THE SIGNIFICANCE OF CLIMATE CHANGE AND LAND USE ON ECOSYSTEM HEALTH AND TERRESTRIAL CARBON IN WESTERNERN ICELAND

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The Icelandic natural environment is highly dynamic, in which climate change has been the main driver of ecosystem variability prior to the Norse colonisation around AD 874. During the post-settlement era, the island's drastic ecosystem change has been mainly controlled by human activities. Healthy ecosystem; soil and vegetation, is not only an important resource to meet human demands but also a prominent sink of atmospheric CO_2. In contrast, soil eroision and the degraded lands are a major source of atmospheric CO_2.

This paper describes the impact of climate change and human activities on vegetation, soil erosion, and soil organic carbon (SOC) in Western Iceland. Analyses conducted include pollen in Histosols and lake sediments, soil properties, soil buildup, SOC in Hisosols and Andosols, and terrestrially-derived SOC in lake sediments.

The pre-settlement landscape was not entirely stable, and relatively small differences in climate may have caused subtle changes in the terrestrial environment. However, the Norse colonists and subsequent occupants caused drastic alternations in the environment and exacerbated environmental deterioration, although the process is spatially variable. The land was almost completely deforested during the early Norse colonisation. Woodlands, the habitat for fragile biota and soils, was highly vulnerable to land use change. The late Medieval climatic change further stressed the terrestrial environments to beyond the threshold of ecosystem resilience. The vegetation denudation accelerated soil erosion, with attendant redistribution of soil over the landscape, and decline in its quality. Vegetated lands were important sinks of windtransported soils, as evidenced by increase in deposition and bulk density, increase in susceptibility to soil erosion, and decline in SOC content. Despite decrease in SOC content, the high sedimentation rate resulted in SOC sequestration in these sites, even though soil quality had declined. The lake analyses of sediment show increase in C fluxes during the periods of major landscape instability in the post-settlement era. These trends indicated that the surrounding organic soil was being eroded and blown into the lake. Barren sites lost soil cover and SOC pool, resulting in net loss of soil resource and the SOC reserves.