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5 Citizen Science Tools for Engaging Local Stakeholders and Promoting Local and Traditional Knowledge in Landscape Stewardship

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Introduction

Citizen science has been proposed as one way of engaging local stakeholders in landscape stewardship (Plieninger and Bieling 2012). Citizen science encompasses a broad array of approaches in which citizens are involved in one or more aspects of assessment and monitoring of the environment (Bonney et al. 2014). In Europe, most citizen science schemes only involve community members in data collection. The design, analysis and interpretation of the assessment results are undertaken by professional researchers.

Recently, experiments have been made to involve community members in all aspects of environmental assessment and monitoring, including scheme design, data interpretation and use of the results for decision making and action (Johnson et al. 2016). Although there are still a number of scientific questions surrounding these approaches and many schemes are still at an early stage of development, the new approaches show a great deal of promise.

A topic corresponding with citizen science is the promotion of traditional and indigenous knowledge associated with land use and landscapes (Berkes 2012). We recognise the differences between local and traditional knowledge, indigenous knowledge and knowledge generally held by citizens. Local and traditional knowledge is held by communities with long-term affiliations to specific landscapes. Indigenous knowledge also has long-term affiliations with landscape but has furthermore a specific legal status being protected under international agreements (Convention on Biological Diversity, Article 8j).

This chapter analyses the challenges and successes of three schemes that stand out from the majority, because they involve natural resource users directly in monitoring attributes central to their livelihoods (Greenland and Finland) or because of the role of digital technology in facilitating the citizen science activities (Faroe Islands).

We begin by describing and explaining the activities and outcomes for each of the three schemes, before presenting our own cross-cutting analysis of the benefits and challenges of such approaches for engaging local stakeholders in landscape stewardship.

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Participatory Monitoring in Arctic Landscapes in Greenland

What Did We Do and Why?

Greenlandic Arctic land and seascapes are vast and utilised by a relatively sparse population living in scattered coastal settlements. Utilisation of marine and terrestrial living resources forms an all-important mainstay for the majority of people in the settlements and it is through this resource use that landscapes are being valued and managed. The people in the settlements are de facto managers of the Greenlandic landscapes through their use of resources.The living resources in Greenlands landscapes are changing rapidly (Post et al. 2009, CAFF 2013). The status of a wide range of key resources and their changing abundance has very direct impact on the incomes and lives of ordinary people in Greenland (Nuttall 2009). Sustaining incomes from living resources and ensuring a sustainable use of the living resources, as well as successful adaptation to the changes in abundance of resources and adjusted management regulations, depend on knowledge about the status of resources and their interaction with landscapes (Riedlinger and Berkes 2001). This requires continuous observation of the environment and an associated continuous reshaping of management interventions (Fig. 5.1).

Scientist based monitoring of the environment is taking place but scientist knowledge of the environment is incomplete and conventional scientific monitoring is logistically difficult and relatively costly. However, local fishermen and hunters undertake on-the-job observations of the environment all year round, through which they make use of first-hand knowledge of the changes in the landscapes and the associated living resources (Danielsen et al. 2014). Their observations and knowledge are, however, not consistently quantified and analysed and when they are used for resource management, it is mostly due to legally required public hearings or sometimes as a contribution from Greenland's Government to negotiations in international environmental agreements. At the same time, the Government of Greenland has a policy of promoting user knowledge in the management of living resources (Greenland Government 1999), a policy that remains to be transferred into a systematic approach in practice.

In response to this, the Greenlandic Ministry of Fisheries, Hunting and Agriculture (APNN) in collaboration with selected Greenlandic municipalities has promoted a simple, field based system for monitoring and managing resources, which is based on observations in the field by local resource users and developed specifically to enable Greenlandic fishermen and hunters to document trends in living resources, to propose management decisions themselves and to take an active role in stewardship of the living resources and their associated landscapes. The system is being applied in a range of different contexts in the North and the South of Greenland and with a focus on different key resources and landscapes.

The system to promote local involvement in monitoring and management of living resources was implemented in communities in NW Greenland in 2010, starting in settlements in the area around Disko Bay and Uummannaq Fjord, expanding to the extreme North around Upernavik and Qaanaaq and was implemented with the focus on

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Figure 5.1 Fishermen and hunters in Greenland see participatory monitoring as a way of having their knowledge being utilized in management decisions that impact upon their livelihoods and that shape the way through which stewardship of the landscape is undertaken. Photo: Martin Enghoff.

monitoring a range of different important living resources and resource impacting activities. A similar system has been expanded to areas in SW Greenland with the focus on monitoring muskox (*Ovibos moschatus*), reindeer (*Rangifer tarandus* spp.) and related resources and resource impacting activities. Whereas the participatory monitoring and management system has been active for around six years in some areas, it has only been active for one to two years in other areas.

A major part of this work has been undertaken under the Nordic Resource Management project. The aim of this project is to investigate, develop and strengthen the role of local knowledge and 'citizen knowledge' in decision making regarding the use of nature and natural resources. Through the project, formats and procedures for capturing local information and promoting participation have been tested as a way of facilitating the use of local knowledge in landscape stewardship. The formats utilised are 'easy to use' matrices that members of community monitoring groups fill out together every three months. They capture information about trends in observations and in utilisation of resources/species. The matrices encourage self-interpretation of the observed changes in resources and, at the same time, they promote discussion and agreement on relevant resource management actions.

