UNIVERSITÀ DEGLI STUDI FIRENZE

AA 2018-19

INVENTARI FORESTALI

Dispensa 1

Introduzione

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Programma del corso

PARTE I
-Scopo e finalità degli inventari forestali
-Introduzione storica agli inventari forestali
-I processi di monitoraggio e gli inventari forestali nel mondo
-Cartografia vs. Inventari
-L'inventario forestale nazionale

PARTE II
-Richiami di statistica
-Stimatori campionari
-Disegni campionari

PARTE III
-Modalità di realizzazione di un inventario forestale
-Unità campionarie
-Strumentazione per il rilievo

PARTE IV
-Il ruolo del telerilevamento
-Cartografia tramite telerilevamento
-La stratificazione tramite telerilevamento
-La stima tramite telerilevamento
-GNSS

Testi di riferimento

Le dispense elaborate per lo svolgimento dell'attività didattica sono tratte dai seguenti testi:

***«Utilizzo di immagini satellitari ad alta risoluzione nel rilevamento delle risorse forestali»*. G. Chirici e P. Corona, 2006 – Aracne Editrice, Roma.**

«Introduzione al rilevamento campionario delle risorse forestali» P. Corona, 2000 – Edizioni CUSL, Firenze.

«Metodi di campionamento per le indagini ambientali» L. Fattorini, C. Pisani. Appunti del corso di «Statistica per l'ambiente», Università degli Studi di Siena.

Alcuni articoli e siti web per approfondimenti

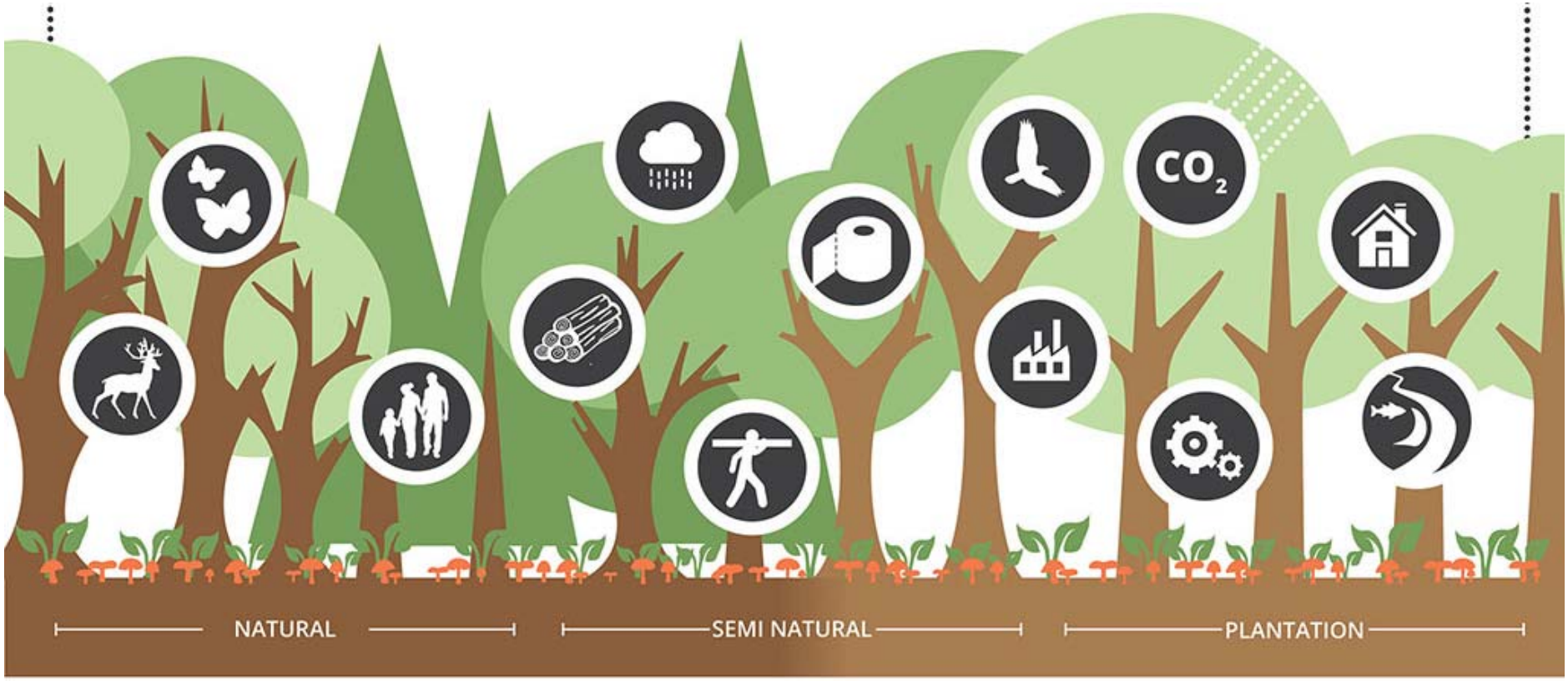
La crescente attenzione in ambito scientifico e sociale e da parte dell'amministrazione pubblica verso i valori del bosco **(servizi ecosistemici)** ha incrementato in misura sensibile la richiesta di informazioni attendibili sotto forma di statistiche, data-base georeferenziati e cartografia tematica

TYPES OF ECOSYSTEM SERVICES

	PROVISIONING	REGULATION & MAINTENANCE	CULTURAL
DEFINITION	Nutritional, material, and energetic outputs from living systems, that can be exchanged, traded, consumed or used by people for manufacturing.	Ways in which living organisms mediate or moderate the environment which affects human performance.	The non-material, usually non-consumptive, outputs of ecosystems that affect people's physical and mental states.
OUTPUTS	Food and Nutrition; Fiber, Biomass and Medicines; Fresh Water; Energy (Hydro & Biomass)	Air Quality; Climate; Water Quantity and Quality; Natural Hazards; Pollution and Waste Breakdown; Nutrient Cycling and Pest Control	Recreation and Tourism; Spiritual and Aesthetic; Research
EXAMPLES	Wood and fish gathered from Vietnam's Can Gio Reserve mangroves has an estimated value of over US$110M per year to local communities, who would otherwise have to buy these products for their household consumption (Kuenzer and Tuan 2013).	Forests in the Lao PDR Sekong Province provide flood control functions valued at US$26.6M per year based on the cost of replacing this function with dams if there were no forests to intercept and regulate rainoff from heavy rain. (Rosales et al. 2005)	Tourists were willing to pay for boat rides in Cambodia's Ream National Park, which could help maximize the Park's revenues and protect its natural resources. (De Lopez et al. 2001)

(Per the European Environment Agency's Common International Classification of Ecosystem Services)

- diversi tipi di bosco forniscono servizi ecosistemici diversi
- **non puoi gestire ciò che non puoi misurare**



Evoluzione storica degli inventari forestali


Mit GOtt!

