



FUTMON
forest monitoring for the future

Forest Health in Europe

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a Life+ co-financed project for the "Further Development and Implementation of an EU-level Forest Monitoring System".



The project coordination centre is situated at the Institute for World Forestry, Hamburg, Germany.

Inform on

- the relevance of forest health assessments in future
- concept of forest health assessments and its methodological progress
- contributions to the challenge of climate change
- the need of scientific collaboration between Level I and Level II
- options for decision support for forest management

v Carlowitz

Concept

1713

Hartig

Wood
production

1804

Oswald

Revenues

1931

Speidel

Multi
function

1972

MCPFE

Sustainable
forest
management

2003





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Criteria and indicators of sustainability

Forest Europe (MCPFE, 2003)



I Forest Resources	II Health and vitality	III Productive functions	IV Biological diversity	V Protective functions	VI Socio-economy
Forest area	Deposition of air pollutants	Increment & production	Tree species composition	Protective forests (soil, water)	Forest owners
Growing stock	Soil chemistry	Round timber	Regeneration	Protective forests (climate ...)	Contribution to GDP
Age	Defoliation	Non-wood products	Natural processes		Net income
Carbon stock	Damaging agents	Forest services	Deadwood		Capital assets
			Genetic resources		Workforce & safety
			Endangered plant species		Trade
			Landscape diversity		Renewable energy
			Conservation of biodiversity		Recycling of paper products
					Recreation
					Culture

Growth (height, diameter)	Foliage density	Discolouration
Fruiting and reproduction	Mortality	Biotic and abiotic agents

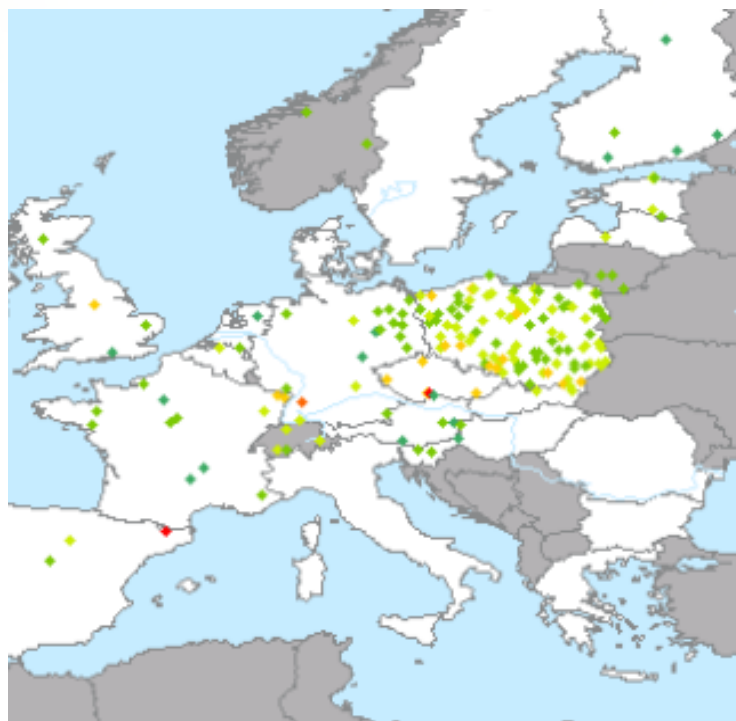
Resilience is the long-term capacity of a system to deal with change and continue to develop.



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Forest Health & tree vitality

Manual



Pinus sylvestris: defoliation in 2009
<http://www.forest-data.org/futmon/webgis>

MANUAL

on

methods and criteria for harmonized sampling, assessment,
monitoring and analysis of the effects of air pollution on forests

