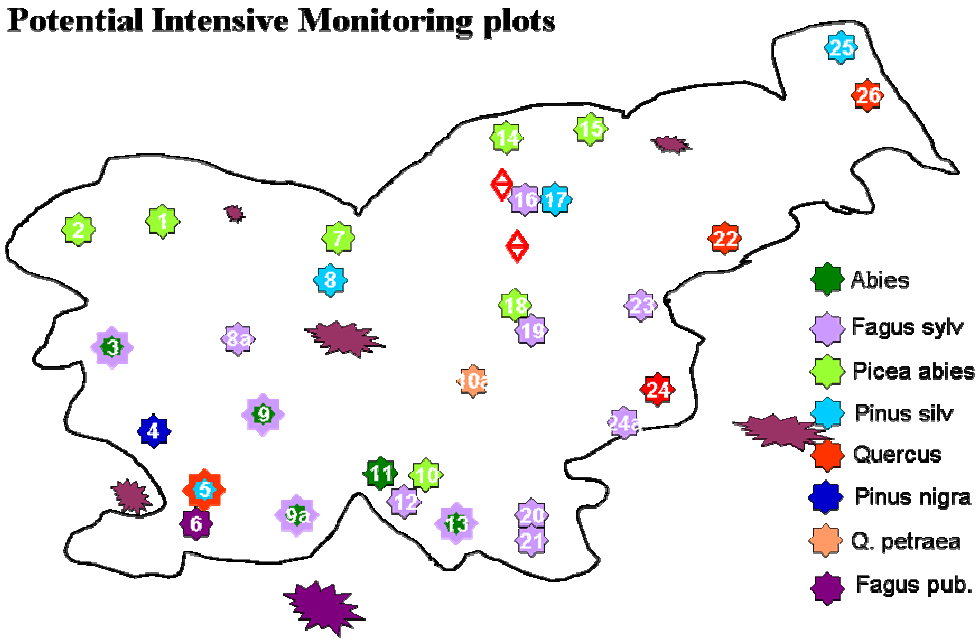


Figure 4 The 30 potential plots that were selected in first instance.

In a second step, the expert knowledge of the scientists in the SFI was used. They were asked to give each potential plot location a rating and select the 10 plot locations they considered to be most effective to monitor the development over the years in Slovenia. In this way 11 potential locations were selected. (see Figure 5). It has to be understood that these potential plot locations give a rough idea on the area (50 x50 km) in which a plot with selected combination of specifications is to be found.

In May 2003 the search for the actual location started. In close cooperation with the regional foresters possible sites were selected and visited. In this period hundreds of locations were visited and reviewed. The ideal plot had to fit with the specifications, as given in Table 1, such as species, soil type, elevation and fit to assess the problems expected. Each plot exists ideally of a uniform area of 100 x 100 meters, is of a common age class and can be reached easily at all times. In addition the ownership situation needed to be such that guarantees can be given for uninterrupted monitoring for at least 10 to 15 years. This means in most cases that state owned or semi-state owned forest were selected. 10 out of the 11 plots could be found before autumn. With the last plot (#6) the ownership situation of the selected site was so difficult that it was finally replaced with another site. Detailed information of the selected 11 plots is given in Annex 1.

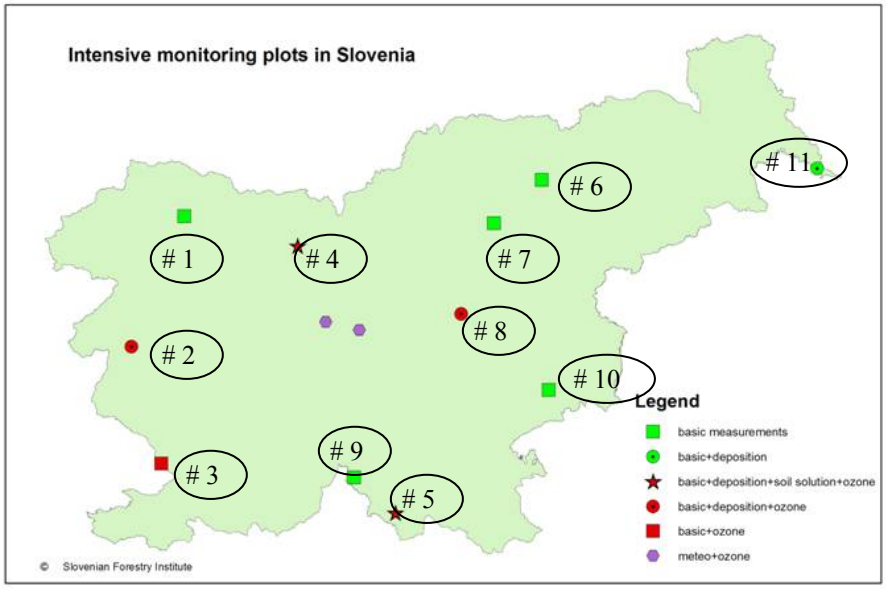


Figure 5 Map with plot locations

Table 1 Selected plots, and some specifications, the expected problems and assessments

	Location	Species	Altitude (m.a.s.l.)	Soil type	Expected Problems	Depo-sition	Meteo-rology	Soil solution	Ozone
1	Pokljuka	Spruce	1350	Eutric Cambisols	Ozone (high), climatic extremes		X		
2	Trnovski gozd	Beech	800	Rendzic Leptosol/EC	Ozone (high), climatic extremes, N	X	X		X
3	Sežana	Black Pine	400	Chromic Cambisols	Ozone, N, drought	X*	X		X
4	Brdo	Pine	450	Dystric Cambisols	N & HM from transport	X	X	X	
5	Borovec	Beech	600	Rendzic Leptosol/EC	Ozone damage & drought/hydrology	X	X	X	X
6	Pohorje	Spruce	1250	Dystric Cambisols	acidification, S	X*	X		
7	Paski Kozjak	Beech	1000	Rendzic Leptosol	S, NO_x, O_3 imissions & recovery after S emissions reduction		X		
8	Zasavje	Beech & spruce	600-700	Rendzic Leptosol/EC	S, N, O_3	X	X		X
9	Loski Potok	Beech/ Fir	950	Rendzic Leptosol/EC	Ozone damage from Croatia & hydrology & Climate change				X
10	Krakovski Gozd	Oak	150	Gleysol	N, water table changes	X*	X		
11	Murska Suma	Oak	200	Gleysol	N, drought, water table changes, metals (?)	X	X		

X = installed and assessed continuously, x* to be temporary assessed by mobile equipment

Plot installation

In summer 2003, the plot installation started by defining the plot boundaries and identifying, numbering and mapping all trees in the plot. In the buffer zone, the trees for monitoring foliar chemistry and intensive phenology were identified and numbered. This was done in accordance with specifications given in the manuals of EU/ICP Forests. Crown condition was assessed, growth parameters (DBH) were measured and foliar samples were taken. A start was made with the determination of the soil type and the soil sampling. Around the central plot area of 50 x 50 m, in the buffer zone, the equipment for deposition and soil solution was installed (Figure 6).

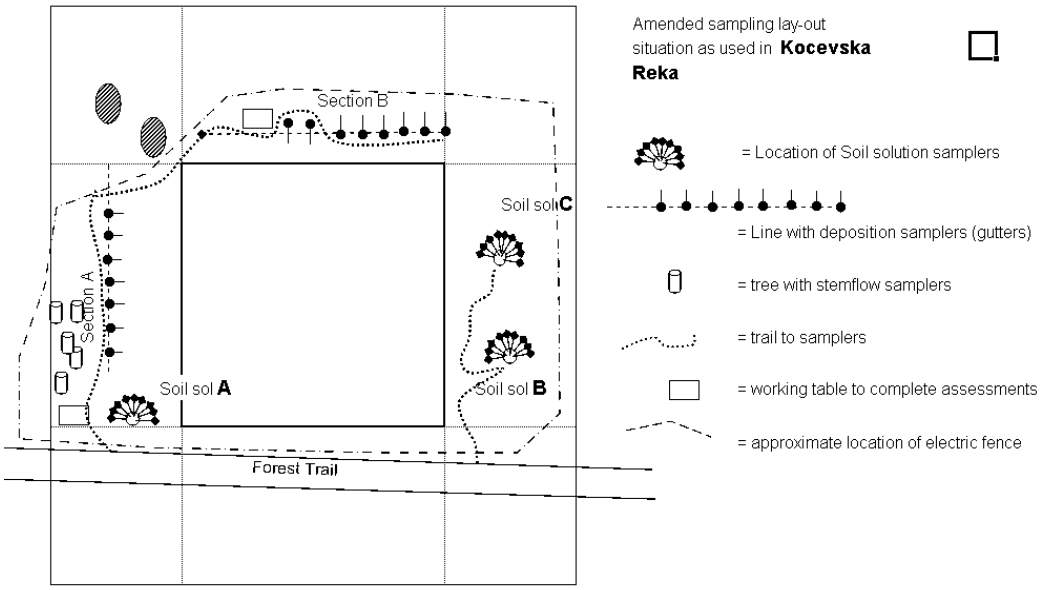


Figure 6 Schematic lay-out of plot #5 Borovec (Kocevska Reka)

Installation of deposition equipment

On 5 plots, deposition sampling equipment was installed. Deposition sampling consists of 4 assessments. In the open air (in a location nearby the plot) 3 bulk samplers were installed to catch the precipitation. Under the canopy in the buffer zone of the plot, the throughfall samplers were installed. Since the canopy is mostly very heterogeneous, gutters were used. The gutters are 2.5 meters long with an opening of 9 mm and an opening length of three times 74 cm. This creates a catchment area of 200 cm^2. The gutters were placed in 2 sections of 7 and 8 each at a right angle on two sides of the plot. The distance between the gutters is approximately 5 meters. The gutters were placed at an angle of 15°. In beech it is mandatory to add stemflow samplers. This was done on 3 plots. For the winter period snow collectors were installed. Both outside and inside the plot the same collectors were installed.

Installation of soil solution equipment

On 2 plots soil solution sampling equipment was installed. At Alterra the lysimeters were prepared using suction cups and under-pressure. The lysimeters were placed at

intervals of 50 cm in a half-circle around the centre point. The centre point is a rectangular pit that houses the 9 bottles with under-pressure. The pit was made so deep that all bottles fit well under the surface, including the space for a well insulated cover. Care had to be taken that the centre point is always downhill of all lysimeters to avoid influence from the collection point. The 9 lysimeters needed therefore 4.0 meters; a radius of approximately 75 cm is thus sufficient to place all lysimeters in half a circle of the central point. The lysimeters were placed form left to right in a systematic order, 0, 20, 40, 0, 20, 40, 0, 20 and 40cm depth. The connection tubes were dug in and led to the central point. A colour coding to each tubes/group and bottle was added that indicates the depth. To protect the connecting tubes from frost the tubes were dug in with the connecting tubes at least be 5 cm below the surface. An impression of the field installation is given in Figure 7.


Installation of Bulk sampler in open area


Installation of throughfall gutters


Installation of Stemflow collectors


Installation of soil solution samplers

Figure 7. Photos of installation of bulk sampler, throughfall gutters, stemflow collector and soil solution samplers

In September 2003 the equipment was purchased and installed in 2 plots (#4; Brdo and #5; Kocevska Reka). During this week of installation, 2 Dutch specialists (Mr Han Möls, ECN and Mr Antonie van den Toorn, Alterra) came over and trained Slovene experts in the construction and maintenance of the equipment. The Slovene experts continued the installation in the other plots afterwards. By the end of October the installation in almost all plots was completed. Only for the stem flow the weather had become too cold for the glue to harden properly and this work had to be completed in the Spring period of 2004.

