

Spitsbergen landscape transformation due to glacial recession under climate warming after the Little Ice Age

Wieslaw Ziaja ¹

¹ Jagiellonian University, Poland



Abstract

The Spitsbergen – the main Svalbard island – has undergone intensive environmental-landscape transformations due to glacial recession under climate warming during the past century, what is best visible in areas abandoned by glaciers. Spitsbergen regions are becoming much smaller due to sea transgression into depressions abandoned by tide-water glaciers and less glaciated due to glacier's recession from areas above the sea level. In glacier-freed areas, glacial landforms and new deposits accumulated by glaciers and proglacial rivers, shaped into new postglacial and glacialuvial landforms, together with new water-bodies (rivers, lakes) consist a completely new terrestrial landscape. This landscape undergoes animal colonization, plant succession and soil formation. Thus an origin of new ecosystems has begun. This transformation is differentiated according to climatic and glacial conditions. The most glaciated regions (with tide-water glaciers being supplied by ice-sheets or field glaciers), like the island's southeast and northwest, are being changed in a more spectacular way and on much more extensive areas than inland glaciers' valleys in the warmest middle-west of Spitsbergen. In order to show these differences, the results of discerning field investigations from Sørkapp Land (the southern Spitsbergen peninsula with its eastern and western coasts) and Nordenskiöld Land (middle-west of the island) are presented. Due to described changes, the thesis that glaciers cover 60% of Svalbard taking 63000 km² lost its veracity, what was stated by Martin-Moreno, Alvarez and Hagen (2017). Nowadays, the values given by them are probably too high because of a quick rate of the changes in the 2010s. The specificity of Svalbard is a very thin layer of Quaternary deposits. Hence, deepening of the active layer on permafrost does not make such dramatic environmental problems like in some another Arctic areas. In many places, assimilating of carbon by new vegetation in photosynthesis may be comparable with its releasing from terrestrial permafrost.

Keywords—climate warming, glacial recession, environmental-landscape transformation, Spitsbergen

Biography:

Wieslaw Ziaja, Ph.D., is a physical geographer and landscape ecologist, a professor and head of the Department of Physical Geography, Institute of Geography and Spatial Management, Jagiellonian University in Cracow (Poland). He took part in 15 summer scientific expeditions to Spitsbergen and has published a few dozen papers in reputed journals and 5 books. His research interests include landscape and natural environment structure and functioning, geographical aspects of nature and landscape protection, physical geography of the Arctic, North Europe, and the Carpathians. Since 2000 AD, he is focused on landscape and environmental transformation of the Arctic, mainly under a contemporary climate change



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