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The communities that take part in the participatory monitoring and management activities are spread out over most of the inhabited coastal area of Western Greenland and they have been selected based on expressed interest by people in the settlements. In each of these communities, a Natural Resource Committee (NRC) has been established, selected through village meetings and consisting of six to ten of the most experienced and interested local hunters, fishermen and other people with knowledge of the environment and resources. The focus for monitoring is decided locally and typically eight to twelve different important living resources have been selected, the utilisation of which constitutes a key aspect of the interaction between people and the landscape. In the selected areas in the South, the focus for monitoring and management is on muskox and reindeer and the monitoring and management includes counting of populations, setting of hunting quotas and regulation of different uses in the landscape.

When members of the NRC are in the field, they collect data from observing living resources and resource use. At quarterly meetings of each committee, the data are summarised, discussed and interpreted and possible management initiatives emanating from the results are considered. The proposed management decisions and the supporting data and analysis are sent to the Village Council for endorsement before being forwarded to the municipal and national authorities. Once a year, the NRC members present their monitoring results at a community meeting to obtain inputs and feed-back from the entire community. Fundamentally, the system is designed so that local people knowing the landscapes and having first-hand knowledge of the resources are using their knowledge in proposing management interventions as an aspect of practical landscape stewardship.

The management proposals from the NRCs relate to how, from a local perspective, living resources can be managed better so as to ensure effective and sustainable utilisation and stewardship of the landscape. Some of the management proposals can be acted upon locally but most need municipal or national approval. Upon receipt of the management proposals, staff of the municipality present them to the municipal Fisheries and Hunting Council, who then make recommendations to the municipality. When the municipality approves a management proposal, it will often require the development of a municipal ordinance. Municipal staff draft the ordinance and submit it to the Ministry of Fisheries, Hunting and Agriculture for technical scrutiny and possible ministerial signature. Specifically, for the activities related to muskox and reindeer monitoring and management in the South, there are opportunities for a higher degree of decentralised management and decision making and here management plans for these resources and the landscapes are being developed. Such management plans and activities will be decided locally and checked and endorsed at municipal and national level.

The participatory monitoring and management has been facilitated through development of observing and reporting formats, which are used by the NRCs involved. People in the settlements are participating in the system on a voluntary basis and they do so because they have an interest in how the resources are being managed. Furthermore, they see the system as a way of having their knowledge utilised in management

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decisions that impact upon their livelihood and shape the way through which stewardship of the landscape is undertaken.

What Was the Outcome and Why?

The participatory monitoring and management system in Greenland has been implemented over the last four to six years with participation of people in around five to six communities. Not all communities which initially started the implementation have been able to continue after the initial activities and others are still relatively new in implementation. Overall, the system has seen the participation of many locally interested citizens and a lot of monitoring has taken place. Much data has been collected and analysed locally. Likewise, wide ranges of management actions have been proposed, of which some have been implemented while others were declined or are still awaiting approval. The management actions proposed were based on local monitoring, covering a wide range of interventions which differed according to the location. However, they all are directly related to utilisation of specific resources or areas and are connected with how the resources and landscapes are being managed. The management proposals include amongst others: Regulation of fishing in certain areas, changes in harvesting procedures, regulation of quotas and sustainable harvest, changes in hunting and fishing seasons, proposals on changes in fishing and hunting regulations, changes in access and means of transportation in certain areas, development of new resource enterprises and ways of utilising resources (Danielsen et al. 2014).

The level of decentralised decision-making power in terms of resource management actions has proven a challenge in a number of cases when laws and regulations do not allow decentralised management actions. Also, the integration of the locally generated knowledge into national scientific monitoring systems and nationally promoted recommendations for management of different resources have proven somewhat difficult despite intentions of promoting local user knowledge. Still, local participation in monitoring of key resources has proven an important aspect in strengthening local stewardship of the resources and associated landscapes. In this way, knowledge of the status of resources is a fundamental aspect of stewardship and local stewardship therefore needs to go hand in hand with local monitoring. The implementation of the system has shown that citizens living in resource dependent communities relate to the landscape through the utilisation of locally important resources. Landscape values are expressed in this way and landscape stewardship should be understood in this context.

The development of a non-complicated system with easy-to-use formats that build on observed trends in different resource populations has been an important aspect of the continuation of the system. It is relatively straightforward and easy to participate. Likewise, the support rendered from the municipalities and from the Ministry has been an important aspect of the implementation of the system. Most importantly, the participation in local monitoring and management activities is undertaken because the local citizens feel it is important and because they want to promote their understanding of the resources and landscape status and dynamics. However, this kind of local landscape stewardship activity also requires that the participants see results in terms of changes

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in management regimes i.e. changes that take the local perspectives into consideration. Although Greenlandic policies have generally been supportive of local user knowledge for management, some of these management actions have met legal and institutional barriers and have proven to be a long process.