4.2 Assessments carried out at the plots

All mandatory assessments are in principal carried out on all plots. On 5 plots deposition is assessed continuously and one set of samplers is used to assess deposition in 3 plots on a temporary basis. Soil solution monitoring is carried out in 2 plots and ozone on 5 plots.

Deposition and soil solution assessment: testing of sampling equipment

As soon as the equipment was installed, the test phase started. During the test phase only quantitative measurements were made in order to detect the comparability of the individual samplers. For this purpose 15 throughfall gutters were installed in each plot. Fortunately it turned out that no strong systematic differences in quantities were revealed between the different gutters. In March/April 10 gutters were selected for the actual monitoring. These 10 gutters are split into 2 groups of 5 gutters.

In the bulk samplers a serious problem was encountered. The capacity of the collecting bottle was too small in some areas during heavy rainfall. The capacity had to be increased to 8 litres (see Figure 8). To ensure a perfect fit between funnels and collecting bottles the whole unit was replaced. The need of this capacity was shown in October 2004 in a period with heavy rainfall. In some plots quantities of 7 litres were collected in that period.

Figure 8 The new (left) and old (right) bulk samplers

Snow sampling is a difficult assessment. International studies have shown that wind conditions may affect the collecting capacity enormously. The sampling devices installed, (tubing with plastic bags, see Figure 9) were difficult to manage and the bags frequently leaked sampled liquid before the quantity could be assessed. A different sampler with rounded conical form was ultimately developed and installed.

Figure 9 Original snow sampler

In the soil solution assessment some practical problems occurred with the under pressure and the proper identification of the different depths. A strict colour coding was applied and all bottles were in the laboratory brought under the required under pressure. In the field only sporadic some additional work had to be done, when the rubber stop had malfunctioned.

In wintertime it became clear that the quantities of samples (ice, snow, etc) were so much that transportation to the car needed to be improved. Backpacks and special covers to insulate the bottles against frost (and heat) were obtained.

With the development of the database and validation procedures a more stringent documentation of field information started. Field forms were developed and procedures for actions were refined. In September 2004 these last improvements were done and the installation of the equipment in the plots was complete.

Meteorological assessments

Meteorology data at 9 of the plots (see Table 1) are obtained by the Meteorological office (ARSO). Existing meteorological stations are used, which in some cases are often located at a certain distance and at another elevation, exposure then the plot itself. To ensure that this obtained information is valid for the plots, a mobile meteorological station has been purchased to verify if the data at the plot and the neighboring station are comparable.

Ozone assessments

On 5 plots ozone assessments are carried out. In accordance with the manuals this is done by passive samplers and in combination with ozone measuring stations for verification. The ozone passive samplers, that were ordered from CEAM in Spain, consist of a housing with 2 replaceable containers with papers impregnated with nitrite that do react with ozone to form nitrate. The active papers, used for assessing the ozone exposure are replaced every 2 weeks in the ozone active season (May – begin September), when ozone can do damage the foliage of the vegetation. For linkage to the actual daily ozone concentrations passive samplers were also installed at active ozone monitoring sites (such as Iskrba). In addition, a small Light Exposed Sampling Sites (LESS) was installed near the Ozone samplers to observe the actual damage symptoms of ozone on the vegetation.

In line with the manual for the Ozone damage working group, ground vegetation is followed through the growing season and regularly checked on signs of ozone damage. Beech and Pinus nigra are sensitive species. Ozone damage can take many different forms and can be easily mixed with other damage symptoms. Common damage symptoms are reddening, bronzing (on beech) stippling (on Pinus nigra) and premature yellowing and dropping of leaves (poplar types). Especially the last symptom is difficult to observe as the leaves have disappeared. Photographing of plants and branches is then needed and training of experts is essential. The field manager thus participated twice in ozone damage training sessions in Switzerland.

Other assessments
All assessments, mandatory according to the EC regulation, are now carried out in the programme. The assessments and analysis are carried out according to the methods specified in the manuals of European Commission and ICP Forests. Crown condition, that was already done for the 43 level I points is now extended to the Level II plots. Photographic documentation (as proposed in the EP Crown condition) is undertaken.

The soil survey started but as it is not mandatory at the moment, it has not been pursued. Samples have been taken of most plots (8/11 plots) and have been delivered to the lab. Here they are dried and stored. There might be a possibility in 2005 to execute the soil analysis under a special project called Bio-Soil.

Foliar survey is done in the odd years (2003, 2005, etc) and was done on selected plots in the late summer and the autumn of 2003 (7/11 plots). For the foliar assessment 5 special trees have been identified and numbered in the buffer zone (991 – 995). These trees are also included in the crown condition assessments. Samples have been collected, dried, and analysed in the laboratory.

Forest Growth is done every 5th year (2004, 2009, etc). The DBH was also assessed during installation and repeated in the autumn of 2004.

Ground vegetation is carried out in the plots. Ground vegetation is especially important to detect reactions of the ecosystem in an early stage. In accordance with the manual, 4 sub-plots of 100 m^2 each have been installed in each plot to follow species richness. In case the plot was fenced also outside the fence. In addition 10 small quadrats (of 4 m^2 each) have been installed to follow the coverage. Side effects are that with the fencing as a special influencing factor the effects of fencing (protection against game) can be followed (5/11 plots).

Phenology is assessed by the plot managers. A manual for Slovenia was prepared and followed. The change in dates of budding, leaf-development and drop is studied all over Europe as it is an important effect of the ecosystem to the climate change.

4.3 Evaluation potential of the monitoring system

With the accession to the European Union an increase in transport through Slovenia is expected. In combination with the completion of the building of the Motorways strong increases already happen and are expected in near future. The effects are manifold and range from an increase in emissions of nitrogen oxides, dust and heavy metals. Dust is one of the factors that play a role in the formation of ozone. The monitoring programme has potential to evaluate these effects as described below.

Acidification and eutrophication
Most of the parent material in Slovenia is of calcareous origin and not sensitive to acidification. This is not the case in the area of Pohorje. In this location also high

rainfall occurs (more than 1500 mm per year). As the average temperature is low, the weathering rate is low also. This makes the area sensitive to acidification.

Although not many large cattle holders exist and the risk for ammonia is low, nitrogen oxides (nitrate etc.) inputs are to be expected from various sources. The effects of nitrogen enrichment are manifold. Nitrophilous species, such as grasses and brambles (Rubus spp), can become evasive. This can cause reductions to other vegetation, such as mushrooms and oligotrophic species. This will have a direct effect on the species composition and biodiversity. At the same time nitrogen is one of the growth stimulating nutrients. This extra growth may cause drought effects due to increased water requirements. When too much nitrogen enters the ecosystem that can not be taken up, leaching will occur. This will cause nitrogen to come into groundwater systems, making it unfit for drinking water.

The input (deposition) of ammonium, nitrate, sulphate and base cations is continuously assessed in 5 plots. In addition, temporary assessments will take place on 3 plots. From these assessments the input of nitrogen and acidity can be calculated. On 2 plots soil solution is assessed and hence the effects of this acid input on the soil can be followed. Any effects of vegetation will be recorded by the ground vegetation assessments.

Climate change

Changes in climate are observed all through Europe. The vegetation period has lengthened in the last 50 years with many days. Vegetation starts earlier in the year to flower and produce leaves. With phenology, the time of development of the trees is followed and recorded. The assessment of ground vegetation and the recording of changes in coverage will also provide possibilities here. The principal steering parameters are temperature and precipitation here. A slight increase in mean temperature in combination with a slight decrease in precipitation can already cause enormous effects on the ecosystem. Meteorology data are collected for 10 plots and phenology is assessed in all plots. This will provide information for the evaluation on climate change.

Ozone

In several parts of Europe, especially Spain, ozone damage has occurred on large scale. Complex models have been developed. The area on the Mediterranean coast of Spain has high urbanization/industrialization at the coastline and a medium high ridge just behind it. The dust particles are transported inland and may cause very high ozone concentrations under influence of sunlight. In Slovenia several areas exists were similar situations can be found. In these areas (e.g. plot #3 is 2 km from Trieste at 400 m.a.s.l. while plots #5 (at 600 m.a.s.l.) and # 9 (at 950 m.a.s.l.) are approx. 30 km from the Rijeka area) ozone samplers have been installed. These assessments will provide information on ozone exposure. The combination with the recognition of damage caused by ozone on the Light Exposed Sampling Sites (LESS) will provide information on the impacts of ozone on the vegetation. Collaboration with the Biotechnical Faculty and the ARSO will optimize the use of assessed data and may lead to other campaigns on ozone.

5 Monitoring, quality control and data validation

Quality control on monitoring and transport

Monitoring is done on a 2-weekly interval. Samples of the first 2-week period are stored locally in a refrigerator and then transported together with the samples of the second 2-week period to the laboratory. Equipment is maintained regularly by the plot managers and every 2 months an inspection by the field manager and responsible experts takes place. Procedures for reporting of irregularities have been developed and are used. Manuals in Slovene language have been made and are kept up-to-date.

The samples are transported every 4 weeks to Ljubljana and are submitted together with additional information to the laboratory. Together with the field manager the laboratory enters the samples for analysis.

Quality control and accreditation of laboratory

The laboratory is now well equipped for the tasks needed. All necessary analysis on the deposition, ozone, soil (solution) and foliar samples can be carried out. International standard procedures are followed and regularly control samples are analysed.

At the start of the project an inventory of the capacity and equipment of the laboratory was made. Several pieces of equipment were old and not working properly anymore and needed to be replaced. The capacity of the laboratory had to be improved. The staff, which was mostly on temporary contracts, had to be trained and given long-term perspectives. The internal organisation of sampling handling, controls, Quality issues and data clearance had to be improved. Table 2 presents the equipment that has been purchased and installed during the 2 years that the project was carried out.

Table 2 The equipment purchased and installed by the project in the laboratory

Equipment	Date of implementation	Realisation
TOC/DOC analyser	Oct 2003	Purchased by project and installed
Oxygen supply	Oct 2003	Purchased by project and installed
Spectrophotometer	May 2004	Purchased by project and installed
Shaker	March 2004	Purchased by project and installed
AAS rinse + diluting system	Oct 2003	Diluting system obtained from Alterra and installed
Moisture analyser/ balance	March 2004	Purchased by project and installed
Oven	July 2004	Purchased by project and installed
Calibrated pipettes set	Oct 2004	Purchased by project and installed
Rotor for microwave digestion	July 2003	Purchased by project and installed

The staff of the laboratory, consisting of 4.5 fte, is now on permanent or long-term contracts. The laboratory assistants are now well trained and all equipment can be

handled by at least 2 persons. The Standard Operation Procedures (SOP) of all methods and equipment have been (or are in the final stage) written out, as is required for accreditation. Quality issues have been improved and standard samples are used as normal procedure. Participation in (international) ring tests is done to ensure international comparable values.

As the cost aspects of a laboratory and the costs per sample to be calculated, appeared to be unclear, a specialists (Mr Jan Japenga) visited the laboratory. He explained the calculating system applied in Alterra and gave a presentation on this issue to the researchers in the SFI. This enforced a different way of thinking on the costs of a laboratory within SFI. This need for proper calculation of the costs is also an essential requirement in view of the co-financing from the side of the European Commission.

