

Metadata

Description of research data

Item	Description	Responsible
<i>Name of the data / code</i>	The dataset for drill-based site preparation (planting spot quality, seedling vitality, and seedling height)	Author
<i>Author & ORCID</i>	Kemppainen, Kalle ^{1,2} , ORCID 0009-0000-6184-8812 Kärhä, Kalle ¹ , ORCID 0000-0002-8455-2974 Tarvainen, Eetu ¹	Author
<i>Authors' affiliation(s)</i>	¹ School of Forest Sciences, University of Eastern Finland, Yliopistokatu 7, FI-80101 Joensuu, Finland (https://ror.org/00cyydd11) ² Natural Resources Institute Finland, Yliopistokatu 6, FI-80100 Joensuu, Finland (https://ror.org/02hb7bm88)	Author
<i>Owner of the material</i>	Kemppainen, Kalle ^{1,2} , ORCID 0009-0000-6184-8812 Kärhä, Kalle ¹ , ORCID 0000-0002-8455-2974 Tarvainen, Eetu ¹	Author
<i>Publisher</i>	Zenodo (after publication)	Author
<i>Funder</i>	University of Eastern Finland (https://ror.org/00cyydd11), Natural Resources Institute Finland (https://ror.org/02hb7bm88).	Author
<i>Description</i>	Five experimental study sites were established in state-owned forest regeneration areas in eastern Finland (27°53'58"E–28°06'58"E, 63°44'25"N–63°48'06"N). These sites were prepared using a drill-based device mounted on a crawler excavator during the 2022 growing season. The study sites were manually planted with Norway spruce (<i>Picea abies</i> (L.) Karst.) and Scots pine (<i>Pinus sylvestris</i> L.) seedlings after site preparation. Manual planting was carried out in early, mid, and late summer for Norway spruce, and in early and late summer for Scots pine.	Author
<i>Methods</i>	The data was collected through field measurements in 2022, 2023, and 2024. The aim was to investigate the quality of drill-based site preparation and the early performance of Norway spruce (<i>Picea abies</i> (L.) Karst.) and Scots pine (<i>Pinus sylvestris</i> L.) seedlings planted in different seasons on five mineral soil stands. The first measurements conducted in 2022 focused on measuring the diameter and depth (cm) of all planting spots (N = 4120). Moreover, the quality of each planting spot was visually evaluated and classified as good, satisfactory, or poor. Follow-up measurements carried out in 2023 and 2024 focused on seedling vitality and height within 60 permanent circular sample plots (r = 5.64 m), which were systematically placed on the study sites. In each measurement, additional spot- and seedling-specific notes were documented. Such remarks included observations of potential factors with negative effects on planting spot quality, such as roots, stumps, stones, and logging residues within the planting spots. Note that seedlings and planting spots were not tracked individually during the follow-up measurements (2023–2024). Further details are provided in Kemppainen et al. (2026).	Author
<i>Variables</i>	See Appendix 1 below and Kemppainen et al. (2026) for detailed description of variables.	Author
<i>Author keywords</i>	mechanical site preparation, drill-based site preparation, forest regeneration, conifer seedlings, manual planting, forest regeneration success	Author
<i>Vocabulary keywords (community standard)</i>	-	Author
<i>Discipline</i>	Forest science	Archive/Repository/Publisher
<i>Type of material</i>	Research data	Author
<i>Language</i>	eng	Author
<i>Time range covered</i>	2022-05-30 – 2024-06-12	Author
<i>Geographic region</i>	FIN (27°53'58"–28°06'58" E, 63°44'25"–63°48'06" N).	Author
<i>Version</i>	Version 1	Author
<i>File format(s)</i>	.csv	Author

Availability of the materials (open, embargo, registration, limited, registration required)	Open. The data and code are available upon request from Kalle Kemppainen or through the open research repository (Zenodo).	Author
Justification for access restrictions	-	Author
Licence	CC BY 4.0	Author
Connections with other research materials	-	Author
Access to the connected research materials	-	Author
Codes only: hardware/software requirements for running the code	-	Author
Connections to other products of research	Kemppainen et al. (2026)	Author
Personal data	No.	Author
Confidential or secret data	No.	Author
Publication date	26.6.2026 (Zenodo)	Archive/Repository/Publisher
Preservation policy	Permanent	Author
Permanent identifier (PID)	https://doi.org/10.5281/zenodo.20917313	Archive/Repository/Publisher

References

Kemppainen K, Miina J, Tarvainen E, Kankaanhuhta V, Laitila J, Peltola H, Strandström M, Kärhä K (2026) Quality of drill-based site preparation and early performance of Norway spruce and Scots pine seedlings planted in different seasons. *Silva Fenn* 60, article id 26011. <https://doi.org/10.14214/sf.26011>.

