

GIS and remote sensing based planning of forest regeneration



*Scientific conference “Industrial Scale Bioeconomy and its Requirements”
14–16 June 2017 in Lappeenranta, Finland*

AIM OF THIS STUDY



Aim of this study is to improve practice of forest site preparation in order to minimize tree damage and cost of thinning of forest stand.

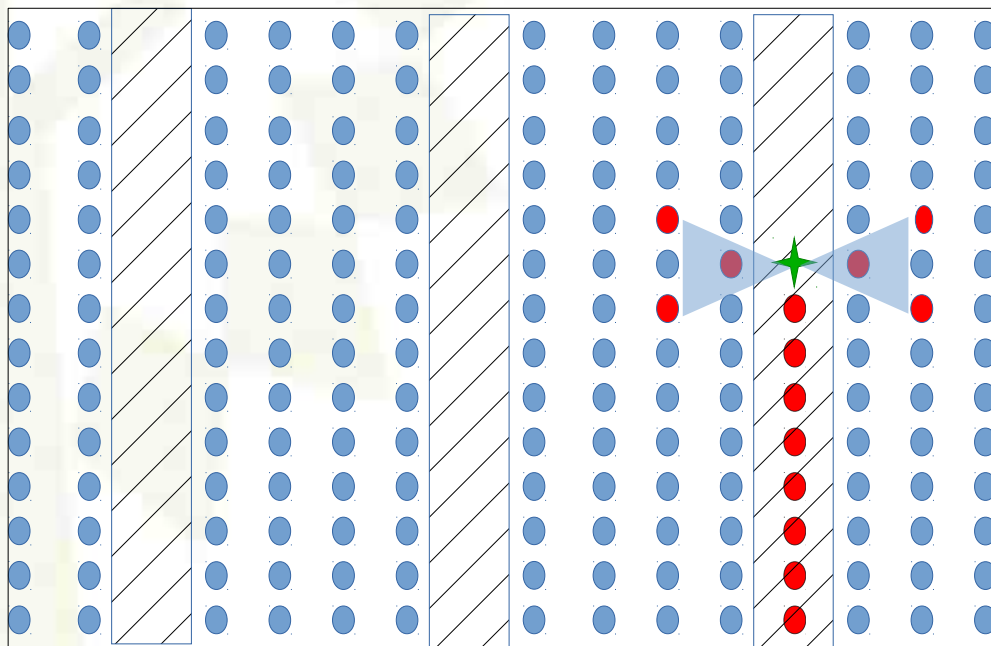
Tasks:

- Identify typical characteristics of forest site preparation;
- Evaluate productivity depending on different forest growing conditions;
- Create schemes of technological corridors for commercial thinning;
- Improve scheme of FSP according to scheme of technical corridors for commercial thinning;
- Evaluate changes in count of manoeuvrers and total distance travelled.

