

Mistra Digital Forest

Sverker Danielsson, Program Director

Global trends

- Fast development of digital tools
- Possibilities of generating high resolution data and data handling
- Circularity and bioeconomy
- Sustainable forestry
- Active debate about forest management
- Traceability





Mistra Digital Forest

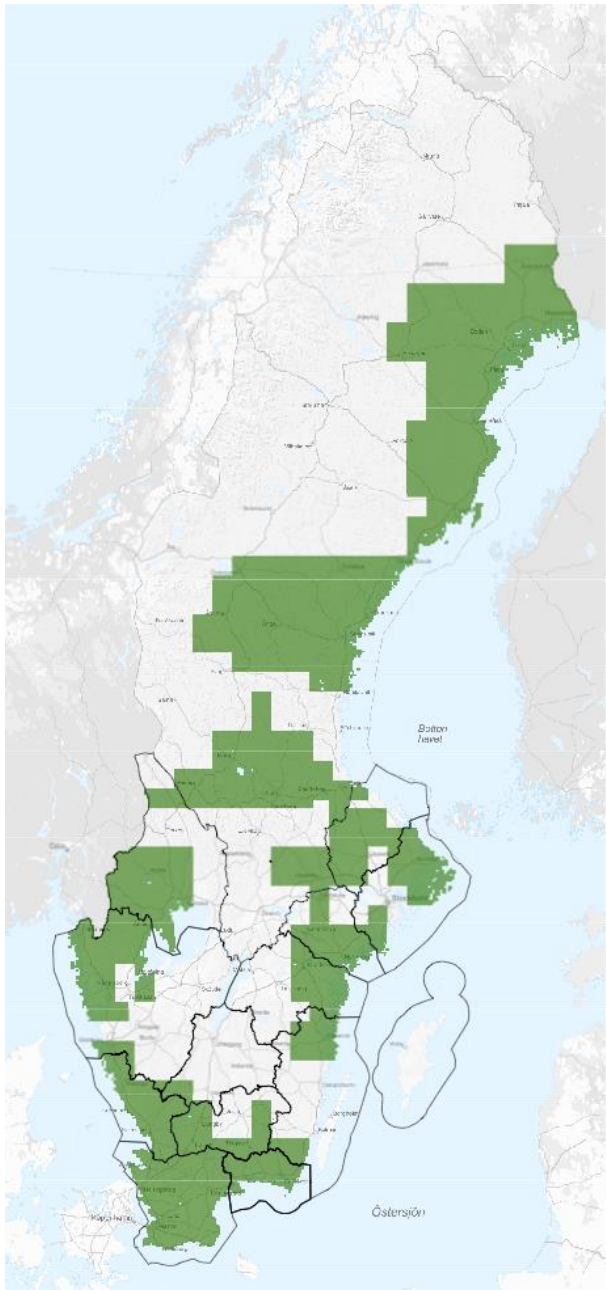
Vision

Digital solutions
for a sustainable
and efficient
forest-based
bioeconomy

Mission

Explore and create
enablers for
realizing a digital
forestry value chain

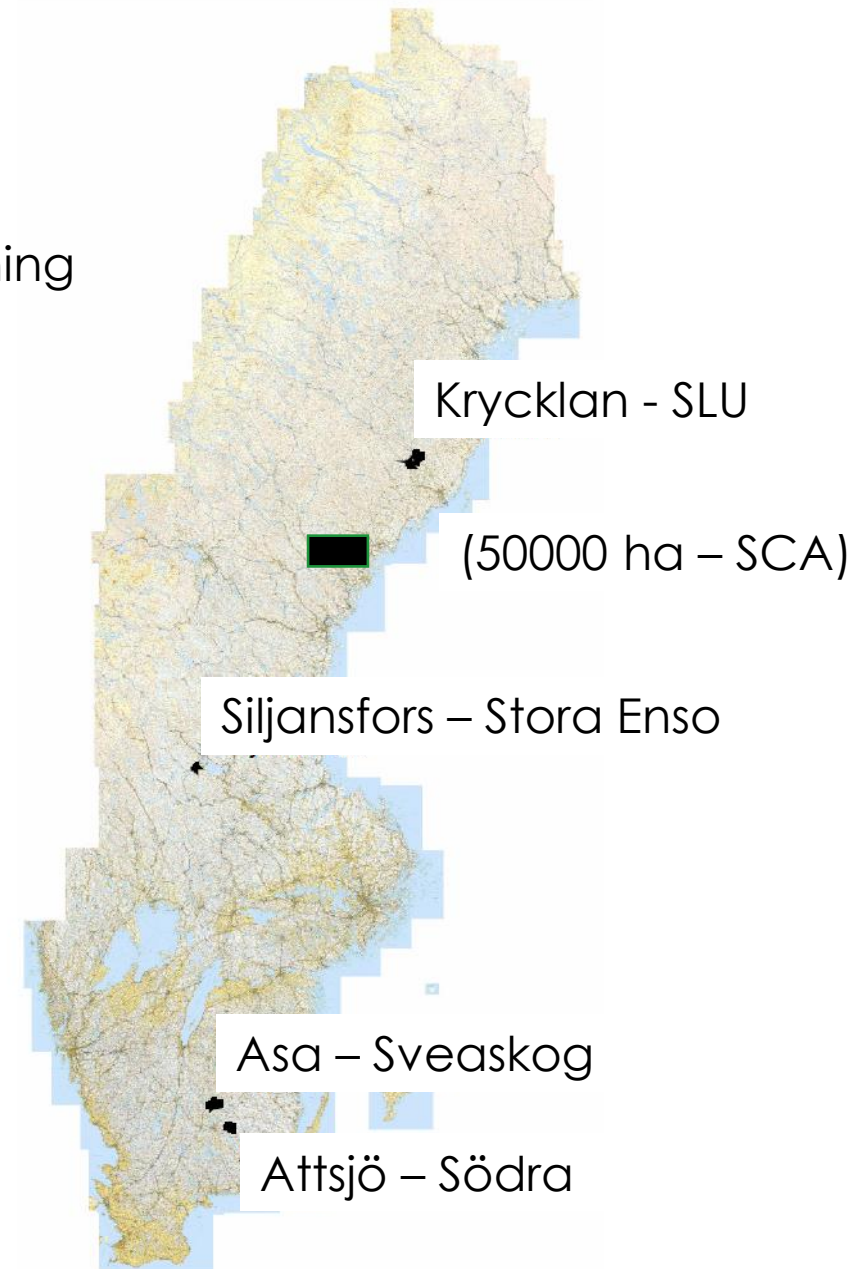




National laser scanning
Status 2021-07-03

Laser scanning

High resolution laser scanning
Digital Forest test sites







Nationell skanning 2011

