

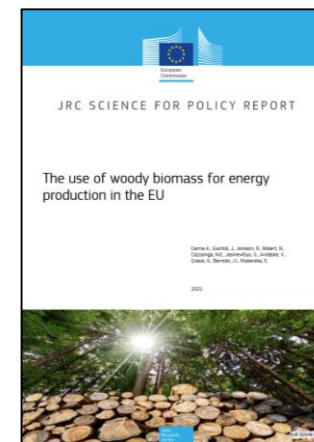
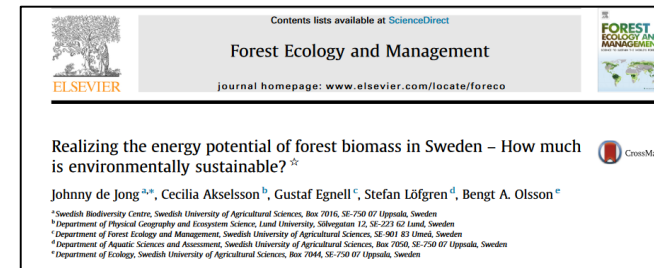
Sustainable harvest levels of forest fuels – a quantitative assessment approach

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Today's talk

- How much can be harvested without harming the environmental objectives?
(Synthesis financed by Swedish Energy Agency)
- Critical biomass harvesting
(going from science to policy)
- Results in relation to JRC Policy report
- A few insights



The task*

“How much **bioenergy** can be harvested from forests, without negative effects on **the environmental objectives?**”
(*Synthesis financed by Swedish Energy Agency*)

Bioenergy handled in this study:
slash, stumps, biomass from thinning, brushwood and wood from conservation management



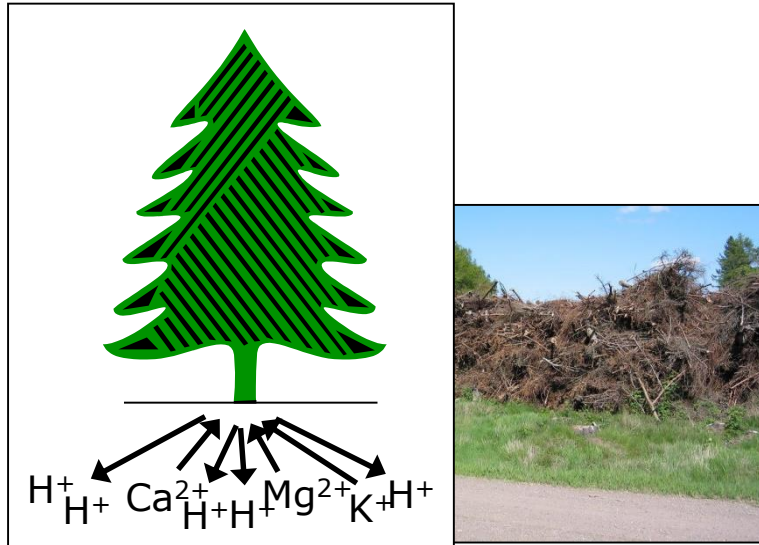
Environmental objectives about:
Biodiversity, acidification,
environmental pollutants (Hg)
and eutrophication



**Project financed by the Swedish Energy Agency and preformed by Johnny de Jong (SLU; project leader), Gustaf Egnell (SLU), Stefan Löfgren (SLU), Bengt Olsson (SLU) and Cecilia Akselsson (LU), 2016-2018.*



Ecosystem effects of removal of forest residues



Removal of nutrients and buffering capacity (→acidification)



Soil disturbance, driving damage



Removal of "dead wood"

Prerequisites and assumptions

- No removal of slash/stumps in areas preserved for nature conservation
- No removal of slash/stumps in some biotope types
- Limited removal of slash from deciduous forest
- Track damages are avoided
- Wood ash recycling in some areas



Method

- Review, interviews and seminars
- Defining harvesting scenarios
- Workshops with expert judgements (from academia and authorities and NGO:s)



Results

Harvest branches	Harvest stumps					TWh/y
28 %	21 %	→	→	→	↘	27
42 %	14 %	↘	→	→	↘	31
28 %	14 %	→	→	→	→	23
42 %	7 %	↘	→	→	→	28
28 %	7 %	→	→	→	→	20