Another important aspect of local monitoring and management activities is the degree to which locally observed trends relate to science generated estimates of the same resources (Gilchrist et al. 2005). Local perspectives on resource population and landscape dynamics differ substantially in several cases from the perspectives generated in science led national level monitoring (Sejersen 2003). There is, however, evidence of a good match between local and science led estimation of specific resource trends, when data from both ways of knowing are available for the same resources in the same area at the same time (Danielsen et al. 2014). The system for participatory monitoring and management has been designed in a way that local observations and perceptions of trends are being triangulated within the communities, between communities and over time, so as to ensure that the locally obtained information is valid and that potential local biases favouring certain information are reduced.

The implementation of a participatory monitoring and management system in Greenland has seen strong aspects of citizen involvement and has proven to be one of the ways through which local participation in landscape stewardship can be promoted. Locally, it appears that having a better discussed picture and a better idea of what is going on with regard to the key resources, leads to an increased interest and caretaking in the management of the resources and of the associated landscape. Locally discussed and agreed rules may be better than top-down decisions, which may not be fully understood locally, hence difficult to implement in the vast Arctic landscapes. Promotion of monitoring and management systems is also a way of promoting social justice, local organisation and participation in environmental decision making. Increased decentralised decision-making power in relation to resources and landscape management may support a better and stronger local involvement in stewardship of the resources and landscapes in Greenland.

Participatory Monitoring in Boreal River Landscapes in Finland

What Did We Do and Why?

In selected areas of Finland, participatory monitoring of natural resources is applied as a tool contributing to local landscape stewardship as part of the Nordic Resource Management Project (Fig. 5.2). When you address local knowledge in the Finnish context it includes Sámi indigenous knowledge and local traditional knowledge systems (Mustonen 2013).

The efforts in Finland were co-ordinated by the non-profit independent Snowchange Co-operative in two ecosystems – the south boreal catchment area of Jukajoki (Mustonen 2014) in North Karelia and in the indigenous Skolt Sámi home area of the Näätämö basin in Lapland from late 2014 to 2016 (Mustonen and Feodoroff 2013). In both areas

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Figure 5.2 Skolt Sámi fishermen, Jouko Moshnikoff and Teijo Feodoroff, on the winter nets on the Näätämö basin, Finland. Lessons from Näätämö basin suggest that participatory monitoring can promote the actual use of local and Skolt Sámi knowledge in landscape management. Photo: Gleb Raygorodetsky.

fishing is an important economic and livelihood activity of the people living there. Ensuring a good quality of the watersheds to support fishing is a fundamental aspect of landscape stewardship.

In Jukajoki and in Näätämö rivers and basins, participatory monitoring activities were implemented with a focus on fishing resources. In 2015–2016 the formats to facilitate and communicate local monitoring were provided for five to eight handpicked, trusted fishermen and their associated teams. The formats were utilised by the fishermen/teams throughout the period. Monitoring observations have been analysed for the first season (2015) and the beginning of the second season (2016). These locations were chosen as they both represent areas where there were ongoing activities and arrangements in place that facilitate co-management and participation in landscape stewardship.

The first case, Jukajoki basin (Mustonen 2014), is located in the villages of Selkie and Alavi. It is heavily damaged by industrial activities in the catchment area and at the same time home to one of the largest aquatic habitat restoration activities in Finland. These activities comprise a total budget of € 2.7 million between 2010 and 2018 and combine local knowledge of Finnish-Karelian peoples, latest science and internationally recognised ways of collaborative management (Mustonen 2013). From the official government side, Center for the Environment, Transport and Economy, Municipalities of Joensuu and Kontiolahti and the Regional Administrative Agency are the participating natural resource management bodies. The restoration activities have been

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internationally regarded as 'best practice' in river management. Jukajoki has therefore, partly due to the participatory monitoring approach provided by the project, risen to international acclaim as a focal area for a new and more participatory approach to governance of natural resources and ecosystems.

The second case is the Skolt Sámi home region of Näätämö watershed in NE Lapland. In establishing participatory monitoring activities here, the project partnered with the Näätämö co-management project which began in 2011. This project provided already existing baselines and a testing ground for the international efforts (Mustonen and Feodoroff 2013). This is a region where the first collaborative management plan for Finland was published in 2013. Overall the ongoing co-management activities in the area aim to reform and renew watershed governance and so better reflect Sámi land and water uses and cultural rights. The Näätämö watershed is a cross border area between Finland and Norway, with the majority of the territory located in Finland. Being one of the most important Atlantic Salmon (*Salmo salar*) spawning rivers in Europe, the watershed is home to the rich cultures of the Indigenous Skolt Sámi, an important stakeholder group in the collaborative management actions. Additional important stakeholders are the Finnish speaking national minority in Norway, the Kvens and local Norwegians and Finns. Main natural resource management bodies in Finland who participate in the local interaction include Metsähallitus, Natural Resources Institute Finland, regional authorities, the Ministry of Forestry and Agriculture as well as the municipality of Inari. Although the area is home to co-management activities of specific projects (as part of the Hammastunturi Wilderness Area), co-management is at the same time a contested field in the area due to the conflict between decentralised local management with local and indigenous governance and the national legislation favouring central decision-making powers of state authorities that leaves limited room for decentralised decision making (Mustonen 2014).

