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# **Multi-functionality and sustainability in the European Union's forests – main messages from the EASAC report & some results from my own research**

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## Outline

- Short about EASAC and the people behind the report
- Main messages from the report
- Effects of forest management on carbon balance
- Recommendations for future actions

# EASAC

EASAC – the European Academies' Science Advisory Council – is formed by the national science academies of the EU Member States to enable them to collaborate with each other in giving advice to European policy-makers. It thus provides a means for the collective voice of European science to be heard. EASAC was founded in 2001 at the Royal Swedish Academy of Sciences.

Its mission reflects the view of academies that science is central to many aspects of modern life and that an appreciation of the scientific dimension is a pre-requisite to wise policy-making. This view already underpins the work of many academies at national level. With the growing importance of the European Union as an arena for policy, academies recognise that the scope of their advisory functions needs to extend beyond the national to cover also the European level. Here it is often the case that a trans-European grouping can be more effective than a body from a single country. The academies of Europe have therefore formed EASAC so that they can speak with a common voice with the goal of building science into policy at EU level.

## Multi-functionality and sustainability in the European Union's forests



EASAC policy report 32

April 2017

ISBN: 978-3-8047-3728-0

This report can be found at  
[www.easac.eu](http://www.easac.eu)

# What is in scientific debate?

READ THE FULL ARTICLE ONLINE  
<http://dx.doi.org/10.1126/science.1247579>

A framework is proposed to guide the selection and integration of different climate-change metrics in biodiversity impact assessments.

## Multiple Dimensions of Climate Change and Their Implications for Biodiversity

Raquel A. Garcia,\* Mar Cabeza, Carsten Rahbek, Miguel B. Araújo\*

## Managing forests in uncertain times

Increasing both forest stocks and timber harvest will buy time while we learn more about how trees absorb carbon, say Valentin Bellassen and Sebastiaan Luyssaert.

Bellassen & Luyssaert Nature 2014

PERSPECTIVE

PUBLISHED ONLINE: 18 AUGUST 2013 | DOI: 10.1038/NCLIMATE1853

nature

Forests in Flux

## First signs of carbon sink saturation in forest biomass

Gert-Jan Nabuurs<sup>1\*</sup>, Marcus Lindner<sup>2</sup>, Pieter J. Verkerk<sup>2</sup>, Katja Gunia<sup>3</sup>, and Giacomo Grassi<sup>5</sup>

European forests are seen as a clear example of vegetation rebound in the Northern Hemisphere; recovering in area and growing stock since the 1950s, after centuries of stock decline and deforestation. These regrowing forests have shown to be a persistent carbon sink, projected to continue for decades, however, there are early signs of saturation. Forest policies and management strategies need revision if we want to sustain the sink.

1) CLIMATE CHANGE  
2) BIODIVERSITY

Climate Change: Feedbacks, and the Benefits of Forests

Gordon B. Bonan

13 JUNE 2008 VOL 320 SCIENCE

Forests in Flux

PERSPECTIVE

## Managing Forests for Climate Change Mitigation

Josep G. Canadell\* and Michael R. Raupach

## Five steps for managing Europe's forests

Support resilience and promote carbon storage, say Silvano Fares and colleagues.

Fares et al., Nature 2015



Europe's forest management did not mitigate climate warming

Kim Naudts *et al.*

*Science* **351**, 597 (2016);

DOI: 10.1126/science.aad7270

# How the report was done

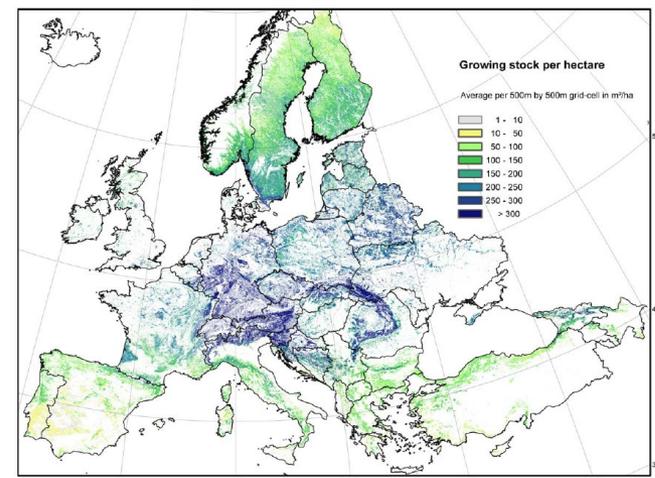
- Hosting for the report: Finnish Academy of Science and Letters
- 19 High level experts from 14 countries:
  - FI, SU, SE, NL, CZ, AU, BE, FR, GE, GR, IT, UK, PO, HU
  - Multidisciplinary approach, including energy, economic, forestry, conservation, ecology and climate change experts
- Workflow:
  - Helsinki, May 2015 – Kick-off workshop
  - Amsterdam, Oct 2015 - Working meeting
  - Brussels, Feb 2016 – 2-day Workshop with EU policy makers & stakeholders
  - Writing the report spring-autumn 2016
  - Reviews from Scientific Academies, Dec 2016-March 2017
  - Brussels, April 11, 2017 - Release of the report
- >250 peer-reviewed references



