

# Sustainable jet fuels from forest wood residues

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# BIOENERGY FROM BOREAL FORESTS

Swedish approach  
to sustainable wood use

## IRENA project

Cooperation between IRENA and Svebio, with support from Swedish Energy Agency.

Authors: Kjell Andersson, Svebio, Seungwoo Kang, IRENA, and Jeffrey Skeer, IRENA.

Purpose: To describe the Swedish use of bioenergy from managed forestry as a model for boreal forestry.

# Managed forestry is carbon neutral

- 1% harvested every year in a 100 year long rotation





# Double standing stock, increasing growth and harvests in Swedish forests

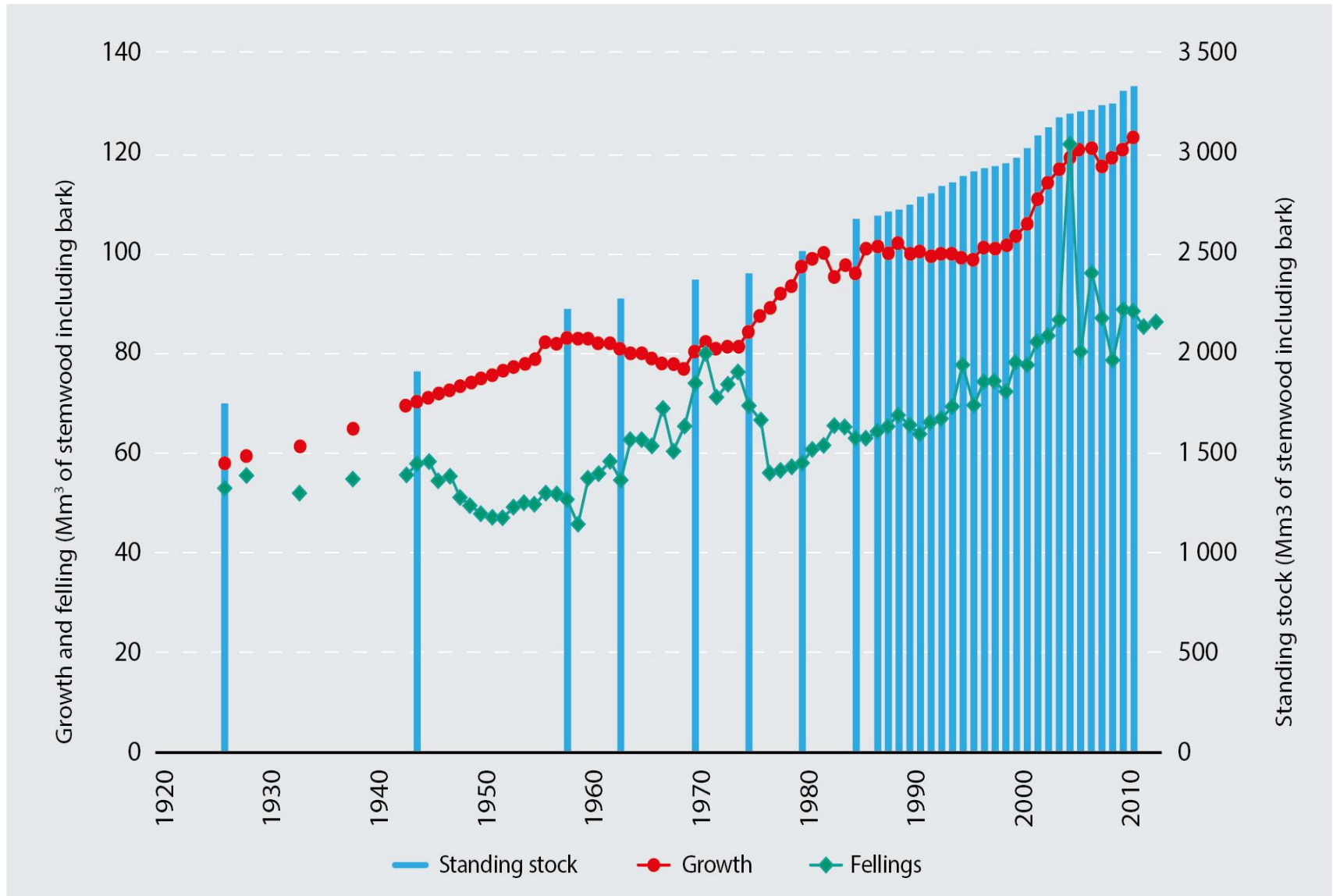
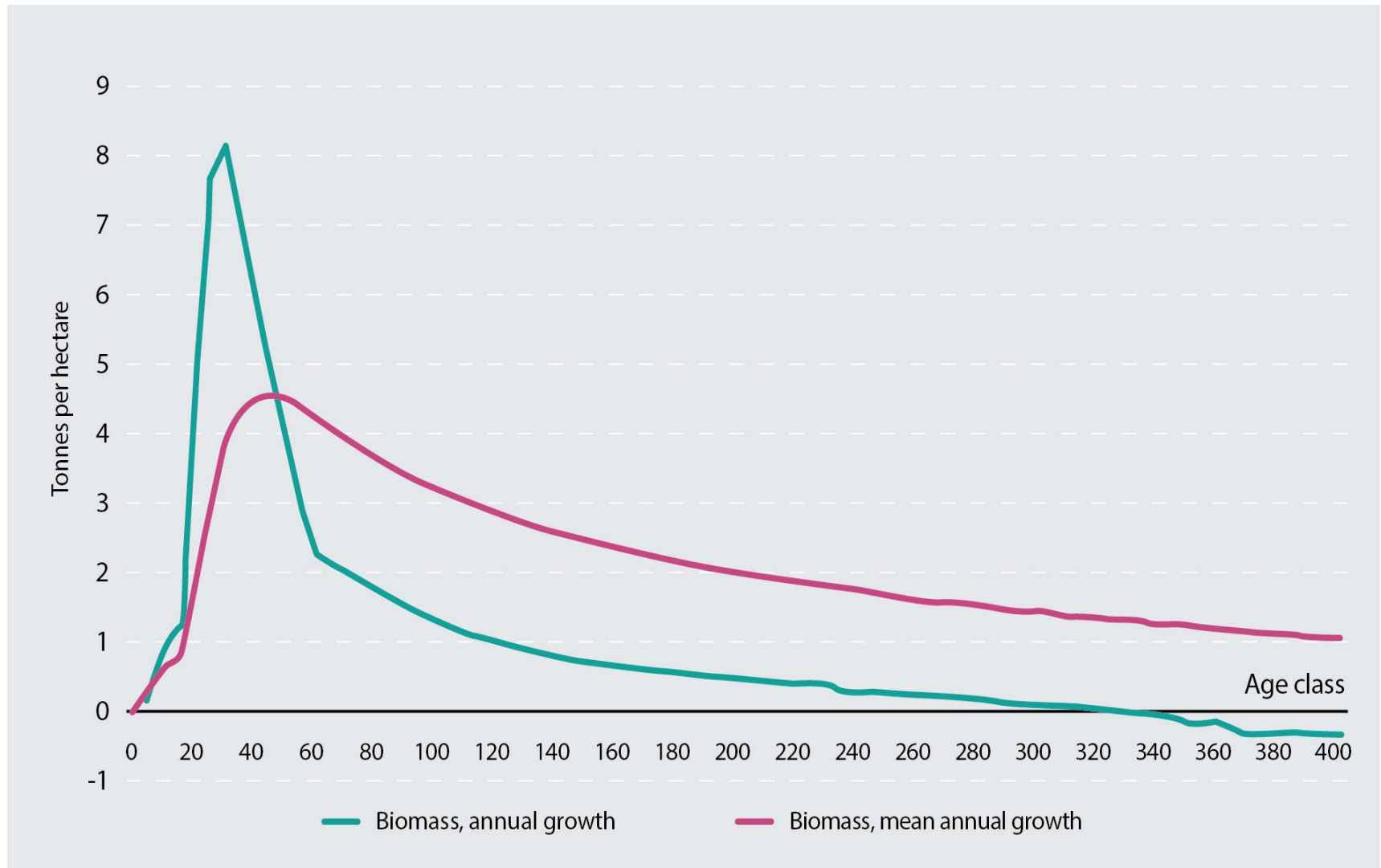
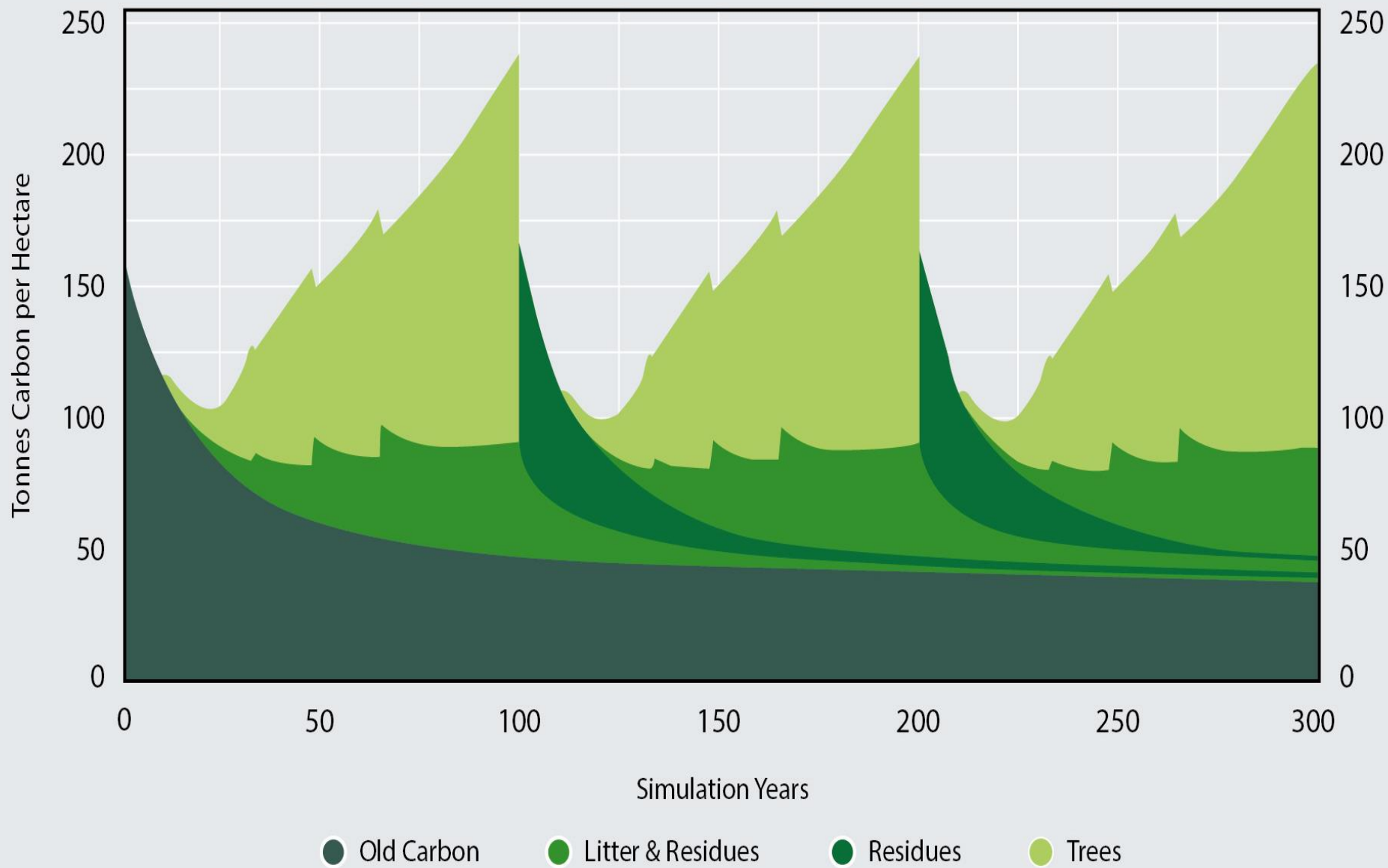
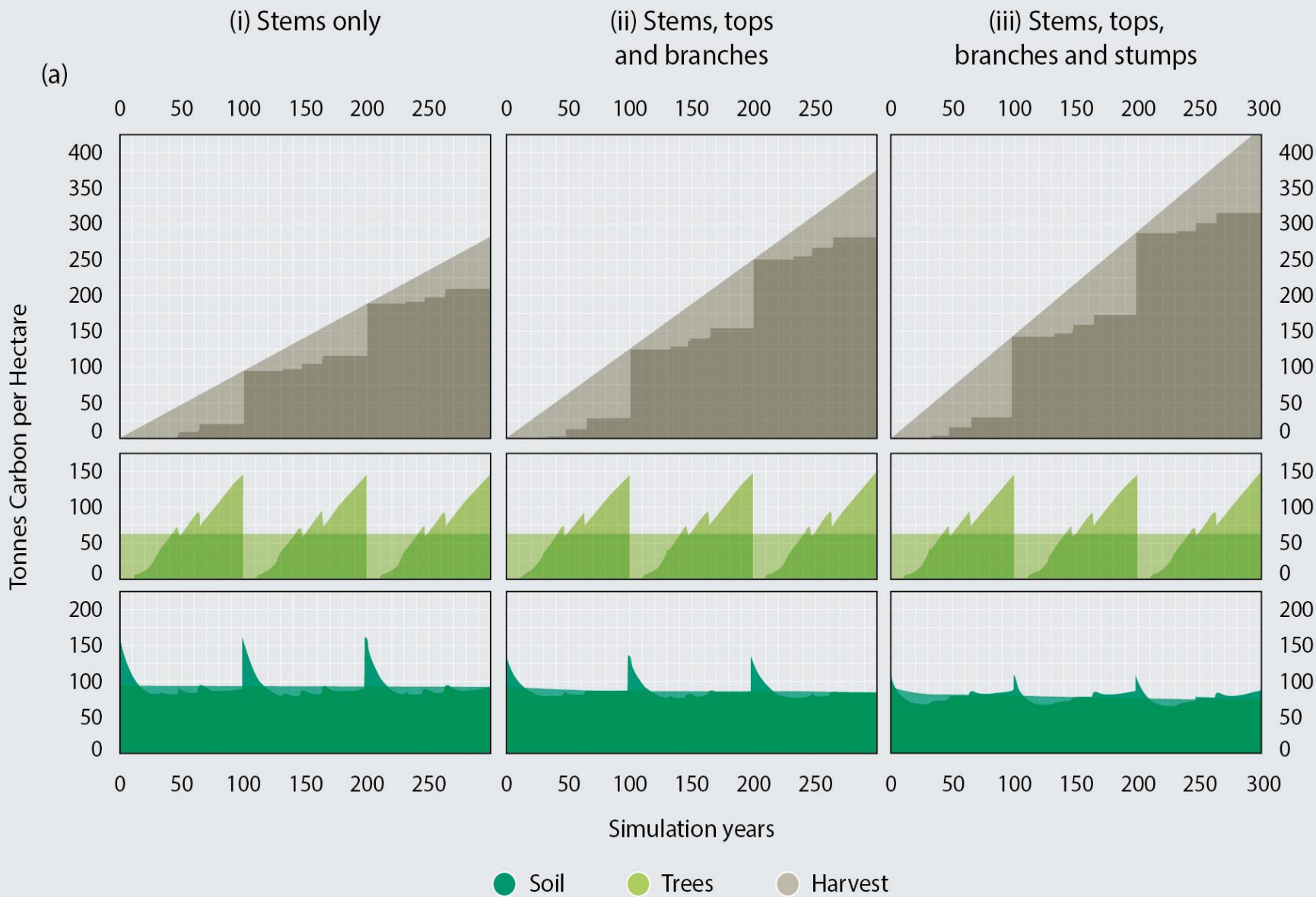