- 0,5-1 punkter/m²
- Flyghöjd 2000 m



Nationell skanning 2019

- 1-2 punkter/m²
- Flyghöjd 2000 m



SCA Digital Forest 2019

- ~20 punkter/m²
- 2 färger



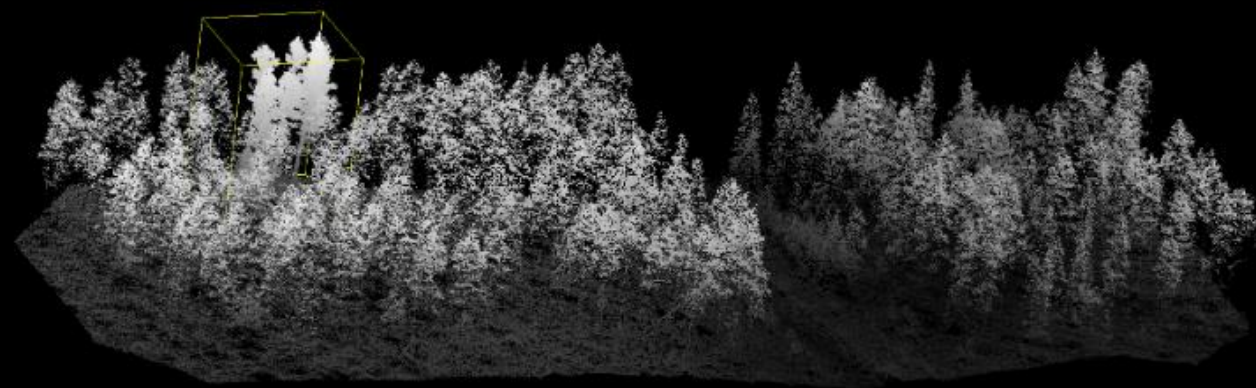
Helikopter 2019

- ~500 punkter/m²
- Flyghöjd 70 m



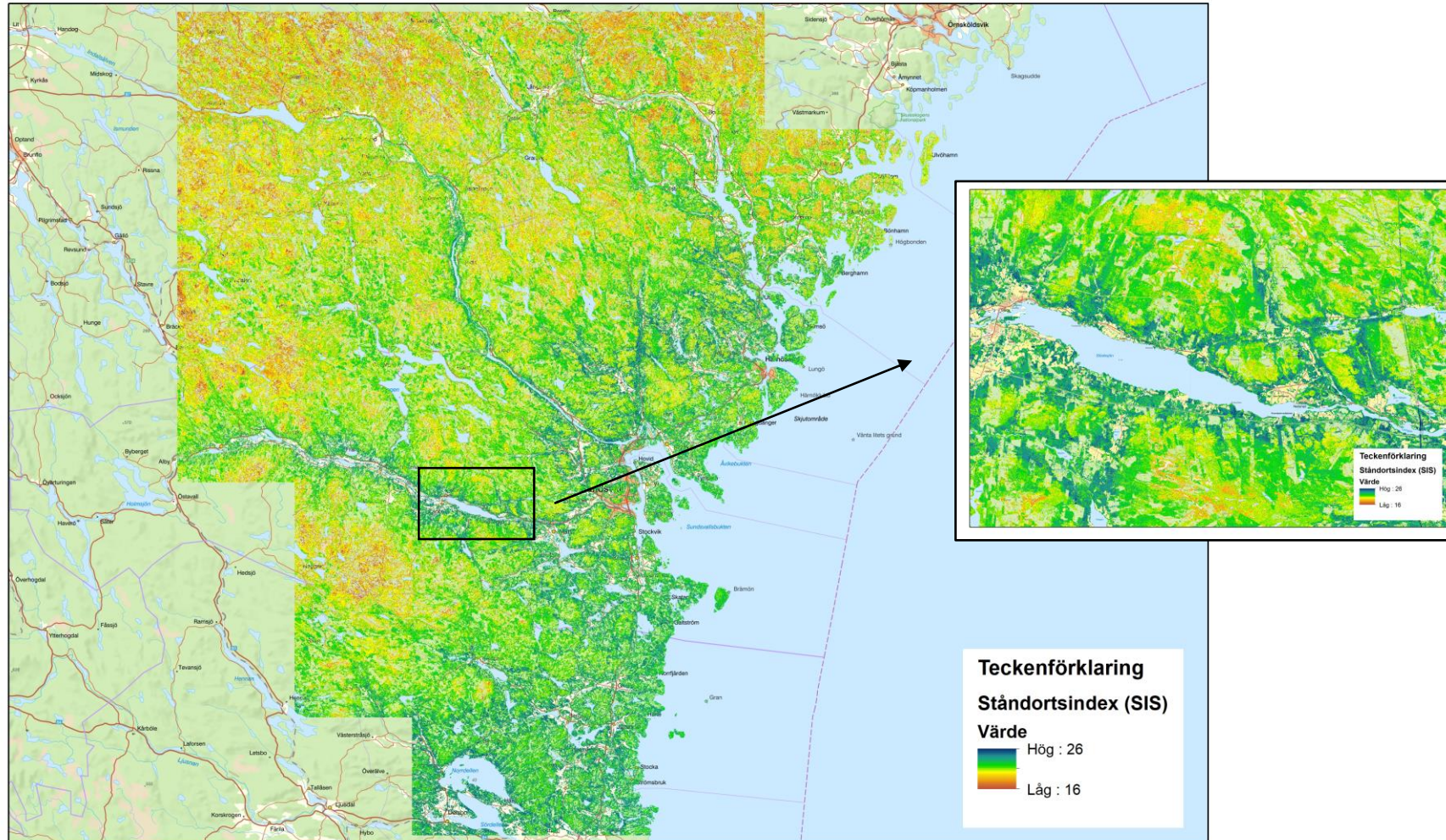
Markburen laser 2019

- Miljoner punkter/m²



Site Index (SIS), Spruce

Height (P90), Height growth (P90), Change in canopy cover, Altitude, Latitude



Correlation between high resolution laserdata and indicators for biodiversity

Eva Lindberg et. al. SLU

Field inventory with the
Forest Biologists'
methodology

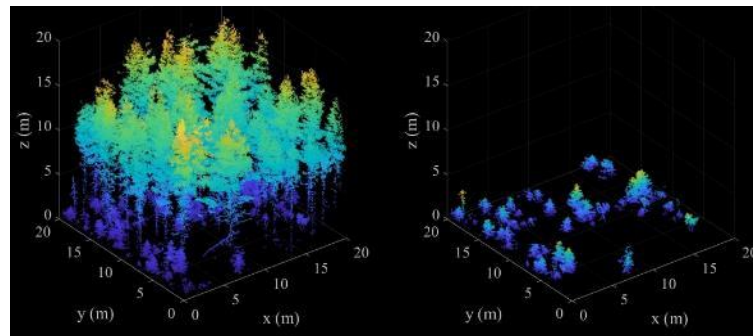
- Site-factors
- Dynamics
- Habitat
- Trees
- Structure
- Dead wood