**Independent, scientific understanding  
on European forests  
- accounting for multi-functionality**

# Main messages – Forests in EU

- Diversity in history, ecological, climatic and edaphic factors, stocks and growth, management, ownership
- Forestry is important branch in many economies
- Many ecosystem services from forests are important for local people as well



## ***EU has only minor influence on the forest policy in Europe***

- International treaties and commitments bind the Union but national legislations overrule the policies regionally → possibilities for conflicts and lobbying
- EU should be able to develop ways for accounting the national differences but simultaneously setting clear incentives for better and transparent policies following the international obligations, esp. *Paris Agreement and Convention on Biological Diversity*

# Net annual fellings (including disturbances) and annual increment in 2010 in European forets

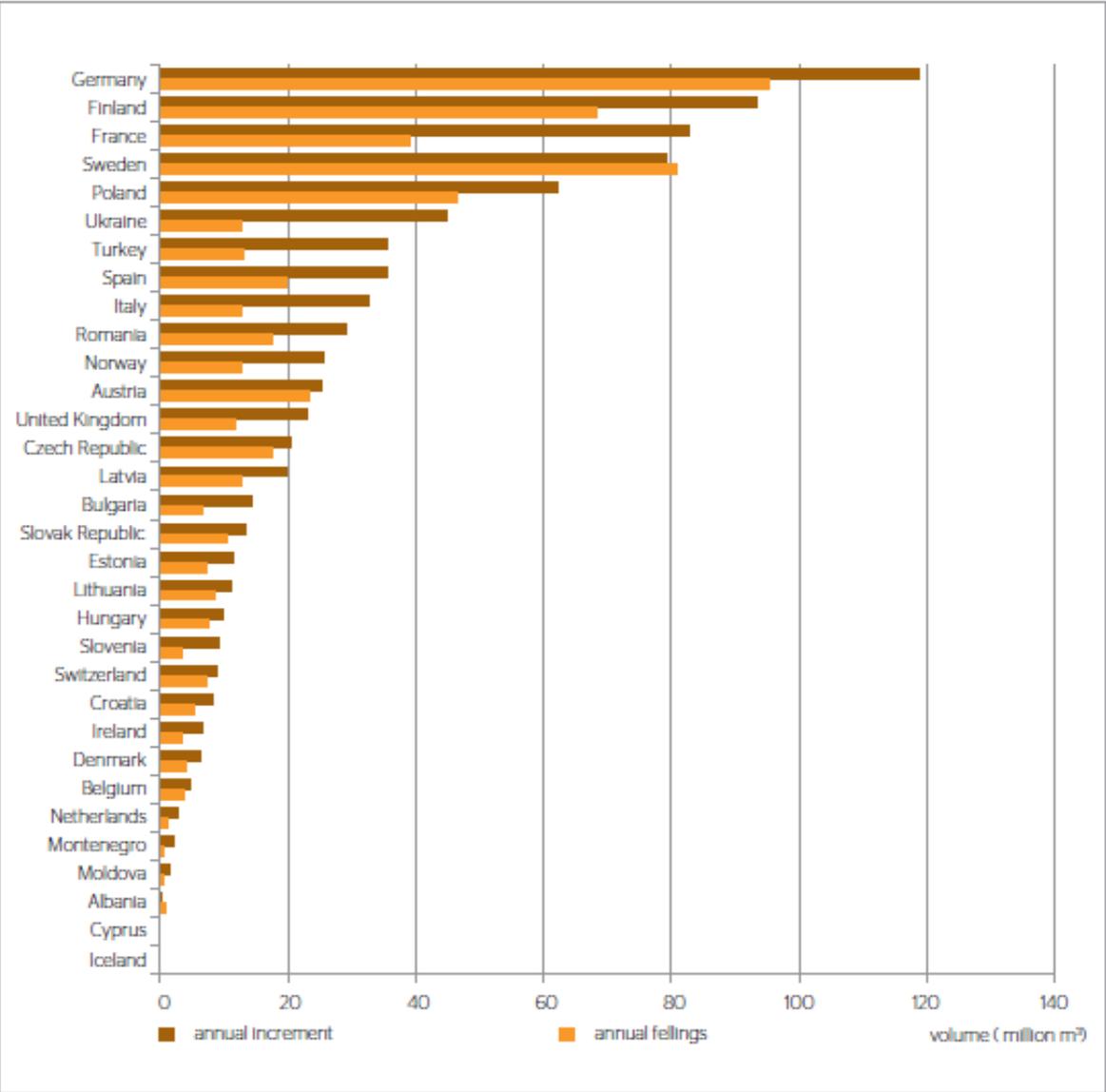


Figure 48. Annual fellings and annual increment for reporting countries in Europe (million m³)

