ArboLiDAR Forest Inventory Balbic

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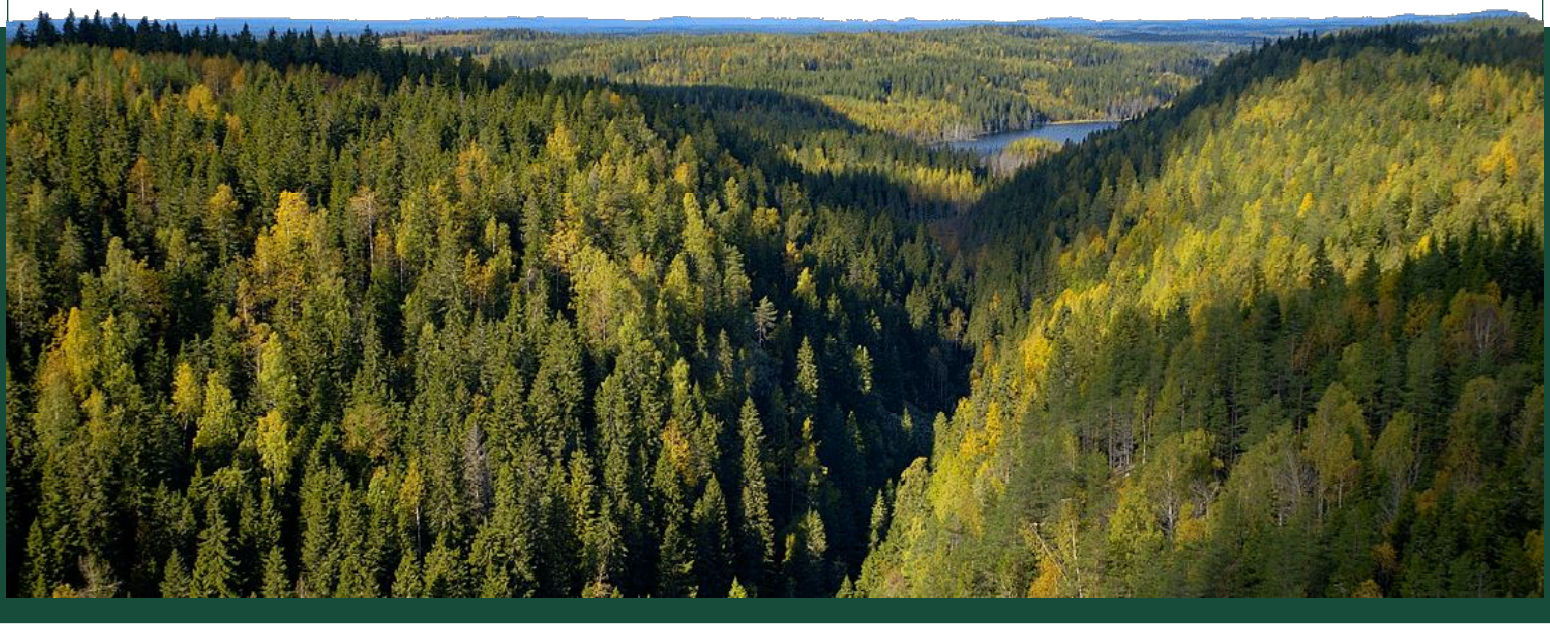
Maria Villikka



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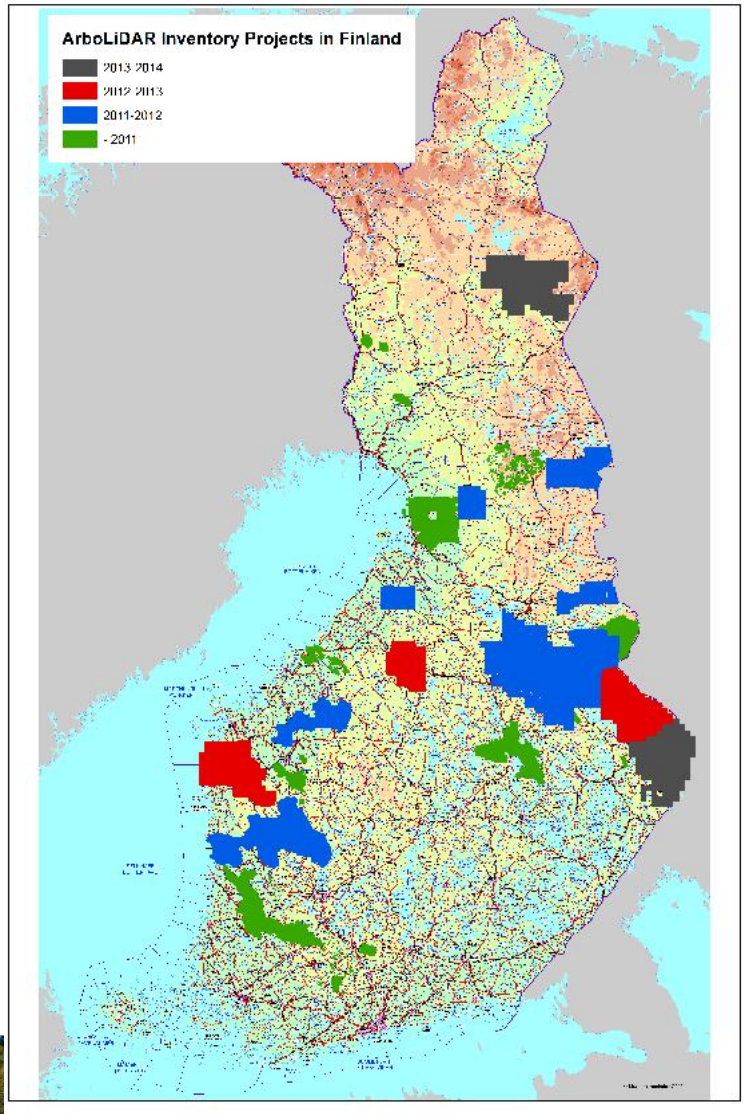
Arbonaut Ltd

