Monitoring of Forest Ecosystems

Forest monitoring and assessment

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FOREST MONITORING SYSTEMS ARE DEFINED AS PROCESSES THAT SUPPORT STRATEGIC DECISION-MAKING BY

(Forest monitoring and assessment for climate change reporting: partnerships, ... //www.fao.org/docrep/010/k1276e/K1276E04.htm)

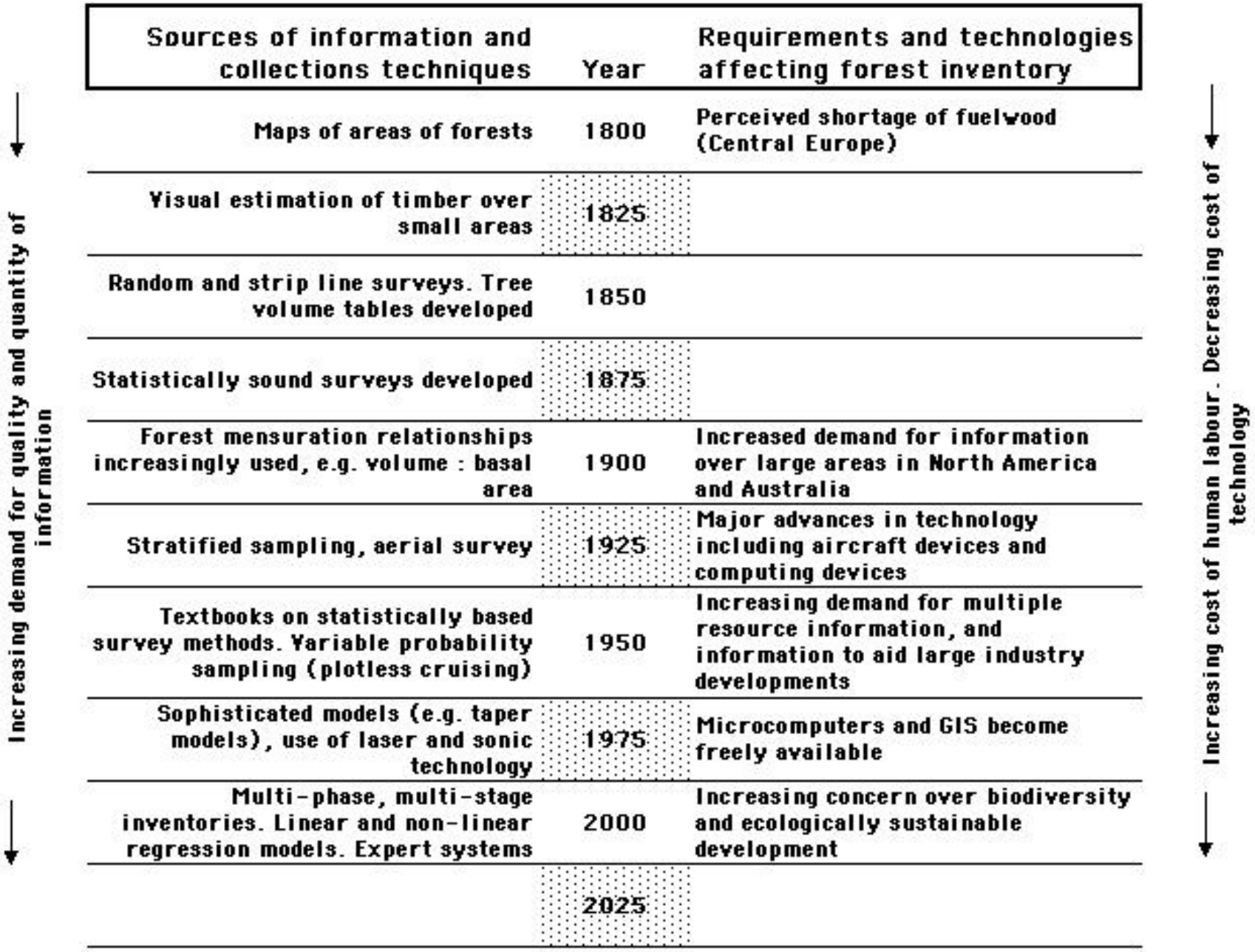
- systematically and repeatedly measuring and observing forest resources, their management, …;
- periodically delivering valid, representative and relevant information on status and trends for the country as a whole.

The purposes of national forest monitoring can be defined by objectives as expressed by relevant policy processes, under the assumption that such objectives also, implicitly, express a demand for systematic and quality-controlled information.

National forest monitoring systems need to be designed to deliver cost-effective and quality-controlled information across the issues

- Socio-cultural: Rural livelihoods, Indigenous people's rights, Rights of access, Tenure and land ownership..
- Economic: Poverty, Food security, Wood productivity and supply, Valuation of forest products and services, Equity, Trade, Energy…
- Environmental: Biological diversity, Soil and water protection, Climate change, Desertification, Air pollution, Invasive species, Wildfire, Pests…

Source: Matteucci G. (ISAFOM)



Source: Matteucci G. (ISAFOM)

Research and Monitoring in the field: a long-history in forest ecosystems

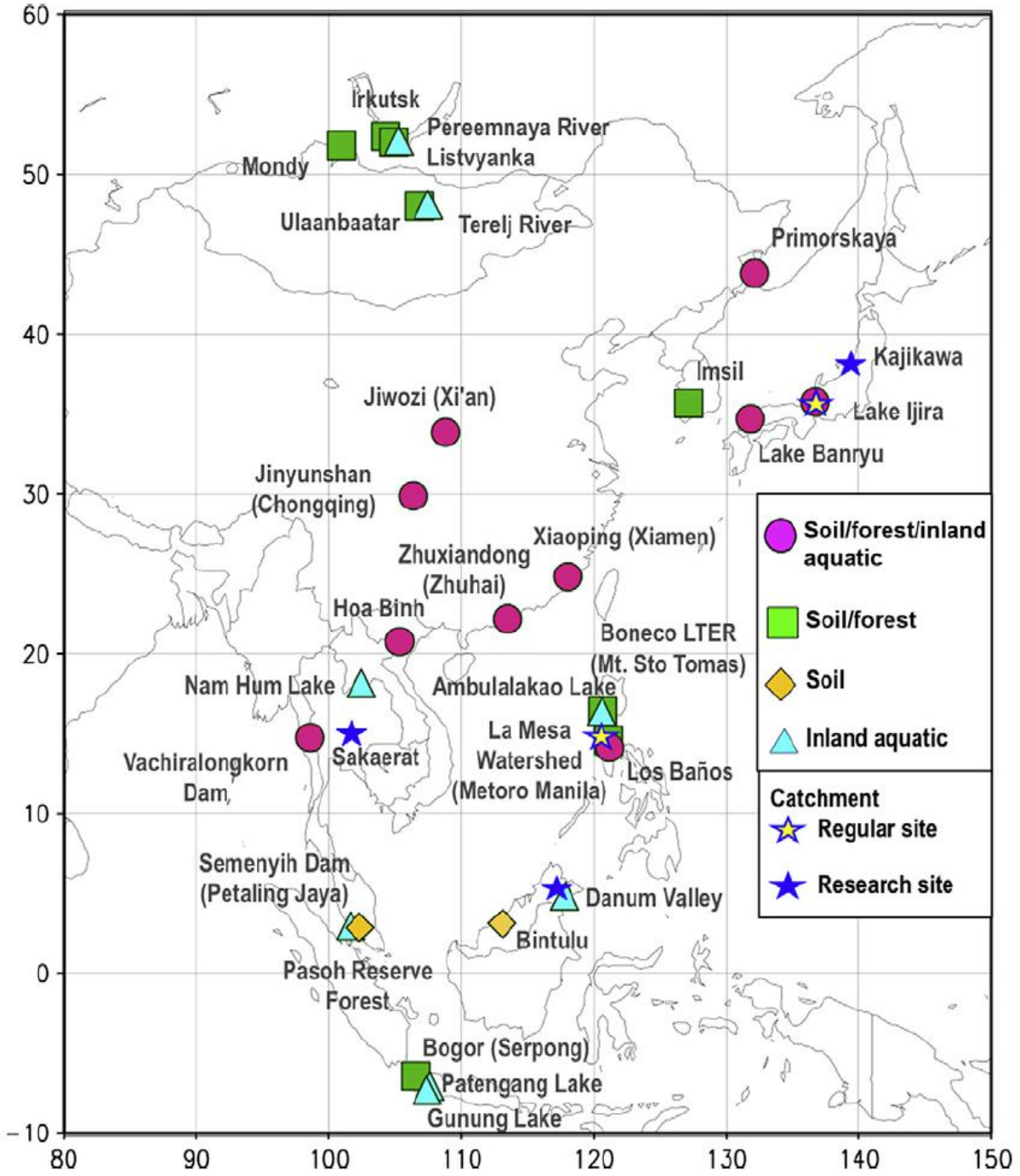
- Ensure forest production in Europe – first field experiments 1850-1920
  - Forest inventories
  - Thinning experiments, growth & yield plots, etc.
  - Regeneration and stand development
- Growing environmental concerns – '60 and '70
  - International Biological Programme
  - UNESCO Man and Biosphere
  - Watershed scale experiments
- Forest degradation and dieback - '80 and '90
  - Ecosystem scale experiments
  - Monitoring of health status of forests, response to pollution
- Global changes – from '90 to today
  - Open-top-chamber, manipulation experiments
  - Ecosystem scale fluxes (*eddy covariance*, flux networks)
  - Remote sensing and modelling

