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Nordic Forest Research
Co-operation Committee (SNS)

Project no: SNS 106

Send the report to SNS-secretary Katrine Hahn Kristensen (hahn@life.ku.dk)

FINAL REPORT for PROJECT

Please notice that the size of text sections in the form can be adjusted if needed.
The length of the final report should not exceed 3 pages. **Supplementary information can be attached**

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| 1. Projekt titel | Askåterföring – långtidseffekter på träd tillväxt |
| 2. Project title | Ash recycling – long-term effects on tree growth |
| 3. Coordinator (name, address, telephone, e-mail) | Dr. Ulf Sikström Skogforsk (The Forestry Research Institute of Sweden) Uppsala Science Park, SE-751 83 Uppsala Phone: +46 18 18 85 52, Fax: +46 18 18 86 00 ulf.sikstrom@skogforsk.se |
| 4. Duration | 2009-01-01 – 2011-12-31 |
| 5. Cost | (Euros) SNS-funding: 90 000 Other funding: 206 505 |

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| <p>6. The purpose of the project / main problems / hypotheses addressed)</p> | <p>In some Nordic countries the energy produced from biofuels makes a substantial part of the total energy production. The intention is to increase the share of renewables in the overall energy mix. The use of logging residues from whole-tree harvesting (WTH) is a common practice in Sweden and Finland, and the use is increasing in Norway. Apart from stem harvesting, as at conventional logging, WTH involves harvesting of tops and branches. This entails a larger export of nutrients, e.g. nitrogen (N), which may have long-term implications on tree growth. In addition, WTH may increase soil acidification. Wood ash recycling has been suggested as a means to counteract or reduce these effects (except for the removal of N).</p> <p>The burning of forest biomass creates wood ash that can be seen either as a waste problem or a resource. In Sweden, the Swedish Forest Agency recommends that wood ash should be recycled to sites where significant amounts of bioenergy have been harvested. Finland and Norway lack recommendations on wood ash recycling. Wood ash recycling counteracts the acidification, but its effect on nitrogen availability in soil and tree growth is not fully understood. These last mentioned effects can be expected to vary with soil conditions.</p> <p>The profitability of utilizing forest residues depends on several factors. Apart from the direct costs and revenues at harvesting and transportation there are other consequences and potential costs which should be considered. This involves e.g. effects on tree growth because of the nutrient removals, and, a possible need for nutrient compensation (fertilization and/or wood ash application) and its effects.</p> <p>The overall aim of this project was to evaluate growth responses up to c. 20 years after liming and ash application in Scots pine (<i>Pinus sylvestris</i> L.) and Norway spruce (<i>Picea abies</i> L. Karst.) stands growing on mineral soils. We have compiled data from field experiments in Finland, Sweden, Norway and Lithuania, and performed a meta-analysis on relevant available data. The objective was to relate the growth responses of liming and ash application to some site variables, with special focus on site quality and C/N in the humus (FH-layer). The following hypotheses were tested. Liming and ash addition in Scots pine and Norway spruce stands growing on mineral soils, within the boreal, nemo-boreal and nemoral vegetation zones, render (i) reduced stem-growth on low-productive sites (high C/N in the FH-layer), (ii) unaffected growth on medium productive sites, and (iii) increased growth on high productive sites (low C/N in the FH-layer).</p> |
| <p>7. Brief description of the research plan and of possible larger deviations from the plan</p> | <p>In the project, we have gathered data from 129 long-term field experiments. In the final analyses, data from 114 experiments with liming and 15 experiments with wood ash application was included. The vast majority of the liming experiments are located in Finland and most of the wood ash experiments in Sweden. Since quite few ash experiments were available, the strategy was to use effects from liming experiments as a prognosis for the effects of ash application. The project consisted of three main phases, (i) compiling a dataset on both existing data and new data from the available experiments, (ii) analyses and evaluation of data in individual experiments, and (iii) a meta-analysis of the entire data-set. For further details, see the section 8 “Results”.</p> |
| <p>8. Results (max 2 pages)</p> | <p>See the attached appendix.</p> |

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| <p>9. What advantages have been gained by the Nordic collaboration</p> | <p>Compiling data from the different countries increases the amount of data and creates opportunities for better and more thorough analyses. Possibly, the results and conclusions will be more reliable and general, and, applicable for a larger geographical and climatic area.</p> <p>A better utilisation of existing long-term experimental data that earlier was not fully exploited.</p> <p>The collaboration creates an opportunity for the researchers with common research interests to get together and analyse/evaluate data, discuss common issues and exchange experiences.</p> |
| <p>10. Publications and other communication activities (International scientific peer reviewed journals, other scientific publications, short communications, web etc.)</p> | <p>Information about the project has been published on the SNS homepage (http://www.nordiskskogforskning.org/sns/forskningsprosjekter/), and on the homepage of Skogforsk (www.skogforsk.se), as well as in conference presentations.</p> <p>A draft of a manuscript “Long-term effects on tree growth of liming and ash application” has been written. However, some further data processing and analyses should be needed in order to evaluate if it is possible to reduce the variation in e.g. tree growth responses, and possibly include more experiments in the dataset. This is necessary before a final draft of the preliminary manuscript can be finalized and submitted to a scientific journal for possible publication.</p> |
| <p>11. Project summary (about 1/3 page) for possible use in the News & Views section of Scandinavian Journal of Forest Research</p> | <p>The use of logging residues from whole-tree harvesting (WTH) is a common practice in some Nordic countries. WTH, compared to stem-only harvest, entails a larger export of nutrients and may increase soil acidification. Wood ash recycling has been suggested as a means to counteract or reduce these effects. The aim of this project was to evaluate growth responses up to c. 20 years after liming and ash addition in Scots pine (<i>Pinus sylvestris</i> L.) and Norway spruce (<i>Picea abies</i> L. Karst.) stands growing on mineral soils within the boreal, nemo-boreal and nemoral vegetation zones of Fenno-Scandinavian countries. Based on data from field experiments in Finland, Sweden and Norway, we have performed a meta-analysis on relevant available data. The objective was to relate the growth responses of liming and ash application to common site variables.</p> <p>According to the preliminary results, there was an indicated trend in the data suggesting that application of wood ash or lime may render reduced stem growth at low-productive sites, whereas the growth seems to be unaffected at medium-productive sites, and may increase at high-productive sites. This was over a period of up to c. 15 years after application of lime and ash. Over a longer observation period (up to c. 25 years), only including limed plots, a similar or a somewhat weaker trend was indicated. There was a large variation around the calculated relationships with a low degree of explanation (R^2) in most cases. Further data processing and analyses should be needed in order to evaluate if it is possible to reduce the variation in the data even more (e.g. tree growth responses), and possibly include some more experiments in the dataset, before more confident conclusions can be drawn.</p> |
| <p>12. Date and signature</p> | <p>Date: 2012-04-26 Signature of project leader/coordinator:</p>  <p>Ulf Sikström</p> |