- Experience in
  - the development of geographical information systems (GIS)
  - ecosystem modeling applications
  - airborne laser scanning (LiDAR) based forest applications
    - Forest inventory for operational purposes
    - Biomass / carbon inventories



LiDAR inventory projects in Finland

- First projects in 2007
- Total LiDAR inventoried area
  ~ 5 million hectares

- Lidar-based inventory project
  - Saves time
  - Produces accurate, up-to-date information
  - Typical size 50 000 – 1 000 000 ha!
  - Reduces the amount of field work required for traditional inventories

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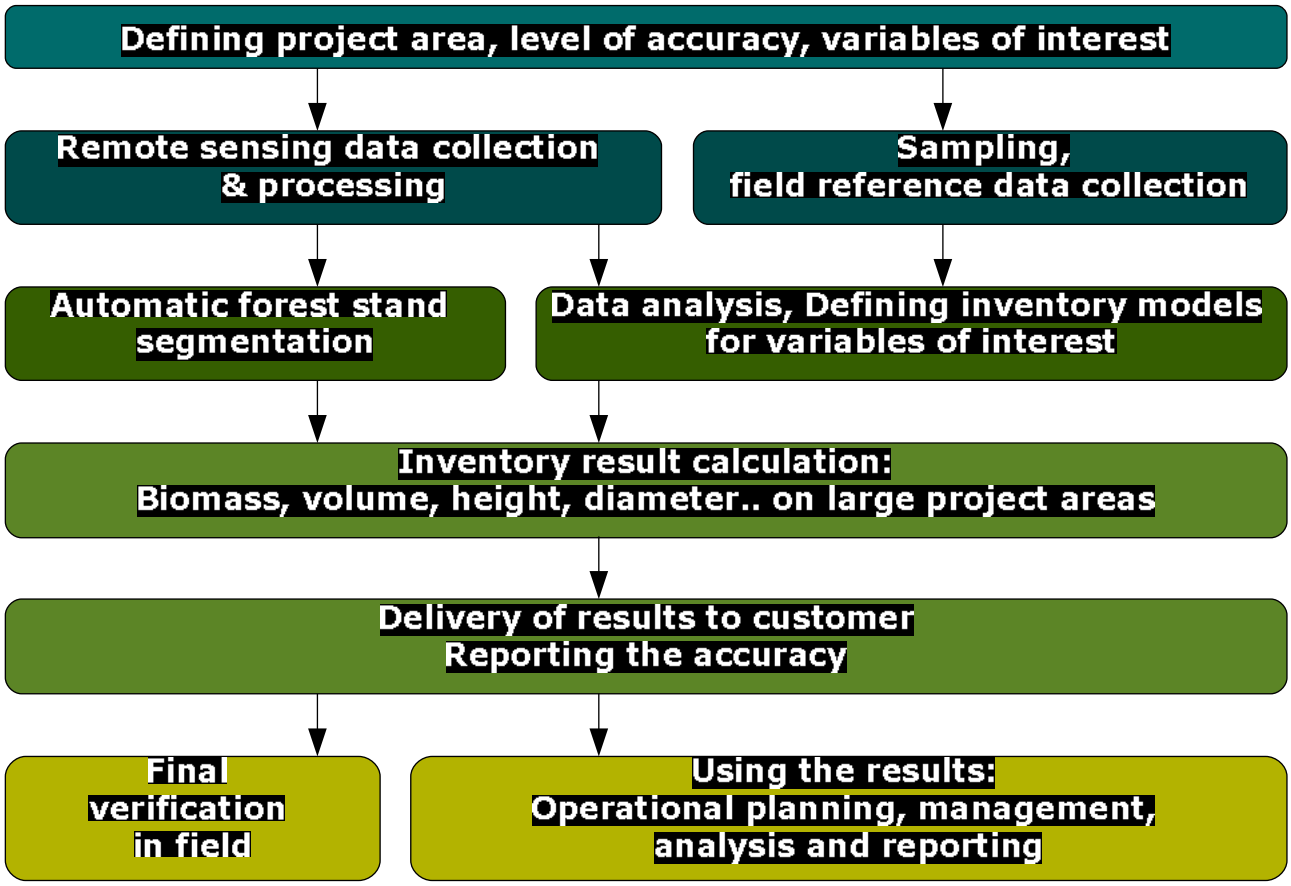
ArboLidar inventory process

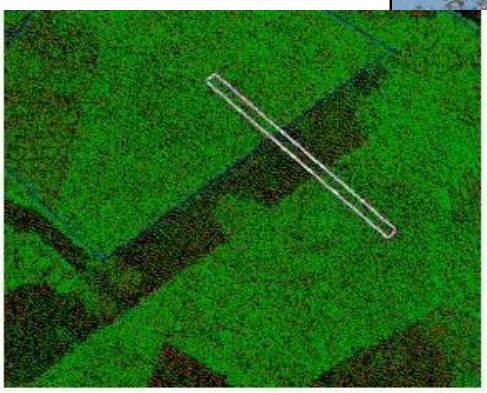


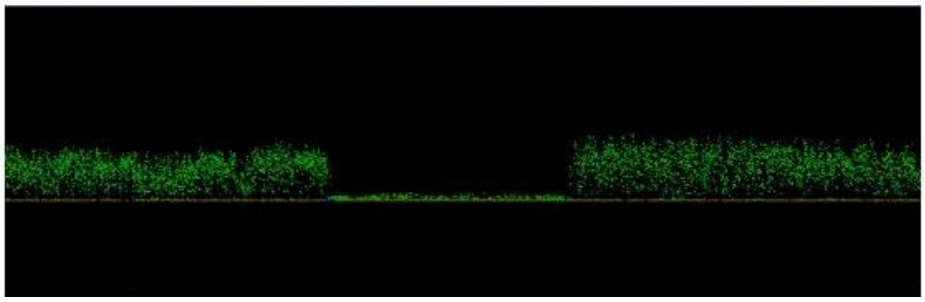
Laser scanning (LiDAR)