Considering the improvement of the laboratory also the possibility of accreditation was studied. Twice, experts from Alterra travelled to Slovenia to carry out a pre-audit and explain needed aspects. Both the head of the laboratory and two assistants visited the laboratory of Alterra and have been shown the way in which an accredited laboratory works. In the last audit it became clear that although a lot of work still needs to be done, accreditation can become reality in 2005.

Data management

A database for the Intensive Monitoring is under development although its completion will take another year and maybe even two years. The data from assessments carried out in 2003 and 2004 can now be entered in the database. The first scripts for validation and storage have been made and tested. Plausibility ranges are used for checking and validation. In September an overall view of all information and data was put together. Here several weak points were detected that had to be solved. During the visit of the colleagues of the UK it became clear that several data problems remain to be solved.

In December 2004 it was decided that a central database of the laboratory will be developed, in which all results of samples, reference materials and quality issues will be stored and handled. When this is complete the whole chain from the sampling in the field, transport to laboratory, preparation and sampling in the laboratory can be controlled and validated from a central database. The validation and recording of disturbing events will then become a more direct and easier task, resulting in higher data quality and better evaluation possibilities.

6 Public relations and communication

The ministry of Agriculture, Forestry and Food as well as the ministry of Environmental and Spatial Planning are the most relevant ministries in Slovenia for the monitoring of forest ecosystems. Hence good relations had to be achieved with these ministries and the related institutes, SFS and ARSO. To achieve this, a start-presentation was organized in the European Centre in April 2003, where the objectives of the project and the relevance of the programme were explained. This presentation was well attended by representatives from the Slovene ministries, institutes, NGO's, universities as well as the Dutch government.

In October 2003, when the plots had been selected and the first plots were installed an official opening of the first plot was organized. Again the policymakers form the relevant ministries and institutes participated as well as the Dutch government. Following the opening and visit of the plot by the Dutch Agricultural Counsellor (Figure 10) a visit was paid to the nearby ozone measuring station Iskrba, illustrating the cooperation between the programmes.

Figure 10 Opening of the first intensive Monitoring plot

At the end of the project a conference was organized. For this conference broad publicity was generated and a communication expert was hired to ensure public interest and press coverage. A folder was developed (Figure 11) and the presentations highlighted the international and National requirements as well as the potential of the Intensive monitoring programme.

Figure 11 Front page of folder for International Conference

The conference was attended by more than 100 persons and opened by the Minister of Agriculture, Forestry and Food and the Dutch ambassador. Among the speakers were also a representative of the European Commission, the chairman of the ICP Forests and the chairman of the expert panel on Deposition.

7 Spin – off and recommendations

Spin-off

During this project the following things have been achieved:

1. Eleven plots have been selected in a careful way and to everybody's satisfaction, with clear aims and criteria.
2. The infrastructure in the field and laboratory has been build-up successfully
3. A QA/QC program has been implemented
4. The database is being set up
5. Organisational structure is in place
6. A good link with ministries is established
7. There is a clear international imbedding
8. There is a long term commitment of ministries

The effects of the project are far-reaching and can be summarized as follows:

1. Improved cooperation within the institute
2. Cooperation with Slovenian Forest Service (SFS), ARSO and university and stronger links with the ministries of agriculture and environment
3. Improved image of SFI both in a national and international context and increased public awareness of the relevance of forestry research.
4. A large potential resource for future scientific and policy oriented research by the establishment of an infrastructure

1 Improved internal co-operation at SFI: This included a better view on the need of chain management and quality aspects of each link. It has changed ideas on co-operation within SFI from individual research work to more interdisciplinary research with researchers from various fields. Within SFI, researchers are working in the intensive monitoring as a team, including various specialists such as dendrology, soil science, phenology and ground vegetation.

2 Improved institutional relationships: The Forest Focus programme covers crown condition assessment on the systematic grid (Level I), intensive monitoring (level II) as well as forest fires and special studies. Hence an overall programme had to be realized to be brought forward to the Ministry of Agriculture (MAFF) and Environment (MOPE) for submission to Brussels. This led to improved institutional relationships with both Ministries and SFI. Similarly the relationships with other institutes improved. At the moment, SFI works in this programme together with SFS, ARSO and several universities/faculties. The approach to work as team of scientists from different sections of SFI together with scientists from other institutes, faculties etc. implies an improvement from rather mono-disciplinary and mono-institutional research to interdisciplinary and inter-institutional research in Slovenia.

3 An improved image of SFI both in a national and international context: With assistance of the Embassy several events have been organised that received national press coverage. At the same time it improved the relation with the ministries and allowed for an open exchange of ideas in a relaxed environment.

A start has been made with the broadening of the Public Relation aspects of the Intensive Monitoring the Forest Focus and the whole institute. In this context a first annual report on the intensive monitoring programme in Slovenia has been made and published. A first step has been made with the development of a website (www.gozdis.si/monitoring). In the week with the final conference a lot of efforts have been given to reach the international community with the organisation of the Expert panel on deposition and the direct follow-up of the international conference, which got quite some attention of the national press.

4 A large potential resource for future scientific and policy oriented research. The intensive monitoring programme has the potential impact to grow to a wide and extensive scientific basis for ecosystem research. The policy making bodies, MAFF and MOPE, are in need of good information on the status and development of ecosystems over time in response to environmental stresses since the expected increased of transport and industry will bring a number of negative consequences. The monitoring system of forest ecosystems can provide information on pollution effects (e.g. ozone) on forest ecosystems. The possibility of negative effects and potential threats has been accounted for in the development of the monitoring system. The results of this basic monitoring net will also provide the policymakers with information on how and where the research should continue. As an example, the ozone assessment in the South-Western part of Slovenia can be used. As ozone damage was expected, one plot (#3 Sezana) was located close to the border of Italy in the smog plume of Trieste. The assessed ozone concentrations have been (even in the relative cool and wet year of 2004) proven to be so high that MOPE is intending to extend the research in this area the next years. Especially in view of the needs of international agreements, information is also needed on carbon sequestration (Kyoto), biodiversity (CBD) and sustainable management (MCPFE), that can partly be obtained form this monitoring system. This holds specifically for effects of climate change and nitrogen impacts on biodiversity.

Recommendations

As shown before the building and initiation phase is now complete and the consolidation phase starts. For this consolidation the following recommendations for the further steps can be formulated:

1. It is recommended to always ensure that the 'cycles are closed'. This means that an action should be followed by a reaction: if something is observed in the field, it has to be reported, action has to be taken to fix it and the sample has to be marked and documented. This should happen throughout the whole process of sampling until reporting on all levels and for each assessment.
2. The laboratory should obtain the ISO 17025 certificate through accreditation in 2005.
3. The data should be stored in a central database and the no individual databases should be established or maintained. It is recommended to back-up the database and formal documents regularly and store the back-up in a safe place and also outside the institute.
4. There should be a very good cooperation with other institutes and monitoring networks, especially within the field of atmospheric research and Air quality, because this discipline is currently lacking in the institute and is necessary to deal with the policy issues.

5. A users platform for infrastructure and data should be established when these are used by external people in the future.
6. Improve the cooperation within the program for assessments (Joint studies, Scientific and/or modelling group, formulate policy questions) and policy support (e.g. by setting up and Environment and Forestry Planning Bureau).
7. Develop strategy plans for :
   The next year 2005 (and 2006) period containing:
   - Communication (PR, Leaflet, information boards for all plots, a 12th (demonstration) plot nearby the SFI, public awareness, etc)
   - Annual report 2004 (and 2005)
   - Data evaluation plan (what can we do already? And how/who will do this? When and how will it be brought to the public?)

   The coming 4 years containing:
   - Data evaluation plan (questions, science, reports, publications)
   - Publishing in scientific journals and reporting plan
   - Communication plan (Pr, public awareness, internal, external, web site, .

   The long term (2015 – 2020)
   - Integration with other monitoring or research work done in Slovenia
   - Combined actions with other International requirements (Kyoto, Biodiversity, Climate change, etc)

   The plans and the program should be evaluated every two years, followed by the necessary action.
8. Keep strong links with the Ministries in order to show the relevance of forestry and forest monitoring. Furthermore, establish a relationship where there is room for policy advice and policy development using the program as a basis input.

Our final recommendation here is to keep the team together and to enhance the cooperation between the different fields of activities of the team members in order to make an optimal use of the collected data and assessed information. A logical next step is to make links to existing research results and to coordinate new research work on or near existing plots and use available data as much as possible.

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Appendix 1 Details of the 11 selected plots

The 11 plots of Intensive Monitoring Programme In Slovenia











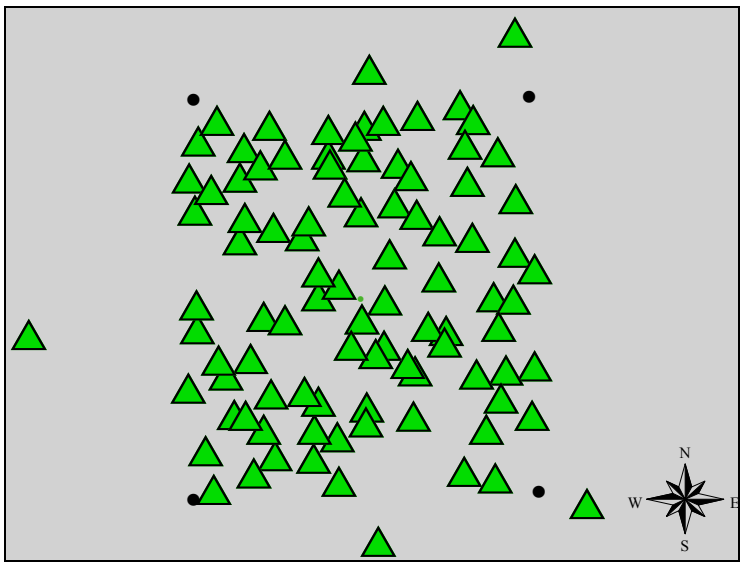
Osnovni podatki: *Basic data:* (1) Pokljuka

Ploskev št.: *Plot no.:*		1
Ime ploskve: *Plot name:*		Pokljuka
Občina: *Community:*		Bled
Karta (TK25): *Map (TK25):*		011-2-4
Gausss-Krüger	X	5 418 719
	Y	5 136 466
Zemljepisna dolžina: *Longitude*:		+13°56´19″
Zemljepisna širina: *Latitude*:		+46°22´02″
Postavljena: *Installed*:		02.07.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		1397 m
Ekspozicija: *Exposition*:		190°
Starost: *Age*:		130 let / *years*
Sklep: *Closure*:		Rahel *Loose*
Naklon: *Inclination*:		10°
Glavna drevesna vrsta: Main tree species:		Smreka (*Picea abies*)
Ekološka regija: Ecological region:		Alpska *Alpine*
Višinski pas: *Elevation zones*:		Altimontanski
Matična podlaga:: *Parent material*:		Morena *Moraine*
Tip tal: *Soil unit*:		Evtrična rjava tla, rendzina *Eutric Cambisols, Rendzic Leptosols*
Gozdna združba: *Forest community*:		Drugotni smrekov gozd s svinjsko laknico (*Aposeri-Piceetum*)
Meteorološki podatki: *Meteorological data*:		ARSO - postaja Rudno polje
Lastnik gozda: *Forest owner*:		Sklad kmetijskih zemljišč in gozdov RS Dunajska 58 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Alojz BUDKOVIČ ZGS – OE Bled

