# Methodologies and results of monitoring activities in lowland forests and urban plantation in Lombardy (IT) and Slovenia

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# Summary

- UPF Monitoring Protocol of EMoNFuR Project LIFE+
- Monitor Network In Lombardy
- Conclusions

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emonfur
establishing a monitoring network to assess lowland forest and urban plantation in Lombardy and urban forest in Slovenia
LIFE+ 10/ENV/IT/399

# EMoNFuR Project



## URBAN AND PERIURBAN FORESTS

MANAGEMENT, MONITORING AND ECOSYSTEM SERVICES

EMONFUR LIFE+ PROJECT EXPERIENCES






ERSAF
ENTE REGIONALE PER I SERVIZI ALL'AGRICOLTURA E ALLE FORESTE

Parco Nord Milano

GOZDARSKI INŠTITUT SLOVENIJE
SLOVENIAN FORESTRY INSTITUTE

RegioneLombardia
Agricoltura

LIFE+10 ENV/IT/000399

establishing a monitoring network to assess lowland forest and urban plantation in Lombardy and urban forest in Slovenia
emonfur

emonfur establishing a monitoring network to assess lowland forest and urban plantation in Lombardy and urban forest in Slovenia

EMoNFUr Project LIFE+ 10/ENV/IT/000399

Establishing a monitoring network to assess lowland forest and urban plantation in Lombardy and urban forest in Slovenia

Action 5

Definition of working protocol of artificial and natural urban and periurban forest sample plots monitoring

*Creation date 15/10/2012*

*Review status*
*Verified by Scientific Board on 07/09/2012*
*Approved by Project Leader on 14/09/2012*
*Verified by Technical Coordinators on 12/10/2012*

**REV_01**

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# Monitoring Objectives

- To know the evolution of the state of health (*sensu lato*) of the formations
- To evaluate the degree of effectiveness in the provision of the main ecosystem services for urban populations;
- Evaluate the management models of governance and treatment of these formations.

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# Monitoring Protocol 1

## Investigation areas

## 1. FORESTS

- Forest investigations
- Pathological investigations

## 2. BIODIVERSTY

- Birds
- Butterflies
- Flora&Habitat
- Carabids

## 3. PEDOLOGY

- C soil vs forest age
- Biological forms

## 4. MITIGATION

- Weather stations in the woods

## 5. LIFE QUALITY

- User preferences

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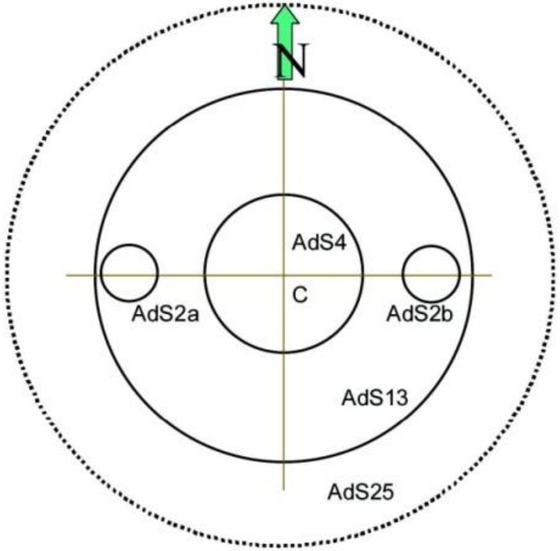
# Monitoring Protocol 2

## 1. FORESTS

## TWO MONITORING LEVELS


## DENDROMETRIC AND DENDROCRONOLOGICAL ANALYSIS

- Forest data in the plots:

  a) **Dendrometric parameters** (e.g. DBH, tree height, crown width, tree growth parameters etc.)

  b) **Dead wood** (dead trees standing, deadwood on the ground and residual stumps)

  c) **Forest structure** (e.g. social position, tree species, vertical layering and renovation)

## FITOPATOLOGICAL INVESTIGATIONS

**The goal** of the phytopathological monitoring **is to assess health condition of trees and trends over time providing the necessary management tools**. To this purpose, a two-level approach was followed:

1. **Basic assessment and monitoring - Surveys and Evaluation Monitoring (SEM)**

   Within the plots the following parameters were recorded: **species; social position; height; age; diameter; percentage of chlorosis; percentage of defoliation**.