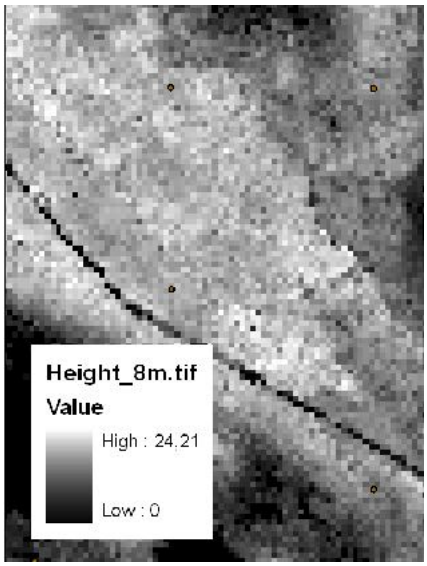
- **Li**ght **D**etection **A**nd **R**anging
- Three components
  1. Distance measurement by laser
  2. Inertial measurement
  3. GPS
- The result is 3D-point cloud (x,y,z coordinates)
- Number of observations varies
- 3D description of vegetation

Input data

- LiDAR (point density 0.5-1 points/m2)
- Digital aerial images
- Field plots as reference data



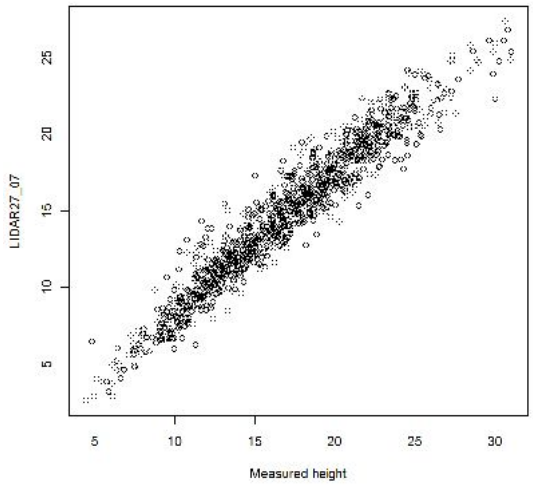


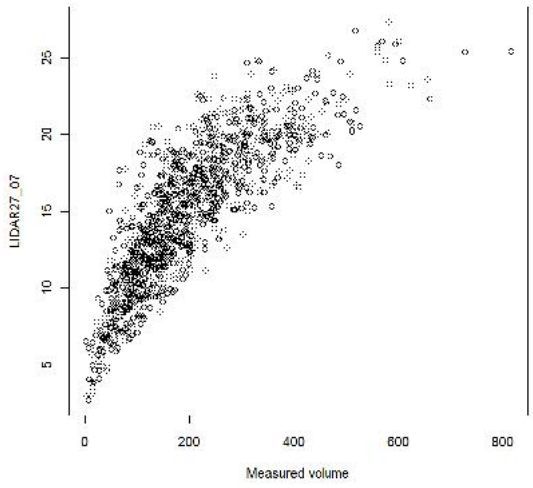


Inventory method and model

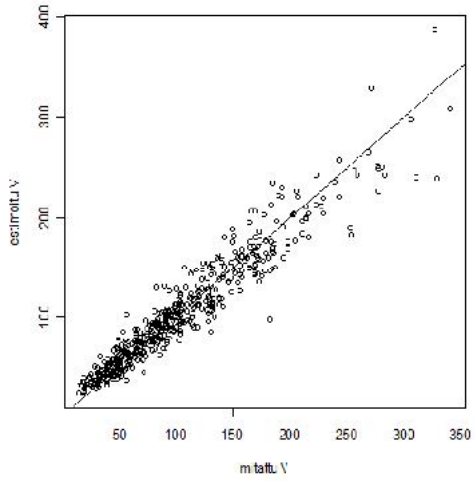
- Combines remote sensing data, field data and mathematical modelling
- Goal is to produce reliable and accurate inventory information
- Area-based method
  - Inventory unit is not a single tree, but an area of specific size
  - Estimation of stand level attributes

Based on the correlation of LiDAR variables and forest stand attributes (field reference data)





Inventory method and model



	Predicted value	Measured value	bias	bias%	RMSE	RMSE%
Total						
mean dbh	20.3	20.6	-0.3	-1.5%	2.8	13.6%
mean height	15.5	15.7	-0.2	-1.3%	1.2	8.0%
basal area	20.2	20.3	-0.2	-0.8%	2.7	13.3%
Volume m3/ha	148.9	145.4	3.5	2.4%	21.2	14.3%
stem count	1292.7	1284.2	8.4	0.7%	290.5	22.5%

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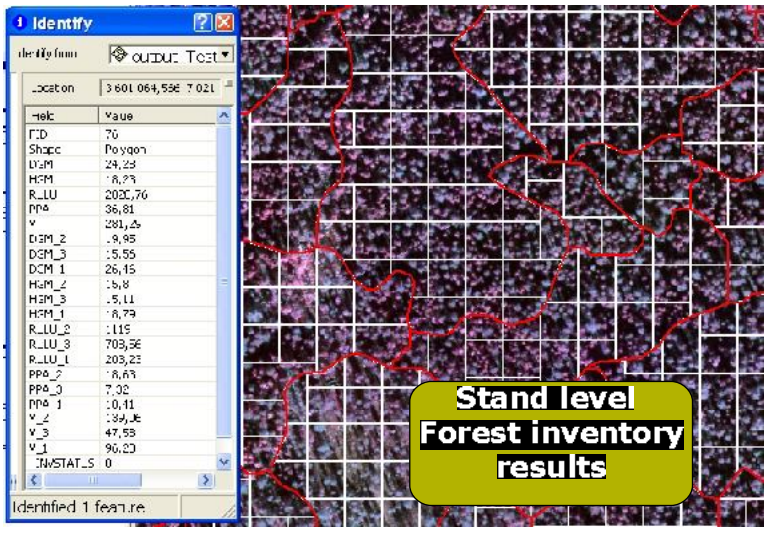
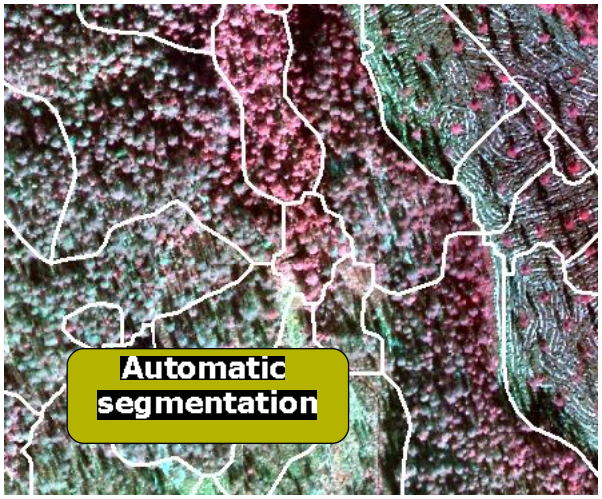
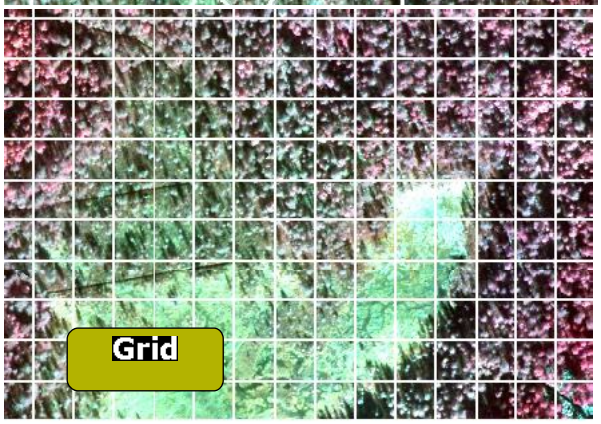
Inventory result calculation

