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Mobility of radiocaesium in boreal forest ecosystems: Influence of precipitation chemistry

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Mobility of radiocaesium in boreal forest ecosystems:
Influence of precipitation chemistry

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Mobility and plant uptake of Cs in soils is generally limited by the presence of clay minerals in the soil. However, cations supplied by precipitation may substantially influence the mobility of radiocaesium in natural surface soil and subsequent transfer to food chains. The chemical composition of precipitation shows substantial variation among different areas in Norway for two main reasons. At sites close to the coast the atmospheric supply of marine cations and anions is many-fold greater than in regions shielded from marine influence by mountains. The southernmost part of the country has been, and still is, substantially affected by soil acidification due to long-range atmospheric transport of acidifying substances from areas elsewhere in Europe. This may explain a much higher greater uptake of 137Cs from the Chernobyl accident in moose in this region than elsewhere (Steinnes et al., 2009), in spite of the fact that some areas farther north received substantially greater fallout. Similarly a much greater transfer of 137Cs to natural birch forest vegetation is evident from the more acidified soils in the south than in comparable ecosystems elsewhere in the country (Thørring et al., 2012). Repeated recordings of activity levels in natural surface soils showed faster leaching of Chernobyl 137Cs relative to inland areas not only in the south but also in coastal areas farther north (Gjelsvik and Steinnes, 2013), indicating that the amounts of marine cations in precipitation also has an appreciable effect on the Cs leaching. The geographical leaching differences still became less prominent with time. Recent lysimeter experiments with undisturbed soil columns obtained from an area receiving high radiocaesium deposition from the Chernobyl accident, applying precipitation with ionic composition characteristic of the different regions mentioned above, did not change the current depth distribution of 137Cs. However, acidic precipitation increased the mobility of Cs added during the experiment. All in all the mobility in boreal soils of freshly added radiocaesium may be considerably affected by the chemical composition of precipitation.

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