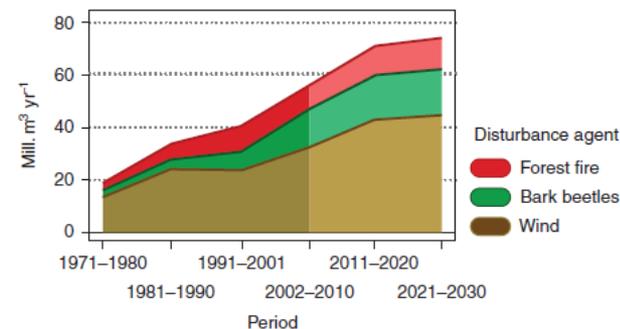
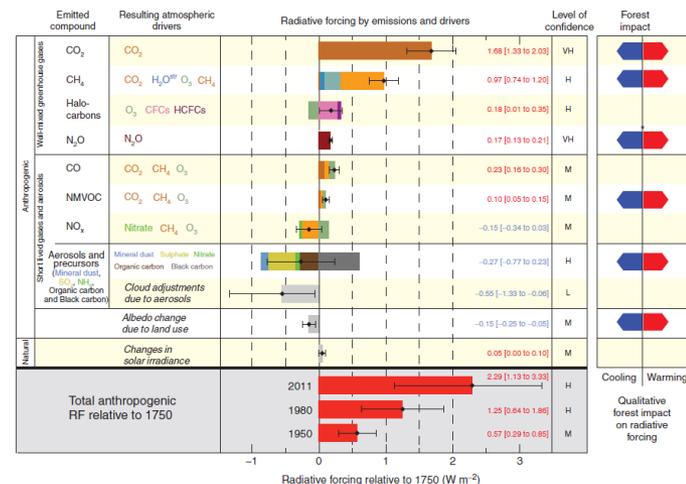
(From FOREST EUROPE, 2015: State of Europe's Forests 2015)

# Main messages - Climate change mitigation

- Forests produce many climate benefits: sequester carbon, contribute to cloud formation, products for substituting fossil fuels and other carbon intensive materials
- Forest carbon sink and storage are dynamic and depend on management

## In future forest policies:

- The forecasted intensification of harvests for e.g. bioenergy will in short and medium term yield in loss of carbon sink and release of carbon from storage: **no mitigation but acceleration of climate change**
- Forests already suffer from climate change; fires, droughts, storms, pathogens: **current management tools are not planned to increase forest resilience nor their climate impact**



# *Main messages - Biodiversity*

- Forest structural elements, old growth forests, and forest continuity are crucial for biodiversity
- Forest management is central in maintaining - or losing - biodiversity values of production forests: genetic, species and habitat diversity
- Good biodiversity implies often good productivity and resilience:
  - 10% decrease in tree species → annual losses of 150-420 billion €

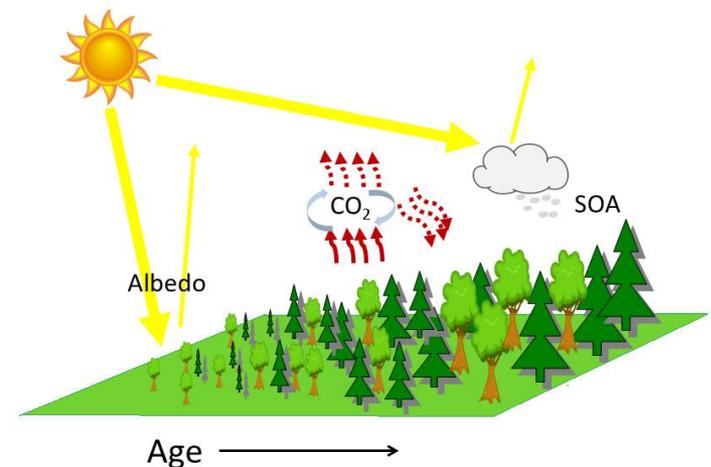


## *In future forest policies:*

- Meeting biodiversity conservation targets is more important than ever, but compromised by **forest use intensification**
- Global and EU –level biodiversity conservation is hampered by exclusive Member State level **land use planning**
- **Protecting the old-growth forests** and maintaining **deadwood** in production forests are key tools for preserving biodiversity

# Main messages – Climate impact

- Climate impact of forest management is not just related to their effects on atmospheric carbon, since changes in albedo, other greenhouse gases and cloud formation can be significant.
- Labelling bioenergy as ‘carbon neutral’ is an oversimplification. The ‘neutrality’ depends on forest type, what kind of biomass is used and how it is utilized.
- A critical factor in the use of forest biomass in energy production is the ‘payback time’ during which the CO<sub>2</sub> concentration in the atmosphere will be increased as a result of using biomass.
- Using wood in durable commodities is recommended.



## ***In future forest policies:***

- The full climate forcing of forestry and use of forest products should be accounted for and considered in land use planning.
- Meeting the targets of the Paris agreement requires rapid reduction of atmospheric CO<sub>2</sub> concentrations and it is not obvious that using biomass for energy substitution is the optimal solution.