2. **Optional assessment and monitoring - Intensive Site Monitoring (ISM)**

   In some cases (e.g. endophytic fungi) it was necessary to **examine plant** tissue samples in laboratory for **definitive identification and diagnosis of the causal agent(s)**.

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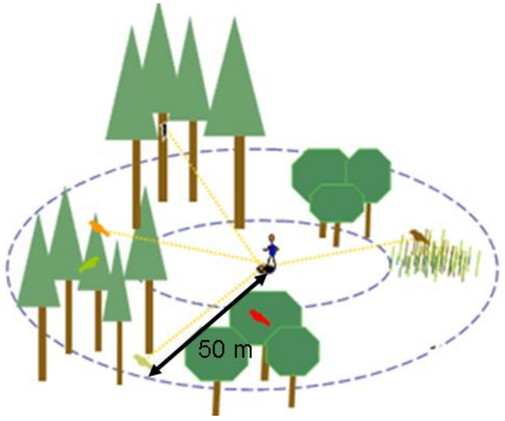
# Monitoring Protocol 2

## 2. BIODIVERSITY

### Birds

Monitoring follows Bibby (Bibby et al., 2000). Birds are monitored twice a year with listening points. The duration of the plays is 10 minutes. The data are entered into a Georreferenced Database. The presence and abundance of the species are correlated with the forest structure and the vegetational data.




### Butterflies

Census between spring and autumn with 4 transects for each area. Data were collected on species and their abundance that are related to the forest structure and vegetation data.

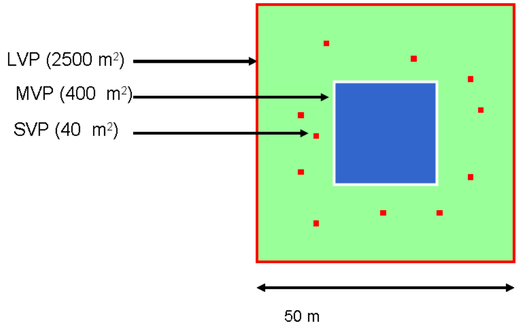
### Carabids

The monitoring method uses drop traps **with** glycolic ethylene. Sampling involves 3 test areas.

During the sampling period the traps are left on site for 7 days.

### Flora& Habitat

Data collection is carried out following a structured monitoring protocol on THREE LEVELS OF DETAIL. Data are collected in all study areas and are reported in a georeferenced database to correlate with forest data



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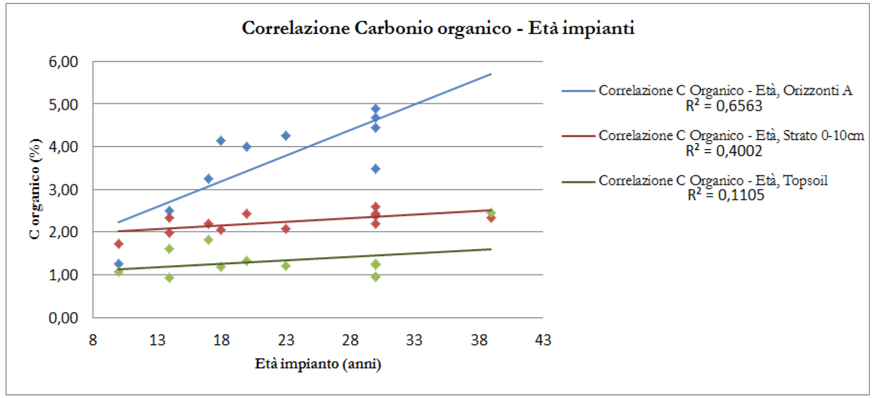
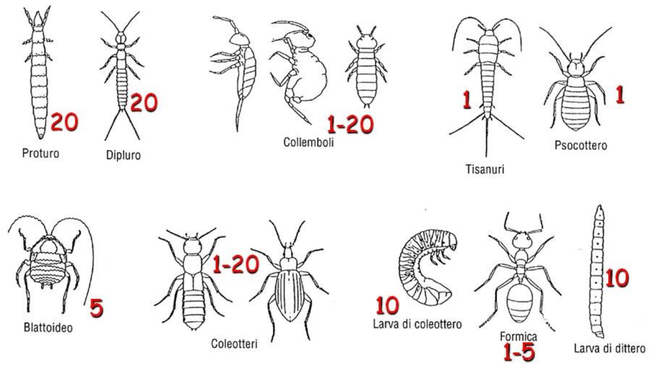
# Monitoring Protocol 2