Meritve: *Measurements:*

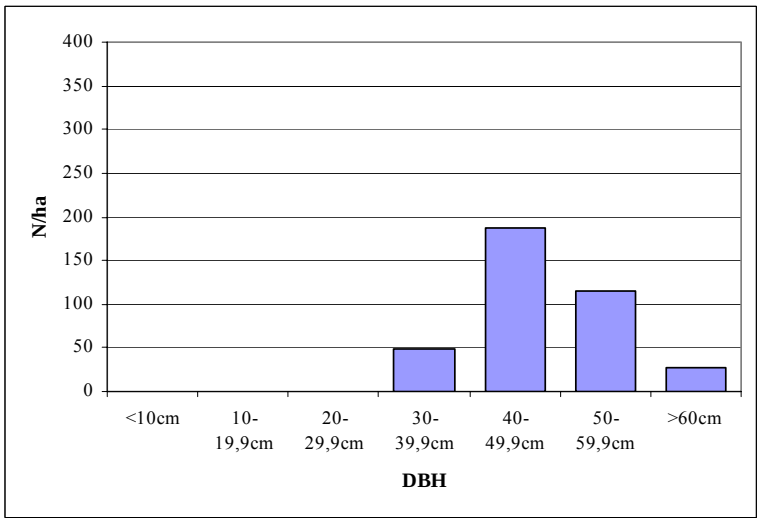
(1) Pokljuka

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✗
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✗
Daljinsko zaznavanje *Remote sensing*		✓



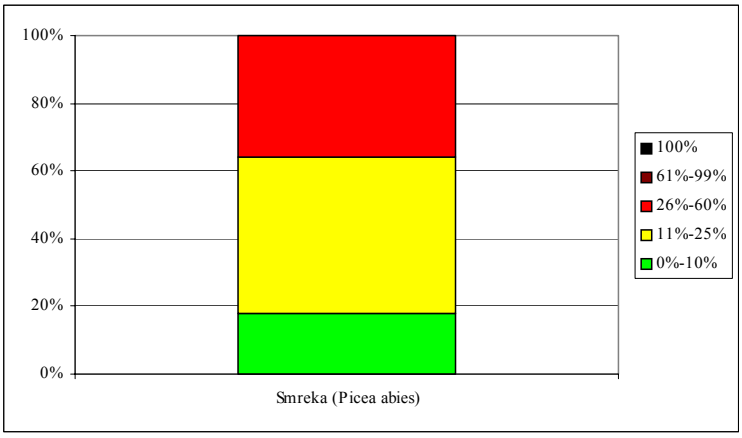
Število dreves/ploskvi
Number of trees/plot

Smreka ***Picea abies***	**95**



Osutost
Defoliation

Povprečna osutost *Average defoliation*	**22,4%**
Delež poškodovanih dreves Share of damaged trees	**34,3%**



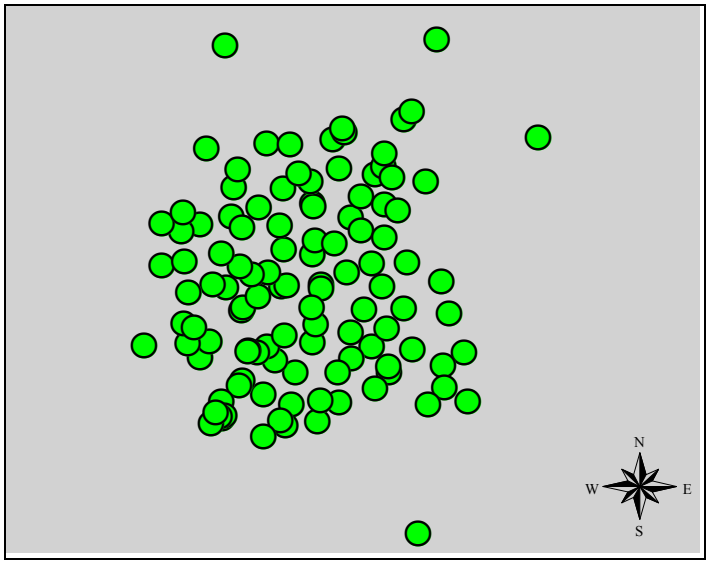
Osnovni podatki: *Basic data:* (2) Trnovski gozd

Ploskev št.: *Plot no.:*		2
Ime ploskve: *Plot name:*		Fondek
Občina: *Community:*		Nova Gorica
Karta (TK25): *Map (TK25):*		028-1-2
Gausss-Krüger	X	5 402 239
	Y	5 095 690
Zemljepisna dolžina: *Longitude*:		+13°43´59″
Zemljepisna širina: *Latitude*:		+45°59´55″
Postavljena: *Installed*:		01.07.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		827 m
Ekspozicija: *Exposition*:		165°
Starost: *Age*:		80 let / *years*
Sklep: *Closure*:		Normalen *Normal*
Naklon: *Inclination*:		10°
Glavna drevesna vrsta: Main tree species:		Bukev (*Fagus sylvatica*)
Ekološka regija: Ecological region:		Dinarska *Dinaric*
Višinski pas: *Elevation zones*:		Montanski
Matična podlaga:: *Parent material*:		Apnenec *Limestone*
Tip tal: *Soil unit*:		Rendzina, rjava pokarbonatna tla *Rendzic Leptosols, Eutric Cambisols*
Gozdna združba: *Forest community*:		Bukov gozd z jesensko vilovino (*Seslerio autumnalis–Fagetum*)
Meteorološki podatki: *Meteorological data*:		ARSO – postaja Nanos-Ravnik in Lokve
Lastnik gozda: *Forest owner*:		Sklad kmetijskih zemljišč in gozdov RS Dunajska 58 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Helena ZORN ZGS – OE Tolmin

Meritve: *Measurements:*

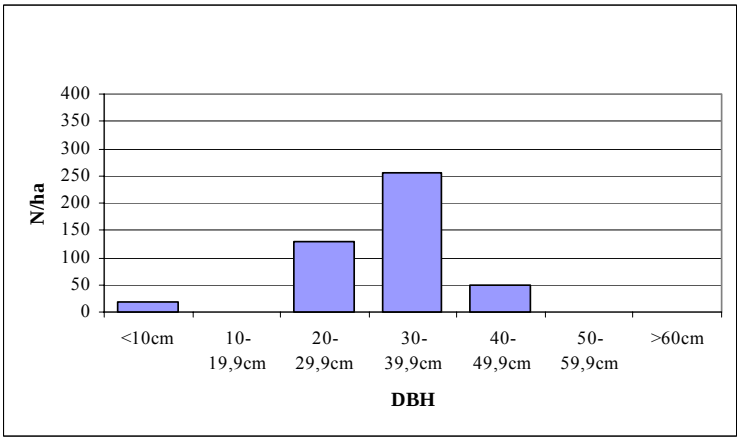
(2) Trnovski gozd

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✓
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✓
Daljinsko zaznavanje *Remote sensing*		✓



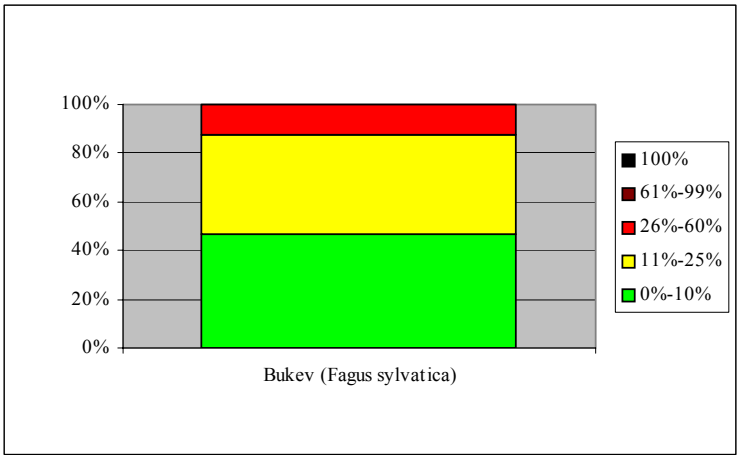
Število dreves/ploskvi
Number of trees/plot

Bukev ***Fagus sylvatica***	**113**



Osutost
Defoliation

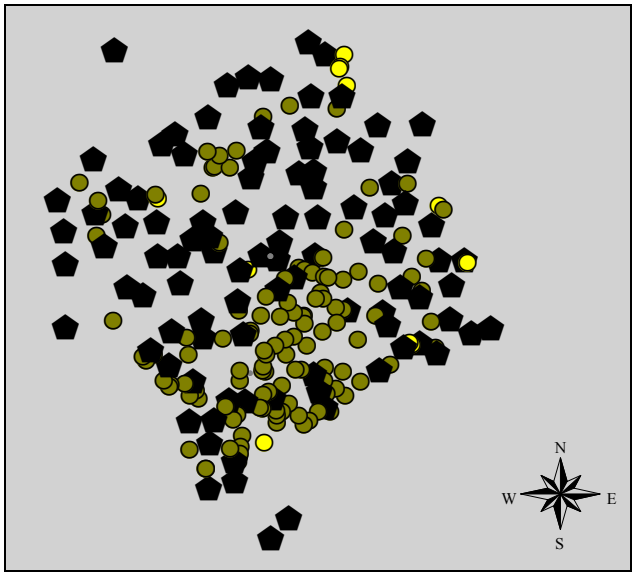
Povprečna osutost *Average defoliation*	**15,7%**
Delež poškodovanih dreves Share of damaged trees	**12,4%**



Ploskev št.: *Plot no.:*		3
Ime ploskve: *Plot name:*		Gropajska gmajna
Občina: *Community:*		Sežana
Karta (TK25): *Map (TK25)*:		028-4-1
Gausss-Krüger	X Y	5 411 589 5 059 052
Zemljepisna dolžina: *Longitude*:		+13°51´35˝
Zemljepisna širina: *Latitude*:		+45°40´15˝
Postavljena: *Installed*:		01.07.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		420 m
Ekspozicija: *Exposition*:		43°
Starost: *Age*:		100 let / *years*
Sklep: *Closure*:		Normalen *Normal*
Naklon: *Inclination*:		5°
Glavna drevesna vrsta: Main tree species:		Črni bor (*Pinus nigra*)
Ekološka regija: Ecological region:		Submediteranska *Sub-Mediterranean*
Višinski pas: *Elevation zones*:		Kolinski
Matična podlaga:: *Parent material*:		Apnenec *Limestone*
Tip tal: *Soil unit*:		Rdeče-rjava pokarbonatna tla *Chromic Cambisols*
Gozdna združba: *Forest community*:		Drugotni gozd črnega bora (*Seslerio–Pinetum nigrae*)
Meteorološki podatki: *Meteorological data*:		ARSO – postaja Godnje
Lastnik gozda: *Forest owner*:		Zasebno lastništvo
Oskrbnik ploskve: *Plot manager*:		

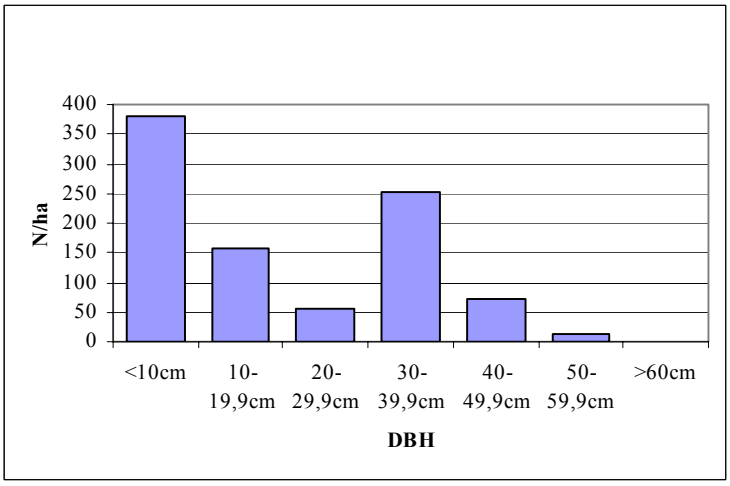
Meritve: *Measurements:* (3) Sežana

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✓*
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✓
Daljinsko zaznavanje *Remote sensing*		✓