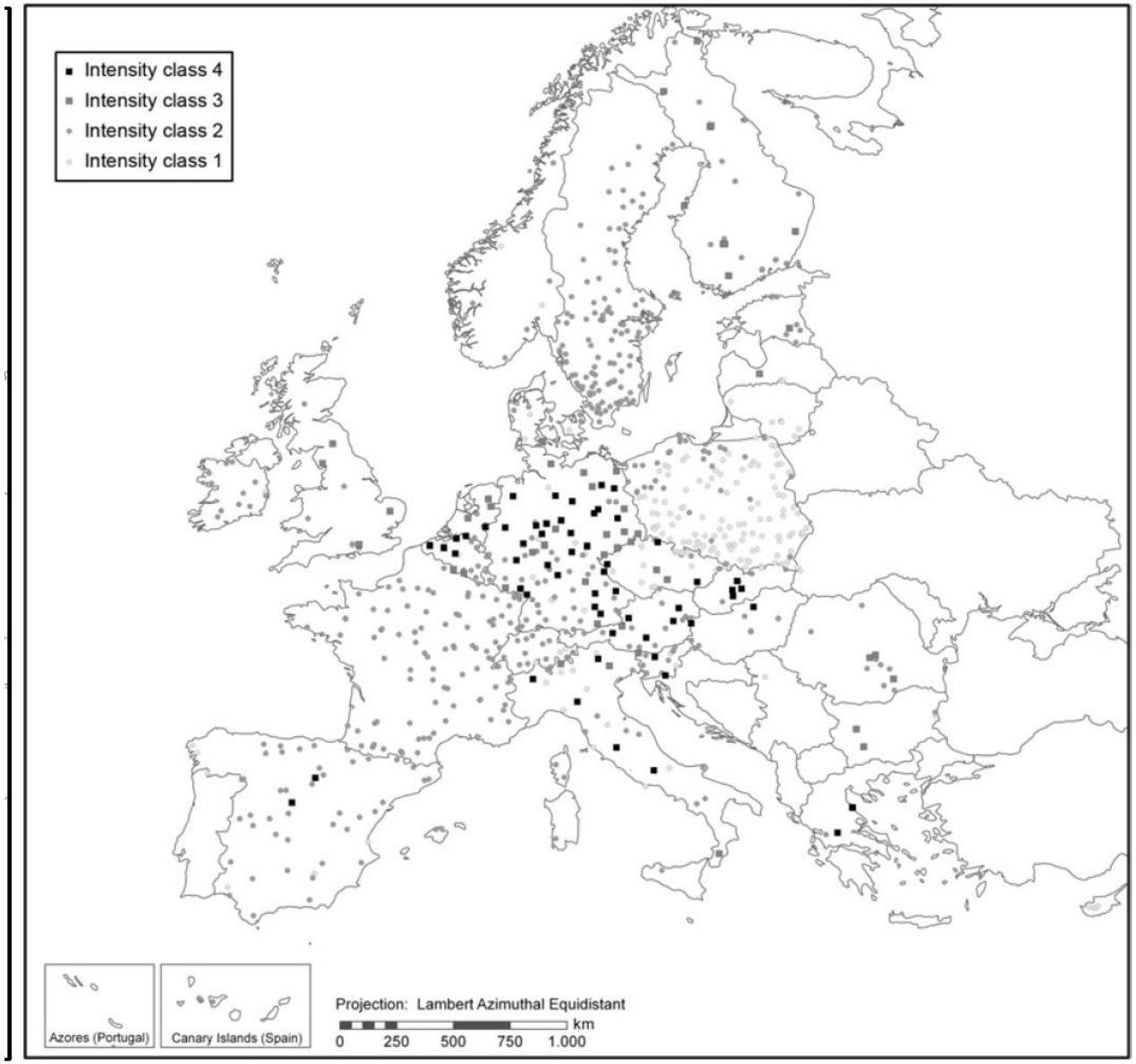
Forest Monitoring (FCM) and Inventories (NFIs)

are networks to get information about primary data sources for large area assessment of forest resources.

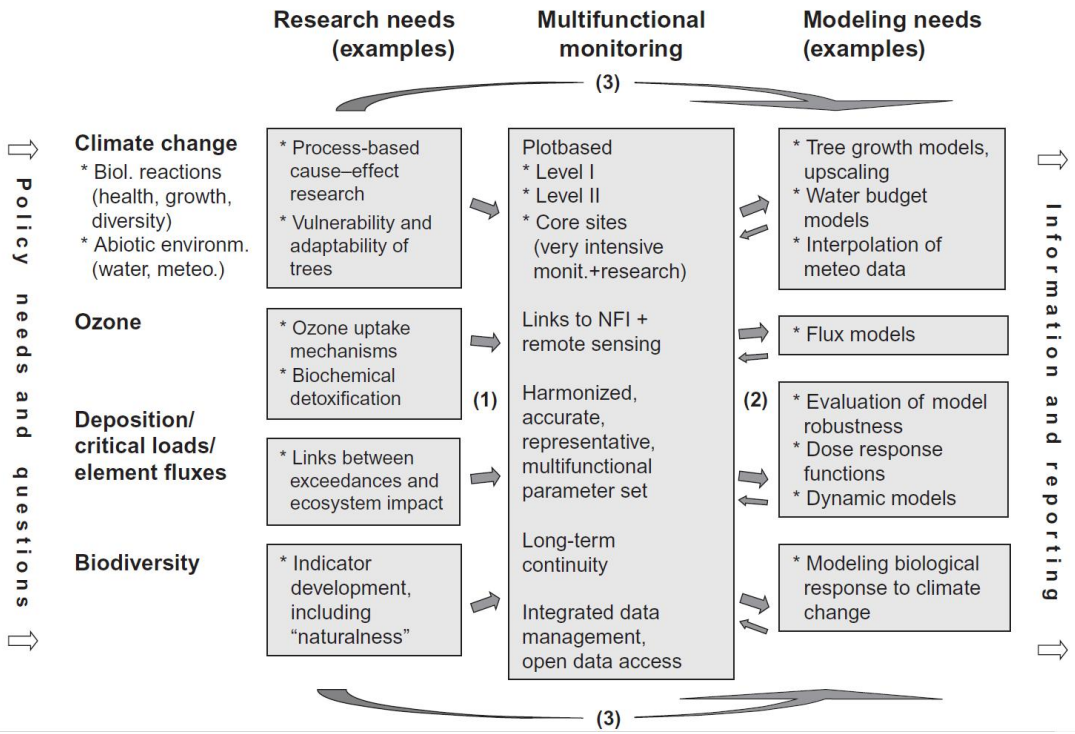
FCM was established in 1980s in response to the concern of monitoring the alleged progressive deterioration of forest condition due to atmospheric pollution (Innes, 1993).