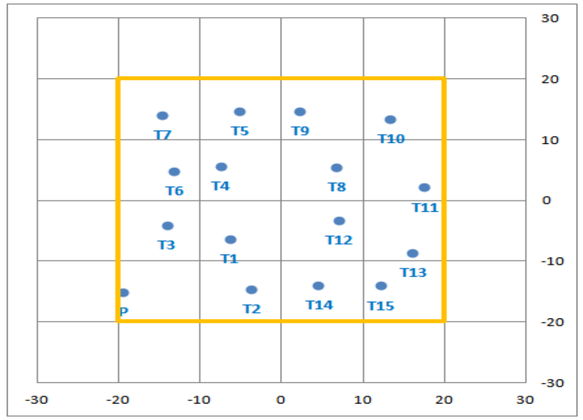
## 3. PEDOLOGY

### Organic Carbon variation according to the age of the forest



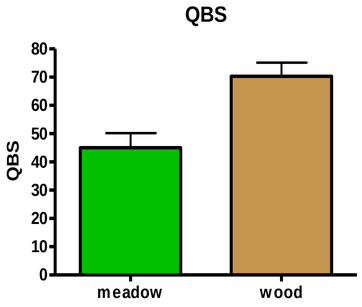

### Evaluation of biological forms in the soil




### Evaluation heavy metals concentrations

| VALUES | Cd (mg/kg) | N (exc.) | Pb (mg/kg) | N (exc.) | Zn (mg/kg) | N (exc.) | Cu (mg/kg) | N (exc.) | Ni (mg/kg) | N (exc.) | Cr (mg/kg) | N (exc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Limiting value | 1 | 13 | 85 | 52 | 200 | 22/1 | 60 | 17 | 50 | - | 100 | 2 |
| Warning value | 2 | - | 100 | 44/1 | 300 | 5 | 100 | 2 | 70 | - | 150 | 1 |
| Critical value | 12 | - | 530 | - | 720 | - | 300 | - | 210 | - | 380 | - |

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# Monitoring Protocol 2

## 4. MITIGATION

In some test areas METEOROLOGICAL STATIONS were installed in order to have long-term data relating to TEMPERATURE and HUMIDITY

- **Air temperature and relative humidity above canopy (about 15 m)**
- **Temperature and relative humidity under canopy (about 8 m)**
- **Air temperature and relative humidity 2 m**
- **Soil temperature at depth of 5 cm**
- **Soil temperature at depth of 30 cm**
- **Soil humidity at depths of 30 cm**

**Real-time weather data on the EMoNFUr website**

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# Monitoring Protocol 2

## 5. LIFE QUALITY

### USER PREFERENCES

Questionnaire on min. 50 different people for age and gender on the following topics

- **DISTANCE (SPATIAL AND TEMPORAL) FROM THE URBAN FOREST**
- **HOW TO USE THE URBAN FOREST (TYPE AND FREQUENCY)**
- **KNOWLEDGE AND PERCEPTION BY THE USER OF THE FUNCTIONS OF THE URBAN FOREST**
- **PSYCHOLOGICAL PERCEPTION of the different types of Urban Forest**