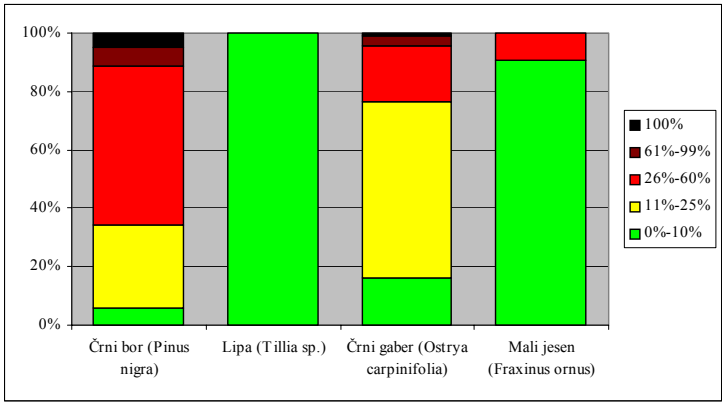
Število dreves/ploskvi *Number of trees/plot*

Črni bor ***Pinus nigra***	**100**
Lipa ***Tilia sp.***	**2**
Črni gaber ***Ostrya carpinifolia***	**119**
Mali jesen ***Fraxinus ornus***	**11**



Osutost *Defoliation*

Povprečna osutost *Average defoliation*	**28,3%**
Delež poškodovanih dreves Share of damaged trees	**40,5%**

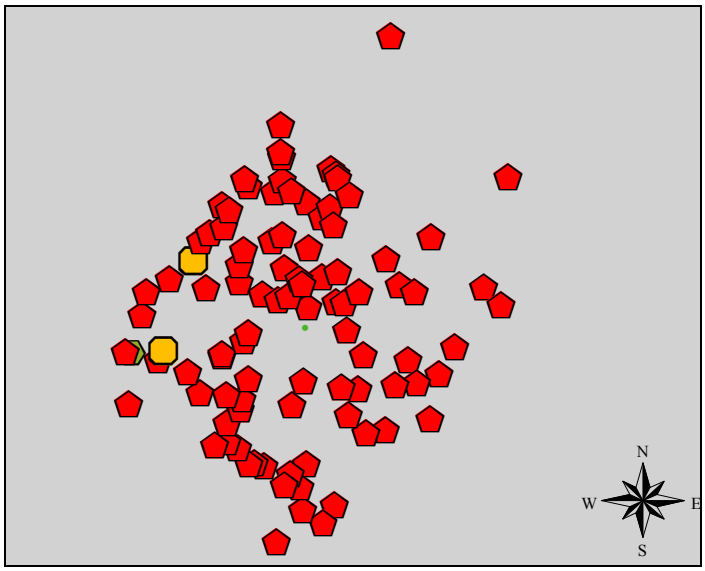


Ploskev št.: *Plot no.:*		4
Ime ploskve: *Plot name:*		Brdo
Občina: *Community:*		Kranj
Karta (TK25): *Map (TK25)*:		012-2-4
Gausss-Krüger	X Y	5 454 133 5 127 146
Zemljepisna dolžina: *Longitude*:		+14°24´00˝
Zemljepisna širina: *Latitude*:		+46°17´14˝
Postavljena: *Installed*:		02.07.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		471 m
Ekspozicija: *Exposition*:		210°
Starost: *Age*:		100 let / *years*
Sklep: *Closure*:		Vrzelast *Gaps*
Naklon: *Inclination*:		5°
Glavna drevesna vrsta: Main tree species:		Rdeči bor (*Pinus sylvestris*)
Ekološka regija: Ecological region:		Predalpska *Pre-alpine*
Višinski pas: *Elevation zones*:		Kolinski
Matična podlaga:: *Parent material*:		Prodni zasip *Fluvioglacial gravels and sands*
Tip tal: *Soil unit*:		Distrična rjava tla *Dystric Cambisols*
Gozdna združba: *Forest community*:		Drugotni gozd rdečega bora z borovnico (*Vaccinio myrtilli-Pinetum*)
Meteorološki podatki: *Meteorological data*:		ARSO – postaja Kranj, Preddvor in Brnik
Lastnik gozda: *Forest owner*:		Sklad kmetijskih zemljišč in gozdov RS Dunajska 58 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Tomaž POLAJNAR ZGS – OE Kranj

Meritve: *Measurements:*

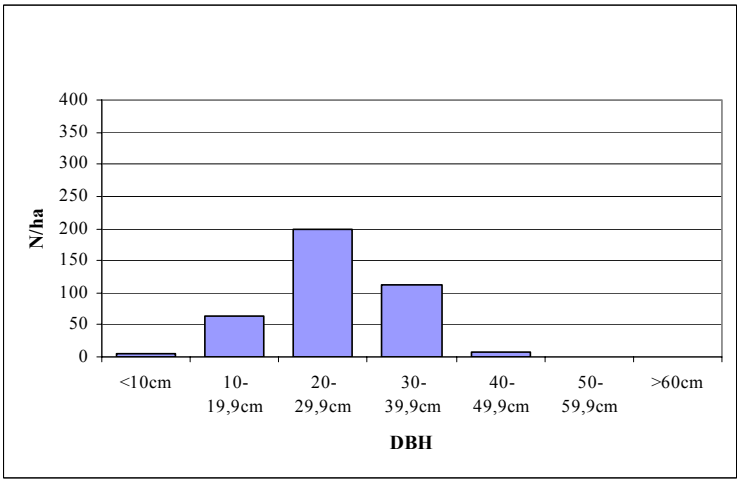
(4) Brdo pri Kranju

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✓
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✓
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✗
Daljinsko zaznavanje *Remote sensing*		✓



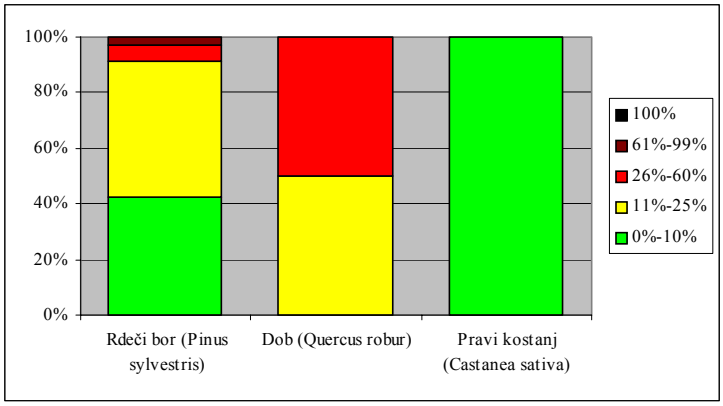
Število dreves/ploskvi
Number of trees/plot

Rdeči bor ***Pinus sylvestris***	**94**
Dob ***Quercus robur***	**2**
Pravi kostanj ***Castanea sativa***	**1**



Osutost
Defoliation

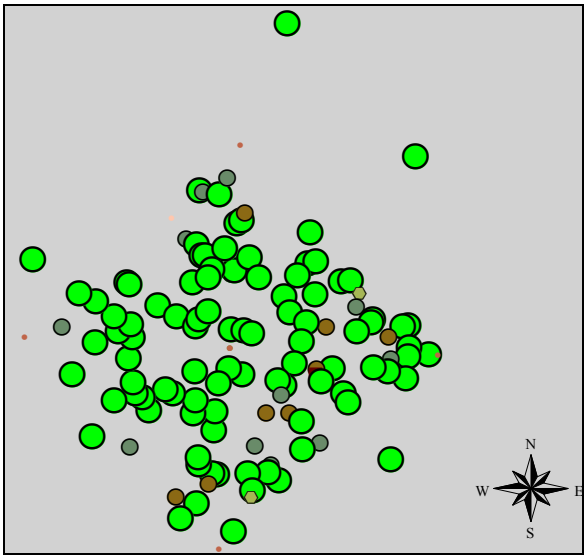
Povprečna osutost *Average defoliation*	**16,3%**
Delež poškodovanih dreves Share of damaged trees	**9,3%**



Ploskev št.: *Plot no.:*		5
Ime ploskve: *Plot name:*		Borovec
Občina: *Community:*		Kočevje
Karta (TK25): *Map (TK25)*:		030-4-3
Gausss-Krüger	X Y	5 484 737 5 043 605
Zemljepisna dolžina: *Longitude*:		+14°48´00″
Zemljepisna širina: *Latitude*:		+45°32´12″
Postavljena: *Installed*:		
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		705 m
Ekspozicija: *Exposition*:		
Starost: *Age*:		/ *years*
Sklep: *Closure*:		Normalen *Normal*
Naklon: *Inclination*:		
Glavna drevesna vrsta: Main tree species:		Bukev (*Fagus sylvatica*)
Ekološka regija: Ecological region:		Dinarska *Dinaric*
Višinski pas: *Elevation zones*:		Montanski
Matična podlaga:: *Parent material*:		Apnenec *Limestone*
Tip tal: *Soil unit*:		Rendzina, rjava pokarbonatna tla *Rendzic Leptosols, Eutric Cambisols*
Gozdna združba: *Forest community*:		Bukov gozd z velecvetno mrtvo koprivo (*Lamio orvalae-Fagetum*)
Meteorološki podatki: *Meteorological data*:		ARSO – postaja Iskrba
Lastnik gozda: *Forest owner*:		Sklad kmetijskih zemljišč in gozdov RS Dunajska 58 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Drago VEREŠ in Janez ŠUBIC ZGS – KE Kočevska Reka

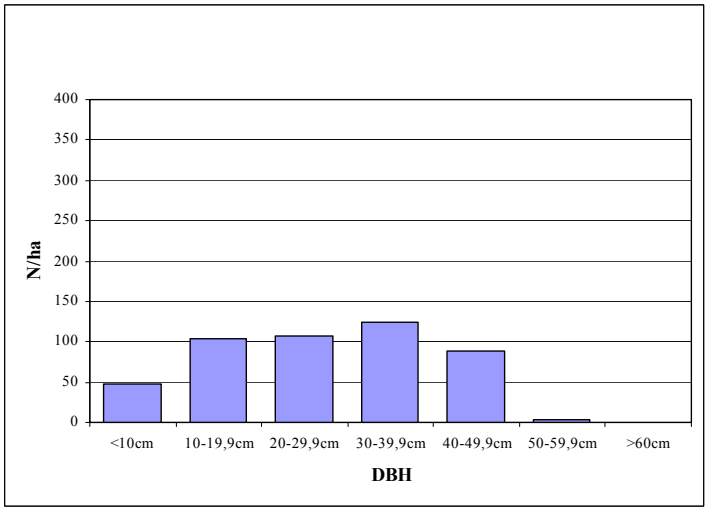
Meritve: *Measurements:* (5) Kočevska Reka

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✓
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✓
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✓
Daljinsko zaznavanje *Remote sensing*		✓