- Stands are the basic units in forest management
- Forest stand boundaries can be automatically generated based on remote sensing data
- Stand level forest attributes are calculated to forest stands or grid







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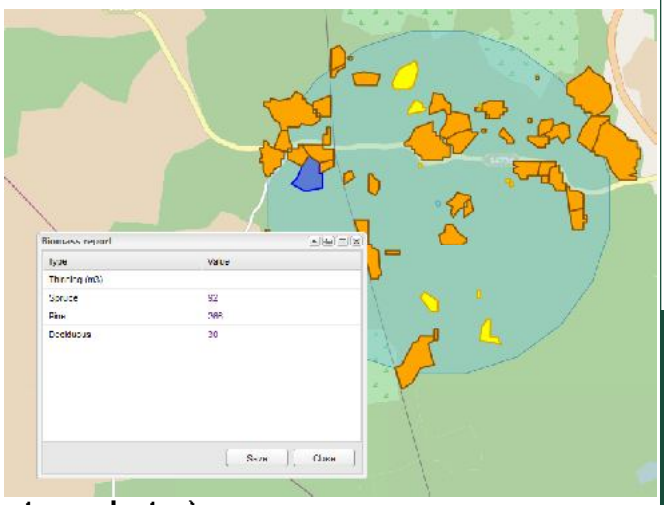
Example case: Biocoal simulator prototype



- Web based application prototype
  - built to Balbic project
  - Balbic = Baltic bioenergy and industrial charcoal
- Consists of:
  - Forest resource database (vector data)
  - GIS-analysis and reporting components
- Potential biomass/bioenergy sources
- Location of existing plants
- Queries

