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On the role of forests and the forest sector for climate change mitigation in Sweden

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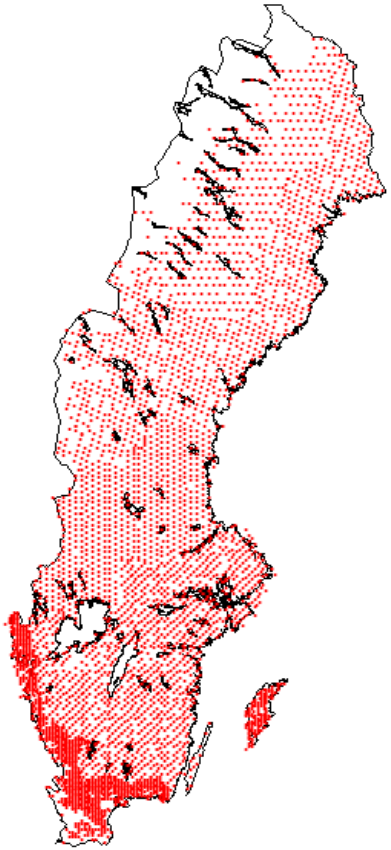
Research questions, we analyse:

- the role of forests and forestry by comparing how atmospheric CO2 concentrations are affected over different time scales by carbon storage in forests and HWPs, and by substitution (given a fixed management system)
- forest protection, nature conservation and their long-term impacts on forest-based climate change mitigation
- the potential for increased fertilization to sustainably increase net CO2 substitution and removals
- the potential benefits and/or increased risks associated with a changing climate on mitigation
- the differences between the real effect of forests and forestry on atmospheric CO2 concentrations and the reported and accounted climate reporting estimates implied by different accounting frameworks

Starting point 2010 (2008-2012)



- Designed based inventory, the NFI, to assess initial state (e.g. areas and carbon pools)
- Carefully measure on the plots – then the uncertainty arises from that a sample and not the entire population is monitored. No bias and the accuracy can be controlled
- Accuracy change in living biomass: 3 Mton CO2/yr, <2%
- All land use categories (30000 permanent + temporary plots)
- Soil inventory less intense
- Same as the Swedish Forest Reference Level

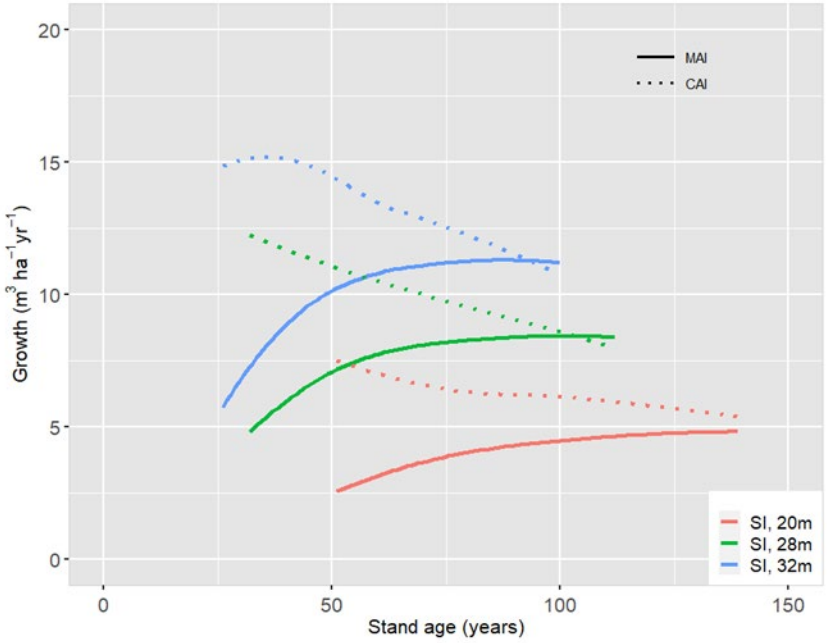
Riksskogstaxeringen
The Swedish National Forest Inventory