Part IV

**Visual Assessment of Crown Condition
and Damaging Agents**

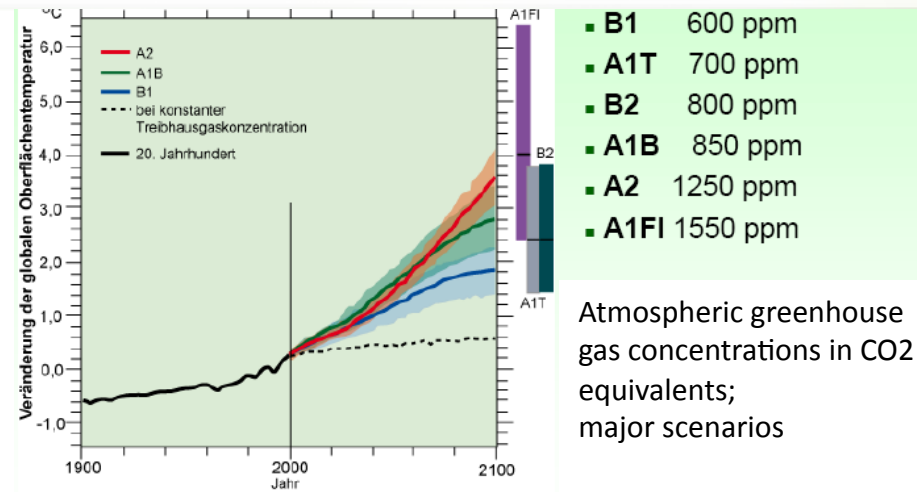
updated: 05/2010



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Climate change A challenge to be mastered



Tree vitality results combine systematical net (Level I) and intensive monitoring (Level II) information

Projections for central Europe: reduction of summer precipitation, increase of winter precipitation, increasing number of heat days comparable to 2003

Biological ecosystem condition:

- crown and tree condition, pests, diseases, mortality
- forest biomass, C-pools, growth
- phenology
- ground vegetation, species diversity
- competition, stability

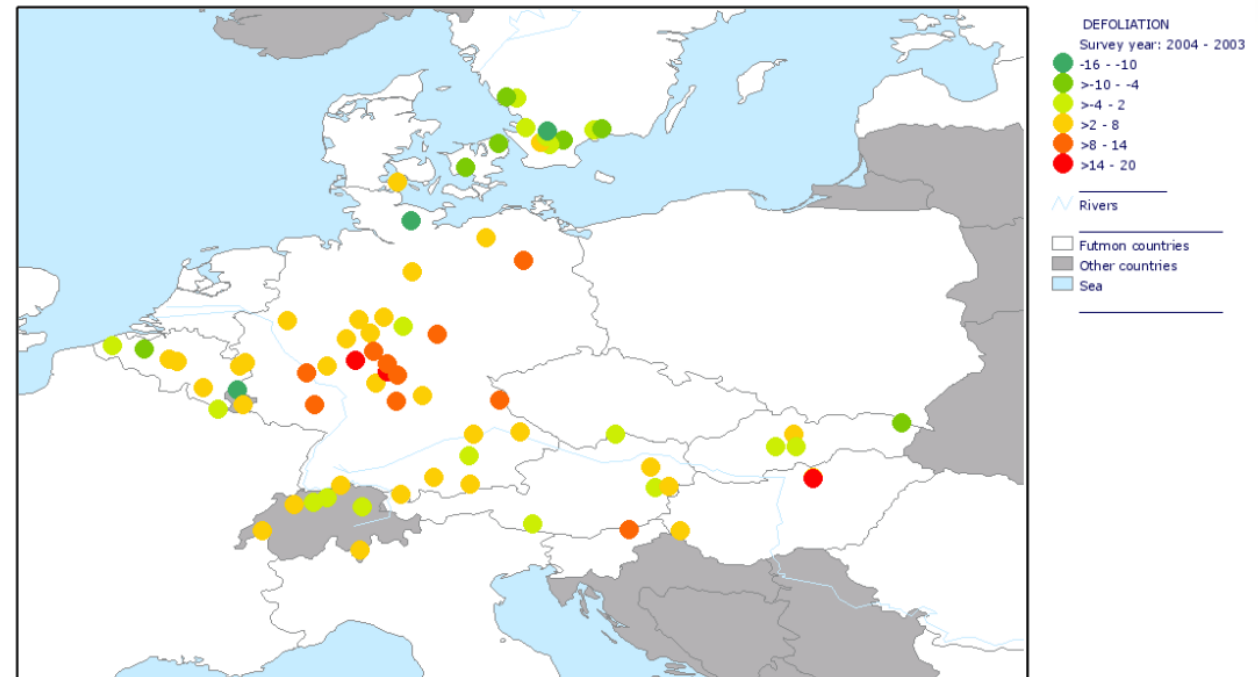
Economical Impact (market of forest products, employees, owners...)