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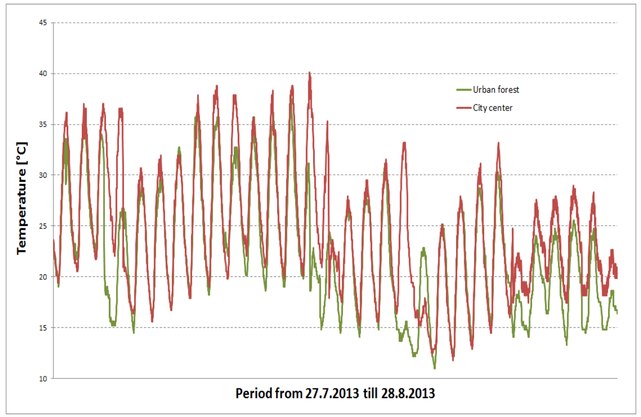
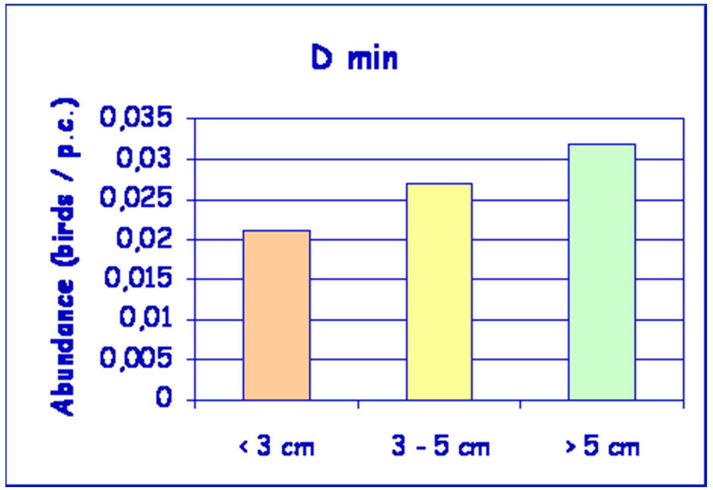
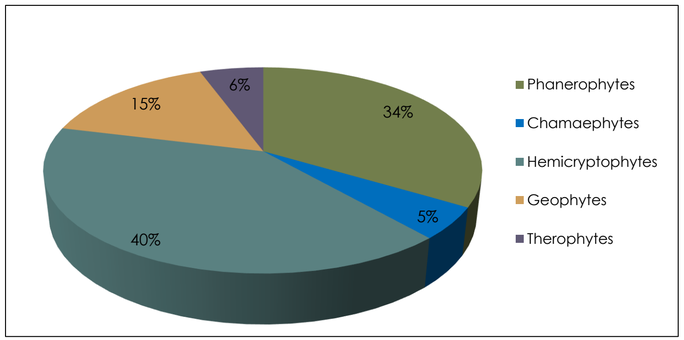
# SUMMARY OF RESULTS

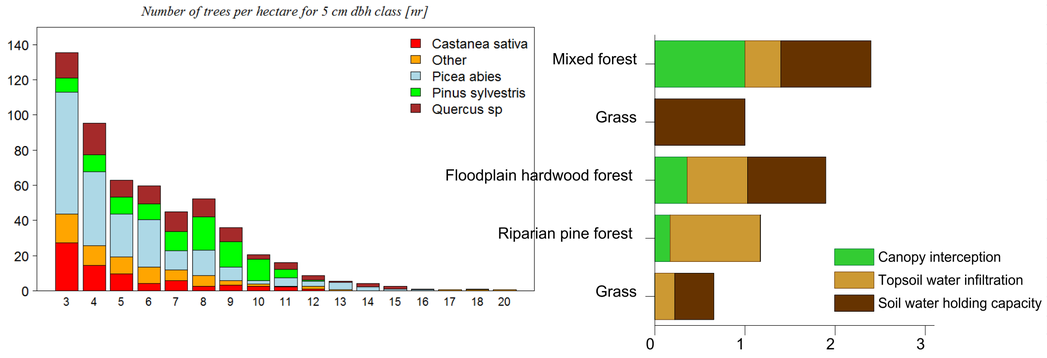



| | Defoliation percentage 2012 | | Defoliation percentage 2013 | |
|---|---|---|---|---|
| | July | September | June | September |
| Carpaneta | 11 | - | 21,4 | 22,9 |
| Bosco Fontana | 13,3 | - | 27,5 | 37,5 |
| Maristella | 11,4 | - | 14,7 | 26,9 |
| Boscoincittà | 48 | 60 | 61,2 | 63,8 |
| PN1a | 9,3 | 43,2 | 28,2 | 19,6 |
| PN1d | 23 | 74,5 | 42,9 | 45 |
| PN2a diradata | 24 | 41,5 | 47,5 | 40 |
| PN2a non diradata | 21 | 61,9 | 61,7 | 50,7 |
| PN9a | 15 | 45,4 | 43,4 | 40,5 |
| Pn14a | 14 | 71,8 | 41,6 | 41 |
| PN18c | 67,6 | 39,2 | 49,4 | 67,6 |
| PN23b | 15 | 65 | 46,7 | 41 |
| PN25a | 7,5 | 61,6 | 16,2 | 14,8 |
| PN28c | 18 | 69 | 25,5 | 37,4 |