SYLVICVLTVRA OECONOMICA,

Oder

Haußwirthliche Nachricht und Naturmäßige

Anweisung

Zur

Wilden Baum-Zucht,

Nebst

Gründlicher Darstellung/

Wie zu förderst durch Göttliches Benedeyen dem allenthalben und insgemein einreissenden

Grossen Holtz-Mangel/

Vermittelst Säe- Pflantz- und Versetzung vielerhand Bäume zu prospiciren/

Alles zu nothdürfftiger Versorgung des Hauß- Bau- Brau- Berg- und Schmeltz-Wesens/

Worbey zugleich eine gründliche Nachricht von den in Churfl. Sächß. Landen

Gefundenen Turff

Dessen Natürliche Beschaffenheit / grossen Nutzen / Gebrauch und nützlichen Verkohlung.

Aus Liebe zu Beförderung des algemeinen Bestens beschrieben

Von

Hannß Carl von Carlowitz/

Königl. Pohl. und Churfl. Sächß. Cammer-Rath und Ober-Berg-Hauptmann.

Mit Königl. Pohl. und Churfürstl. Sächß. allergnädigsten PRIVILEGIO.

LEIPZIG/

verlegts Johann Friedrich Braun 1713.

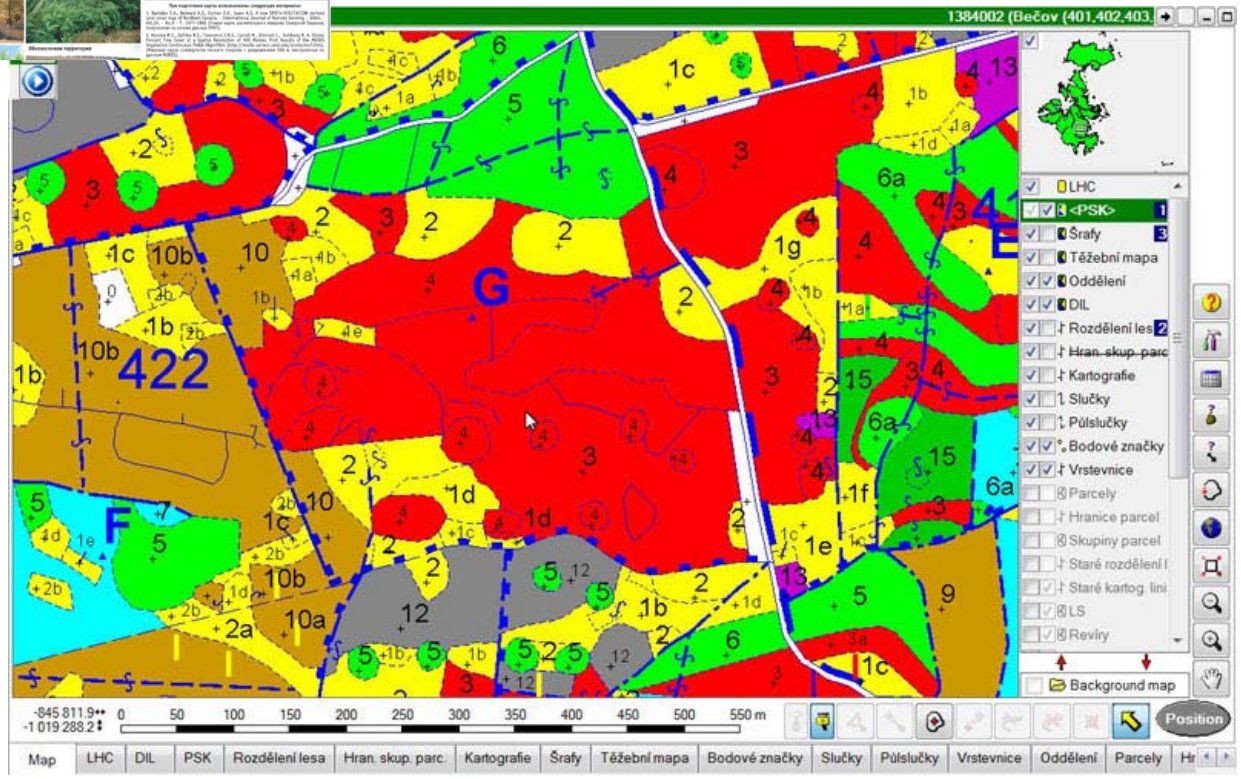
- Gli inventari forestali nascono e si sviluppano per permettere la stima della **consistenza economica** della risorsa bosco
- Nel 1713 Von Carlowitz per primo stabilisce che l'utilizzo delle risorse forestali deve avvenire in modo **sostenibile** per garantirne la perpetuazione alle generazioni future
- Il concetto di sostenibilità nel tempo **si amplia** includendo altri aspetti oltre alla produzione legnosa (biodiversità, assismilazione CO_2, ecc.)
- Gli inventari forestali diventano **multifunzionali** e permettono (potenzialmente) la quantificazione di tutti i servizi ecosistemici del bosco

Carlowitz HC von. (1713). Sylvicultura oeconomica, oder haußwirthliche Nachricht und Naturmäßige Anweisung zur wilden Baum-Zucht. Leipzig: Braun.