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Defoliation *Fagus sylvatica*

2004 vs. 2003



0 240 480 720 960 1200 km

1 : 16604074

Fagus sylvatica: defoliation
in 2004 compared to 2003

<http://www.forest-data.org/futmon/webgis>

Fagus sylvatica: C-allocation in 2003 compared to 1998 - 2002

Compartment	mean 1998-2002	2004
	Biomass in t ha⁻¹ a⁻¹	
stem wood, branches	6,7	3,3
Foliage biomass	3,3	3,6
fruit compartments	1,8	4,6
sum	11,8	11,5



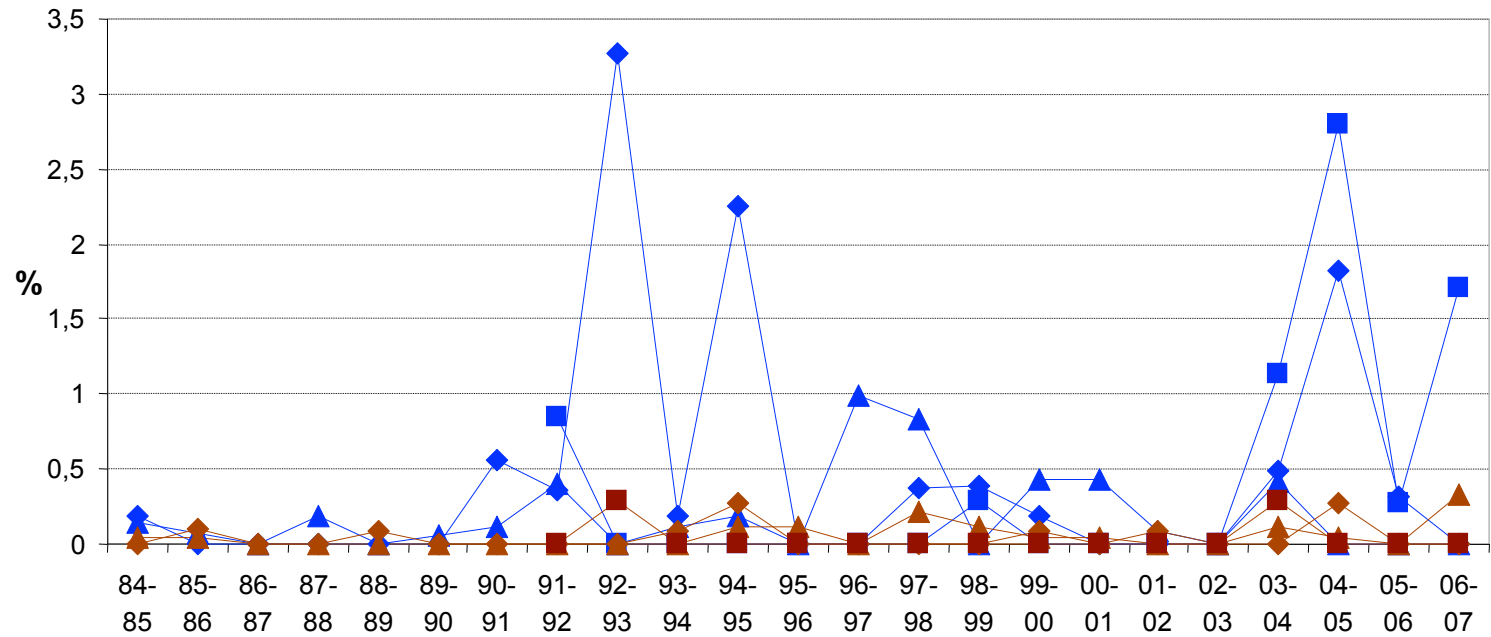
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Annual mortality

■ *Picea abies* and ■ *Fagus sylvatica*

Systematic net (Level 1); central European countries



Storms in 1990, 1992

Heat & drought in 2003



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Picea abies mortality and bark beetles



Sudden changes in forest condition often related to abiotic/biotic damage.

Extensive tree health monitoring networks are useful in revealing the impacts of widespread biotic damage in boreal forests.