Selection of indicators



Models for
indicators
as functions of
stand structure

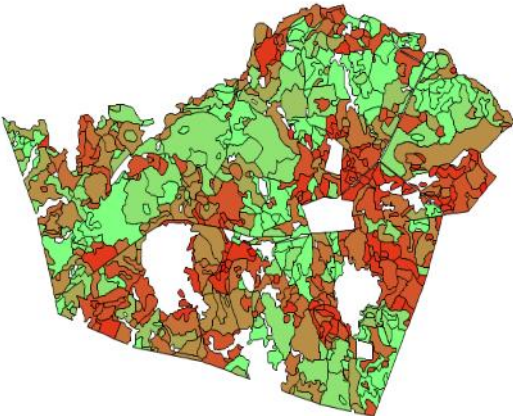


Stand structure from dense ALS data

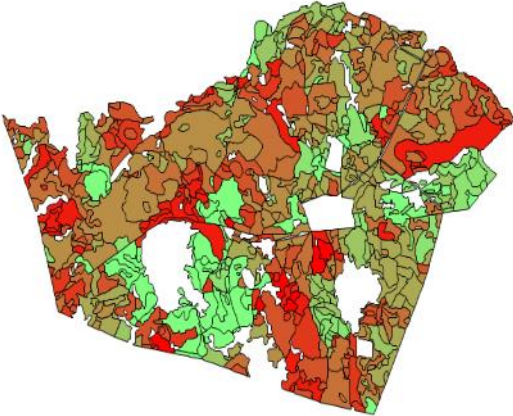
Risk modelling Karin Öhman, SLU

Exempel "heatmaps" for Hälleskog in south of Sverige, results from Heureka, SLU