The approach to participatory monitoring was introduced by the Nordic Resource Management project and monitoring formats were given to two Skolt Sámi fisherman teams active on the river: The first team led by a male Elder in his mid-sixties, consisting of three Skolt Sámi fishermen and a second team led by a reindeer herder fisherman in his mid-forties consisting of additional Skolt Sámi fishermen. Main fish for harvesting and monitoring were northern pike (*Esox lucius*), grayling (*Thymallus thymallus*), Atlantic salmon, white fish (*Coregonus lavaretus*), sea trout (*Salmo trutta*) and burbot (*Lota lota*). Utilisation of these fish resources is seen as one of the key aspects of the local interaction with the landscape. Both teams used the resources provided to monitor and document observations, catches and weather, as well as anything unusual from June to July in 2015 and 2016. The project co-ordinators visited the teams in April, June–July and early October. During these visits, the monitoring data were collected and oral histories were recorded (Mustonen 2015).

What Was the Outcome and Why?

Jukajoki catchment area and Näätämö basin represent the pilot locations for the use of formats to promote participatory monitoring and documentation of local and indigenous

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resource utilisation and governance. The fishermen found the inclusion of formats for participatory monitoring useful in both areas. It facilitated the local monitoring of key resources and the communication of key aspects of local knowledge.

In Jukajoki, the participatory monitoring captured a good number of important observations that are relevant in relation to the management of the watershed. In 2015 the fisherman teams recorded extreme weather events at the beginning of the season, such as very strong winds and cold weather that had not been seen at this time of the year for fifty to sixty years. For the first time in this river, rainbow trout (*Oncorhynchus mykiss*) were caught – an introduced species but also a species that the fishermen consider to be a useful indicator of good water quality. Plentiful catches of perch (*Perca fluviatilis*) also suggested good water quality. During midsummer, weather conditions close to normal were recorded.

Early results from 2016 indicate a new round of extreme weather, with very high temperatures early of up to 28°C in May. The common bream (*Abramis brama*) spawned weeks ahead of 'normal'. Catches in June were at relative low level perhaps because the sites of harvest and spawning were affected by this weather. The second crucial observation in 2016 was made in the sub-catchment area of Kissapuro, where a local landowner, as a part of the project activities, observed ammocoetes-stage brook lamprey (*Lampetra planeri*). Brook lamprey is a species that the fishermen consider to be a useful indicator of good water quality. The fishermen therefore interpreted this observation as suggesting that restoration efforts were being successful in Kissapuro basin and it helped guide the management.

The template formats of the Nordic Resource Management project for participatory monitoring have facilitated the documentation and use of local knowledge. The fishermen believe that it contributes to better documentation and monitoring and felt that their catch diaries and observations conveyed locations and amounts as well as indicator species and weather events well. It enhanced the monitoring and documentation of fish harvesting activities and it allowed assessment of changes in weather, fish resources and river water quality.

The participatory monitoring contributed to co-management and it complemented other initiatives on including local perspectives in the landscape stewardship. In addition to the participatory monitoring and documentation, the Jukajoki fishermen believe that mapping and interviews focused on traditional and local knowledge (Mustonen 2013) would be able to contribute to deeper and more complex local knowledge that is also needed for the management of the river and for the stewardship of the landscape. The co-management arrangements in Jukajoki include a guaranteed process of considering such local knowledge in the landscape management process.

The main results from the Näätämö basin include documentation of extreme weather events, e.g. early summer in 2015 which was exceptionally rainy and cold. In mid-July 2015, unusual grayling behaviour was reported. Grayling was still present in the pools that salmon prefer to use for spawning, such as Pyöreäsuvanto. The presence of grayling in these areas of Näätämö at this time of the year suggested that the male salmon had not driven them out as is usually the case. In 2015 fishermen reported 'dead salmon roe' at the bottom of the spawning areas, suggesting that as the water levels were very low

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in the autumn of 2014 and that the ice may have wrecked parts of the hatching roe over winter.

In both cases, Jukajoki and Näätämö, participatory monitoring was an important aspect of the management of the landscape. Knowing what is going on and obtaining knowledge from those who use the resources promotes landscape stewardship. In both cases, the monitoring tools are seen as suitable for documenting observations, harvest and uses of a basin. Participatory monitoring is an approach that can promote the actual use of local and Sámi knowledge. Relationships and interaction between the local Sámi and Jukajoki fishermen and the rivers and landscapes are deep and complex and in order to ensure that these perspectives are included in the stewardship of the landscape, there is also need to utilise more in-depth tools such as workshops, mapping and interviews where oral histories (Mustonen 2015) are being captured.

The Use of Facebook for Monitoring Hare Hunting in Outfield Landscapes in the Faroe Islands

What Did We Do and Why?

Hare hunting has a significant cultural value for people in the Faroes Islands (Fig. 5.3). On a pilot basis, from 2012 to 2016, the University of the Faroe Islands tested the use of digital technology for participatory monitoring of hare hunting in the outfield landscapes of the country. Through this initiative, the use of Facebook for capturing local information and for promoting participation in landscape stewardship was tested.