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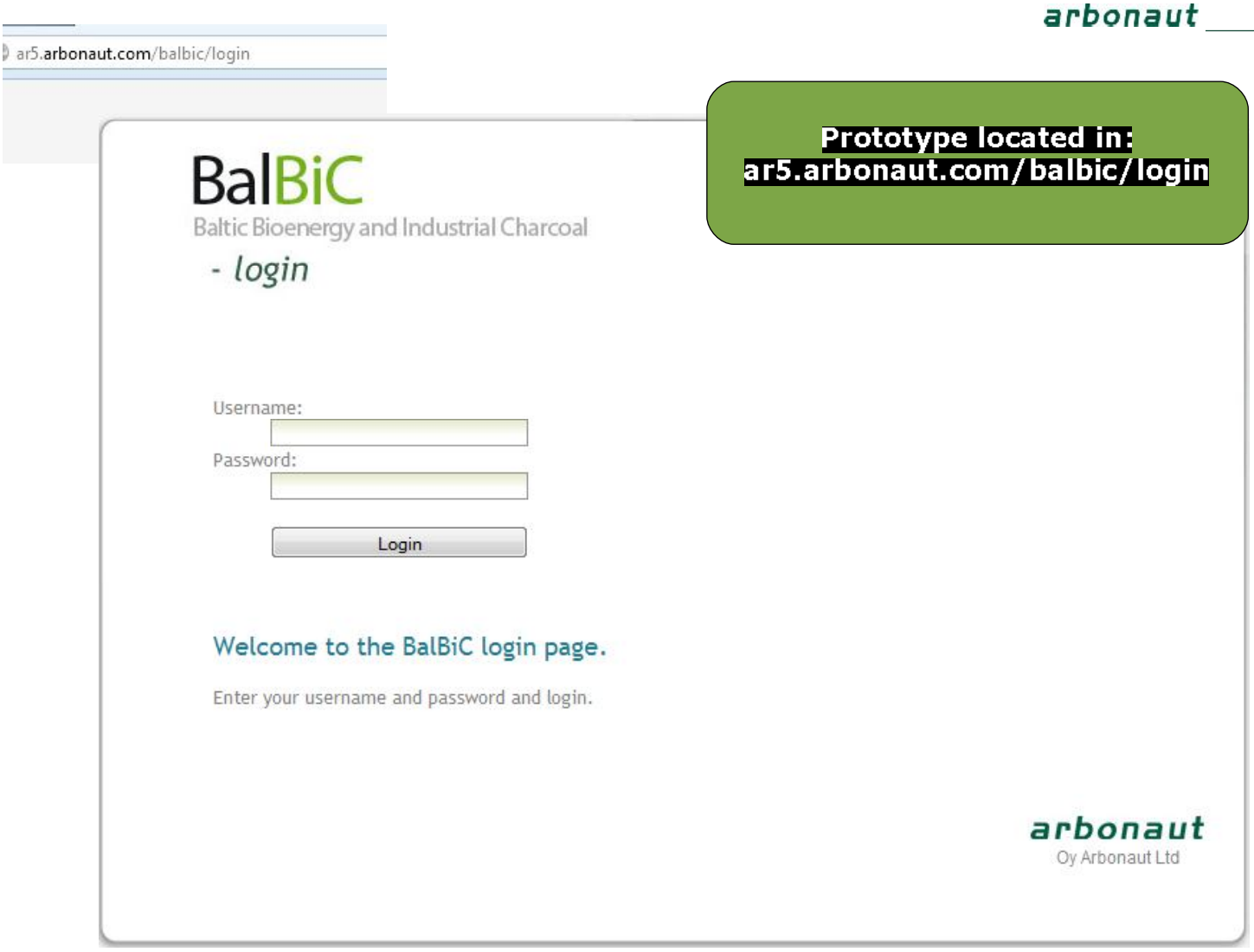
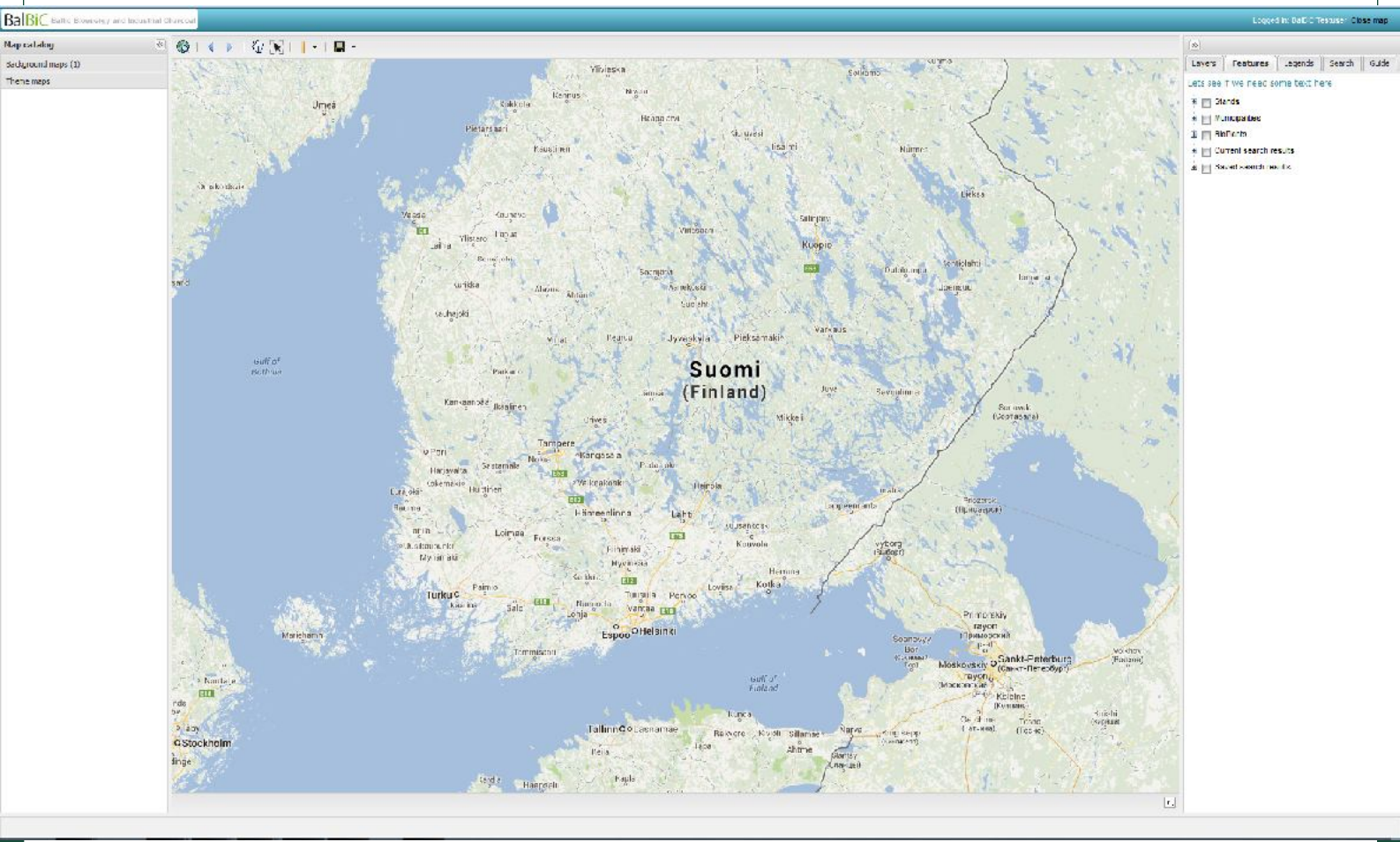


Prototype located in:
ar5.arbonaut.com/balbic/login


BalBiC
Suomi
(Finland)
Layers
Features
Legends
Search
Guide
Oulu
Tampere
Turku
Helsinki
Espoo
Tallinn
Stockholm
Gankt-Peterburg
Kuopio