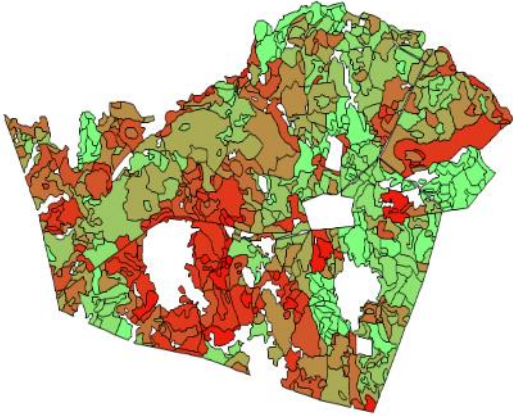
Year 2021



Year 2041



Year 2061



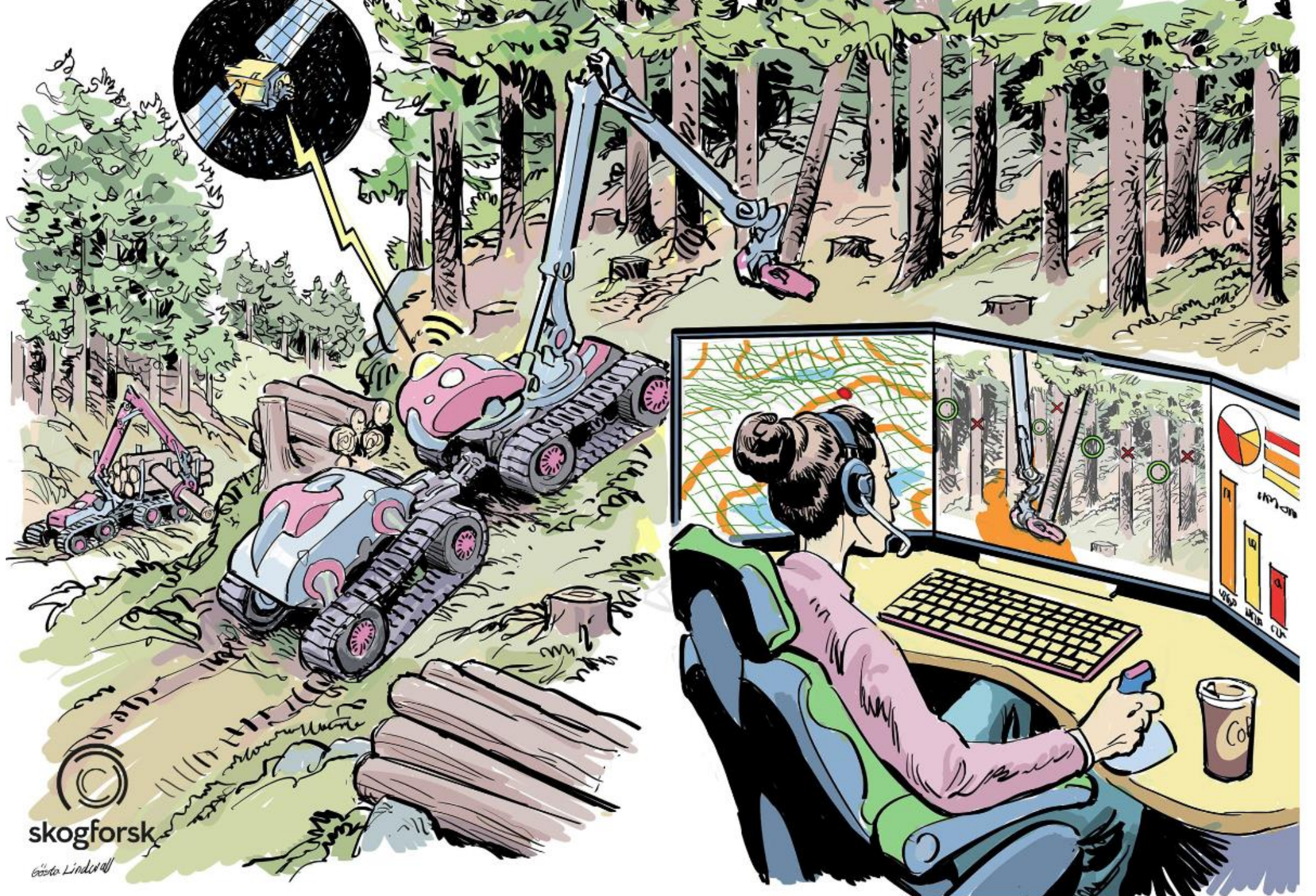
Low risk for storm damages



0

1

High risk for storm damage



skogforsk

© 2010 Lindorff



W
SVEASKOG

eXtractor

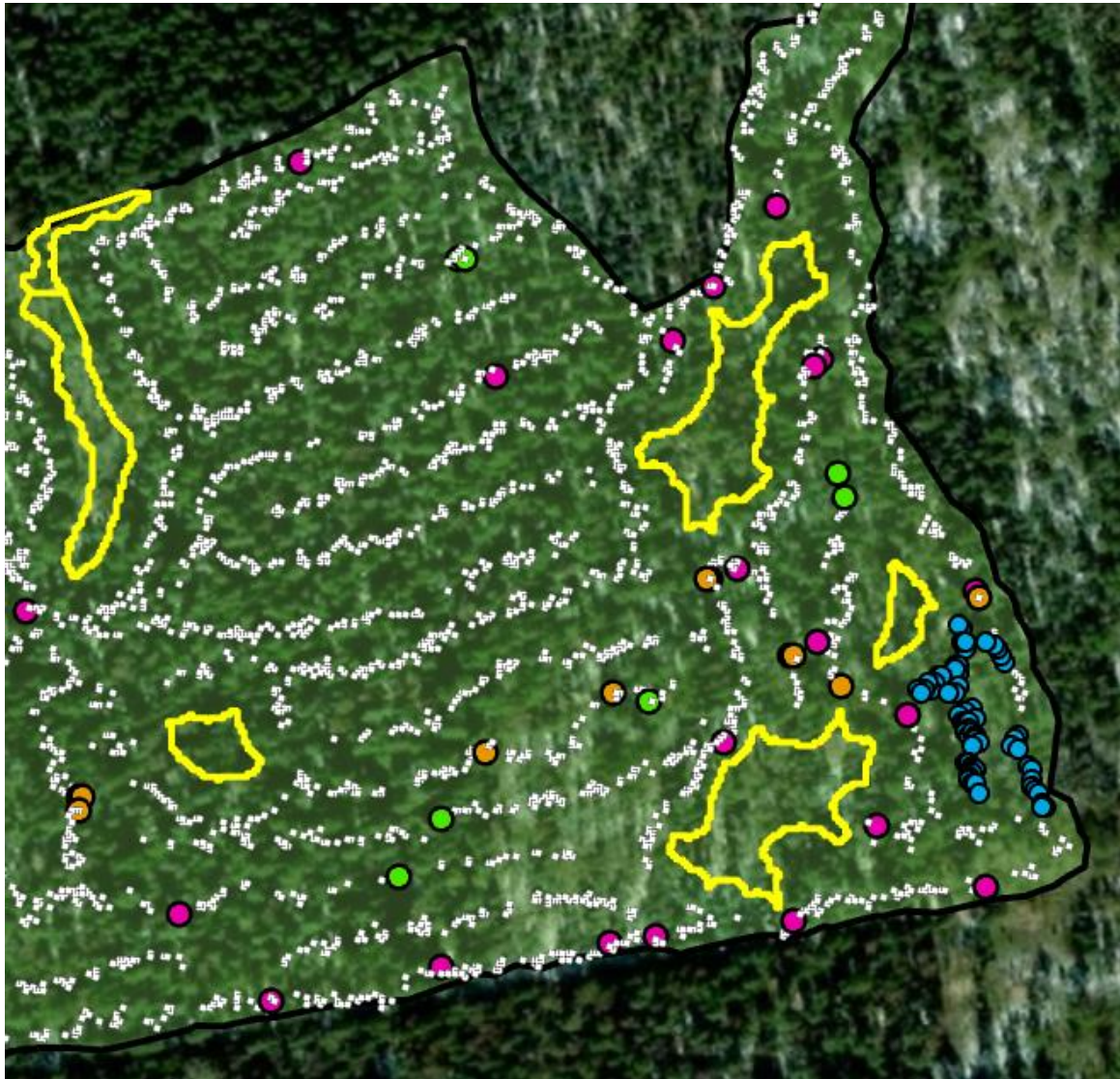
Rexroth
Bosch Group
The Drive & Control Company

