Green Transition and Regional Sustainability

Luleå, 10-12 October 2023

Wind power

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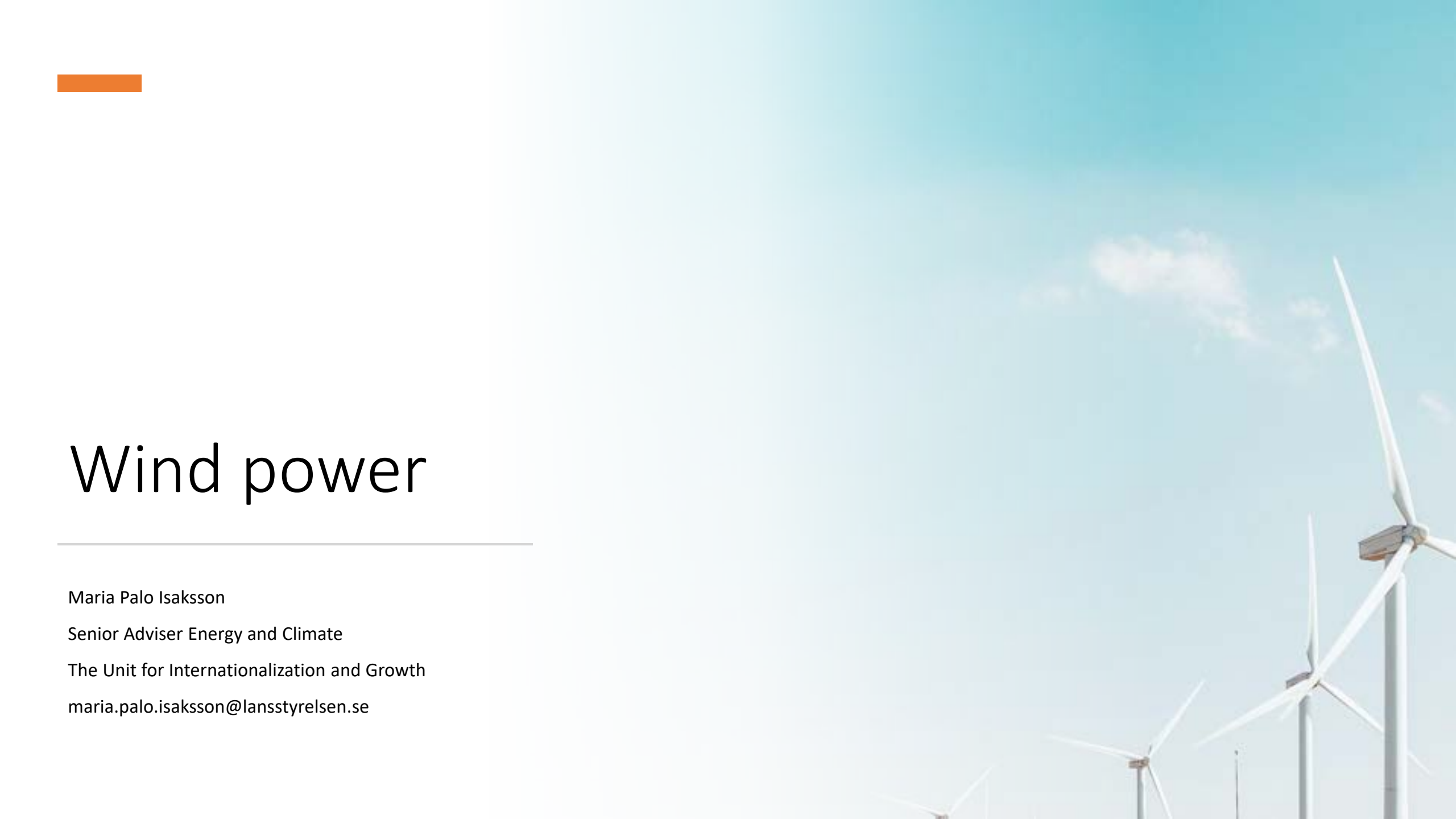
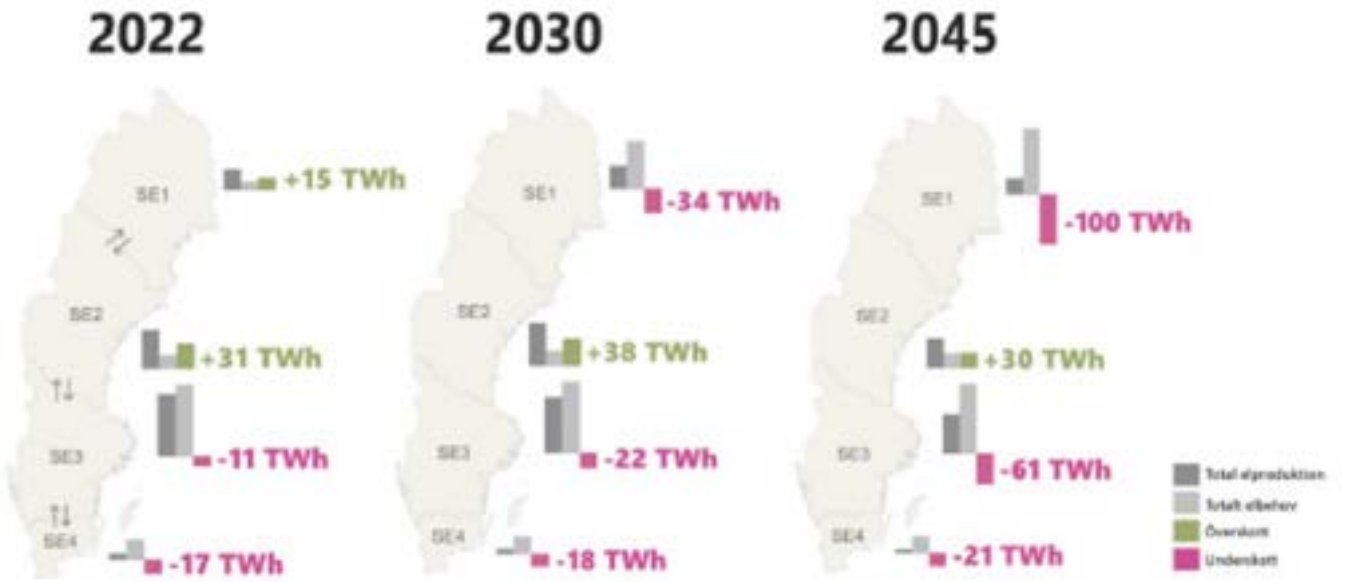


Why are we focusing so much on wind power?

- Transition from fossil fuels to more sustainably produced energy
- The amount of electricity needed will exceed the amount currently produced and what is under contstruction
- Wind power the fastest and financially most viable option up until approx 2035
- Consequences of a failed scale-up will be dire



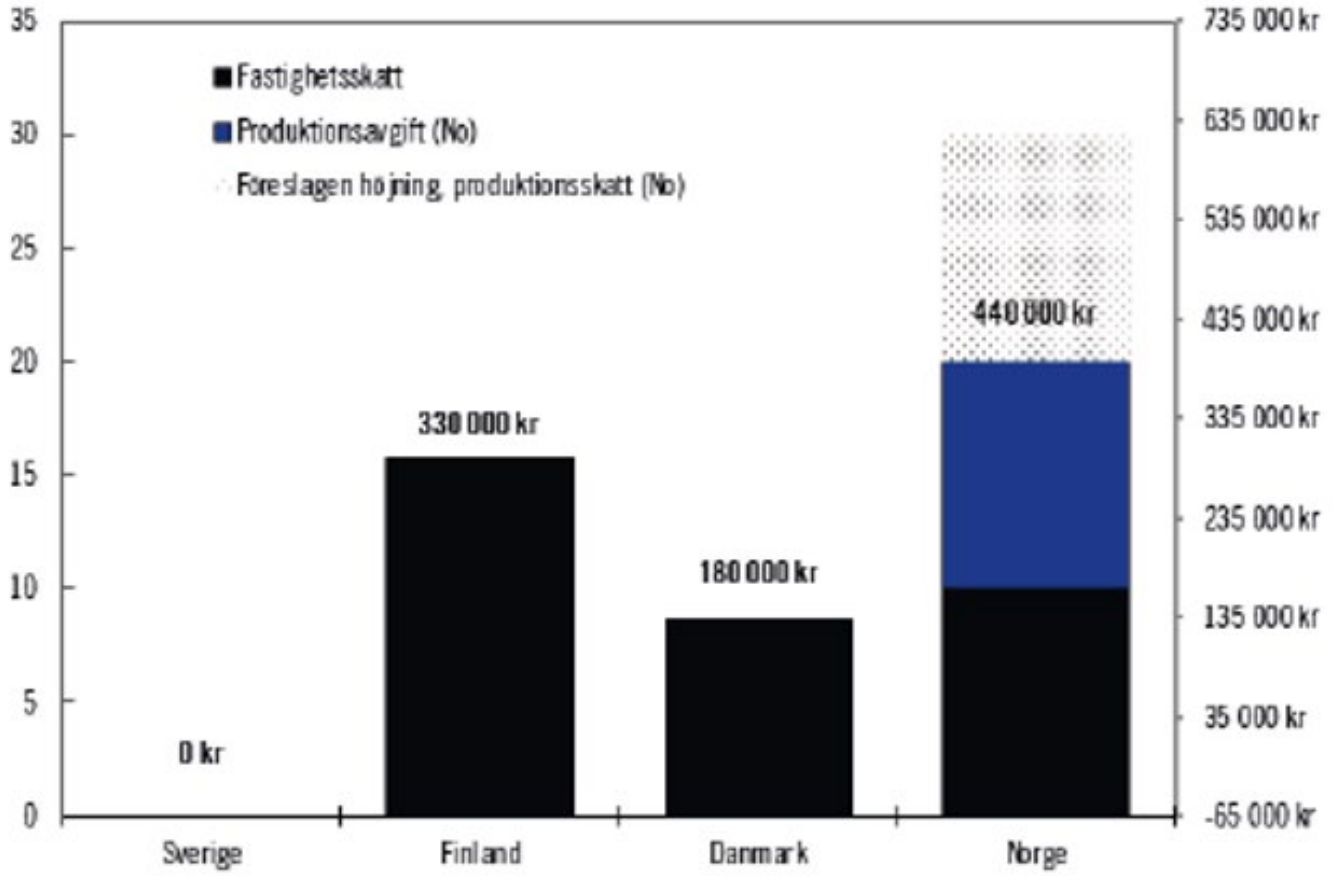
Figur 2 Energibalansen i Sveriges fyra elområden idag (2022) samt i en framtid med hög grad av elektrifiering (baseras på Energiföretagen Sveriges uppdaterade Högelscenario 2022) år 2030 och 2045 i en situation då ingen ny elproduktion tillkommer utöver den som redan finns på plats/är under byggnation idag. Kartor av Profu (hämtat från uppdrag för Energiföretagen Sverige).

Länsstyrelsen Norrbotten

	Estimated Electricity Consumption by 2035	Estimated Wind Power Capacity (Onshore and Offshore)
Finland	128-188 TWh	200 TWh by 2040
Norway	159 TWh	150 TWh by 2040
Sweden	150-250 TWh	117 TWh by 2030*

* In March 2022 there were applications to the Swedish Power Grid to connect offshore wind power with a potential of up to 378 TWh

Incentives for Municipalities in Sweden, Norway, Finland and Denmark



Länsstyrelsen Norrbotten

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Fred. Olsen Renewables

Possibilities and challenges for wind power

Pontus Grahn

Fred. Olsen Renewables AB

Agenda

Fred. Olsen Renewables

- Why Windpower? Are there possibilities?
- Why not Wind Power? Are there challenges?
- The industry´s suggestion on How to solve issues

Levelized Cost of Energy

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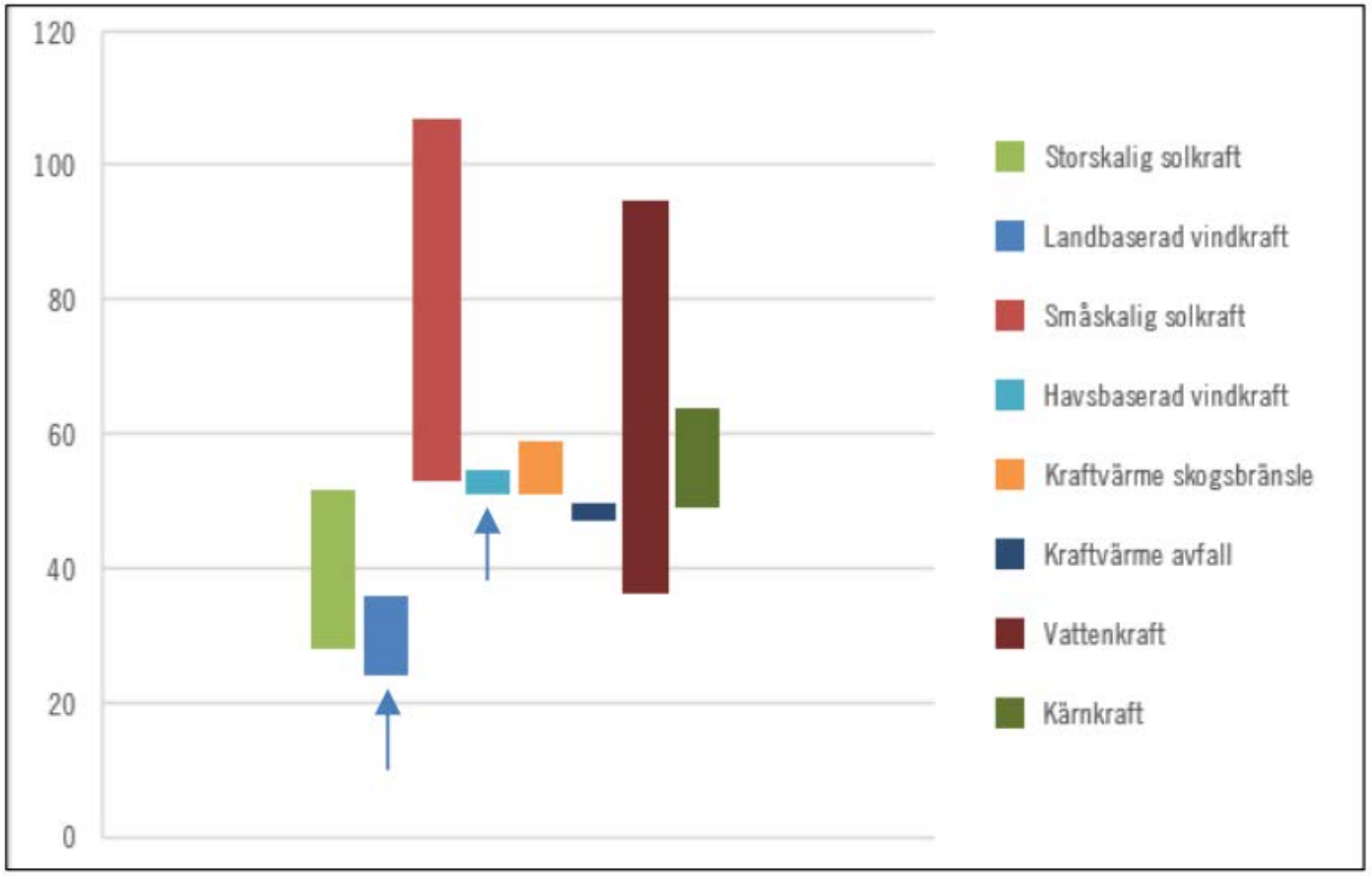
Figur 1.2 Produktionskostnad (LCOE) för olika kraftslag

Öre/kWh. Land- och havsbaserad vindkraft markerad med pilar



Källa: Energiforsk (2021), El från nya anläggningar [dokument-ID 77]. Pilarna inritade av Incitamentsutredningen.

Possibilities

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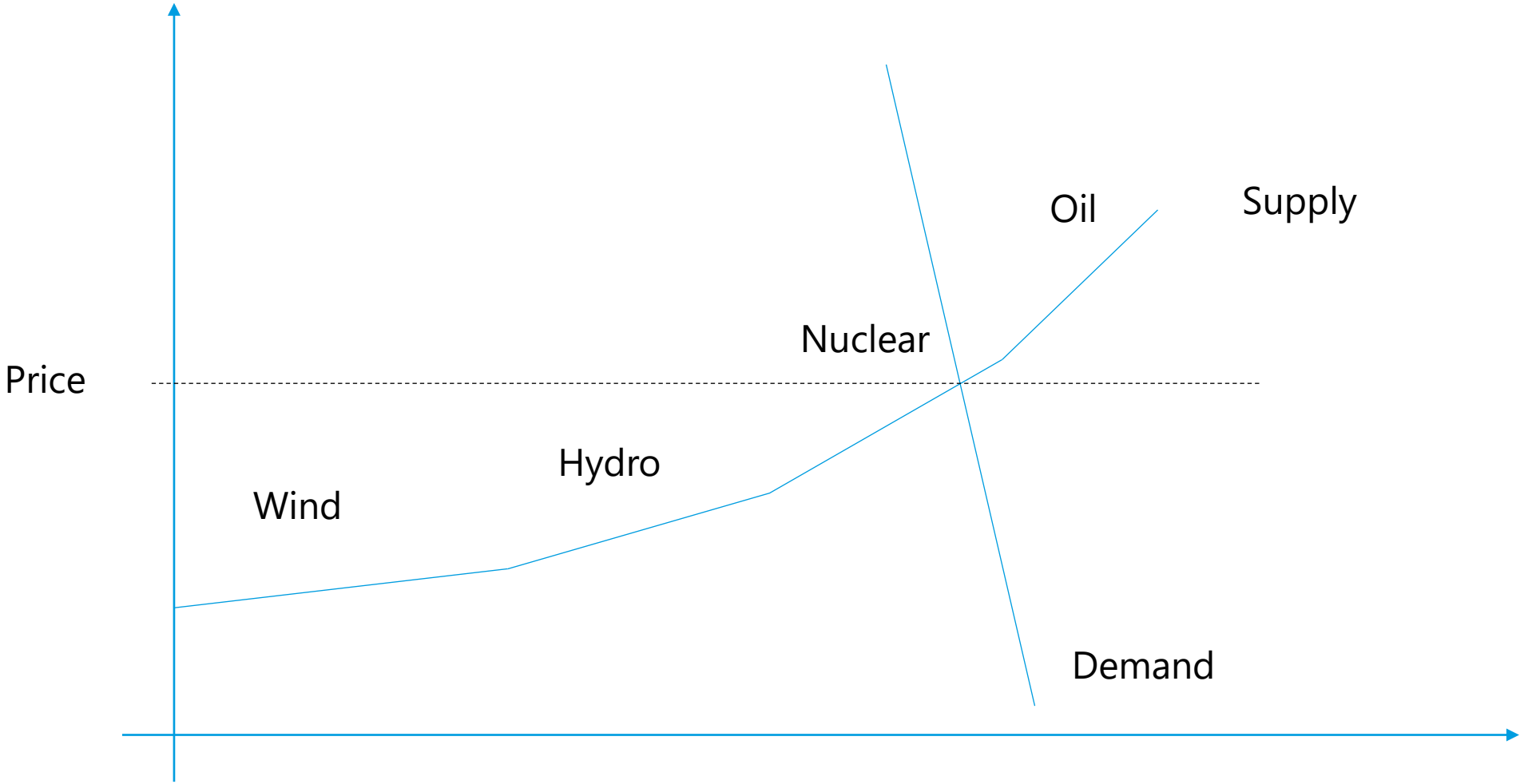
"Average Day"



Possibilities

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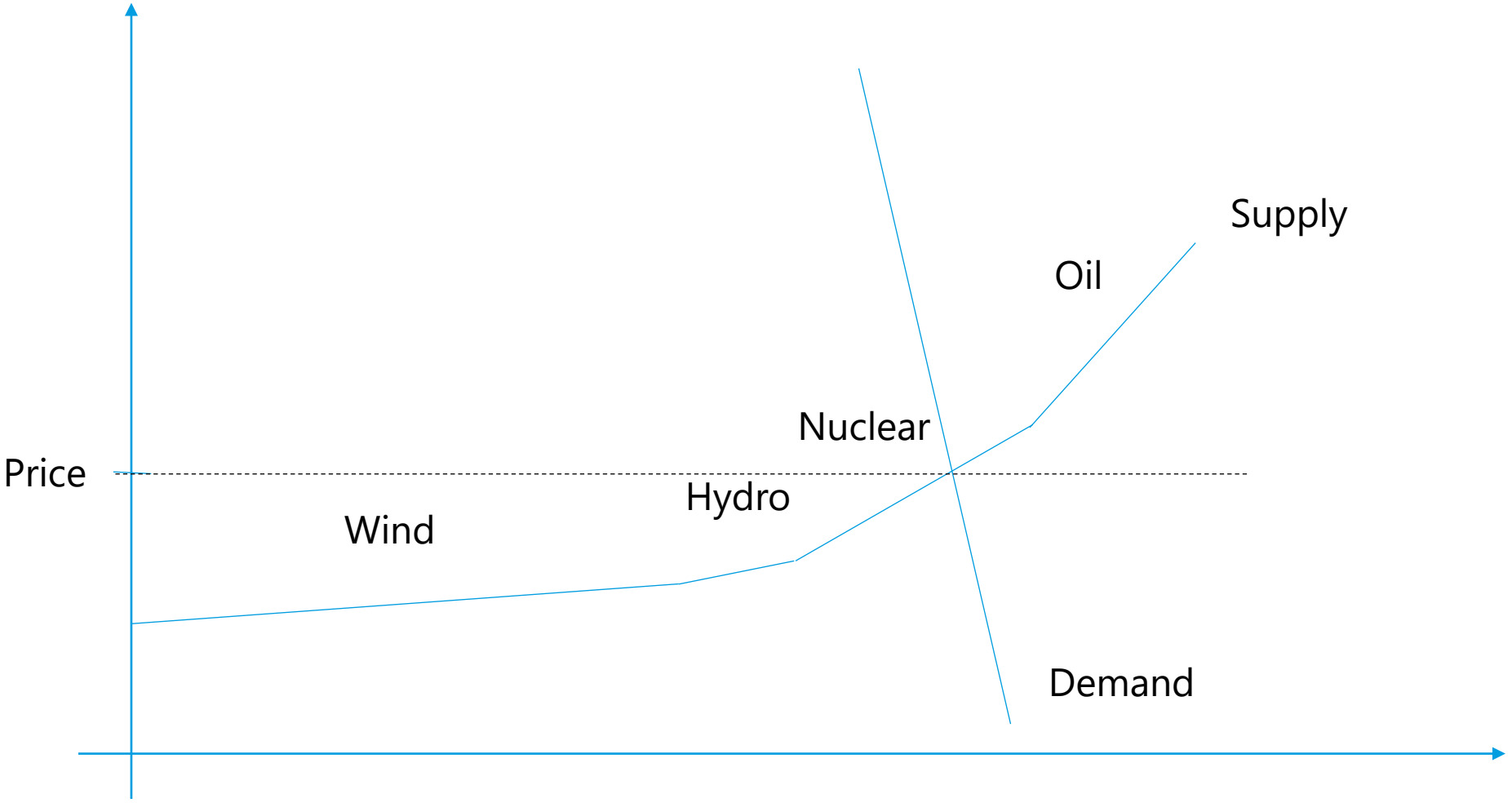
"Windy Day"