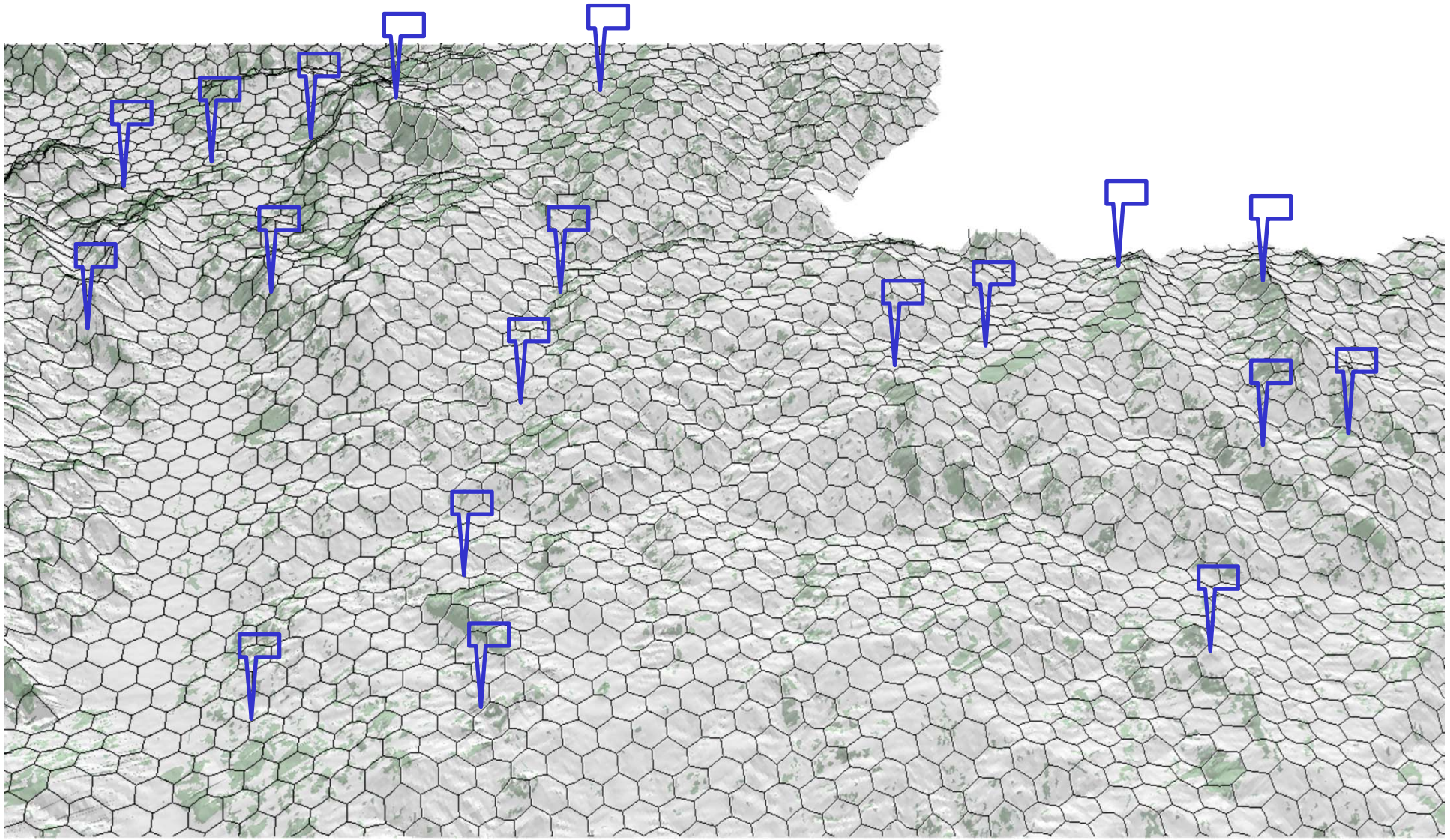
Evoluzione storica

- Nel XIX secolo i primi inventari sono realizzati a livello di comprensorio o di grandi proprietà forestali
- I primi inventari sono:
  - **Comprensoriali**: prevedono la suddivisione del territorio in unità di gestione che vengono periodicamente rilevate (in maniera simile a come oggi vengono realizzati i piani di gestione)
  - **Statistici**: si basano sul rilievo di un piccolo campione estratto della superficie forestale indagata
- Ci si rende conto che una stima delle risorse nazionali non può derivare dall'aggregazione di inventari locali
- Nascono quindi i primi Inventari Forestali Nazionali (tutti su base campionaria): 1919 Norvegia, 1921 Finlandia, 1923 Svezia, 1928 USA

Inventario forestale su base comprensoriale (basato sul censimento)



Inventario forestale su base statistica (basato sul campionamento)

