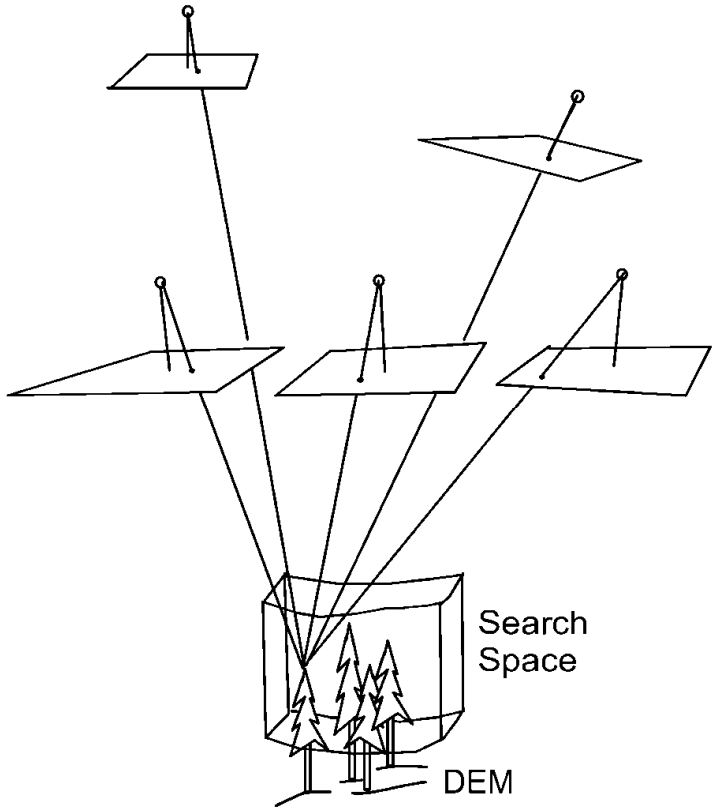
Timo Tokola, Kehittyvä metsäenergia -seminaari 16.12.2010

