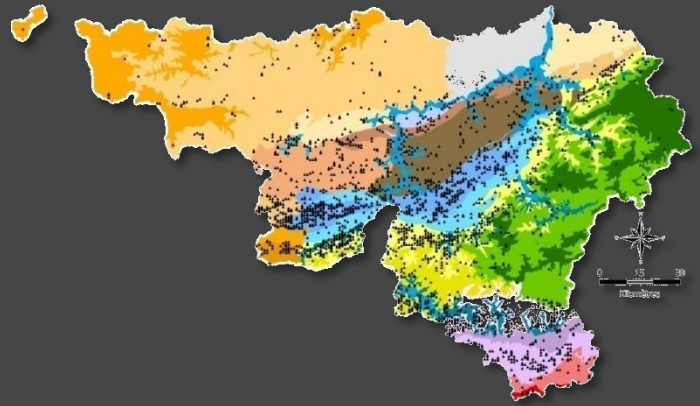
Regional scale simulation of the forest resources evolution in Southern Belgium (Wallonia)

PERIN J.[1], PITCHUGIN M.[1], LEJEUNE P.[1], HÉBERT J.[1]



IUFRO 125TH ANNIVERSARY CONGRESS

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Gembloux Agro-Bio Tech
Department of Biosystems Engineering

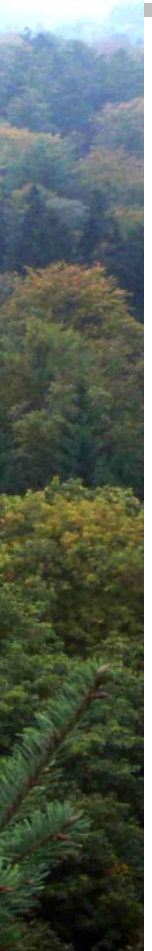
BIOSE
Gestion des
Ressources Forestières

LIÈGE université
Gembloux
Agro-Bio Tech

Wallonie

SPW
Service public
de Wallonie

Objectives



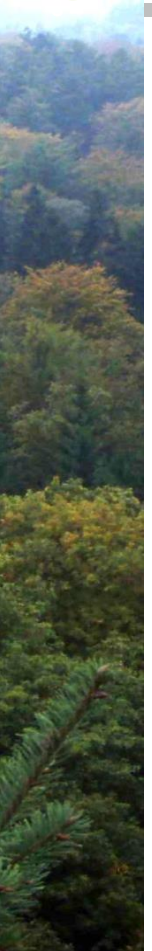
Developping methods and tools to :

1) **Assess the current forest resources with accuracy**

2) **Study the likely outcome of changing forestry**

3) **Predict forest resources evolution**

Context : Southern Belgium forest



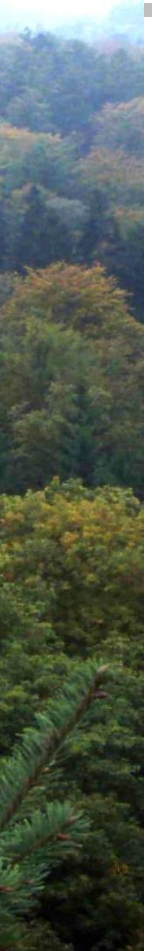
Cover 1/3 of Wallonia :

- 450 000 ha of productive forest stands
  ≈ 50 % public managed forest (DNF)

Small-scale intensive forest management :

- Highly fragmented forest
- Generally thinned every 6 to 12 years
- Main harvesting method = clearcutting

Context : Southern Belgium forests



Undergoing transformation to deal with :

- Climate change and forest disturbances
- New environmental regulations
- New economic opportunities

