

## **Spatio-temporal patterns in Arctic tundra greening and browning**

### **- identification of key environmental factors (TURNING)**

The natural environment of the Arctic is changing now intensively. This relates to the all elements of the nature, both abiotic and biotic. The changes, which result in the intense melting of glaciers and permafrost and the transformation of fauna and flora, are primarily associated with a rapid increase in temperature. Large-scale warming in the Arctic has accelerated during recent decades and is occurring at a rate that is twice that of the global trend. One of the most spectacular phenomena occurring in the Arctic under the influence of climate change is the so-called tundra greening. The Arctic tundra, a woodless plant formation occurring in the northern hemisphere in high latitudes, consists mainly of low creeping dwarf shrubs, as well as mosses and lichens. The increase in temperature caused that since the end of the 1980s, species changes and expansion of plants have been observed, even in areas previously completely barren, constituting polar deserts with an extremely poor living world. In recent years, however, a change in this trend has been observed and the phenomenon of tundra browning tundra occurs. It seems that this process may be affected by the emerging soil moisture deficiency, which in turn can lead to drying and, in extreme cases, dying of plants. This negative phenomenon, leading to a decrease in biodiversity, an increase in the number of wildfires and the intensity of geomorphic processes, is far from understood. This is primarily due to the complexity of the Arctic natural environment and the impact of a number of driving factors, such as climatic conditions (temperature, precipitation, snow depth), permafrost melting, soil cover features, landform processes.

The aims of this project, based on join methods from detailed ground-based analysis to satellite-derived observations, are: an assessment of physical disturbance in Arctic terrestrial ecosystems in all vegetation and landscape types, an examination of greening and browning of the Arctic tundra in relation to water, air temperature, snow depth, geomorphic and soil conditions. Research will be conducted along the west coast of Spitsbergen, the largest island of Svalbard. The Svalbard Archipelago, located between the northern part of continental Europe and the North Pole, is characterized by remarkable natural diversity. This provides an excellent opportunity to observe contemporary changes in a natural environment that is characteristic of the High-Arctic islands. In our research, we will use both satellite imagery and drone surveying to analyze the spatial distribution of biotic and abiotic phenomena, as well as the results of field work. Direct field work in designated research areas will allow us to carefully analyze the geomorphic processes activity and the characteristics of vegetation and soil cover. Detailed ground-based research: ecological, pedological and geomorphological will verify the accuracy and reliability of satellite imaging. All these elements, together with climatological research, will answer the question what factor determines the contemporary changes in the tundra ecosystem. These changes can affect not only the entire Arctic nature, but also the human life environment. These studies will be conducted by an interdisciplinary team of scientists from research centers in Poland and Norway, who have extensive experience in working in difficult arctic conditions and knowledge of changes in the natural environment.