Paikkatietojärjestelmien hyödyntäminen metsäenergian hankinnassa

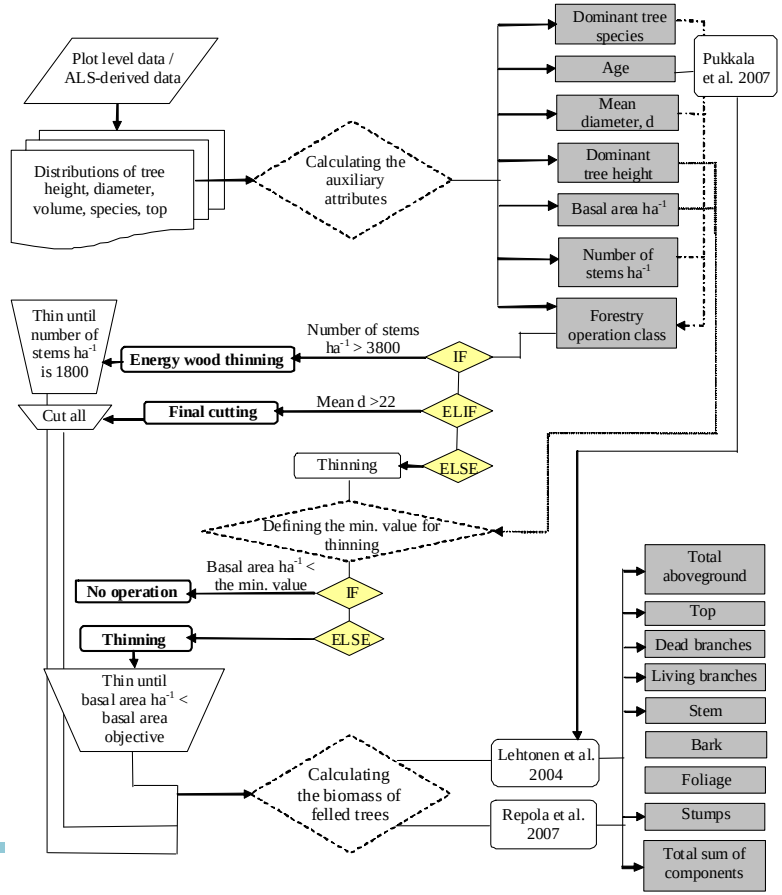
ITÄ-SUOMEN YLIOPISTO

Kartoitusta taivaalta



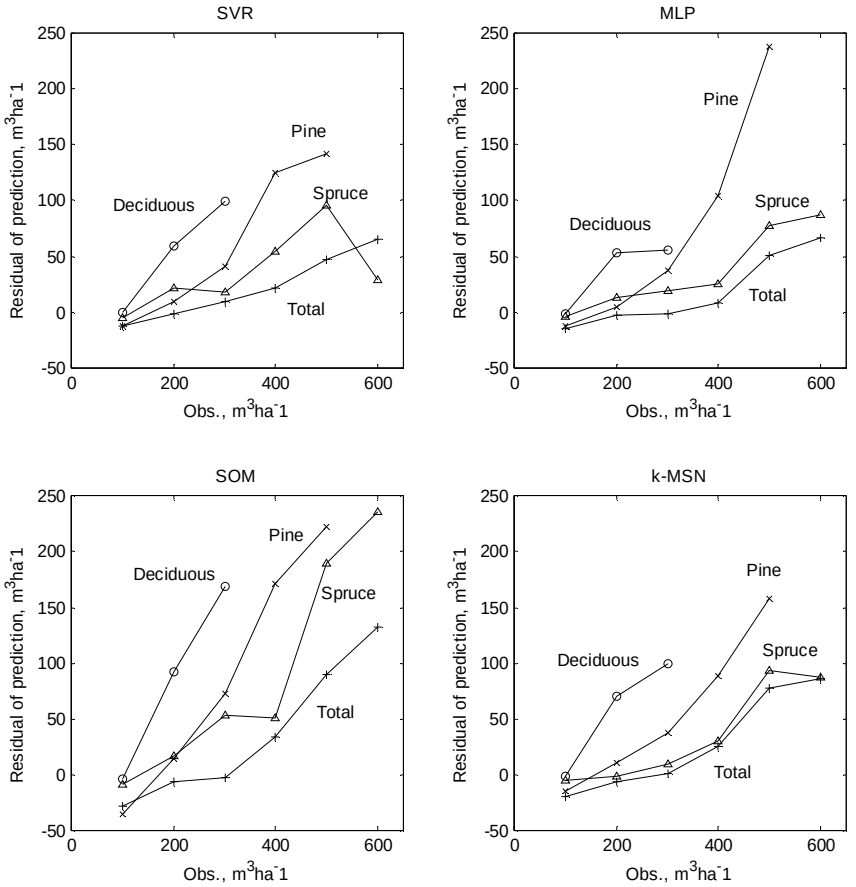
Laserin soveltaminen nuorempien energia puumetsien ja uudistushakkuukohteiden hakkuutähdebioenergian kuvaamiseen

- The approach used for assigning the plots to operation classes resulted in moderate accuracies (75%).
- Predicting the biomass components removed in forest treatments, with RMSEs of 33.0-69.4% in the case of final cutting and 71.0-228.0% in the case of thinning.
- Kotamaa, E., Tokola, T., Maltamo, M., Packalén, P., Kurttila, M. and Mäkinen, A. 2010. Integration of remote sensing-based bioenergy inventory data and optimal bucking for standlevel decision making. European Journal of Forest Research 129 (5):875-886.



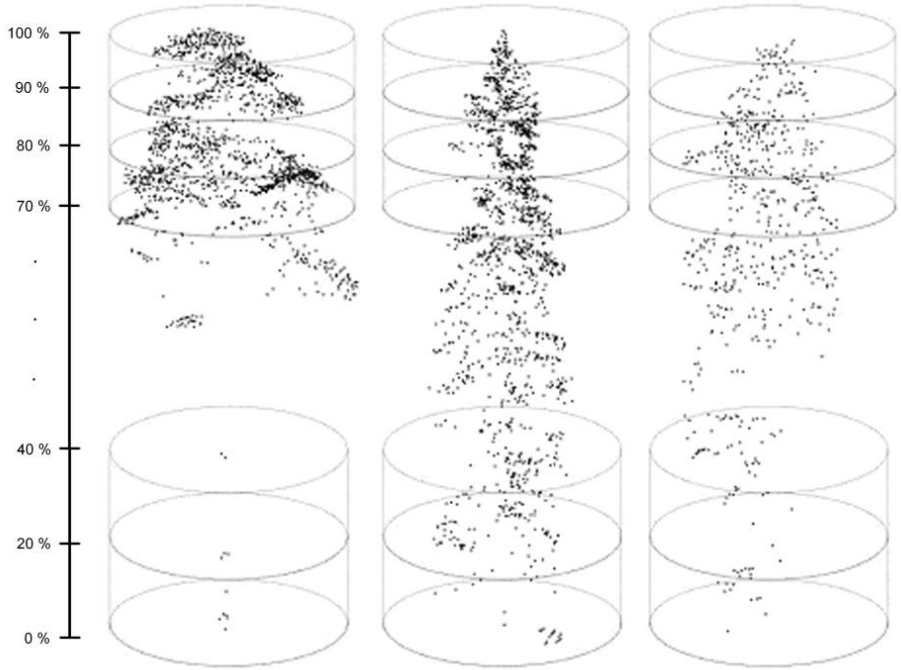
Neurolaskennan soveltaminen laseraineiston muuttujien valinnassa