Illustration: Swedish Forest Inventory 1925 - 2010

## Young forests have the highest growth rate and carbon up-take

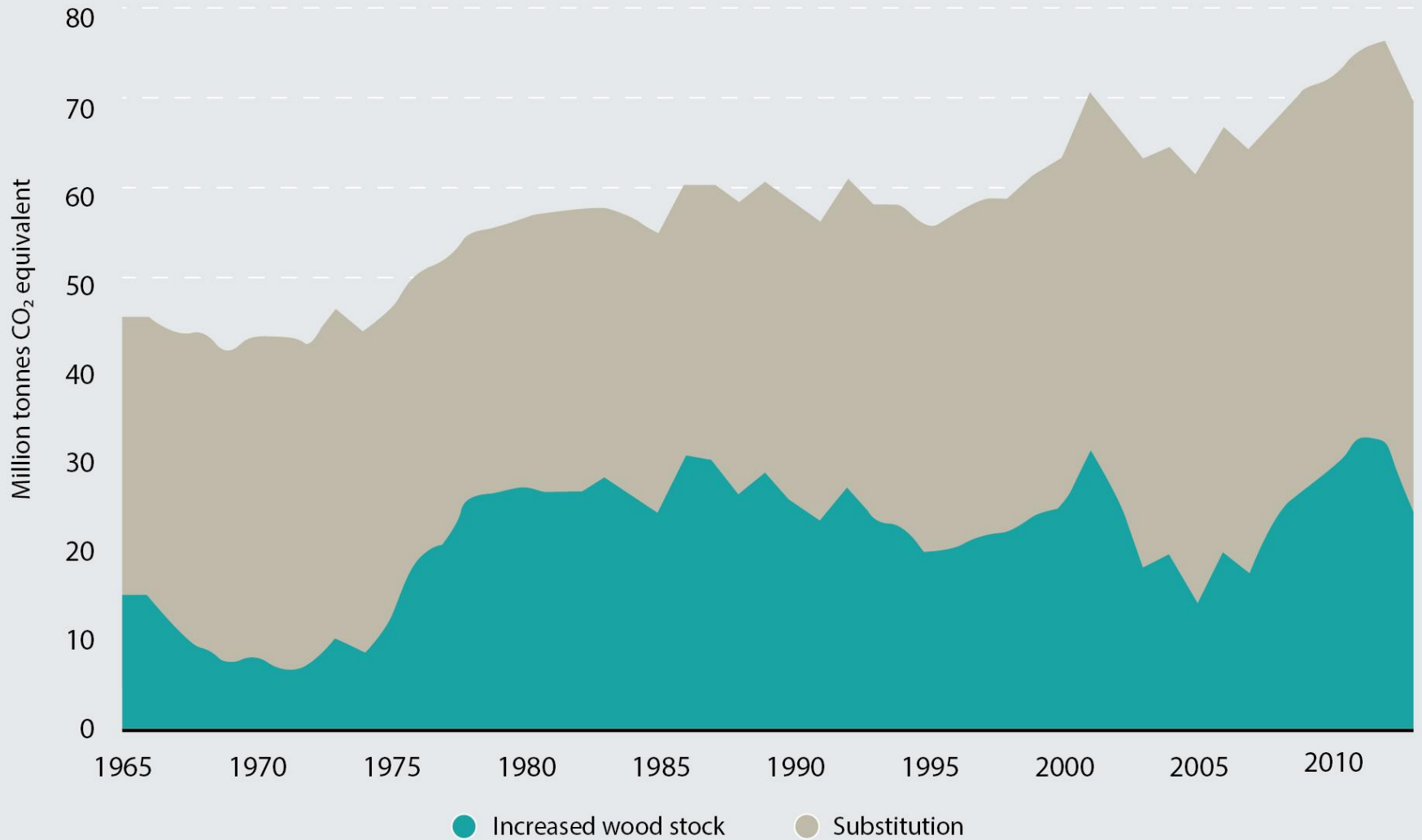


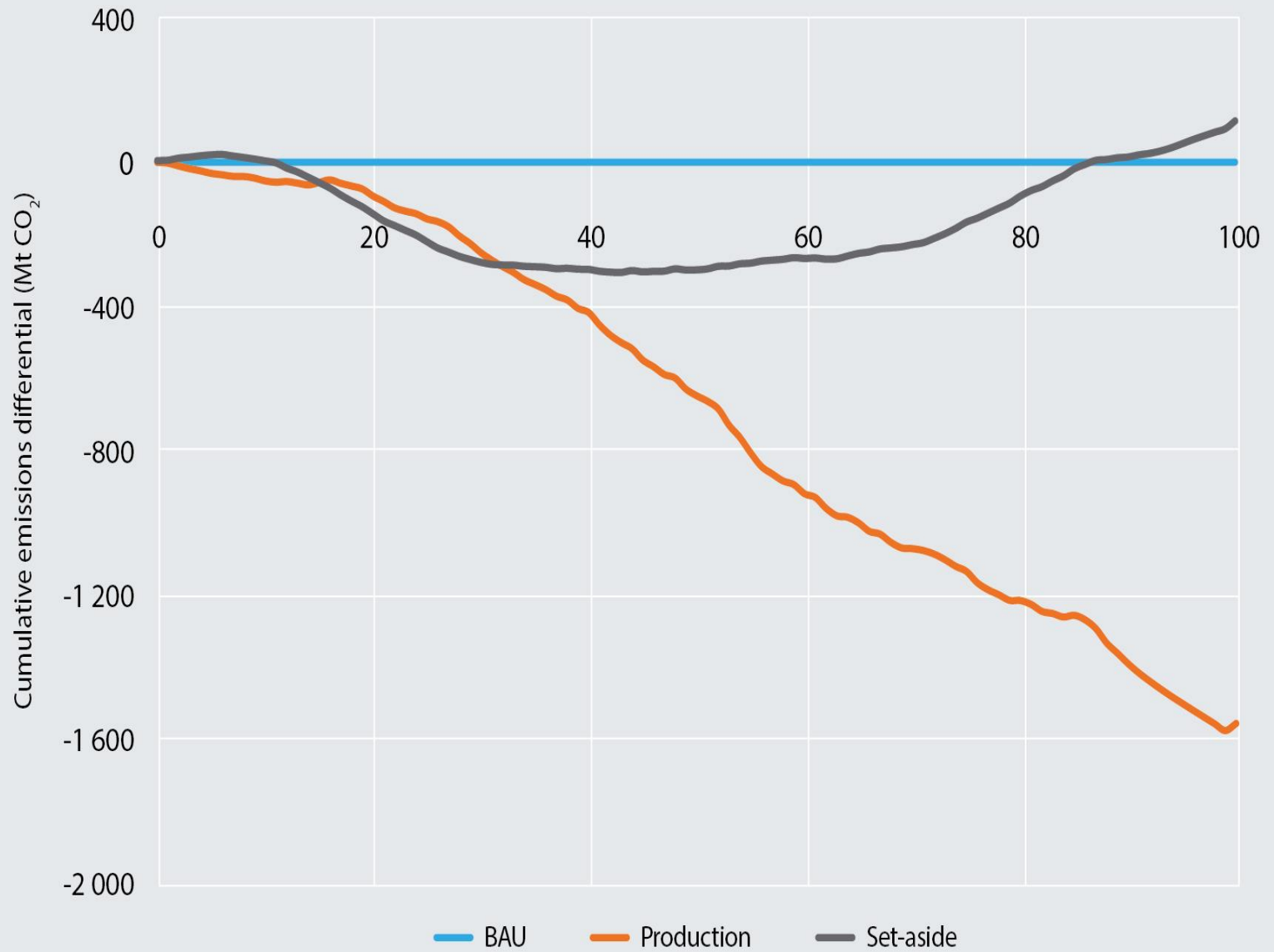