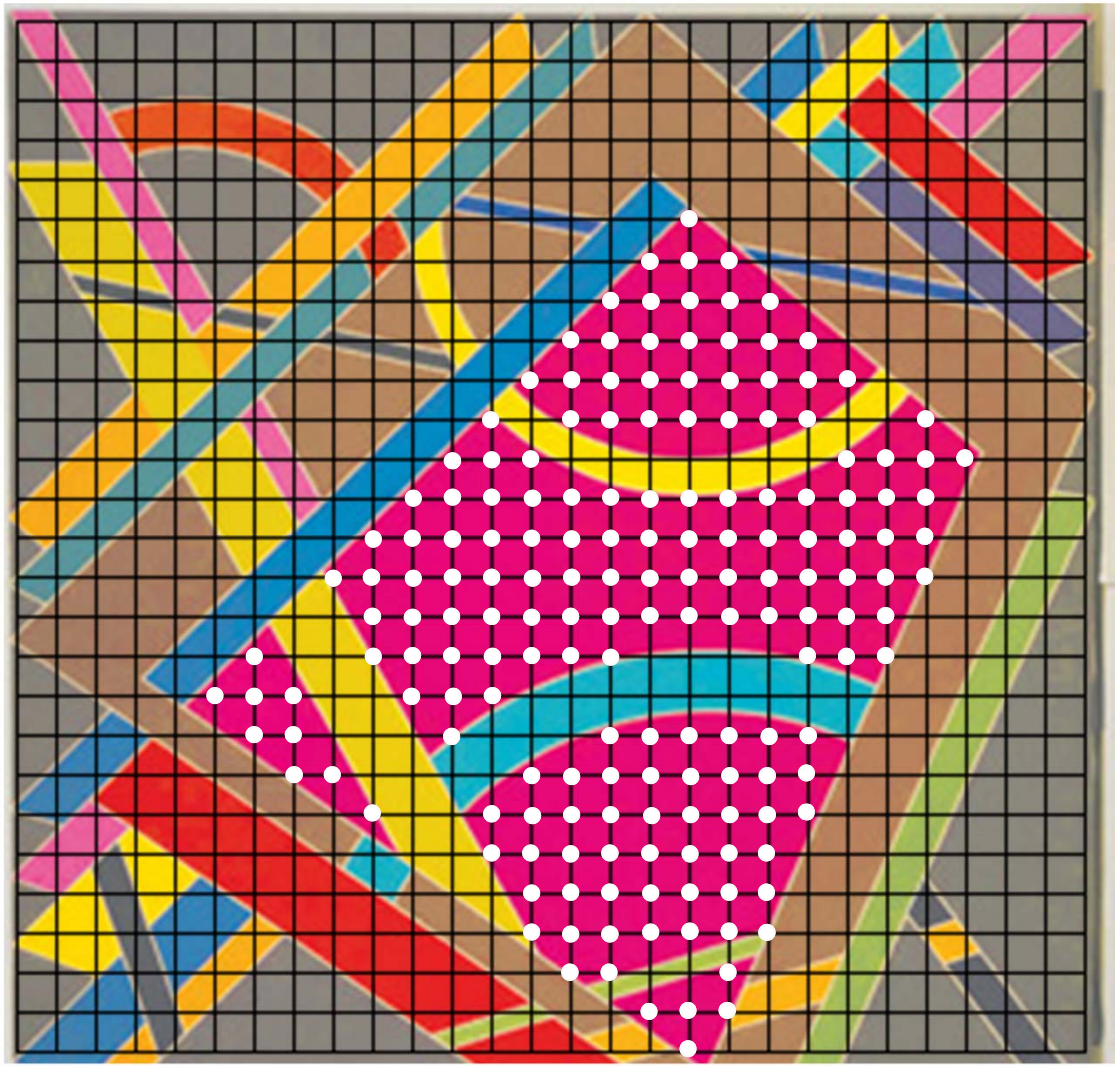


Qual’è la superficie coperta dal colore viola?
Sapendo che il dipinto è 1 m^2

Griglia di 28 x 28 nodi = 784 nodi

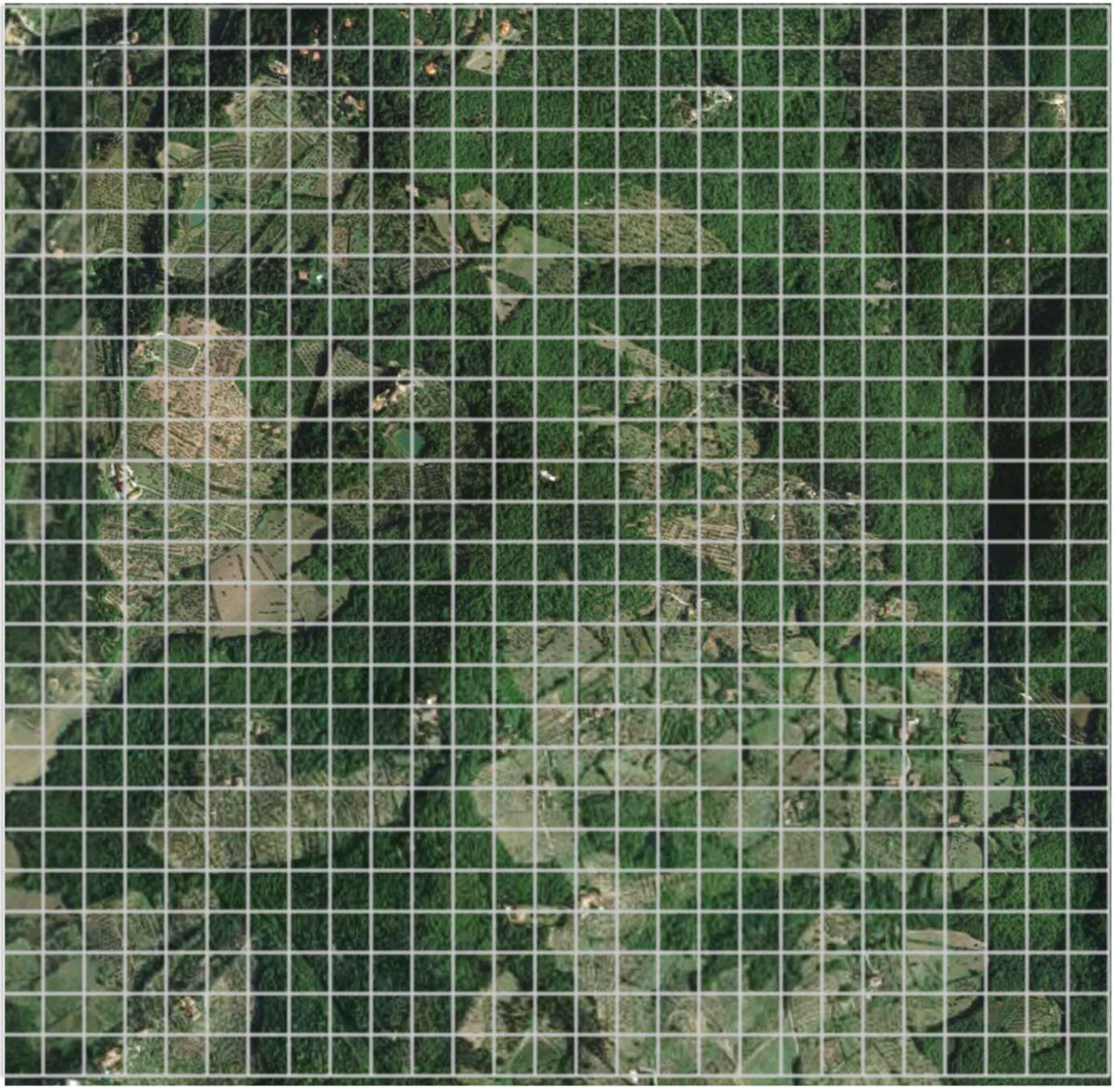
175/784=0.22 m^2

STIMA NON VALORE VERO!



Qual’è la superficie coperta dal bosco?