- Representative dataset is the most important factor
- Volume classes with small number of field data are unreliable.
- K-MSN&SVR stable
- Niska, H., Skön, J.P., Packalén, P., Tokola, T., Maltamo, M. and Kolehmainen, M. 2010. Neural Networks for the Prediction of Species-Specific Plot Volumes Using Airborne Laser Scanning and Aerial Photographs. IEEE Transactions on Geoscience and Remote Sensing 48 (3): 1076-1085.



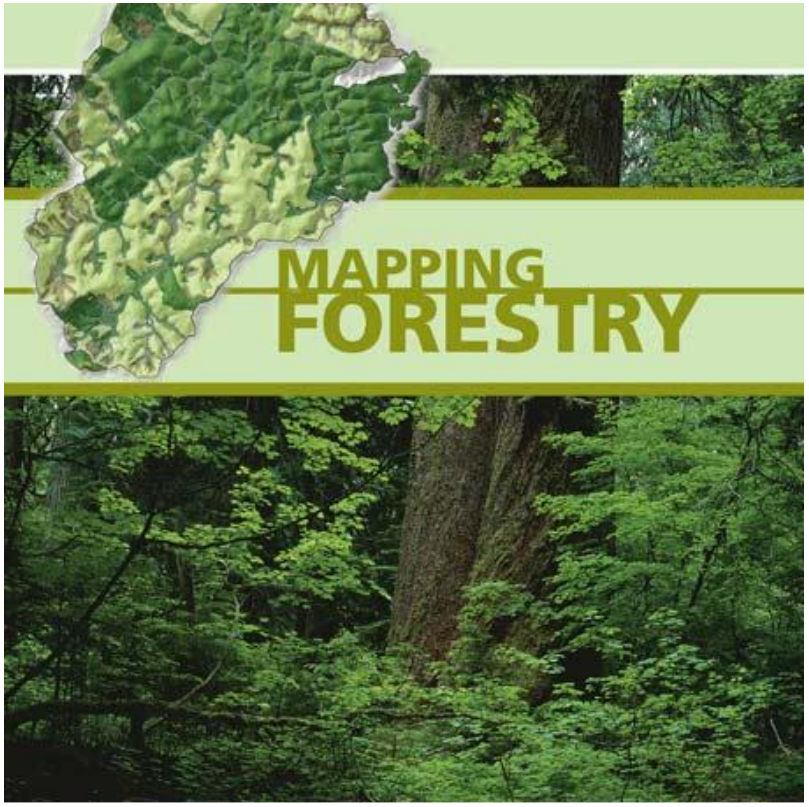
Laseraineisto lähtötietoina ilmasto adaptiivisiin prosessipohjaisiin kasvumalleihin

