Geophysical Research Abstracts
Vol. 15, EGU2013-1274, 2013
EGU General Assembly 2013

pH sensitivity of Swedish forest streams related to catchment characteristics and geographical location – Implications for forest bioenergy harvest and ash return

Anneli Ågren (1) and Stefan Löfgren (2)

(1) Dept. of Forest Ecology and Management, Swedish University of Agricultural Sciences, 901 83 Umeå, Sweden (anneli.agren@slu.se), (2) Dept. of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, P.O. Box 7050, 750 07 Uppsala, Sweden (stefan.lofgren@slu.se)

Whole-tree harvesting acidifies forest soils more than conventional harvest of stems. There is concern that this excess acidification will also affect surface waters and counteract the well-documented recovery from acid deposition in streams and lakes. Here we present a first attempt to identify the landscape types within Sweden where the streams are most sensitive to acidification and potentially in need of protection from excessive biomass harvest or countermeasures such as ash application. Conservative estimates indicate that forest slash must be harvested from >30 ha to produce the amount of ash needed to restore 1 ha acidified surface water. This highlights the need for careful planning of where ash should be distributed.

Streams with a high pH are well buffered by the bicarbonate system and not sensitive to a potential pH decline. Streams with a low pH are also well buffered by dissolved organic carbon and aluminum and are not likely affected by bioenergy harvest. However, streams in the intermediate pH range (5–6.2) are potentially sensitive to acidification from excess base cation removal due to whole-tree harvesting. In such streams a small change in acid neutralizing capacity (ANC) can change pH dramatically.

The pH sensitivity of 218 streams in different regions (northern, central, southern, and southwest Sweden) was defined from stream water pH and related to catchment characteristics and stream water acid–base chemistry. At the national level, catchments with till soils and a large proportion of forested wetlands formed the most pH sensitive areas. Because of regional variability in acidification history, amount and distribution of quaternary deposits, vegetation cover, etc. pH sensitivity was determined by different landscape elements in different regions. For example, in northern Sweden streams draining forest mires were the most pH sensitive streams. The patchy spatial distribution of this landscape type, makes it difficult from an administrative point of view to develop simple guidelines for where e.g. forest slash harvest should be restricted or where ash applications should be recommended. At the regional level, lakes and forests on mineral soils were also identified as sensitive landscape types. Contrary to the general believe by Swedish authorities, the historically most acidified southwestern part of the country is the least pH sensitive due to the high buffering capacity at low pH. In order to develop effective management guidelines across Sweden, it is most critical to identify streams with the highest pH sensitivity (pH range 5-6.2). The study is now expanded to include another dataset of 200 randomly selected headwater forest streams in southern and central Sweden, to continue the development of a management tool for planning whole-tree harvesting and ash distribution.