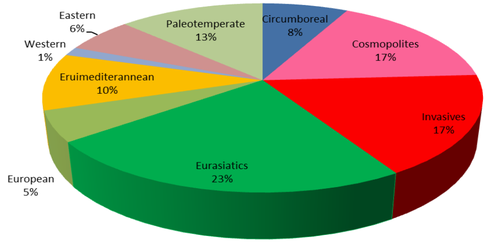



| Temperatures (°C) | Milan | Parco Nord Milano | Cooling effect of urban forest |
|---|---|---|---|
| Annual average minimum temperature | 12.3°C | 11.6°C | -0.7°C |
| Annual average maximum temperature | 17.7°C | 17.5°C | -0.1°C |
| Annual average temperature | 14.5°C | 14.0°C | -0.5°C |




| depth (cm) | 0,5 | 1,0 | 1,5 | 2,0 | 2,5 | 3,0 | 3,5 | 4,0 | 4,5 | 5,0 | 5,5 | 6,0 | 6,5 | 7,0 | 7,5 | 8,0 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | fully eaten | half-eaten | % |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | | | |
| 1 | ○ | ● | ○ | ○ | ○ | ○ | ○ | ◎ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | 1 | 1 | 9,4 |
| 2 | ● | ● | ● | ● | ● | ● | ● | ○ | ○ | ○ | ○ | ○ | ○ | ◎ | ◎ | ○ | 7 | 2 | 50,0 |
| 3 | ● | ● | ● | ● | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ○ | ○ | ○ | 12 | 0 | 75,0 |
| 4 | ● | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ● | ○ | ○ | ○ | ◎ | ● | ○ | 6 | 1 | 40,6 |
| 5 | ○ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 15 | 0 | 93,8 |
| 6 | ● | ● | ◎ | ● | ● | ● | ● | ○ | ○ | ○ | ● | ● | ● | ● | ● | ◎ | 11 | 2 | 75,0 |
| 7 | ● | ● | ○ | ○ | ◎ | ◎ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | 2 | 2 | 18,8 |
| 8 | ● | ○ | ● | ● | ◎ | ○ | ○ | ◎ | ● | ◎ | ○ | ○ | ○ | ○ | ○ | ○ | 4 | 3 | 34,4 |
| 9 | ○ | ● | ● | ● | ● | ● | ◎ | ○ | ○ | ○ | ● | ● | ● | ○ | ◎ | ○ | 9 | 2 | 62,5 |
| 10 | ● | ● | ● | ● | ● | ○ | ○ | ● | ● | ● | ○ | ○ | ○ | ○ | ○ | ○ | 8 | 0 | 50,0 |
| 11 | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | 8 | 0 | 50,0 |
| 12 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 16 | 0 | 100,0 |
| 13 | ◎ | ◎ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | 0 | 2 | 6,3 |
| 14 | ● | ● | ● | ● | ● | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ○ | ○ | ○ | 6 | 0 | 37,5 |
| 15 | ● | ● | ◎ | ● | ● | ● | ◎ | ● | ● | ● | ◎ | ● | ○ | ○ | ○ | ○ | 9 | 3 | 65,6 |
| 16 | ○ | ○ | ○ | ◎ | ○ | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ● | ● | ○ | 3 | 1 | 21,9 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | tot | 49,4 |