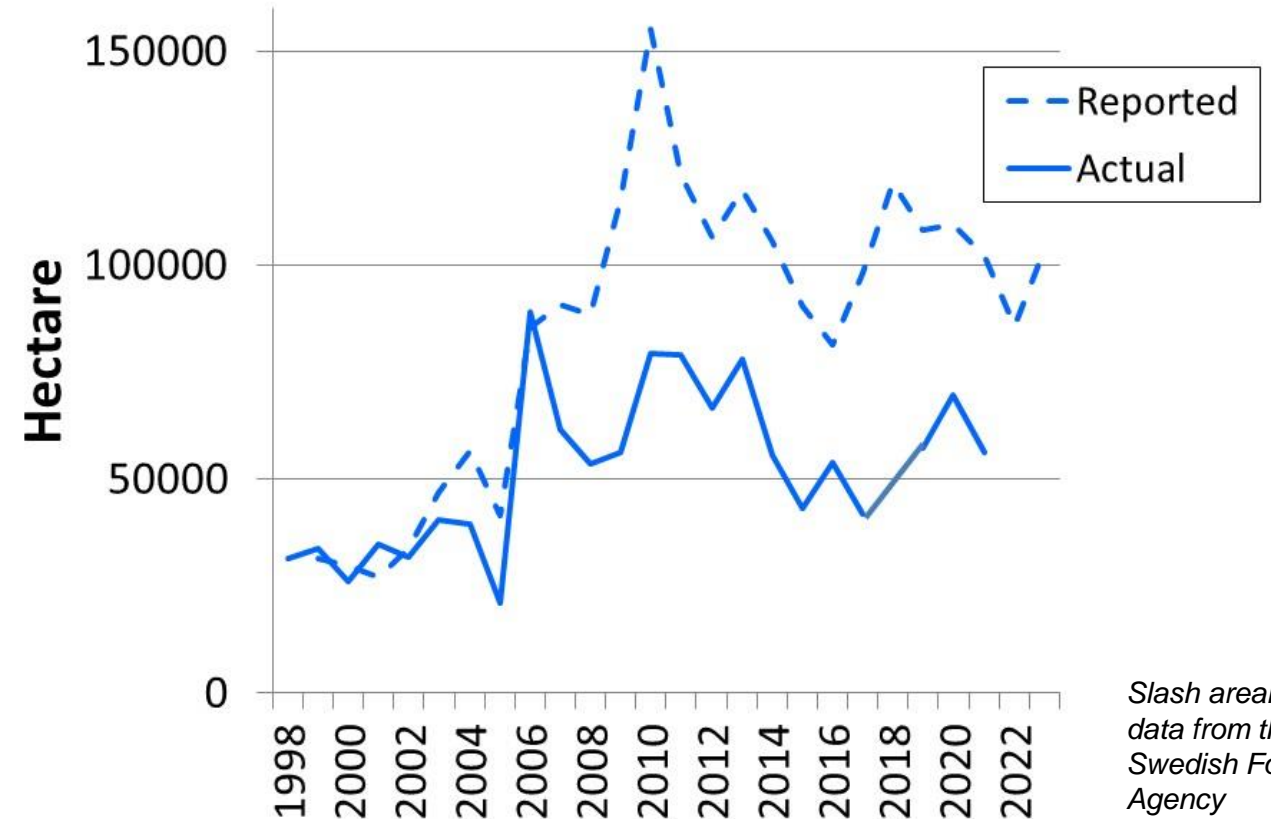
Modified from de Jong et al, 2017. Forest Ecology and Management.

40 % of slash 20 % of stumps on a landscape scale
70% on a stand scale

Results

- Harvesting of slash on max 50% of the clearcut area (biodiversity and acidification limiting)
- Stump harvesting on max 10-20% of the clearcut area (biodiversity limiting)
- Potential to increase slash+stump harvesting 2.5 times

Note: *Difficult to follow up since the data on slash harvesting (also "actual") is very uncertain*



Slash area data from the Swedish Forest Agency

Biodiversity

- A large-scale extraction will have negative effects, but a careful extraction combined with monitoring is possible.
- Difficult to set limit values (varies depending on substrate, region)
- Large potential for slash harvesting, much less for stump harvesting
- Slash removal from pine and deciduous forest should be limited
- Storage piles can serve as insect traps
- Avoid some substrates and landscapes. Compensate and concentrate!
- Knowledge needs: More organism groups (now mostly beetles, mosses, lichens and wood fungi), long-term effects