Possibilities

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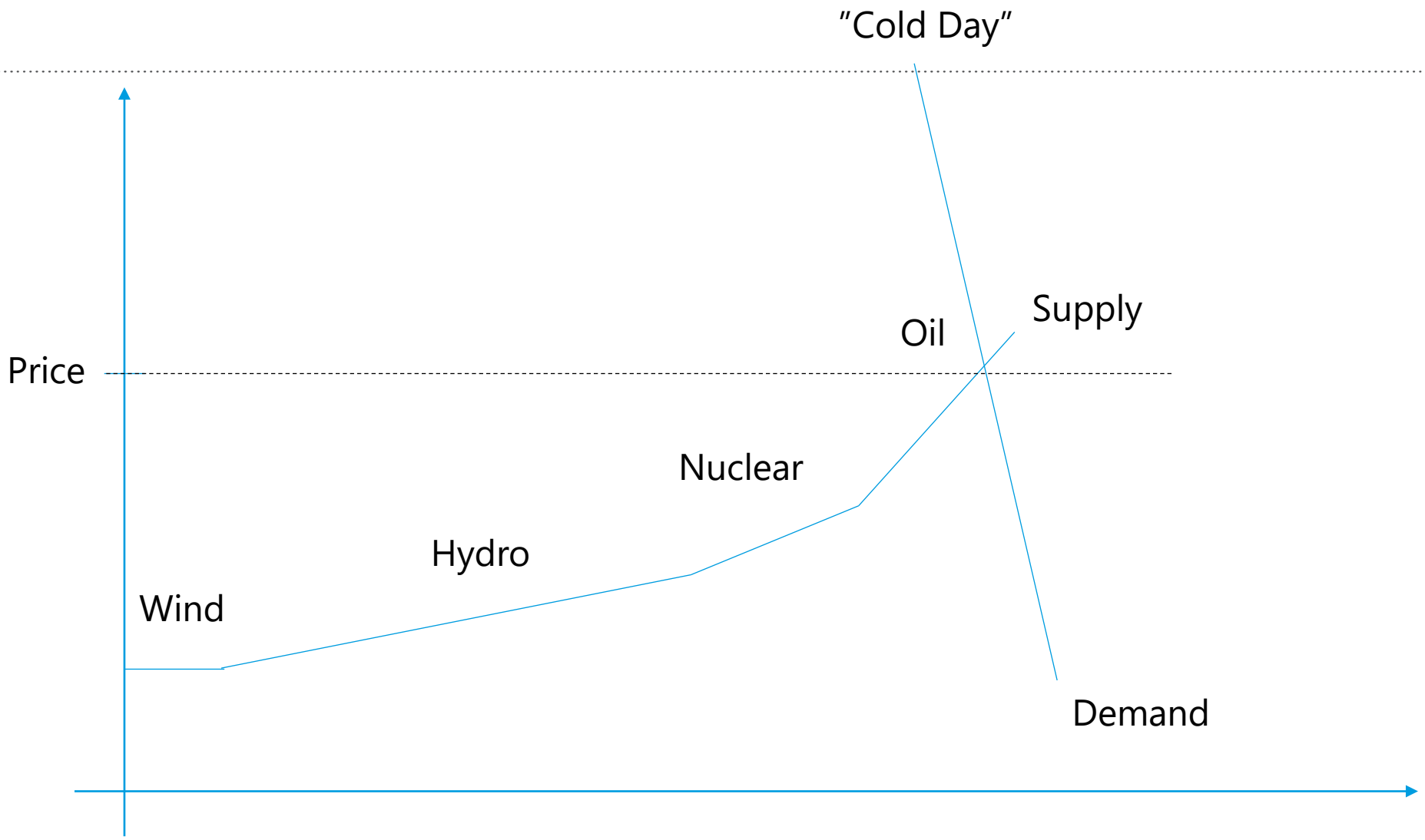
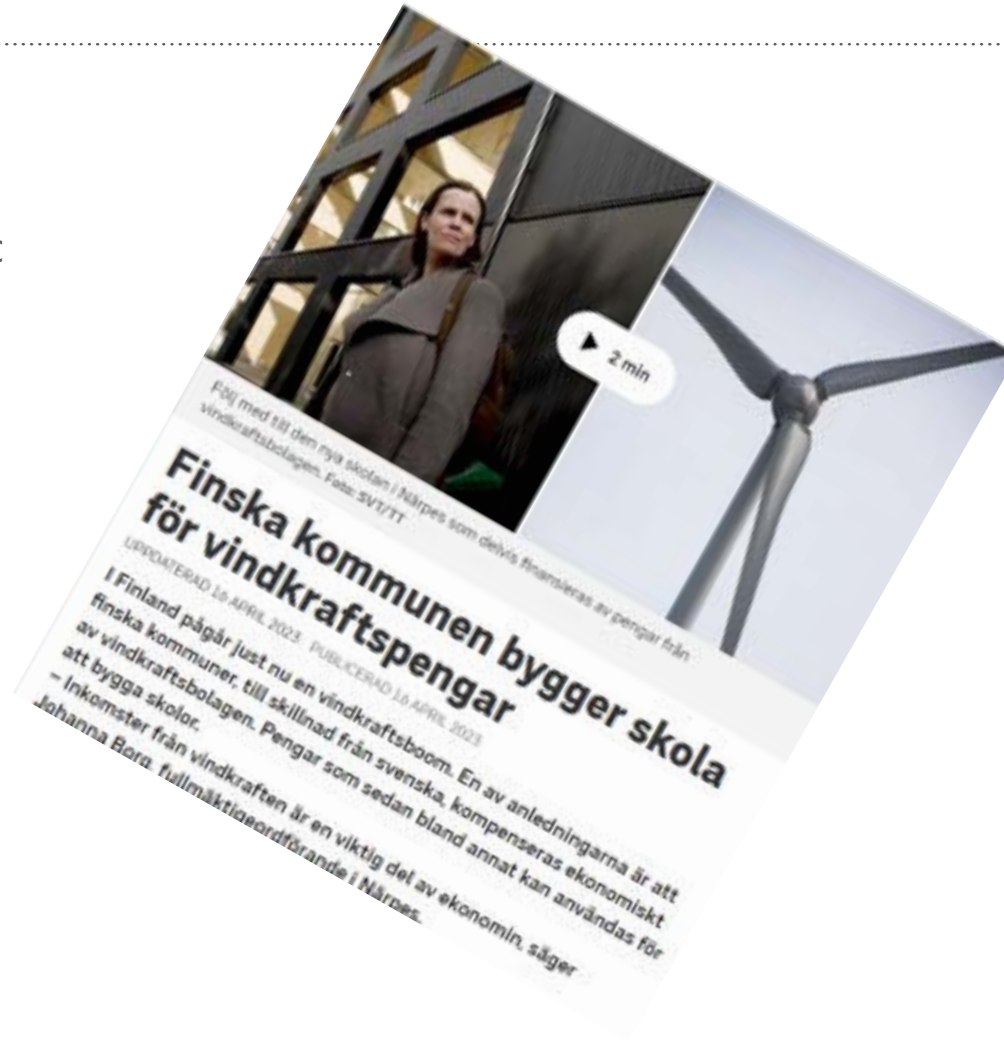


Possibilities

- Summary
  - Onshore wind has the lowest LCOE of any commercially available power source as of today, and is thus the best from a socio-economic standpoint as of today
  - Wind Power has an equally low carbon footprint with large scale written-off nuclear- and hydropower.
  - Wind Power is a quite new power source in the large scale energy system. Ongoing development with regards to recycling, technology in progress, incentives are missing sometimes
  - Wind power have no issues to be an integrated part of the Nordic Power System
  - No significant efforts for large scale power storage or user flexibility – As of yet! Wind Power is from a technical standpoint possible to expand very fast
  - Wind Power have a possibility to create added value locally and regionally rapidly



Possibilities

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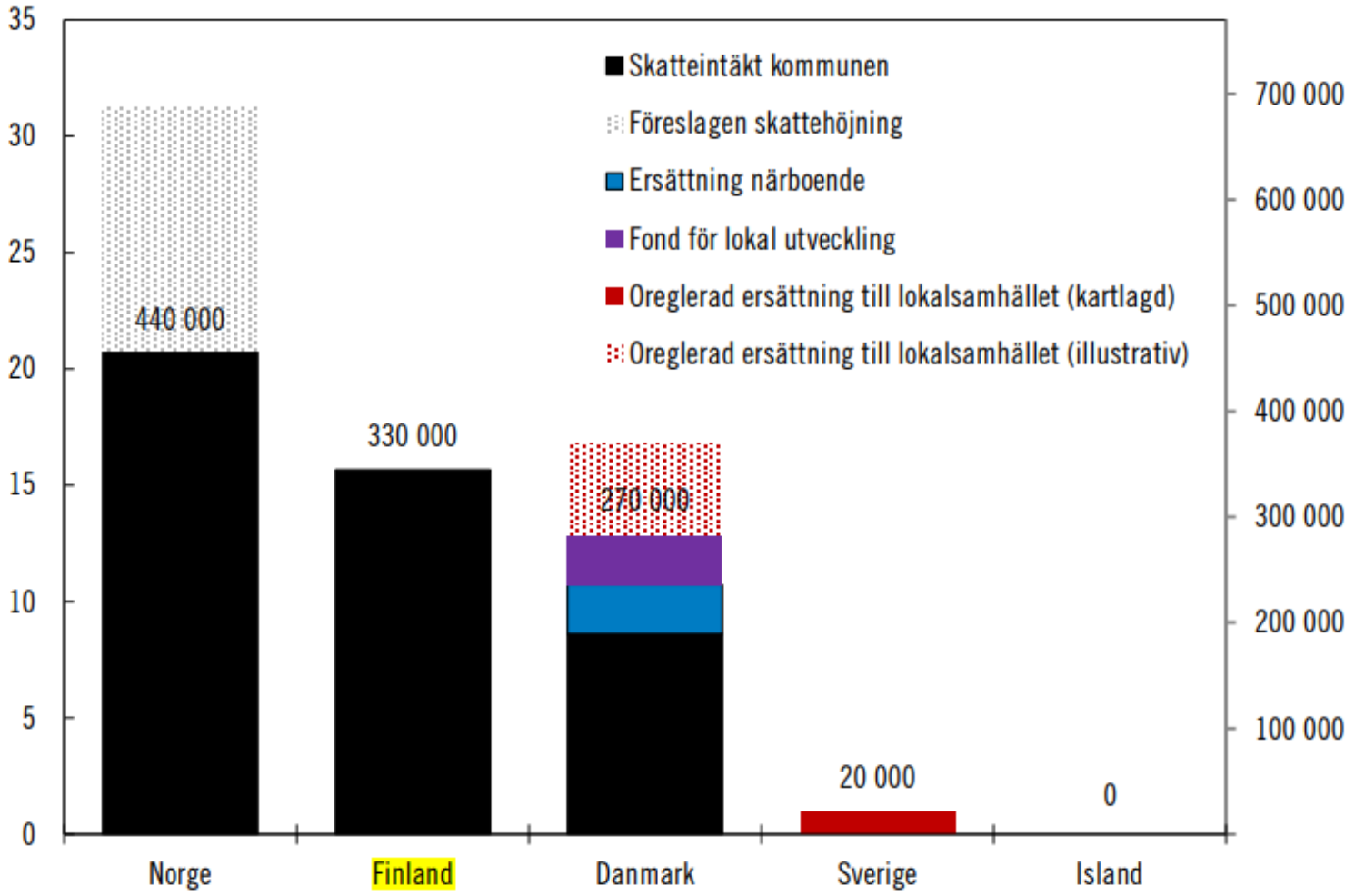
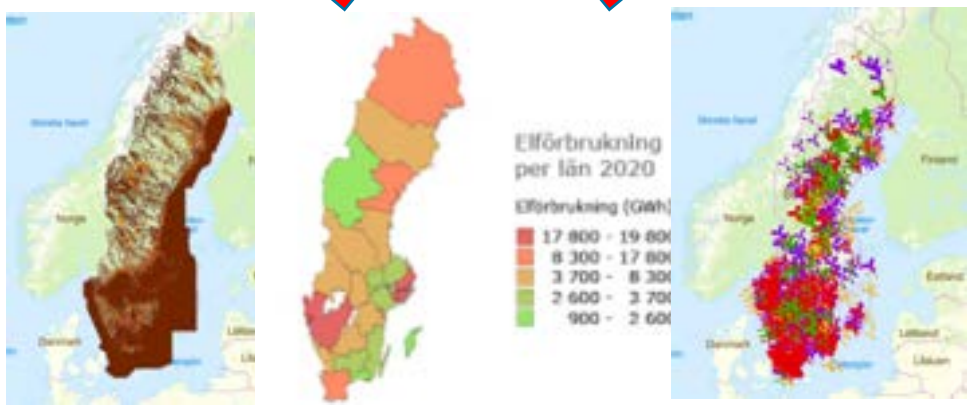
Figur 8.2 **Landbaserad vindkraft: Incitaments- och kompensation till kommun, lokalsamhälle och närboende**

SEK per producerad MWh samt SEK per 6 MW vindkraftverk



Challenges

- "Alternative facts" with regards to wind power are very common and goes through almost every aspects of our business.
  - Subsidies
  - Micro plastics
  - Destruction of grid
  - Etc.
- Wind power have some inherent environmental externalities, Noise, Shadow flickers, Transformed Land use, Obstacle lights.
- Wind power (In Sweden) is thus only possible in areas with no inhabitants or daily human activity,
  - Which means areas that often holds other values – often non-market priced.
  - In Finland, the situation is quite different
- Sparse Population – Scarce Common resources – Issues with local, regional and national financial distribution – Exports are not always seen as something positive.
- NIMBY effect - Almost everywhere!
  - Norway – Municipality Veto – And a very good compensation.



Challenges – North Sweden

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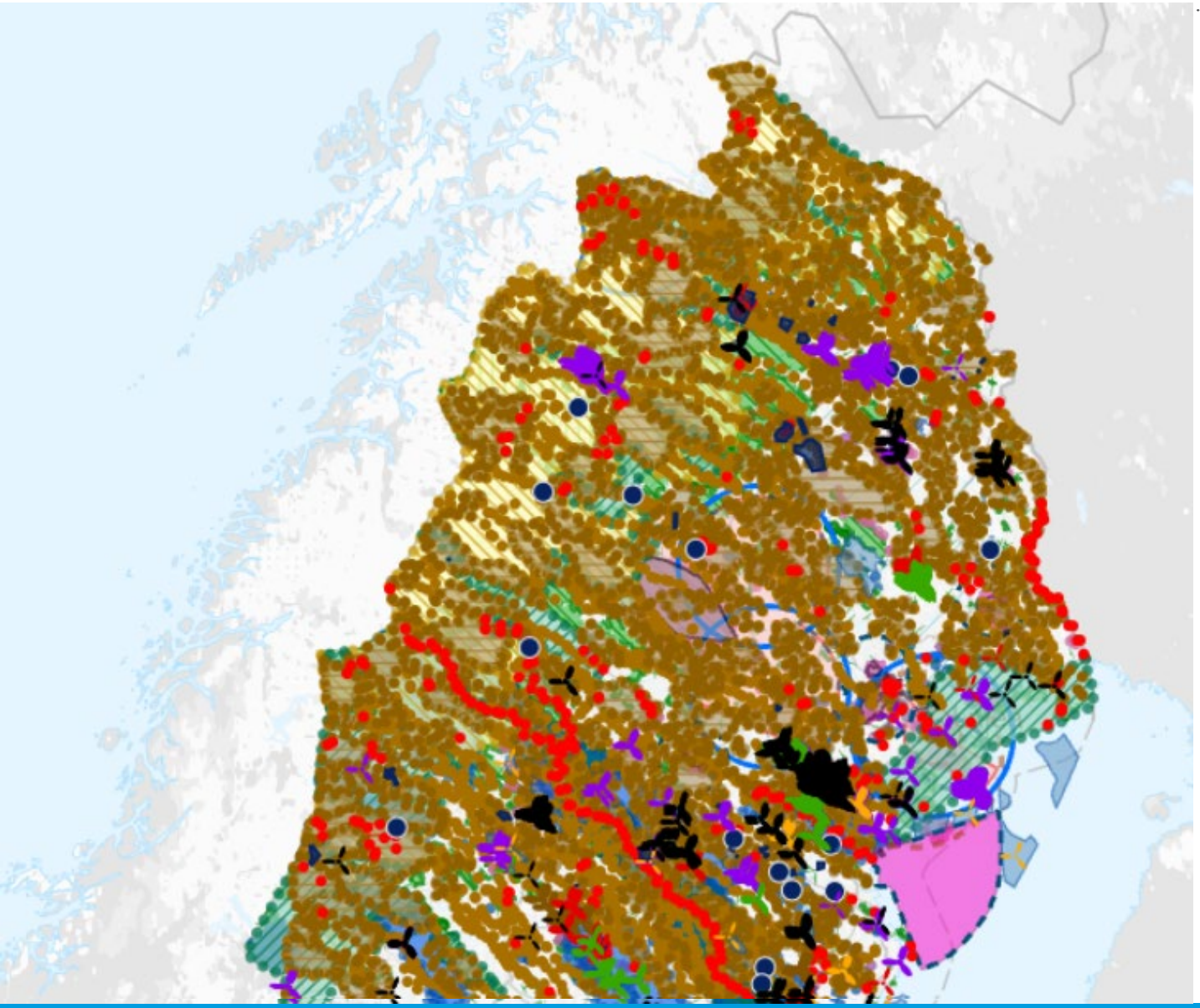

Opportunities - Finland

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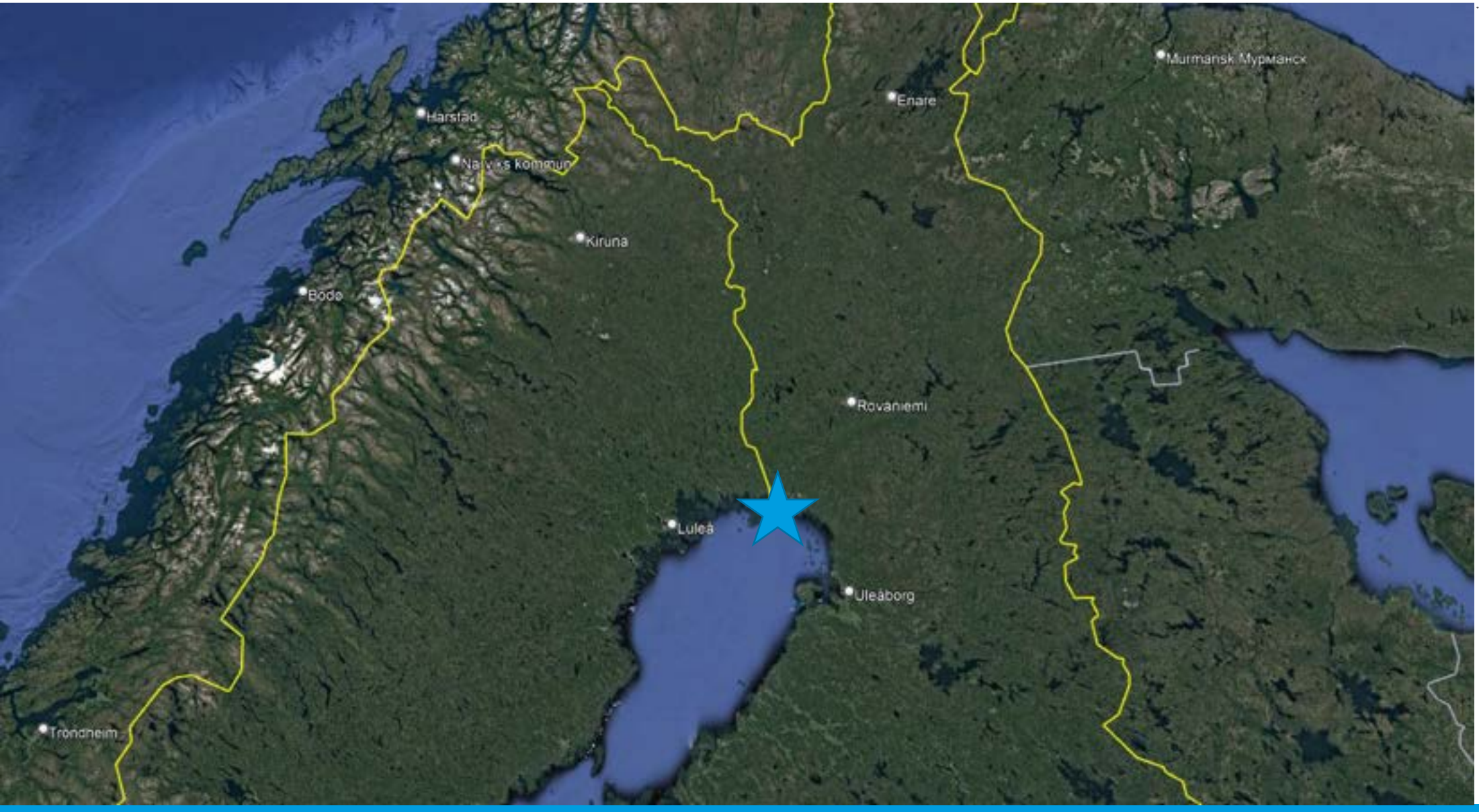
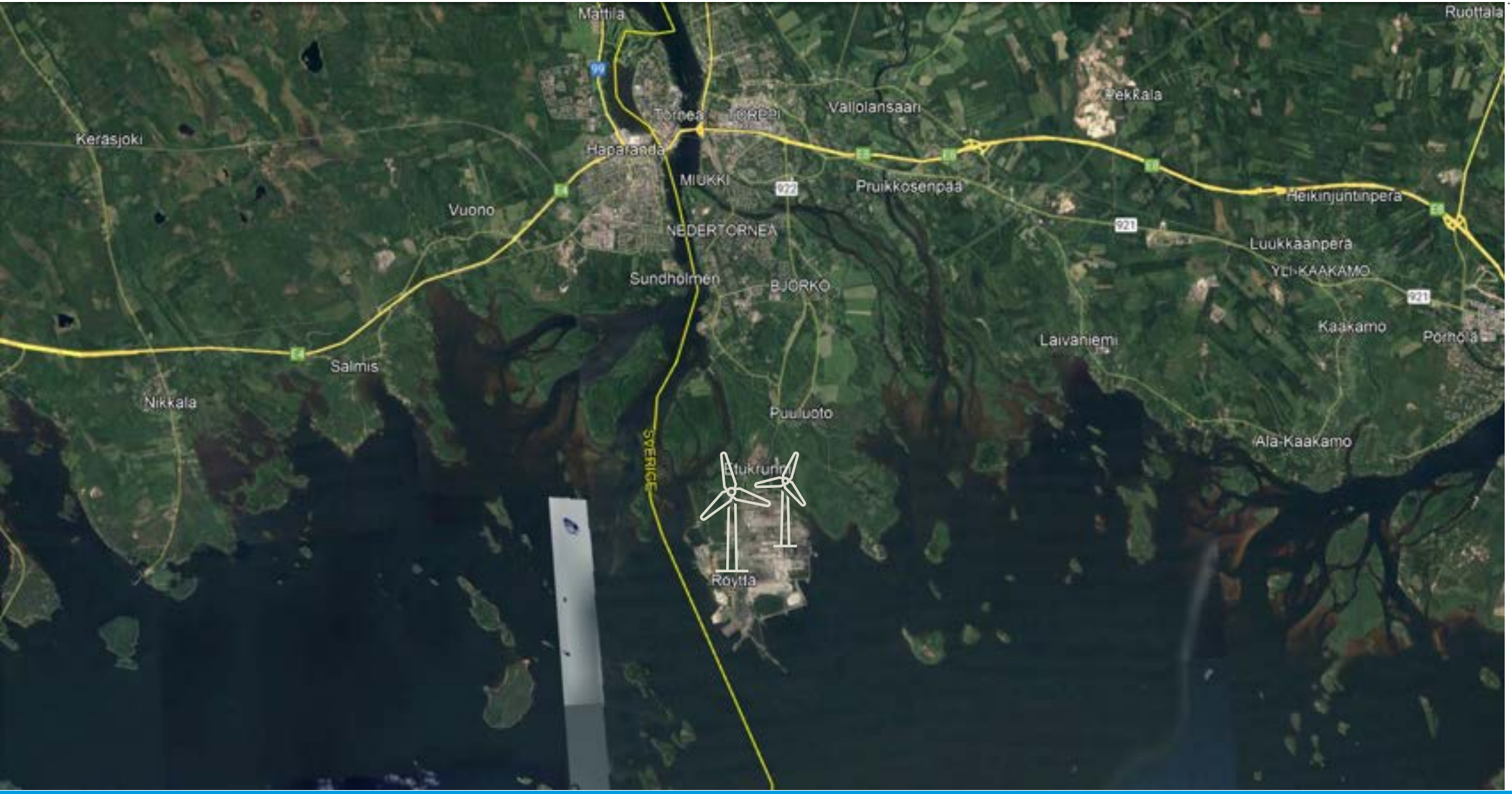


Röyttä - Tornio




94 meters
~350 meters
Google Earth

How to solve issues

- Energy and electricity (and thus especially with regards to wind power) needs to be seen as a long term local, regional, national and international interest –
  - There is not room nor time for the political friction with regards to Energy poilcy we see today
  - Every kWh will be needed.
- National planning and priorities are required, as well as a transparent and planable path to permits.
  - Reformation of Veto (Sweden & Norway)
  - Reform of the interpretation of national interests – and the courage to make priorities.
    - Avoidance to take decisions is also de facto a decision!
- Electricity must be seen as a tradable and transferable commodity
  - Both within our countries, as well as between our countries.
  - My belief is that we could and should learn from each other over all the local, regional as well as national borders!

Thank you!

Fred. Olsen Renewables

Pontus Grahn
Project Development Manager
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A permit expert's view on the environmental sustainability of wind power

Mrs Gabriella Hammarskjöld
Senior Permitting Advisor
Sweco
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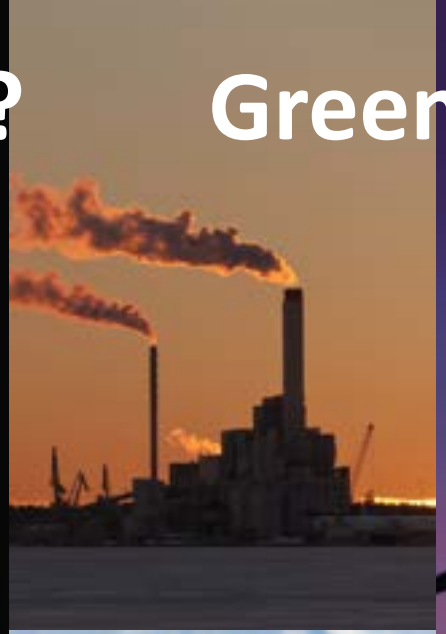
Why More Wind Power?

Green Transition Urgent Matte



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Wind Power Permit Processes in Part of Barents Region What is needed in the future?

- Over-all differences between Norway, Sweden and Finland's permit processes.
- What is needed in the future permit processes to keep the past positive wind development trend?

➢ Challenges and conflicts of interests.

➢ What have we done about them?

➢ New Proactive actions to reach green transition and avoid a climate change crisis.