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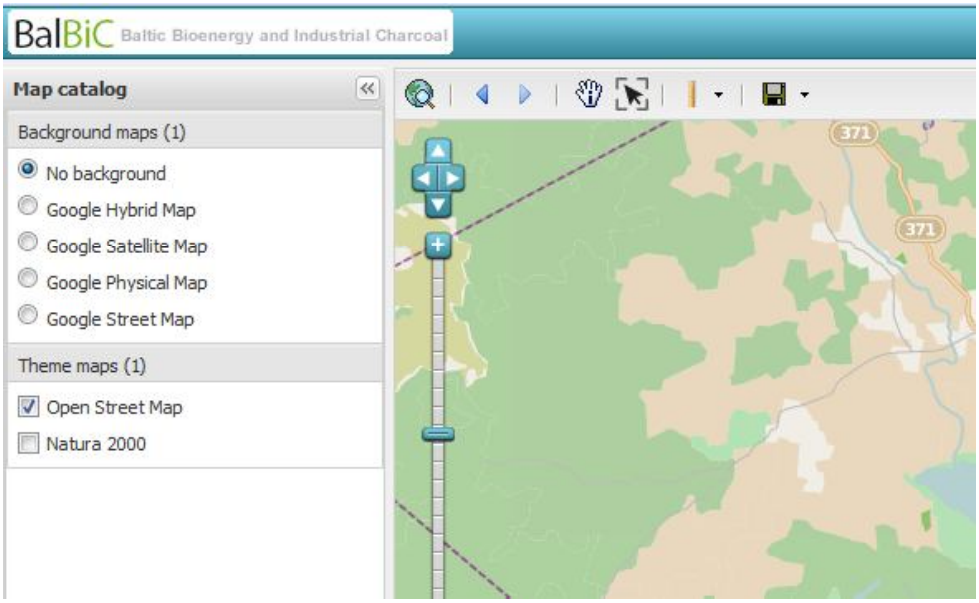
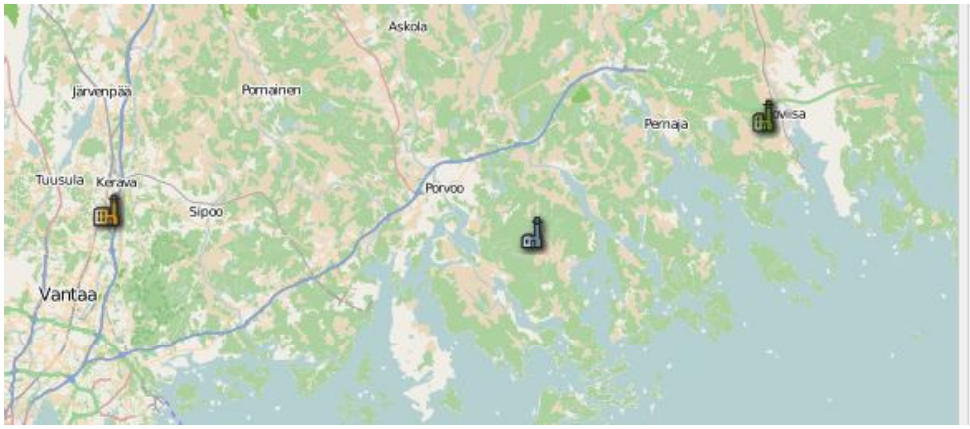
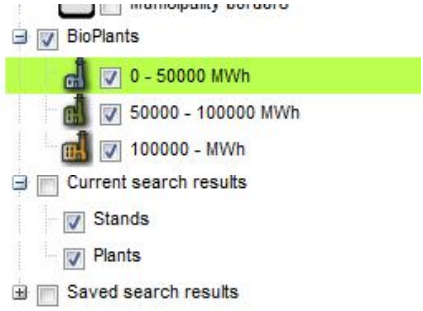


Background and theme maps

Basic tools: Zoom, pan, selection..





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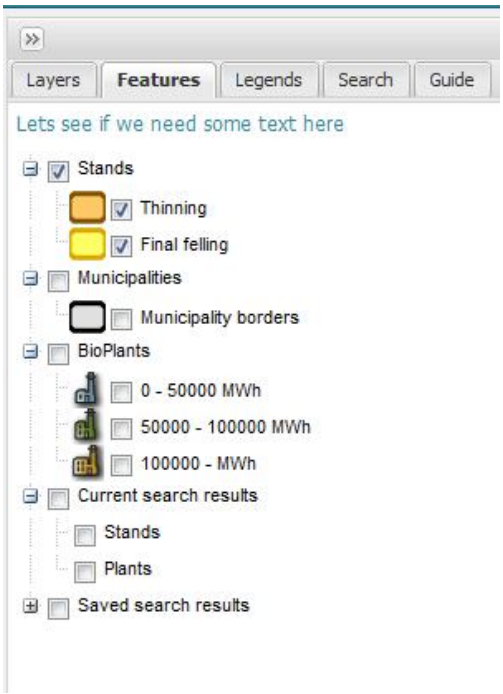
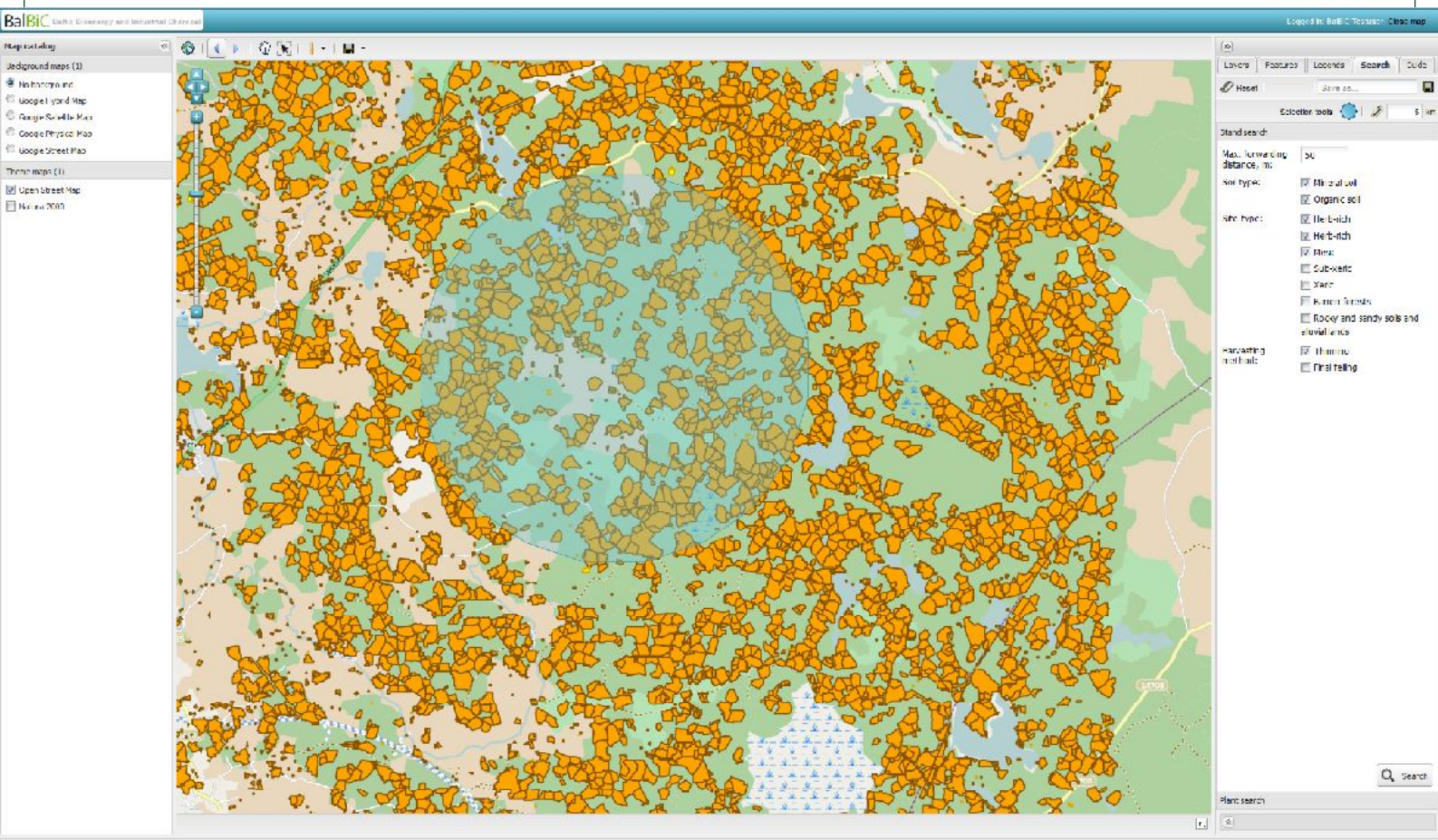
Features:
Stands, municipalities, plants
Search results