NFIs have been traditionally designed to provide country-based estimates on the kind, amount, and condition of timber and nontimber forest resources (Corona et al.,





Level II plots of ICP Foretsts 2006-2010


Research needs (examples)
Multifunctional monitoring
Modeling needs (examples)
(3)
Policy needs and questions
Information and reporting
Climate change
* Biol. reactions (health, growth, diversity)
* Abiotic environm. (water, meteo.)
Ozone
Deposition/ critical loads/ element fluxes
Biodiversity
* Process-based cause–effect research
* Vulnerability and adaptability of trees
* Ozone uptake mechanisms
* Biochemical detoxification
* Links between exceedances and ecosystem impact
* Indicator development, including “naturalness”
(1)
Plotbased
* Level I
* Level II
* Core sites (very intensive monit.+research)
Links to NFI + remote sensing
Harmonized, accurate, representative, multifunctional parameter set
Long-term continuity
Integrated data management, open data access
* Tree growth models, upscaling
* Water budget models
* Interpolation of meteo data
* Flux models
(2)
* Evaluation of model robustness
* Dose response functions
* Dynamic models
* Modeling biological response to climate change
(3)

Country	*Systematic grid spacing (km × km)*
Albania	–
Andorra	–
Austria	3.889 × 3.889
Belarus	–
Belgium (Walloon Region)	1 × 0.5
Bulgaria	–
Croatia	–
Cyprus	–
Czech Rep.[a]	2 × 2
Denmark	2 × 2
Estonia	5 × 5
Finland	3 × 3 to 10 × 10
France[a]	1.41 × 1.41
Germany	2 × 2 to 4 × 4
Greece	–
Hungary	–
Ireland[a]	2 × 2
Italy[a]	1 × 1
Latvia	2 × 2 to 4 × 4
Liechtenstein	–
Lithuania	4 × 4
Luxembourg	1 × 0.5

Members

The ENFIN group was established in 2003 with a core group of 17 members. Since then the number of participating countries and organisations has been increasing steadily. Currently, the ENFIN group is composed 32 different organisations from 29 member countries.

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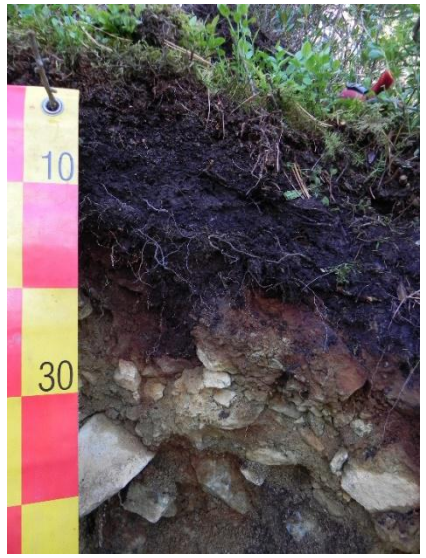
National Forest Inventories (NFI) represent comprehensive, reliable, large-scale monitoring systems. ENFIN serves as a European network to promote NFIs, harmonise forest information and support a broad range of forest related policies.

Adopted by		
rests Level I		
		Number of plots
2010		
		622
		11
		1651
		1957
2010		
		239
		288
		130
		108
		44
		620
		3149
		48
		555
		1505
		80

renz, 2011).

Example - Slovenia: Pyramids of different levels of monitoring of the condition of Slovenian forests, at different levels, intensity and purposes as part of Slovenian forestry information system



Main objectives of the ICP Forest Forest monitoring are:

The objective of the programme is to gain insight into spatial and temporal changes of the forests‘, condition and to as certain the impacts of stress factors, including air pollution, on forests.

Monitoring of forest damages, which are followed via defoliation indicators and inventory of tree damages; the objectives of forest damage monitoring at level I plots are (1985 -):

- periodic information on spatial and temporal trends of tree vitality at the levels of the country and EU;
- to ascertain the trend of health condition of tree species and forest degradation;
- and to report on condition of forests at different spatial levels, such as national reports as stipulated by the

The work at Level II („intensive monitoring of forest ecosystems“; 1993/4 -): is monitoring of the changes in indicators and processes: crown defoliation of tree leaves, health condition of trees, LAI, tree growth, vegetation changes, phenology, forest floor/soils, mineral nutrition of trees, pollutants deposition, input and output of matter (q&q of precipitation, leaf-litter dynamics, quality of soil solution), meteorological parameters, presence and signs of vegetation damage owing to O_3, ….

Diverse forest structure and tree species composition

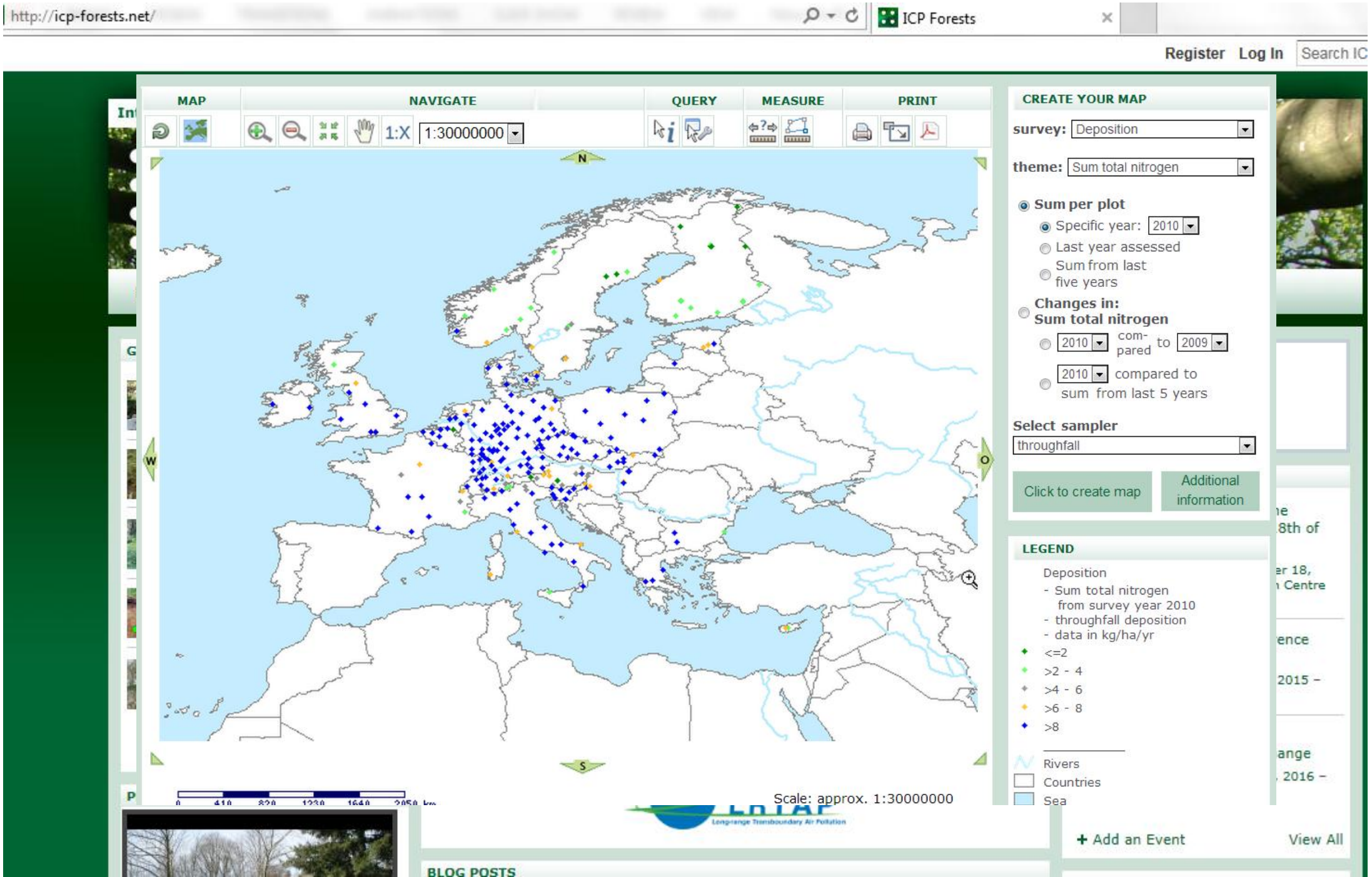
Forests cover 1.2 million ha of the Slovenia's total land. 35% of the forests belong to the group of even-aged forests, 57% to uneven-aged, ca. 4% to coppice and the rest to other groups such as multilayer forest, bushy forest, and so forth. Out of the total forestland 75% of forests are private and 25% of them belong to the state and municipalities (SFI 2013).