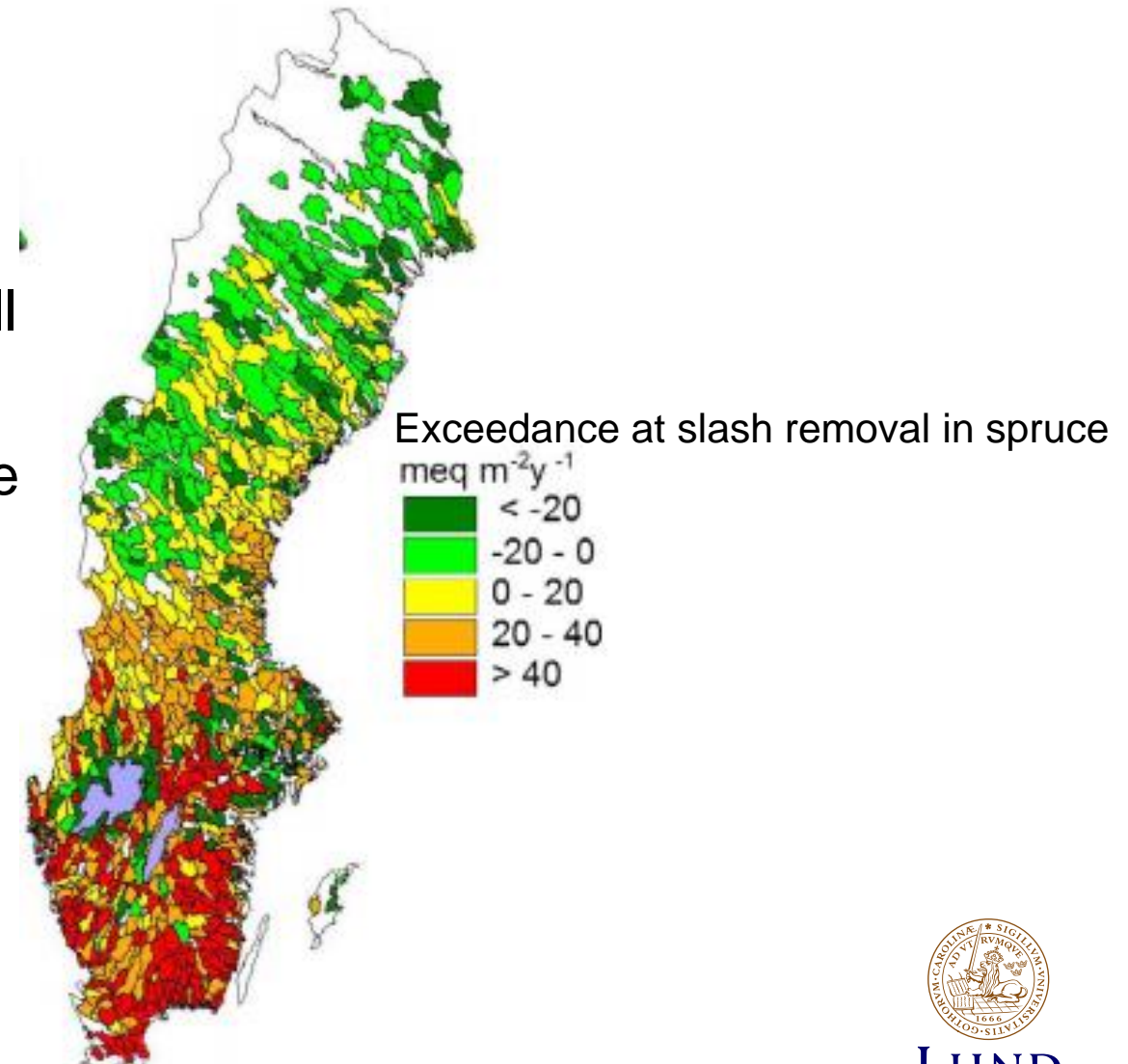
Acidification (and nutrient sustainability)

- Harvesting of slash and stumps leads to reduced buffering capacity (loss of base cations) and slows down recovery from acidification (soils and surface water)
- Slash removal has a larger effect than stump removal
- Size of effect depends on region (acidification history), tree species, soil type and catchment properties,
- Ash recycling can compensate, at least partly, for losses of base cations (and P)
- Knowledge needs: Long-term effects, Links between soil and water