- New concept for growth estimation



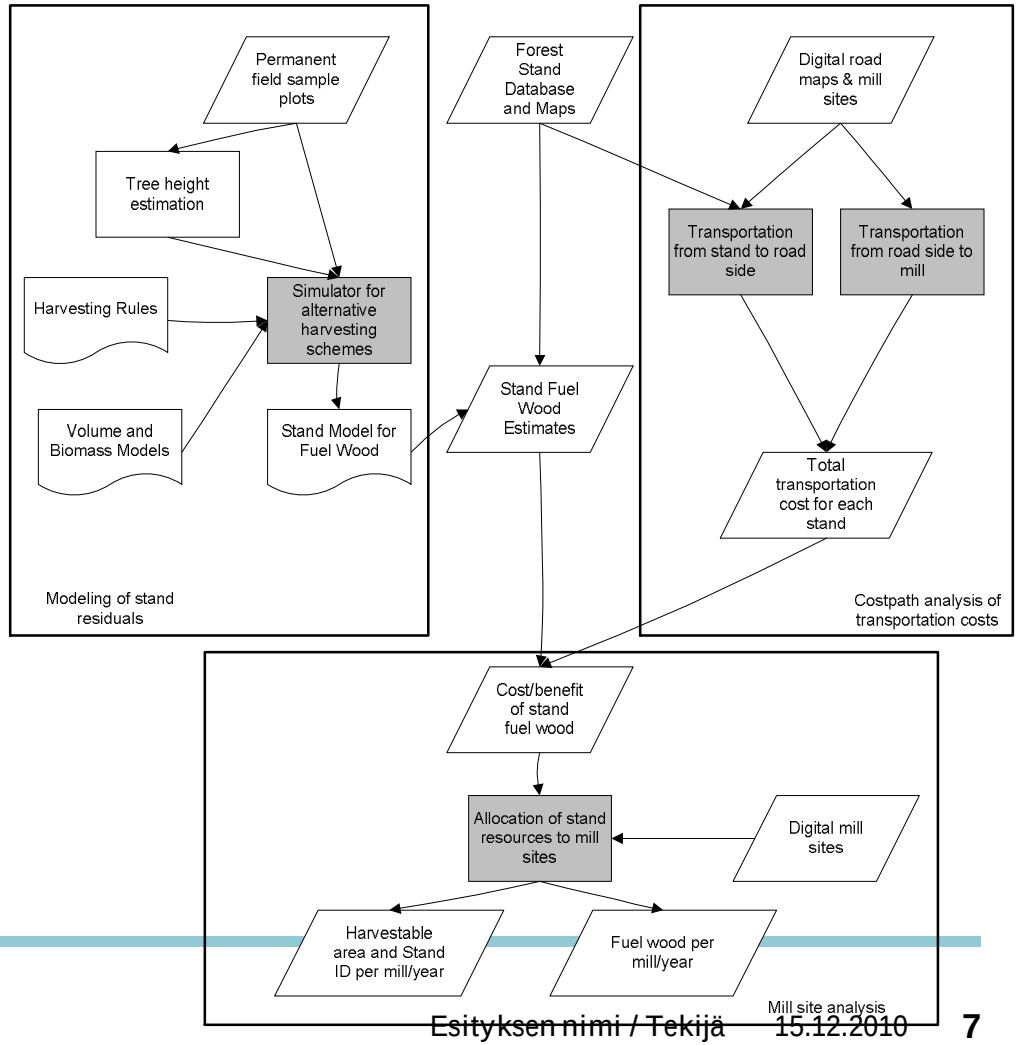
- Härkönen, S., Tokola, T., Vauhkonen, J., Packalén, P., Mäkelä, A. Linking airborne LiDAR data to a climate-adaptive forest growth model. Submitted to Remote Sensing of Environment.
- Vauhkonen, J., Korpela, I., Maltamo, M. & Tokola, T. 2010. Imputation of single-tree attributes using airborne laser scanning-based height, intensity, and alpha shape metrics. Remote Sensing of Environment 114(6): 1263-1276.

Potentiaalin alueellista GIS mallinnusta



Energy wood potential – Comparison of empirical and theoretical diameter distribution

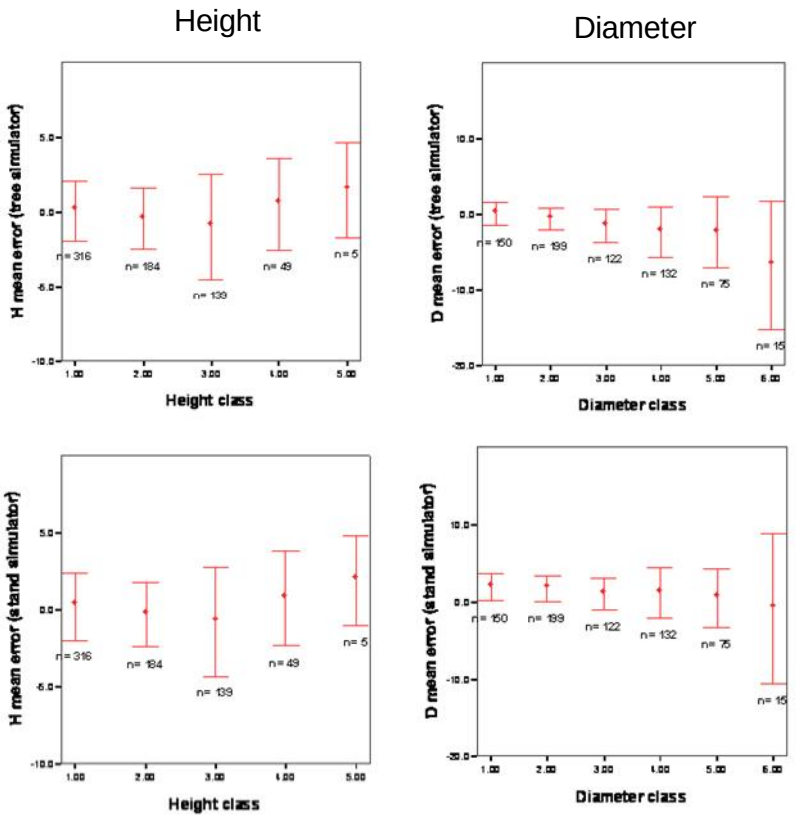
- Potential higher that using traditional methods
- The amount of residual wood was 24% higher in permanent sample plots than estimated using method used in Pasanen et al. (1997).