Areas under nature protection encompass 39,7% of the national territory. This area includes diverse protected areas, such as national, regional and landscape parks and diverse reservations and areas belonging to the Natura 2000 network. Approximately 70% of this territory belongs to forests.

Natural regeneration is the prevalent way of forest regeneration (ca. 97 %). The highest shares of tree species have Norway spruce and European beech (both 31%), silver fir (7%) and oak sp. (ca. 5.5%) (SFI 2013).

Other forest statistics (SFI 2013 – UNFCCC_KP_NFI 2012):

- Mean growing stock volume: 333,9 m^3/ha;
- Total growing stock volume: 400,68 million m^3;
- Mean gross growing stock volume increment: 8,60 m^3/ha;
- Total annual growing stock vol increment: 10,32 million m^3;
- Planned annual harvest: 6,0 million m^3 (1,5% of the total growing stock volume);
- Mean deadwood volume: 19,83 m^3/ha;
- Total deadwood volume: 23,8 million m^3.


http://icp-forests.net/
ICP Forests
Register
Log In
Search IC
MAP
NAVIGATE
QUERY
MEASURE
PRINT
1:X
1:30000000
CREATE YOUR MAP
survey:
Deposition
theme:
Sum total nitrogen
Sum per plot
Specific year:
2010
Last year assessed
Sum from last five years
Changes in:
Sum total nitrogen
2010
com-pared
to
2009
2010
compared to sum from last 5 years
Select sampler
throughfall
Click to create map
Additional information
LEGEND
Deposition
- Sum total nitrogen from survey year 2010
- throughfall deposition
- data in kg/ha/yr
<=2
>2 - 4
>4 - 6
>6 - 8
>8
Rivers
Countries
Sea
N
S
W
O
Scale: approx. 1:30000000
+ Add an Event
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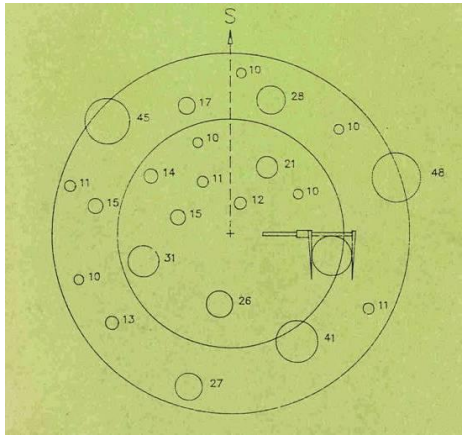
FOREST INVENTORY – Slovenian Forests Service

- Integral part **of forest management**.
- 10 year circle; each year 1/10 of forests is premeasured.
- Combination of field descriptions of all stands and tree measurements at permanent sampling plots (PSP).
- assessment of realized measures:
  - realized cut according to cut type, tree species
  - realized silviculture, protection and other measures by type of measure.
- Forestry chronic & diary, field foresters.