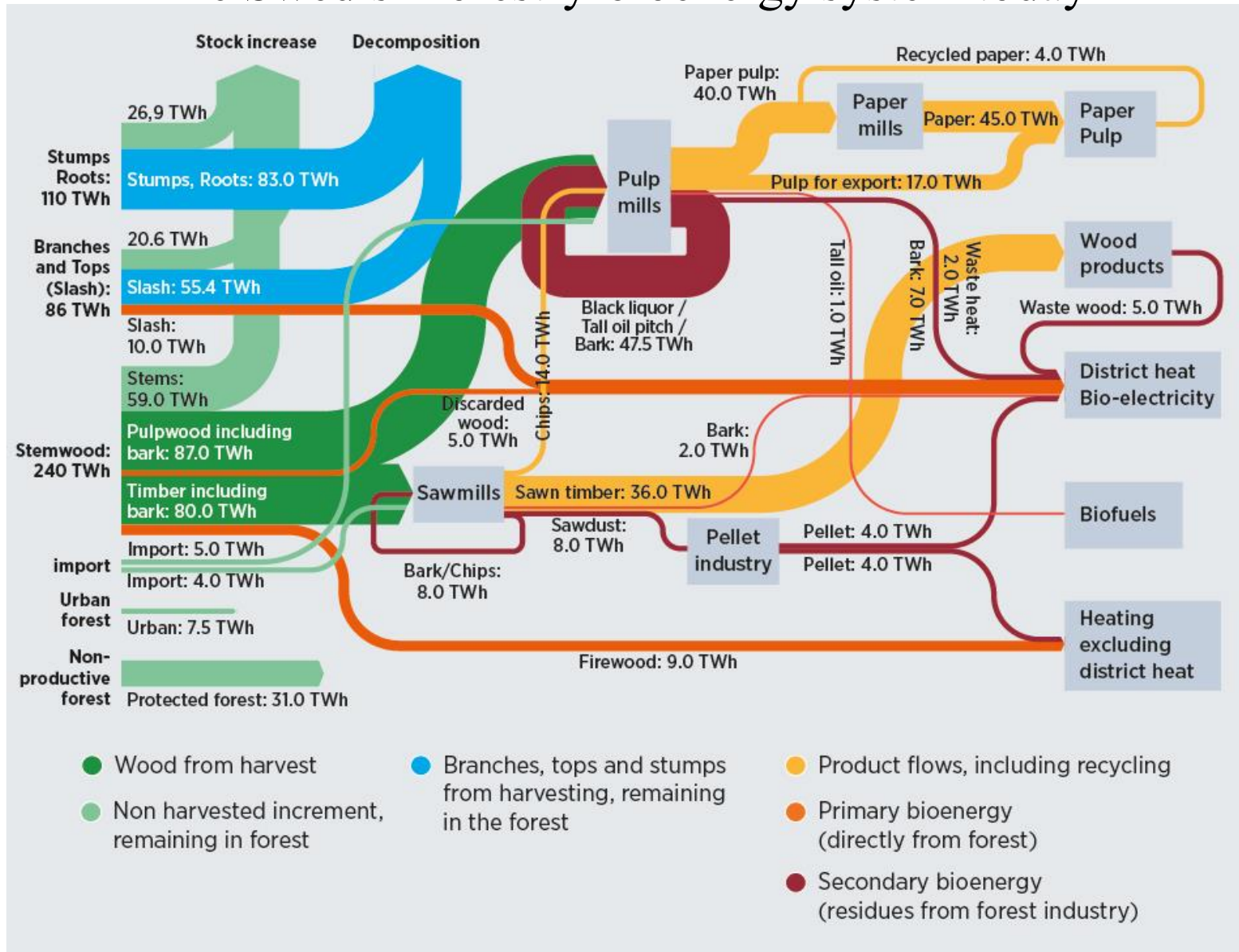


## Annual climate benefit, Sweden





# The Swedish forestry-bioenergy system today



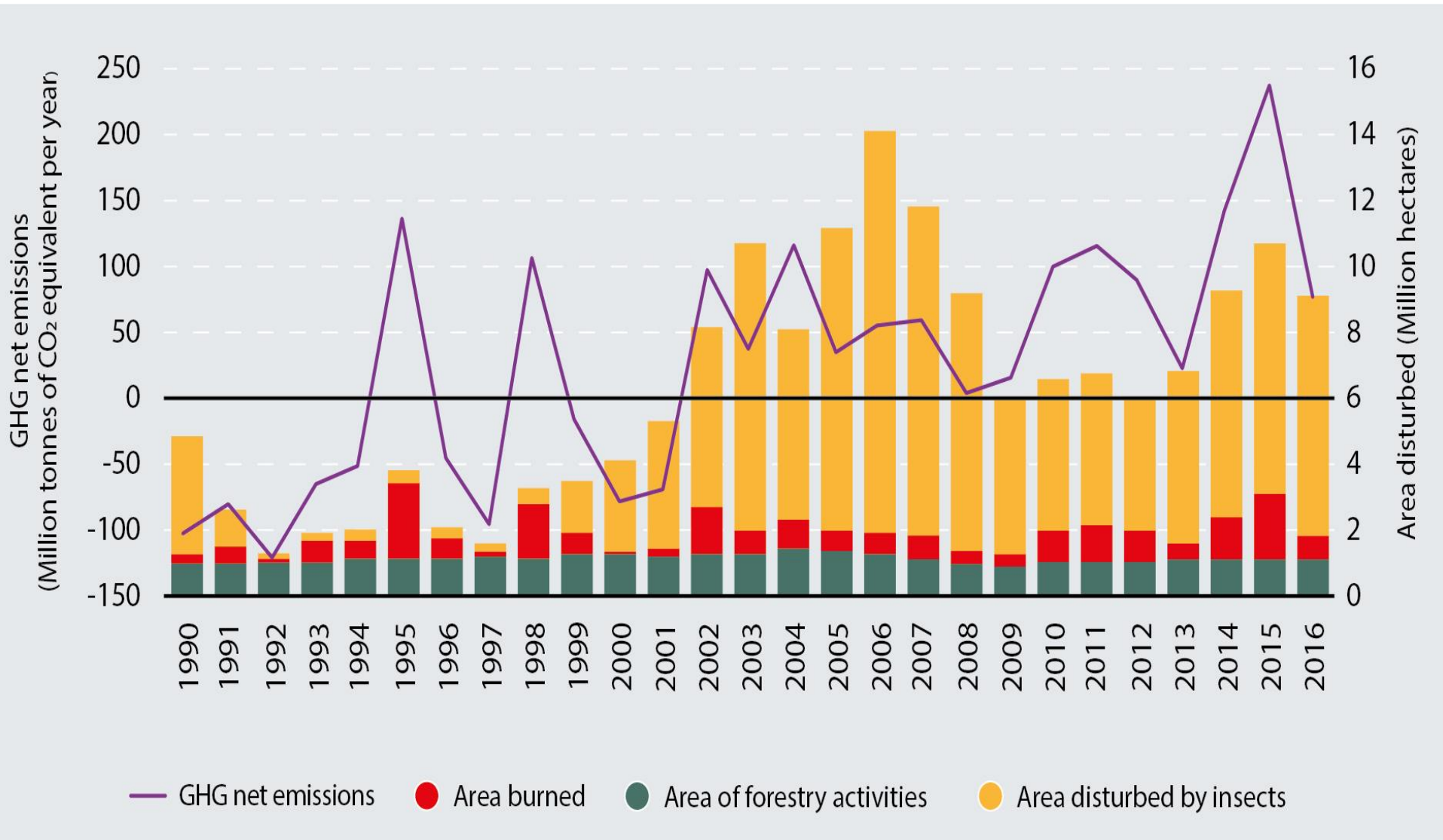
# Potential biomass for energy from boreal forestry