The Faroese outfield is divided into 454 areas. The owners have the right to use their outfield area, including the right to hunt wildlife. The owner can take advantage of this right or sell it. Often the right to hunt wildlife is sold on auction a week before the hunting season begins, usually for one season at a time. The price for the right to hunt hares in an outfield area for one season can vary from less than € 100 to more than € 4,000. The hunting period for hares in the Faroe Islands is from 3 November to 31 December every year.

The mountain hare (*Lepus timidus*) was introduced to the Faroese Islands from Norway as a hunting object in the years 1855 and 1858 (Bloch 1982). Four hares were released each year on the main island Streymoy. They reproduced and some were moved to the other islands. Today the species occurs on fifteen of the eighteen islands of the country. Although there has been hare hunting in the Faroe Islands for more than 150 years, no official hunting statistics exist and no assessment of the hare population has been made. An evaluation of the sustainability of the Faroese hare hunting was therefore impossible.

In 2012 the University of the Faroe Islands began recording of how many hares were shot. The result was surprising. During the first year 5,381 hares were registered shot on 649 trips in 199 outfields across the islands (Magnussen 2013). Undoubtedly many hunting trips were not reported. Exactly how big a portion went unreported is not known, but by assuming that 75 per cent of the shot hares were reported, it was provisionally

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Figure 5.3 Hare hunting has a significant cultural value for people in the Faroe Islands. Facebook has been used, both for capturing local information, and for promoting participation in the stewardship of the outfield landscapes. Photo: Eyðfinn Magnussen.

estimated that the hare population in the Faroe Islands in 2012 was approximately seven thousand individuals. This was a remarkable number because in the Faroese schools the children are taught that the Faroese hare population is only about five thousand individuals.

The study has been repeated three times since and there has been great interest in participating in the scheme. The data reported from hare hunters is summarised in Table 5.1. In 2013, 7,756 hares were reported shot on 904 trips in 269 outfields. In 2014, the results were 9,318 hares reported shot on 1,123 trips in 348 outfields. In 2015, the figures were lower: Only 4,012 hares were registered shot on 636 trips in 197 outfields. From these figures, we estimate the total Faroese hare population 2013–2014 to be in the order of 15,000–20,000 hares (Magnussen 2014a, b, 2015, 2016). The survey was particular successful in 2014 when information about hare catches was obtained from 348 (77 per cent) of the 454 outfields in the country (Fig. 5.4).

But how do you manage to capture information on the use of the outfield landscapes for hare hunting in a country where there is no official hunting statistics? Staff of the University of the Faroe Islands created a Facebook group where the hunters could report their catches and hunting experiences and communicate with other hunters and

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Table 5.1 Results of hunters' voluntary reports of the number of shot mountain hare (*Lepus timidus*), and the location of their hunting trips with the use Facebook (2012–2014) and a web-based database (2015), in the Faroe Islands.

Year	2012	2013	2014	2015
Number of hares reported shot	5,381	7,756	9,318	4,012
Hunting trips reported	649	904	1,123	636
Outfields with hunting reports	199	269	348	197
Villages with hunting reports	68	77	88	67
Islands with hunting reports	13	15	15	14
Number of observers	183	283	366	212

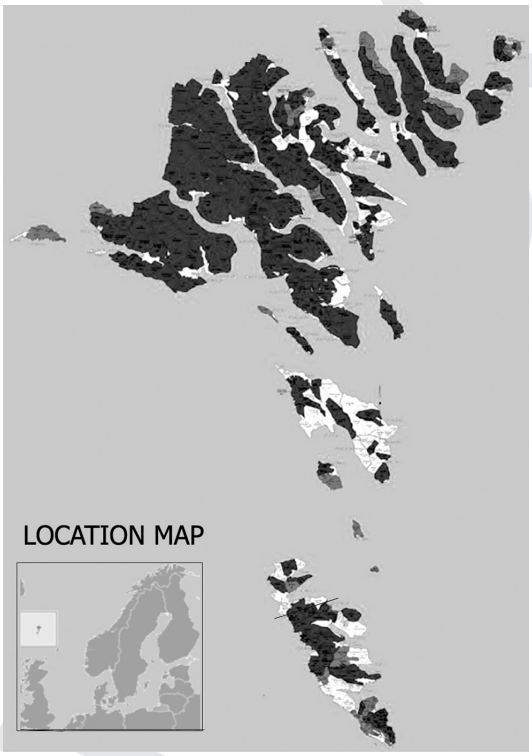

Figure 5.4 The locations of the 348 outfields in the Faroe Islands where hunters voluntarily self-reported information on hare hunting with the use of Facebook (2014). The map shows outfields where hares were shot and reported (dark), and outfields where hares are known to be shot, but catches not reported or where no hunting trips were undertaken (grey). For ten of the fifteen islands, where hares live, the dataset covered all outfields. On three islands, there are no hares.