- Vainio, P., Tokola, T., Palander, T. and Kangas, 2009. A GIS-based stand management system for estimating local energy wood supplies. Biomass and Bioenergy 33:1278 – 1288

Simulaattorin vaihtoehtoiset malliketjut – puut vai puujoukot?

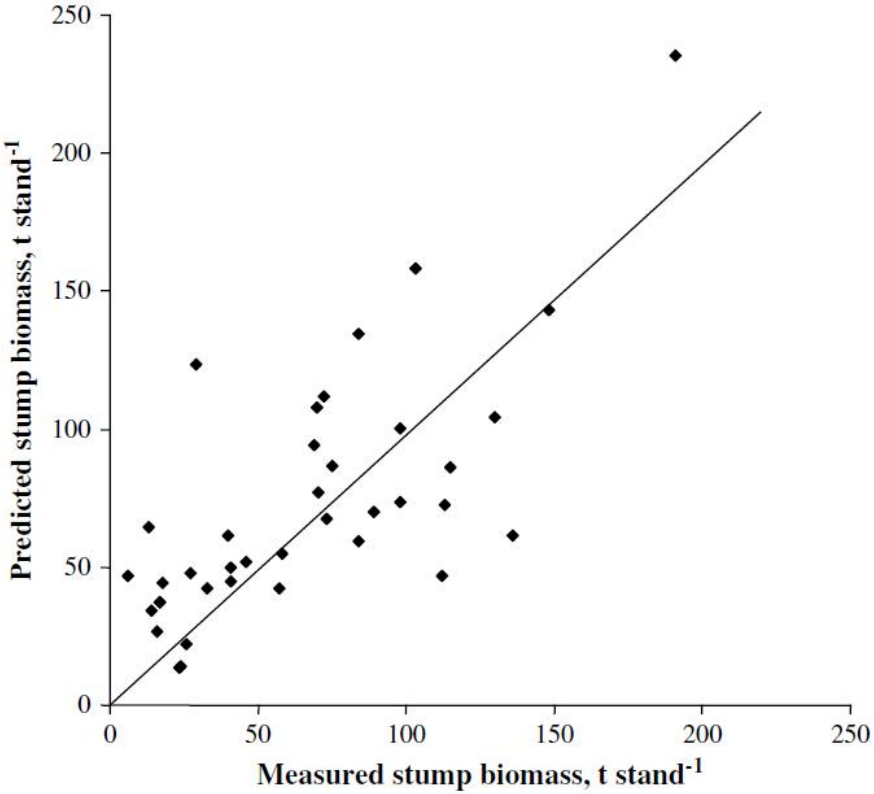
- The combined simulator turned out to be the least biased of the tested simulators for D13, while the V and H were estimated least biased with the tree simulator.
- Mortality models useful only for scenario modeling
- Härkönen, S., Mäkinen, A., Tokola, T., Rasinmäki, J. Kalliovirta, J. 2010. Evaluation of forest growth simulators with NFI permanent sample plot data from Finland. Forest Ecology and Management 259 (3):573-582.



Juuribiomassa ennustus hakkuukoneen tiedoista

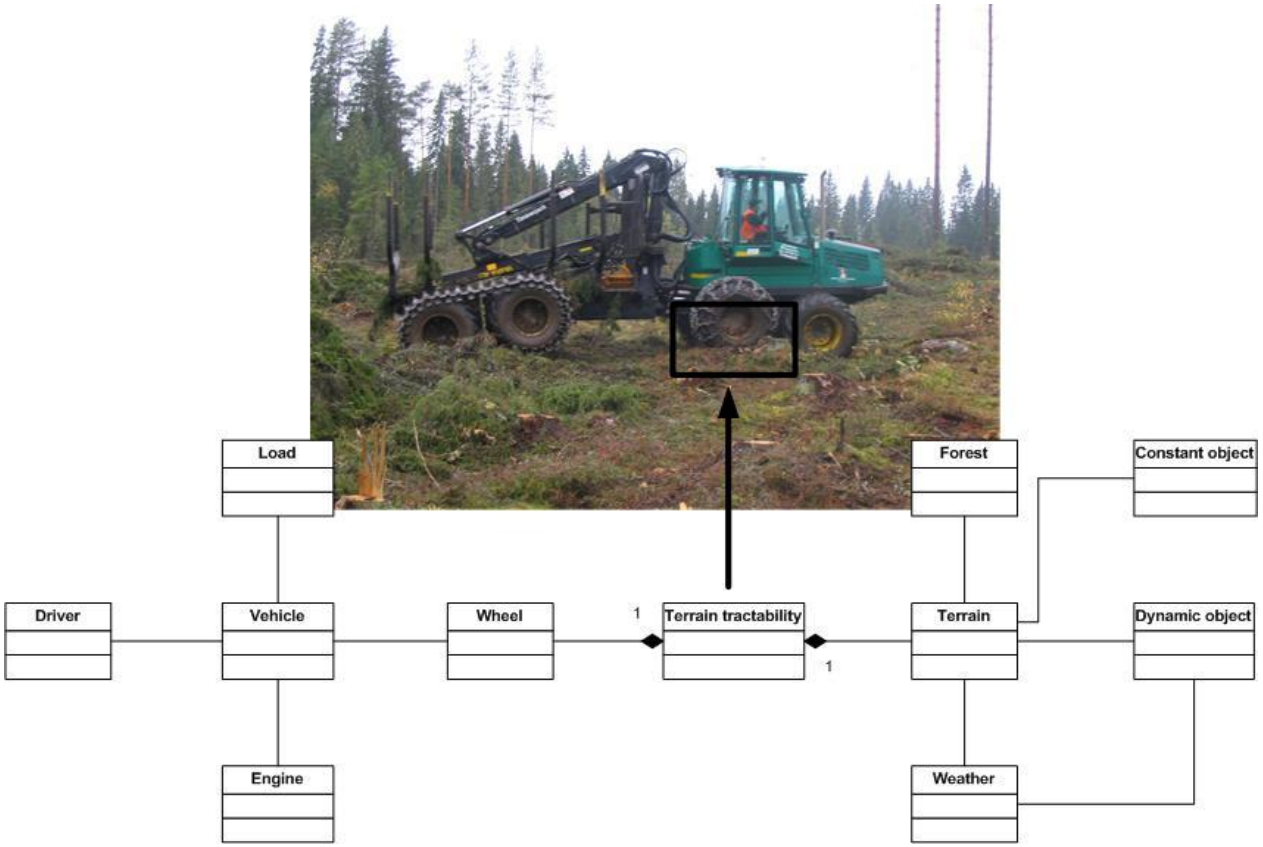
Hakkuukone aineistoon perustuva bioenergia-komponenttien ennustus

- The independent variables of the best fit model were the cumulative sum of biometric biomass estimates, and the cumulative sum of the square of the diameter at 30% relative height.
- The R^2 value obtained was 60% which was higher than the R^2 values of the stump biomass model (52%).

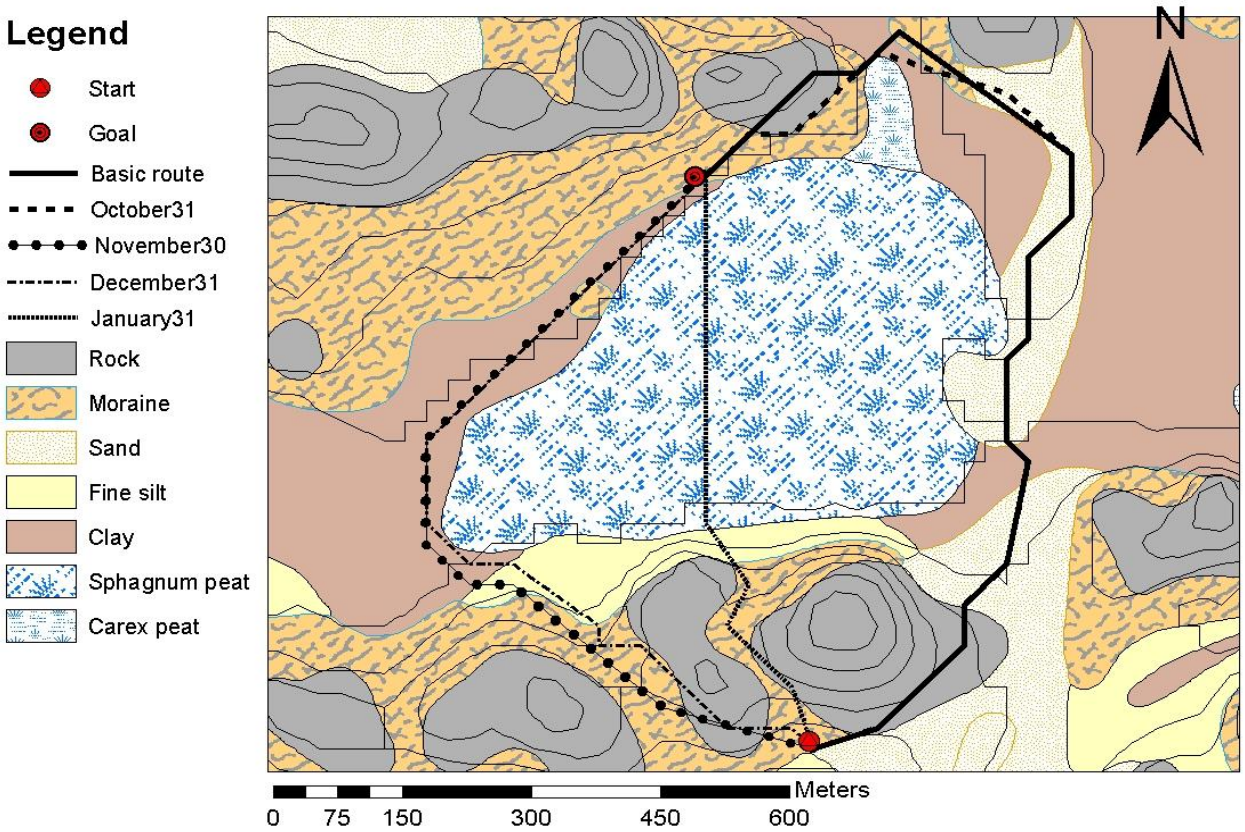


- Palander, T., Vesa, L., Tokola, T., Pihlaja, P., Ovaskainen, H. 2009. Modelling the stump biomass of stands for energy production using a harvester data management system. Biosystems Engineering 102:69 – 74.

Kulkukelpoisuus ja korjattavuus



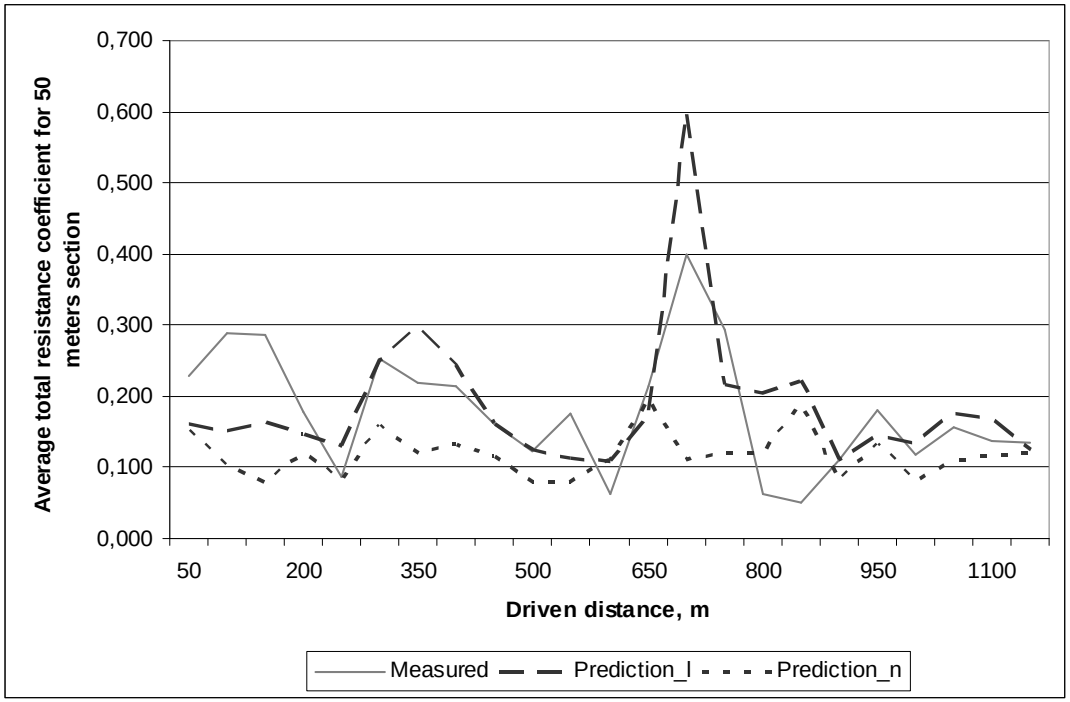
Optimal route during winter 2002-2003



Suvinen, A. Tokola, T. and Saarilahti, M. 2009. Terrain trafficability prediction with GIS analysis. Forest Science 55(5):433-442.

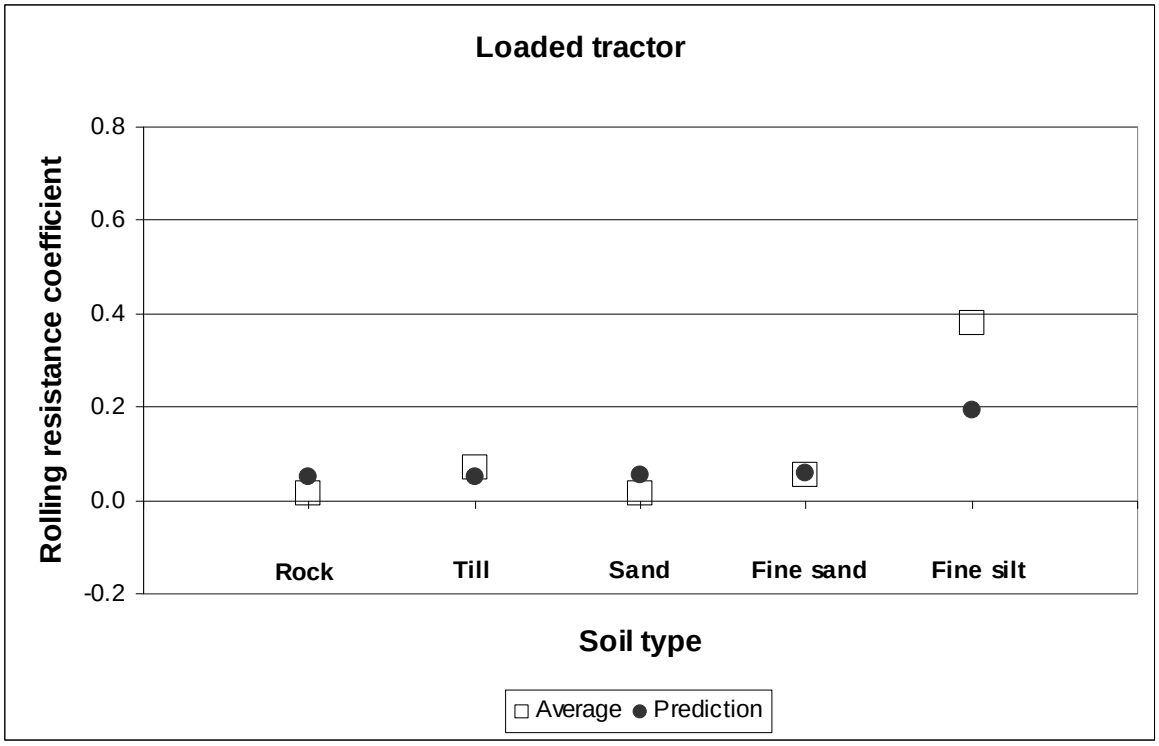
Use of alternative DEM - Average total resistance coefficients for a loaded tractor over 50 m sections

The solid grey line shows the measured values, the dotted line (Prediction_n) values predicted from the 25x25 m DEM and the dashed line (Prediction_l) values predicted from the more accurate terrain profile.



Predicted resistance by soil quality

Average measured rolling resistance values (squares) on each soil type for a loaded forwarder, together with predicted values (circles) based on a digital soil type map and the rolling resistance coefficients



Yhteenveto

1. Kartoitusta – Laserkeilausta eri menetelmillä
2. Kartoitus – Kasvuennusteisiin uusia tuulia
3. Alueellinen potentiaalin kartoitus – Laskentamenetelmällä lisää tarkkuutta
4. Hakkuukoneaineistojen käyttö – tehostuu ja antaa lisätietoa
5. Kulkukelpoisuus ennustus paranee – mahdollistaa paremman korjuu ajoituksen ja suunnittelun

Kiitos !

ITÄ-SUOMEN
YLIOPISTO

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