OFFSHORE WIND

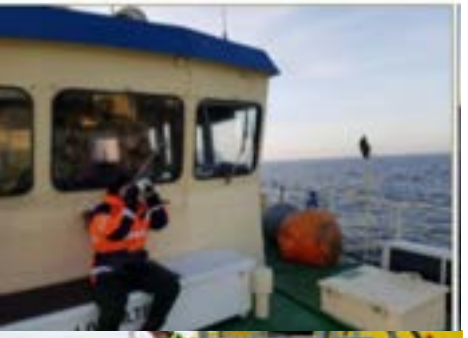
Growing Conflict of interest's North Baltic Sea:

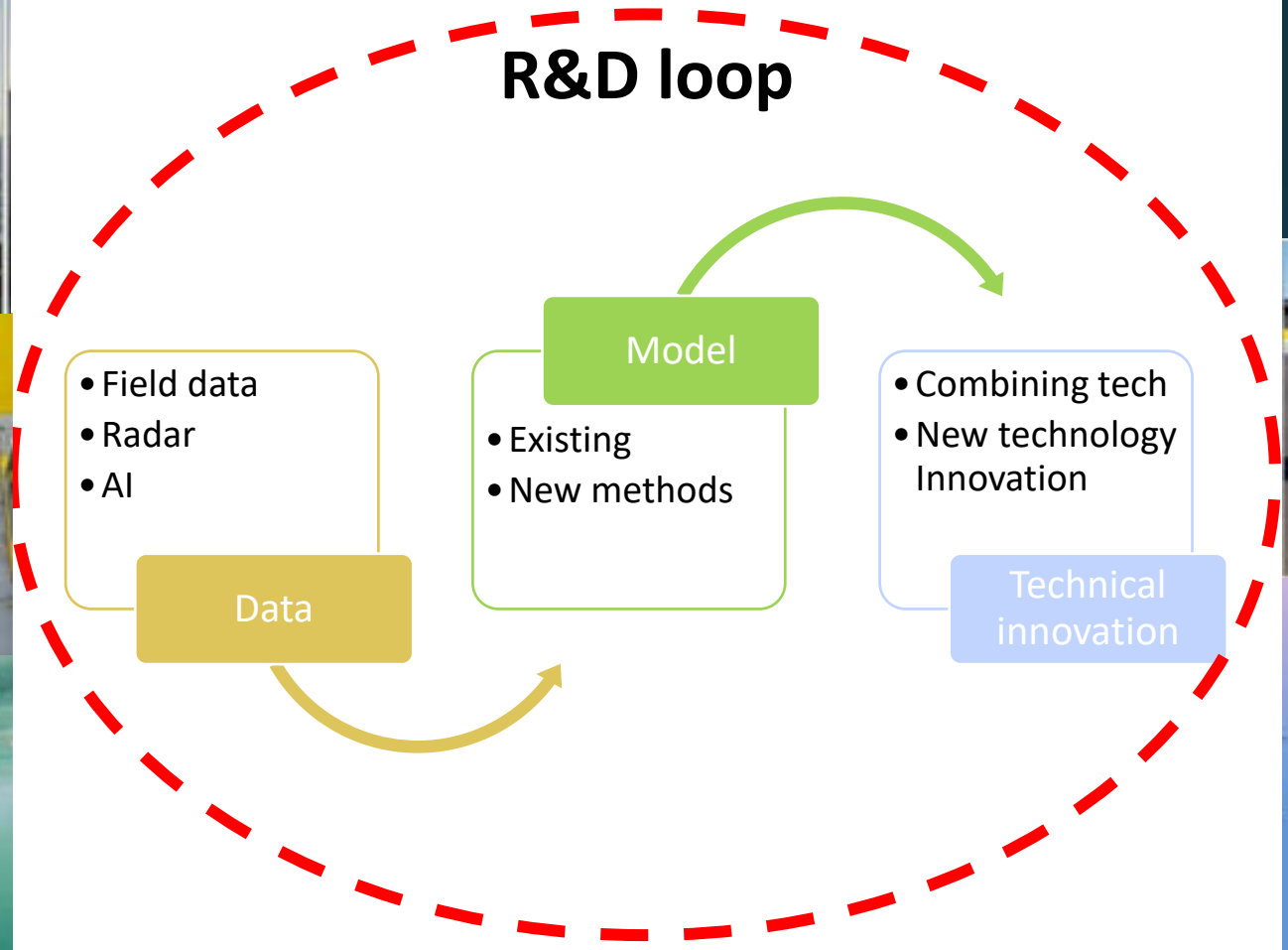
- High Offshore Wind Competetion
- Shipping routes and marine safety
- Fishermen Associations
- Nature values/Natura 2000
- Municipal veto in SE Territorial sea

Permitting Challenges Offshore Wind and Biodiversity

- **Nature values**
  - Marine Mammals
  - Spawning fish
  - Sea birds
  - High seabed nature values
- **Permitting Mitigation Strategies**
  - Avoiding or Seasonal Restrictions
  - AI and Stop mechanism
  - Large Double Bubble Curtain and
  - Hydro Sound Dampers
  - Micro Siting for Seabed nature

Offshore Wind Permitting – High Level of Science Excellences





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ONSHORE WIND

Growing Conflict of Interests in Barents Region:

- Natura 2000, EU Habitats Directive, Bird Directive
- Defence Expanding
- Local interests
- Municipal veto
- Sami interests Reindeer

The Importance of Early Local and Social Anchoring

- The importance of early local and social anchoring and dialogue
- Building Trust
- Active listening
- Municipal veto issues
- Compensation to neighbors and municipalities

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Sami Interests
Reindeer Herders and Wild Reindeer

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More Science and Local Reindeer Herders Knowledge Gives Local Site Adapted Protection Measures

- Research done by SLU and in Norway.
- Reindeer disturbance from Wind Power is complex involving both noise and visibility.
- Reindeer is a wild animals following the instinct of the herd.
- The Climate change impact the reindeer lands.
- The local Sami knowledge is important.
- The dialogue and co-working climate between parties are not functioning well in several onshore wind cases.
- More science is needed in this area!
- Authorities need to develop better guidance considering also involving local Sami herder's expertise on local conditions.

Electrical Power Connection Planning often starts too late….

What can we do about it?

Long Term Sustainable Wind Development
Need more coexistence and Innovation

- The size of turbines increases so fast – can noise level decline?
- Wind fundament is visible far off – colour of blades and obstacle lightning
- How can the localization processes improve?
- Innovation programmes between countries!

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Handling conflict of interest breeds innovation

- The importance of daring to handle relevant goal conflicts
- Usually create new thinking and innovation

- Requires Courage, Trust and Genuine Cooperation!

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Finlands miljöcentral
Finnish Environment Institute

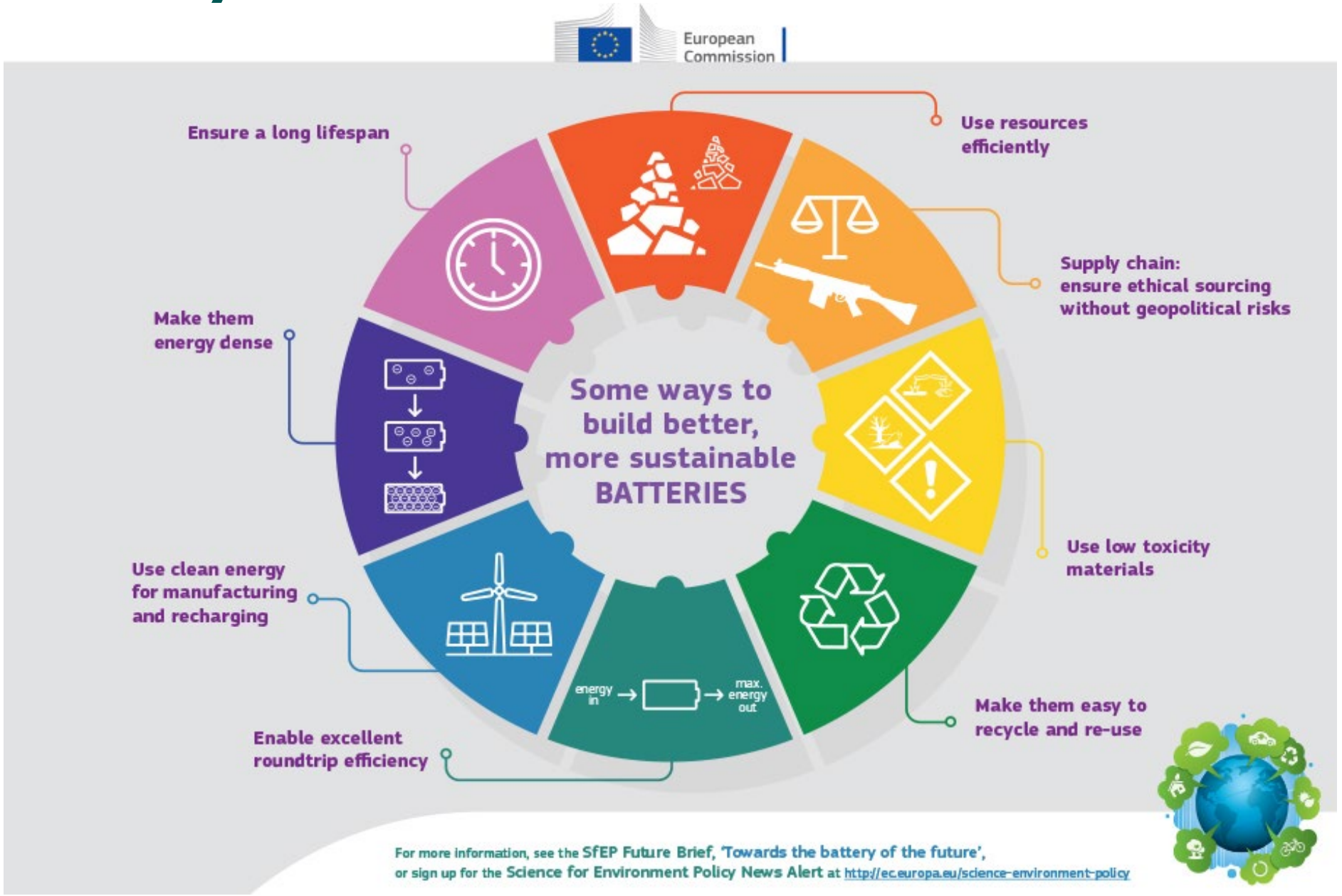
Ympäristöministeriö
Miljöministeriet
Ministry of the Environment

Ulkoministeriö
Utrikesministeriet

Sustainable Green Transition in the Barents Region

Capacity building on battery value chain operations in Nordic Barents regions

Battery value chain



Background

- Green Transition is changing energy sources from fossil to renewable ➔Demand and production of batteries is increasing
- Recycling of battery minerals and sustainable mining operations are prerequisites for safeguarding accessibility to battery raw materials in the long term
- Better understanding of the environmental risks in the whole battery value chain is needed
- How to ensure that green transition will consider also social and cultural aspects and values of indigenous people
- Processes are developing, legislation and requirements developing
  - IED revision
  - DNSH–principle, climate and other environmental objectives
  - Critical Raw Materials Act
  - EU Battery Strategy and Regulation

- Sharing knowledge and experiences needed

Objectives

- To exchange experiences and knowledge related to environmental issues connected to battery value chain operations and activities in the Barents area
- Improve practices of administrative processes
  - Most significant environmental issues connected to battery value chain.
  - Common understanding of the changing regulations
- To enhance Nordic co-operation for follow-up actions
  - Preparedness for joint input to EU processes
  - Shared view how to operate in changing regulatory environment as support to local authorities

Activities

- Establishing the Nordic network
  - Environmental authorities
  - Stakeholders: Operators, local communities, researchers, consulting companies
- Site visits
  - Finland: November 2023
  - Sweden: Spring 2024, TBC
  - Norway: Autumn 2024, TBC
- Workshops in each country collecting information and changing experiences in connection with the site visits.
- Pre-study report to identify the most significant environmental challenges of the battery value chain. The report will also describe possible steering instruments
- Develop Nordic joint project proposal. This follow-up project would
  - Identify the overall environmental impacts and Best Available Techniques (BAT) for the different stages of the value chain
  - Produce guidance for administrative procedures and recommendations for battery value chain operators

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Complementary projects

Reconceptualizing Boundaries Together Towards Resilient and Just Arctic Future(s) (REBOUND)

- One work package creates guidance that enhances achieving social license to operate (SLO) within permitting and planning processes related to mining and wind power sectors. The main deliverables will be:

  1) socio-cultural criteria to complement the Do No Significant Harm evaluation of green transition projects in the Arctic

  2) more acceptable and constructive forms of interaction within planning processes.

Best Available Techniques for manufacturing and recycling of electric vehicle batteries (NCM BAT group project)

- The project will provide information on best available techniques (BAT) in the production, reuse and recycling of batteries including procedures for emission reduction in each stage of the value chain as well as minimization of environmental risks.
- The intention of the project is to support building of knowledge, adding of value in the sector and to support the sector in reducing its environmental impacts and risks.
- Finalisation in 2023

Kiitos!
Tack!
Takk!

Timo Jouttijärvi, Kaj Forsius, Emmi Vähä

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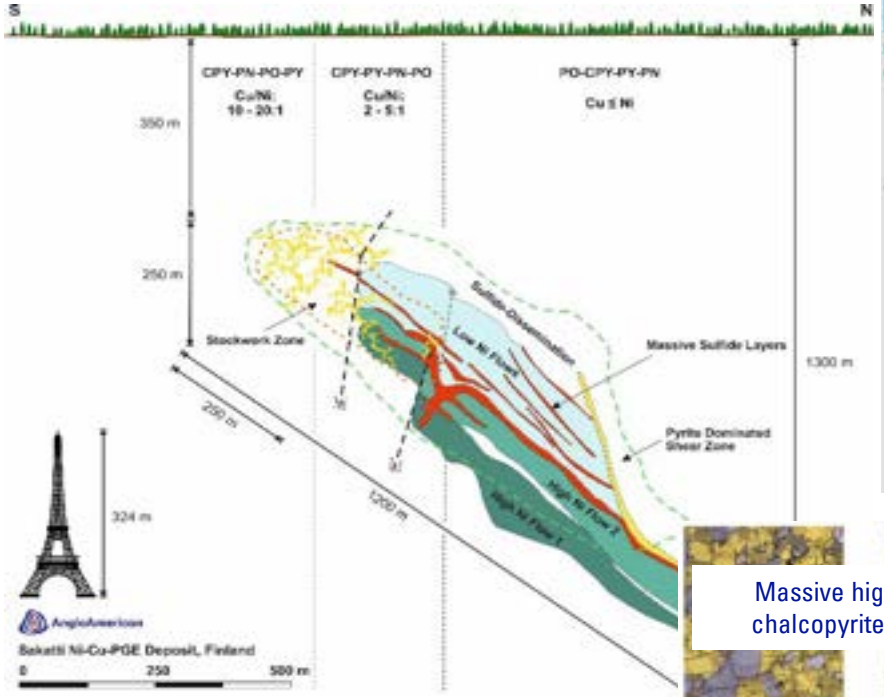
Mining and nature compensations - can the effects of mines land use on nature be compensated for, and if how?

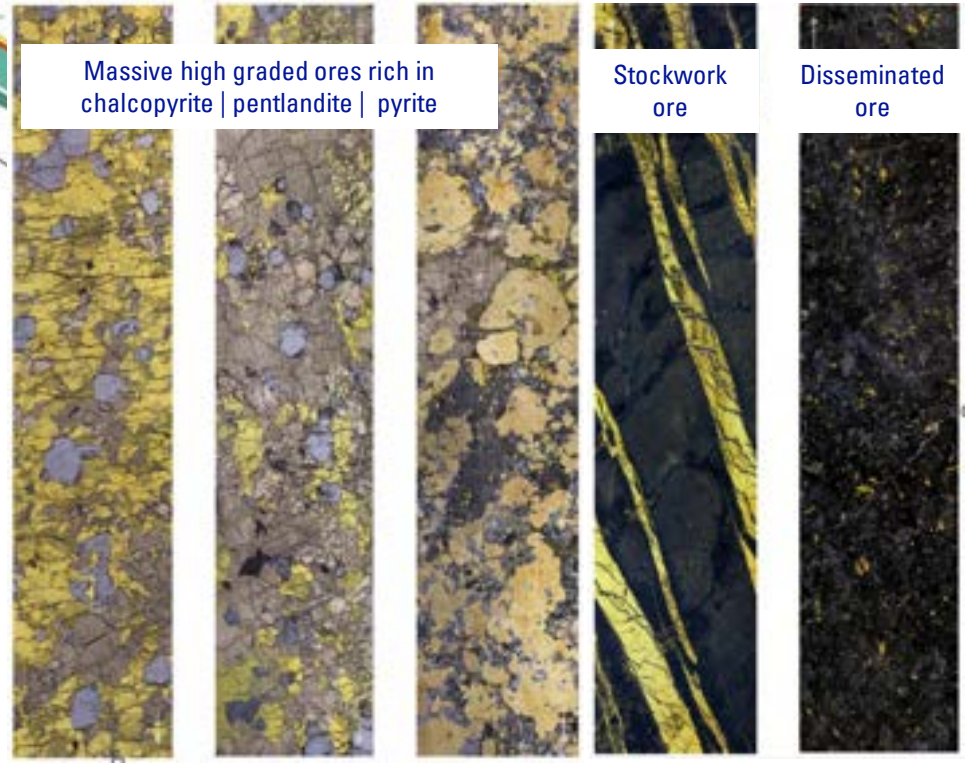
Ulla Syrjälä
AA Sakatti Mining Oy, Finland
October 2023

Where Anglo American operates

* Number of operating mining assets/major projects under development per business unit

AA - Sakatti project





Cu %	4.5	2.9	0.8	1.3	0.3
Ni %	2.3	3.6	1.4	0.3	0.2

- AA Sakatti Mining Oy is Finnish subsidiary of Anglo American
- Operates in Sodankylä, Finnish Lapland
- About 50 employess

- Sakatti project: Cu-Ni-PGE deposit in Northern Finland
- Mining 1.25 – 2.2 Mt/a during 20 years of life of mine
- Production 250 000 t/a concentrates (separate nickel and copper concentrates)

- Project in permitting phase

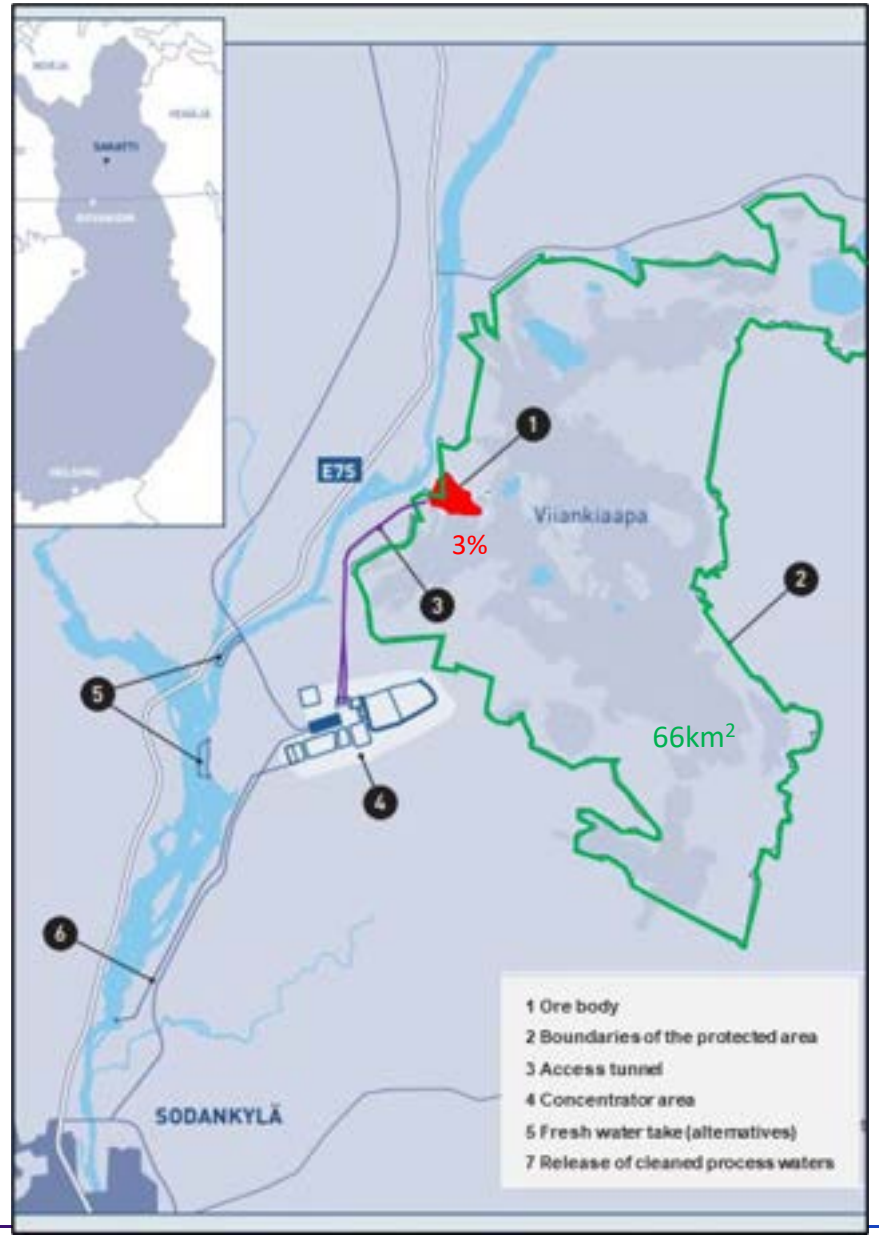
Sustainable mining

The Sakatti ore deposit is located **underneath the Viiankiaapa Mire Protection Area**. The area is also part of the Natura 2000 network of protected areas.

The mine will be an underground development, and **no aboveground structures will be located in the Natura 2000 area**. We have designed the mine in a way that it can be built and operated sustainably and with all due care for the environment.

Environmental responsibility is at the heart of the Sakatti project. We are thinking innovatively and are developing and implementing **new technologies** to help us improve how we work, while **minimizing our environmental footprint**.

Sakatti aims to be a leader in mining sustainably and responsibly. Our **aim is that Viiankiaapa mire stays similar as it is now** and the impacts of mining will be minimal.



Our strategy on a page

The pillars supporting our plan

Our Sustainable Mining Plan is built around three Global Sustainability Pillars aligned to the UN's Sustainable Development Goals.

Healthy Environment

Maintaining a healthy environment by creating water-less, carbon, neutral mines and **delivering positive biodiversity outcomes**.

Thriving Communities

Building thriving communities with better health, education and levels of employment.

Trusted Corporate Leader

Developing trust as a corporate leader, providing ethical value chains and improved accountability to the communities we work with.

Healthy Environment

Biodiversity

To deliver net positive impact (NPI) across Anglo American through implementing the mitigation hierarchy and investment in biodiversity stewardship.

Milestones and targets

2020: NPI methodology, biodiversity value assessments and site-specific indicators in place at sites in high risk environments. An established biodiversity framework, supporting processes, capacity and resources in place to enable rigorous application of the mitigation hierarchy across the mining lifecycle. **Formalise partnerships to support NPI, which are aligned with existing regional and national biodiversity stewardship initiatives**.