Sveriges officiella statistik

General assumptions scenarios

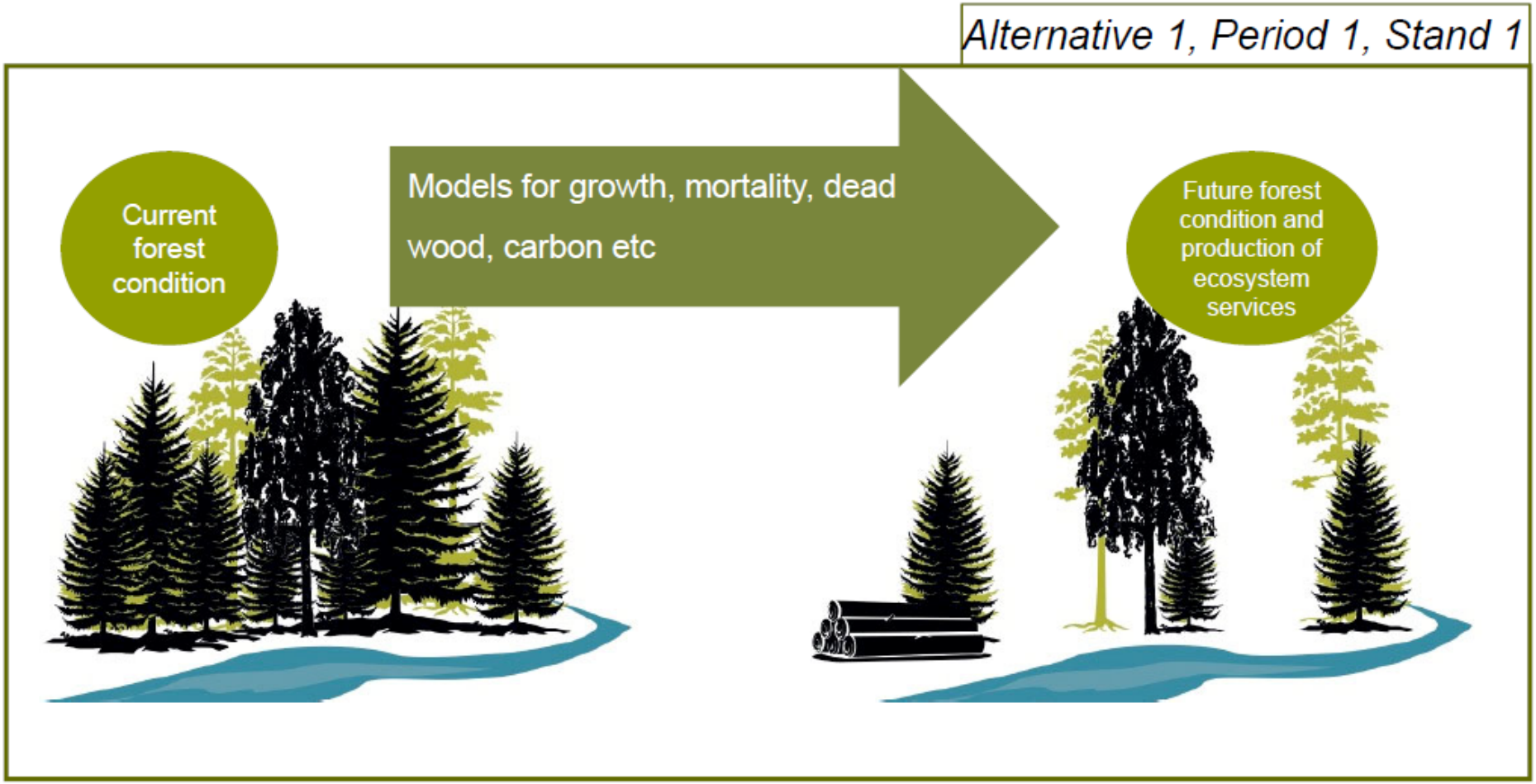
- To maximise the removal (tree growth), when should we harvest?
- When the MAI peaks = when the CAI and MAI crosses

- *In all scenarios we harvest the net growth in forest used for wood supply and no harvest in forest not used for wood supply*
- *To reach a net removal of zero in all carbon pools we make simulations for 200 years*



