

Assessment of Climate Change Impacts and Adaptation Measures in Cold, Snowy Regions

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[Abstract]

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This study aimed to promote adaptation measures for snow changes associated with climate change in Hokkaido, a prefecture centered in the primary sector and positioned as Japan's resource and food supply base, with snow cover that lasts for 4–5 months. We performed a detailed evaluation of the snow-linked changes and their corresponding effects and developed adaptive measures to ensure the sustainability of Hokkaido's livelihood and primary industries.

We detected a decrease in snowfall and snowpack across many areas of Hokkaido. Additionally, although the average days of snow removal are expected to decrease in the future, these changes are expected to be limited in years with heavy snowfall and inland regions. We also expect an increase in heavy wet snow, thawing, and refreezing of snow and ice in midwinter. These changes could result in various consequences, such as increased snow accretion and snow loads, accidents due to snowslides or slippery roads, and potholes. Furthermore, secondary and tertiary impacts, expressed as an impact chain, include a decrease in average snowfall that would force snow removal workers to leave their jobs, making it difficult to maintain snow removal skills; this would result in inadequate snow removal systems in the event of occasional heavy snowfalls. Predicted impacts on agriculture include unexpected plant growth due to decreased soil freezing depth, increased wind erosion damage, and increased dispersal of soil due to a shorter snow cover period; some positive impacts were also identified, such as Hokkaido potentially becoming a region where one of the main apple varieties in Japan (i.e., “Fuji”) can be harvested.

To promote the widespread implementation of adaptive measures, in addition to appropriately predicting climate- and community-linked changes, it will be necessary to gain a comprehensive understanding of the inhabitants, as this would help implement context-driven adaptive strategies based on the appropriate selection of adaptation measures as climate change scenarios progress (adaptation pathway). The methodology was developed to ensure the sustained implementation of adaptive measures and includes visualization of changes in lifestyle-related indices during the winter based on simulated forecast data, the creation and use of an educational video to help people realize specific future changes and introducing participatory discussions for local stakeholders to propose local adaptation pathways.

The results of this study will encourage efforts by regional climate change adaptation centers and local governments in cold snowy regions, contributing to the promotion of adaptation measures in Japan.