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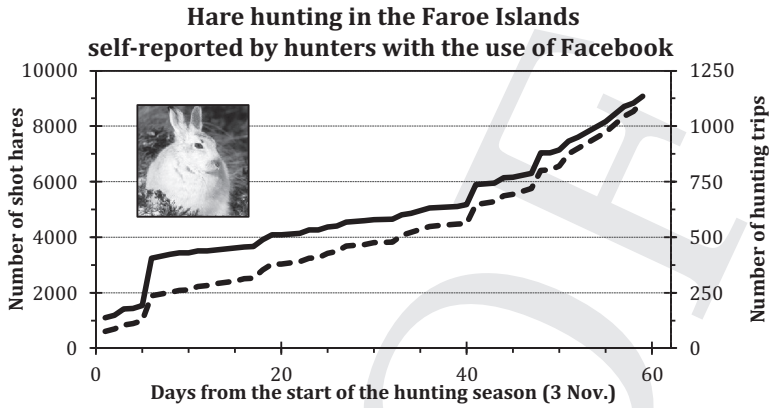

Figure 5.5 Daily numbers of shot mountain hare (-----) and hunting trips (- – -) in Faroe Islands, 2014, based on self-reporting by hunters with the use of Facebook (cumulative figures; n = 9,318 hares and 1,123 hunting trips).

scientists. The information from the hunters was then entered into a database where calculations and comparisons were made and the results were published on the same Facebook page. The use of the Facebook page enabled the collection of information on hare hunting and simultaneously promoted discussions on the use of the outfield landscapes.

What Was the Outcome and Why?

As the hunting season progressed the hunters could follow how it went in the different outfields throughout the country. The small 'data tag' that each hunter delivered for his outfield was then joined in a common puzzle. The hunters could follow their own figures and discuss hare hunting and the use of the outfields with other hunters.

Every year, when the hunting season was over a report was written by the University staff summarising the results. The hunters could see charts of how many hunting trips were performed and how many hares were shot on each island and in each village and how the hunting had developed over the season (Fig. 5.5). For example, one can read that 74 per cent of the total annual hare catches was shot in twelve of the total fifty hunting days in a season (2014). In addition to recording the results from each of the 1,123 hunting trips, one recognises that in the best hunting area they shot 214 hares for the entire season. On the trip in which they got the most hares, eight hunters shot sixty-six hares, but the most common yield was one- to-four hares per trip, as was the case for 44 per cent of the hunting trips. We also learned that many people in the country go hare hunting. In 2014 about twelve hundred hunters took part in the hunting. This is a high proportion of the inhabitants since the population in the islands is only forty-eight thousand people.

The use of Facebook enabled a dialogue between hunters and scientists on hares and hunting in the outfields based on collaboration and trust. The fact that the information

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on hare hunting is 'owned' by the hunters themselves is essential for the hunters, unlike in other countries where such figures often come from external organisations who may not be trusted by the hunters.

We further found that the size of the catches affects the hunter's intention to report it. We learned that when the hunters obtained a lot of hares, the catches were reported soon after the hunting trip; when the catches were small, the reporting was slower or the catches were not reported at all.

Although the experiences from monitoring hare hunting with the use of Facebook was useful and it provided the first evidence based estimate of the hare population in the Faroe Islands, there were challenges. It was very time-consuming for the scientist to enter data from the Facebook page into a database and a lot of information was incomplete. In Facebook, the text field is free and it is not possible to specify required information as a default. Some hunters only reported their total catch and forgot to write the date, place and other details. Likewise, sometimes they used multiple names for the same outfield. Therefore, it was often necessary to contact the hunters to obtain a complete string of data encompassing 'island, village, outfield, date, number of shot hares, number of guns, name of observer'.

In an effort to increase the quality of the entered observations and to reduce the time spent on cleaning and organising the data, a web-based-database was created in 2015, named 'www.haran.fo'. On this webpage, the hunters were supposed to personally enter their catch information. The required fields were set as default values and geographic data had to be selected from drop-down menus. In this manner a complete string of necessary data could be communicated in the right format in a single process. The data entered was transmitted directly into the database which then would be analysed; the results were quickly published on the webpage, making the findings available for hunters and the public almost in real-time.

The webpage was used instead of Facebook during the hare hunting season in 2015. Technically the webpage approach worked better than the use of Facebook. There were fewer encoding errors and less data cleaning work for the scientist. The 2015-hunting season was however bad, probably due to poor weather conditions during the hunting season and limited recruitment in the hare population linked with poor weather in the spring, so that the reports of hunting trips and shot hares were fewer than the previous years (Table 5.1). An advantage of the web-based system is that it works automatically and saves time for the scientists. However, the close communication and dialogue between the hunters and the scientists, critical for effective landscape stewardship, were lost.

The Potential for Engaging Local Stakeholders in Landscape Stewardship from Participatory Monitoring

A number of lessons have emerged from these three case studies and from other participatory monitoring schemes. We summarise these below and offer some suggestions on

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Table 5.2 Summary of benefits and challenges of participatory monitoring for engaging local stakeholders in landscape stewardship.

Key potential benefits	– Mobilizes citizens for taking active part in landscape stewardship – Connects local citizens with land management agencies – Reduces distrust between citizens and government – Can provide accurate and locally meaningful information on landscape values – Facilitates that landscape management actions become responsive to the local situation – Promotes multiple ways of knowing and multiple perspectives on landscape management
Challenges	– Government agencies must be willing and able to incorporate citizen information into landscape management decisions – Some landscape stewardship decisions are taken by international agencies who do not in practice take local community observations and insights into consideration – In natural science quarters, some remain sceptical about citizen-based information – Protocols for connecting the multiple ways of knowing need to be further tested and developed, both with digital and analogue approaches

what further research is required to fully evaluate the effectiveness of this strategy for engaging local stakeholders in landscape stewardship.