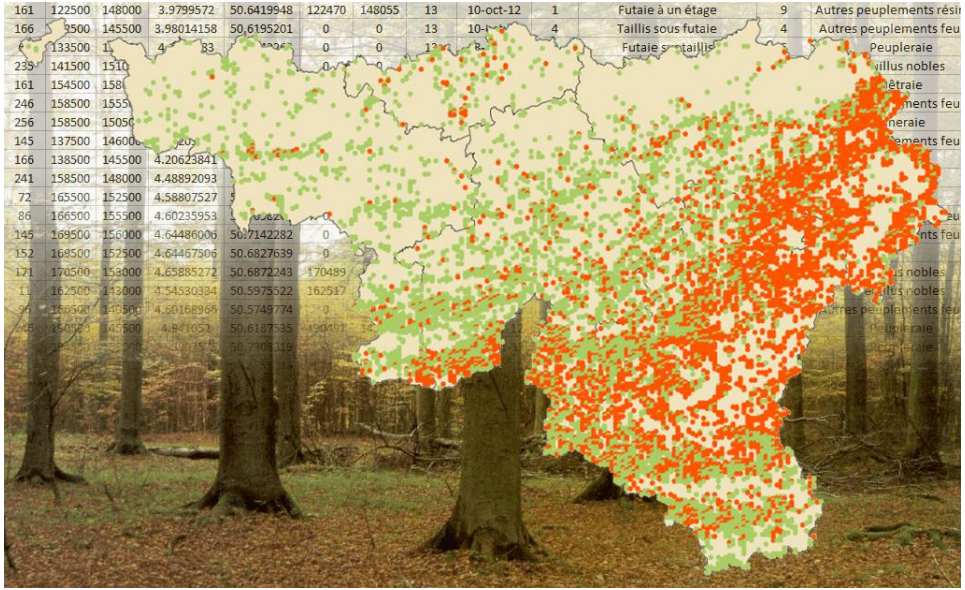
Question : What impact on wood industry supply?

➔ **Need updated data and simulation tools**

Wallonia forest observation network

Permanent Forest Inventory of Wallonia (FIW)

- Systematic sampling : 0.1 ha every 1000 * 500 m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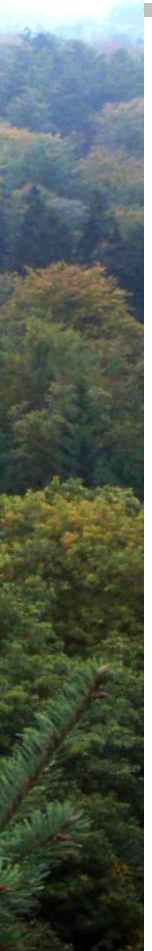
Wallonia forest observation network



➔ Fast composition changes underway

	Species	Estimated area (ha) 2001	Estimated area (ha) 2012	Variation (ha/yr)	
Softwood	Norway spruce	167 000	141 000	-2 364	-15%
	Douglas-fir	20 000	27 500	682	+38%
	Other	26 000	24 000	-182	
	Total	**212 500**	**192 500**	**-1 818**	-9%
Hardwood	Oak	108 000	109 000	91	
	Beech	59 500	65 500	545	
	Other	71 500	81 500	909	
	Total	**239 000**	**255 500**	**1 500**	+7%