2030: **Deliver NPI on biodiversity across Anglo American.**

How to achieve the NPI - Starting point 2016

Methods:

- The work is done in cooperation with Anglo American Group and Fauna & Flora International (FFI).
- The best experts from Finland were chosen
- A critical examination of how compensations have been successful around the world

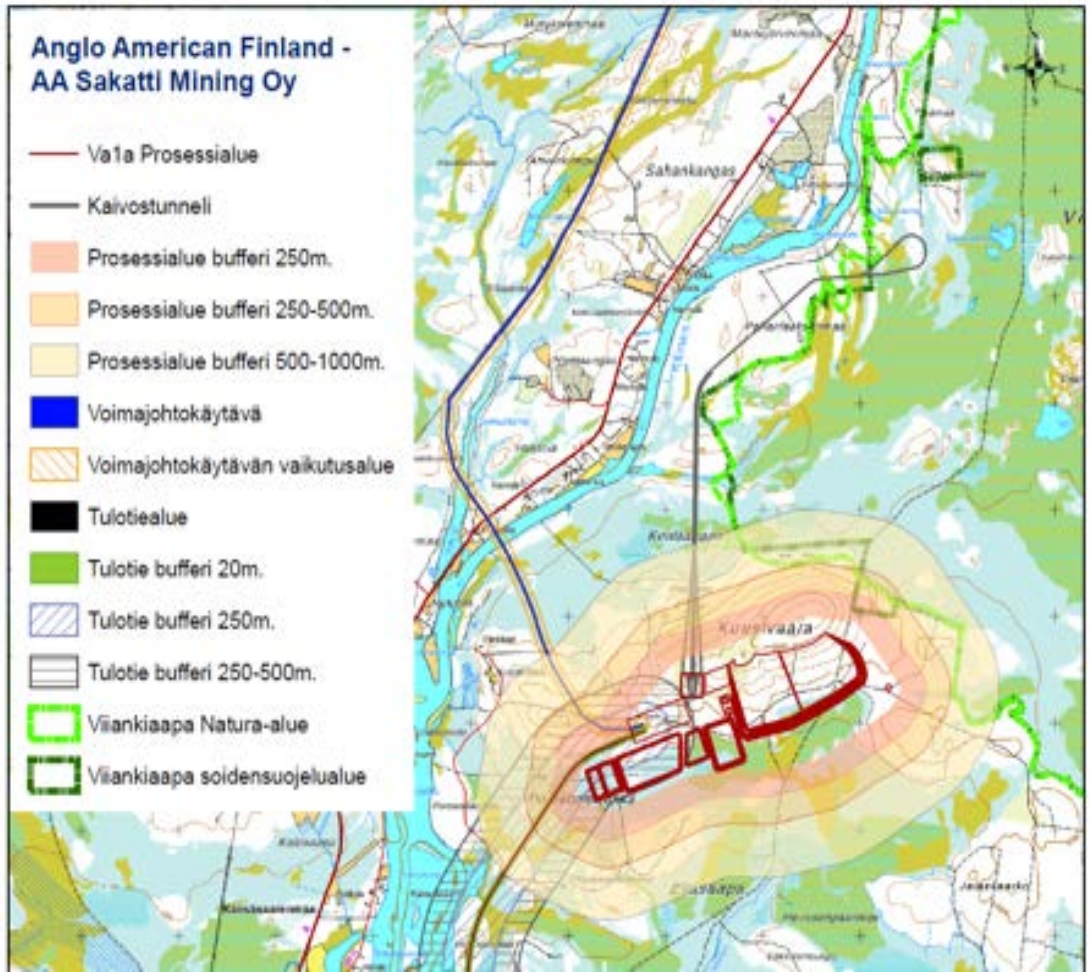
Decisions:

- The company acquires land, and it is permanently protected
- VEC is already mentioned in the EIA, and will be part of the environmental permit application

Aim: Credible, voluntary, net positive, compensation **at the level of main habitat types**

How to achieve the NPI - Impacts

- Both direct and indirect losses are compensated, inside and out of the protected area
- The peatlands are in high ecological condition, the forests are mostly young production forest
- Sources of damage: underground mining activities (lowering of the groundwater level), process area, access road and power line
- Sources of indirect impacts: noise, vibration, light, dust, traffic, human presence, habitat fragmentation



How to achieve the NPI - Estimate of impacts

Methods:

When net damage is estimated, one combines

I. The size of impact area

II. The intensity of impact in different zones

III. The habitat type and condition of areas suffering from impacts

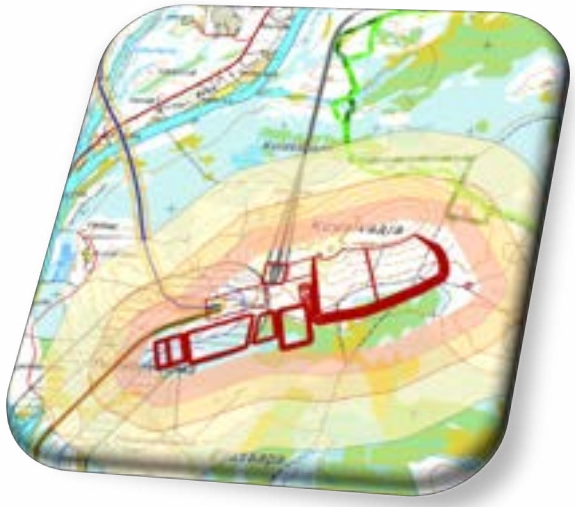
- Inside and out of the protected area
- For every source of impact
- Direct and indirect losses
- In different habitats
- Accounting for habitat condition

- Unit of evaluation: habitat hectare, hha = ”1 lost hectare of natural-condition habitat”

Results:

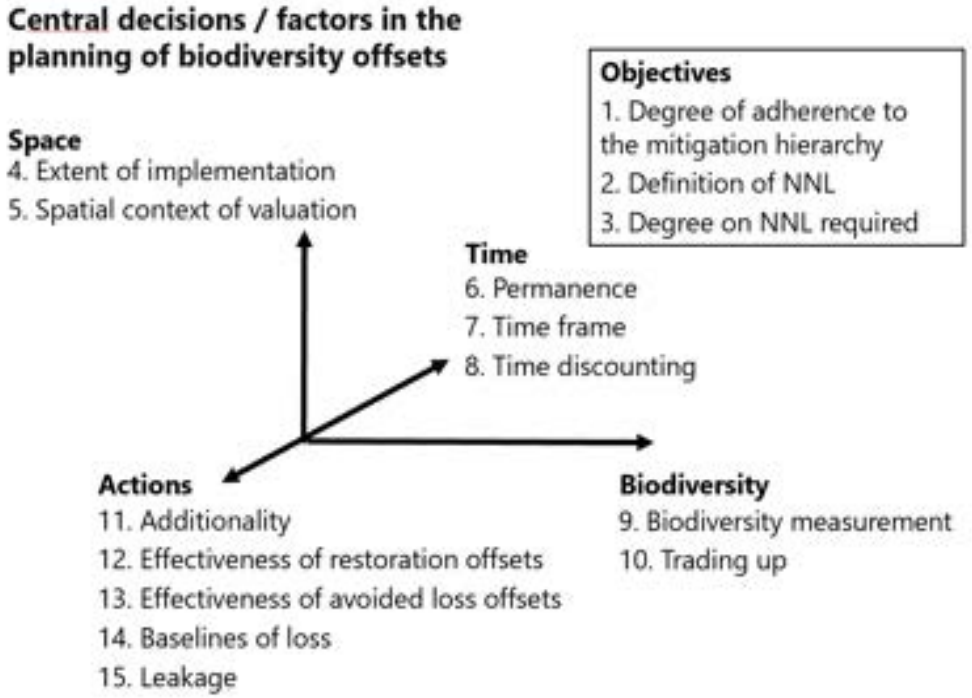
- Total: 500 – 750 hha

- Peatlands / wetlands: 50 – 60%
- Indirect: 50 – 70%
- Inside the protected area: 3 – 14%
- Greatest source: process area



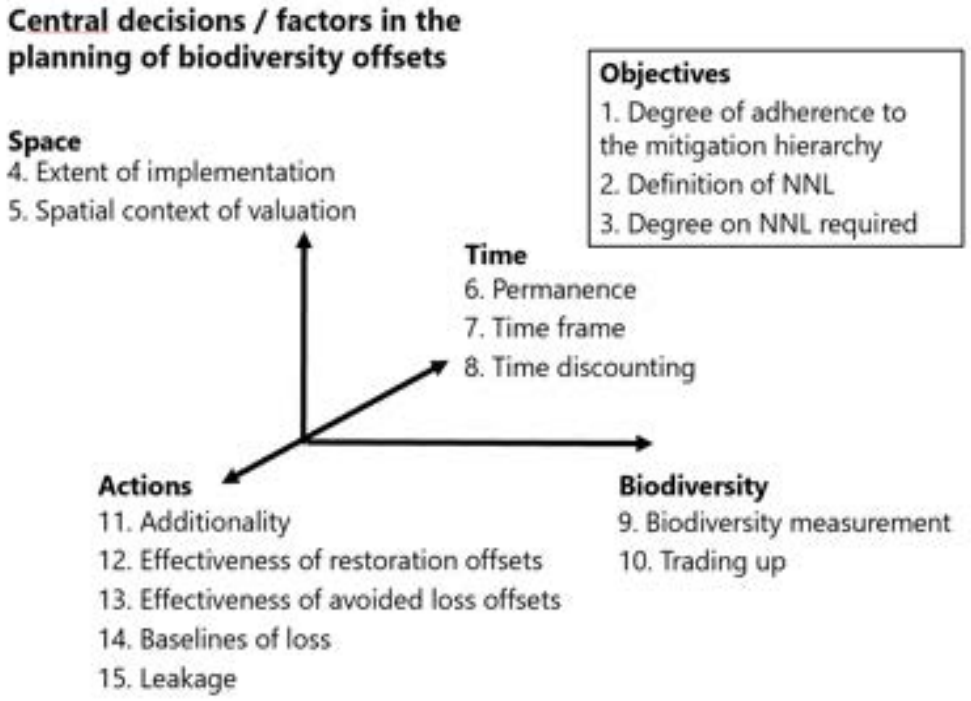
How to achieve the NPI: 15 important factors

#	Factor	Suggested decision
1	Degree of adherence to the mitigation hierarchy	Large investment into modern underground mine with processing outside of the protected area
2	Definition of NNL (No Net Loss)	On average, at the level of main habitat type
3	Degree of NNL/NPI required	30% net positive, inside the designated evaluation time interval
4	Implementation area	• The northern aapa mire zone for peatlands • Lapland for forests
5	Evaluation reference frame	National and EU
6	Permanent / temporary offsets	Permanence is required
7	Evaluation time interval	30 years: offsets must on average deliver over this time period
8	Time discounting	Delayed gains are discounted at a 1.5% yearly rate



How to achieve the NPI: 15 important factors

#	Factor	Suggested decision
9	Measurement	Peatlands and forests at the level of main habitat type, accounting for habitat condition
10	Trading up	Take opportunities at implementation, does not influence design
11	Additionality	On do actions that don't have resources otherwise
12	Response of restoration offsets (peatlands)	Estimated from scientific literature
13	Response of avoided loss offset (forest)	Estimated from logging statistics
14	Background trend of avoided loss estimation	Estimated from logging statistics
15	Leakage	Assume that logging pressure relocates fully, reducing net gains from protection.

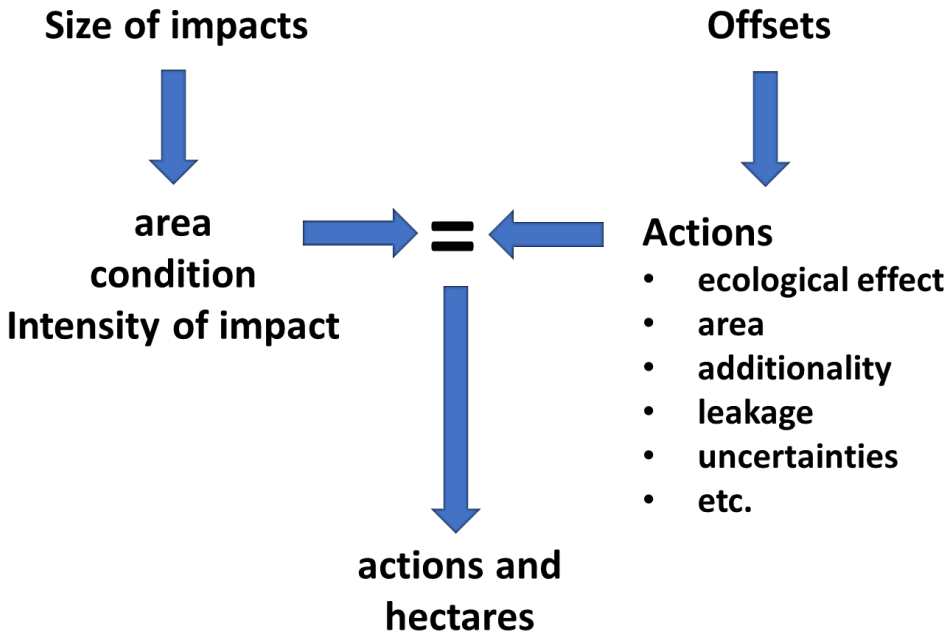


How to achieve the NPI: size of compensation area

Methods:

- Size of offset = impact [hha] x multiplier
- Multiplier: if one hha of habitat is lost, how many hectares of action are needed to achieve the desired level of NNL/NPI?

- A total multiplier is composed from partial multipliers.
  Peatlands ~15
  Forest ~10



Results:

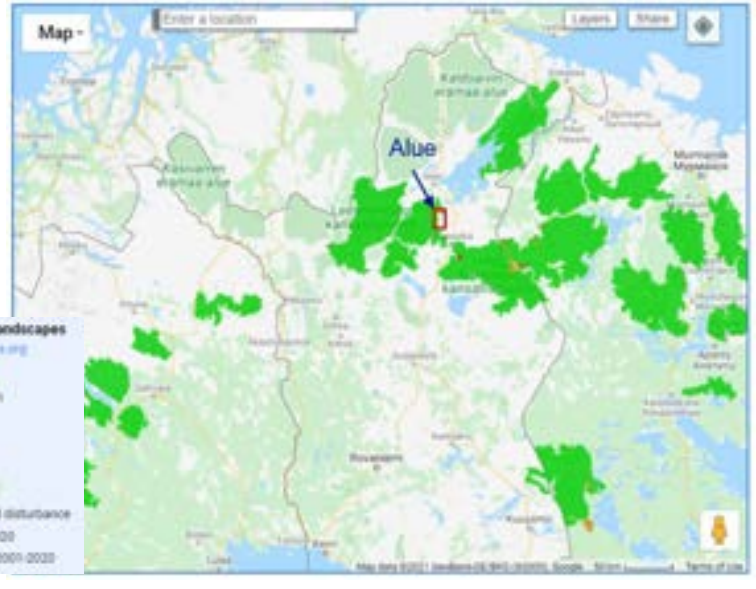
~peatland 2500 ha
~forest 3000 ha

	losses in habitat hectares [hha]****					offset area		
Alt.	direct	indirect*	total**	forests	peatland, wetland	forests [ha]	peatland [ha]	NPI %***
1A	266	293	559	231	328	2470	4920	125 - 200
1B	261	252	513	206	307	2200	4610	120 - 190
2A	317	431	748	314	434	3360	6510	130 - 200
2B	317	380	697	287	410	3070	6150	125 - 200
3A	175	432	607	307	300	3290	4500	140 - 210
3B	181	359	540	257	283	2730	4250	140 - 220

Voluntary Ecological Compensation - Forest

- Anglo American is committed in new mine project for net positive (NPI) compensation at the level of the main habitats
- Transparent, scientifically sound assessment methodology utilised to define to need of off-set land
    - Impacted area 500 ha x 15 = total off-set area needed 7,500 ha (forest, mire)

- In May 2022 about 3000 hectars of Intact Forest Landscape was purchased as an early commitment ~120 km north from the mine site
    - Intact forest landscape (IFL) is an unbroken natural landscape of a forest ecosystem and its habitat–plant community components, in an extant forest zone.



Mitigating the impacts of mining in Sakatti

Sakatti is committed to Net Positive Impact, NPI

Avoid

- No above-ground structures within the protected area
- Leaving NE satellite out of the mine plan

Minimize

- Minimizing CO_2 footprint; CO_2 neutrality target
- Minimizing waste rock and tailings deposition
- Minimizing water footprint by dry stacking

Restore

- Restoring ditched mires in Sodankylä

Compensate

- Voluntary ecological compensation, purchasing of 3000 hectares of ancient forest landscape in Inari to be transferred to private protected area
- Natura compensation

Net Positive Impact (NPI)

Challengers of ecological compensations

- No set rules; in Finland the voluntary ecological compensation came into law only this autumn
- Finding areas eligible for compensation in nearby areas
- In the case of Sakatti, voluntary activity is mixed with mandatory, possible natura 2000 compensation; the forest can't replace the mire, can it?
- In reality, NPI is achieved only with considerable coefficients, it is not understood that the area requirements are extensive

Can the effects of mines land use on nature be compensated for?

- Yes, with the help of the inventory of real effects/damage and comprehensive coefficients, a credible compensation target is obtained
- Requires extensive base line surveys, land purchases to protect the area permanently and restoration measures (mires)

Thank you

Green Transition and Regional Sustainability

Luleå, 10-12 October 2023

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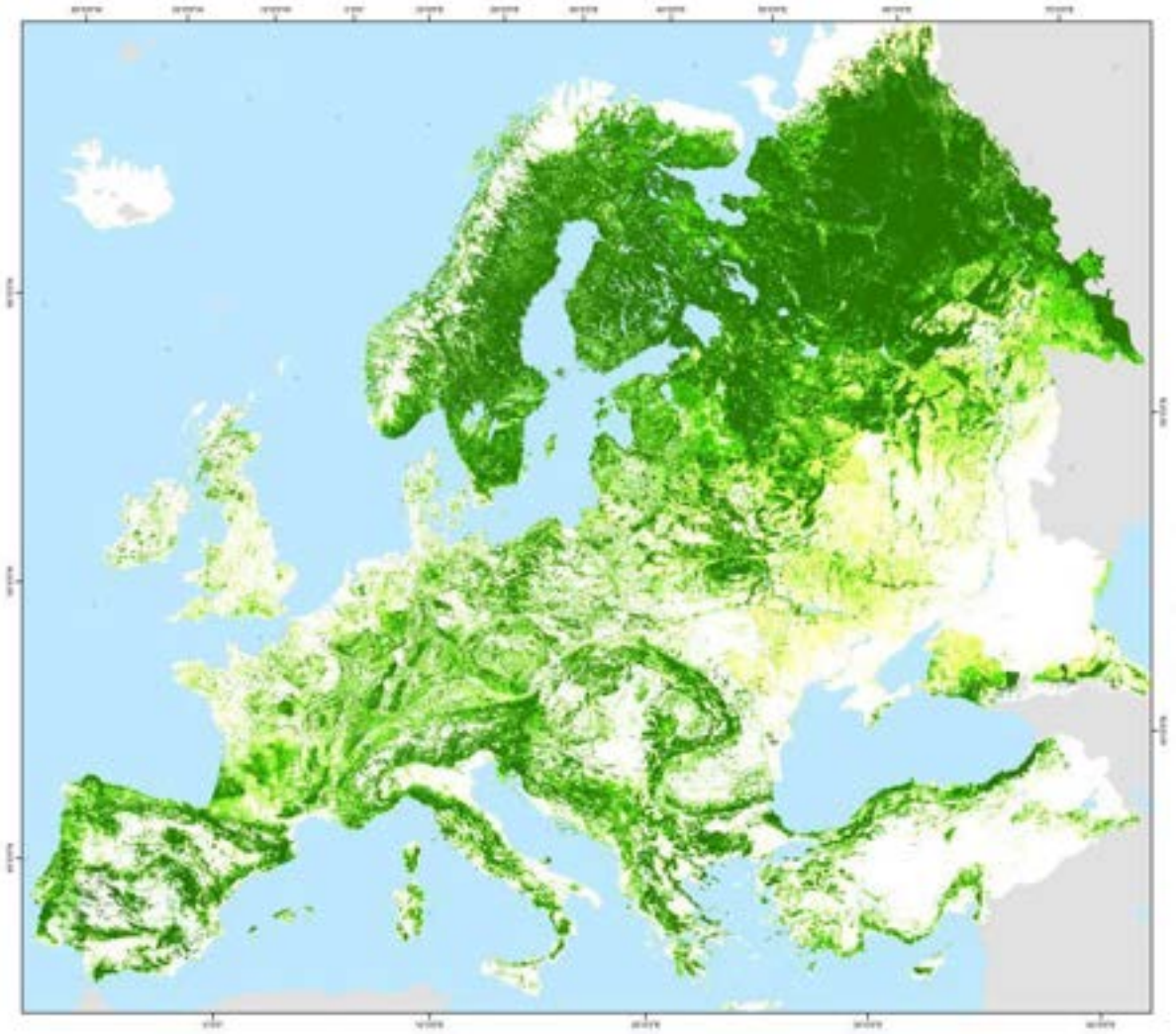
Forest use in the north

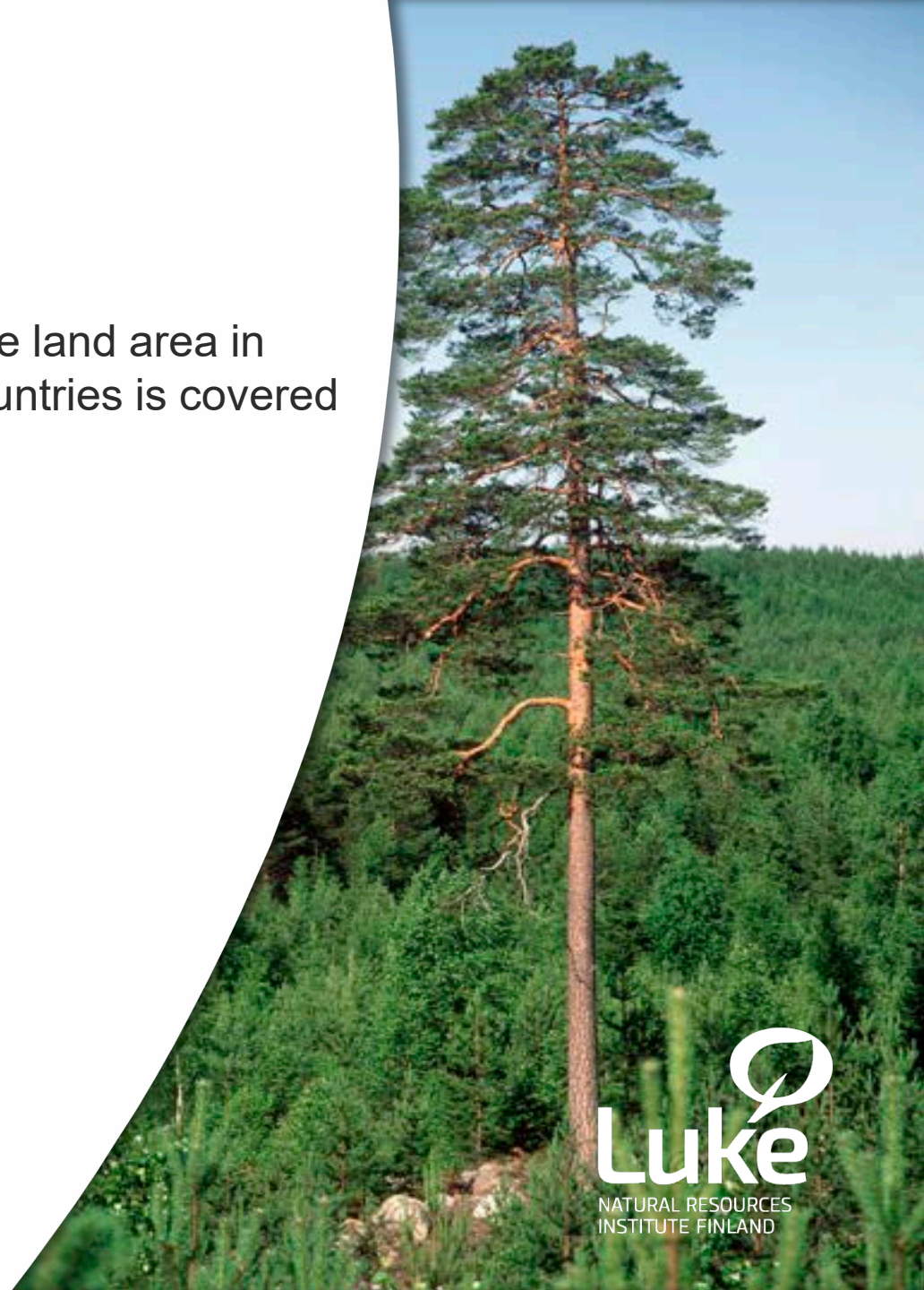
Pasi Rautio
Research professor (silviculture)
Natural Resources Institute Finland, Rovaniemi

European forest resources



Most of the land area in Nordic countries is covered by forests

Source: Päivinen et al. 2003, Schuck et al. 2002, Kempeneers et al. 2011



Deforestation:

Landsat images showing the amount of deforestation in Borneo from 2000 to 2018.

Large forests fires in Amazon in 2019

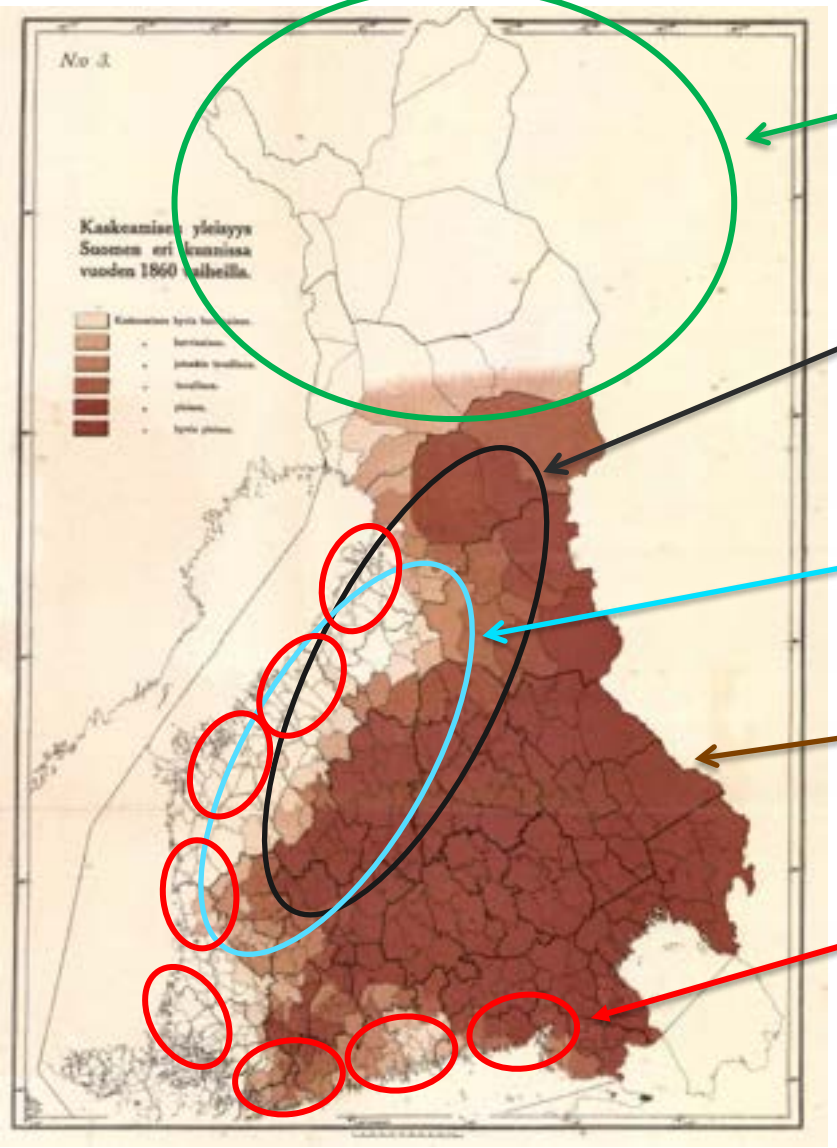
Source: M.C. Hansen et al., University of Maryland, Google, USGS, NASA

Historical forest use: slash-and-burn agriculture

Eero Järnefelt: ”Kaski”

In large parts of Finland slash-and-burn agriculture prevailed for thousands of years → exported also to Sweden (Finnskogen)

Historical forest use



Area of intact forests?