There are several benefits of participatory monitoring for landscape stewardship (Table 5.2). One is that participatory monitoring can mobilise citizens to observe and discuss the status of the environment and to propose management actions of relevance to landscape stewardship. By involving citizens in creating knowledge about the status and changes in the landscape, further interest is generated among the citizens to actively participate in landscape stewardship.

Another is that it connects local citizens who have a stake in the areas with organisations and government agencies who hold decision-making power related to landscapes and who are responsible for transforming national policies into practice.

Linked to this, participatory monitoring can be a way of softening the widespread distrust between local communities in landscapes and government and scientist executed monitoring and decision making. To establish effective landscape stewardship a constructive dialogue between these partners is of great importance.

Participatory monitoring builds on attention to specific attributes of the landscape. In our case studies, these attributes are a limited number of species and their status and trends. Monitoring of specific species populations can be a tangible way of following changes in the landscape. To a large extent local citizens assign values to the landscape precisely because they utilise different species in the landscape. From the perspective of the local citizens, the species that are utilised and monitored by local citizens can be considered proxy indicators of the 'health' of landscapes.

Participatory monitoring is capable of generating locally meaningful and accurate information on the status and trends in attributes that are of relevance to landscape

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management (Chandler et al. 2016, Danielsen 2016). The decisions that emanate from participatory monitoring are concerned with aspects of direct relevance to the citizens and they often connect food production for rural livelihoods with conservation of biodiversity. Participatory monitoring can thus be an important tool for linking management planning and execution more closely with its evaluation, so management actions become more responsive to the field situation, encouraging a processual approach to planning and management of the landscape. In many landscapes in Europe, alternative options available for obtaining regular and representative information on the status of landscape values to guide stewardship are limited due to the costs associated with scientist-led, centrally managed monitoring schemes.

Participatory monitoring also has the advantage that it can connect local and indigenous observations and knowledge with government-led land management, thereby promoting local and indigenous perspectives as valid and important perspectives for sound management of landscapes (Eira et al. 2013, Mustonen 2015).

There are also a number of potential challenges (Table 5.2). One is that government structures often have difficulties in incorporating citizen information into government decision-making processes. Sometimes government agencies' decentralisation largely remains as a policy text on glossy paper, for instance forming part of the objective of a law. Government processes are not adept at implementing the policies in reality. For a lot of aspects related to landscape management the central government still makes the final decisions even in countries with governments embarking on decentralisation. Participatory monitoring has limited effectiveness in terms of contributing to landscape stewardship in situations where decision-making power remains fully centralised. Linked to this, another challenge is that citizen involvement requires some form of incentives for the citizens. If citizens are involved without having a real say in the landscape stewardship or management, then local interest in participation will inevitably fade away (Constantino et al. 2016). In other words, if local perspectives are not incorporated into the landscape management, participatory monitoring and local stewardship are not likely to continue for long. In some Arctic countries, including Greenland, some landscape stewardship aspects are decided upon above the state level, by international agreements who typically do not take local community observations and insights into consideration (Tengö et al. 2016). Also in development of participatory monitoring and management systems it should be recognised that some of the indigenous and traditional knowledge can, due to its local cultural context, be difficult to translate directly into multi-stakeholder landscape management actions (Mustonen 2014).

Another challenge is that some natural scientists remain sceptical about the reliability of citizens' assessments of the status of the environment (Nordic Council of Ministers 2015). Likewise, some of the protagonists of indigenous and local knowledge do not accept integration of citizen and scientist executed, government led monitoring of the environment. Moreover, in several countries formats for connecting the multiple ways of knowing about the environment have not been developed, so a lot of the talk about the importance of local knowledge in national and international policies remains unimplemented (Tengö et al. 2016).

One potential challenge is that in situations in which constraints or demands on resources may condition quotas or financial payments to communities, the local

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communities might have an incentive to report false positive trends in those natural resources so they can continue to harvest the resources to obtain payment, even though the resources may actually be declining. Systems ensuring triangulation and periodic review of the participatory monitoring results will therefore be required although this is no different to any well-designed natural resource management initiative, whether the monitoring is implemented by communities, governments or the private sector (Lund 2014).

The use of digital technology for participatory monitoring can help facilitate communication of the status of key landscape values. Tools such as Facebook can promote collaboration and trust between community members and scientists. Technologies using webpages connected to databases may potentially reduce data entry errors and thereby increase the quality of generated data on the environment (Brammer et al. 2016). However, it is unclear as to what extent these digital approaches can mobilise citizens for taking active part in landscape stewardship.

Another challenge for participatory monitoring is that the costs associated with participatory monitoring are often put more heavily on other stakeholders (community members; community organisations; fishermen, hunter and farmer organisations; and facilitating organisations) than those of conventional scientist executed monitoring schemes and these stakeholders often have limited ability to influence government budgeting processes and thereby get access to finance aid for participatory monitoring.