➔ A better time resolution is required

Method : updating FIW data

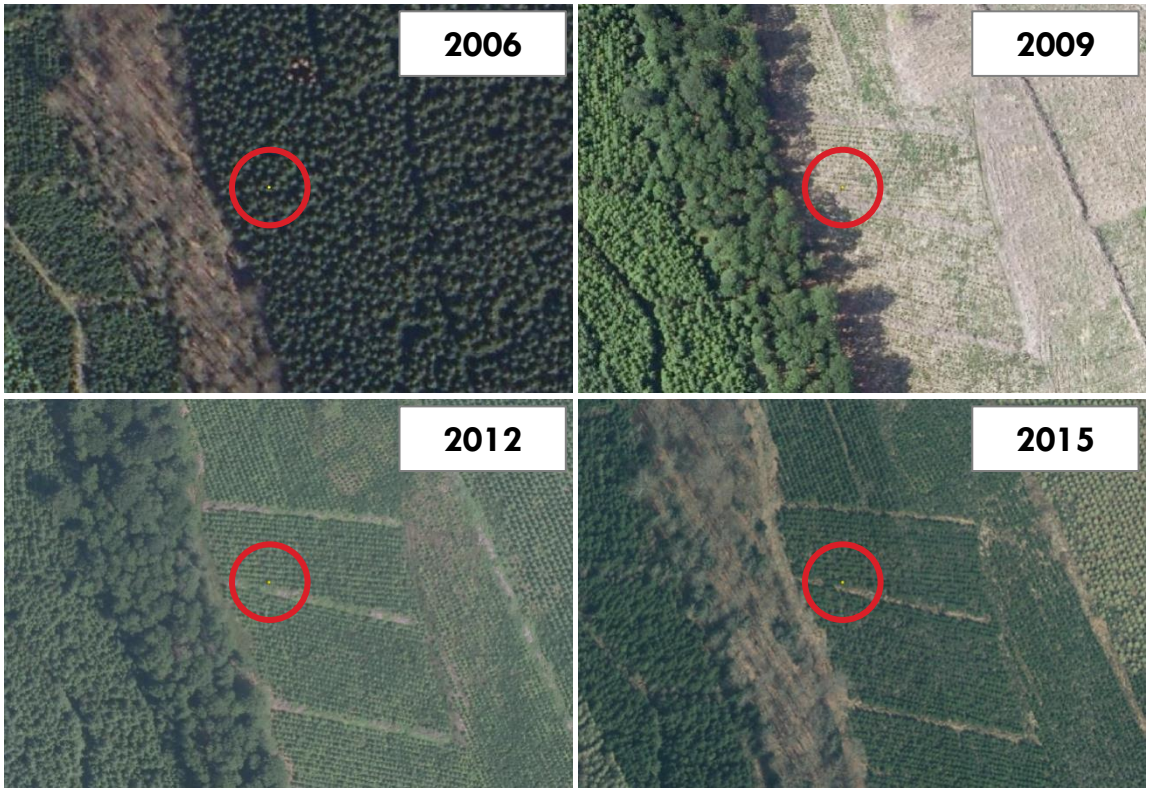
FIW data were updated using aerial photographic cover :

Photo interpretation on PSP coordinates (11 079 plots)

Working pace :
≈ 400 plots / hour

➔ **1 213 CC identified**

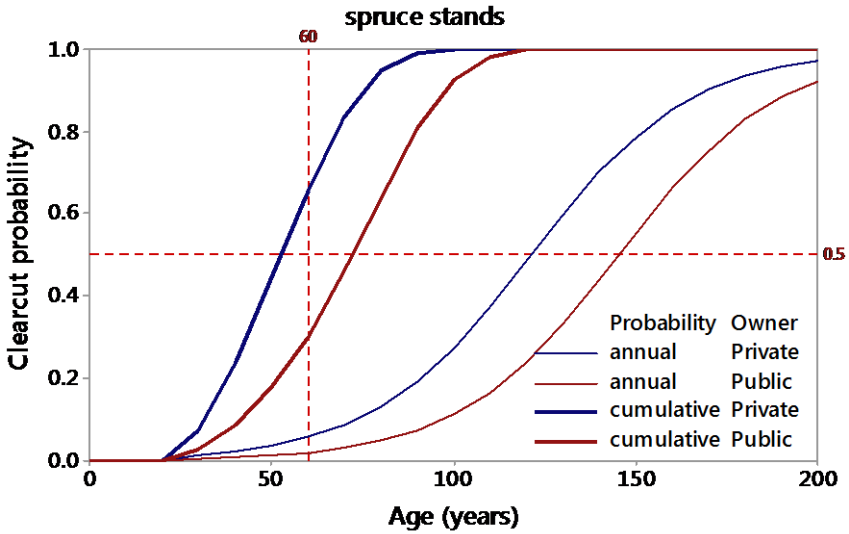
In example :
41 years spruce stand sampled in 1998