BalBiC
Logged in: BalBiC Testuser Close map
Map switcher
Background maps (1)
No background
Google Hybrid Map
Google Satellite Map
Google Physical Map
Google Street Map
Theme maps (1)
Open Street Map
Natura 2000
Layers
Features
Legends
Search
Guide
Reset
Save as...
Selection tools
Stand search
Max. harvesting distance, m:
50
Soil types:
Mineral soil
Organic soil
Site types:
Herb-rich
Herb-rich
Mesic
Sub-xeric
Xeric
Rocky and sandy soils and alluvial sites
Harvesting methods:
Thinning
Final felling
Search
Plant search

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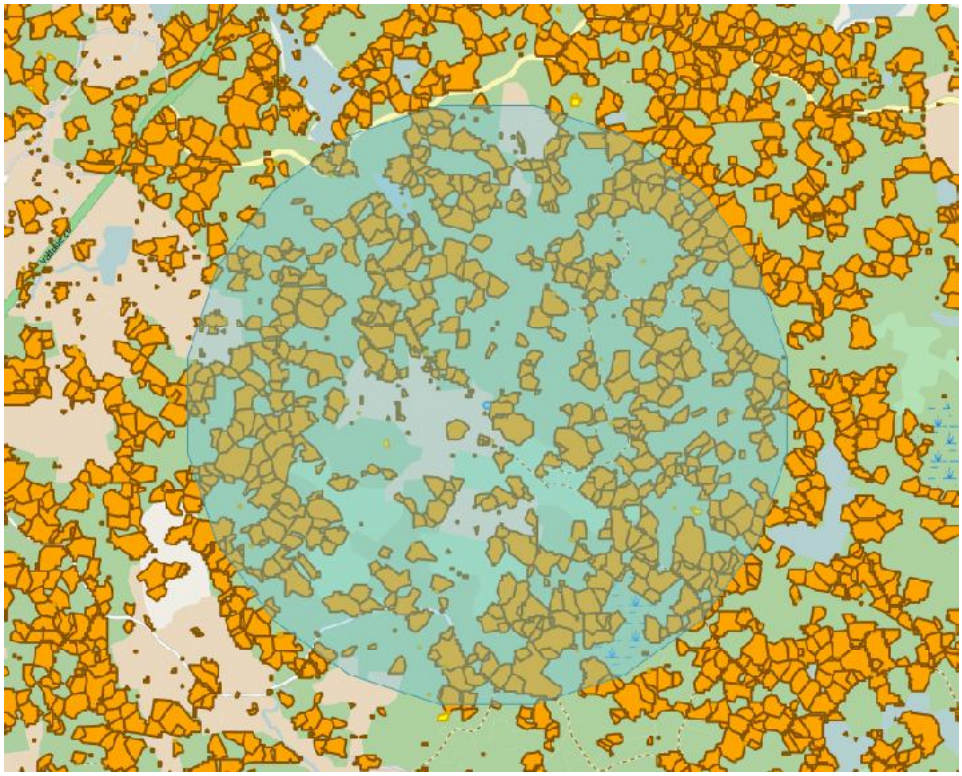
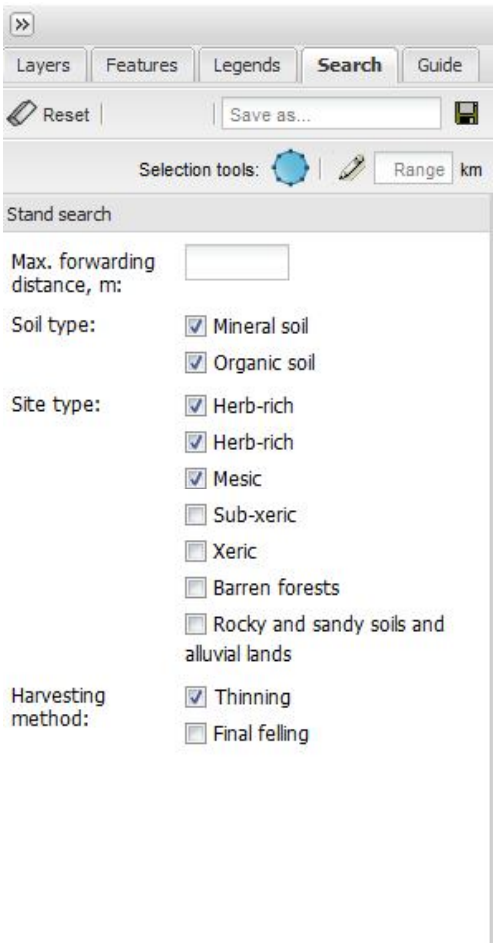
GIS functionality to make queries of the biomass database