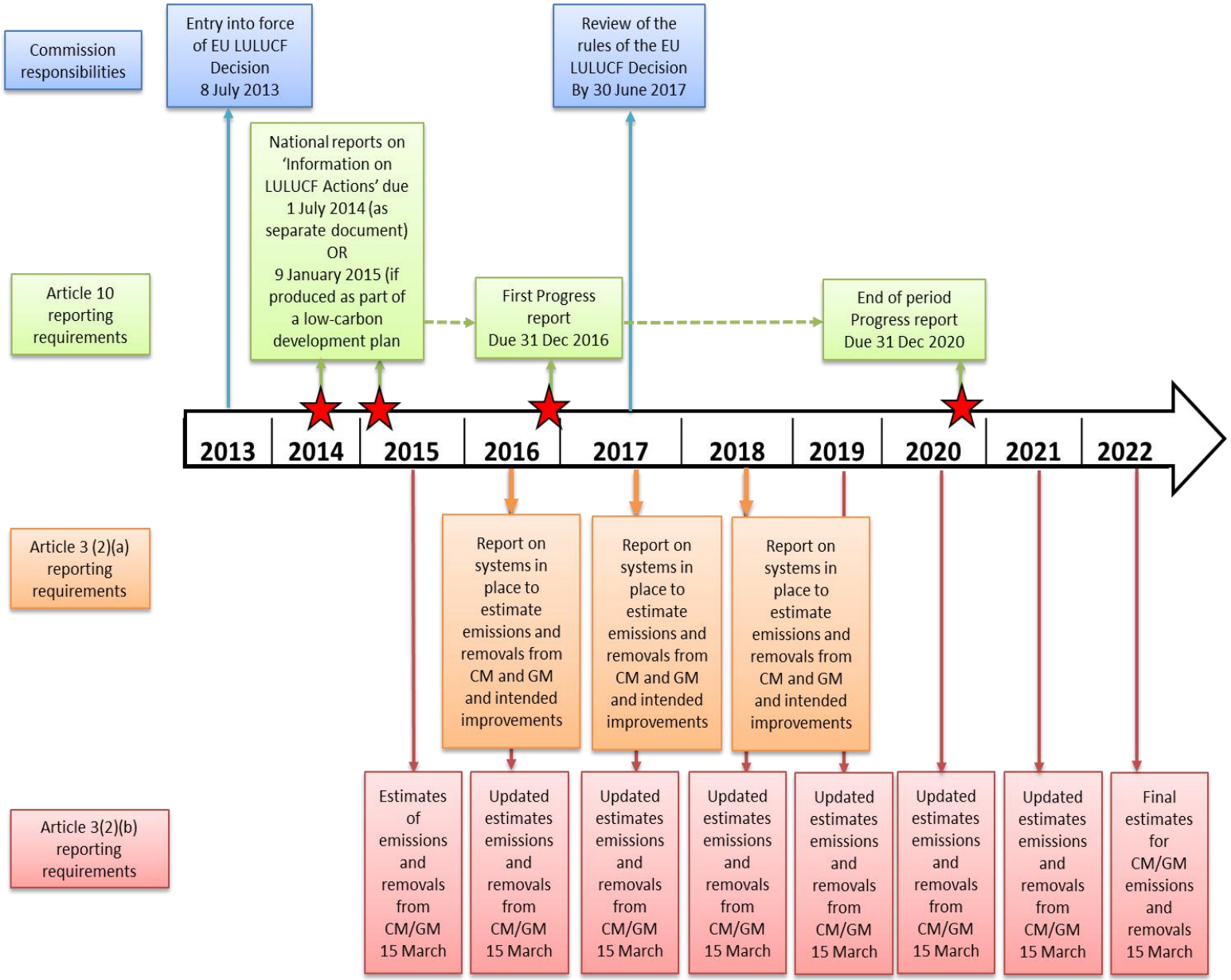
Permanent sampling plots

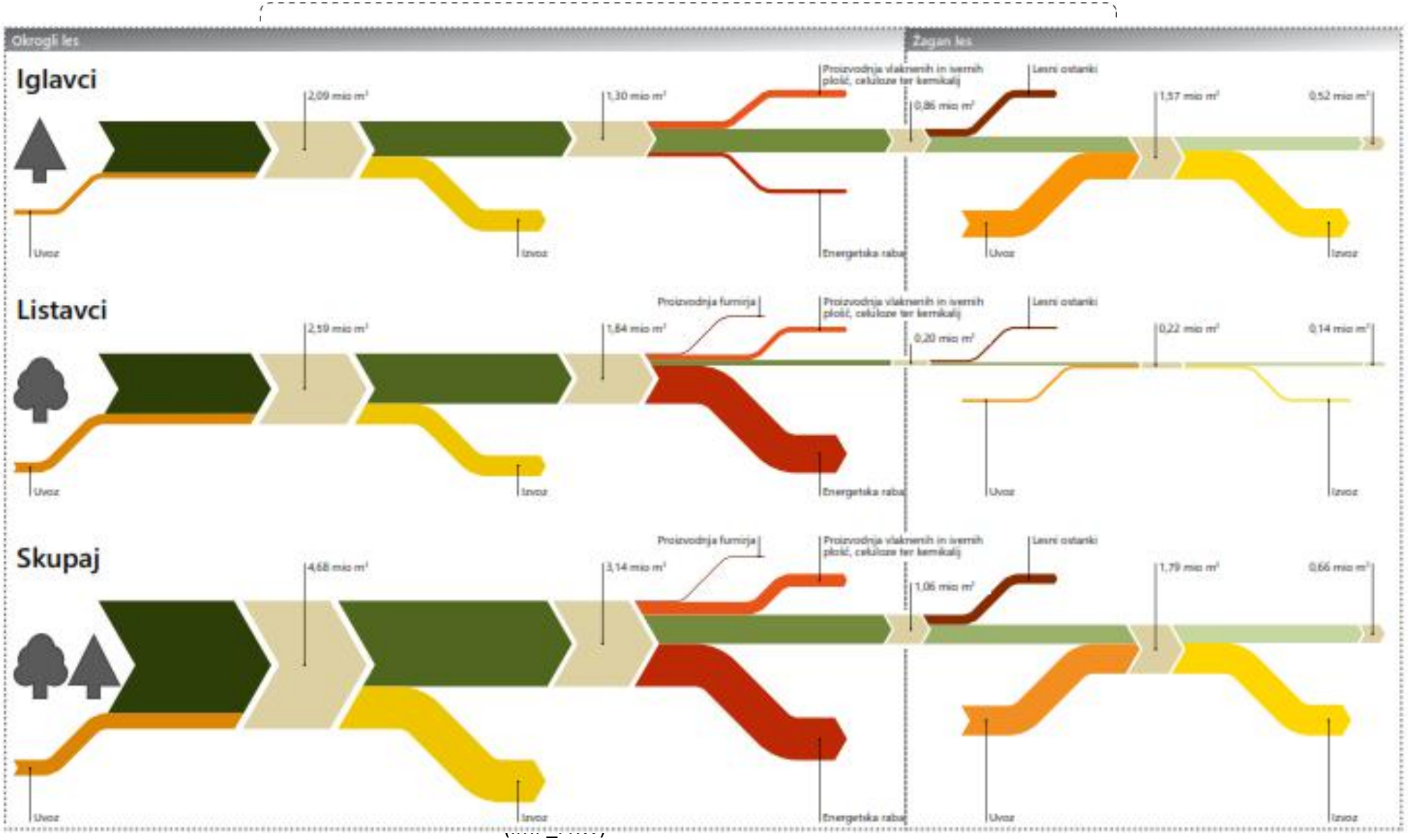
- more than 100.000 plots covering all Slovenian forest
- systematic grid of PSP (250×500 m; 250×250 m)
- two concentric circles (200 and 500 m2)
- smaller circle → trees with dbh ≥10 cm are surveyed; larger circle → trees with dbh ≥30 cm are registered



UNFCCC, KP and EU LULUCF/AFOLU reporting – national reports NIR

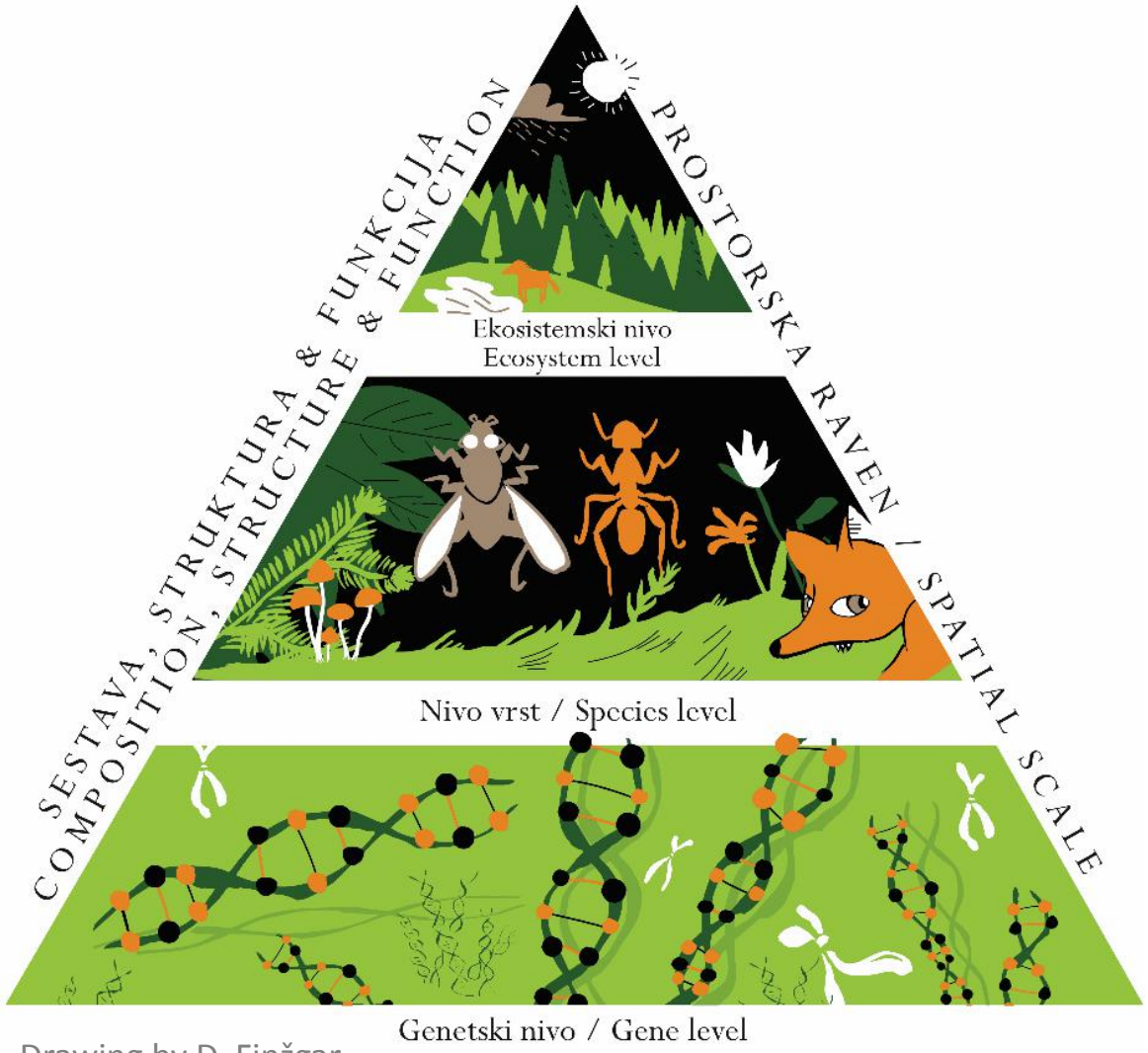
Iterative reporting and planning associated with Art. 10 and Art. 3(2) for accounting period 2013-2020