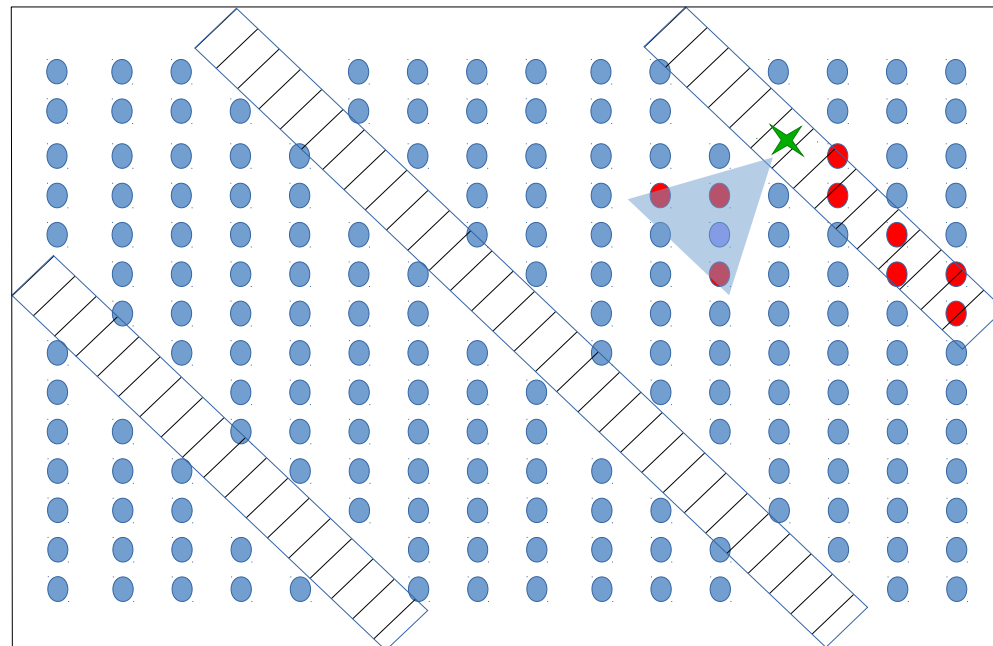
TYPICAL SCHEMES OF FOREST SITE PREPARATION



Technical corridors
parallel to forest site
preparation



Technical corridors in 45°
degree against forest site
preparation



CONFIGURATION OF FOREST STANDS

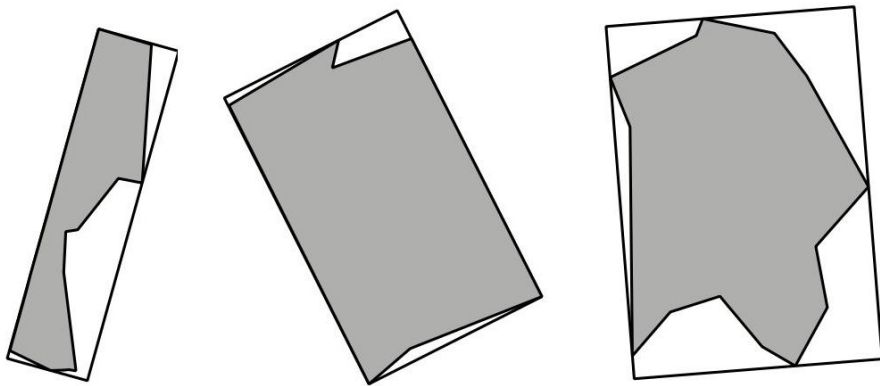


Outstretchiness

0.24

0.6

0.7

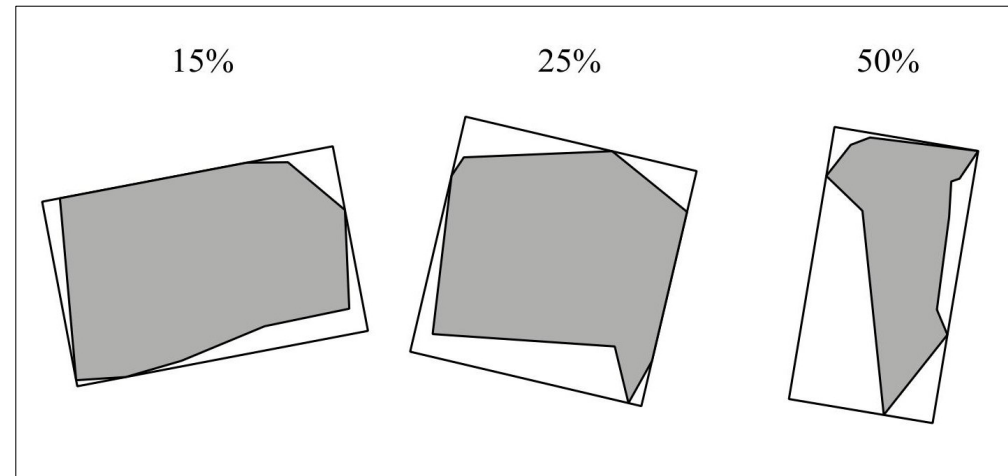


Complexity

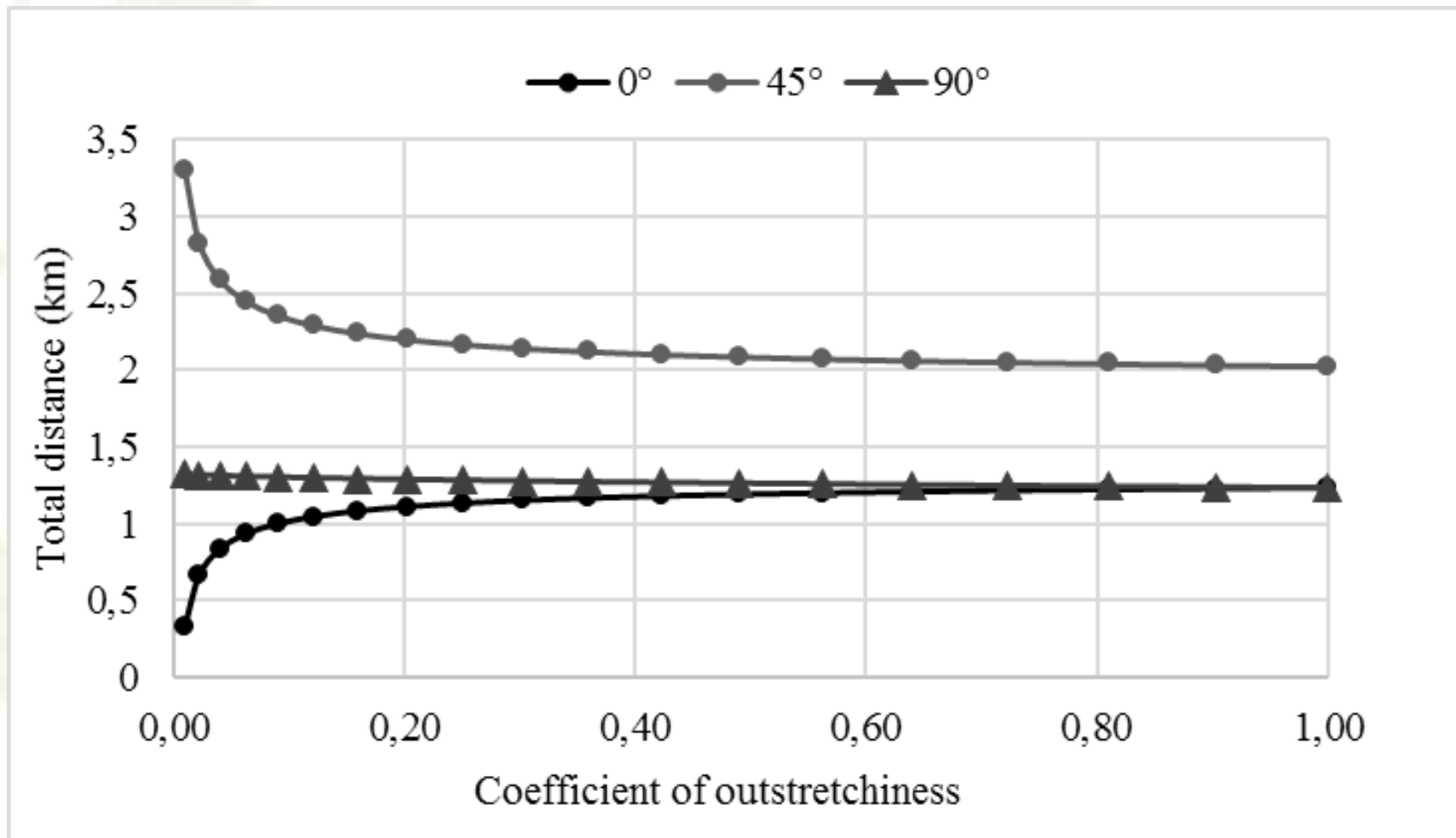
15%

25%

50%



TRAVELLED DISTANCE OF FSP MACHINERY AGAINST OUTSTRETCHINESS OF FOREST STAND



TURNING DISTANCE OF FSP MACHINERY IN DIFFERENT FOREST TYPES



Forest type	Average turning distance (m)	Average turning count (count ha⁻¹)	Total turning distance (km ha⁻¹)	Total area (ha)	Forest stand count
<i>Myrtillosa</i>	32	20	0.63	15.71	12
<i>Oxalidosa</i>	29	16	0.47	70.09	33
<i>Hylocomiosa</i>	27	17	0.46	16.06	11
<i>Myrtillosa mel.</i>	27	19	0.52	22.37	15
<i>Mercurialosa mel.</i>	32	12	0.37	7.82	4
Average	28	17	0.48	132.05	75

ASPECT OF FOREST STANDS



- North – south (0° - $2,5^{\circ}$; $337,5^{\circ}$ - 0° ; $157,5^{\circ}$ - $202,5^{\circ}$);
- Northeast – southwest ($22,5^{\circ}$ - $67,5^{\circ}$; $202,5^{\circ}$ - $247,5^{\circ}$);
- Southeast – northwest ($112,5^{\circ}$ - $157,5^{\circ}$; $292,5^{\circ}$ - $337,5^{\circ}$);
- West – east ($67,5^{\circ}$ - $112,5^{\circ}$; $247,5^{\circ}$ - $292,5^{\circ}$).