Area affected by tar production during 1700 -early 1900

Lot of peatlands: fertile ones ditched for agriculture during hundreds of years,

Area affected by slash-and-burn culture in Finland in 1860

Area of sawmills and ship building around 1750

Most of the herb-rich forests were cleared for agriculture

Heikinheimo 1915: *Kaskiviljelyksen vaikutus Suomen metsiin*

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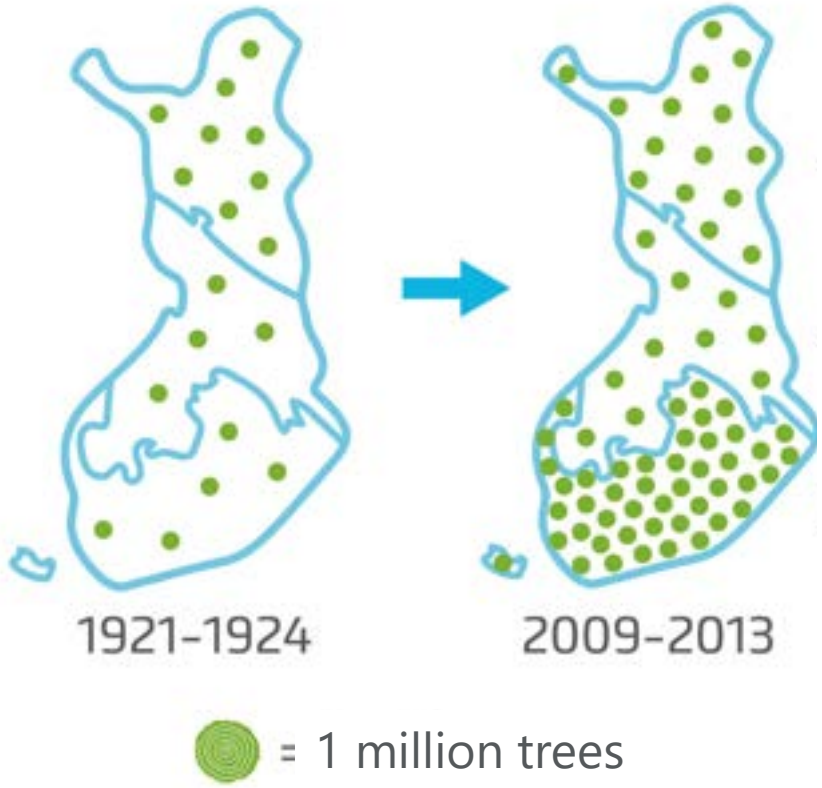
Amount of large trees (diam. 40+ cm) in NFI 1 vs. NFI 11

Quantity of large trees has multiplied, 325%



Source: Henttonen, Nöjd & Mäkinen 2020. European Journal of Forest Research. 139:279-293.

Also forests in north were used

Forest assessment in 1890's in Lapland:

"Mean age of forest is 250 years. Basically, no regeneration can be seen. Only few saplings for reindeer to scrub their antlers."

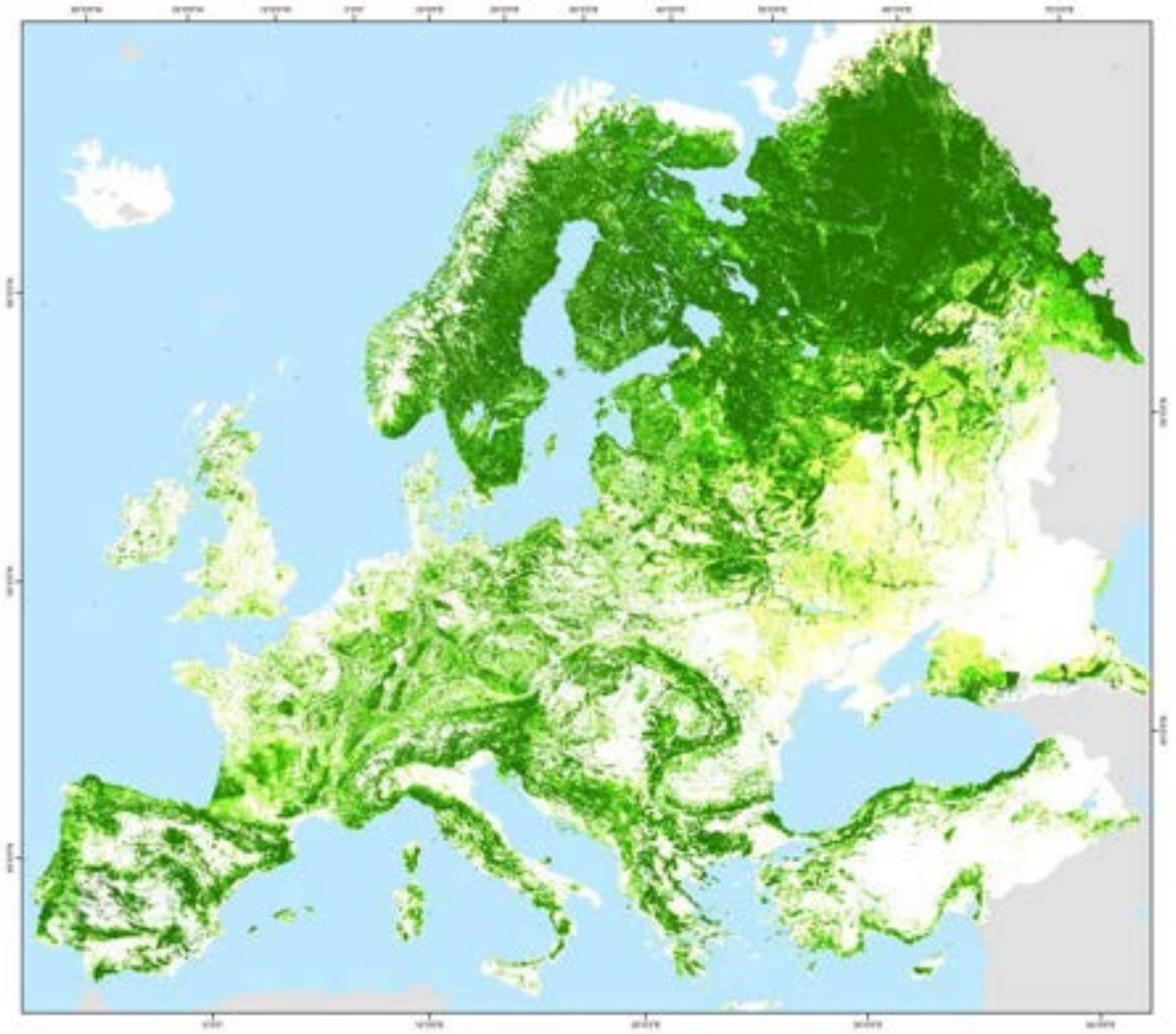
(Sandström ym. 2021: Savuinen savotta)

Taksaattori Karl Brander kirjoitti 1890-luvulla Lapin kruunumetsien kartoitusretkellä:

"Metsän keski-ikä on 250 vuotta. Mistään uudelleen kasvusta voi tuskin puhua, sillä ne harvat nuoret puut, joita löytyi, olivat melkein kaikki porojen turmelemia."

(Sandström ym. 2021: Savuinen savotta)

So how did we end up here?



Source: Päivinen et al. 2003, Schuck et al. 2002, Kempeneers et al. 2011

Development in forestry:

Breeding programmes

Silvicultural methods: soil preparation

Development in forestry :

Silvicultural methods: sowing, planting, thinnings….


Photo: Metsälehti


Photo: STT, UPM, 4H


Photo: Erkki Oksanen/Luke

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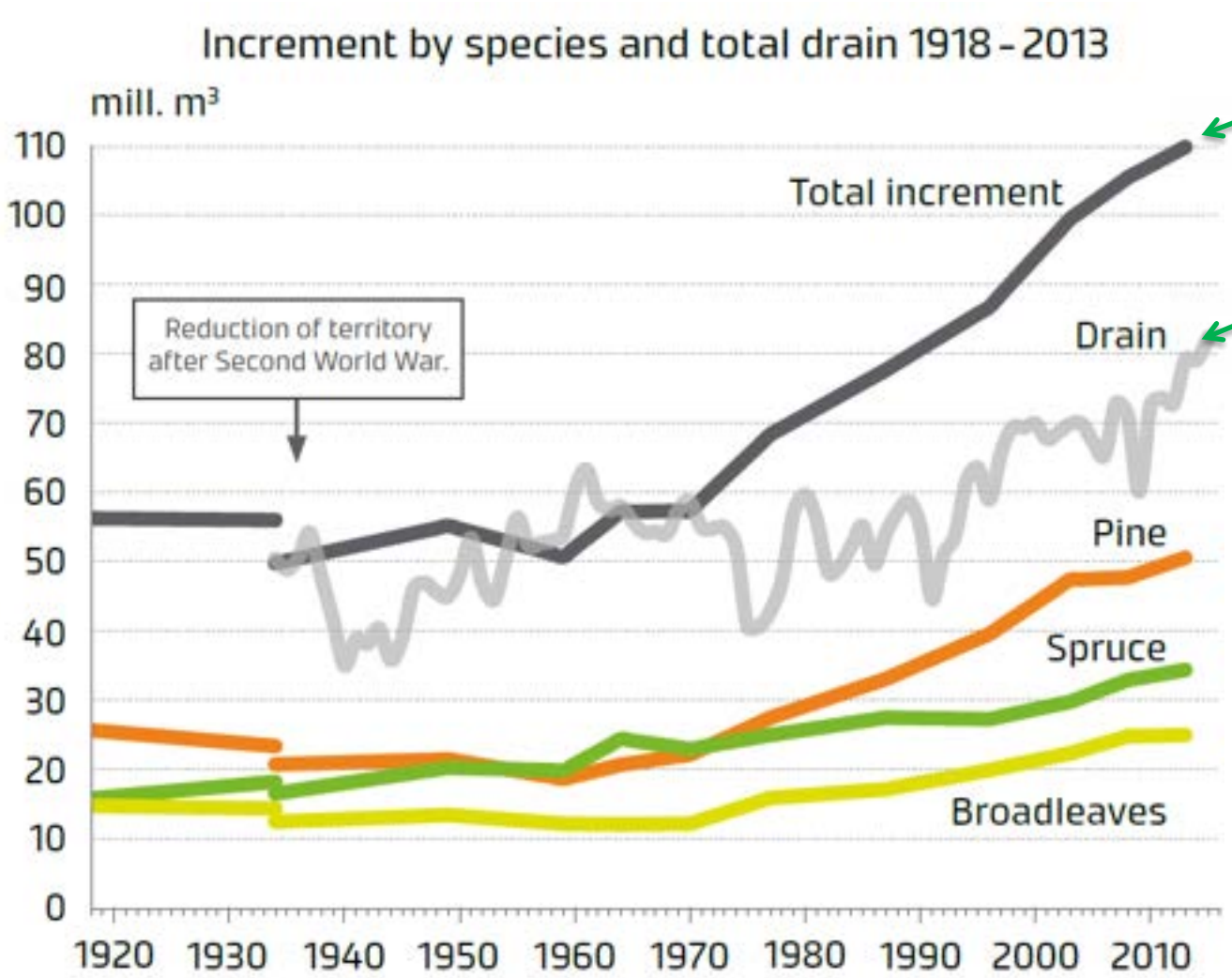
Present state



Source: Luke: National Forest Inventory of Finland

Annual forest growth (mill. m^3)

Annual forest cuttings

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New needs (and demands)

Timber use now on sustainable level, but nowadays many other land use modes especially in the north

- recreation, hunting, berry and mushroom picking, tourism, reindeer herding, carbon binding and storage, biodiversity conservation, landscape values
- National regulations and policy instruments: Forest law, Environmental law, National forest strategy, Certification…
- EU regulations and policy instruments: Biodiversity strategy, Forest strategy, Taxonomy, Natura 2000, Carbon offset, Ecological compensation…

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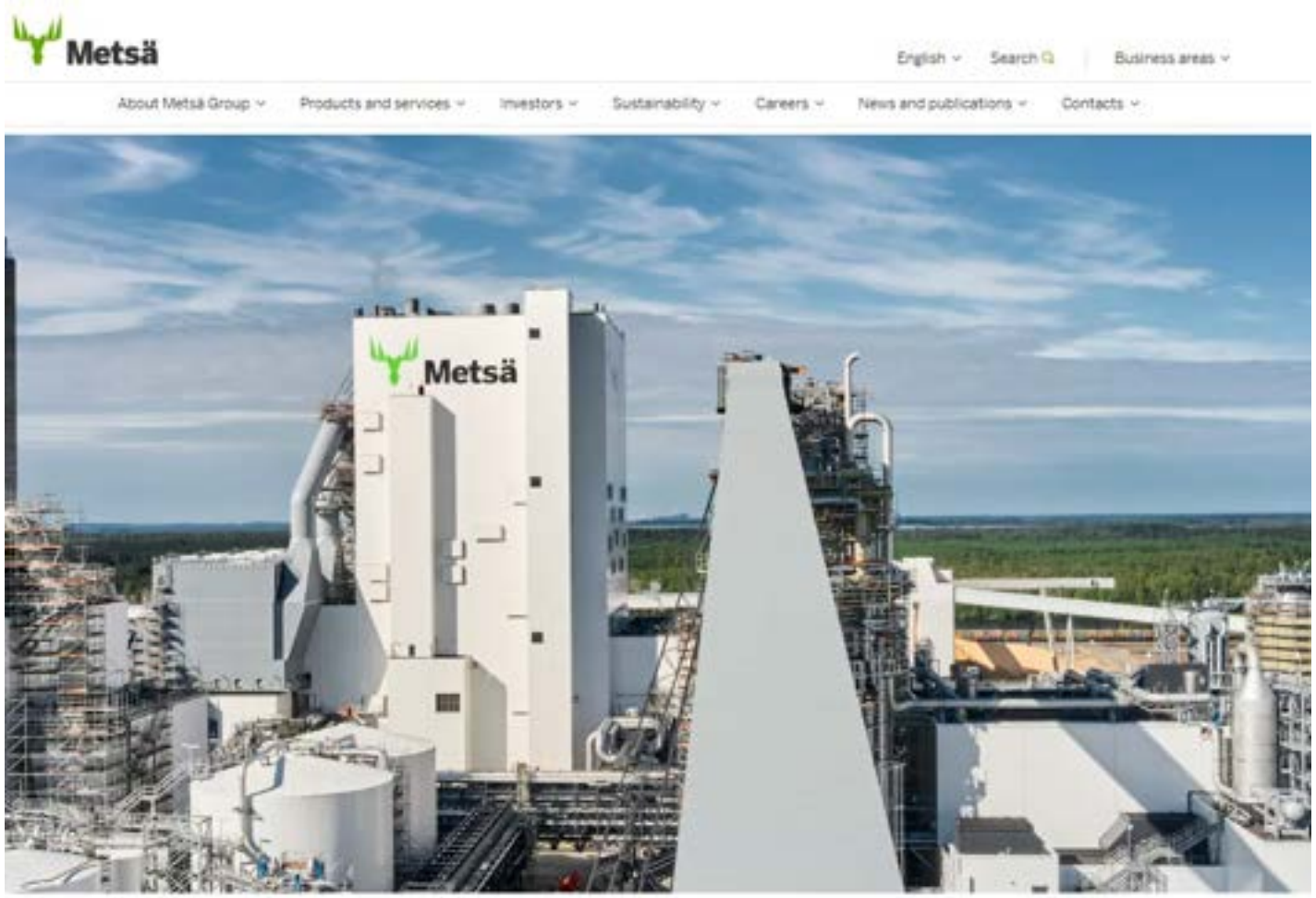
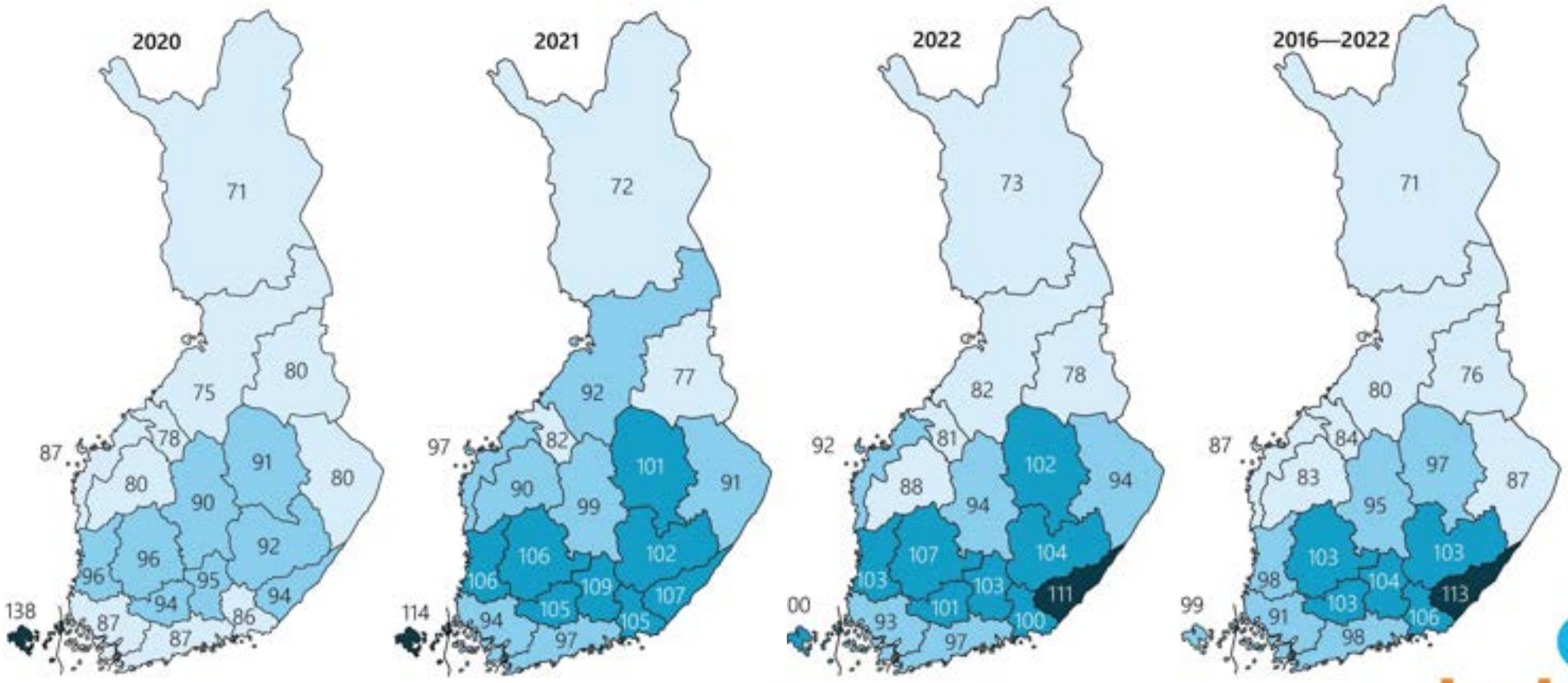
Why is forest industry interested in north?



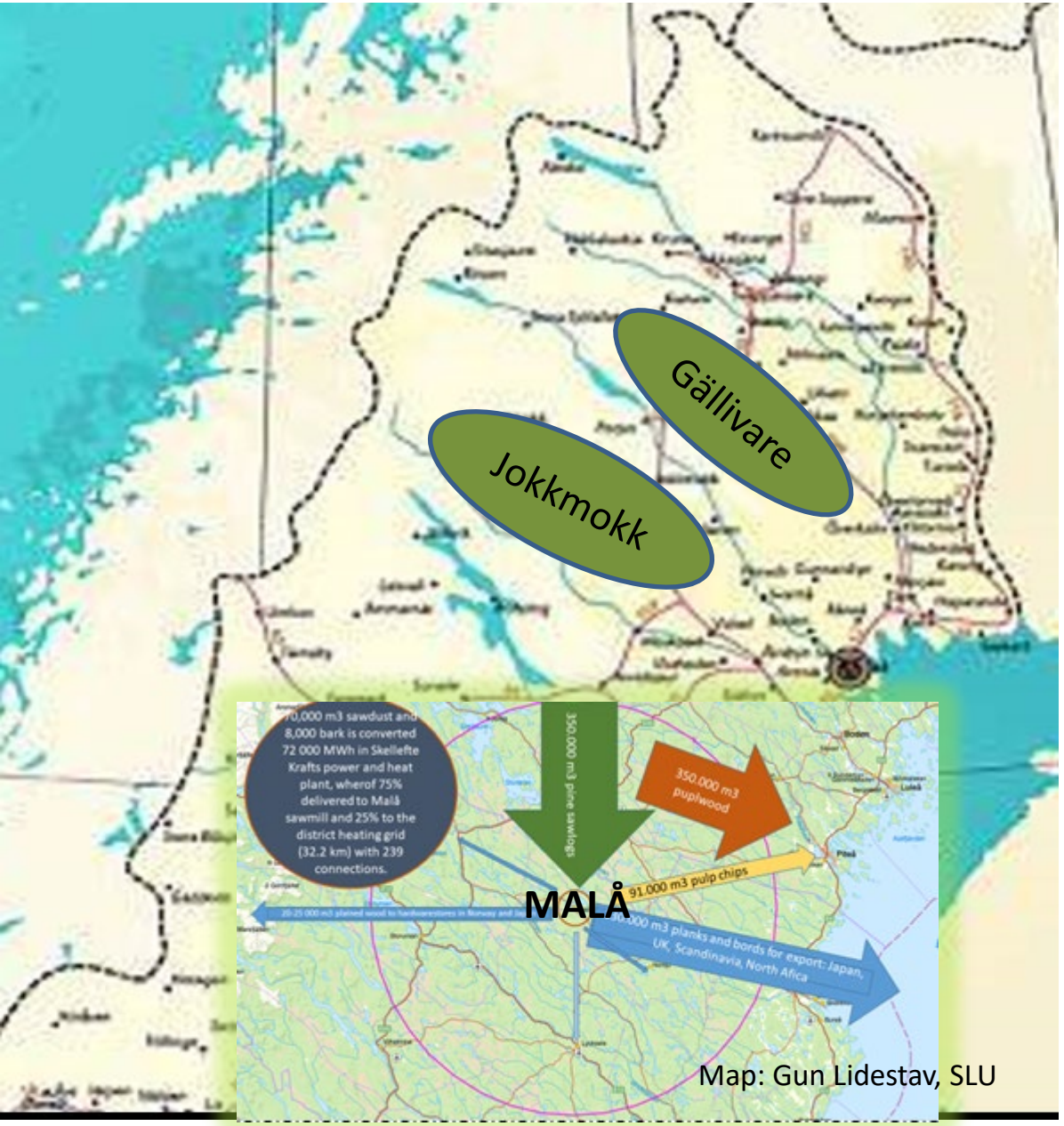
Kemi bioproduct mill needs 7.6 mill m^3 timber

Why forest industry is interested in north?