Fluxes of wood – assessments for Slo for year 2013 (SFI)

Monitoring of genetic diversity - an early warning system to aid the assessment of a species response to environmental change at a long-term temporal scale – started at SFI in 2015 (Life+ EU project)



Drawing by D. Finžgar

Forest genetic monitoring (FGM)

- First proposed by experts from FAO, Group on forest genetic resources in 1996 (Namkoong *et al.* 1996, 2002)
- Simplified for practical use by experts from EUFORGEN working group on forest genetic monitoring (Aravanopoulos *et al.* 2013) and German programme for conservation of forest genetic resources (Konnert *et al.* 2011)

Need (e.g. Koskela *et al.* 2012) **and mandate** (CBD, Article 7) **to**:

- develop methodology of FGM
- implement and test FGM in practice

http://www.lifegenmon.si/

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LIFE FOR EUROPEAN FOREST GENETIC MONITORING SYSTEM

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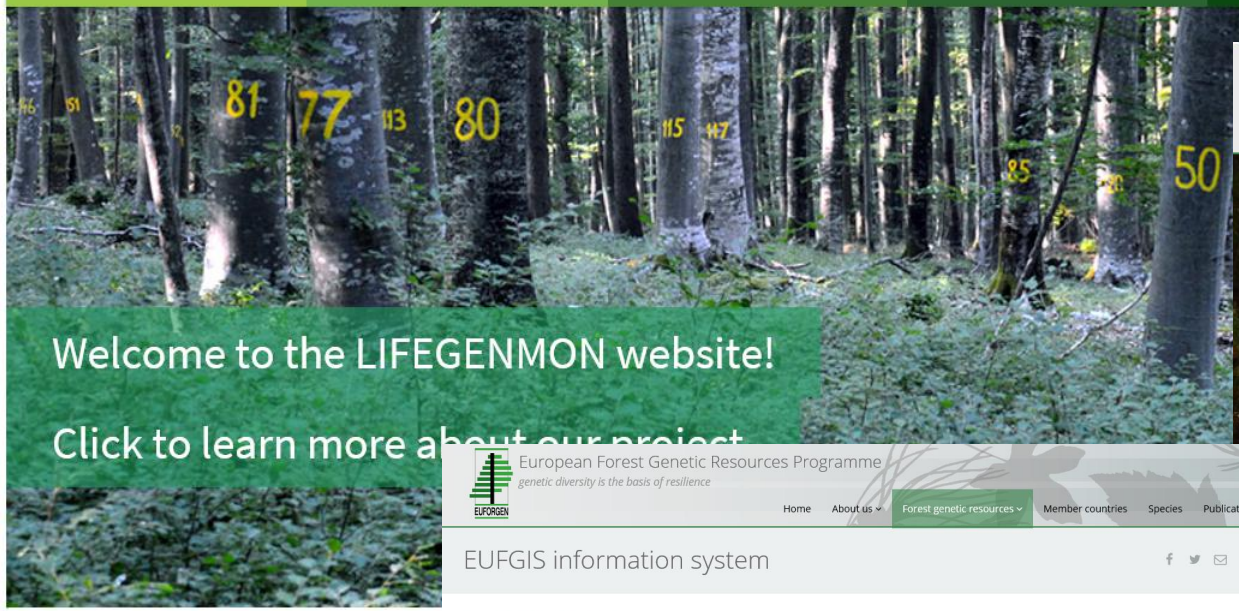

Welcome to the LIFEGENMON website!

Click to learn more about our project

What's new?

Forest science is alive and well: 10 point

11 Oct 2017

The LIFEGENMON project was presented at the IUFRO 125th Anniversary Congress

Freiburg, Germany, 18-22 September 2017

LIFEGENMON project was presented at the IUFRO 125th Anniversary Congress in Session 45 "Forest policy and biodiversity strategy: The relevance of forest genetic resources" .

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Oct 25, 2017

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genetic diversity is the basis of resilience

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EUFGIS information system

Home › Forest genetic resources › EUFGIS information system

This information system provides geo-referenced information on the conservation of forest genetic resources in Europe and access to detailed data on genetic conservation units of forest trees in different countries. The data is provided and updated by national focal points based on pan-European minimum requirements and data standards for the units.

EUFGIS serves as a documentation platform linking national inventories on forest genetic resources in Europe. This supports the countries in their efforts to conserve forest genetic resources as part of sustainable forest management, as agreed in the context of Forest Europe.

The countries can use EUFGIS for various reporting efforts, such as the State of Europe's Forests and the State of World's Forest Genetic Resources reports. It can also be used for identifying gaps in genetic conservation efforts within the distribution ranges of forest trees, developing genetic conservation strategies for forest trees at pan-European level and sampling tree populations for research purposes.

Visit the EUFGIS information system

Forest genetic resources

- Why do they matter?
- Conservation
  - Pan-European strategy
- Use
- Climate change
- Forest management
- EUFGIS information system

News | Events

Forest science is alive and well: 10 take-home messages from IUFRO 2017

13/10/2017

Regreening Iceland

19/09/2017

1500 trees planted in the Generations' Forest in Finland

31/08/2017

OTHER NEWS

Distribution maps

Maps depicting distribution ranges of 45 European tree species are available in different formats from the respective species pages.

SPECIES

Video

Picture, in your mind's eye, Iceland. You're more likely to see ice and rock than green forests... or?

SEE OTHER VIDEOS

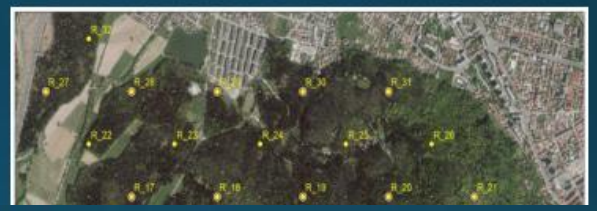
Monitoring of urban forests: *Italian – Slovenain* case study *Emonfur (Life+ EU project)*

INTRODUCTION **METHODS** RESULTS CONCLUSIONS

Study area

Municipal forests of Ljubljana (locations Rožnik and Gameljne)

- Rožnik: 31 plots (500 x 500 m)
- Gameljne: 3 plots near the river Sava



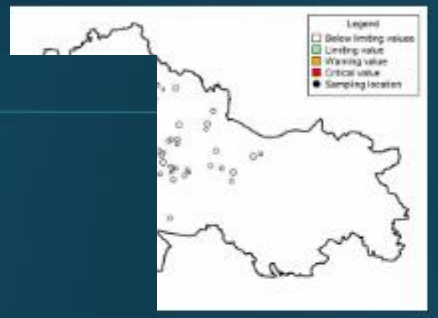
INTRODUCTION **METHODS** RESULTS CONCLUSIONS

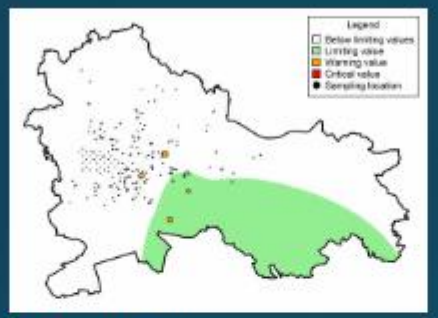
- FIELD WORK:
  - soil samples were taken from 5 different depths per plot:
    Ol+f, Oh, 0-10, 10-20, 20-30 cm.

  - soil classification (**World Reference Base for Soil Resources (WRB)**)
- ANALYSES of soil samples in the Laboratory for Forest Ecology of Slovenian Forestry Institute for: - pH value,
  - C, N, S elemental analysis,
  - burden of heavy metals (Cd, Cr, Cu, Ni, Pb, Zn) in the soil.