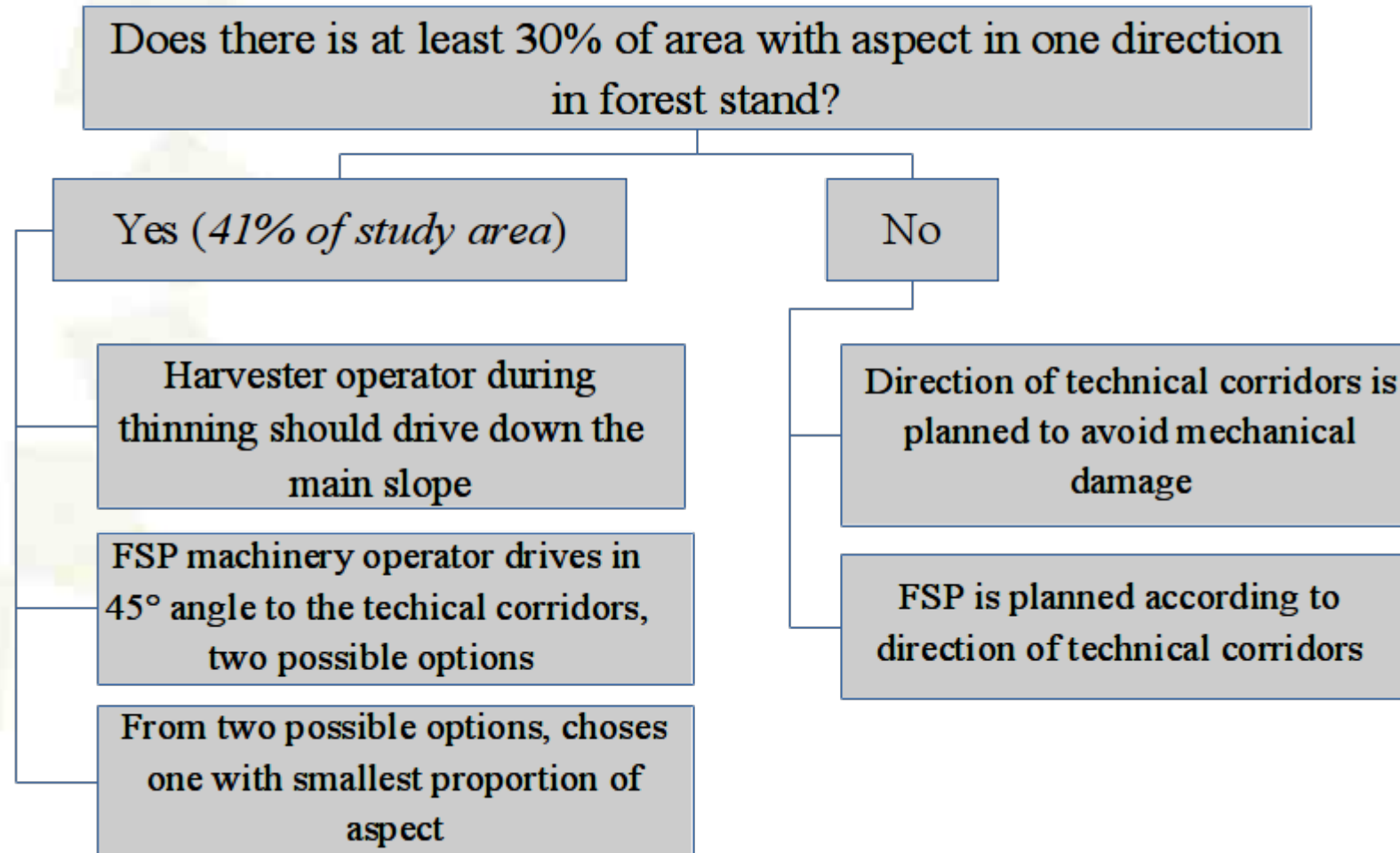
Forest stand area	Average maximal value	Average 2nd maximal value	Average 3rd maximal value	Average minimal value
Average	31,0%	25,6%	22,82%	20,5%
Minimal	25,5%	16,4%	9,0%	0,00%
Maximal	55,1%	34,0%	25,9%	24,4%
Stdev	5,9%	2,4%	2,6%	3,8%

SLOPE OF FOREST STANDS



Slope	Count of forest stands	Proportion %	Stdev
0°-3°	88	81,48%	1,93
4°-6°	15	13,89%	3,92
7°-9°	4	3,70%	-
19°	1	0,93%	-

RECOMMENDATIONS FOR FSP PLANNING



SECINĀJUMI



- FSP usually occurs in the same direction as longitudinal axis of forest stand parcel without taking into account terrain. Travelled distance of FSP and consumed time can be modelled in regularly shaped forest stands. Forest type doesn't influence total travelled distance of FSP machinery.
- Direction of FSP machinery to the longitudinal axis of forest stand has significant influence on productivity and by changing direction, costs of FSP may rise. To accurately calculate additional costs, empirical data about FSP machinery speed and fuel consumption is needed.
- Before terrain data are included into planning of FSP, different methods for detection of groundwater movement and wet areas should be analysed, to better evaluate areas with higher risk to disturbances.

THANK YOU!

Research was implemented in Latvian State Forest Research Institute “Silava” (LSFRI Silava) within the scope of memorandum between JSC “Latvia state forests” and LSFRI Silava from October 11, 2011 “On cooperation in scientific research”.