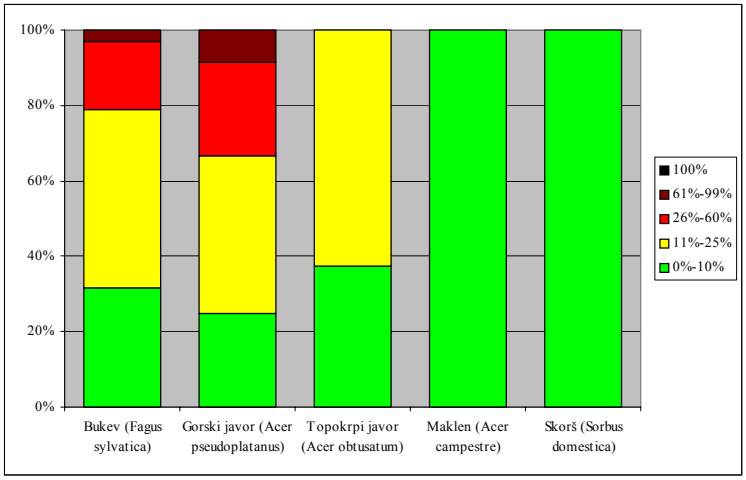
Število dreves/ploskvi
Number of trees/plot

Bukev ***Fagus sylvatica***	**95**
Gorski javor ***Acer pseudoplatanus***	**12**
Topokrpi javor ***Acer obtusatum***	**8**
Maklen ***Acer campestre***	**1**
Skorš ***Sorbus domestica***	**2**



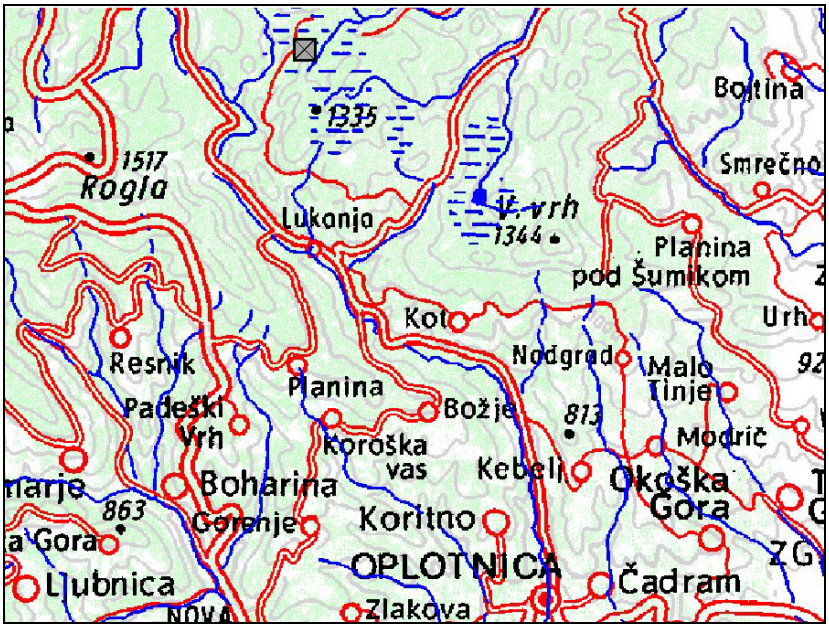
Osutost
Defoliation

Povprečna osutost *Average defoliation*	**19,9%**
Delež poškodovanih dreves Share of damaged trees	**20,2%**



Osnovni podatki: *Basic data:* (6) Pohorje

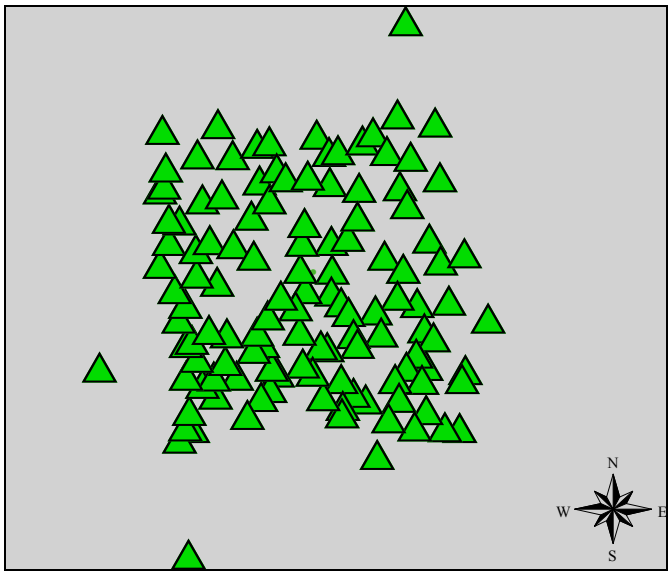
Ploskev št.: *Plot no.:*		6
Ime ploskve: *Plot name:*		Kladje
Občina: *Community:*		Slovenska Bistrica
Karta (TK25): *Map (TK25):*		014-2-2
Gausss-Krüger	X	5 530 522
	Y	5 147 809
Zemljepisna dolžina: *Longitude*:		+15°23´32˝
Zemljepisna širina: *Latitude*:		+46°28´27˝
Postavljena: *Installed*:		21.05.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		1304 m
Ekspozicija: *Exposition*:		287°
Starost: *Age*:		80 let / *years*
Sklep: *Closure*:		Rahel *Loose*
Naklon: *Inclination*:		0°-5°
Glavna drevesna vrsta: Main tree species:		Smreka (*Picea abies*)
Ekološka regija: Ecological region:		Pohorska
Višinski pas: *Elevation zones*:		Altimontanski
Matična podlaga:: *Parent material*:		Dioritoid (Tonalit) *Dioritoid (Tonalite)*
Tip tal: *Soil unit*:		Distrična rjava tla *Dystric Cambisols*
Gozdna združba: *Forest community*:		Drugotni gozd smreke z vijugasto masnico (*Avenello flexuosae-Piceetum*)
Meteorološki podatki: *Meteorological data*:		ARSO – postaja Rogla
Lastnik gozda: *Forest owner*:		Sklad kmetijskih zemljišč in gozdov RS Dunajska 58 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Igor AHEJ ZGS – OE Maribor



Meritve: *Measurements:*

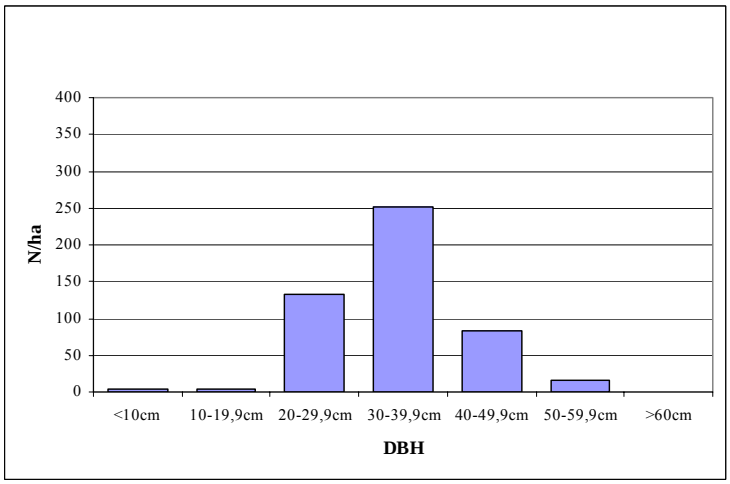
(6) Pohorje

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✓*
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✗
Daljinsko zaznavanje *Remote sensing*		✓



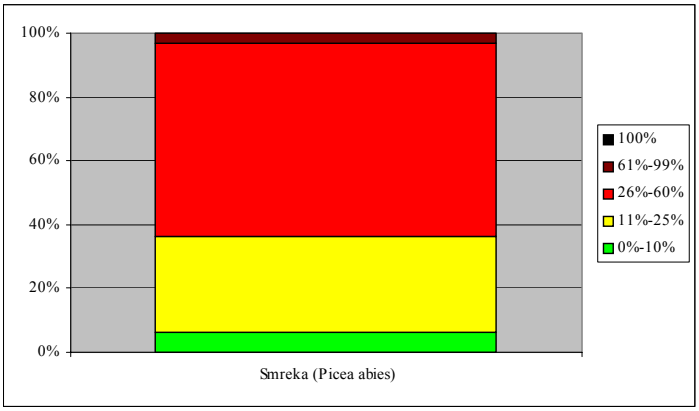
Število dreves/ploskvi
Number of trees/plot

Smreka ***Picea abies***	**124**



Osutost
Defoliation

Povprečna osutost *Average defoliation*	**32,9%**
Delež poškodovanih dreves Share of damaged trees	**63,7%**



Osnovni podatki: *Basic data:* (7) Paški Kozjak

Ploskev št.: *Plot no.:*		7
Ime ploskve: *Plot name:*		Smolnik
Občina: *Community:*		Dobrna
Karta (TK25): *Map (TK25):*		014-1-2
Gausss-Krüger	X	5 518 116
	Y	5 137 628
Zemljepisna dolžina: *Longitude*:		+15°12´00″
Zemljepisna širina: *Latitude*:		+46°21´20″
Postavljena: *Installed*:		30.06.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		1000 m
Ekspozicija: *Exposition*:		30°
Starost: *Age*:		80 let / *years*
Sklep: *Closure*:		Normalen *Normal*
Naklon: *Inclination*:		28°
Glavna drevesna vrsta: Main tree species:		Bukev (*Fagus sylvatica*)
Ekološka regija: Ecological region:		Predalpska *Pre-alpine*
Višinski pas: *Elevation zones*:		Montanski
Matična podlaga:: *Parent material*:		Dolomit *Dolomite*
Tip tal: *Soil unit*:		Rendzina *Rendzic Leptosols*
Gozdna združba: *Forest community*:		Bukov gozd z velecvetno mrtvo koprivo (*Lamio orvalae-Fagetum*)
Meteorološki podatki: *Meteorological data*:		ARSO – postaja Velenje in TEŠ – postaja Graška Gora
Lastnik gozda: *Forest owner*:		Družina Galle
Oskrbnik ploskve: *Plot manager*:		Boris ŽEROVNIK ZGS- OE Celje

Meritve: *Measurements:* (7) Paški Kozjak

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✗
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✗
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		
Daljinsko zaznavanje *Remote sensing*		✓

Število dreves/ploskvi
Number of trees/plot

Osutost
Defoliation

Povprečna osutost *Average defoliation*	**%**
Delež poškodovanih dreves Share of damaged trees	

Osnovni podatki: *Basic data:* (8) Zasavje

Ploskev št.: *Plot no.:*		8
Ime ploskve: *Plot name:*		Lontovž
Občina: *Community:*		Trbovlje
Karta (TK25): *Map (TK25):*		014-3-3
Gausss-Krüger	X	5 505 437
	Y	5 107 755
Zemljepisna dolžina: *Longitude*:		+15°03´50″
Zemljepisna širina: *Latitude*:		+46°05´45″
Postavljena: *Installed*:		04.07.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		950 m
Ekspozicija: *Exposition*:		290°
Starost: *Age*:		80 let / *years*
Sklep: *Closure*:		Normalen *Normal*
Naklon: *Inclination*:		20°-25°
Glavna drevesna vrsta: Main tree species:		Bukev (*Fagus sylvatica*)
Ekološka regija: Ecological region:		Predalpska *Pre-alpine*
Višinski pas: *Elevation zones*:		Montanski
Matična podlaga:: *Parent material*:		Dolomit *Dolomite*
Tip tal: *Soil unit*:		Rendzina, rjava pokarbonatna tla *Rendzic Leptosols, Eutric Cambisols*
Gozdna združba: *Forest community*:		Bukov gozd z velecvetno mrtvo koprivo (*Lamio orvalae-Fagetum*)
Meteorološki podatki: *Meteorological data*:		ARSO – postaja Dobovec in Kum TET – postaja Kovk
Lastnik gozda: *Forest owner*:		Sklad kmetijskih zemljišč in gozdov RS Dunajska 58 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Milan BAJDA ZGS – OE Ljubljana