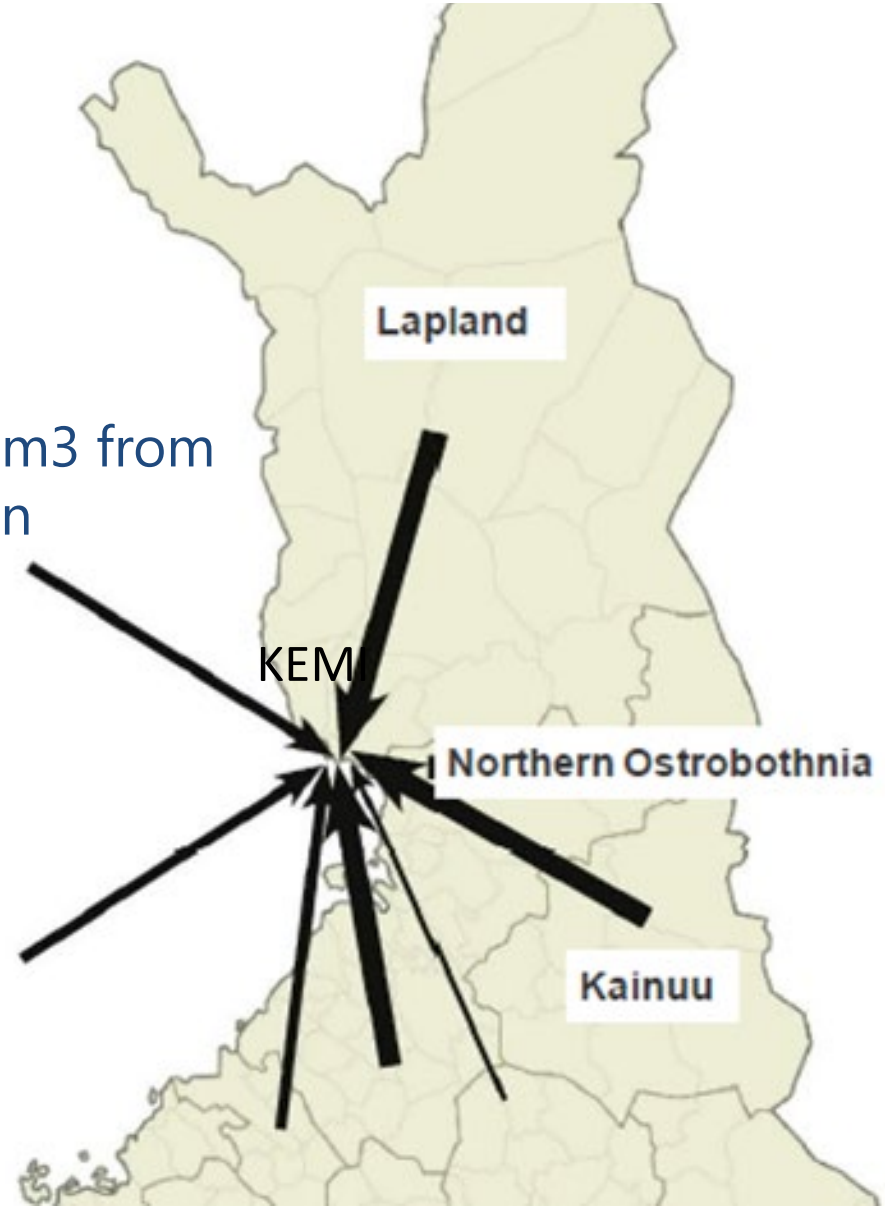
Percentage of actual total removals from the estimated maximum sustainable yield for 2016-2025, %



Forest hubs: the flow of timber and products are of main interest



1 mill. m3 from Sweden



Source: Metsä Fibre / Jari-Pekka Johansson, 4. Nov. 2021

ArcticHubs - Global drivers, local consequences:

Tools for global change adaptation and sustainable development of industrial and cultural Arctic "hubs" (2020-2024)

Call: H2020-LC-CLA-2018-2019-2020 (Building a low-carbon, climate resilient future: climate action in support of the Paris Agreement)
Topic: LC-CLA-07-2019 (The changing cryosphere: uncertainties, risks and opportunities),
Type of action: **RIA**

Pasi Rautio
Kukkolaforssen Aug. 29. 2023

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869580.

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The steps in the forestry scenario process (Sweden-Finland) in 2023

1. Survey insights →

Forest expert survey in summer 2023 focusing on Lapland & Norrbotten by 2035

2. Workshop insights →

Working on potential future developments in a workshop 29.8.2023

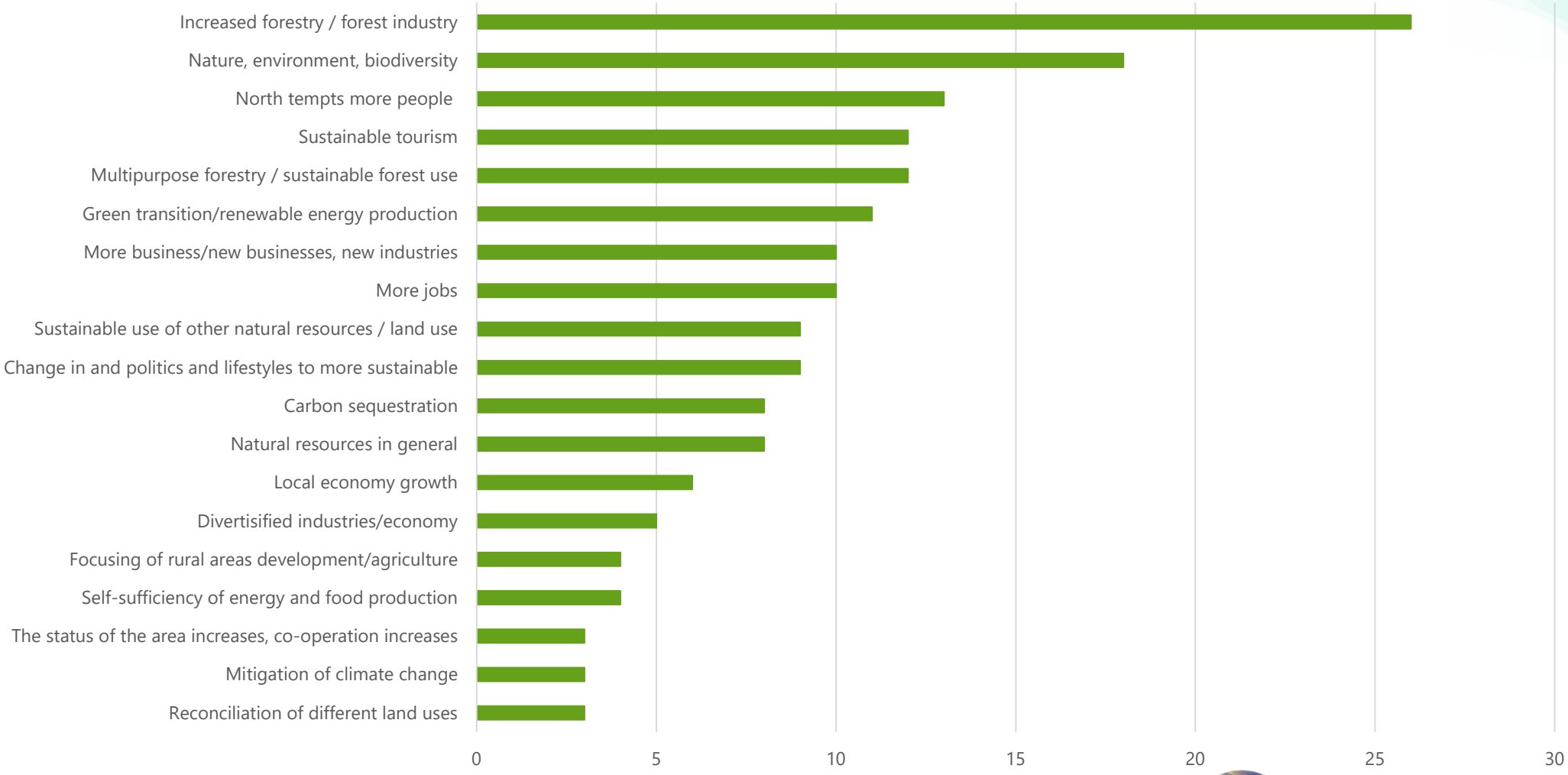
3. Future scenarios

Writing scenarios, Autumn 2023

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869580.

Source: Rikkonen et al.

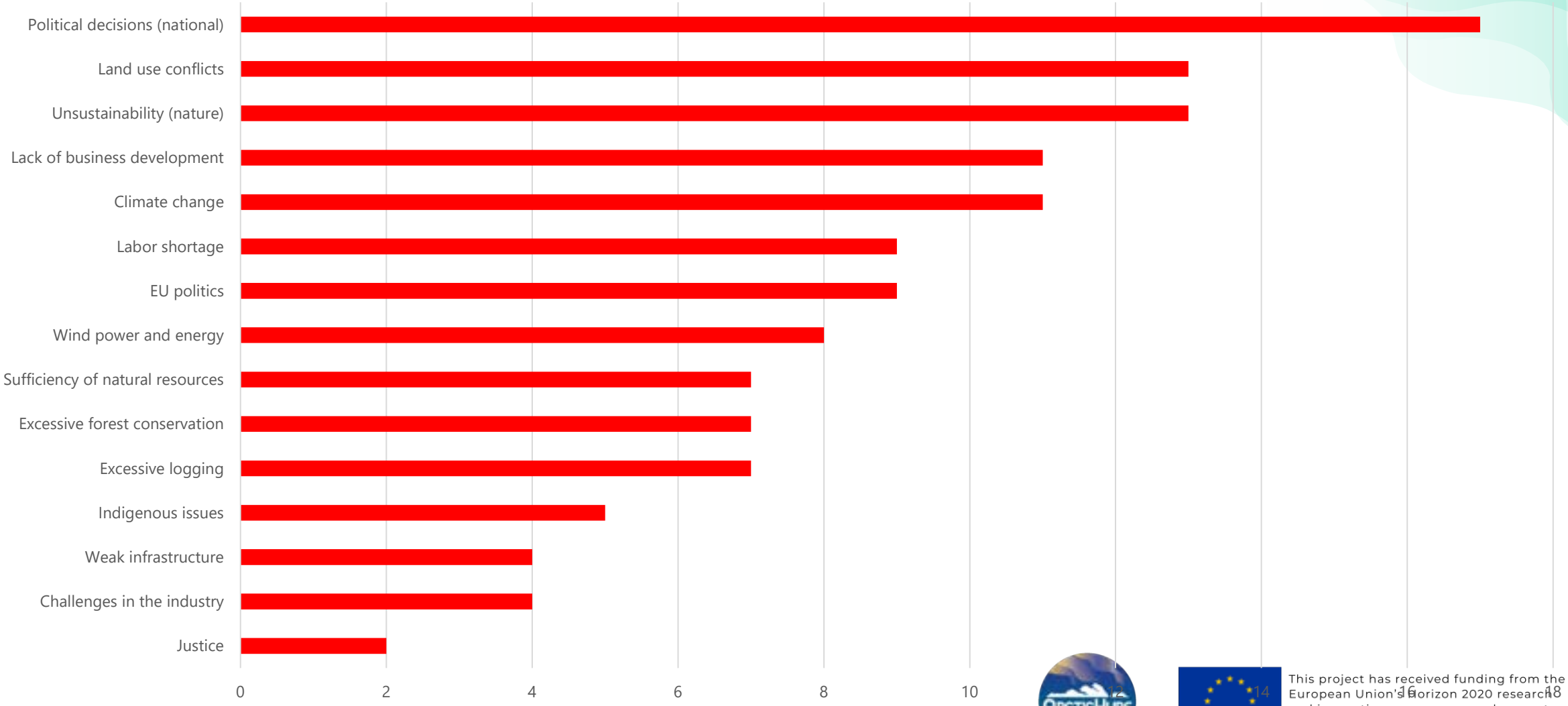
The opportunities in development in Lapland, Norrbotten and Västerbotten until 2035



Source: Rikkonen et al.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869580.

Threats for the development in Lapland, Norrbotten and Västerbotten until 2035



Source: Rikkonen et al.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869580.

Word cloud: Taru Rikkonen

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869580.

Future potential: Effect of climate change?

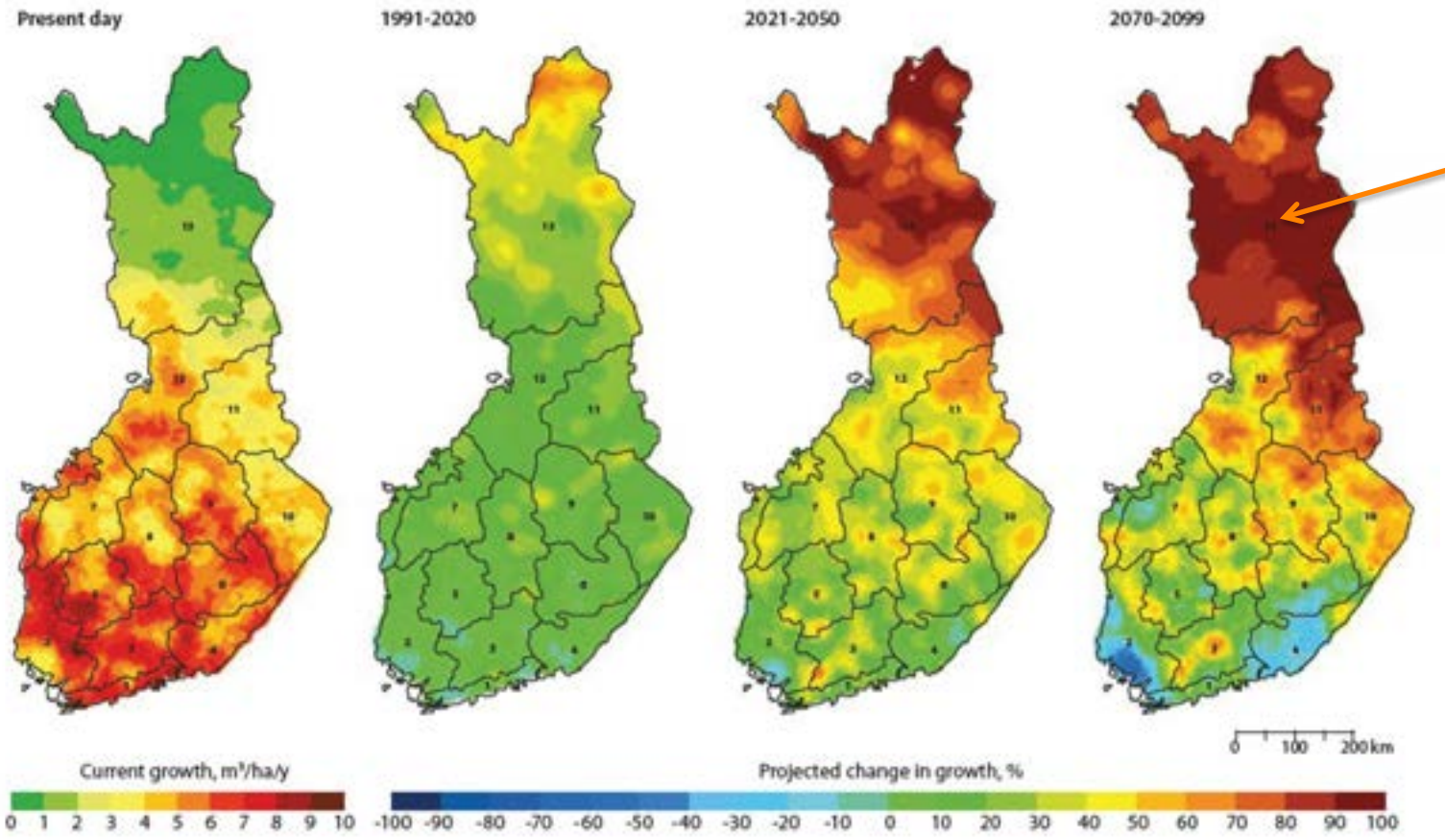


Figure 6.10 Integrated growth of Scots pine (*Pinus sylvestris*), Norway spruce (*Picea abies*) and birch (*Betula* spp.) under the current climate and under projected future climates in Finland. From left to right: total current growth and percentage change in total forest growth for 1991–2020, 2021–2050 and 2070–2099. The numbers on the maps refer to the Finnish Forest Centres. Kellomäki et al. (2005).

Compared to 1980's forest growth is predicted to be 100% higher

Kellomäki et al 2005. Adaptation of forest ecosystems, forests and forestry to climate change. FINADAPT Working Paper 4, Finnish Environment Institute.

Future of forests in north

Top of the Jursulapää fell 1931

Top of the Jursulapää fell 2022

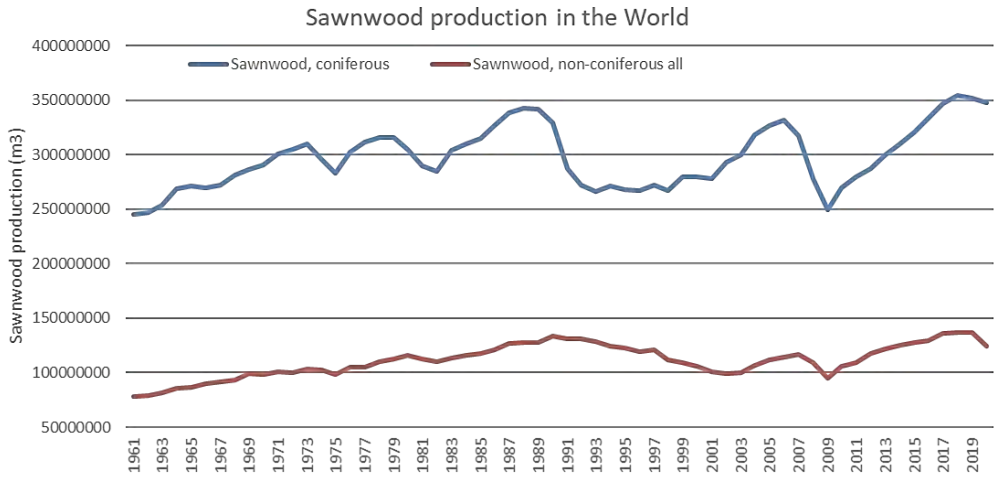
Source: Lapin Kansa 30.9.202, Risto Pyykkö: Kadonneet maisemat. Photos: Erkki Mikkola & Tapio Tynys

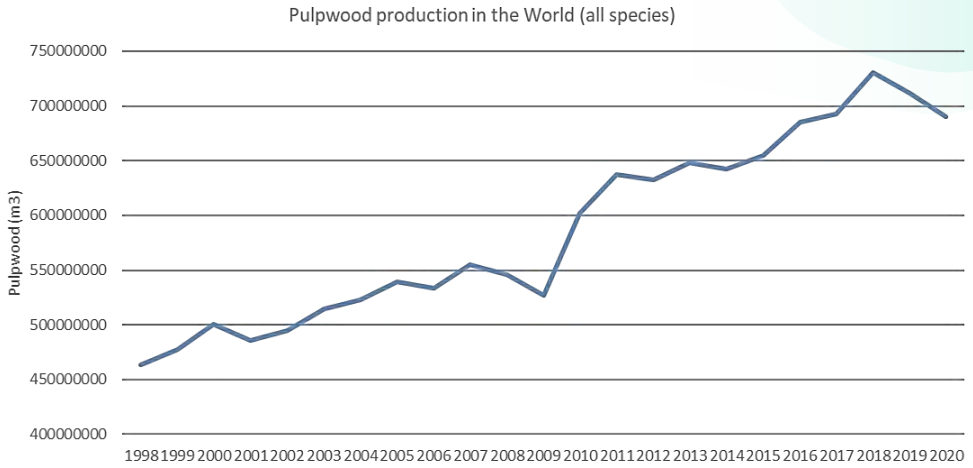
www.luke.fi/arctichubs

Thank You!

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869580.

Regional conditions and Global drivers





Source: FAO (https://www.fao.org/faostat/en/#data/FO)

	Lapland (FI)	Norrbotten (SE)	Västerbotten (SE)
Forest area	4.9 M ha	3.9 M ha	3.2 M ha
Annual growth	11.4 M cu.m./year	11 M cu.m/yr	12 M cu.m./yr
Cuttings	4.9 M cu.m./year	5.5 M cu.m.sk/year	9.0 M cu.m.sk/yrs
Enterprises	5 major sawmills 1 pulp- and paper mill	8 major sawmills 3 pulp-and paper mills	8 major sawmills 1 pulp- and-paper mill
Employment	3500	5600	3700

Eriksson, V & Lundmark, R. 2020. Skogsnäringen i Norrbotten fram till och med 2030 – Definition och kartläggning, | Rapportserie inom Regional förnyelse | 2020 | | Luleå tekniska universitet | Skogsprogrammet Västerbotten. Temaområde skogsbruk Version 3 februari 2020. Finnish Statistical Yearbook of Forestry 2021. Luonnonvarakeskus, Helsinki 2021.

Green Transition and Regional Sustainability

Luleå, 10-12 October 2023

Trade-offs and synergies between forest policy priorities, a Nordic perspective

Kyle Eyvindson

10 October 2023

Related to:

communications earth & environment

ARTICLE

https://doi.org/10.1038/s43247-023-00771-z OPEN

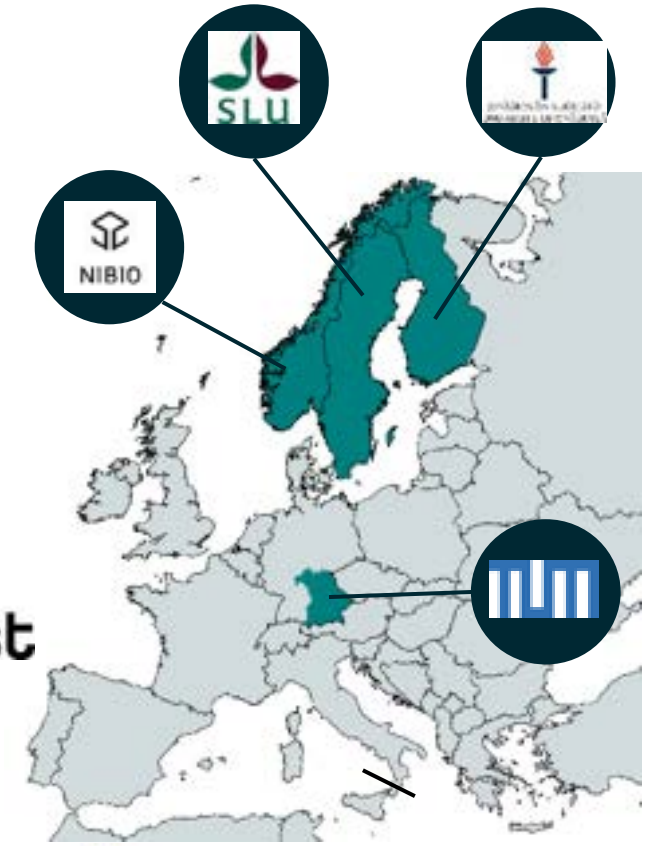
Check for updates

Climate targets in European timber-producing countries conflict with goals on forest ecosystem services and biodiversity

Clemens Blattert[1,2,3✉], Mikko Mönkkönen[1,2], Daniel Burgas[1,2], Fulvio Di Fulvio[4], Astor Toraño Caicoya[5], Marta Vergarechea[6], Julian Klein[7], Markus Hartikainen[8], Clara Antón-Fernández[6], Rasmus Astrup[6], Michael Emmerich[9], Nicklas Forsell[4], Jani Lukkarinen[10], Johanna Lundström[11], Samuli Pitzén[10], Werner Poschenrieder[5], Eeva Primmer[10], Tord Snäll[7] & Kyle Eyvindson[1,2,12,13]

Clemens Blattert[a,b,*], Kyle Eyvindson[a,b,c,d], Markus Hartikainen[e], Daniel Burgas[a,b], Maria Potterf[a,b], Jani Lukkarinen[f], Tord Snäll[g], Astor Toraño-Caicoya[b], Mikko Mönkkönen[a,b]

MultiForest



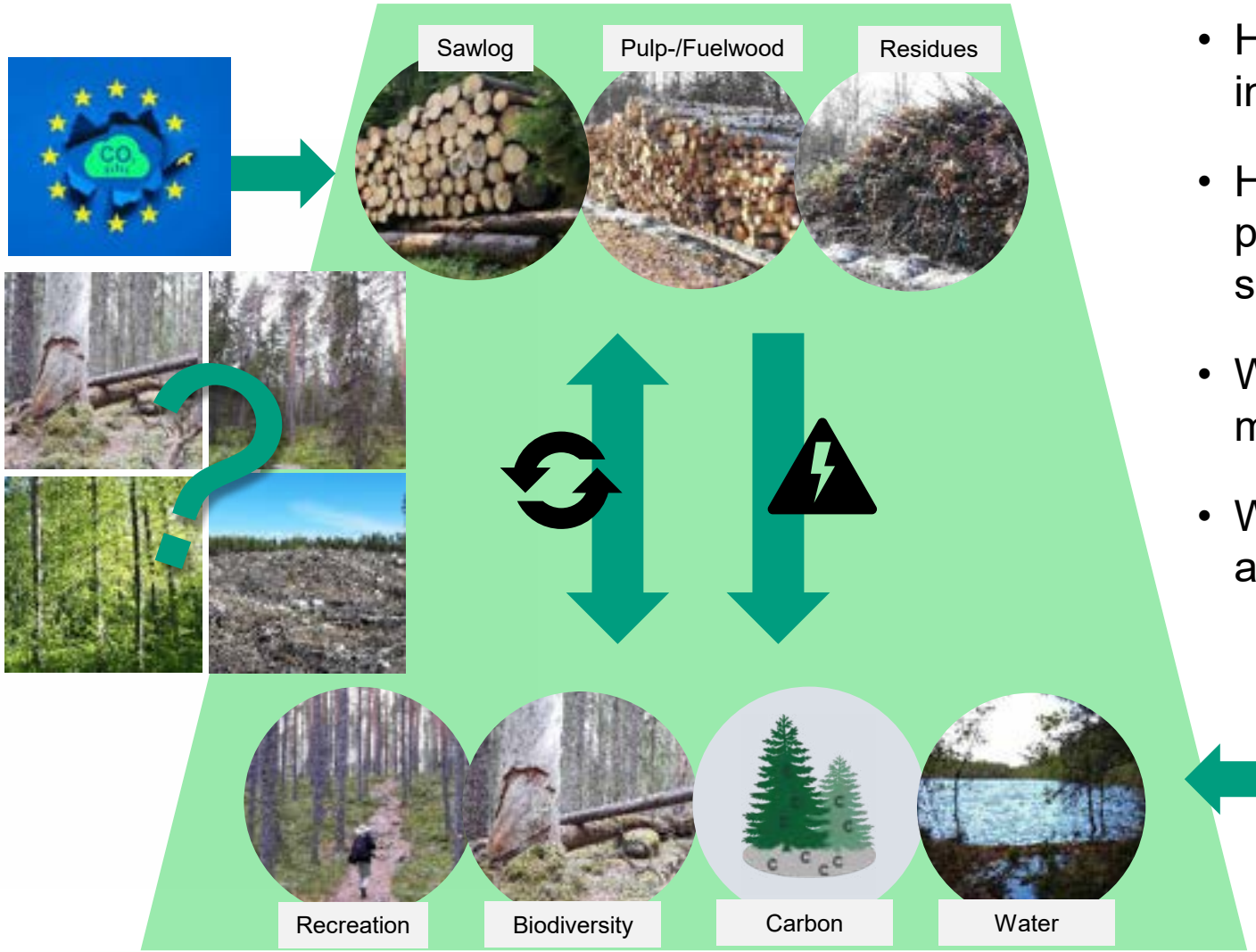
The Issue:

- Forests contribute a wide variety of benefits
  - Timber, carbon, habitat…
- Stakeholders and groups prioritize issues differently.
  - Ministry of Agriculture & Forestry
  - Ministry of Environment
- Strategies defined in policies may not be coherent – leading to inefficiencies…

1 2 3

3 2 1

Research questions



- How will EU climate change mitigation targets impact future timber harvest demands?
- How consistent are mitigation targets with sectoral policies guiding demands for forest ecosystem services & biodiversity (FESB)?
- What is the impact on FESB if mitigation targets must be achieved?
- What is the optimal forest management for achieving the divergent policy objectives?