Nevalainen, S. et al. (2011)



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Defoliators on *Quercus robur*



Different organisms: *Evannis defoliaria*,
Operophtera brumata, *Tortrix viridana*,
Thaumetopoea processionea, *Lymantria dispar*...)
Roskams, Sioen (2011)



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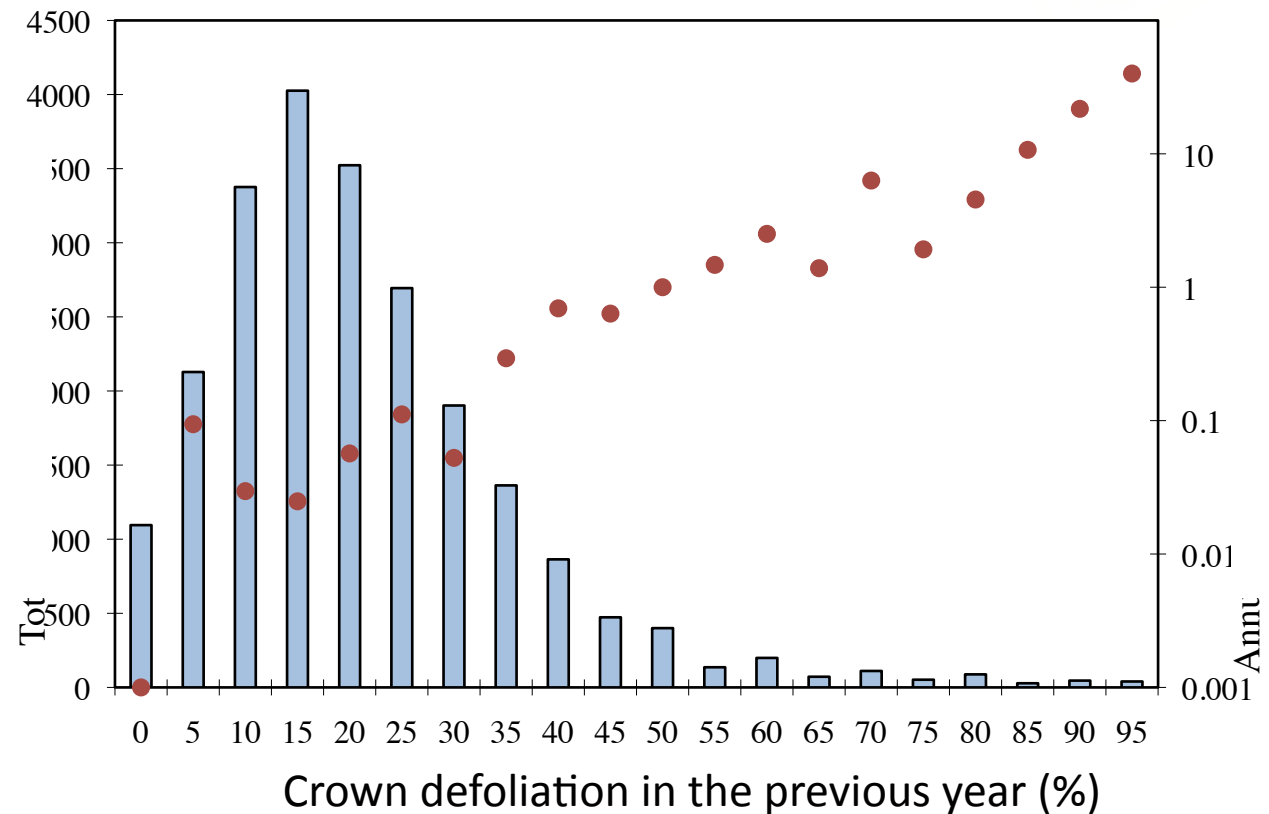
Crown defoliation and tree mortality

