Development platform for autonomous forestry machines

Håkan Lideskog
Datorstödd maskinkonstruktion
Luleå tekniska universitet

2018-11-29
R&D in Forestry

• To use our R&D resources efficiently we need the prerequisites for a future scenario

• The biobased circular economy, what does that comprise?

• Efficient forestry R&D output depend on many things
  – Should we maximize profitability in value chains on sub-levels?
  – Should we minimize the ecological footprints? To what cost?
  – Who forms the political agenda? Politicians, product developers, forestry owners, wood refiners?
Other areas are doing it

Electric site

Autonomous drive
So why not (yet) in forestry?

- Development cost per vehicle is high
- Lack funding for large endeavours such as automation or semi-automation
- Companies rely on robust and well-recognized technology

Read more: Lideskog et al. (2015) Development of a Research Vehicle Platform to Improve Productivity and Value-extraction in Forestry. Procedia Cirp
Research focus strategy

• Uncertain future scenarios →
  – Focus on stand alone research questions with inherent value
  – Enable modular and flexible solutions
Research in Forestry
Harvesting and forwarding

- Navigation with optimised routes with respect to sustainable aspects, off-board and on-board
- Detect individual trees’ biomaterial performance and respective positions
- New system solutions for increased biomass harvest
Example: Route planning for harvesting and forwarding

• "Off-board" optimization with respect to economy and environment
• "On-board" corrections with respect to
  – Soil properties
  – Inclination
  – etc.
Reforestation

Mounding

+ 

Manual planting

Disc trenching
Reforestation

M-Planter

Bracke Forest P11
Reforestation

- Navigation/route planning for continuous site preparation and planting
- Automation/Semiautomation of site preparation (and planting)
- Minimize soil impact from machine and equipment
- Address other eco-system services during operation
- Log data for future needs
What needs to be identified?

How to gather data for that purpose?

How to interpret that data?

How to control the machine given the interpretation?

Object properties and characteristics

Information retrieval

Information analysis

Object avoidance or target identification

Sensing tools and methods

Algorithms

Object definitions related to silvicultural activity
Example: Selective mounding
(Cont.) Selective mounding
Example: Autonomous agricultural machine

Development of a self-learning system for autonomous route planning and navigation of agricultural machines
Example: Auto2

- Move the operators from machines to office-like working environments, encompassing:
  - Autodrive – Autonomous drive from A to B
  - Autosafety – Establish safety zone around machine
  - AutoRemote – Teleoperation and feedback to operators
Development platform for autonomous forestry machines
Thanks!