King Fork

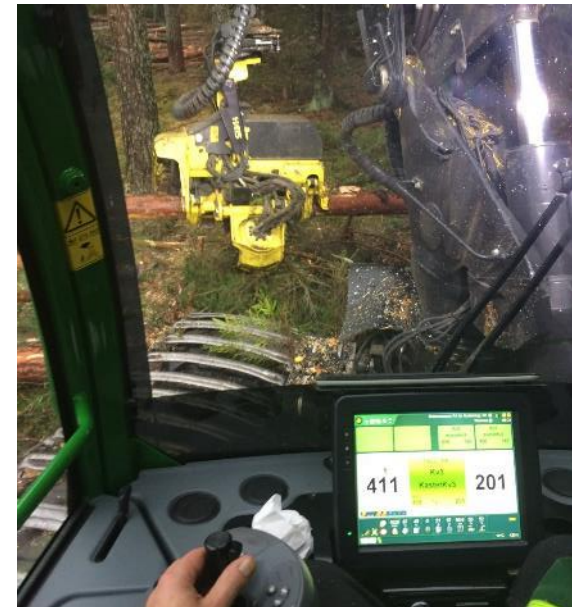
X
is energy

eXtractor

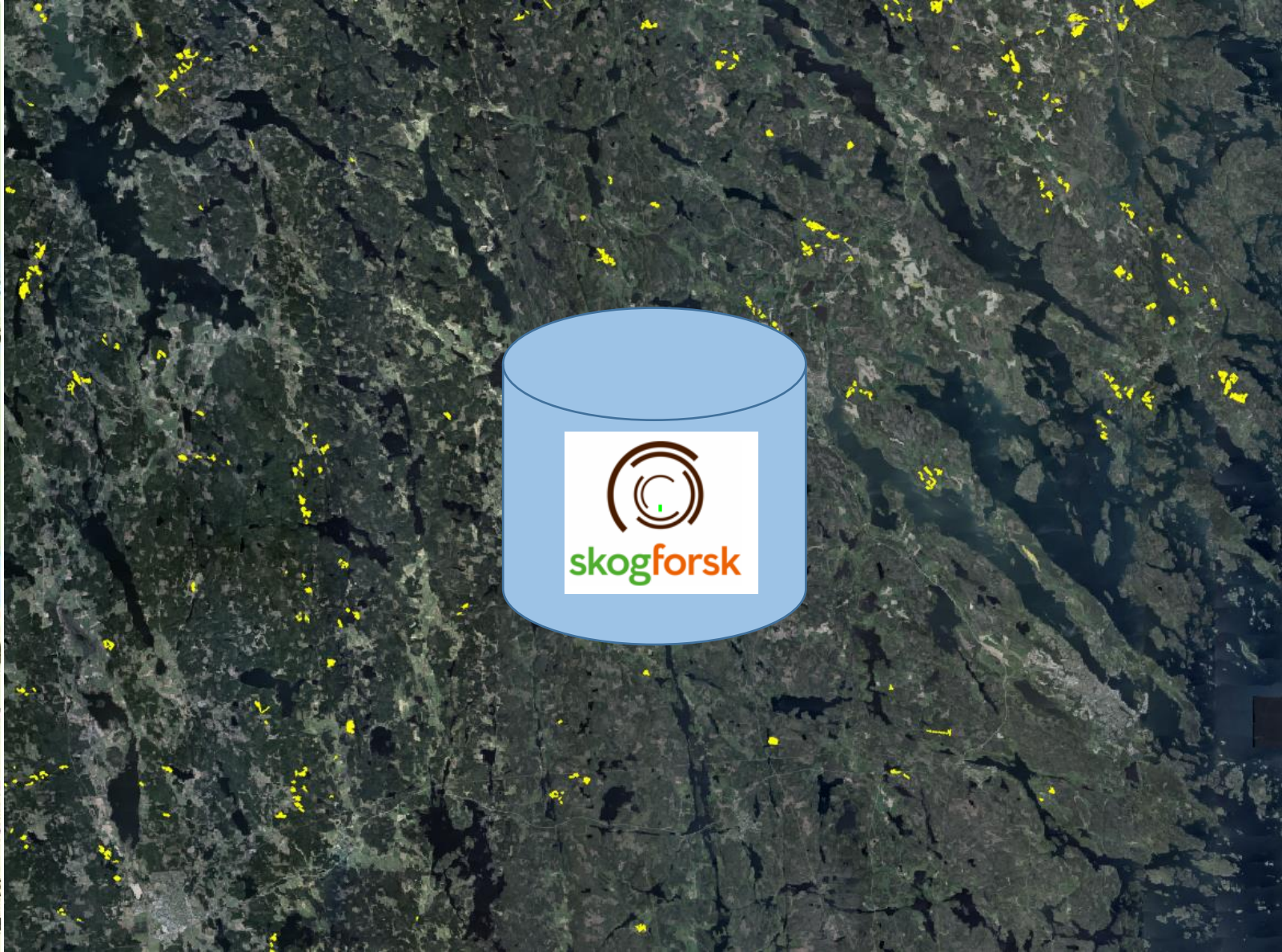