Sapendo che il quadrato è 1 km^2

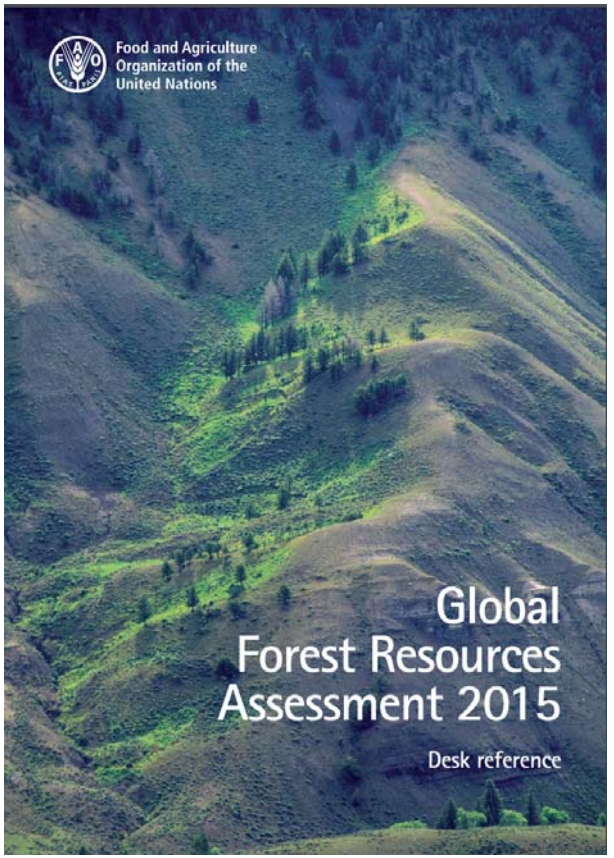


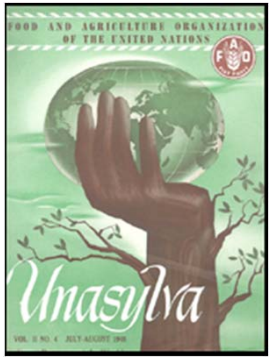
Perchè gli IFN?

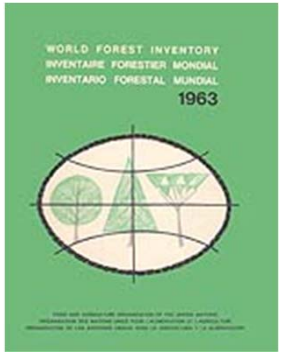
- Gli IFN permettono di soddisfare la richiesta di informazioni sulla consistenza delle risorse forestali proveniente da:
  - **Livello nazionale**: le statistiche forestali permettono di orientare gli interventi politici, tecnici ed economici del governo a livello di pianificazione strategica
  - **Livello sub-nazionale** (regionale): gli IFN permetttono in genere la derivazione delle statistiche a livello geografico sub-nazionale per orientare gli indirizzi di pianificazione forestale
  - **Livello sovra-nazionale**: diversi processi internazionali richiedono la produzione di statistiche aggregate di vasti ambiti internazionali o globali. Sono numerosi i processi internazionali la cui implementazione richiede di disporre di stime attendibili sulle risorse forestali. Gli IFN si identificano come la principale fonte informativa.

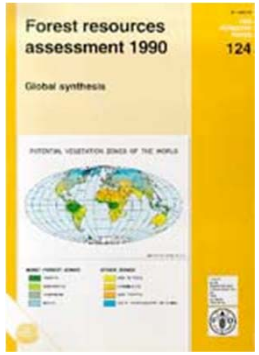
FAO Forest Resource Assessment

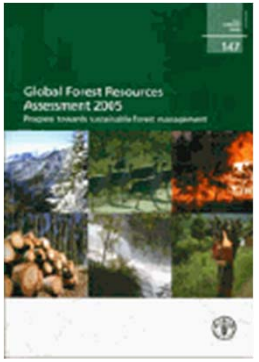
- La FAO inizia nel 1948 il progetto per un inventario mondiale delle risorse forestali
- Il progetto utilizza le statistiche prodotte dai paesi che hanno un proprio IFN e utilizza diverse metodologie per stimare le principali variabili forestali per i paesi che non possiedono un IFN (con particolare attenzione per i paesi centro-americani, africani e asiatici)
- Dal 1980 il progetto è definito Forest Resource Assessment ed ha cadenza decennale
- Dal 2000 è definito **Global Forest Resource Assessment** ed ha cadenza quinquennale

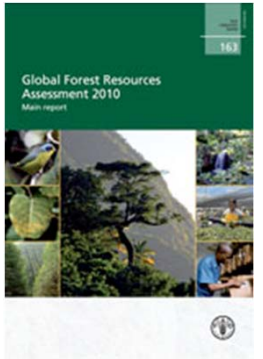












Deforestazione: cambio **permanente** di uso del suolo, da bosco verso un uso del suolo diverso (in genere agricolo o urbano)

Reforestazione: processo opposto alla deforestazione in aree che preventivamente sono state deforestate

Afforestazione: processo opposto alla deforestazione in aree preventivamente **non** deforestate

Esempi:

- Una tagliata in un ceduo o in una fustaia non sono deforestazione
- Un incendio non è, in genere, deforestazione
- Una piantagione di pioppi non afforestazione
- Il taglio della piantagione di pioppi non è deforestazione

Forest Europe growing life
Ministerial Conference on the Protection of Forests in Europe