Forest sectoral policies

Workflow

Modelling timber harvest demands for EU climate change mitigation ambitions

Forest data (National Forest Inventory)

Climate scenario (current, RCP4.5)

Forest simulation

Forest Ecosystem service & Biodiversity (FESB) **Indicators**

Management:
- Rotation Forestry (RF)
- Intensifiy / extensify RF
- Continuous cover forestry
- Set aside
- Adaption to climate change

Top-down
Prioritize timber demands for EU mitigation ambitions

Optimization scenarios

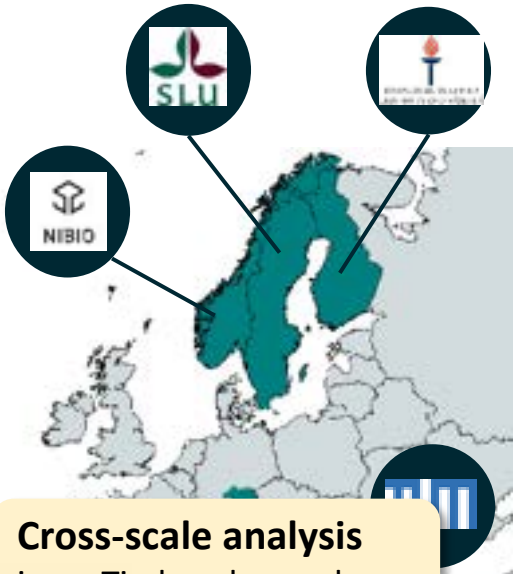
Bottom-up
Optimize for FESB demands of national policies

Analyse FESB demands of three national policies
- National forest strategy
- Biodiversity strategy
- Bioeconomy strategy

Optimal forest management for demands

Solved with new optimization tool*

*Eyvindson et al. 2023
https://doi.org/10.12688/openreseurope.15812.1



Cross-scale analysis
i. Timber demand achievement
ii. Management requirements
iii. Impacts on FESB

Study regions:
- **Finland**
- **Sweden**
- **Norway**
- ~~**Germany (Bavaria)**~~

National policy demands

- Optimization scenarios



Supplementary Table 2: Optimization scenarios of **Sweden**

Optimization scenarios of Sweden describing the applied indicators and optimization rules to address the FESB demands of the three natio
with step = order of optimization steps following the priority assigned to objectives, red = epsilon constraint, blue = maximize objective. Th
equations types (Eq.) for the individual objective functions are explained in Supplementary Note 6.

Ecosystem services & biodiversity	Indicator (unit)	National forest strategy Objective / Constraint	Eq.	step	Biodiversity strategy Objective / Constraint	Eq.	step	Bioeconomy strategy Objective / Constraint	Eq.	step
Wood production	Net Present Value (SEK)	Maximize	55a	2	Maximize	55a	3	Maximize	55a	6
	Wood increment (m^3 ha^{-1} yr^{-1})				Maximize	55a	2	Target 2050: 5.5 m^3 ha^{-1} yr^{-1}	53b	1
	Average harvest volume (m^3 ha^{-1} yr^{-1})	Maximize (even-flow)	55a	2	Maximize (even-flow)	55a	3	Maximize (even-flow)	55a	4
	Total harvest volume (m^3 yr^{-1})	Enabled constraint: Harvest ± 10% of increment	54b	1				Target 2060: 120 Mm^3	53b	1
Bioenergy	Harvested residues (m^3 yr^{-1})									
Nonwood [a]										
Game [a]										
Biodiversity Conservation	Share of regime SA (%)	12.8%	53a	1	17%					
	Deadwood volume (m^3 ha^{-1})	No decrease	52	1	Target 2050: increase by 6 on managed land					
	Old, deciduous-rich forest area (ha)	No decrease	52	1	Target 2050: increase by 6 on managed land					
Climate regulation	Carbon in wood and soil (t CO_2 ha^{-1})	No decrease	52	1	No decrease					
Recreation	Recreation index (-)	No decrease	52	1	No decrease					
Water protection	Share of regime CCF (%)				10%					
Resilience	Deciduous volume (m^3 ha^{-1})	No decrease	52	1	Target 2050: increase by 6 on managed land					

a) No up-to-date indicator models were available for assessing the nonwood and game in Sweden at the tim

Erosion & Water	No clearcut on peat
Climate regulation	Carbon sink 27.88 $MtCO_2$ (2025)
Recreation	Maximise
Resilience	Maximise

	Bioeconomy strategy
vest	Max roundwood harvest
	Max biomass harvest

Supplementary Table 3: Optimization scenarios of **Norway**

Optimization scenarios of Norway describing the applied indicators and optimization rules to address the FESB demands of the three nationa
step = order of optimization steps following the priority assigned to objectives, red = epsilon constraint, blue = maximize objective. The corre
types (Eq.) for the individual objective functions are explained in Supplementary Note 6.

Ecosystem services & biodiversity	Indicator (unit)	National forest strategy Objective / Constraint	Eq.	step	Biodiversity strategy Objective / Constraint	Eq.	step	Bioeconomy strategy Objective / Constraint	Eq.	step
Wood production	Harvest net value (NOK)	Maximize	5a	1				Maximize	5a	1
	Harvested volume (Mm^3)				Maximize (even-flow)	5a	1			
Bioenergy	Harvested residues (kt)	Maximize: plots with harvest costs < 150 NOK	5B	2				Maximize: plots with harvest costs < 200 NOK	5B	2
Nonwood [a]										
Game [a]										
Biodiversity Conservation	MIS [a] area (ha) (*Gjerde et al. 2007*)	No decline allowed	2	3	No decline allowed	2	1	No decline allowed	2	3
	Deadwood volume (Mm^3)				No decline allowed	2	1			
	Bilberry [a] cover (%)				No decline allowed	2	1			
	MIS [a] area (ha) (*Gjerde et al. 2007*)				Maximize	5a	1			
	Dead wood volume ($Mm3$)				Maximize	5a	1			
	Bilberry [a] cover (%) [a]				Maximize	5a	1			
Water protection	Harvest vol. in protect areas (Mm^3)				No increase allowed	57	1			
Climate regulation	Natl. CO_2 in harvested wood product (kt)	Maximize	5c	2				Maximize	5c	2
	Natl. CO_2 in forest (MKI): including CO_2 in living biomass, and mineral soils (*Liski et al. 2005*)							Maximize	5d	2
Recreation	Harvest vol. in city forest (Mm^3)				No decline allowed	2	2	No decline allowed	2	3
	Shannon index (-) (*Jost 2006*)				No decline allowed	2	2	No decline allowed	2	3
Resilience [a]										

Constraint (strong target)
Maximise best as possible

Policy analysis framework: Primmer et al. 2021, Ecosystem Services

How to compare?

Optimization scenarios

Top-down

Bottom-up

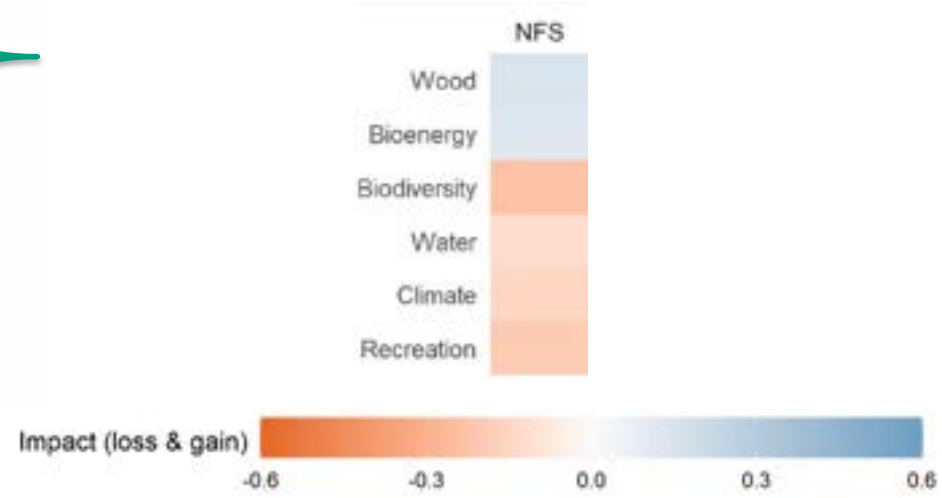
Indicator provision

Normalized

$$\frac{x_{i,j,k,l.m} - min_i}{max_i - min_i}$$

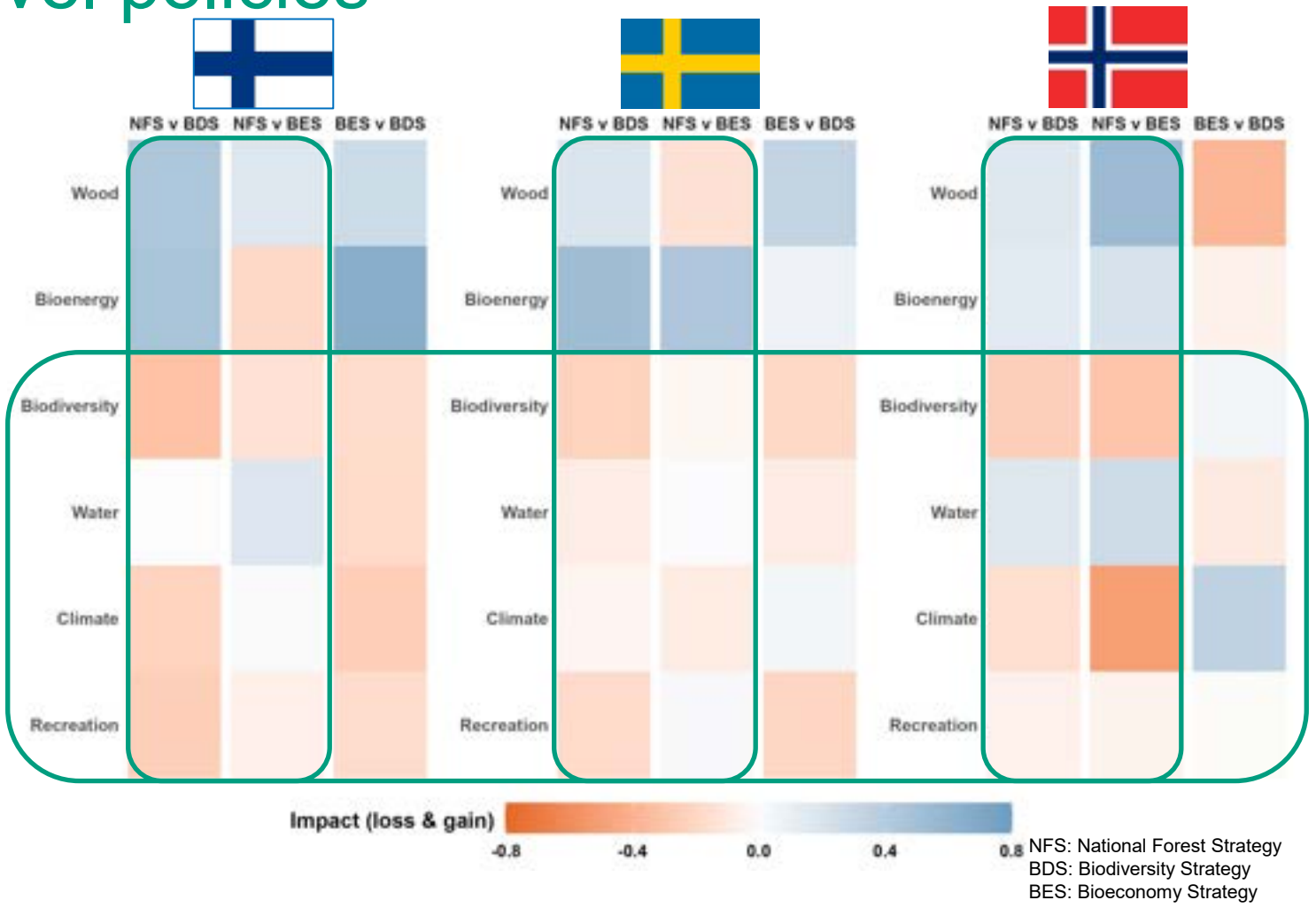
$$\frac{x_{i,j,k,l.m} - min_i}{max_i - min_i}$$

- **Difference** between top-down and bottom-up indicators
- **Grouped by ecosystem services** category



Comparing country level policies

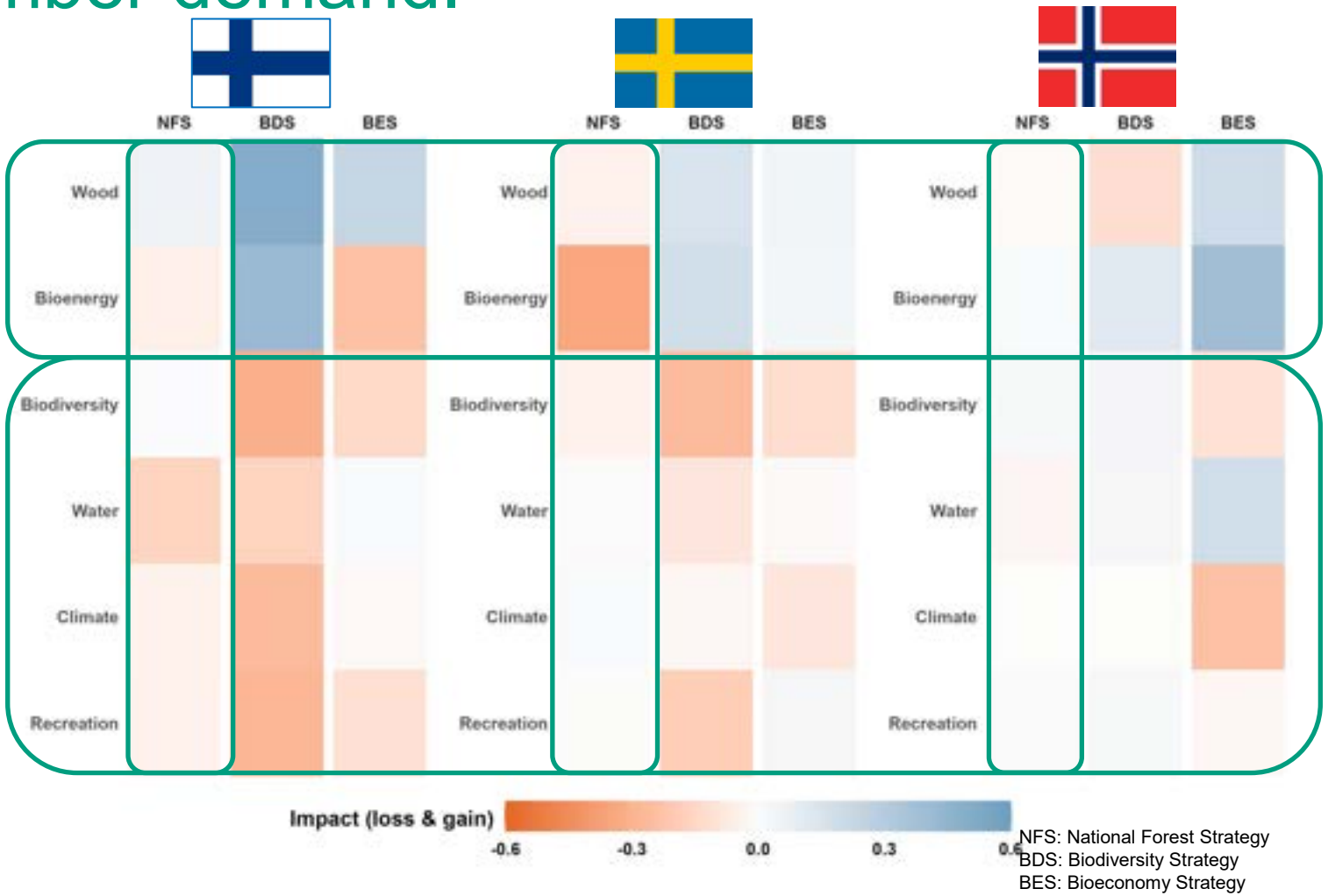
- Dramatically higher timber and biomass extraction for NFS
- Higher harvesting reduces non-timber services & biodiveristy



NFS: National Forest Strategy
BDS: Biodiversity Strategy
BES: Bioeconomy Strategy

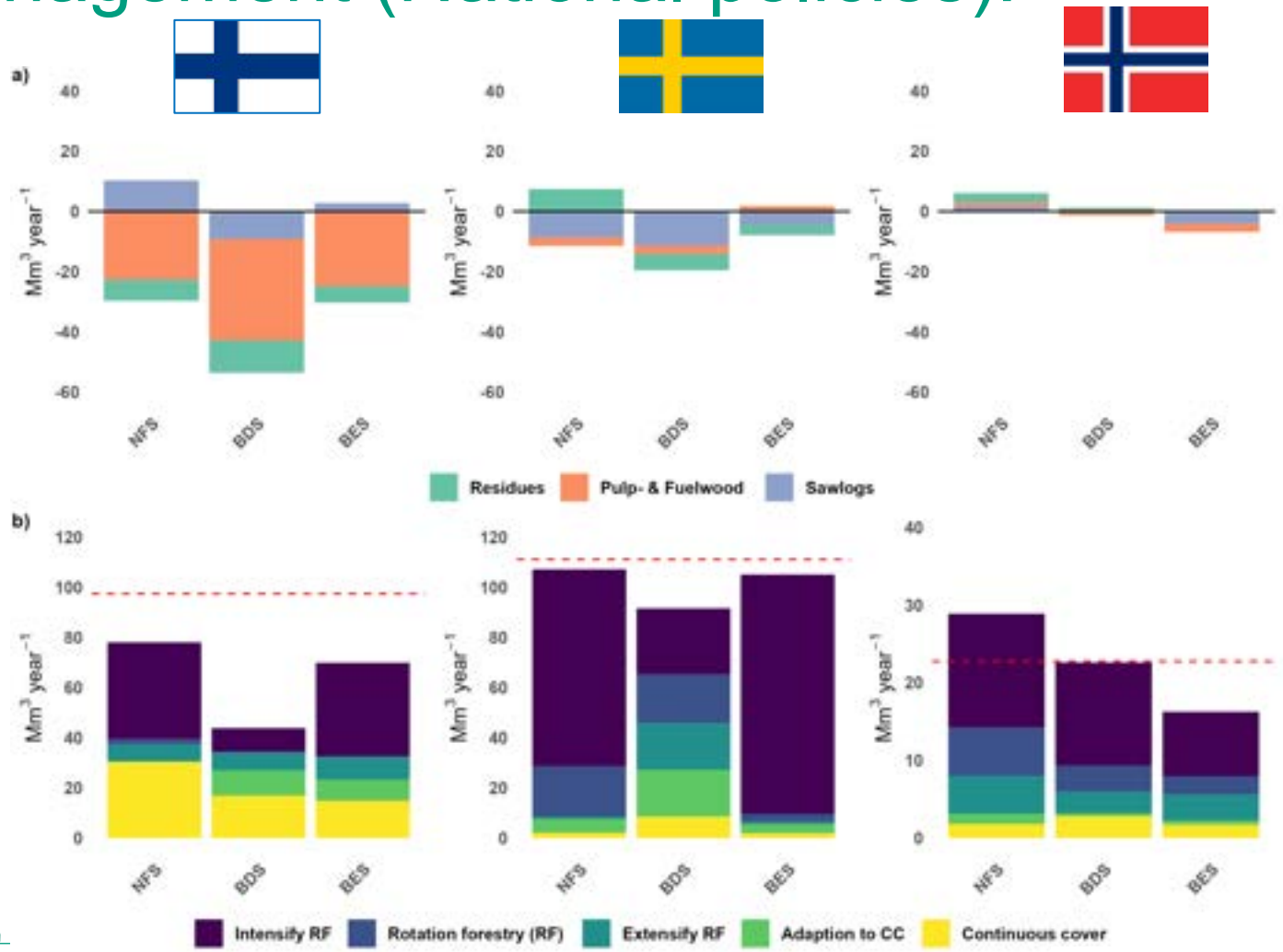
Impact of top down timber demand.

- Lower non-timber services and biodiversity
- Higher wood & bioenergy extraction
- NFS most similar to EU mitigation ambitions
- SWE & NOR less impacted than FIN:
  - NOR has low harvest demands
  - SWE has high harvest targets across policies



Harvesting rates and Management (National policies):

- Similar patterns for SWE & FIN
  - Diversified management & lower harvests
  - NFS prioritizes timber extraction
- Patterns differ in NOR:
  - Due to priorities of policies
    - BDS aims to max even-flow of timber

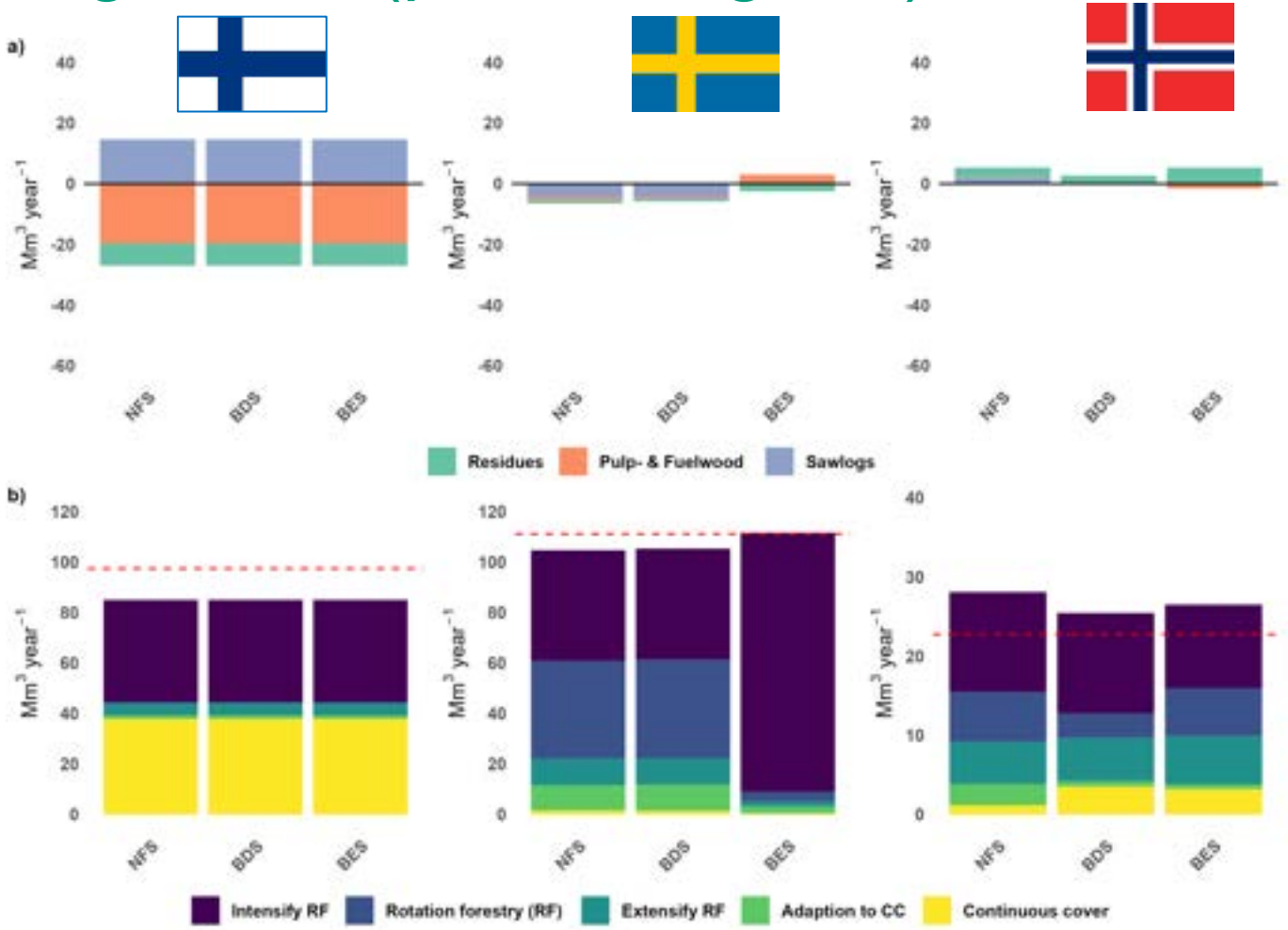


Norwegian University of

NFS: National Forest Strategy
BDS: Biodiversity Strategy
BES: Bioeconomy Strategy

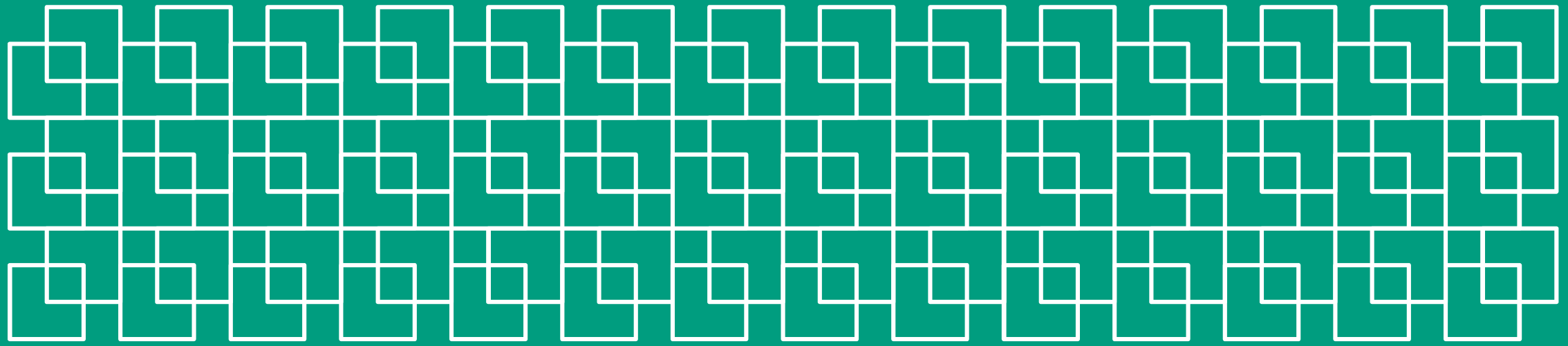
Harvesting rates and Management (prioritizing EU):

- Harmonization of management
- Relatively diverse management for SWE & NOR
- High proportion of CCF for FIN
  - Likely due to differences in how CCF is modeled



NFS: National Forest Strategy
BDS: Biodiversity Strategy
BES: Bioeconomy Strategy

Thank you!