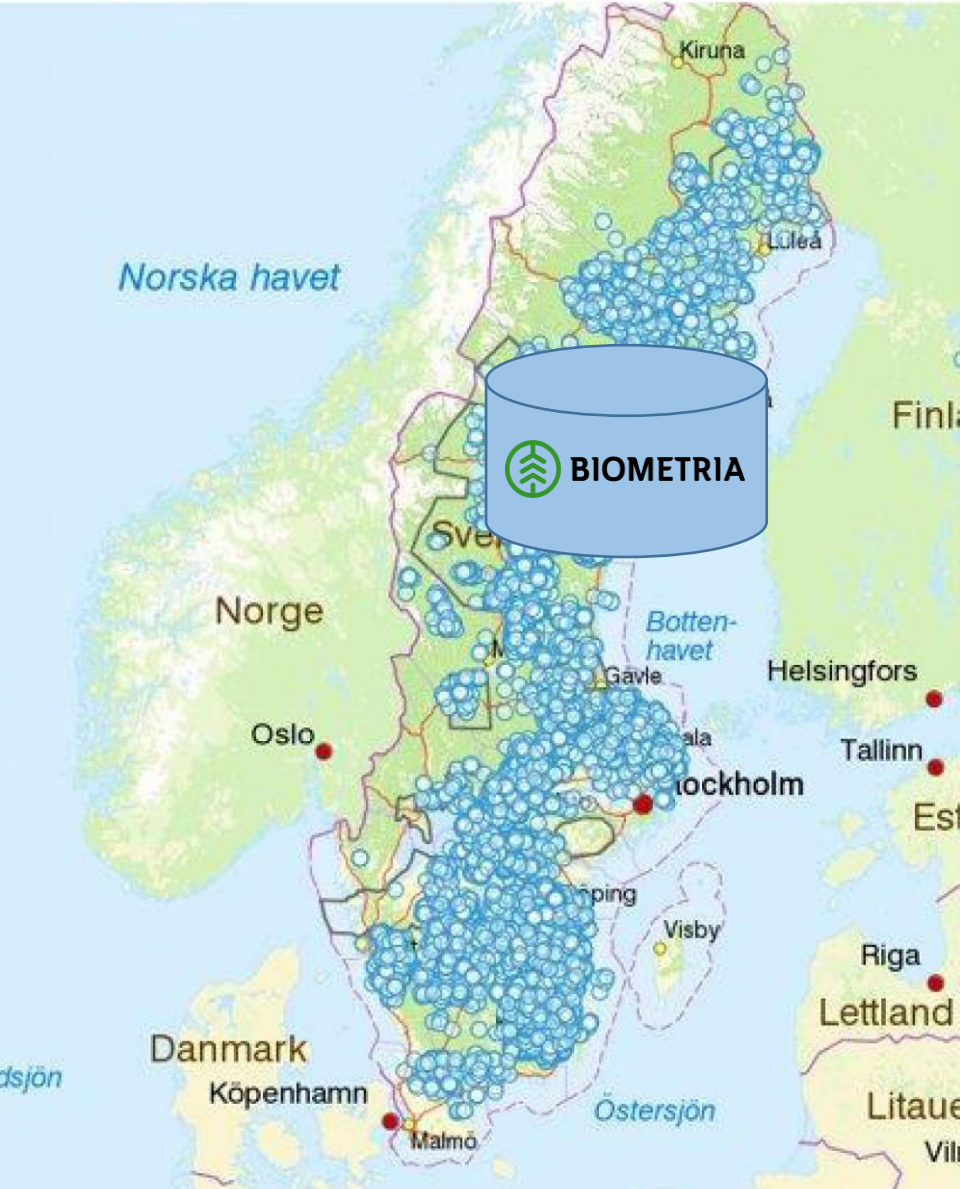
Data from harvesters – Maria Nordström et.al. Skogforsk