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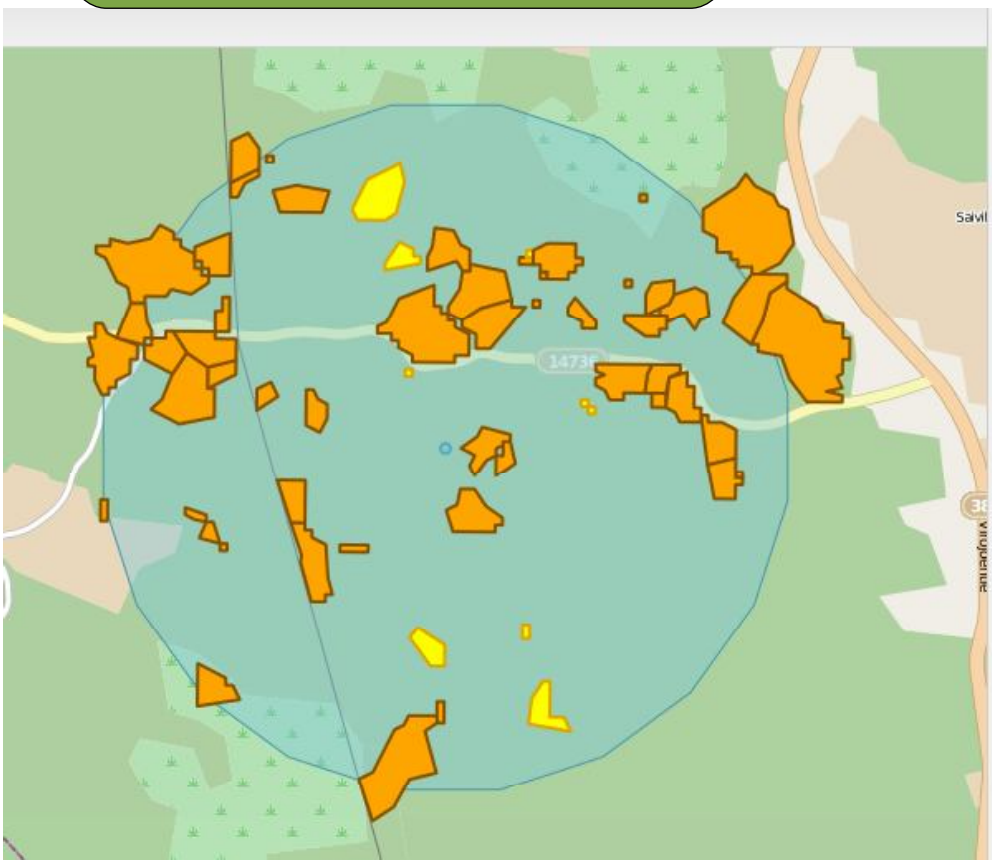
Biomass sources based on search criteria: Distance, distance to road, Soil & site type, Harvesting method



Layers | Features | Legends | **Search** | Guide

Reset | Save as...

Selection tools: 2 km

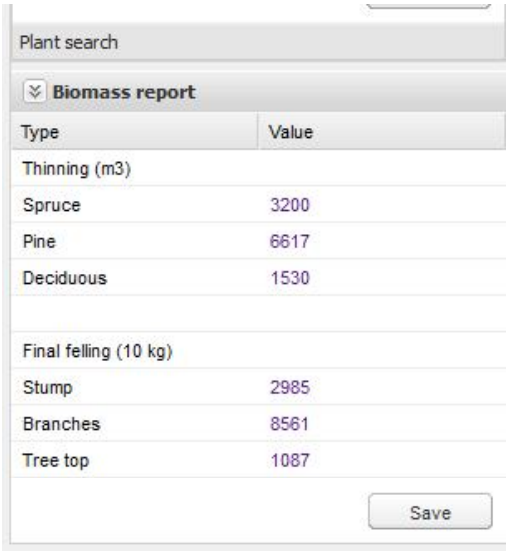
Stand search

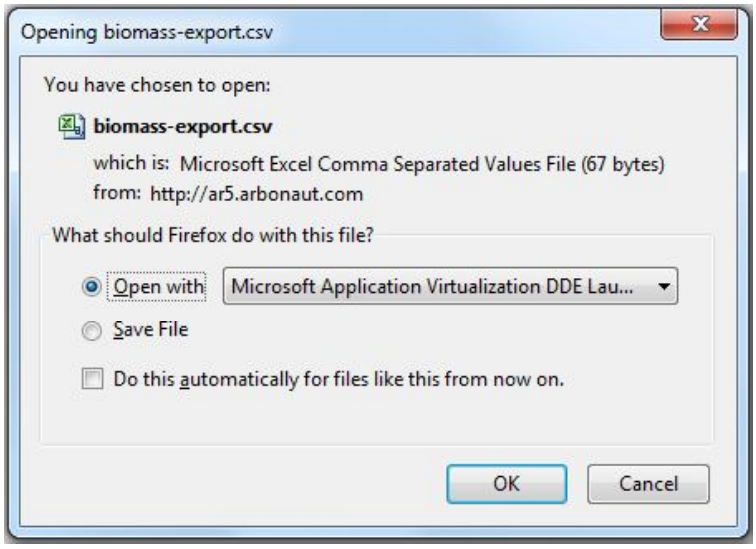
Max. forwarding distance, m: 200

Soil type:
- [x] Mineral soil
- [ ] Organic soil

Site type:
- [x] Herb-rich
- [x] Herb-rich
- [x] Mesic
- [ ] Sub-xeric
- [ ] Xeric
- [ ] Barren forests
- [ ] Rocky and sandy soils and alluvial lands

Harvesting method:
- [x] Thinning
- [x] Final felling





Biomass report of the search result

Thank you!