Green Transition and Regional Sustainability

Luleå, 10-12 October 2023

A deliberative mini-public: The process and outcomes of Lapland Forest Jury

Katariina Kulha

Green Transition and Regional Sustainability

Luleå, 10.10.2023

DELIBERATING CLIMATE ACTIONS

Lapland Forest Jury

Autumn 2022:

"We want to hear residents' views on the use of Lapland's forests and invite you to a **Citizens' Jury...**"

6000

residents invited

240

volunteers

33

Jury members

Task: How to use Lapland's forests in a climate-smart and fair way?

DELIBERATING CLIMATE ACTIONS

Lapland Forest Jury

...learn about forest use,
hear and question experts

5.-6.11.

...discuss in small groups and amongst the whole Jury

19.-20.11.

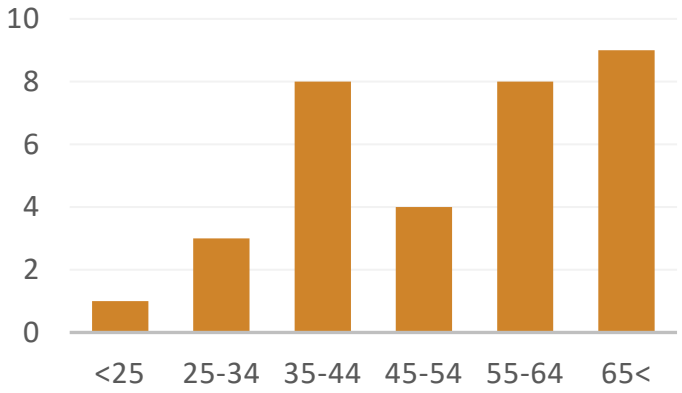
...write a common statement with recommendations for climate-smart & fair forest use

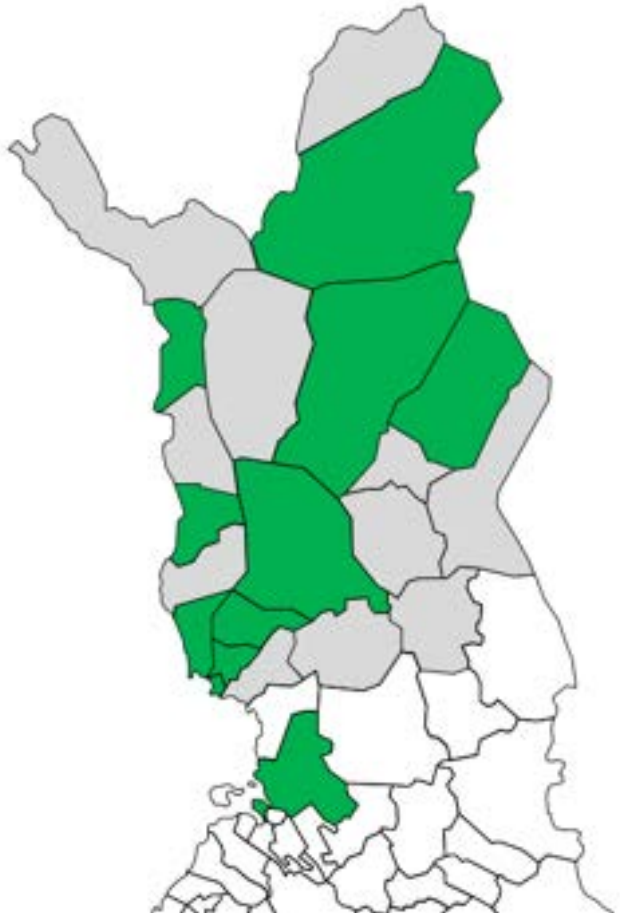
→ statement is handed to the Green Transition Committee of Lapland on 28.11.

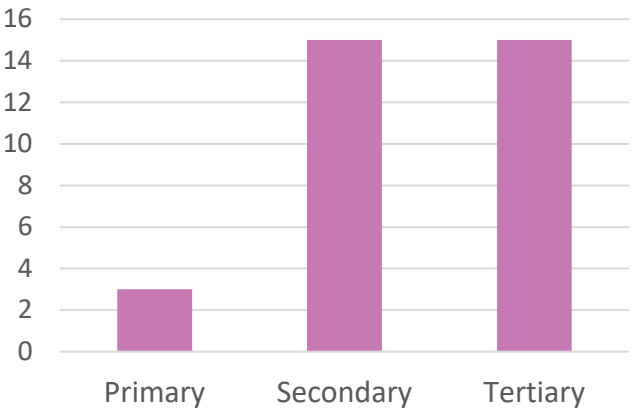
A deliberative mini-public – meaning what?

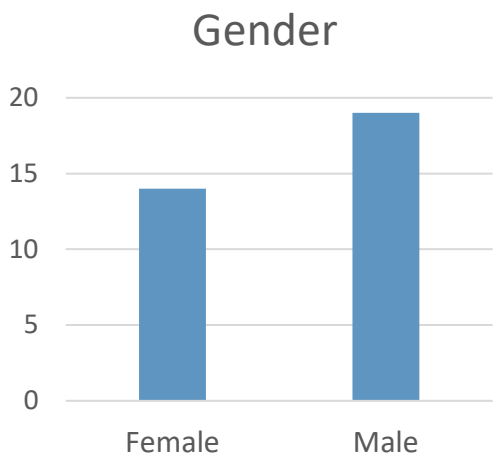
- An (almost) **randomly selected group of people** come together to **learn** and to **deliberate** on a given topic to produce an **informed public opinion**.
  - A method of citizen participation
  - Output can be: a statement, policy recommendations, a voting result or an information leaflet.
- Benefits e.g.:
  - equal, inclusive & informed discussion
  - brings together diverse knowledge and worldviews
  - can deal with complex questions & trade-offs;
  - can help unravel political gridlocks

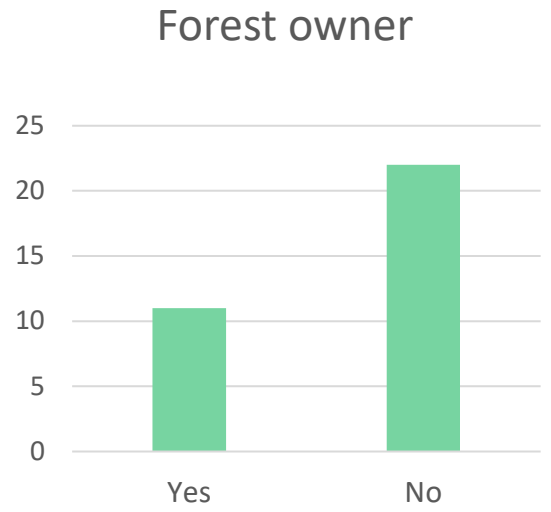
Jury composition











DELIBERATING CLIMATE ACTIONS

Why? - Forest Jury background

LAPIN LIITTO

- Initiated by Regional Council of Lapland
- Motivation & task linked to Lapland's Green Deal
- Green Transition Committee as recepient of recommendations

- The Jury was carried out by FACTOR research project

Luke
NATURAL RESOURCES INSTITUTE FINLAND

UNIVERSITY OF TURKU

Syke

DELIBERATING CLIMATE ACTIONS

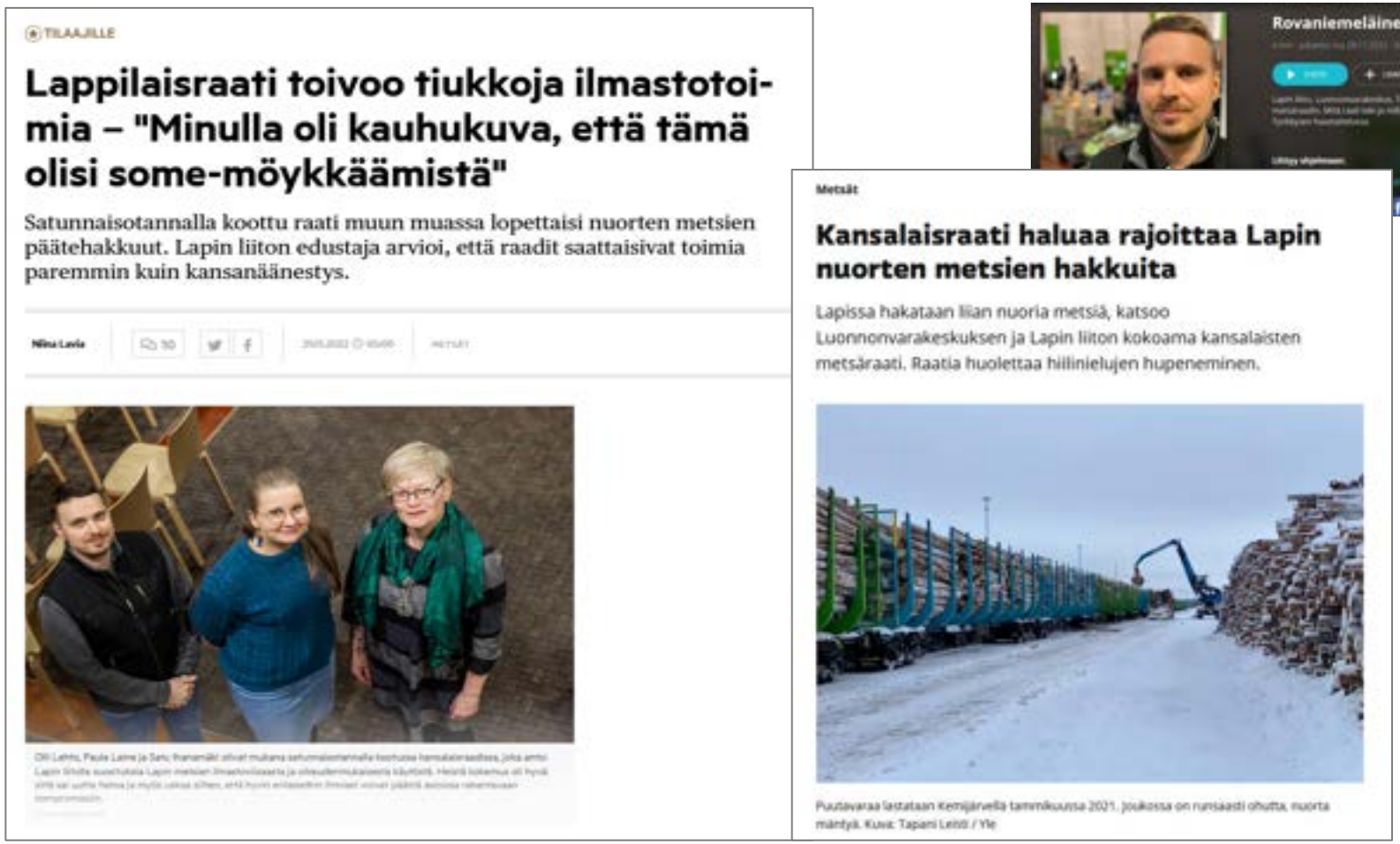
The Jury's verdict – What is needed?

- **Up-to-date information** of the state of forests and forest management methods
- Open decision-making and **participatory planning** involving all stakeholders & forest users
- **Safeguarding carbon sinks** & biodiversity, e.g. stop logging of underdeveloped forests, logging quotas
  - ...but reduce emissions, too!
- **Long-sighted decision-making** and forecasting to avoid unsustainable logging levels
- **Incentives** to conserve
- **Compensation** of damages to nature

DELIBERATING
CLIMATE ACTIONS

utu.fi/factor

Impact: Visibility


TILAAJILLE

Lappilaisraati toivoo tiukkoja ilmastotoimia – "Minulla oli kauhukuva, että tämä olisi some-möykkäämistä"

Satunnaisotannalla koottu raati muun muassa lopettaisi nuorten metsien päätehakkuut. Lapin liiton edustaja arvioi, että raadit saattaisivat toimia paremmin kuin kansanäänestys.

Niina Levis

Metsät

Kansalaisraati haluaa rajoittaa Lapin nuorten metsien hakkuita

Lapissa hakataan liian nuoria metsiä, katsoo Luonnonvarakeskuksen ja Lapin liiton kokoama kansalaisten metsäraati. Raatia huolettaa hiilinielujen hupeneminen.

Puutavaraa lastataan Kemijärvellä tammikuussa 2021. Joukossa on runsaasti ohutta, nuorta mäntyä. Kuva: Tapani Lento / Yle


LAPPI PUHUU

Metsätiedolle myös Lapissa selkeä tarve

- 15 % have heard of Forest Jury, over 7% have read (parts of) the statement

DELIBERATING CLIMATE ACTIONS

Impact: Responses by the Green Transition Committee

- Production of a comprehensive report about the state of forests in Lapland
- FurtherinDeveloping tools for compensation especially in tourism
  (to steer funding for conservation efforts)
- g the Jury's statement to arenas where forest-use planning happens
- Encouraging training about new forest maintaining methods

- ...story to be continued.

DELIBERATING CLIMATE ACTIONS

Find out more & read the Forest Jury statement:
utu.fi/factor

Thank you!

Katariina Kulha
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DELIBERATING CLIMATE ACTIONS

Green Transition and Regional Sustainability

Luleå, 10-12 October 2023

Voluntary forest protection in Northern Norway

Lisa Bjørnsdatter Helgason

Environmental Director, County Governor of Troms and Finnmark

Acknowledgements: Cathrine Amundsen and Tiia Kalske

Statsforvalteren i Troms og Finnmark

County Governor of Troms and Finnmark

October 2023

In Norway, 60 % of the land-living species that we know today, approx. 33,000 different species, are connected to forest ecosystems.

Especially, old natural forest areas are important areas for many species, and half of the red-listed species in Norway have their living areas in forest ecosystems. A large proportion of these species are negatively affected by forestry.

Voluntary forest protection have been an important strategy for Norway in order to preserve biodiversity. When the forest is protected as a nature reserve, the forest is protected against wood cutting and development.

As such, voluntary forest protection contributes to the achievement of at least, two national goals for biodiversity:

- A representative selection of Norwegian nature must be preserved for future generations.
- No species and habitat types shall be eradicated, and the development of threatened and near-threatened species and habitat types shall be improved.

Status for forest protection in Norway

Kilden - skogportal (nibio.no)

Foto: Lichen community in Nordneset and Akkarvika NR. Photo: Rådgivende biologer

In 2004 Norway started with the voluntary forest protection scheme. At that time 1,6% of the forest in Norway was protected.

The Storting (Norwegian Parliament) decided in 2016 that 10% of the forest in Norway must be protected. They also decided that what is to be protected on privately owned land must be done as voluntary protection.

By now, approximately 5,2 % of the forest areas in Norway is protected.

In order to achieve the political goal, the proportion of protected area must be doubled from the current level. In addition to the privately owned forest that is protected through voluntary protection, some state-owned forest has been protected.

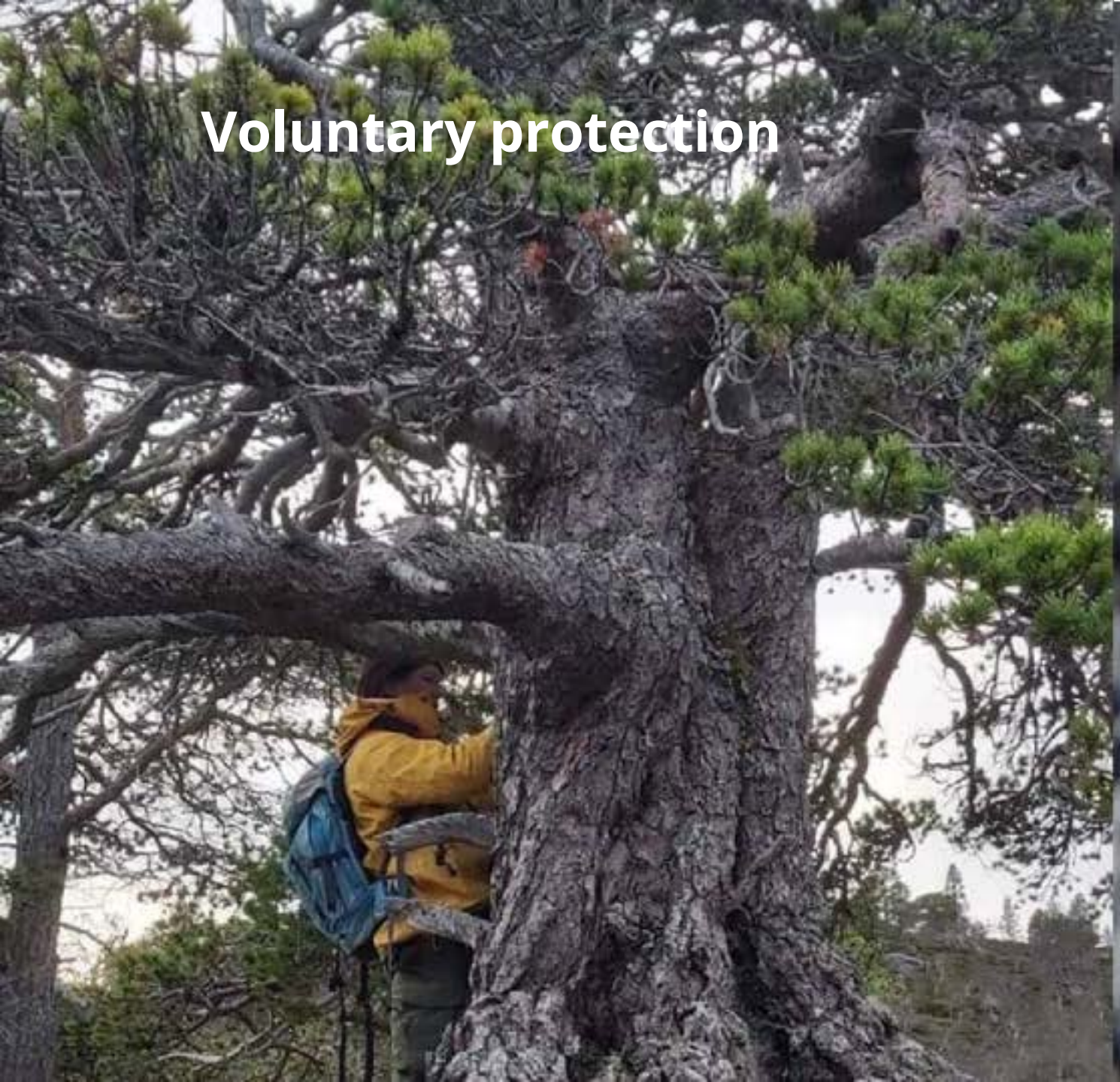
In 2022, NOK 435,7 million was allocated for forest protection. The grants for the forest protection cover the compensations to forest owners, as well as the work around the preparation of a nature reserve.

In the state budget for 2023, NOK 424 million has been allocated for the protection of forests.

In the suggested budget for 2024 there is a suggested cut of 100 million NOK.

This cut could slow down the processes of voluntary forest protection in Norway.

Voluntary protection



Photos: Gyrd Harstad. Photo 2: Nållav. Cathrine Amundsen

In 2016, an evaluation of the forest protection was carried out, and the report came with a recommendation of areas and types of nature that should be prioritized for forest protection in the future.

The following areas were recommended:

1. Known occurrences of important forest types with high nature value and low coverage in current forest protection, especially in counties with overall low degree of forest protection and high land use intensity, as well as lowland forest in boreonemoral and south boreal zones.

2. Known valuable occurrences of other important forest types, especially lowland forest in boreonemoral and south boreal zones.

3. Other forest on productive ground, without major influences from intensive forestry or technical development, particularly lowland forest in boreonemoral and south boreal zones, or other areas of high value to biodiversity.

4. Large contiguous forest areas or areas that may contribute to create a higher degree of ecological connectivity between existing areas of protected forest.

The process of voluntary forest protection

Field expedition to coastal pine forest Forrholtan – in Kvæfjord. Photo: Gyrd Harstad

1. The forest owner offers forest areas for protection – through forest organizations or directly to the County Governor

2. The County Governor decides whether the area's biodiversity should be investigated/mapped and if the offered areas should be prioritized for forest protection. If the areas offered are valuable, the state and the owners continues the proses.

3. Decision and further processes: The next step in the Processes: valuation of the forest (between the owners and the State through lawyers and forest organizations)

4. Proposal of the forest protected area according to the Biodiversity Act. Final decision taken by a royal resolution.

Protected areas through voluntary protection

Old growth coastal pine forest in Forrholtan, Kvæfjord. Not protected. Photo: C. Amundsen

The past 8 years
5 nature reserves established
All old growth forest types
In total 5 595 daa (22,6 km2)

Now in progress 1 area

Period 2015 – 2022 (8 years)

- Lavangselva NR, Balsfjord municipality: 2 202 daa. Protected in 2015.

- Blåberget NR, Bardu municipality: total area 958 dekar, ca. 492 dekar productive forest. Protected in 2017, and extended in December 2019, following the wish of the landowners.

- Tennelia NR, Senja municipality: 214 dekar. Protected in 2022. Calcareous birch forest.

- Kastnesåsen and Grønlikollen NR, Dyrøy municipality: 2 219 dekar. Protected in 2022. Deciduous forest and warm loving species. First nature protection area in this municipality.

One area in process right now: Nordneset and Akkarvika NR.

Old growth aspen forest in Nordneset and Akkarvika Naturer Reserves. Photo: Rådgivende biologer

Illustration photo. Dark-red helleborine *(Epipactis atrorubens)* is a lime demanding orchid. Tennelia nature reserve in Senja. Photo: Cathrine Amundsen

Nordneset og Akkarvika nature reserve: Old rich deciduous forest.

Tennlia nature reserve: Small area with rich lime birch forest and lots of dead wood, as well as species-rich bottom vegetation

Illustrasjonsfoto.

Rødflangre (Epipactis atrorubens) er en kalkkrevende orkidé som finnes spredt i Tennelia naturreservat på Senja. Foto: Cathrine Amundsen

Offered areas – biodiversity mapping 2023

Foto: Bogen nature reserve. Karlsøya, Karlsøy kommune. Foto: Cathrine Amuindsen

2 areas are subject for biodiversity mapping in 2023.

Skibotndalen 1 and 2, Storfjord municipality (4,36 km2)

Hovmannsstien, Kvæfjord municipality (130 dekar)

The forest is being mapped and analysed for: types of forests and size of forest areas, Dead wood, sizes and amounts lying trees, standing trees, threathened species, biotope diversity, Calcareous bedrock, vegetation zone and Site index (bonitet – productive forest).

https://frivilligvern.no/hva-er-frivillig-vern/

https://brage.nina.no/nina-xmlui/handle/11250/2441926

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Statsforvalteren i Troms og Finnmark

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Green Transition and Regional Sustainability

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