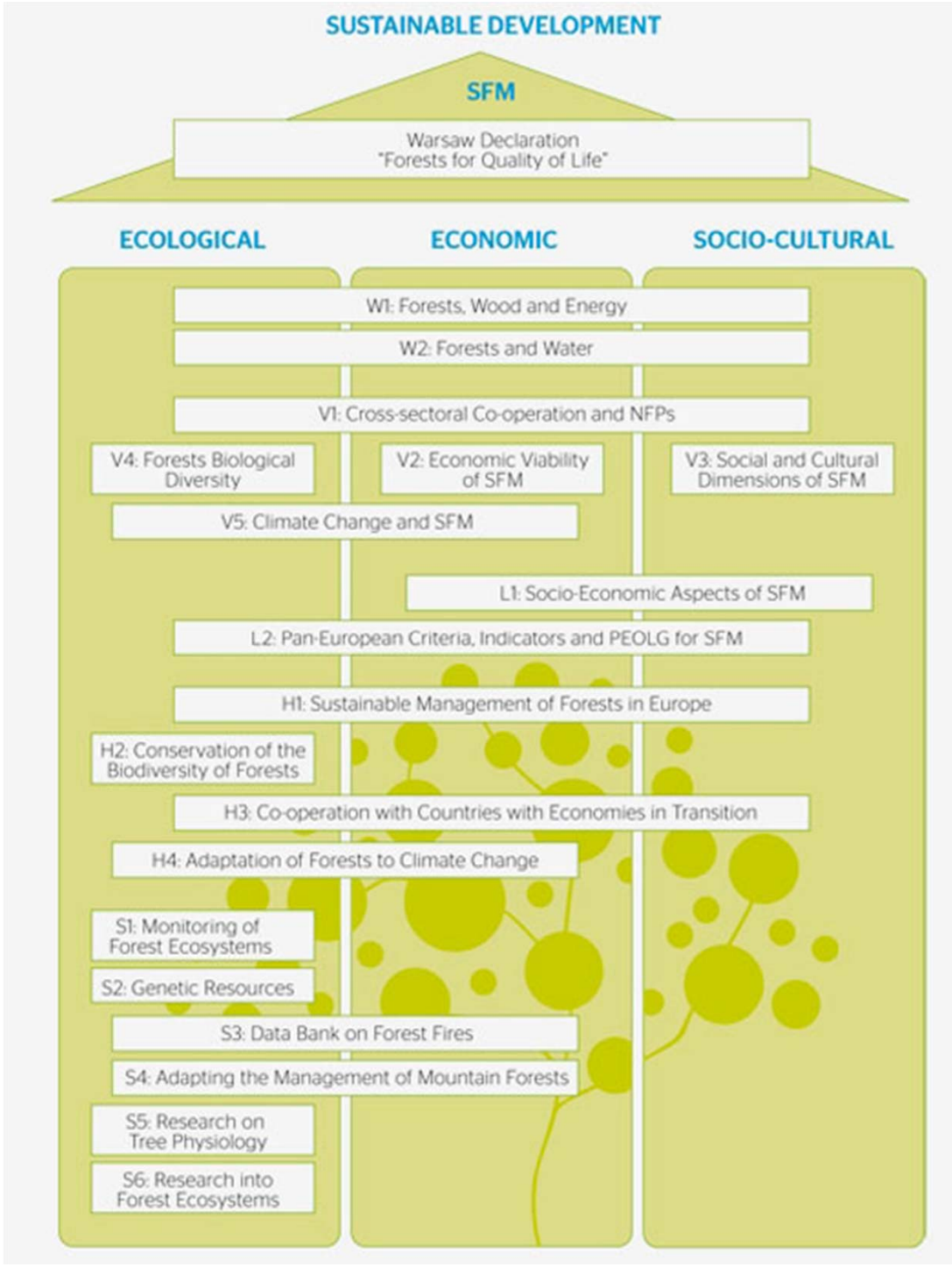
MCPFE Forest Europe

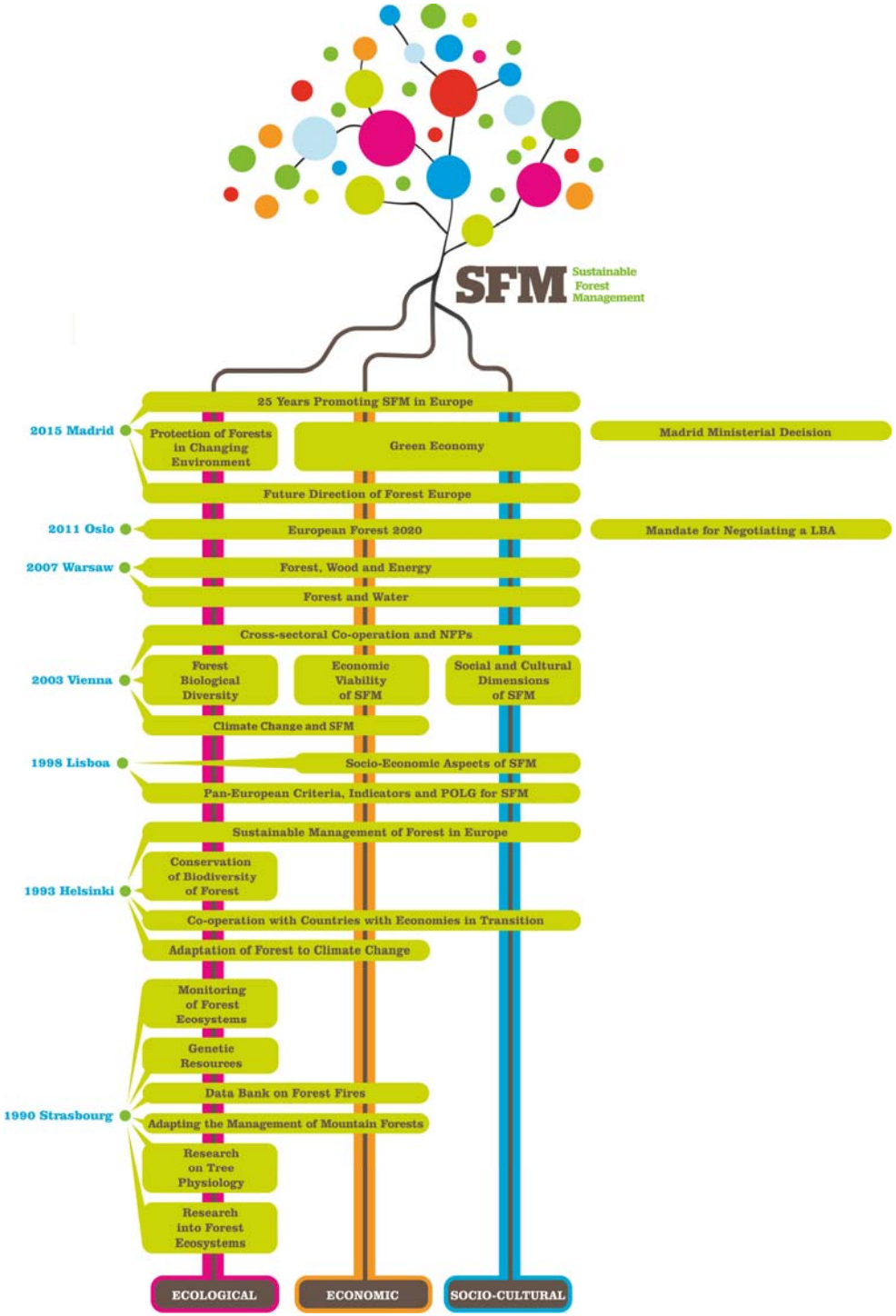
- Fondata nel 1990 vi partecipano ad oggi 46 Paesi
- Sono coinvolti i rappresentanti dei Ministeri dei Paesi membri attivi in ambito forestale
- Ha per scopo l'implementazione di strategie comuni e coordinate in ambito pan-europeo per la gestione sostenibile delle risorse forestali
- Sono state approvate 19 risoluzioni nell'ambito di 7 conferenze interministeriali