Conclusions

Our study suggests that participatory monitoring can be an effective way of facilitating landscape stewardship approaches in the 'real world'. Participatory monitoring can be seen as one form of citizen science. However, whereas in most citizen science schemes the community members' role is limited to data collection, in participatory monitoring schemes, the local community members analyse what goes on in the landscape and what can be done about it and this leads to a more profound involvement of citizens in the governance of the areas (Kennett et al. 2015).

The involvement of citizens in monitoring is an important aspect of including citizens in landscape stewardship. It is difficult to decentralise landscape management without involving citizens and local resource users in following what is happening with the landscape. Therefore, we recommend that landscape stewardship includes the involvement of citizens in actual monitoring of what is going on.

The tools for participatory monitoring, both digital and analogue, however need further development, refinement and testing, to incorporate integration of local knowledge into national monitoring systems. It is also recommended that policies promoting use of local knowledge are translated into concrete regulations on how local knowledge should be used.

Just as participatory monitoring is benefitting from focusing on resources that are important for local people; we believe that landscape stewardship would benefit from prioritising resources that have significant utilisation value for the people living in the

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landscape. Our experiences suggest that local landscape stewardship is particularly promoted in those areas where there is a high degree of decentralised decision making assigned to the local citizens.

References

Berkes, F. (2012). *Sacred Ecology*. 3rd edn. New York: Routledge.

Bloch, D. (1982). Animal life on the Faeroe Islands. In *The Physical Environment of the Faroe Islands*, G. K. Rutherford (ed.). The Hague: Dr. W. Junk Publishers, pp. 53–68.

Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J. & Parrish, J. K. (2014). Next steps for citizen science. *Science*, 343, 1436–1437.

Brammer, J. R., Brunet, N. D., Burton, A. C., Cuerrier, A., Danielsen, F., Dewan, K., Herrmann, T. M., Jackson, M., Kennett, R., Larocque, G., Mulrennan, M., Pratihast, A. K., Saint-Arnaud, M., Scott, C. & Humphries, M. M. (2016). The role of digital data entry in participatory environmental monitoring. *Conservation Biology*. In press.

CAFF (2013). Status and trends in Arctic biodiversity. In *Arctic Biodiversity Assessment*, H. Meltofte (ed.). Akureyi, Iceland: Conservation of Arctic Flora and Fauna, pp. 44–69.

Chandler, M., See, L., Copas, K., Bonde, A. M. Z., López, B. C., Danielsen, F., Legind, J. K., Masinde, S., Miller-Rushing, A. J., Newman, G., Rosemartin, A. & Turak, E. (2016). Contribution of citizen science towards international biodiversity monitoring. *Biological Conservation*. In press.

Constantino, P. A. L., Buening, J. K., Silvius, K., Danielsen, F., Poulsen, M. K., Arroyo, P., Cruz, A. T., Ribeiro, K. T., Hvalkof, S., Durigan, C., Tofoli, C., Kinouchi, M. R., Leão, A., Estupinan, G., Tawada, R. & Fonseca, C. B. (2016). Monitoramento participativo da biodiversidade e dos recursos naturais (in Portuguese). *Biodiversidade Brasileira*, 16, l8–33.

Danielsen, F., Topp-Jørgensen, E., Levermann, N., Løvstrøm, P., Schiøtz, M., Enghoff, M. & Jakobsen, P. (2014). Counting what counts: Using local knowledge to improve Arctic resource management. *Polar Geography*, 37, 69–91.

Danielsen, F. (2016). *Expanding the Scientific Basis for how the World can Monitor and Manage Natural Resources*. Copenhagen: University of Copenhagen and NORDECO.

Eira, I. M. G., Jaedicke, C., Magga, O. H., Maynard, N. G., Vikhamar-Schuler, D. & Mathiesen, S. (2013). Traditional Sámi snow terminology and physical snow classification – two ways of knowing. *Cold Regions Science and Technology*, 85, 117–130.

Feodoroff, P. & Mustonen, T. (2013). *Näätämö and Ponoi River Collaborative Management Plan*. Kontiolahti: Snowchange Cooperative.

Gilchrist, G., Mallory, M. & Merkel, F. (2005). Can local ecological knowledge contribute to wildlife management? Case studies of migratory birds. *Ecology and Society*, 10, 20. (http://www.ecologyandsociety.org/vol10/iss1/art20/).

Greenland Government (1999). *Landstingslov nr. 12 af 29. oktober 1999 om fangst og jagt, §2 stk. 3.* (http://dk.nanoq.gl).

Johnson, N., Behe, C., Danielsen, F., Krümmel, E.-M., Nickels, S. & Pulsifer, P. L. (2016). *Community-Based Monitoring and Indigenous Knowledge in a Changing Arctic: A Review for the Sustaining Arctic Observing Networks*. Ottawa: Inuit Circumpolar Council.

Kennett, R., Danielsen, F. & Silvius, K. M. (2015). Conservation management: Citizen science is not enough on its own. *Nature*, 521, 161.

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CUUK3247-05 CUUK3247/Bieling ISBN: 978 1 107 14226 8 February 24, 2017 16:30

Lund, J. F. (2014). