



How to incentivize the role of forests and forest-based resources from a climate perspective in the light of the Paris agreement

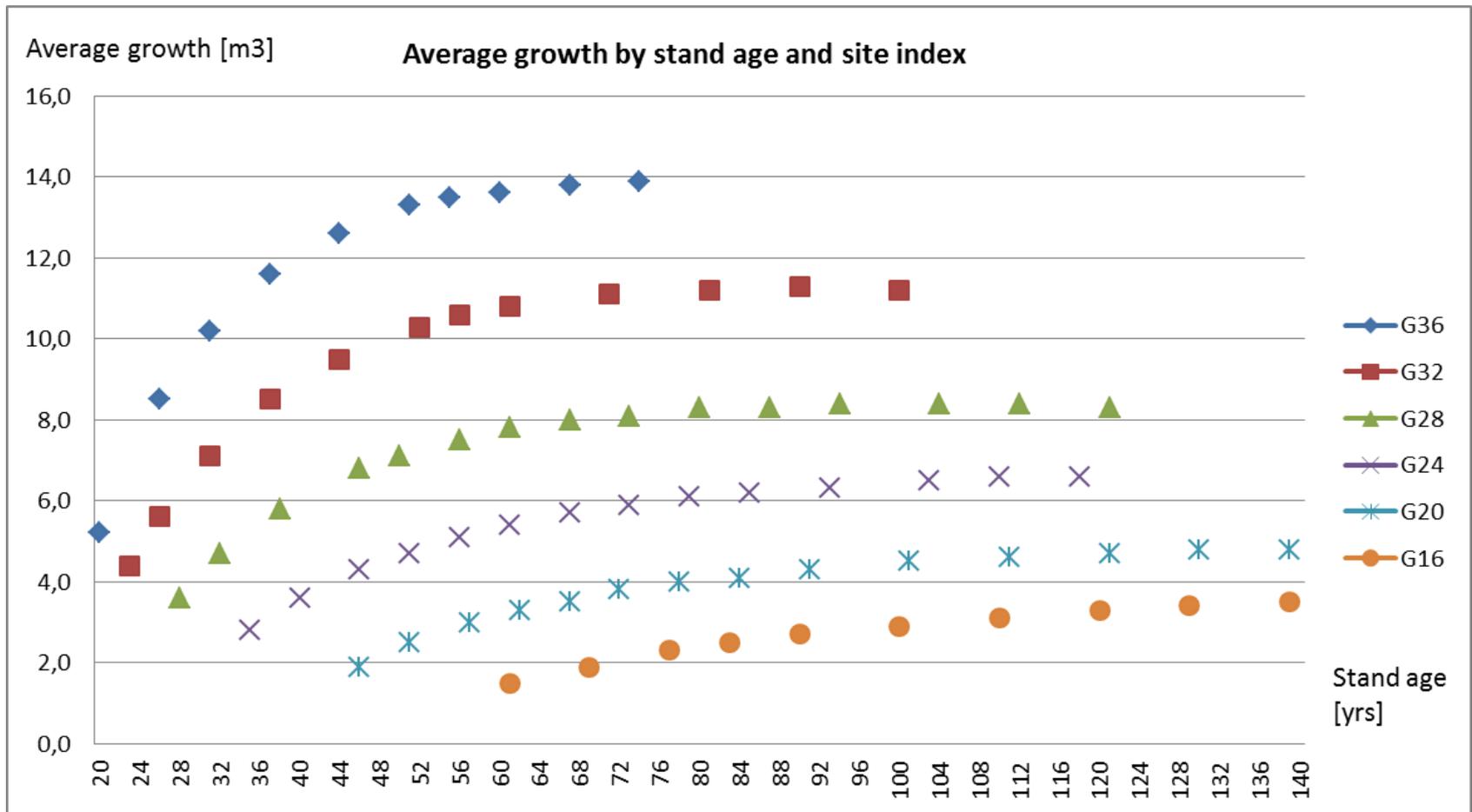
- The role of forestry from a pure climate perspective
- The potential for improvements
- Incentive structures