Appendix 1

Measurement 2022

Variable	Type of variable	Clarification
site_id	Categorical	1 = 1. site (Norway spruce), 2 = 2. site (Norway spruce), 3 = 3. site (Scots pine), 4 = 4. site (Scots pine), 5 = 5. site (Scots pine).
spot_id	Categorical	Order number of the measured site preparation spot in the study site.
tree_species	Categorical	Planted tree species; 1 = Norway spruce seedlings, 2 = Scots pine seedlings.
site_type ^a	Categorical	1 = sub-xeric heath (<i>Vaccinium-vitis-idaea</i> type), 2 = mesic heath (<i>Vaccinium myrtillus</i> type), 3 = herb-rich heath (<i>Oxalis-Myrtillus</i> type).
season	Categorical	1 = early summer (week 22), 2 = midsummer (week 29), 3 = late summer (weeks 35 and 36).
spot_diameter	Numeric	Diameter of planting spot (cm) measured from the top of the humus layer.
spot_depth	Numeric	Depth of planting spot (cm) measured from the top of the humus layer.
spot_quality	Categorical	1 = poor, 2 = satisfactory, 3 = good.
note_dummy_1_stump	Dummy	0 = no stump, 1 = stump recorded; indicates the presence of ground or soil obstacles that reduce planting spot quality.
note_dummy_2_root	Dummy	0 = no root, 1 = root recorded; indicates the presence of ground or soil obstacles that reduce planting spot quality.
note_dummy_3_stone	Dummy	0 = no stone, 1 = stone recorded; indicates the presence of ground or soil obstacles that reduce planting spot quality.
note_dummy_4_logging_residues	Dummy	0 = no logging residues, 1 = logging residues recorded; indicates the presence of ground or soil obstacles that reduce planting spot quality.
note_dummy_5_water	Dummy	0 = no water, 1 = water recorded; indicates the presence of water within the planting spot.
note_dummy_6_humus	Dummy	0 = no humus, 1 = humus recorded; indicates the presence of humus layer residues within the planting spot.

note_dummy_7_logging_trail	Dummy	0 = no logging trail, 1 = logging trail recorded; referring to machine tracks formed during the harvesting.
----------------------------	-------	---

Measurements 2023 and 2024

Variable	Type of variable	Clarification
year	Categorical	Measurement year (2023 and 2024).
site_id	Categorical	1 = 1. site (Norway spruce), 2 = 2. site (Norway spruce), 3 = 3. site (Scots pine), 4 = 4. site (Scots pine), 5 = 5. site (Scots pine).
plot_num	Categorical	Order number of the measured sample plot in the study site.
plot_id	Categorical	Refined sample plot number linking the study site, specific sample plot, and the planting season (N = 60).
seedling_id	Categorical	Order number of the measured seedling in the sample plot.
tree_species	Categorical	1 = Norway spruce, 2 = Scots pine.
site_type ^a	Categorical	1 = sub-xeric heath (<i>Vaccinium-vitis-idaea</i> type), 2 = mesic heath (<i>Vaccinium myrtillus</i> type), 3 = herb-rich heath (<i>Oxalis-Myrtillus</i> type).
season	Categorical	1 = early summer (week 22), 2 = midsummer (week 29), 3 = late summer (weeks 35 and 36).
seedling_position	Categorical	Whether the seedling was planted in the middle (1), side (2), or outside (3) of the site preparation spot.
seedling_height	Numeric	Height of planted seedling (cm).
planting_depth	Categorical	0 = loose seedling, 1 = normal (2–3 cm), 2 = shallow (root plug shallow and/or exposed), 3 = deep (shoot clearly less visible than usual).
seedling_compaction	Categorical	0 = loose seedling, 1 = compacted, 2 = uncompacted (soil compaction around the planted seedling).
seedling_angle	Categorical	0 = loose seedling, 1 = upright (<20°), 2 = askew (20–40°), or 3 = prone (>40°).
seedling_vitality	Categorical	1 = dead, 2 = weakened, 3 = healthy.
spot_type	Categorical	1 = hole, 2 = elevated, 3 = flat.
spot_quality	Categorical	1 = poor, 2 = satisfactory, 3 = good. Note. Evaluated only in 2022 and 2023.
spot_diameter	Numeric	Diameter of site preparation spot (cm).
note_dummy_1_stump	Dummy	0 = no stump, 1 = stump recorded; indicates the presence of ground or soil obstacles that reduce planting spot quality.
note_dummy_2_root	Dummy	0 = no root, 1 = root recorded; indicates the presence of ground or soil obstacles that reduce planting spot quality.
note_dummy_3_stone	Dummy	0 = no stone, 1 = stone recorded; indicates the presence of ground or soil obstacles that reduce planting spot quality.
note_dummy_4_water	Dummy	0 = no water, 1 = water recorded; indicates the presence of water within the planting spot.
note_dummy_5_humus	Dummy	0 = no humus, 1 = humus recorded; indicates the presence of humus layer residues within the planting spot.
note_dummy_6_peat	Dummy	0 = no peat, 1 = peat recorded; indicates planting spots with peat cover and paludified areas.
note_dummy_7_tree_top_browsing	Dummy	0 = no tree-top browsing, 1 = tree-top browsing recorded; indicates seedling damage.
note_dummy_8_loose_seedling	Dummy	0 = no loose, 1 = loose recorded; indicates seedlings that had come out of the soil (loose).
note_dummy_9_logging_residues	Dummy	0 = no logging residues, 1 = logging residues recorded; indicates the presence of ground or soil obstacles that reduce planting spot quality.
note_dummy_10_tree_top_breakage	Dummy	0 = no tree-top breakage, 1 = tree-top breakage recorded; indicates seedling damage.
note_dummy_11_brush	Dummy	0 = no brush; 1 = note brush; indicates naturally regenerated broadleaf trees.
note_dummy_12_logging_trail	Dummy	0 = no logging trail, 1 = logging trail recorded; referring to machine tracks formed during the harvesting.

References

^a Cajander, A.K. 1926. The theory of forest types. Acta For Fenn. 29: 7193. <https://doi.org/10.14214/aff.7193>.