Swiss Level I



Total number of assessed trees

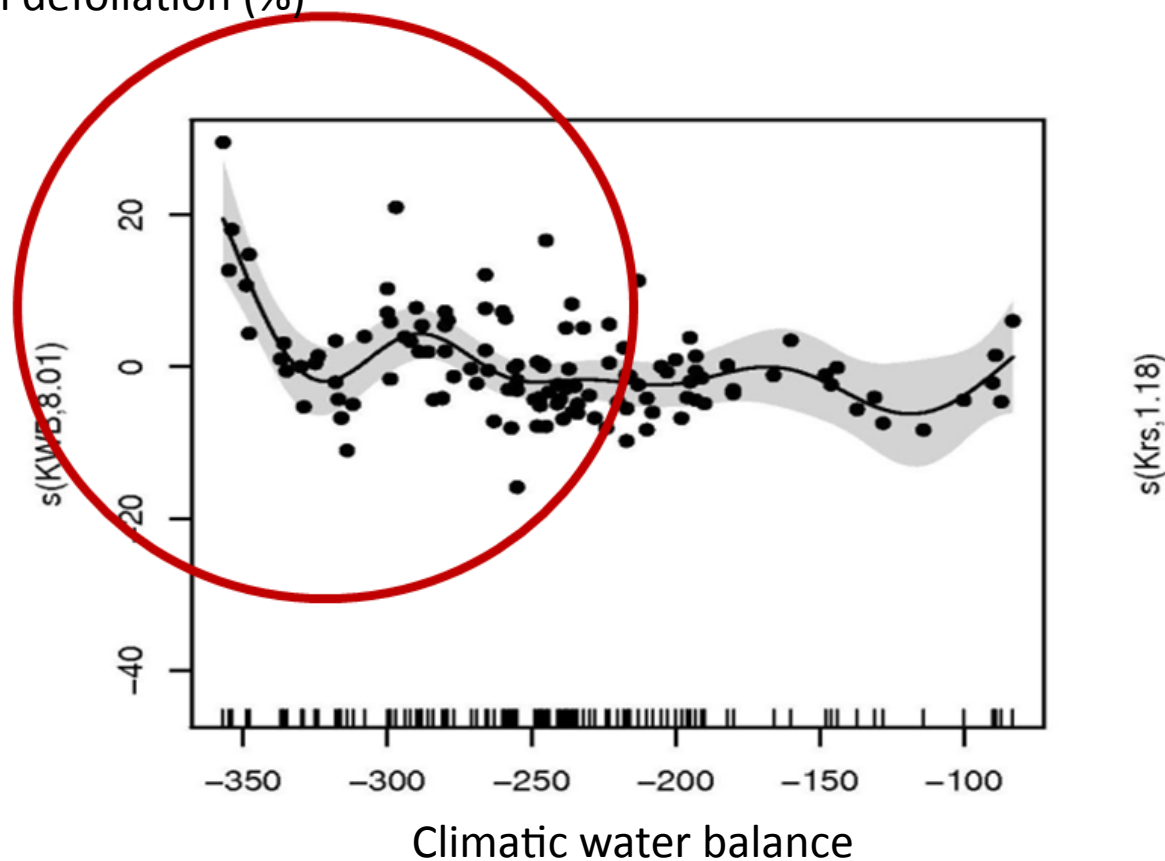
Annual mortality in % (log scale)



Since annual mortality is a rare event (0,3 % per year, Europe), defoliation > 50 % is a good estimator for risk evaluations

(Dobbertin, 2011)

Mean defoliation (%)



Decreasing Beech vitality on sites if climatic water balance is more negative than -325

GAM models: Defoliation 03-07 f (age, CWB, AWC, soil nutrient supply, temperature, elevation, position, liming, exposition, stand structure).
Adj. R²: 0,773; only age: Adj. R²: 0,49
Heuristic selection of variables
G32: GAM VS f (stand age***, CWB**, crown distance ***)

Definition of tree specific drought risk

(sum available water capacity and climatic water balance)

Risk	<i>Picea abies</i>	<i>Fagus sylvatica</i>	<i>Quercus robur</i>
high	< -350	< -400	- 500
low	0 to - 116	0 to -134	0 to -166

Spellmann et al. 2011

Forest Health assessments

- quantify criteria and indicators of sustainable ecological forest development (time series of results)
- support quantitative and up-to-date information on forest risks. The management of forest risks is crucial to further develop the stability of forest ecosystems by way of example as a precondition for carbon sequestration and climate mitigation by forests in Europe.
- result as an example in site drought limits of tree species. The forest sector gains by results of forest health assessments decision support for silviculture under changing climatic conditions: Tree species selection on given sites
- Forest health assessments contribute significantly to the European wide forest and nature information system.



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Thank you for you attention