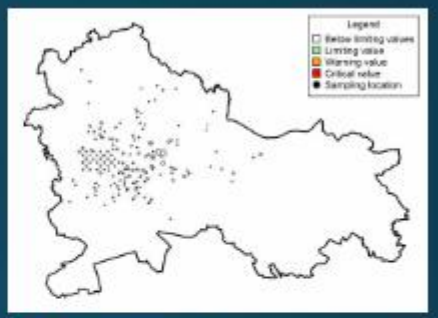
INTRODUCTION METHODS **RESULTS** CONCLUSIONS

ADDITIONAL (merged results of EMONFUR and URBSOIL (2006) projects): maps of heavy metals spatial distribution in the soils (0-10 cm) of the City of Ljubljana

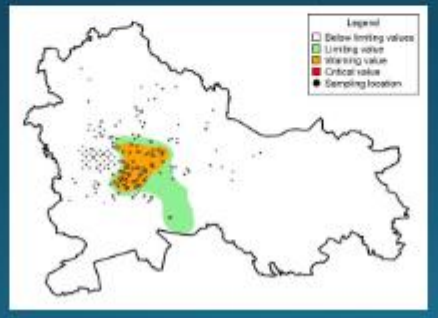




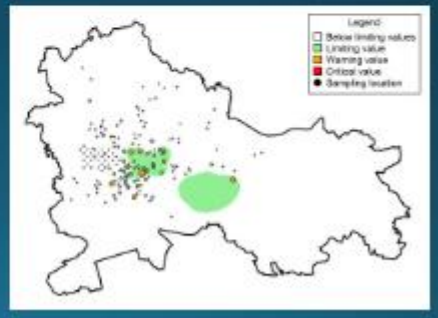
Cd (cadmium)



Cr (chrome)



Pb (lead)



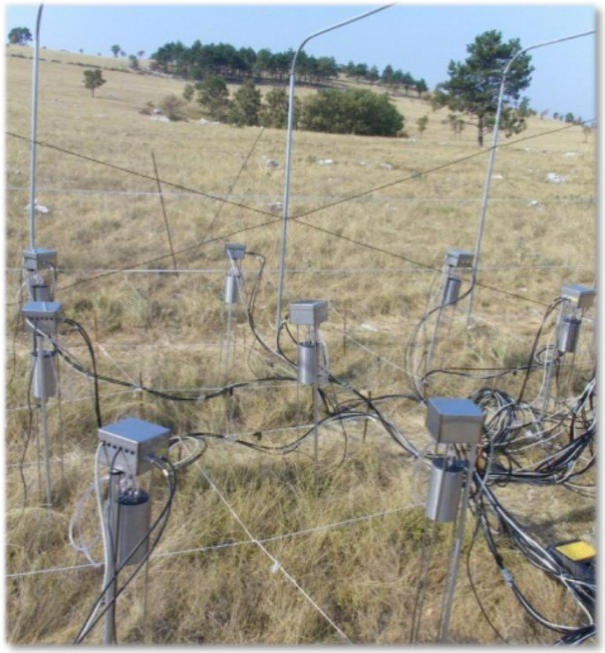
Zn (zinc)

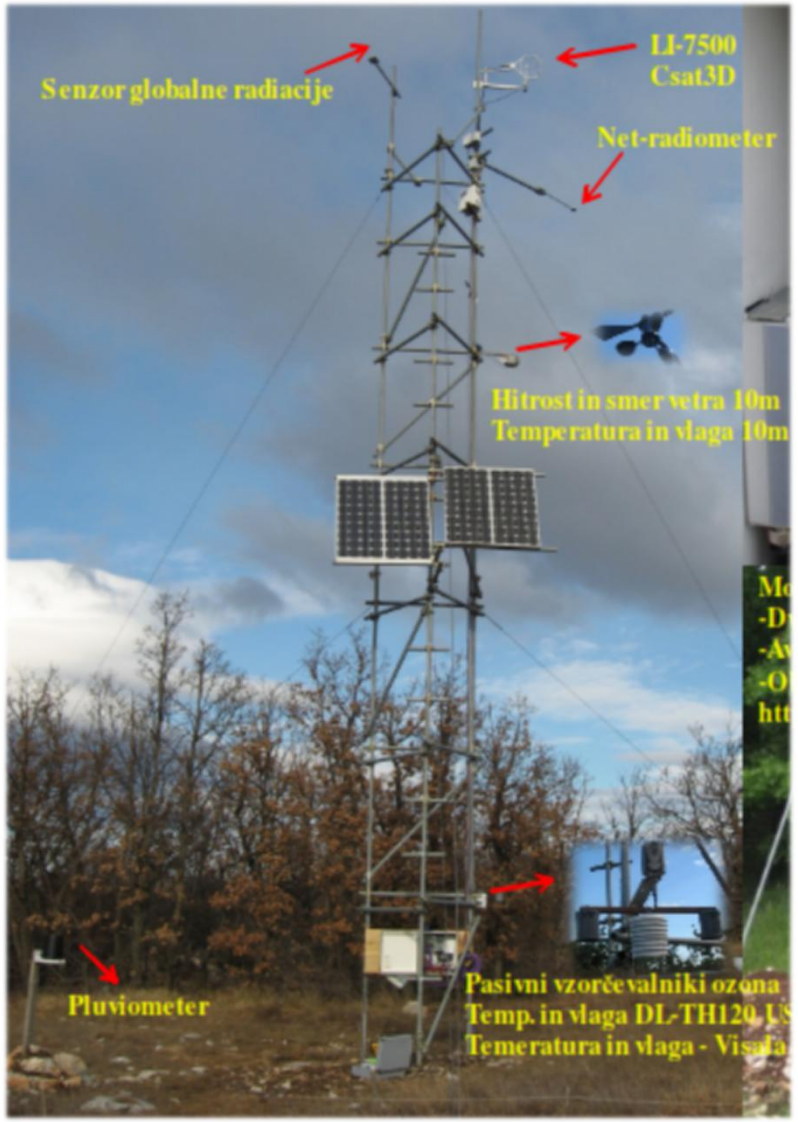
ons (forest, kindergarten and school playgrounds, riverbanks, parks, roadsides)

C flux measurements: Net ecosystem exchange measurements via Eddy covariance method, drought experiments, soil respiration measurements

CO_2 Stable Isotope Analyzer – CCIA-46
Applications with a stable carbon dioxide isotopologues analyzer – model CCIA-46 ($^{13}CO_2$, $^{12}CO_2$, $^{12}CO^{17}O$, $^{12}CO^{18}O$ in ppm and the isotopic ratios of $\delta^{13}C$, $\delta^{17}O$, $\delta^{18}O$ in real time).

- high concentration measurements via dynamic dilution system and manual sample injection via syringe,
- use in net ecosystem exchange measurements via Eddy covariance method or connected to an automated soil respiration system (*Karst plot; Slovenian – Italian cooperation)*.