Digitalised nature conservation monitoring with new stem codes



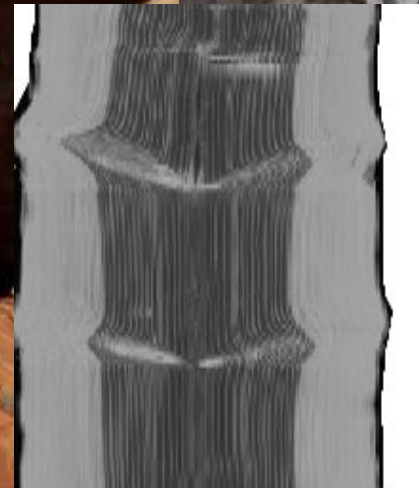
The digital forestry – data from harvesters



Modelling fiber properties

Forestry data

- Twig type
- Max twig diameter
- Density (raw, dry)
- Juvenile fraction
- Heart wood fraction
- Age
- Bark
- Sommarvedsandel



Fiber dimensions

- Fiber length
- Fiber width
- Fiber wall thickness

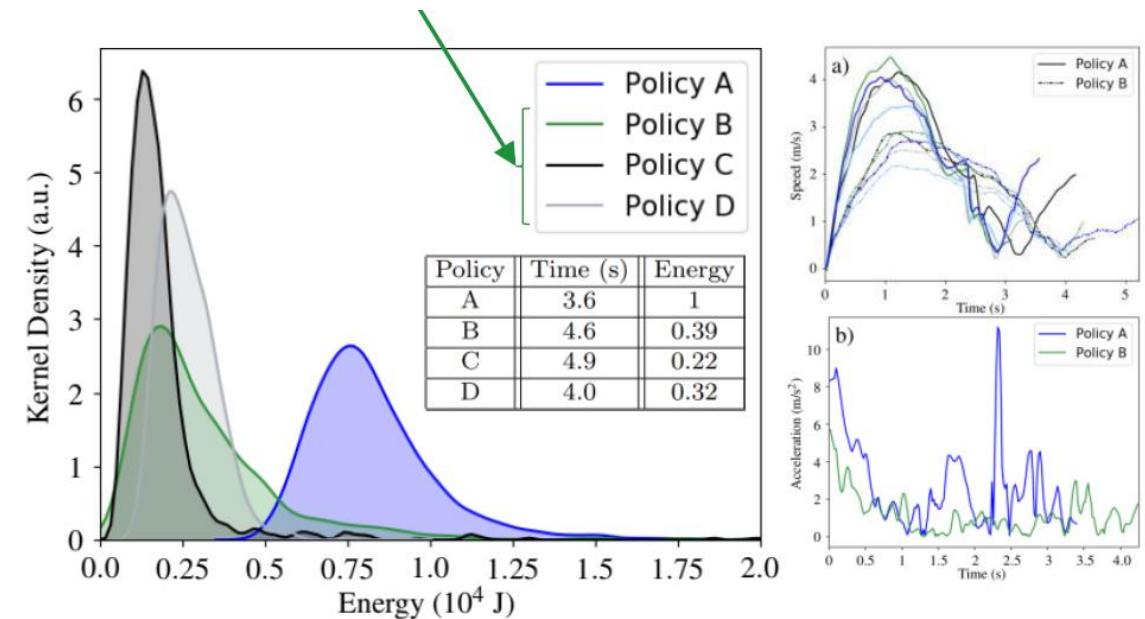
Reinforcement learning control of a forestry crane manipulator



J. Andersson, K. Bodin, D. Lindmark, M. Servin, and E. Wallin, Reinforcement Learning Control of a Forestry Crane Manipulator. arXiv:2103.02315. Submitted manuscript (2021)

Submitted to IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (2021).

