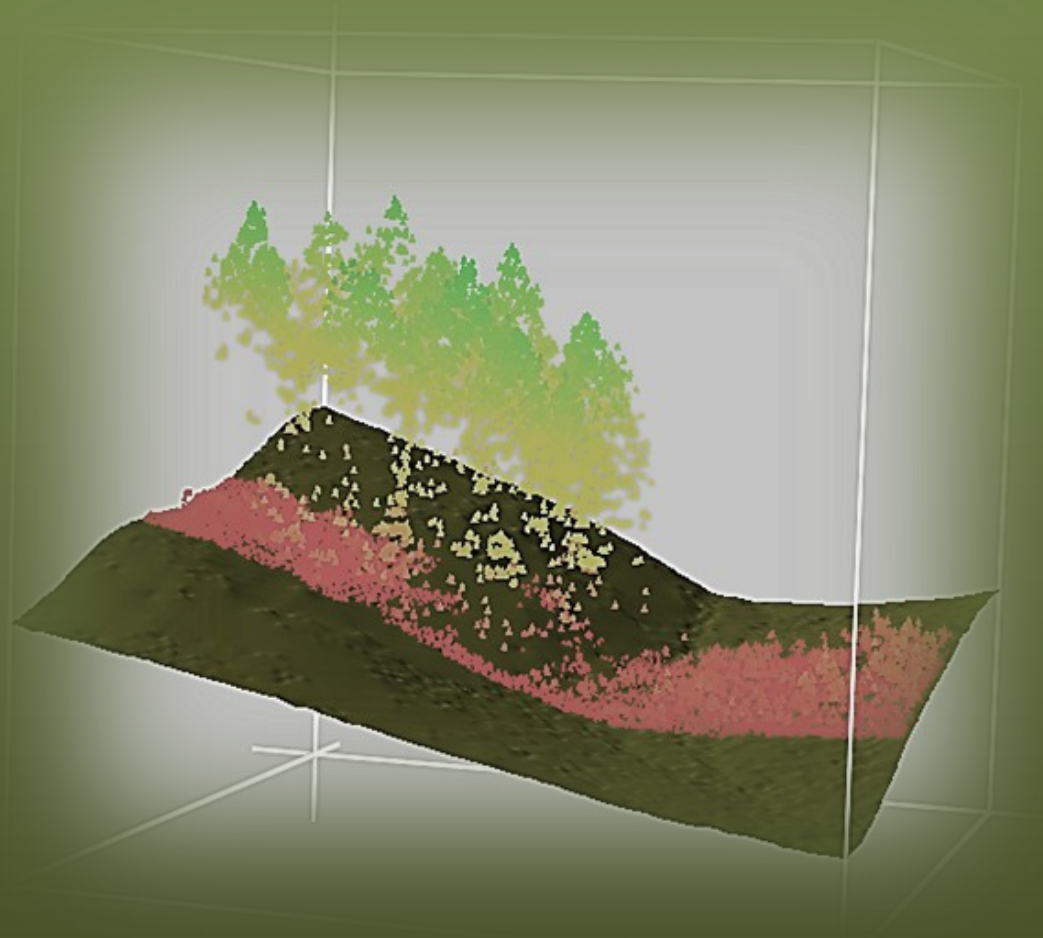
Development of a forest stand top-height model for Airborne Laser Scanning Data (ALS)



Under the project
ForseenPOMERANIA

Table of content

- Airborne Laser Scanning (ALS) got more and more priority for forestry
- LIDAR Data makes it possible to collect precise information about trees over large areas
- This study investigated the advantage and accuracy of a stand height-model and stand volume only from LIDAR data

- Introduction
- **Material and Methods**
  - Area of Investigation
  - Data collection
  - Data calculation
- Results
- Conclusion
- Sources

Germany

http://www.wikipedia.org/

Brandenburg

http://www.piratenbrandenburg.de

Beech Pl-No	21_2	21_3	21_5	111_a4	134_2	134_3	166_a3	174_c_9	183_1	183_2	3298_a5	
TopHeight (m)	35.8	35.2	36.2	15.6	25.6	28.5	22.2	35.7	30.1	31.0	27.0	
Volume (m^3/ha)	576.7	616.3	626.3	77.0	285.3	339.5	280.8	795.0	481.9	503.7	358.7	
Pine Pl-No	**63_5**	**85_2a**	**85_2b**	**210_1**	**210_2**	**150_1**	**150_2**	**150_3**	**150_4**	**150_5**	**114_3**	**114_4**
TopHeight (m)	25.4	23.1	21.8	33.7	34.0	18.8	18.2	17.6	18.2	18.5	16.7	17.7
Volume (m^3/ha)	408.3	207.8	175.5	454.0	445.0	226.8	285.3	214.8	255.0	293.3	199.6	232.2

All plots with Top-Height and Volume parameters

Collection from ground data (Measuring by hand)

- Data which measured by hand were nesessary to create the equation for the model and have a ground base to compare the calculated results
- Plots where no single tree data existed were recorded new (DBH, Height per single tree)
- All plots were georefenced with an high accuracy by using a GPS device (TOPCON - GNSS Receiver) and a tachymeter (SOKIA Set 5G)

Collection from ALS data (Measuring by plane)

- To overfly all plots, 5 different dates were necessary. Altogether 3 different laser measuring equipments were used
- The flight time is very important (no snow or rime)
- The data recieved from the ALS are the DTM 2 and the unclassified first class data

Calculation of the data from ALS

- The raw Data from ALS, DTM 2 and unclassified first class data, were processed by the “Eberswalde forestry state center of excellence” (LFE)
- To get the crown height model, the DTM pixel values are subtracted from the DSM pixel values
- Calculated Parameters by the Software FUSION: Elev. P01, …, Elev. P99; Hmax; Hmean; Cc; Elev. 2m