# Effects of forest management on carbon balance

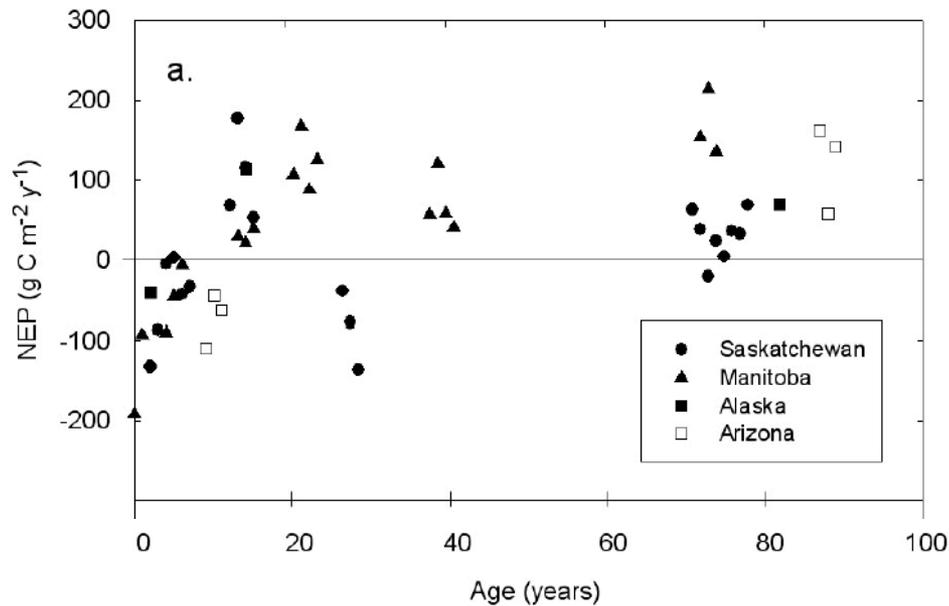


# Even-aged silviculture dominate in boreal forests

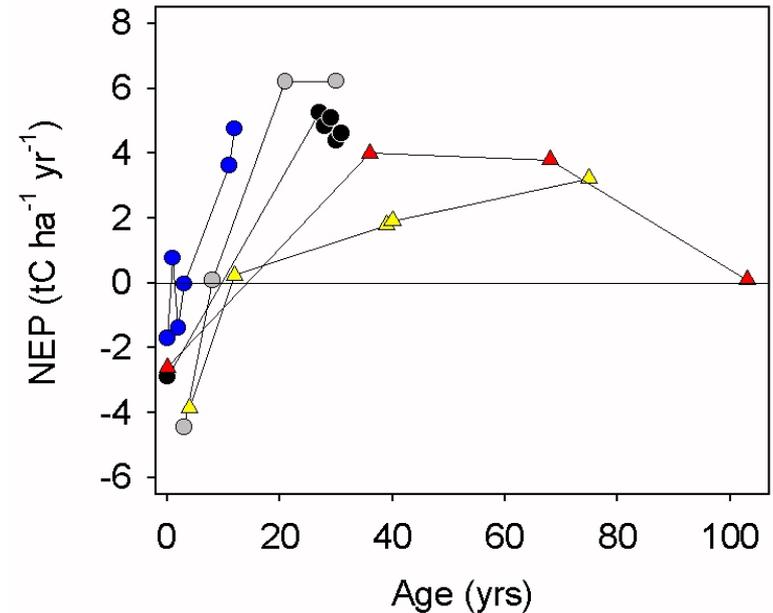


How does this silvicultural method affect C-balance?