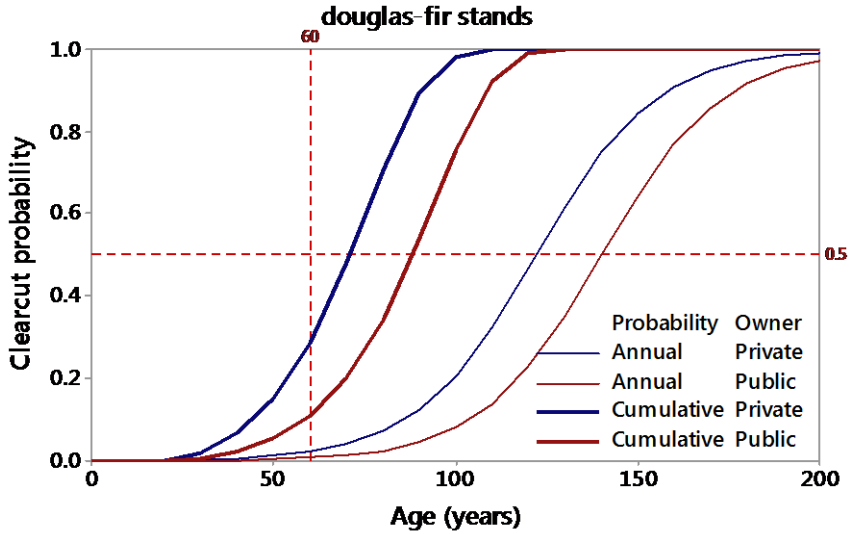


Method : updating FIW data

Photo interpretation results analysis :

- Clearcut area ≈ 4 500 ha/yr (80% in softwood)
- Clearcut probability = f(species, owner, age, SI)

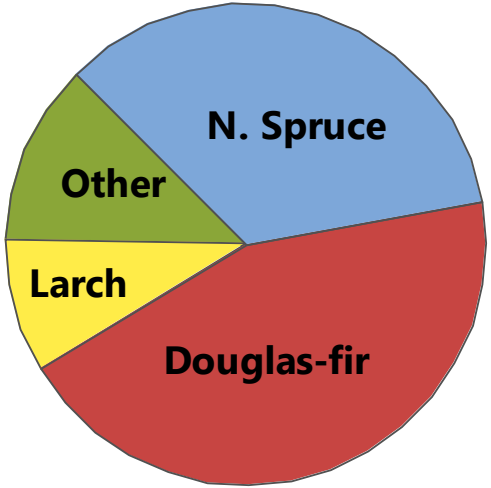




Method : updating FIW data

Reforestation survey in recent clearcuts (N = 529) :

- Total reforestation rate ≈ 92 %
- Reforested species in softwood stands :



- Low productivity softwood ➔ hardwood

Method : simulating forest stands evolution

Development of a forest simulation software :

- Integrated in the CAPSIS[1] platform (java)
- From the tree level to the regional scale

First version fully functional (GYMNOS)

- For pure even-aged softwood stands

New version in development (SIMREG)

- Expansion to other species and structures

[1]Computer-aided projection of strategies in silviculture (http://www7.inra.fr/capsis/)

Method : simulating forest stands evolution

Operating of GYMNOS

- Virtual stand creation from basic variables
  - Nha, Age, Hdom, Cg, Stdev
- Integrate latest growth and allometric models
  - Tree level distance independent
- Several thinning procedures available
  - Type and intensity are perfectly configurable

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Contents lists available at SciVerse ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Modelling the top-height growth and site index of Norway spruce in Southern Belgium

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European Journal of Forest Research

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Distance-independent tree basal area growth models for Norway spruce, Douglas-fir and Japanese larch in Southern Belgium