- Russia 3,1 EJ – 1 116 TWh
- Canada 1,35 EJ - 486 TWh
- Canada "salvage wood" – 750 TWh
- Europe exkl. Russia 1 000 – 1 400 TWh
- Total 3 000 – 4 000 TWh

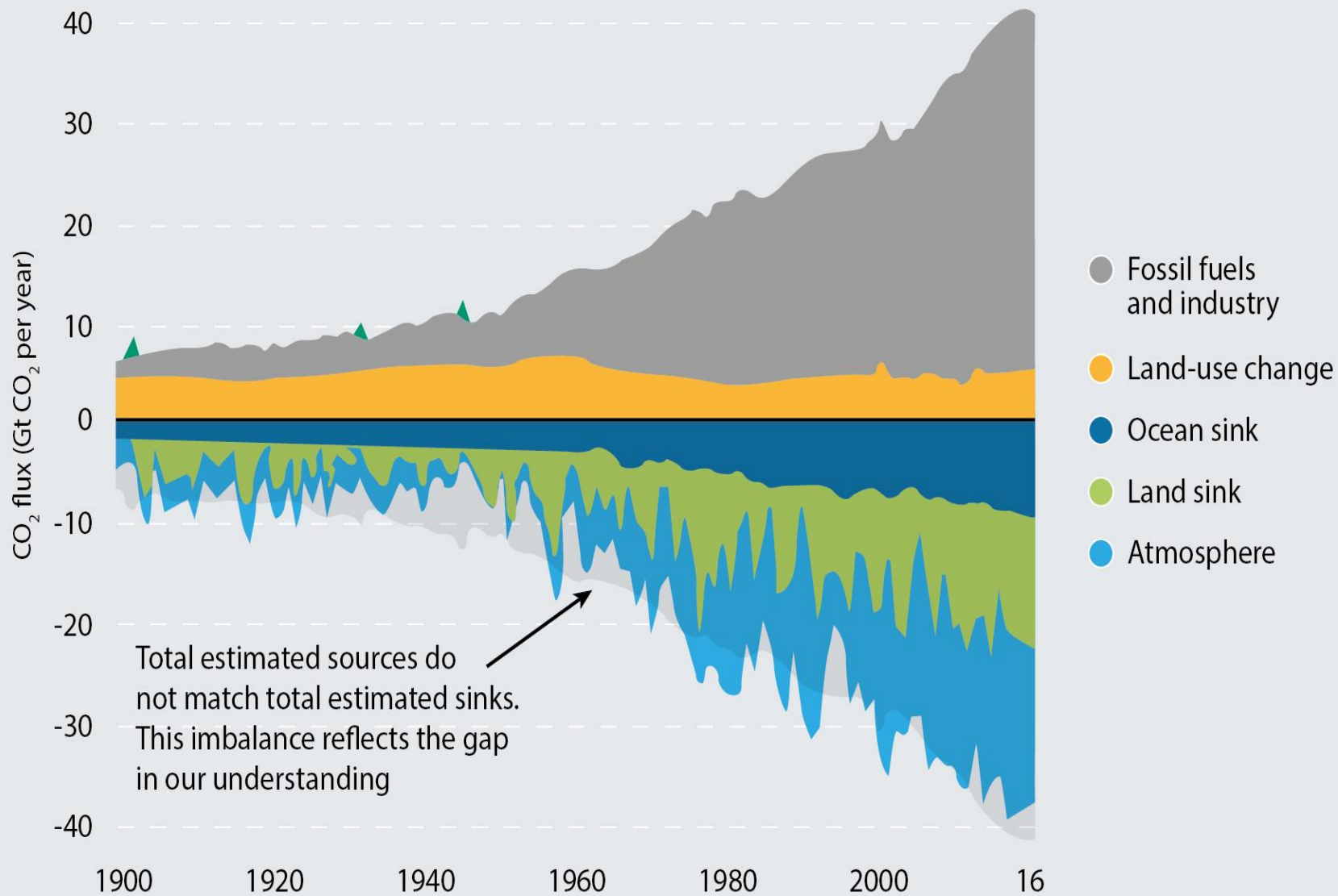
Calculations based on similar managed forestry practices as in Sweden, and use of stemwood for industrial products.

