

New land, new opportunities. Vegetation succession and soil formation within the heterogeneous moraines formed by the Skaftafellsjökull and Breiðamerkurjökull outlet glaciers in Southeast Iceland.

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Retreating glaciers expose heterogeneous landscapes where primary vegetation succession becomes active. These glacier forelands are excellent sites to study the effects of landscape on vegetation establishment and the commencing soil formation. Where the location of the glacier terminus is known in time, a chronosequence can be established, thus allowing for assessing the role of time on both vegetation succession and soil development. In Iceland, glaciers have been more or less retreating since the end of the Little Ice Age in ~1890, exposing thick moraines mostly composed of ground basaltic material of volcanic origin. In a research from southeast Iceland, soil formation was studied in front of two outlet glaciers, Skaftafellsjökull and Breiðamerkurjökull, and the developing soil properties analyzed with regards to the age of the surface, vegetation, avifauna and topography.

At Skaftafellsjökull, soils were sampled along three moraines of known age. The vegetation was dominated by mosses but dwarf shrubs and shrubs (willows and birch) characterized the older moraines. Vegetation cover and plant group cover was affected by the profile position (summit, shoulder, backslope, footslope, toeslope) and the shape of the topographic features (ridge, slope, depression). The cover was significantly greater in toeslopes and footslopes when compared to the backslopes and featured significantly more shrub cover. The vegetation cover was significantly denser in depressions than on ridges and slopes, predominantly comprising mosses and shrubs. On the other hand, macro-lichens predominated on ridges. The vegetation cover and soil properties showed the strongest relation between total vegetation cover, cover of mosses, macro-lichens and dwarf shrubs. The concentration of SOC, N and ammonium oxalate extractable Al increased significantly with increase in vegetation cover and showed similar trends of increase in the cover by mosses, macro-lichens and dwarf shrubs. Profile position and the topographic shape were also significantly connected with several of the soil properties studied.

At Breiðamerkurjökull, similar trends were observed between vegetation and the underlying soil properties. There, the presence of seabirds, mainly the great skua and the Arctic skua, has created stark differences between the regular moraine environment and the 'bird mounds' that have formed at sites where the birds regularly perch and defecate. These sites were commonly found on the top of moraine ridges although they featured also on more level ground. They were characterized by vigorous growth of grasses, thick soil that contained amounts of carbon and nitrogen up to 16 times higher than in the surrounding moraines.

The study shows that depressional features in the moraines are sites of the most rapid vegetation succession and soil formation, a result from abiotic factors such as higher moisture content and sheltered locations. The rates however are succeeded at sites where avifauna adds nutrients into the developing soil, creating point centered effects and affecting the biogeomorphic characteristics of the moraines.