RegWise simulation model

Heureka

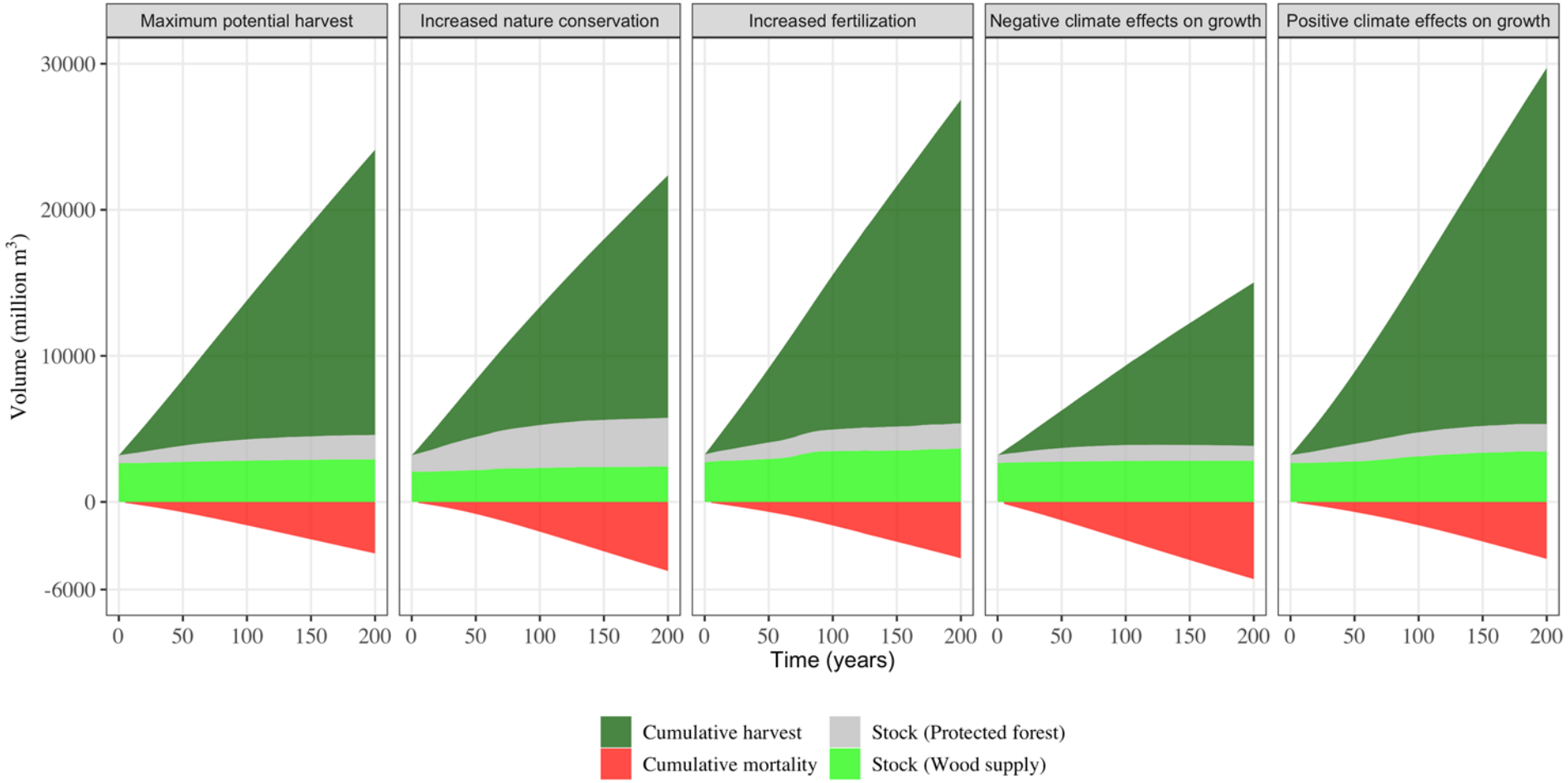


Scenarios

Table 1) Scenarios and Objectives

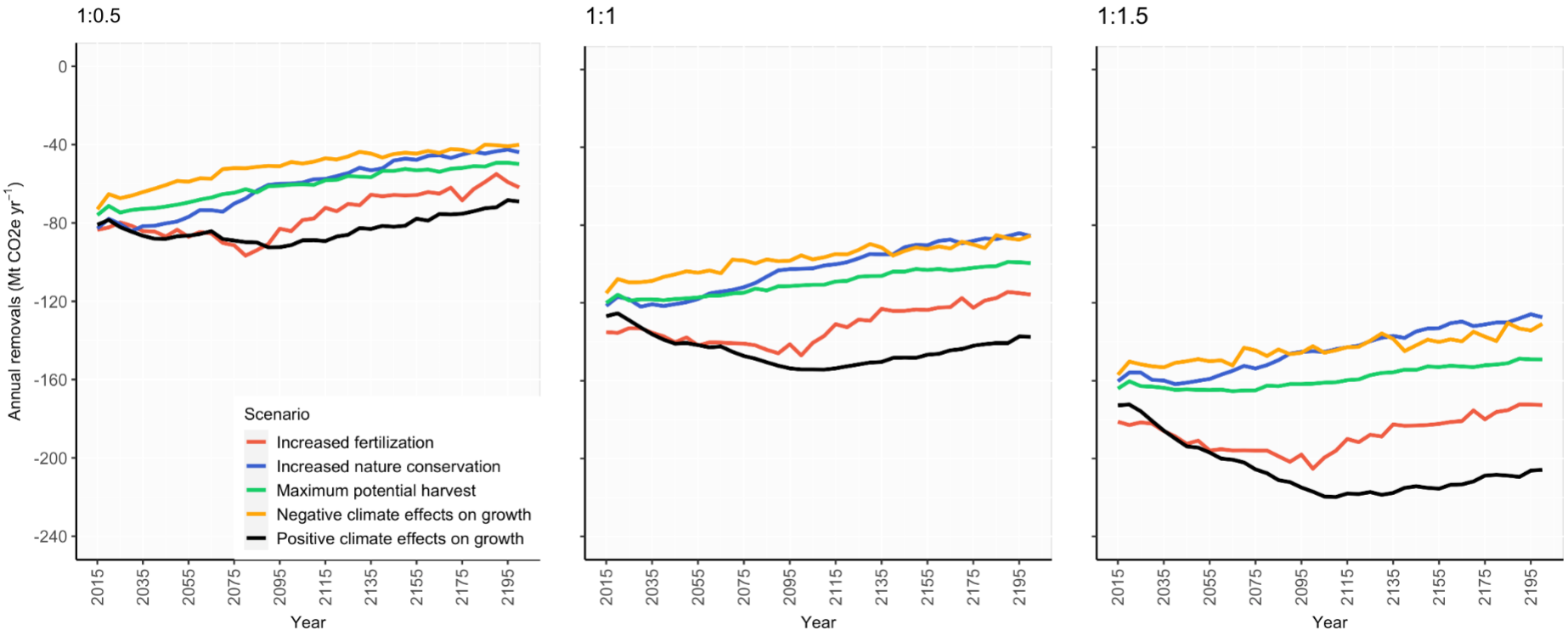
Scenarios	Objectives
Maximum Potential Harvest	Base scenario
Increased Nature Conservation	Study effects of increasing forest land set-asides (3.7 Mha)
Increased fertilization	Fertilisation (restricted by law)
Negative Climate Effects on Growth	Double mortality
Positive Climate Effects on Growth	Growth based on IPCC RCP 4.5 scenario

Volume stem wood (numbers refers to all carbon pools after peak)



-99 Mton CO2/år -85 Mton CO2/år -112 Mton CO2/år

The potential of fertilization and of increasing the substitution efficiency are high



Reporting, accounting and climate benefits are different

Sweden MFL 2021-2025

UNFCCC Reporting	NET change in pools [M tonne CO2/yr]							"1 m3 to 0.5 tonne CO2" substitution	Total Climate	"1 m3 to 1 tonne CO2" substitution	Total Climate
Sweden MFL 2021-2025	living	soil	other	dead	long lived	short lived	REPORTED				
Scenario	biomass	litter	emissions	wood	HWP	HWP	Total	Harvest	**Effect**	Harvest	**Effect**
Maximum Potential Harvest	-16,9	-5,4	0,1	-4,3	-3,9	-0,2	**-30,7**	-44,0	**-75**	-88,1	**-119**
Increased Nature Conservation	-33,3	-5,3	0,1	-2,7	-2,0	0,3	**-42,9**	-37,6	**-81**	-75,3	**-118**
Increased fertilization	-9,3	-4,7	0,1	-7,7	-6,1	-1,2	**-28,9**	-50,8	**-80**	-101,7	**-131**
Negative Climate Effects on Growth	-10,6	-5,7	0,1	-5,6	-3,3	-0,1	**-25,2**	-42,1	**-67**	-84,2	**-109**
Positive Climate Effects on Growth	-19,1	-5,8	0,1	-5,6	-4,4	-0,5	**-35,3**	-46,8	**-82**	-93,6	**-129**

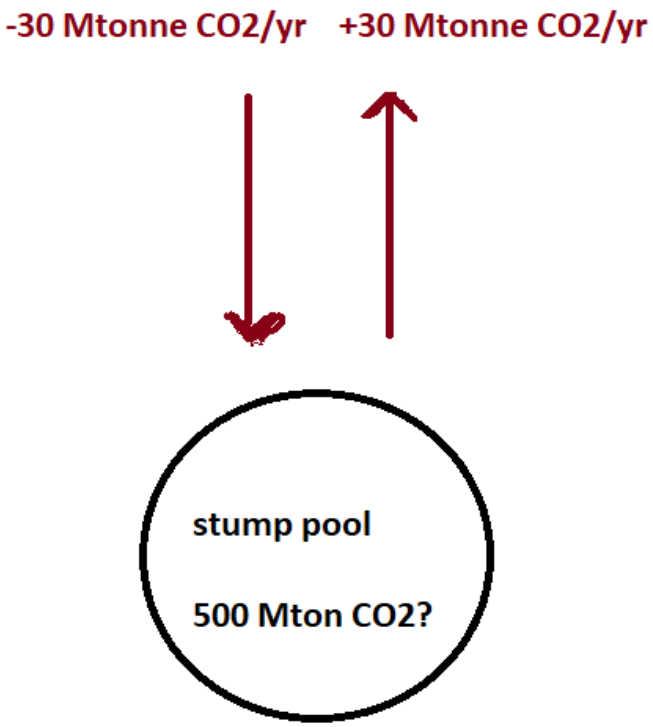
EU Accounting	NET change in pools relative to the required Reference Level [M tonne CO2/yr]						
Sweden MFL 2021-2025	living	soil	other	dead	long lived	short lived	ACCOUNTED
Scenario	biomass	litter	emissions	wood	HWP	HWP	Total
Maximum Potential Harvest	13,4	-4,0	0,0	-1,6	-0,6	0,8	**8,1**
Increased Nature Conservation	-3,1	-3,8	0,0	0,1	1,3	1,4	**-1,1**
Increased fertilization	20,9	-3,2	0,0	-5,0	-2,8	-0,1	**9,9**
Negative Climate Effects on Growth	19,6	-4,2	0,0	-2,8	0,0	1,0	**13,5**
Positive Climate Effects on Growth	11,1	-4,3	0,0	-2,9	-1,1	0,6	**3,4**
Reference Levels (effective caps)	-30,2 (cap)	-1,5 (cap)	0,1 (cap)	-2,7 (no cap)	-3,3 (no cap)	-1,1 (cap)	**-38,7 (Total FRL)**

Remove cap on MFL, one accounting model for all land, full flexibilities and no separate LULUCF pillar

The potential of reducing harvest may be zero but the potential of increasing growth is high

- Increased nature conservation vs. Maximum potential harvest (another 3.7 Mha conserved area)
- Increased fertilisation vs. Maximum potential harvest (fertilize 0.2 Mha ten years before final felling)

	tonneCO2/yr*m3	
	decreased harvest	increased production
	conservation	fertilization
2020	-0,10	-1,46
2040	-0,25	-1,49
2060	0,09	-1,67
2200	0,88	-1,54



1 m3 stemwood = 0,75 tonne whole tree biomass x 0.5 C x 44/12 CO2 = 1,4 tonne CO2