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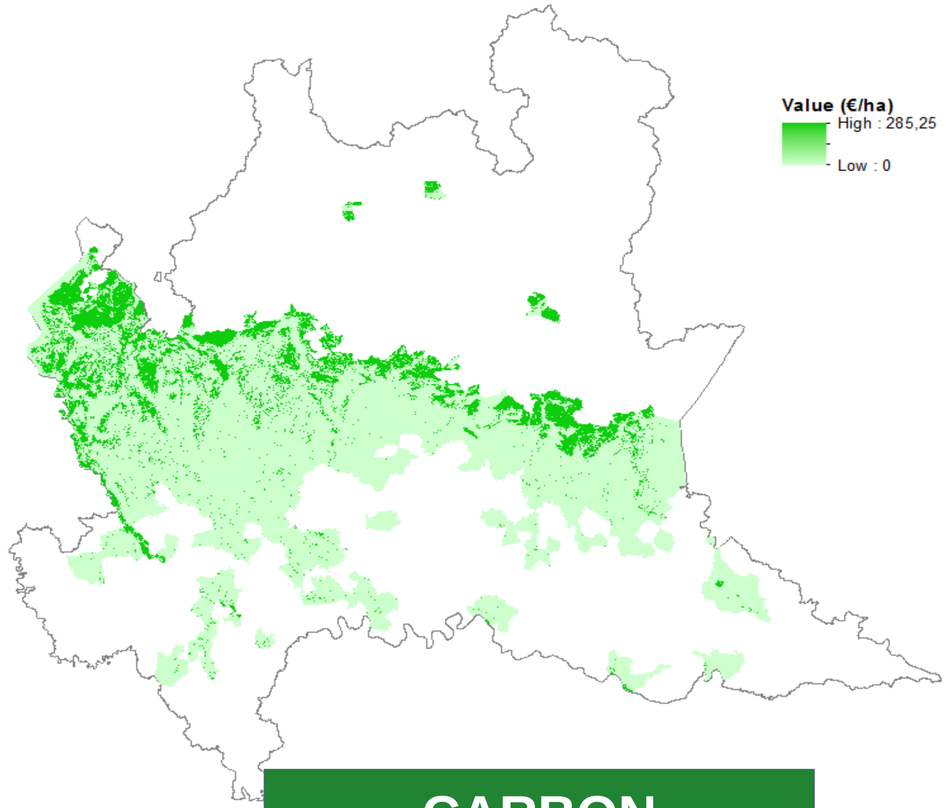
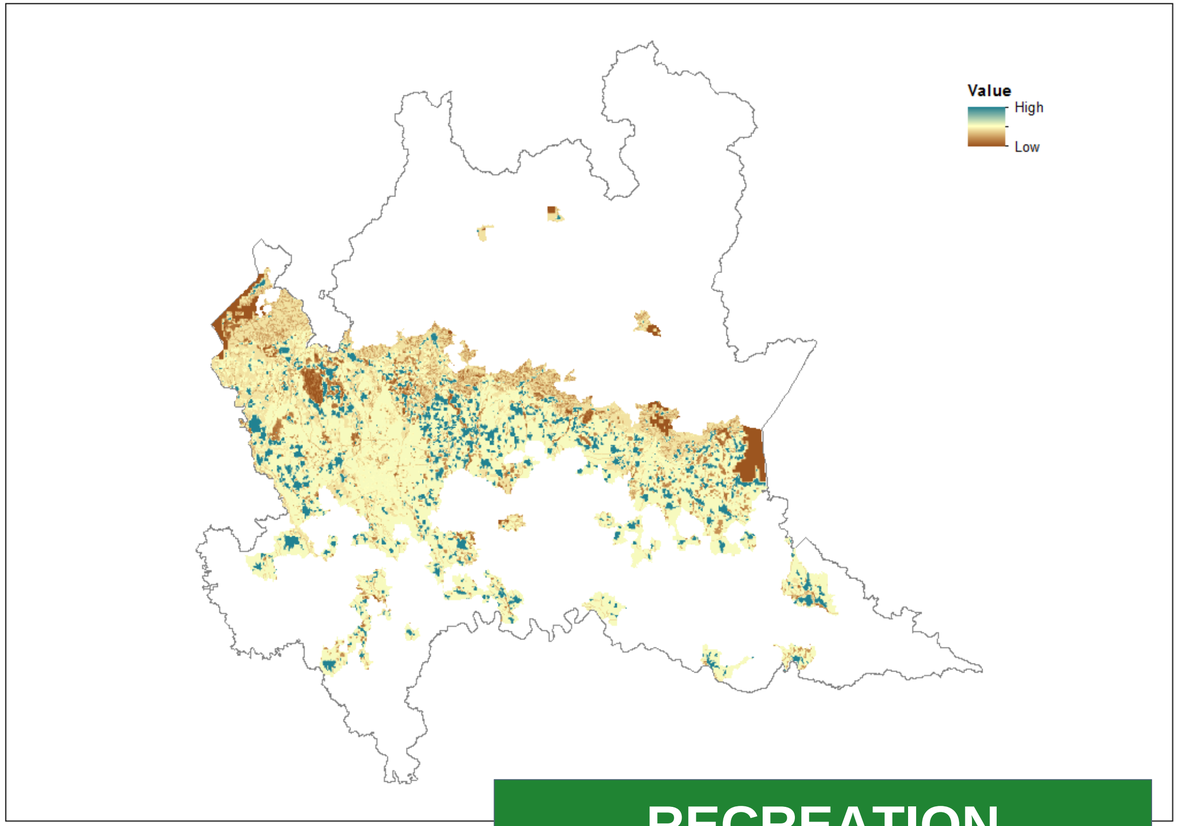
# ECOSYSTEM SERVICES