Source: IRENA – Bioenergy from boreal forests

# Carbon emissions from forests in Canada







Source: Global Carbon Project

# Close relation between growing stock in forests and development

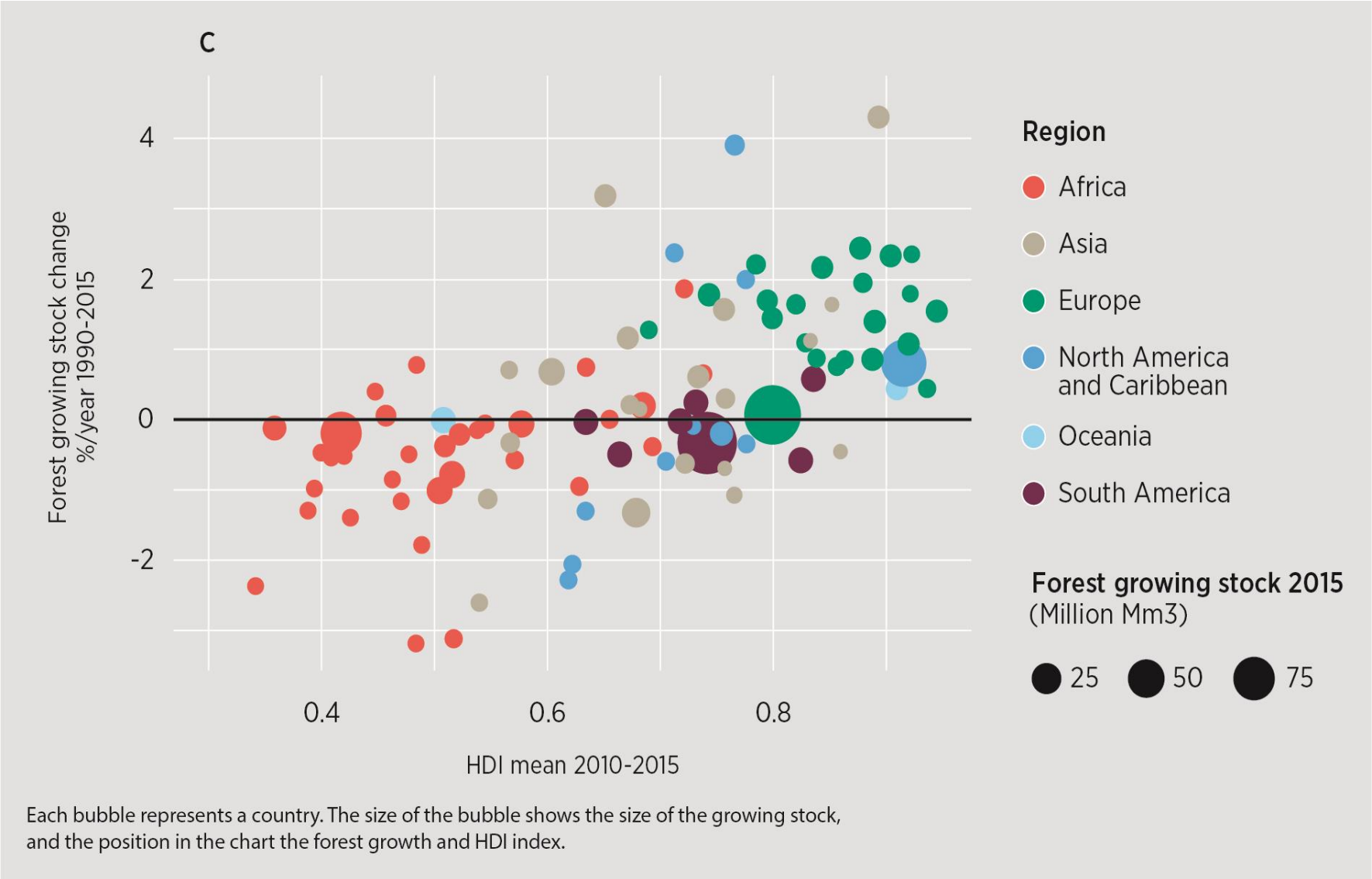


Illustration: Pekka Kauppi et al.