Meritve: *Measurements:*

(8) Zasavje

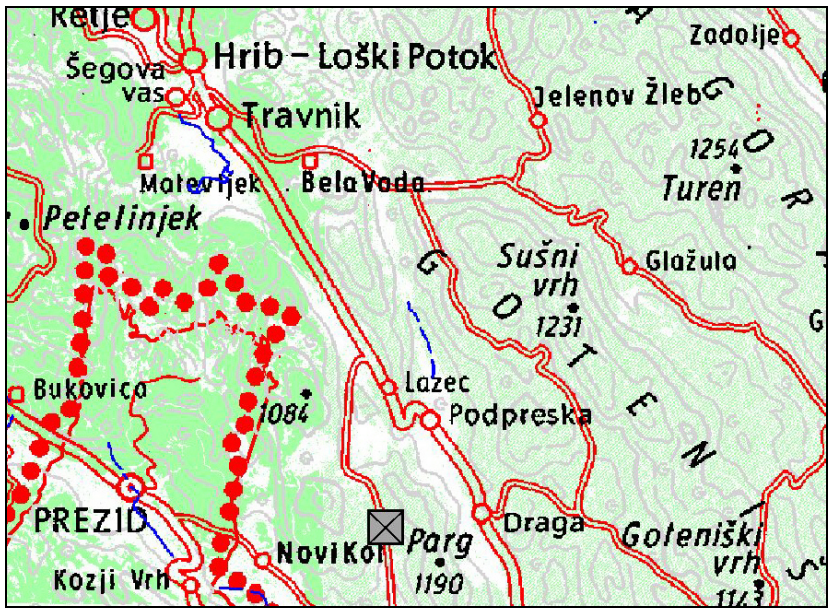
	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✓
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✓
Daljinsko zaznavanje *Remote sensing*		✓

Število dreves/ploskvi *Number of trees/plot*

Osutost *Defoliation*	
Povprečna osutost *Average defoliation*	**%**
Delež poškodovanih dreves Share of damaged trees	

Osnovni podatki: *Basic data:* (9) Loški potok

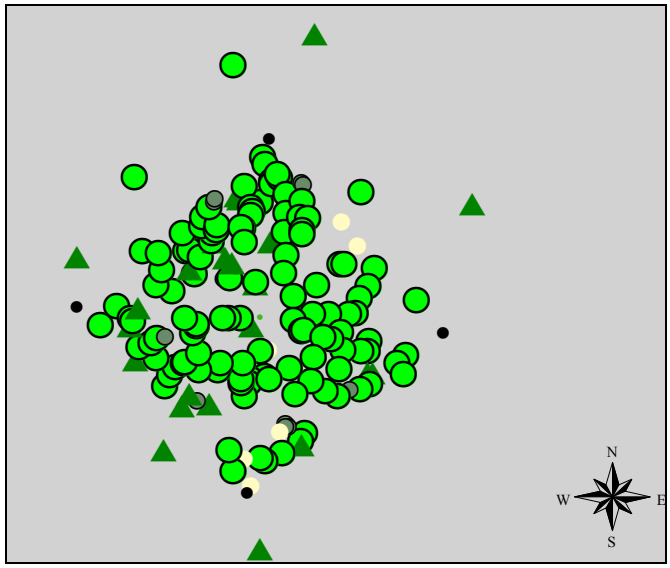
Ploskev št.: *Plot no.:*		9
Ime ploskve: *Plot name:*		Travljanska gora
Občina: *Community:*		Loški potok
Karta (TK25): *Map (TK25):*		030-2-2
Gausss-Krüger	X	5 471 818
	Y	5 054 755
Zemljepisna dolžina: *Longitude*:		+14°38´01″
Zemljepisna širina: *Latitude*:		+45°38´11″
Postavljena: *Installed*:		
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		955 m
Ekspozicija: *Exposition*:		
Starost: *Age*:		/ *years*
Sklep: *Closure*:		Rahel *Loose*
Naklon: *Inclination*:		
Glavna drevesna vrsta: Main tree species:		Jelka (*Abies alba*)
Ekološka regija: Ecological region:		Dinarska *Dinaric*
Višinski pas: *Elevation zones*:		Montanski
Matična podlaga:: *Parent material*:		Dolomit *Dolomite*
Tip tal: *Soil unit*:		Rendzina, rjava pokarbonatna tla *Rendzic Leptosols, Eutric Cambisols*
Gozdna združba: *Forest community*:		Dinarski jelovo-bukov gozd s spomladansko torilnico (*Omphalodo-Fagetum*)
Meteorološki podatki: *Meteorological data*:		ARSO – postaja Trava
Lastnik gozda: *Forest owner*:		Sklad kmetijskih zemljišč in gozdov RS Dunajska 58 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Matjaž PAJNIČ ali Stanko ANZELJC ZGS – OE Kočevje



Meritve: *Measurements:*

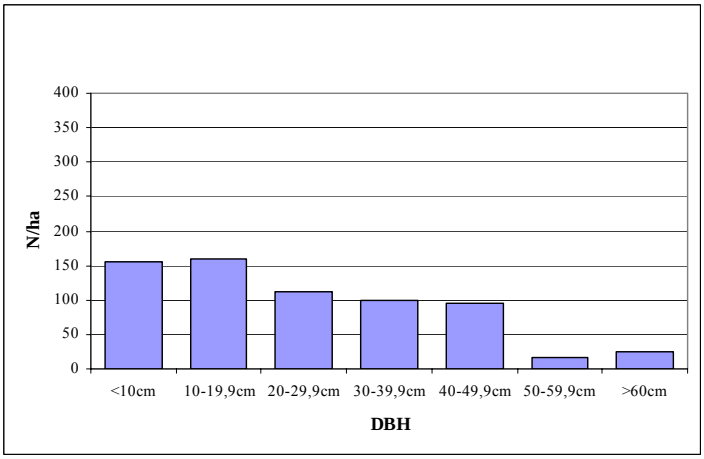
(9) Loški potok

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✗
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✗
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✓
Daljinsko zaznavanje *Remote sensing*		✓



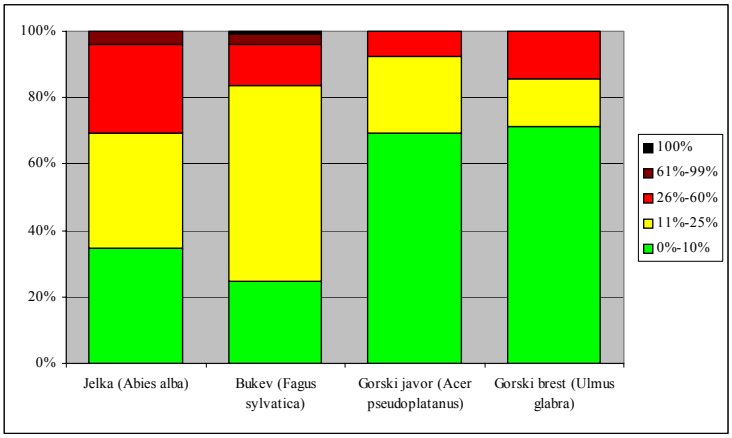
Število dreves/ploskvi
Number of trees/plot

Jelka ***Abies alba***	**23**
Bukev ***Fagus sylvatica***	**121**
Gorski javor ***Acer pseudoplatanus***	**13**
Gorski brest ***Ulmus glabra***	**7**



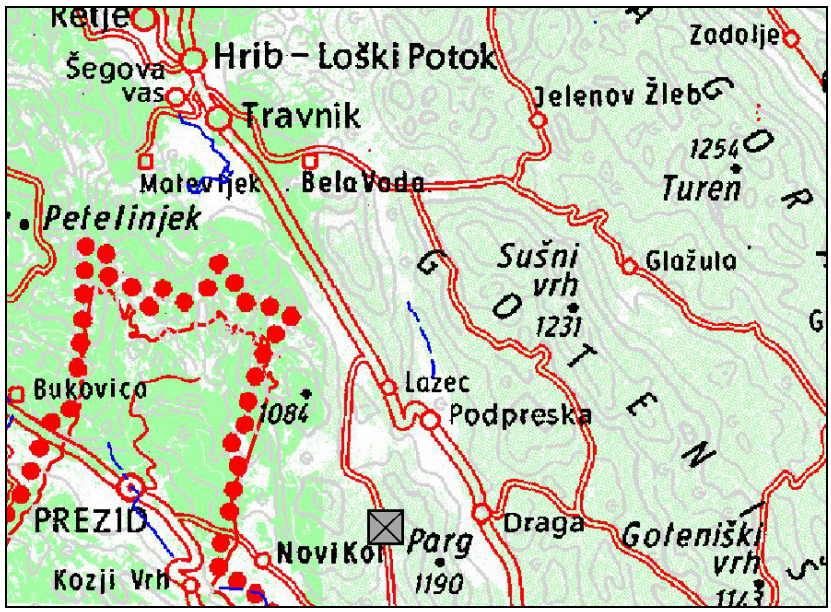
Osutost
Defoliation

Povprečna osutost *Average defoliation*	**19,4%**
Delež poškodovanih dreves Share of damaged trees	**15,9%**



Osnovni podatki: *Basic data:* (10) Kostanjevica

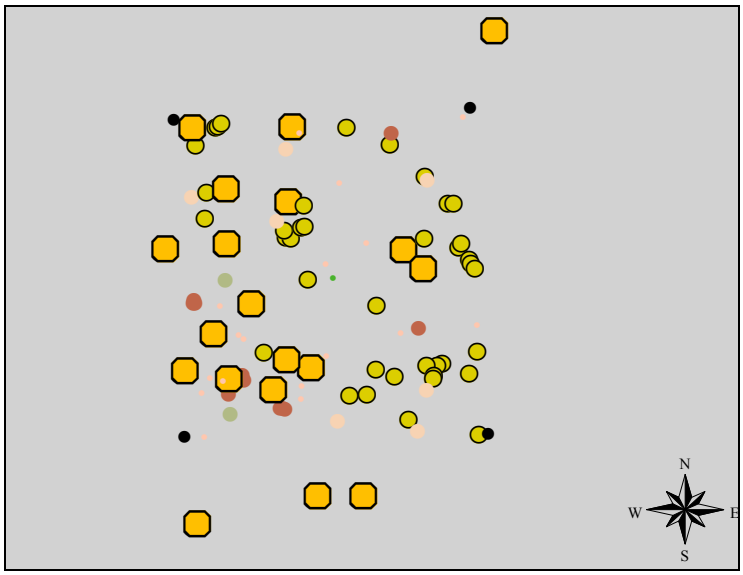
Ploskev št.: *Plot no.:*		10
Ime ploskve: *Plot name:*		Krakovski Gozd
Občina: *Community:*		Krško
Karta (TK25): *Map (TK25):*		031-2-2
Gausss-Krüger	X	5 532 688
	Y	5 082 059
Zemljepisna dolžina: *Longitude*:		+15°24´59″
Zemljepisna širina: *Latitude*:		+45°52´55″
Postavljena: *Installed*:		28.05.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		160 m
Ekspozicija: *Exposition*:		
Starost: *Age*:		130 let / *years*
Sklep: *Closure*:		Rahel *Loose*
Naklon: *Inclination*:		0°
Glavna drevesna vrsta: Main tree species:		Dob (*Quercus robur*)
Ekološka regija: Ecological region:		Predpanonska *Pre-pannonian*
Višinski pas: *Elevation zones*:		Kolinski
Matična podlaga:: *Parent material*:		Pleistocenski sedimenti *Pleistocene sediments*
Tip tal: *Soil unit*:		Oglejena tla *Gleysols*
Gozdna združba: *Forest community*:		Gozd doba oz. belega gabra z evropsko gomoljčico (*Pseudostellario europaeae–Quercetum roboris / Pseudostellaria europaeae–Carpinetum betuli*)
Meteorološki podatki: *Meteorological data*:		NEK – postaja Cerklje
Lastnik gozda: *Forest owner*:		Nadškofija Ljubljana Ciril Metodov trg 4 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Miloš KLAUS ZGS – OE Brežice