- Learns fast and energy efficient log grasping
- times the grapple swing
- Success rate 97 %
- Energy-optimization in reward
- Robustness to log position, slope and more



Recent studies on unmanned forest machine and smart flow crane control



- TFP – terrängfordonsplattformen Luleå University of Technology (LTU) and SLU
- "Medium sized forest machine"
- Remote controlled or fully autonomous
- Robotics in field; mobility, sensors, etc



TFP in action



CRANE WITHOUT
CONTROL



SMART FLOW
CONTROL

PRESENT SITUATION

Forest production and the potential of digitalisation in the future

← INTERCONNECTION OF DIGITAL PROCESSES →



■ High level of digitalisation ■ Partly digitalised but large parts remains ■ Digitilisation initiated, a lot remains

Prioritized by forest companies with forest- and technical managers

IN 5-10 YEARS

Forest production and the potential of digitalisation in the future

OPPORTUNITIES FOR DIGITALISATION FOR CUSTOMERS



Lowest need and potential Greatest need and potential

The category received no response

Prioritized by forest companies with forest- and technical managers

IN 5-10 YEARS

Forest production and the potential of digitalisation in the future

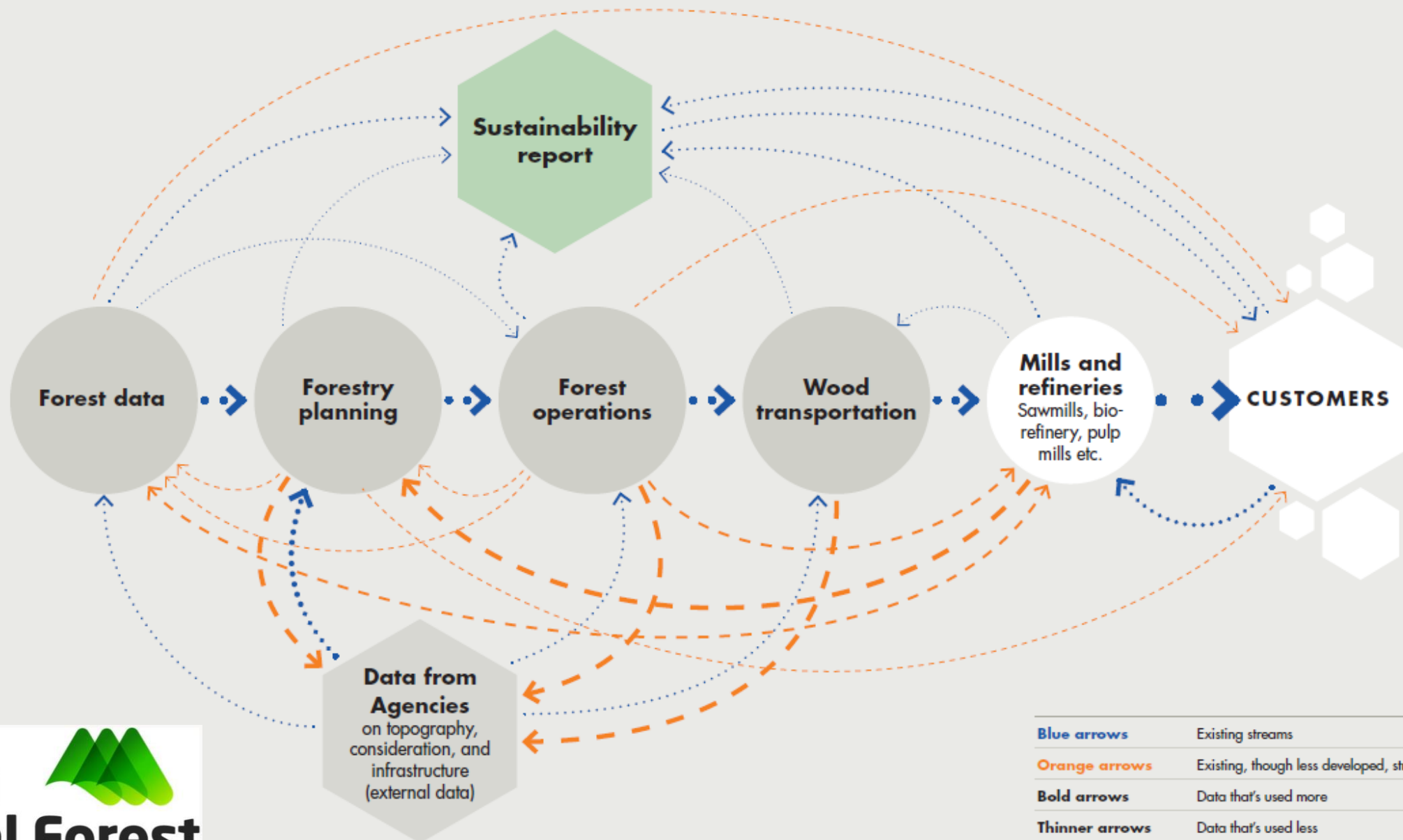
← OPPORTUNITIES FOR DIGITALISATION FOR CUSTOMERS TASK 0:3; 0.4; 0.5; 3:1 →



Lowest need and potential Greatest need and potential

The category received no response

Data and information streams



Mistra Digital Forest

- R&D Program 2019-2027
- Provides data and knowledge to industry
- Developing digital tools towards a more efficient and sustainable forestry
- Evaluating new possibilities that high resolution data brings for future biorefineries

www.mistradigitalforest.se/in-english/