Authors | Authors and affiliations

Jérôme Perin, Hugues Claessens, Philippe Lejeune, Yves Brostaux, Jacques Hébert

Method : simulating forest stands evolution

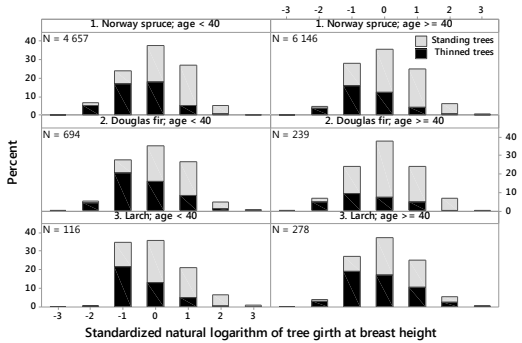
Operating of GYMNOS at the regional scale

INPUT = regional forest inventory data

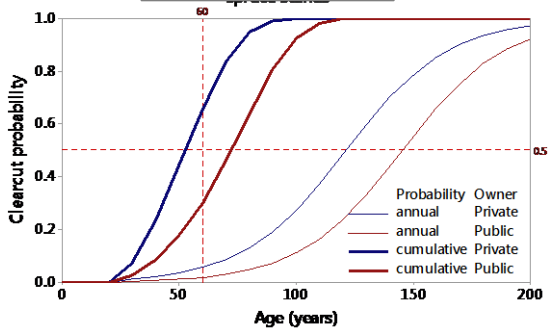
- Each sampled plots ➔ several virtuals stands

Forest management calibrated with 3 process :

