Metadata form of Silva Fennica

This form is designed for writing the elements of metadata, which are used in the description of research materials such as data and codes. The form is based on the work done in the Work Group "Description of research materials" under the Finnish Open Science Coordination.

Item	Description	Responsible
Name of the data / code	Data from: Volume growth responses of Scots pine and Norway spruce to nitrogen fertilization: quantitative synthesis of fertilization experiments in Finland	Author
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Publisher	The actor who has the right to publish the metadata, materials and/or description of the materials. This may be an archive, a repository, or a research organisation. Give the ROR of the organisation if available.	Author
Funder	The funding to produce the material come from the PREFER-project and UNITE flagship funded by the Research Council of Finland **https://ror.org/05k73zm37**	Author
Description	The dataset contains volume growth responses (m^3 ha^{-1} yr^{-1}) of Scots pine and Norway spruce to nitrogen fertilization (kg ha^{-1}), extracted from previously published forest fertilization studies implemented in Finland. It also contains the initial stand volume, site type (Cajander, 1949), the location of each study sites, time since fertilization, long-term (1961-1990) effective annual temperature sum and long-term mean annual precipitation. With this data we studied the impact of these variables on the volume growth responses (m^3 ha^{-1} yr^{-1}) and created predictive models describe how much the N fertilization may increase annual volume growth of Scots pine and Norway spruce stands.	Author
Methods	We searched for published research articles of forest fertilization studies from Finland. The Pearl growing method was used for searching the articles. Google Scholar, the open repository of the Natural Resources Institute Finland (Jukuri), and Library databases of Oulu university and University of Eastern Finland were used for the search. Included articles were expected to contain information on the amount of applied fertilizer (kg ha^{-1}), nutrient concentration in the fertilizer, and the obtained growth response in terms of stand volume (m^3 ha^{-1}). Stands with initial volume less than 50 m^3 ha^{-1} were excluded, and if the stands were repeatedly fertilized only the volume growth between the first and the second fertilizer application was included into the dataset. Total growth response after the fertilization was calculated by subtracting the values of	Author

	unfertilized control plots from the values of the fertilized plots. The total growth response was divided with the time since fertilization to obtain the mean annual growth response (m^3 ha^{-1} yr^{-1}). This enable comparison between studies with different durations. We also extracted initial stand volume, site type, location of study sites, time since fertilization, long-term effective annual temperature sum and long-term mean annual precipitation from the articles. If the long-term (1961-1990) temperature sum or precipitation were not reported, we retrieved them from the Finnish Meteorological Institute open data repository. We grouped the locations into three groups and created a dummy variable for Northern, Middle, and Southern Finland. Additionally, we used the latitude of the study site in the analysis. We also sorted site types into two groups, one contained medium-fertile (MT) sites and the other less fertile sites (VT and CT). One-way ANOVA was used to study the differences in growth responses between the created location groups and nonparametric ANOVA to study differences between site types using Kruskal–Wallis test and Wilcoxon rank sum test. Linear mixed effect models were used to explain the observed mean annual volume growth responses. The statistical analyses were performed with R 4.2.2.	
Variables	Article identification number (article_id); Dominant tree species (tree); Annual mean volume growth response obtained by N fertilization (v_incr_annual_compare, m^3 ha^{-1} yr^{-1}); Applied nitrogen dose (FN, kg ha^{-1}); Long-term mean annual precipitation (Pa, mm); Long-term effective temperature sum (Tsum); Factor variable for location in Finland (location); Location in Southern Finland (GS, Boolean); Location in Middle Finland (GM, Boolean); Location in Northern Finland (GN, Boolean); Latitude in decimal degree (Glat); Forest site type (site_type); Site fertility group (Gfertility, Boolean); Initial stand volume (V_ini, m^3 ha^{-1}); Time since fertilization (SF, a)	Author
Author keywords	Climatic conditions; Forest management; Growth response; Nitrogen fertilization	Author
Vocabulary keywords (community standard)	Nutrient management; Picea abies; Pinus sylvestris https://agrovoc.fao.org/browse/agrovoc/en/	Author
Discipline	Field(s) of study to which the material is related. This is generally given by the repository as they use specific classifications.	Archive/Repository/Publisher
Type of material	Research data	Author
Language	eng	Author
Time range covered	1962-2007	Author
Geographic region	FIN	Author
Version	Version 1	Author
File format(s)	.csv	Author
Availability of the materials (open, embargo, registration, limited, registration required)	Open	Author
Justification for access restrictions		Author
Licence	CC BY 4.0	Author
Connections with other research materials	The material is derived from (IsBasedOn) 11 previously published articles: Gustavsen & Lipas (1975); Hirvelä & Hynynen (1990); Laakkonen et al. (1983); Levula (1991); Lipas (1988); Lipas & Levula (1980); Lipas et al. (1983); Moilanen & Meriluoto (1984); Saarsalmi et al. (2010); Saarsalmi et al. (2014); Salonen (1973). Also, if not reported in the	Author

	articles, the long-term (1961-1990) temperature sum of precipitation were retrieved from the Finnish Meteorological Institute open data repository.	
Access to the connected research materials	Open data Finnish Meteorological Institute https://en.ilmatieteenlaitos.fi/open-data, **https://ror.org/05hppb561** Gustavsen, H., Lipas E., (1975) http://urn.fi/URN:ISBN:951-40-0188-5 Hirvelä, H., Hynynen, J., (1990) http://urn.fi/URN:ISBN:951-40-1133-3 Laakkonen, O., Keipi, K., Lipas, E., (1983) http://urn.fi/URN:ISBN:951-40-0645-3 Levula, T., (1991) http://urn.fi/URN:ISBN:951-40-1180-5 Lipas, E., (1988) http://urn.fi/URN:ISBN:951-40-0805-7 Lipas, E., Levula, T., (1980) http://urn.fi/URN:ISBN:951-40-0432-9 Lipas, E., Levula, T. Välikangas, P., (1983) http://urn.fi/URN:ISBN:951-40-0997-5 Moilanen, M., Meriluoto, M., (1984) http://urn.fi/URN:NBN:fi-metla-201211127146 Saarsalmi, A., Smolander, A., Kukkola, M., Arola, M., (2010) https://doi.org/10.1007/s11104-009-0256-y Saarsalmi, A., Smolander, A., Moilanen, M., Kukkola, M., (2014) https://doi.org/10.1016/j.foreco.2014.04.031 Salonen, K., (1973) http://suo.fi/article/9417	Author
Codes only: hardware/software requirements for running the code	R	Author
Connections to other products of research	Publications and other products of research that are connected to the material. Provide the DOI of your article in Silva Fennica and other journals if the material is used in several articles.	Author
Personal data	The material does not contain personal data.	Author
Confidential or secret data	The material does not contain confidential or secret information.	Author
Publication date	24.01.2025	Archive/Repository/Publisher
Preservation policy	The material will be permanently preserved in an open access data repository.	Author
Permanent identifier (PID)	10.5281/zenodo.14733005	Archive/Repository/Publisher