## UPF CONTRIBUTION TO THE ECONOMIC VALUE OF THE STOCK OF C




CARBON

## RECREATIONAL VALUE OF UPF




RECREATION

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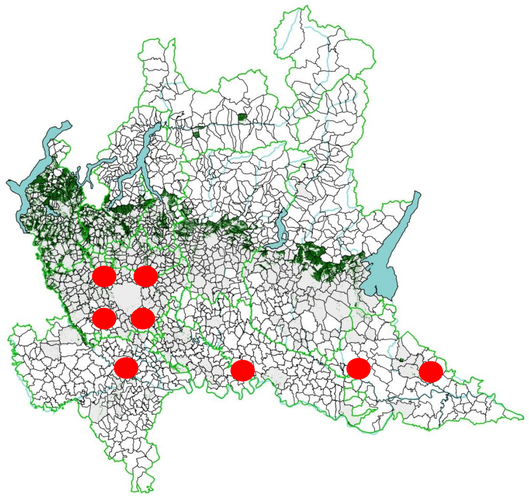
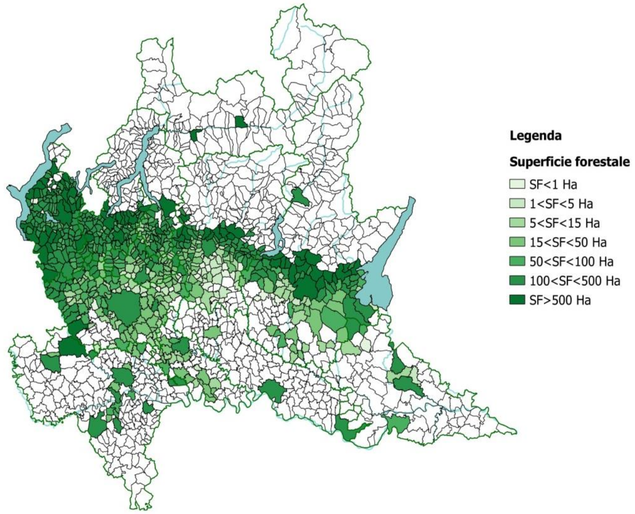
# MONITOR NETWORK IN LOMBARDY REGION

## The system is based on three levels



8 Permanent, representative equipped and structured plots




-Inventory of artificial and natural urban and periurban forest

-1300 points of National Forests Inventory


Annual Report on Regional Forests

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# MONITOR NETWORK IN LOMBARDY REGION

## Frequency of surveys

Annual surveys:
Weather data (continuos products)
Defoliation of plants

Surveys every 5 years
To be carried out only in plants aged <30 years:
dendrometric parameters, biomass, dead wood
flora (vegetation and habitat),
fauna (birds)

Surveys every 10 years:
dendrometric parameters, biomass, dead wood, health status, social preferences and uses
flora (vegetation and habitat),
fauna (birds, carabidae, other taxa)
+
Inventory update

**Cost of the network:** annual management €. 21,000
Periodic surveys in the 10 years €. 205,000

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# Conclusions

A. The LIFE Emonfur Project has defined a monitoring protocol as a support tool for UPF managers

B. The protocol helps to evaluate UPF in the three aspects: ecological, functional and social

C. The protocol helps to evaluate the status and evolution of UPF and also allows the assessment of the quality of ecosystem services

D. A monitoring network with the same protocol can help to understand the function of the UPF in the protection of urban areas

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Life
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# Thank you for your attention