# Chronosequence studies is a tool to assess this question



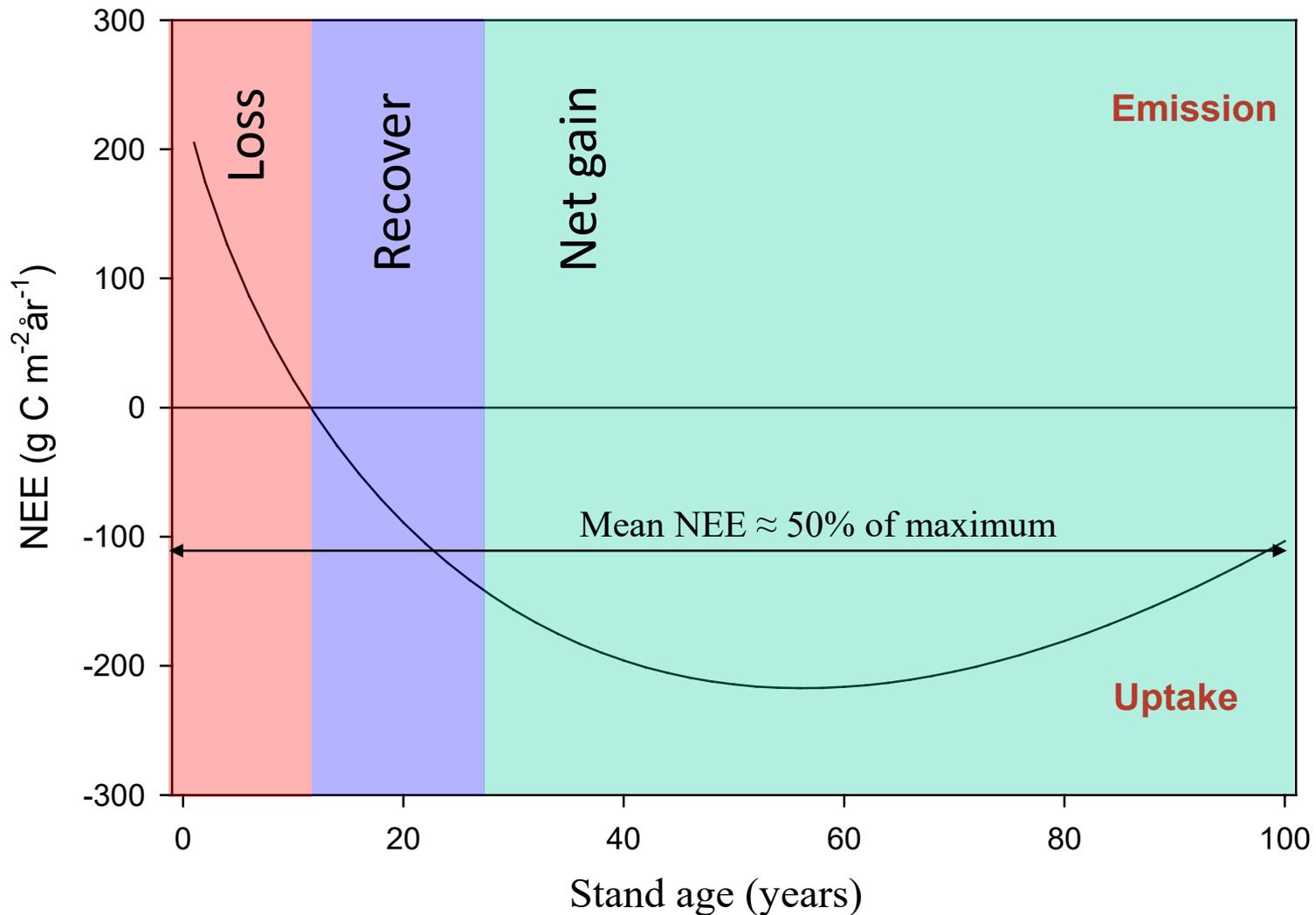
North-American chronosequences  
(Amiro et al. 2010, JGR v. 115)



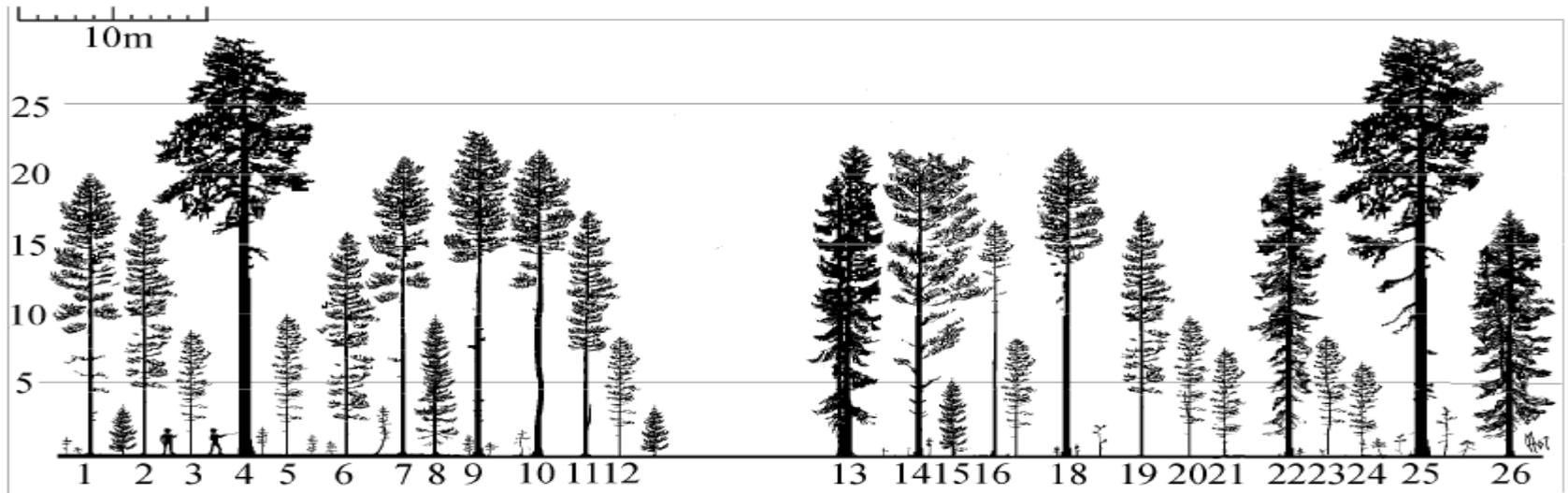
European chronosequences  
(cf. Magnani et al. 2007 Nature)