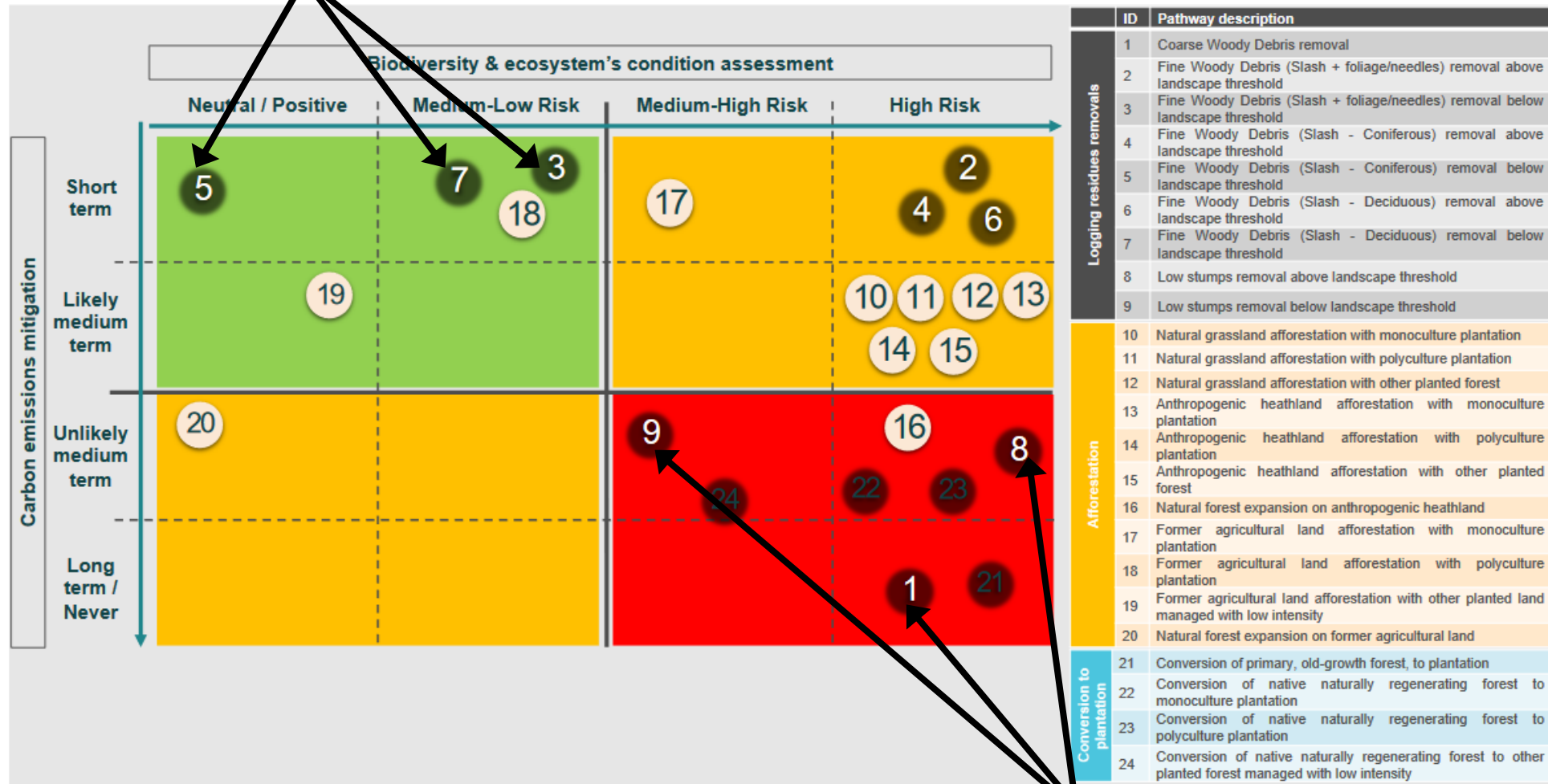


Critical biomass harvesting

- Going from science to policy (acidification)
- "How much can be harvested, and still avoid harmful effects"
- Based on chemical calculations (same formula as for "Critical loads")



Slash (fine woody debris) removal” below landscape threshold”, coniferous (5) and deciduous (7), including needles and foilage (3)



JRC Science for Policy Report, 2021.
The use of woody biomass for energy production in the EU. JRC12271

Low stump removal above (8) and below (9) landscape level, and coarse woody debris removal (1)



Insights

Scale:

- Environmental objectives (and different species) differ regarding the scale of interest (stand/landscape).

Limitations of results:

- Different conditions in different regions need to be accounted for
- Results valid for some specific prerequisites, which are seldom fulfilled and/or difficult to follow up

Policy:

- Landscape level more difficult than site level (policy-wise).
Research on policy instruments needed
- Definitions, prerequisites and choice of words important!

