MEASURING OF WHEEL RUTS DEPTH IN FOREST TERRAIN WITH DRONE AND DIGITAL STEREO PHOTOGRAMMETRY

Tomas Nordfjell  & Rasmus Wictorsson, SLU
Purpose

The overall purpose was to develop a method for measuring ruts made by forest machines in regeneration-felled areas with a flying drone and digital photogrammetry, and to investigate the accuracy with this method.
Purpose

The overall purpose was to develop a method for measuring ruts made by forest machines in regeneration-felled areas with a flying drone and digital photogrammetry, and to investigate the accuracy with this method.

The detailed aims was to evaluate if the accuracy differs between:

i) a drone flight altitude of 60 or 120 m.
ii) ruts in the middle of an open clear-cut or close to other stands
iii) deep or shallow ruts
What is photogrammetry?
With overlapping photos, and some software it is possible to create 3D pictures, and to do measurements of heights and distances.
RESULTS
RESULTS

- The precision was in general much higher than expected. Probably better than the manual reference measurements!

- Also the higher flight altitude (120 m) gave good results
RESULTS

- The precision was the same for deep and shallow ruts

- The distance from other stands did not effect the result in this study
60 m flight altitude

120 m flight altitude
Harvesting site, 60 m flight altitude

\[ Y = 0.87 \times X + 4.93 \]

\[ R^2 = 0.83 \]
Harvesting site, 120 m flight altitude

\[ Y = 0.86X + 5.26 \]

\[ R^2 = 0.77 \]
Manual measurements are however not a good and stable reference on an ordinary harvesting site!
Manual measurements are however not a good and stable reference on an ordinary harvesting site!
Because of this, we wanted to do comparisons under more controlled conditions as well.
An agricultural field and simulated ruts done with a small excavator and three different average depths
Agricultural field 60 m flight altitude

\[ Y = 1.03 \times X - 0.91 \]

\[ R^2 = 0.99 \]
Agricultural field 120 m flight altitude

\[ Y = 1.01X - 2.38 \]
\[ R^2 = 0.99 \]
Discussion and conclusions
Even not included in this study, this method will also give more detailed results like “What is the volume of the rut” and “how have the soil been effected close beside the rut”
The only problem! Water filled ruts. Measures only down to water level
Conclusions

Even with this limitation:
I am convinced that this will be the new standard method to follow up rut formation after ordinary harvesting operations!
Thank you for listening!

Tomas Nordfjell, Professor Forest Technology
Swedish University of Agricultural Sciences
Tomas.nordfjell@slu.se
www.slu.se