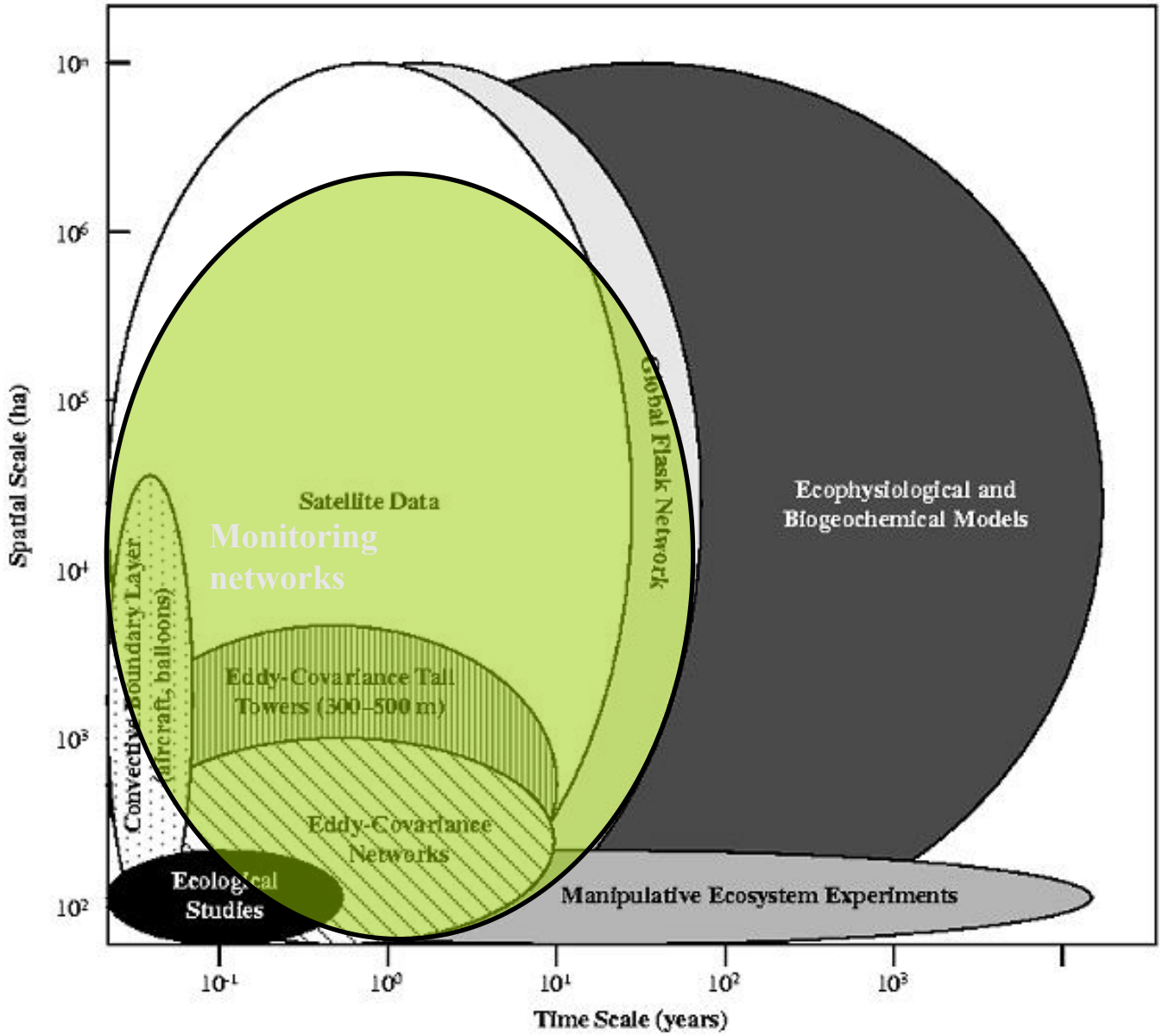




Future and Forests Monitoring activities?

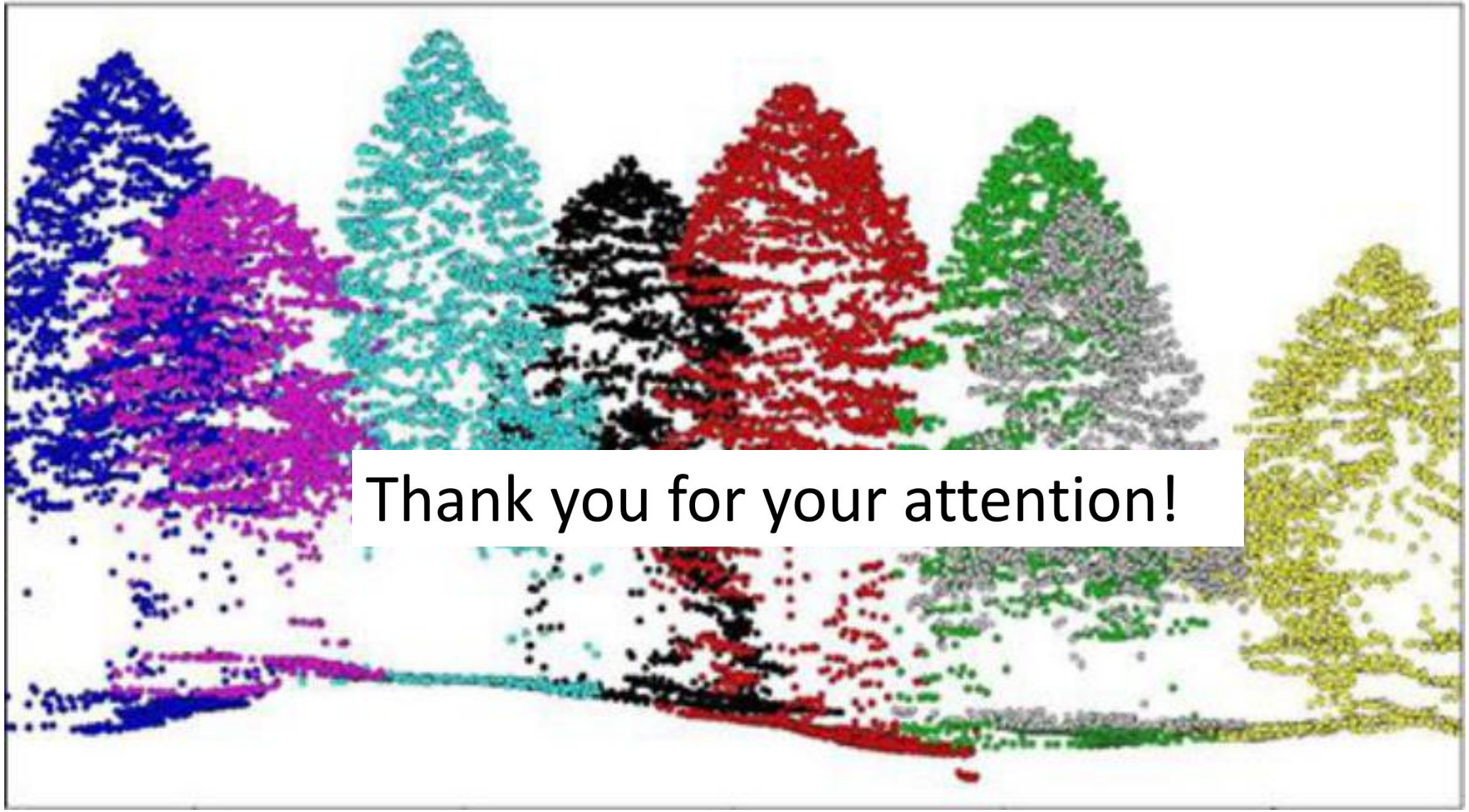
- Biodiversity & functional diversity
- Climate changes, soil protection, water protection
- Wood fluxes monitoirng
- Ecosystem services
- Land use changes
- Belowground complexity & C dynamics
- Net Ecosystem C Exchange in time & space
- Monitoring of genetic diversity - Forest genetic monitoring
- Monitoring of urban forests
- New pollutants – new monitoring technics
- Bioindicator use – monitoring optimization
- Global networks of flux measurements (Fluxnet 683 sites)
- Infrastucture networks – EU (lter; over 40 sites), global networks
- New GIS technics, lidar …

multiple approaches to address complex processes and scaling issues in terrestrial carbon cycle



International Conference on China-CEECs Forestry Research and Education Cooperation; October 30-31, 2017, Beijing, China

- ✓ Closer Integration of monitoring and research is needed
- ✓ We need to improve process understanding and address scaling issue (research+ monitoring)
    - o impacts of climate change
    - o Modelling, Future projections
- ✓ Need for quantitative data on a large number of plots (e.g. level I)
- ✓ Need for quality assurance and error budgeting (monitoring!)
- ✓ Open policy for data sharing
- ✓ Exploit overlaps between monitoring and research networks: e.g. future EU research infrastructures as LTER, ICOS, LifeWatch, EXPEER, ICP Forests nets, **cooperation within 16 + 1 process** …
- ✓ Integrated evaluation, modelling, up-scaling exercises;
- ✓ Value for money (international and national);
- ✓ **Exchange of China and CEECs countries experiences of Forest monitoring and data assessment….**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