Calculation of the data from ALS and Ground together

- The assessment of the correlation between the terrestrial characteristics and the laser data, the software IBM SPSS Statistics 20 was used
- The calculation was a multiple linear regression with step wise variable selection

Calculated Models and their accuracies for the different spiecies

Beech (Calculated Model and the accuracy)

Tree species	Forest Parameter	Model	R^2	BIAS
Beech	Height	**2.208+1.025*Elev.P80**	0.994	-0.125 m
Beech	Volume	**-427.903+31.868*Elev.P90**	0.895	0.122 m³/ha

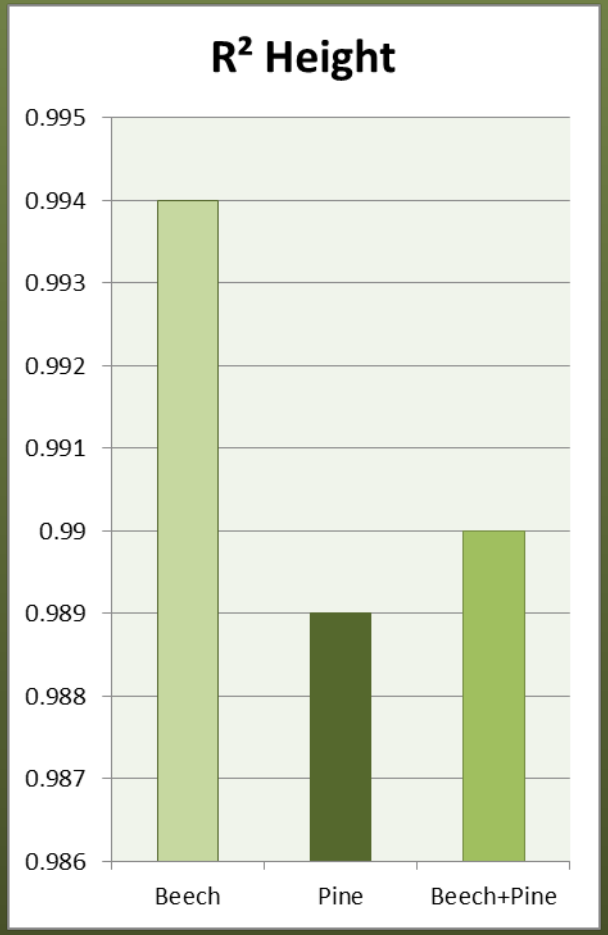
Pine (Calculated Model and the accuracy)

Tree species	Forest Parameter	Model	R^2	BIAS
Pine	Height	**1.721+1.149*Elev.P60**	0.989	-0.060 m
Pine	Volume	**-104.247+58.014*Elev.P20 -21.844*Elev.P99**	0.879	0.152 m³/ha

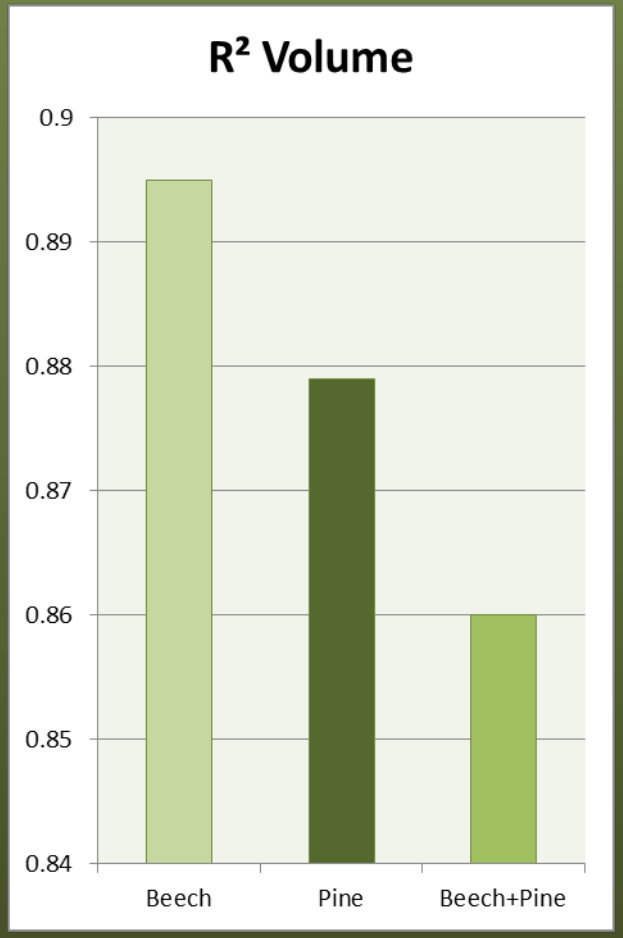
Beech and Pine (Calculated Model and the accuracy)

Tree species	Forest Parameter	Model	R^2	BIAS
Beech + Pine	Height	**2.580+1.021*Elev.P80**	0.990	0.250 m
Beech + Pine	Volume	**-318.886+22.118* Elev.P30+364.278*Cc**	0.860	0.120 m³/ha

Comparison of R^2



Comparison of the different R^2 values regarding to the height



Comparisson of the different R^2 values regarding to the volume

- With the connection of ALS and forest inventory data, statements about forest parameters can be made in the future
- Currently the high costs of ALS are one of the most important reasons for the low accessibility of LIDAR data
- Because of the high accuracy, the useful information and the comparatively simple automation of the processing of the data the area should be investigated further on

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Thank you for your kind attention

Questions ?