OBSERVE THAT NUMBERS ARE PRELIMINARY

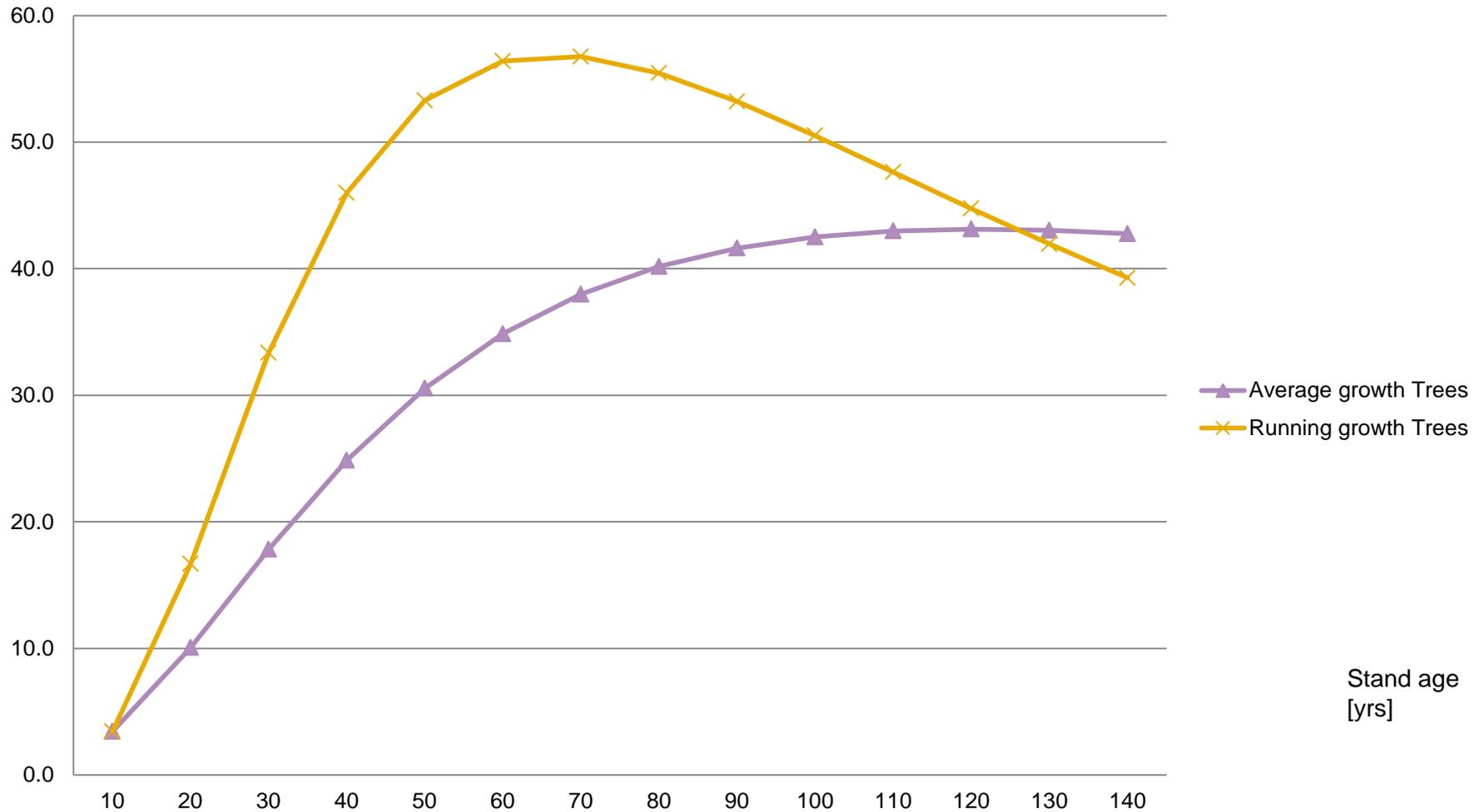
Uppsala August 2018

The role of forestry from a pure climate perspective

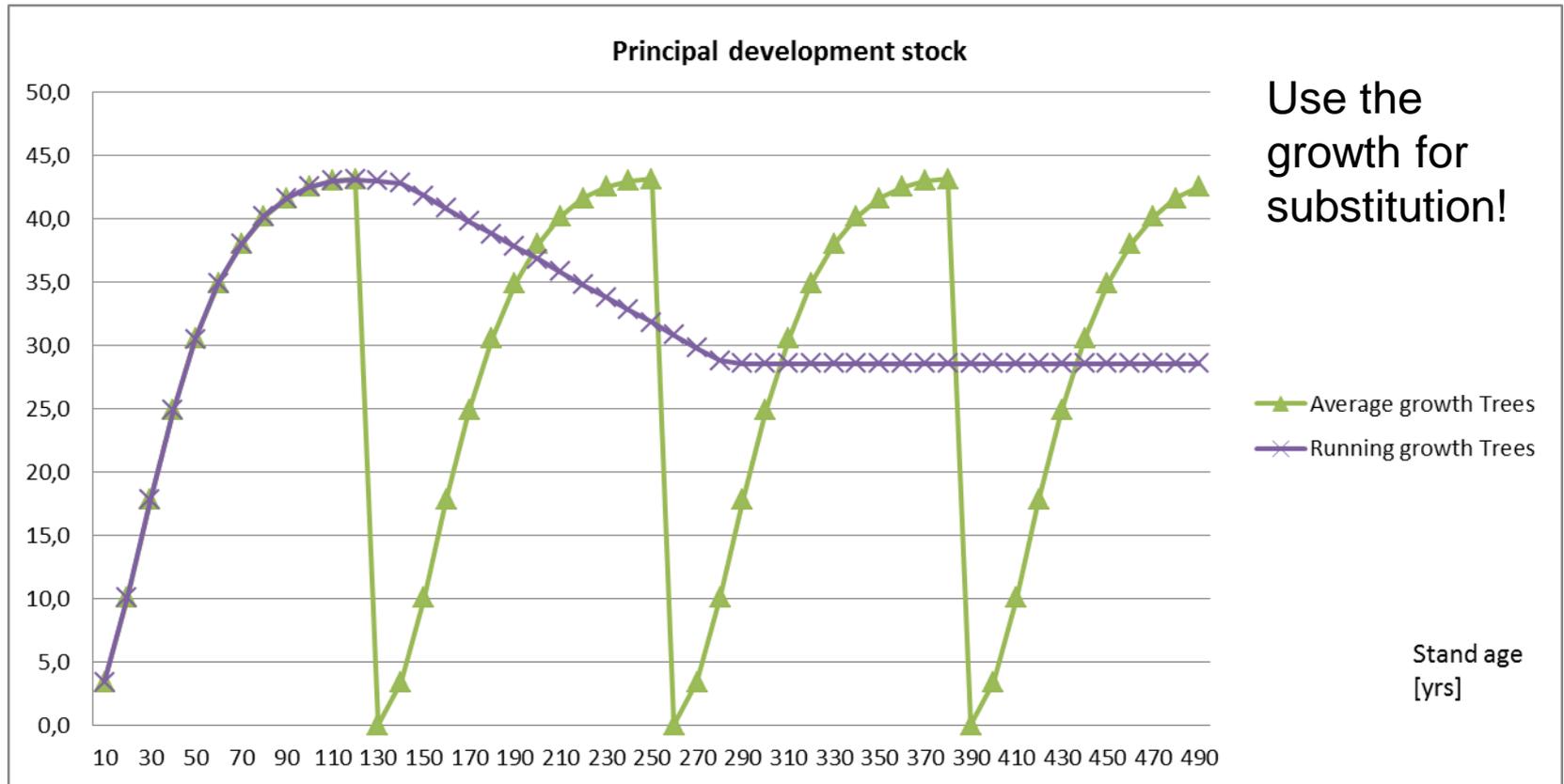
- Is to, in the long run, maximize growth and use the growth for substitution
- **Meanwhile avoid "other" emissions**



The maximum growth is obtained if harvesting when the average growth peaks



If the standing stock in a “natural forest” is 2/3 of the standing stock in a managed forest, then both systems stores approximately the same



If we harvest at the optimal rotation period for all stands the net-removal should zero –not a removal!!!

The potential and incentives for improvement

System boundaries [Mton CO2/yr]

Land owner and producer = Sweden

Consumer=
Importing country

Changes in pools Forest Management

- -35 Living biomass
- 7.7 Litter
- -7.2 Dead wood
- -18 Mineral soils
- 4.5 Organic soils
- -6.6 Harvested wood products

Terrestrial emissions (CH4 and N2O)

- 0.8 CH4
- 0.3 N2O

Accounting restricted by a cap
“Net-net accounted” using a Forest
Reference Level

Substitution

Harvest: -130

Full credits if used for
substitution

Harvest -139 (FM+D)
Stem+bark
0.42 100% -77
(Branches partly used)
0.15 50% -14
(Stumps not used)
0.18 50% -17

FM=28.3 Mha 2015



Intensive management from fertilization on 15% of productive forest land

- Potential Forest management for Sweden (JO 2008/3958)

Year	5	15	25	
Living biomass	-2.4	-3.3	-8.9	Mton CO2/yr
Soil	-0.8	-1.1	-3.0	
Total	-3.2	-4.4	-12	



Accounting restricted by a cap “Net-net”

Avoid management on organic soils?

- Potential Forest management (10 Mton CO₂/yr; JO 2008/3958)

	Areas	Emissions
Forest management	28295 kha	
Organic soils	3755	4.5 Mton CO ₂ /yr
Drained organic	997	1.2
Growth		-6.9



Wildfires (currently 25000 ha/yr with a direct emission of 3.6 Mton CO₂)?

- Potential Forest management for Sweden **assuming 1 Mha/yr:**

	Emissions
CH ₄	1.4 Mton CO ₂ /yr
N ₂ O	0.1
Lost growth	5
Direct emission	144
Tot	5/145

Accounted under Forest management but Natural Disturbances if >3



Drought decreases growth by... Adaptation...



Climate cost for conservation?

- Forest management for Sweden:

	Sweden	
2015	[Kha]	[Mton CO2/yr]
Forest land	28132	
Productive	23503	118
Protected Forestry act	989	5
Voluntary protected*	558	3
Certified area**	719	4
Not protected	21237	106
Improductive	4629	12
Protected	4629	

*=Forest agency 2017. Table 5

**=Forest agency 2017. Table 7 is 14377 kha 5%
10 eternal trees per ha
restrictions in species



System boundaries [Mton CO₂/yr]

Land owner and producer = Sweden

User = Importing country

Changes in pools Deforestation

- -0.3 Living biomass
- 0.9 Litter
- 0.0 Dead wood
- 0.7 Mineral soils
- 0.1 Organic soils
- IO Harvested wood products

Terrestrial emissions (CH₄ and N₂O)

- 0.0 CH₄
- 0.0 N₂O

“gross-net accounted” for 20 years

Substitution

Harvest: -8.8

Full credits if used for substitution

For 1 M ha:
A removal for substitution of around 5 Mton CO₂/yr is lost forever

D=0.3 Mha or 11 kha/yr 2015

System boundaries [Mton CO₂/yr]

Land owner and producer = Sweden

User = Importing country

Changes in pools Afforestation/Reforestation

- -1.5 Living biomass
- -0.3 Litter
- 0.0 Dead wood
- 0.2 Mineral soils
- 0.2 Organic soils
- NO Harvested wood products

Terrestrial emissions (CH₄ and N₂O)

- 0.0 CH₄
- 0.0 N₂O

“gross-net accounted” for (20 or) 30 years

Substitution

Harvest: 0

Full credits if used for substitution

For 1 M ha:
A removal for substitution of around 5 Mton CO₂/yr is gained forever

AR=0.4 Mha or 14 kha/yr 2015

Avoid management on organic soils?

- Potential Cropland

Cropland	Areas	Emissions
Mineral soils	2690 kha	-3.7 Mton CO ₂ /yr
Organic soils	139	3.2



**Full credits
Accounting “net-net”**

Current potential?

2016	Sweden			Removal or	Accounting
	[Kha]	[Kha]		reduced emission	(Incentives)
				[Mton CO ₂ /yr]	
Forest land	28204	90	Stumps 50%	-17	FULL
		3500	Intensive management 15%	-9	NO
		1000	Drained organic soils	?	NO
			Prevent wildfires	?	NO/ND
			Optimal rotation periods	?	NO
			Genetic improvment	?	NO
			New species	?	NO
			Conservation cost	?	NO
			Climate change	?	
Cropland	2790	139	Organic	-3.2	FULL
Grassland	516	52	Afforestation 10%	-0,3	PARTLY
Wetlands	7378	738	Afforestation 10%	-3,7	PARTLY
Settlements	1886				
Other land	4342	434	Afforestation 10%	-2,2	PARTLY
Total	45116				

For what and how much should the government pay land owners?

- **Subsidies for stump extraction in Finland**
- **Full payment for rewetting organic cropland?**
- **Subsides for long term investments (Afforestation, intensive management, genetic improvements, introduce new species, ...)?**
- **Pay for difference between optimal economic rotation period and max growth optimal rotation period**

What does the government already do?

- **Law about regeneration and minimum age for harvest**
- **Has promoted bioenergy**
- **Conservation of forests**
- **Prevent forest fires**
- **Plan Deforestation**

Within the ERA-gas project FORCLIMIT/INVENT we plan to redo this study for EU conditions (using Sweden as a case country)

FACCE
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MONITORING & MITIGATION OF GREENHOUSE GASES
FROM AGRI- AND SILVI-CULTURE

FOR MORE INFORMATION, VISIT: ERAGAS.EU