Forest Europe growing life
7th Ministerial Conference
Madrid 20-21 October 2015

Strasburgo, 1990 Helsinki, 1993 Lisbona, 1998 Vienna, 2003 Varsavia, 2007

Forest Europe growing life
Ministerial Conference on the Protection of Forests in Europe
Oslo 14-16 June 2011


SUSTAINABLE DEVELOPMENT
SFM
Warsaw Declaration
"Forests for Quality of Life"
ECOLOGICAL
ECONOMIC
SOCIO-CULTURAL
W1: Forests, Wood and Energy
W2: Forests and Water
V1: Cross-sectoral Co-operation and NFPs
V4: Forests Biological Diversity
V2: Economic Viability of SFM
V3: Social and Cultural Dimensions of SFM
V5: Climate Change and SFM
L1: Socio-Economic Aspects of SFM
L2: Pan-European Criteria, Indicators and PEOLG for SFM
H1: Sustainable Management of Forests in Europe
H2: Conservation of the Biodiversity of Forests
H3: Co-operation with Countries with Economies in Transition
H4: Adaptation of Forests to Climate Change
S1: Monitoring of Forest Ecosystems
S2: Genetic Resources
S3: Data Bank on Forest Fires
S4: Adapting the Management of Mountain Forests
S5: Research on Tree Physiology
S6: Research into Forest Ecosystems


SFM
Sustainable Forest Management
25 Years Promoting SFM in Europe
2015 Madrid
Protection of Forests in Changing Environment
Green Economy
Madrid Ministerial Decision
Future Direction of Forest Europe
2011 Oslo
European Forest 2020
Mandate for Negotiating a LBA
2007 Warsaw
Forest, Wood and Energy
Forest and Water
Cross-sectoral Co-operation and NFPs
2003 Vienna
Forest Biological Diversity
Economic Viability of SFM
Social and Cultural Dimensions of SFM
Climate Change and SFM
1998 Lisboa
Socio-Economic Aspects of SFM
Pan-European Criteria, Indicators and POLG for SFM
Sustainable Management of Forest in Europe
1993 Helsinki
Conservation of Biodiversity of Forest
Co-operation with Countries with Economies in Transition
Adaptation of Forest to Climate Change
Monitoring of Forest Ecosystems
Genetic Resources
Data Bank on Forest Fires
1990 Strasbourg
Adapting the Management of Mountain Forests
Research on Tree Physiology
Research into Forest Ecosystems
ECOLOGICAL
ECONOMIC
SOCIO-CULTURAL

Improved Pan-European Indicators for Sustainable Forest Management

as adopted by the MCPFE Expert Level Meeting 7-8 October 2002, Vienna, Austria

1 Quantitative Indicators

Criterion 1: Maintenance and Appropriate Enhancement of Forest Resources and their Contribution to Global Carbon Cycles

1.1 Forest area
Area of forest and other wooded land, classified by forest type and by availability for wood supply, and share of forest and other wooded land in total land area

1.2 Growing stock
Growing stock on forest and other wooded land, classified by forest type and by availability for wood supply

1.3 Age structure and/or diameter distribution
Age structure and/or diameter distribution of forest and other wooded land, classified by forest type and by availability for wood supply

1.4 Carbon stock
Carbon stock of woody biomass and of soils on forest and other wooded land

Criterion 2: Maintenance of Forest Ecosystem Health and Vitality

2.1 Deposition of air pollutants
Deposition of air pollutants on forest and other wooded land, classified by N, S and base cations

2.2 Soil condition
Chemical soil properties (pH, CEC, C/N, organic C, base saturation) on forest and other wooded land related to soil acidity and eutrophication, classified by main soil types

2.3 Defoliation
Defoliation of one or more main tree species on forest and other wooded land in each of the defoliation classes "moderate", "severe" and "dead"

2.4 Forest damage
Forest and other wooded land with damage, classified by primary damaging agent (abiotic, biotic and human induced) and by forest type

Criterion 3: Maintenance and Encouragement of Productive Functions of Forests (Wood and Non-Wood)

3.1 Increment and fellings
Balance between net annual increment and annual fellings of wood on forest available for wood supply

3.2 Roundwood
Value and quantity of marketed roundwood

3.3 Non-wood goods
Value and quantity of marketed non-wood goods from forest and other wooded land

3.4 Services
Value of marketed services on forest and other wooded land

3.5 Forests under management plans
Proportion of forest and other wooded land under a management plan or equivalent

Criterion 4: Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems

4.1 Tree species composition
Area of forest and other wooded land, classified by number of tree species occurring and by forest type

4.2 Regeneration
Area of regeneration within even-aged stands and uneven-aged stands, classified by regeneration type

4.3 Naturalness
Area of forest and other wooded land, classified by "undisturbed by man", by "semi-natural" or by "plantations", each by forest type

4.4 Introduced tree species
Area of forest and other wooded land dominated by introduced tree species

4.5 Deadwood
Volume of standing deadwood and of lying dead-wood on forest and other wooded land classified by forest type

4.6 Genetic resources
Area managed for conservation and utilisation of forest tree genetic resources (in situ and ex situ gene conservation) and area managed for seed production

4.7 Landscape pattern
Landscape-level spatial pattern of forest cover

4.8 Threatened forest species
Number of threatened forest species, classified according to IUCN Red List categories in relation to total number of forest species

4.9 Protected forests
Area of forest and other wooded land protected to conserve biodiversity, landscapes and specific natural elements, according to MCPFE Assessment Guidelines

Criterion 5: Maintenance and Appropriate Enhancement of Protective Functions in Forest Management (notably Soil and Water)

5.1 Protective forests – soil, water and other ecosystem functions
Area of forest and other wooded land designated to prevent soil erosion, to preserve water resources, or to maintain other forest ecosystem functions, part of MCPFE Class "Protective Functions"

5.2 Protective forests – infrastructure and managed natural resources
Area of forest and other wooded land designated to protect infrastructure and managed natural resources against natural hazards, part of MCPFE Class "Protective Functions"