Conclusion: Clear-cuts are source during the first 7-15 years with 1<sup>st</sup> year emissions  $\sim 200\text{-}500 \text{ g C m}^{-2}$

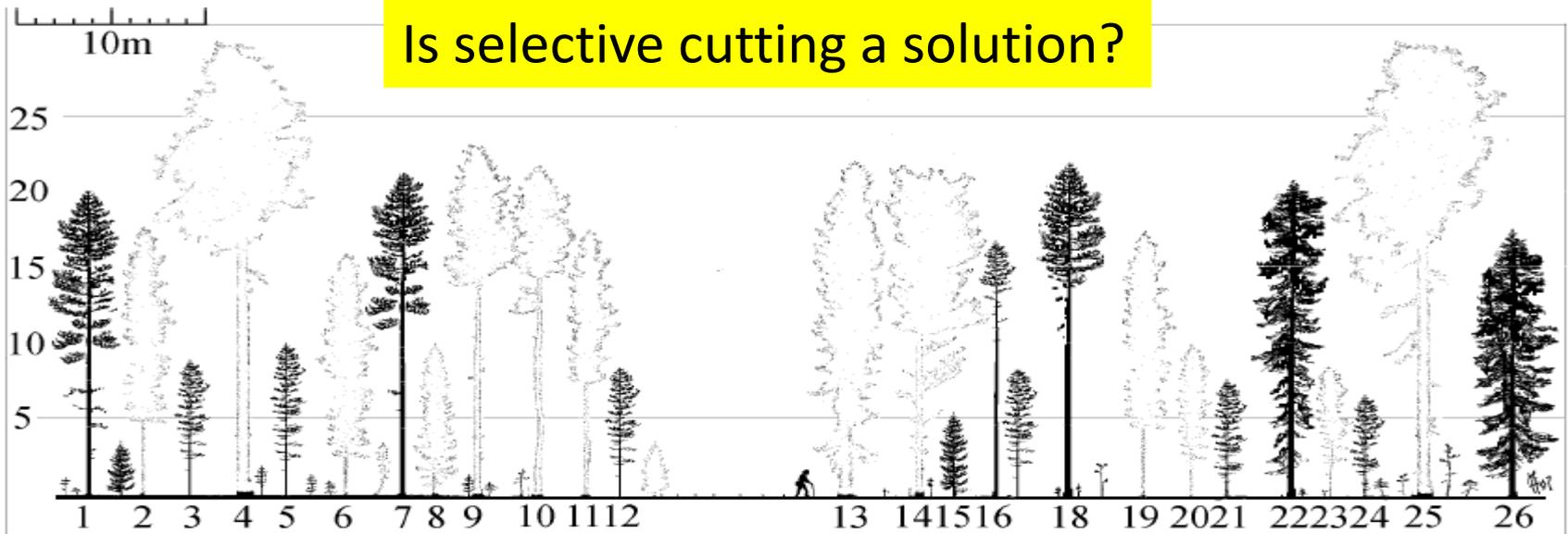
# A simple model of NEE vs. age based on the European study



So, what can be done to reduce or better, eliminate these emissions?



Is selective cutting a solution?



(from Mats Hagner)

# What evidence do we have showing that continuous cover forestry is better than clear-cut forestry (from climate point of view)?

- We are lacking continuous cover forests that are suitable for our methodology so there are no direct evidence (but coming soon!).
- But - we can use thinning as a surrogate for continuous cover management.

# Thinning experiment

Site: Norunda 60°05'11.39"N, 17°28'46.21"E, 45m alt  
Mixed Pine/Spruce on podzol, dystic regosols.  
Morain, sandy till as well as gravelly till with high  
boulder frequency.

Before thinning:

LAI = 4.5 Basal area = 46.7 m<sup>2</sup> ha<sup>-1</sup>

72% pine, 28% spruce

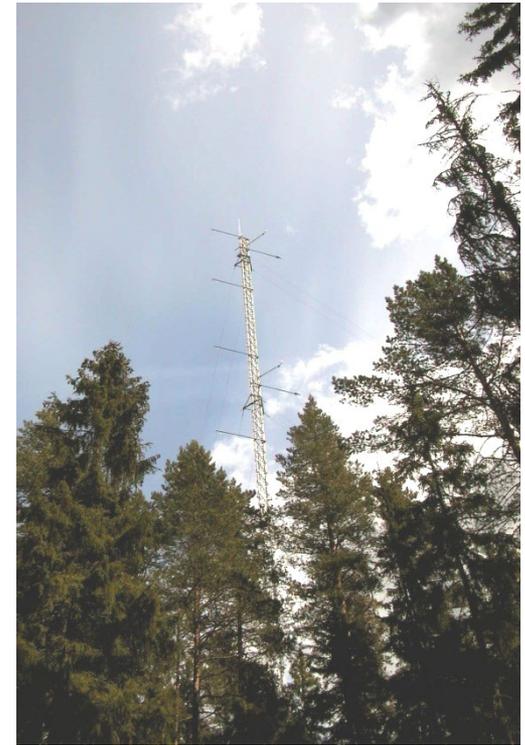
After thinning:

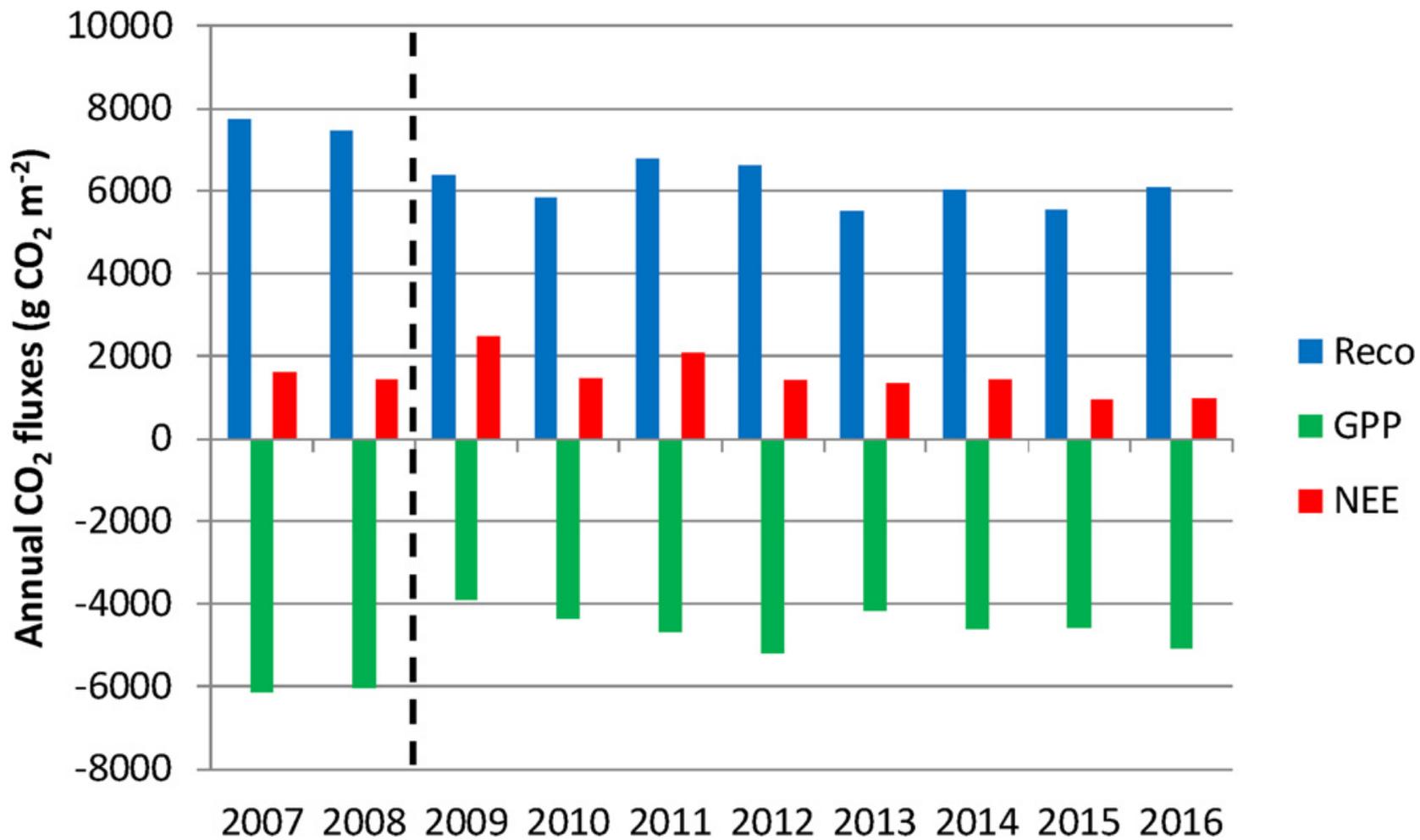
LAI = 2.8 Basal area = 36.7 m<sup>2</sup> ha<sup>-1</sup>

82% pine, 17% spruce

Thinning operation January-March 2009

Harvested ca 25% of tree volume





(Lindroth et al. 2018 Agric. For. Met. 262:59-70)

# A first preliminary analyses of NEE from a continuous cover forest as compared to three forests under rotation management