Meritve: *Measurements:*

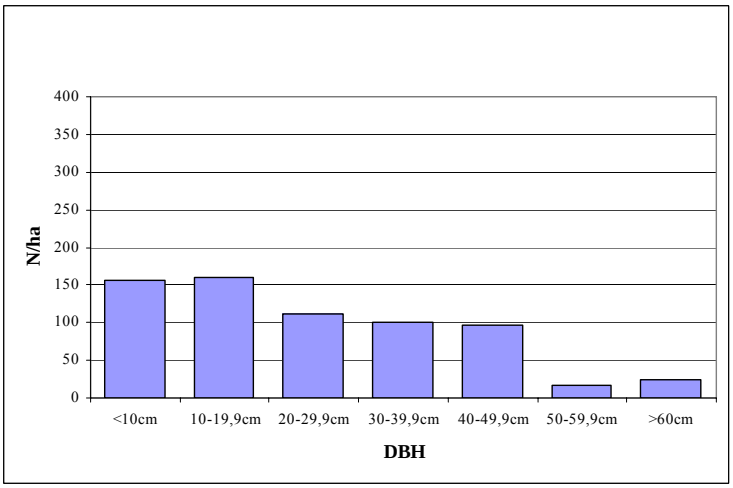
(10) Kostanjevica

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✓*
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✗
Daljinsko zaznavanje *Remote sensing*		✓



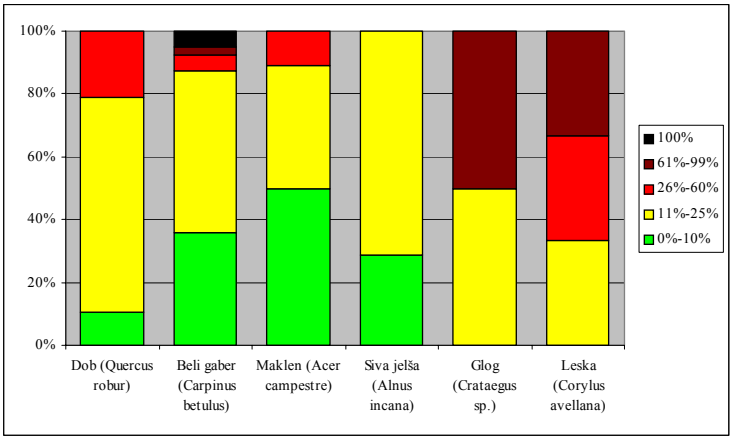
Število dreves/ploskvi
Number of trees/plot

Dob ***Quercus robur***	**19**
Beli gaber ***Carpinus betulus***	**39**
Maklen ***Acer campestre***	**18**
Siva jelša ***Anus incana***	**7**
Glog ***Crataegus sp.***	**2**
Leska ***Corylus avellana***	**12**



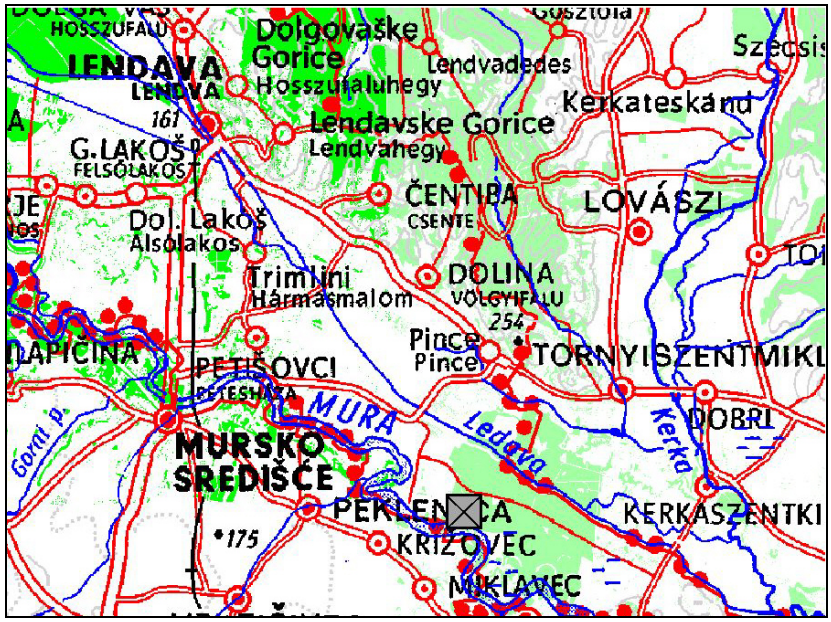
Osutost
Defoliation

Povprečna osutost *Average defoliation*	**21,9%**
Delež poškodovanih dreves Share of damaged trees	**19,6%**



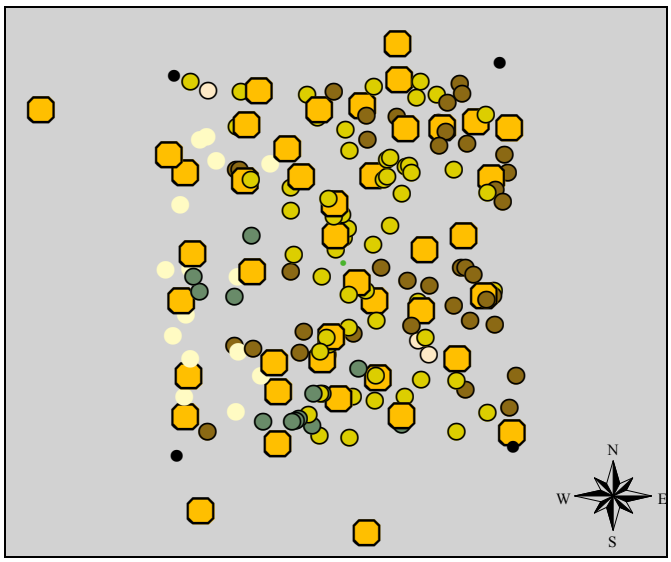
Osnovni podatki: *Basic data:* (11) Lendava

Ploskev št.: *Plot no.:*		11
Ime ploskve: *Plot name:*		Murska Šuma
Občina: *Community:*		Lendava
Karta (TK25): *Map (TK25):*		017-1-1
Gausss-Krüger	X	5 616 509
	Y	5 151 426
Zemljepisna dolžina: *Longitude*:		+16°30´46″
Zemljepisna širina: *Latitude*:		+46°29´49″
Postavljena: *Installed*:		03.07.2003
Površina: *Size*:		0,25 ha
Skupna površina: *Total size*:		1,0 ha
Nadmorska višina: *Altitude*:		170 m
Ekspozicija: *Exposition*:		
Starost: *Age*:		130 let / *years*
Sklep: *Closure*:		Normalen *Normal*
Naklon: *Inclination*:		0°
Glavna drevesna vrsta: Main tree species:		Dob (*Quercus robur*)
Ekološka regija: Ecological region:		Predpanonska *Pre-pannonian*
Višinski pas: *Elevation zones*:		Kolinski
Matična podlaga:: *Parent material*:		Rečni nanosi *Alluvium*
Tip tal: *Soil unit*:		Oglejena tla *Gleysols*
Gozdna združba: *Forest community*:		Gozd doba in belega gabra (*Querco roboris-Carpinetum*)
Meteorološki podatki: *Meteorological data*:		ARSO – postsja Murska Sobota in Lendava
Lastnik gozda: *Forest owner*:		Sklad kmetijskih zemljišč in gozdov RS Dunajska 58 1000 Ljubljana
Oskrbnik ploskve: *Plot manager*:		Janez KOLENKO ZGS – OE Murska Sobota



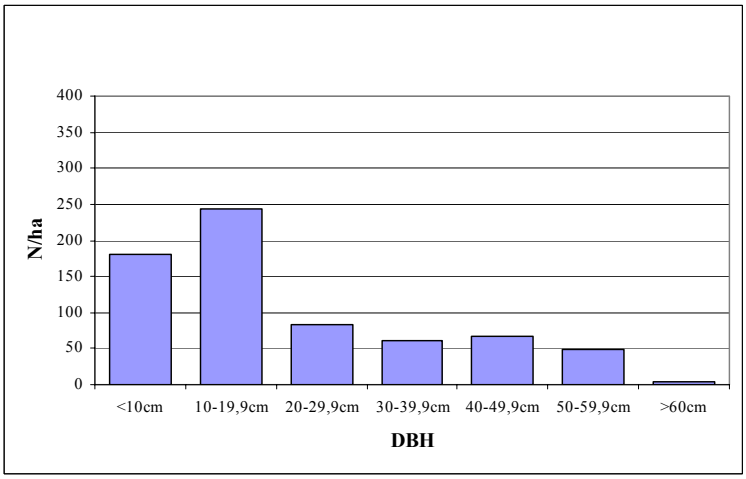
Meritve: *Measurements:* (11) Lendava

	Pogostost *Frequency*	
Stanje krošenj: *Crown condition*	Letno *Annually*	✓
Vsebnost elementov v listju/iglicah *Foliar analysis*	Vsaki 2 leti *Every 2 years*	✓
Lastnosti in stanje tal *Soil survey*	Vsakih 10 let *Every 10 years*	✓
Kemizem talne raztopine *Soils solution analysis*	Stalno *Continuously*	✗
Rast dreves *Icreament measurements*	Vsakih 5 let *Every 5 years*	✓
Pritalna vegetacija *Ground vegetation assessment*	Vsakih 5 let *Every 5 years*	✓
Zračne usedline *Deposition measurements*	Stalno *Continuously*	✓
Meteorološki podatki *Meteorological measurements*	Stalno *Continuously*	✓
Fenologija *Phenological observations*	Stalno *Continuously*	✓
Kakovost zraka *Air quality*		✗
Daljinsko zaznavanje *Remote sensing*		✓



Število dreves/ploskvi
Number of trees/plot

Dob ***Quercus robur***	**43**
Gorski javor ***Acer pseudoplatanus***	**13**
Maklen ***Acer campestre***	**40**
Gorski brest ***Ulmus glabra***	**15**
Beli gaber ***Carpinus betulus***	**57**
Češnja ***Prunis avium***	**4**



Osutost
Defoliation

Povprečna osutost *Average defoliation*	**27,8%**
Delež poškodovanih dreves Share of damaged trees	**39,8%**