Criterion 6: Maintenance of Other Socio-Economic Functions and Conditions

6.1 Forest holdings
Number of forest holdings, classified by ownership categories and size classes

6.2 Contribution of forest sector to GDP
Contribution of forestry and manufacturing of wood and paper products to gross domestic product

6.3 Net revenue
Net revenue of forest enterprises

6.4 Expenditures for services
Total expenditures for long-term sustainable services from forests

6.5 Forest sector workforce
Number of persons employed and labour input in the forest sector, classified by gender and age group, education and job characteristics

6.6 Occupational safety and health
Frequency of occupational accidents and occupational diseases in forestry

6.7 Wood consumption
Consumption per head of wood and products derived from wood

6.8 Trade in wood
Imports and exports of wood and products derived from wood

6.9 Energy from wood resources
Share of wood energy in total energy consumption, classified by origin of wood

6.10 Accessibility for recreation
Area of forest and other wooded land where public has a right of access for recreational purposes and indication of intensity of use

6.11 Cultural and spiritual values
Number of sites within forest and other wooded land designated as having cultural or spiritual values

$\sum$ = 35 quantitative indicators

- Tra le molteplici attività Forest Europe produce, dal 2003 un report sullo stato delle foreste in Europa
- Sono stati prodotti per ora Quattro report: 2003, 2007, 2011, 2015
- I report si basano su questionari somministrati agli IFN

Protocollo di Kyoto

- IPCC = UNEP + WMO
- IPCC Intergovernmental Panel on Climate Change
- UNEP United Nations Environmental Programme
- WMO World Meteorological Organization

Ginevra, la sede del WMO presso la quale è ospitato l'IPCC

- Nasce nel 1988, ad oggi 194 Paesi sono membri dell'IPCC
- Scopo dell'IPCC è la valutazione dei trend dei cambiamenti climatici, fornisce informazioni utili per I governi per la mitigazione dei cambiamenti climatici e dei relativi impatti ambientali, sociali ed economici
- Le attività sono divisi in tre gruppi di lavoro:
  - WG1: climate change assessments
  - WG2: climate change impacts
  - WG3: climate change mitigations
- Il principale strumento sono gli Assessment Report: 1990, 1995, 2001, 2007, 2010, …
- Con AR2 viene identificato il cosìdetto Protocollo di Kyoto

LULUCF: Land Use, Land Use Change and Forestry

Robert T. Watson, Ian R. Noble, Bert Bolin, N. H. Ravindranath, David J. Verardo and David J. Dokken (Eds.)

Special report IPCC, 2000

Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories

J Penman, D Kruger, I Galbally, T Hiraishi, B Nyenzi, S Emmanul, L Buendia, R Hoppaus, T Martinsen, J Meijer, K Miwa and K Tanabe (Eds)

IPCC National Greenhouse Gas Inventories Programme, 2000

IPCC Guidelines for National Greenhouse Gas Inventories

Simon Eggelston, Leandro Buendia, Kyoko Miwa, Todd Ngara, Kiyoto Tanabe (Eds.)

Institute for Global Environmental Strategies (IGES) for the IPCC2006

- Viene ribadita l'importanza del corretto monitoraggio dei cambiamenti di uso del suolo per la stima dei processi bio-geo-chimici che stanno alla base del fenomeno del cambiamento climatico
- In particolare dei processi di deforestazione, reforestazione e afforestazione
- Vengono identificate le definizioni standard internazionali e i metodi da adottare per rendere comparabili le statistiche che ogni Paese firmatario del protocollo di Kyoto deve produrre annualmente

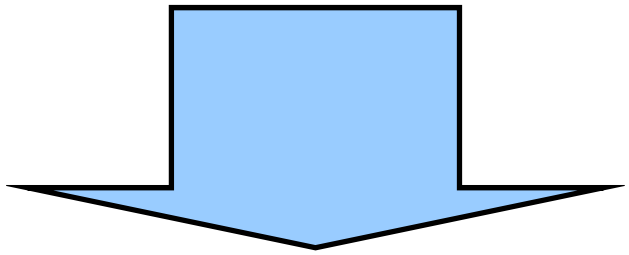
Biodiversità: SEBI2010 e SEBI2020

Streamlining Biodiversity Indicators
L'Unione Europea è impegnata attraverso l'agenzia europea per l'ambiente (EEA – European Environmental Agency) nel monitoraggio dei trend temporali dei livelli di biodiversità
Nell'ambito della strategia per la protezione della biodiversità delle nazioni unite (CBD – Convention on Biological Diversity) l'UE si impegna nella riduzione del tasso di decremento della biodiversità
Dopo il 2010 è stato affermato il concetto che ancora non esistono sufficienti basi di dati per il monitoraggio della biodiversità.

UN Convention on Biological Diversity

COUNTDOWN 2010

Halt the loss of biodiversity



UNEP

COUNCIL OF EUROPE CONSEIL DE L'EUROPE

ECNC

EEA/UNEP/ECNC ***SEBI2010 SEBI2020*** *initiative*

(Streamlining European 2010/2020 Biodiversity Indicators)

The 26 indicators proposed by the SEBI 2010 process

1	Abundance and distribution of selected species
2	Red List Index for European species
3	Species of European interest
4	Ecosystem coverage
5	Habitats of European interest
6	Livestock genetic diversity
7	Nationally designated protected areas
8	Sites designated under the EU Habitats and Birds Directives
9	Critical load exceedance for nitrogen
10	Invasive alien species in Europe
11	Occurrence of temperature-sensitive species
12	Marine Trophic Index of European seas
13	Fragmentation of natural and semi-natural areas
14	Fragmentation of river systems
15	Nutrients in transitional, coastal and marine waters
16	Freshwater quality
17	Forest: growing stock, increment and fellings
18	Forest: deadwood
19	Agriculture: nitrogen balance
20	Agriculture: area under management practices potentially supporting biodiversity
21	Fisheries: European commercial fish stocks
22	Aquaculture: effluent water quality from finfish farms
23	Ecological Footprint of European countries
24	Patent applications based on genetic resources
25	Financing biodiversity management
26	Public awareness

World governments fail to deliver on 2010 biodiversity target

Cambridge (United Kingdom), 29 April 2010- World leaders have failed to deliver commitments made in 2002 to reduce the global rate of biodiversity loss by 2010, and have instead overseen alarming biodiversity declines. These findings are the result of a new paper published in the leading journal Science and represent the first assessment of how the targets made through the 2002 Convention on Biological Diversity (CBD) have not been met.