## Demonstrationsområde: Romperöds blädningsskog

Demo site: The forest with selective felling in Romperöd

Fastiget: Rumperöd 1:1

Kommun: Östra Göinge

Län: Skåne

Ägare : Karin och David Göransson

Demoområdets areal: Ca 30 ha



Svartberget,  
Västerbotten  
Mixed pine &  
spruce ca 100  
years old

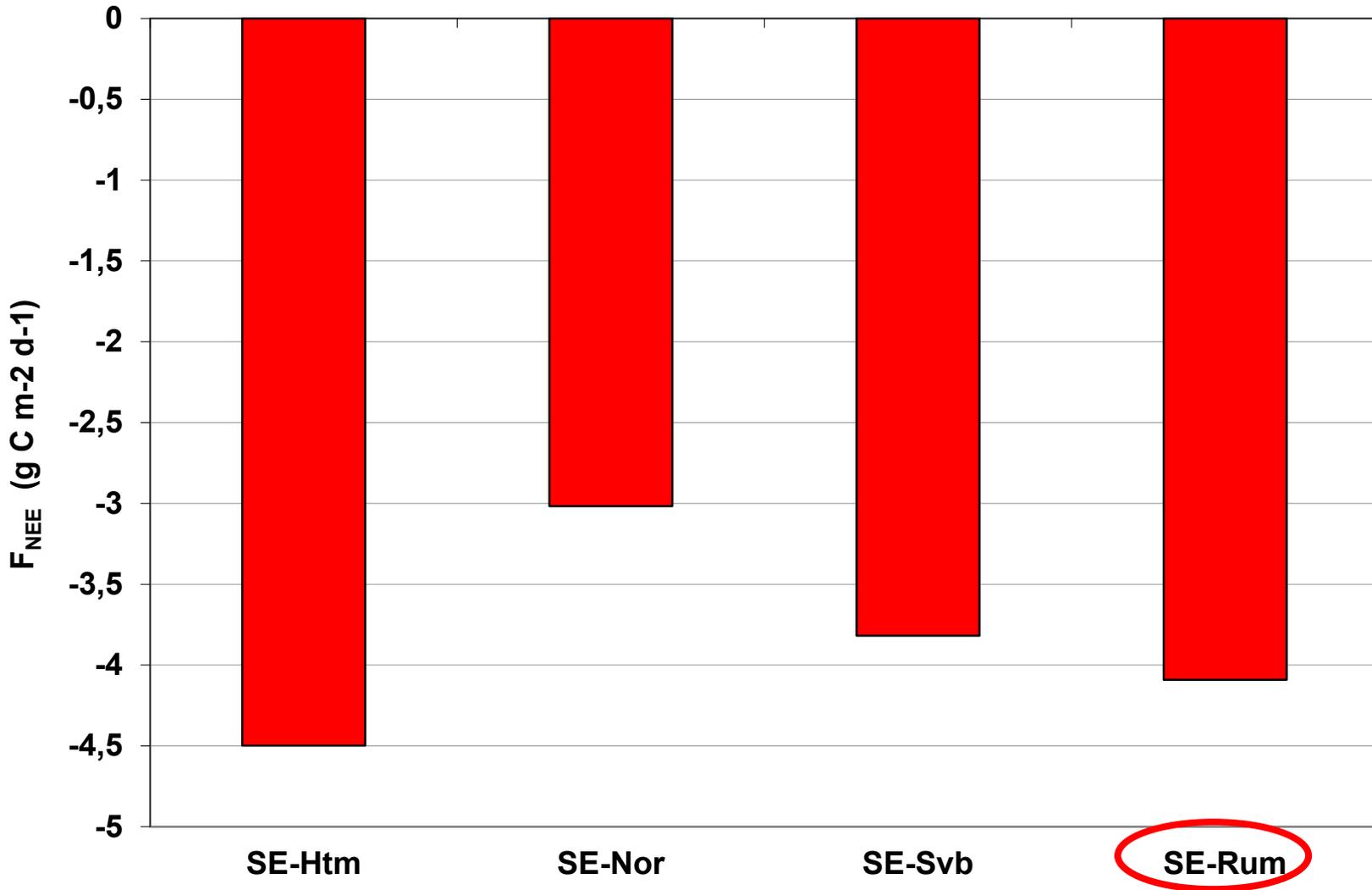


Norunda, Uppland  
Mixed pine &  
spruce ca 120  
years old



Hyltemossa, Skåne  
Spruce ca 30 years  
old

# Mean uptake (NEE) during clear summer day



## Recommendations for future actions

Clarify the climate impact of *selection management system in comparison with rotation management* including carbon balance and other GHGs, energy balance, effects of albedo and BVOCs as well as aspects related to biodiversity and resilience.

Further the understanding on the consequences of a possible shift from rotation to selection management in the forestry sector, in terms of forest growth, disease and damage risks, conditions for extraction of residue materials and decomposition rate of organic matter and carbon storage in the soil.

Analyze and compare *the role of biomass in different sectors*. There is an obvious risk that all sectors (industry, transportation, electricity, heating etc) have expectations of biomass as a mitigation option which taken together add up to far more than what can be made available while providing a range of other important social, economic and ecological functions.

Establish at national level a *system for integrated analysis of which mitigation options are leading to the most efficient reductions of the radiative forcing including non-GHG gasses* in the atmosphere until 2100. Such analysis should include relevant sectors - forestry, agriculture, energy and industry and also consider sustainability issues.