

Land Users – Land Watchers

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Abstract

GróLind is a collaborative project with the aim of monitoring Icelandic vegetation and soil resources. It was founded in 2017 by the Icelandic National Associations of Sheep Farmers, the Farmers Association of Iceland, Ministry of Industries and Innovation, and the Soil Conservation Service of Iceland. GróLind is a collaborative project and cooperation with stakeholders, such as the science community, landowners, and others, is a fundamental concept in the project.

In this project, the state of vegetation and soils are evaluated. Currently, a citizen science project is being developed within GróLind, in which land-users will annually monitor, using a mobile app, the conditions of the land they utilize. The monitoring will be based up on permanent photo-points and simple ecological measurements. These data will be used together with more detailed measurements done by specialists, to assess the state and changes in Iceland's vegetation and soil resources.

Land users' participation provides more extensive and accurate monitoring, both spatially and temporally. Cooperation between scientists and land users increases the flow of knowledge and trust between groups, ensuring that the knowledge gained in the project will be used for sustainable land management. Furthermore, the data will be used to develop research-based indicators for sustainable land-use that later can simplify the monitoring.

Background

Citizen involvement in scientific work has a rich history and its importance is gaining recognition as well as trust (Miller-Rushing, Primack, & Bonney, 2012). The main trend in the involvement is that the gathering of numerical data by the public which are then processed and analyzed by professionals. Citizen science projects where everyone can participate in research or monitoring work, regardless of their scientific background, is called citizen observatory. Nowadays, the citizen observatories take advantage of latest technology and the usage of smartphones in data gathering. Environmental monitoring is a good example of citizen observatory. Citizen contributes to the monitoring work with compilation of data which increases knowledge of the environment and environmental changes. These leads to better management strategies and increased quality of decisions and operations (Dickinson, Zuckerberg, & Bonter, 2010; Liu, Kobernus, Broday, & Bartonova, 2014; Tweddle, Robinson, Pocock, & Roy, 2012).

In Iceland, there has been little emphasize on terrestrial environmental monitoring, especially monitoring vegetation and soil resources. The monitoring has mostly been confined to areas subject to heavy industry, forestry, or land restoration (Vísinda- og tækniráð, 2017) despite that most of Iceland can be defined as rangelands for sheep (Stefánsson et.al., 2020), and large parts of the country's vegetation and soil resources are utilized in various ways e.g., rangelands, outdoor recreation/tourism, hunting reindeers and wild birds. Large part of the sheep rangelands of unstable, poorly vegetated and unproductive ecosystems (Marteinsdóttir *et al.*, 2020) and many are badly degraded (Arnalds *et al.*, 2001) at least partly due to unsustainable grazing practices (Barrio *et al.*, 2018). These resources should, due to its scopes and variety of utilization, be well suited as a public observation project.

In order to increase the knowledge on Icelandic terrestrial ecosystems, including rangelands, the GróLind project was established in 2017. It based

on an agreement between the Icelandic National Associations of Sheep Farmers, the Farmers Association of Iceland, Ministry of Industries and Innovation, and the Soil Conservation Service of Iceland. The project is run by the Soil Conservation Service of Iceland and funded until 2026, but an independent interdisciplinary science committee oversees the project. The project is still in its early phase, but now for the first-time stakeholders and scientist are working together to generate data that can be used for sustainable land management. In a land that is extensively used for sheep grazing and that has an history of land degradation it is surprising how little focus has been on gathering reliable data. The aim of the project is to establish a long-term monitoring program of the terrestrial ecosystem of Iceland as well as construct a set of indicators regarding sustainable land use. The monitoring methods are based upon ecosystem functions such as soil and site stability and biotic integrity. The methods include both remote sensing technique and ground measurements. The ground measurements are threefold, detailed measurements, general measurements, and citizen science measurements.

Public participation in GróLind's monitoring improves traditional data collection and thus provides more extensive data and information. In addition, it increases participants' knowledge, skills and interest in the subject and promotes better decision-making in social ecological systems (Shirk, 2012; Wehn, 2019). This project will be the first large scale citizen observation vegetation monitoring project in Iceland, but until now citizens observation projects have focused on avian research, glaciology and meteorological observation. In this paper we discuss the citizen science part of the GróLind project which has the main aim to increase cooperation and partnership between different stakeholders in regard to sustainable land management, as well as create knowledge on land condition in Iceland.

Land users – Land Watchers

Citizen Science project within GróLind is named Land Users-Land Watchers. As the name indicate the focus is to engage land users in monitoring. However, that does not exclude others from participate, such as landowners without livestock, travel associations, sororities and other interested groups and individuals. In this project, participants will set up a permanent monitoring point in an area that they use, or are particularly interested in, and monitor the condition of vegetation and soil with the help of a smart phone. Monitoring is expected to take place, at least every other year. Participants will learn how to monitor and to recognize the signs of degradation. The monitoring data will

become a part of the data in GróLind's long term monitoring program and participants will be able to access their own data at any time. The citizen observatory project was presented in the spring of 2019 at GróLind's introductory and consultation meetings, with land users and stakeholders, held all over the country. There sheep farmers and others showed considerable interest in participating in the project. This is not surprising as there is a long tradition for the participation of the public and sheep farmers in various projects that The Soil Conservation Service of Iceland has organized. The project *Farmers heal the land*, that has been running since 1990, is a good example of this. In that project, farmers get support, in form of consultation, seed and fertilizers to do reclamation work on their own land. There is also a similar project running that supports groups of farmers to do reclamation work in the rangeland commons they use for sheep grazing during summer.

The methodology of Land users – Land watchers is still under development and in the summer of 2021, a test group of farmers will test the project methods. After the test period the methods will be finalized, and the project will begin formally in 2022.

Methodology

The Land Users - Land watchers' measurements should be quick, take no longer than 15 minutes and not require any expertise. At the same time, they must be linked to land conditions, be detailed enough to be used in the analysis of remote sensing data and be compatible to other monitoring data collected within the GróLind project. The monitoring should be done at least every other year, but participants can monitor their points annually or even few times over the year. The participants choose a monitoring site, subject to certain criteria. The site must be in a homogeneous area which is not cultivated. Restoration sites may be included but other cultivated land, e.g., forestry, meadows, fields, and green areas in settlements are not within the project. Participants must have a permit, from landowners, to conduct the monitoring. Measurement sites will be marked with a special pole provided by the project. The monitoring method include among others, photo points, step point transects to measure vegetation cover and bare ground and visual estimation of soil erosion, flowering, and vegetation cover. These methods are a simplified version of other monitoring methods done in the GróLind project and like those methods based up on methods developed to monitor rangelands in the USA (Pellant *et al.*, 2020) and Australia (Tongway *et.al.*, 1995).

Participants will use a mobile app to record measurements. The application does not require an internet connection to collect information, but an internet connection is required to send the information to a web server's database. The project database maintains all data collected by participants and when new measurements are submitted, the participant receives a standard report which summarizes the information collected and compares it to data from previous years. While anyone who is interested will be able to take part in the project, in the beginning a

special emphasis will be placed on getting farmers to participate.

Conclusion

Incorporating land users in monitoring, gives them an unbiased platform to monitor how the land responds to their land-use. This should allow them to better adapt their land-use to the current land conditions. The project also gives participants the opportunity to be a part of the GróLind project, which will hopefully increase their interest and confidence in its results.

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