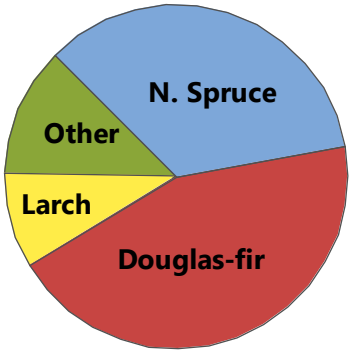
Thinning

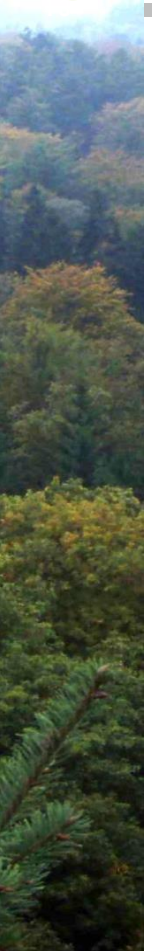


Clearcut



Reforestation





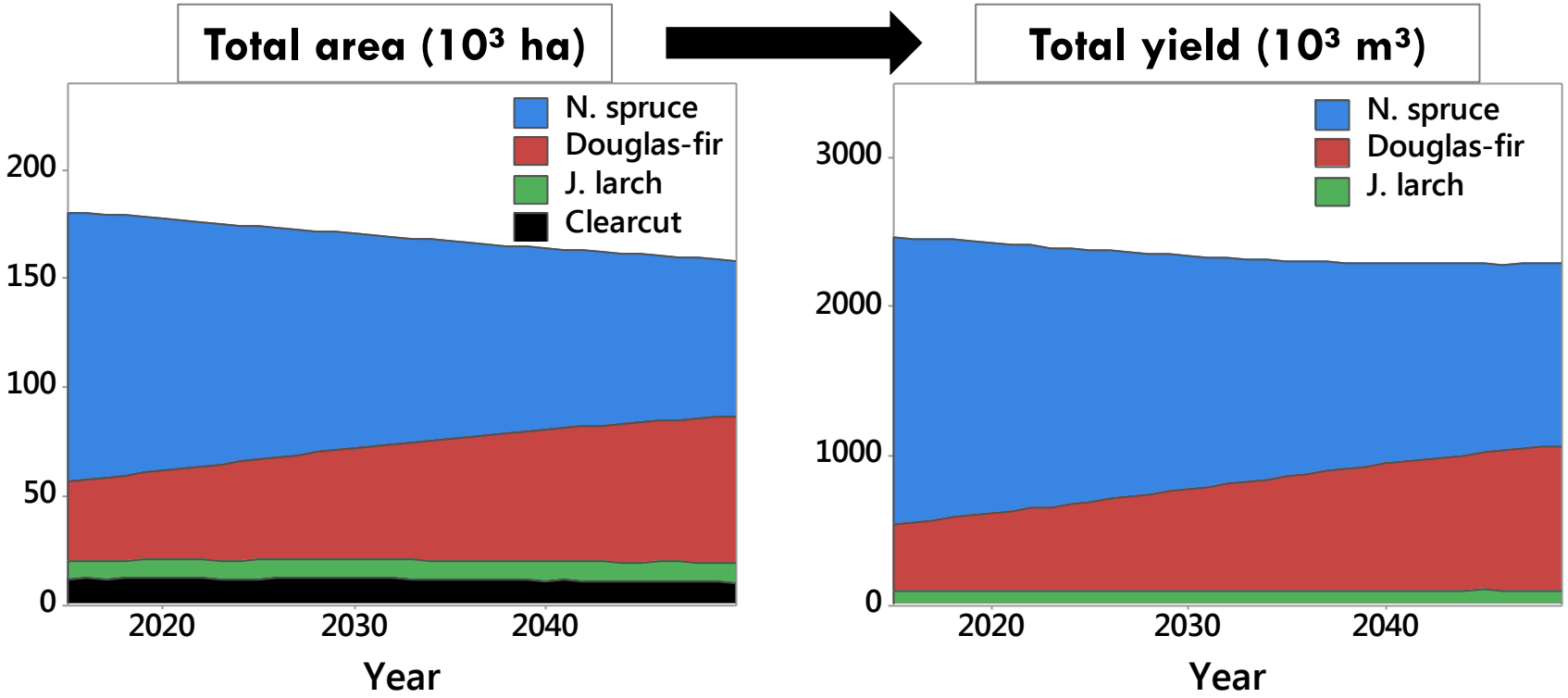
Operating of GYMNOS at the regional scale

Performances

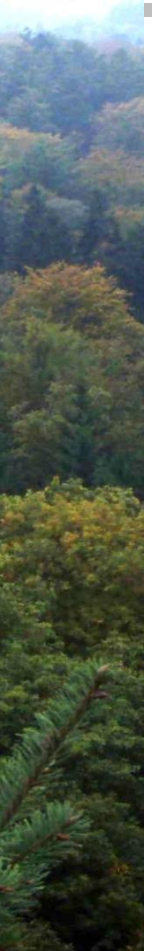
- 200 000 ha for 50 years ≈ 90 min

  ➔ $1.2 * 10^6$ annual tree growth /s

Simulation of Wallonia softwood evolution



Simulation of Wallonia softwood evolution



Conclusions :

Unsustainable harvesting rate

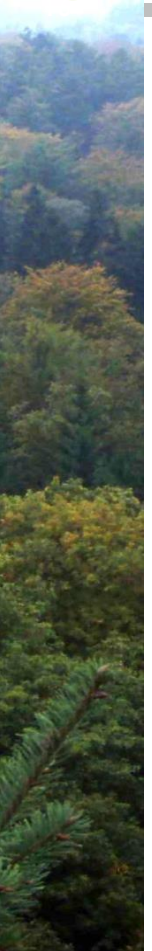
- ≈ 1.2 * yield

Partially offset by high yield of douglas-fir

- DF yield ≈ 1.3 * NS yield

➔ **Possible solution : ↗ douglas-fir reforestation**

Short-term prospects



Automatic detection of clearcuts :

- With Sentinel-1 and Sentinel-2 data

Improvement of the simulator :

- Expansion to other species and structures

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Thank you !