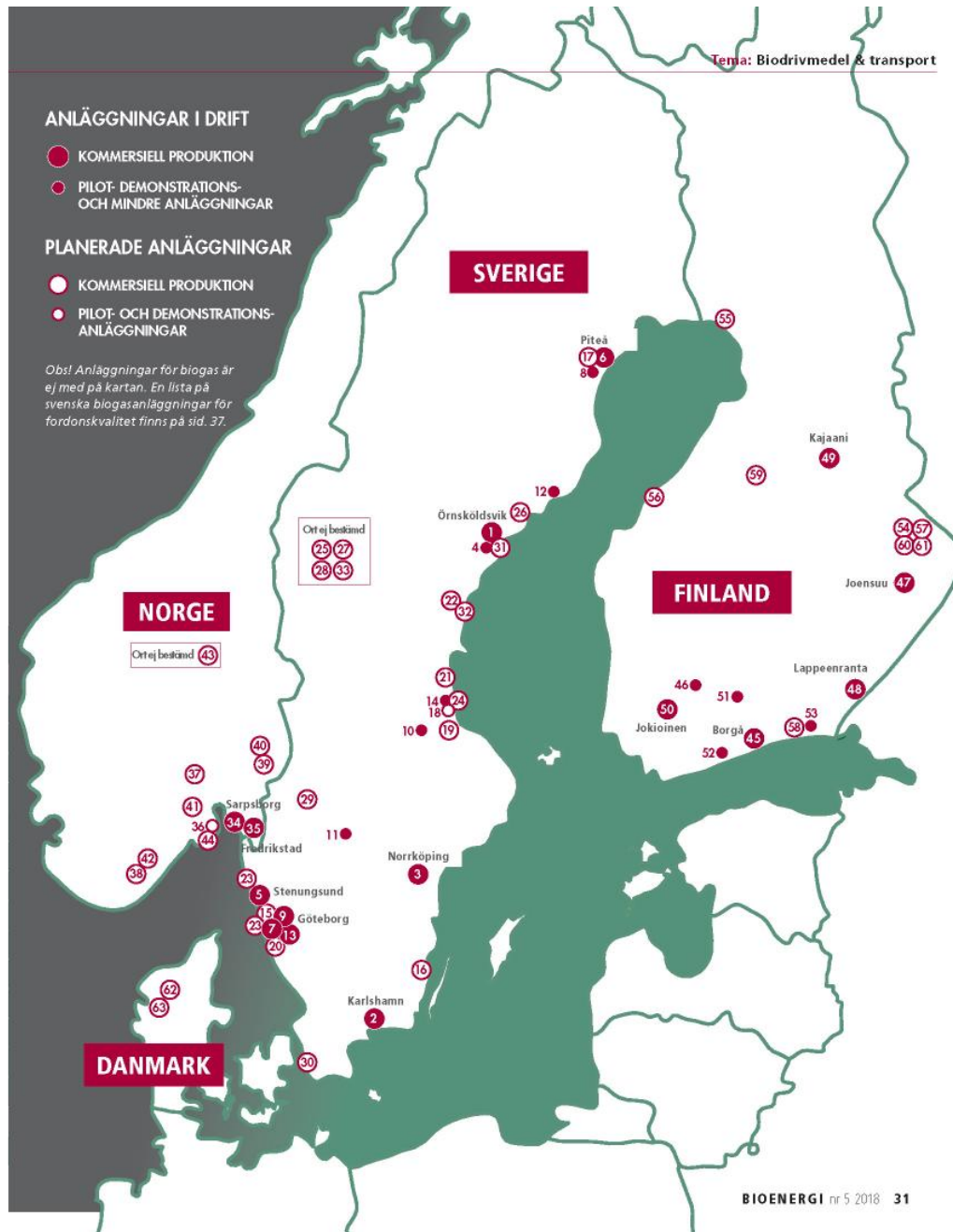
**ANLÄGGNINGAR I DRIFT**

- KOMMERSIELL PRODUKTION
- PILOT- DEMONSTRATIONS- OCH MINDRE ANLÄGGNINGAR

**PLANERADE ANLÄGGNINGAR**

- KOMMERSIELL PRODUKTION
- PILOT- OCH DEMONSTRATIONS- ANLÄGGNINGAR

Obs! Anläggningar för biogas är ej med på kartan. En lista på svenska biogas-anläggningar för fordonskvalitet finns på sid. 37.



# Biofuel projects in the Nordic countries

Mapping in Svebio's magazine Bioenergi November 2018

15 commercial plants in operation with a total capacity of 12 TWh.

+ 10 pilots and demonstration plants in operation.

37 full scale projects or extensions in planning, with a total capacity of 35 TWh.

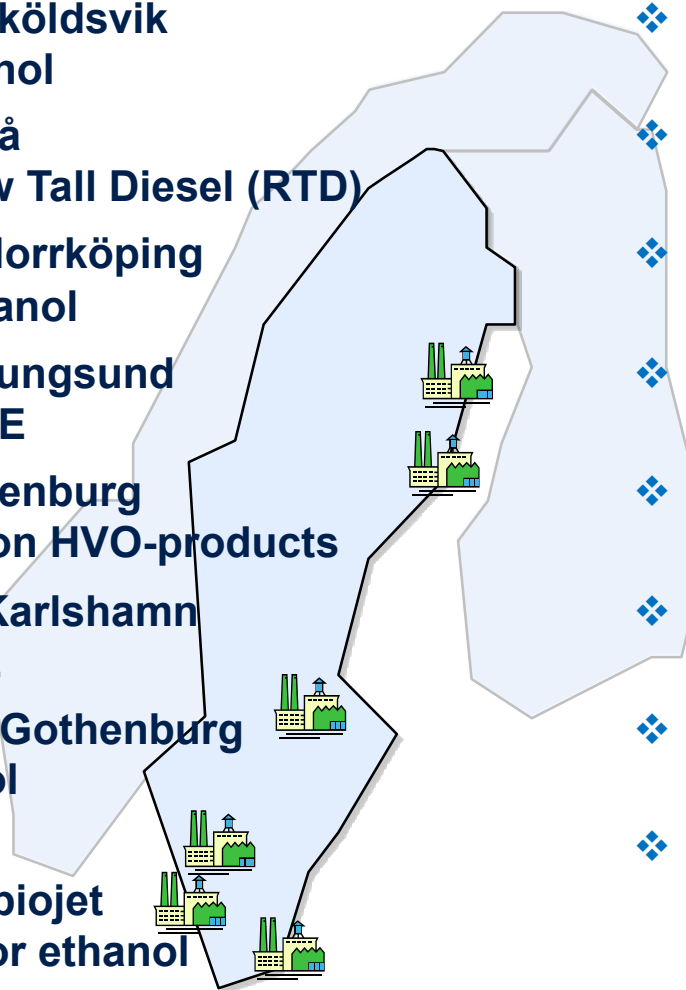
+ 2 planned pilots.

Not on the map:  
59 biogas plants for transport fuels = 1.5 TWh capacity.

# Promising development for new biofuel plants

## Plants in operation

- ❖ SEKAB in Örnsköldsvik  
19 500 m<sup>3</sup> ethanol
- ❖ SunPine in Piteå  
100 000 m<sup>3</sup> Raw Tall Diesel (RTD)
- ❖ Agroetanol in Norrköping  
230 000 m<sup>3</sup> ethanol
- ❖ Adesso in Stenungsund  
148 000 ton RME
- ❖ Preemraff Gothenburg  
Circa 230 000 ton HVO-products
- ❖ Ecobrånse in Karlshamn
- ❖ NEOT @ St1 in Gothenburg  
5000 m<sup>3</sup> ethanol
- ❖ Pilot plants at:  
Piteå for DME+biojet  
Örnsköldsvik for ethanol



## Plants in development

- ❖ Södra in Mönsterås  
5000 t biomethanol in 2019
- ❖ SunPine in Piteå  
50 000 m<sup>3</sup> Raw Tall Diesel (RTD) 2020
- ❖ St1 Refinery in Gothenburg  
200 000 ton HVO biofuels 2020
- ❖ Pyrocell in Gävle  
26 400 t pyrocruide 2021
- ❖ Preem Gothenburg w Diamond Green  
1 300 000 ton biofuels 2022-24
- ❖ SCA in Östrand?  
100 000 ton RTD 2021
- ❖ RenFuel in Vallvik  
30 000 t crude bioliquids 2021
- ❖ SCA in Östrand  
300 000 ton biofuels 2021

*Selected plants, e.g. biogas plants not shown.*

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Where to find the report?

IRENA website:

<https://www.irena.org/publications/2019/Mar/Bioenergy-from-boreal-forests-Swedish-approach-to-sustainable-wood-use>

[www.svebio.se](http://www.svebio.se)

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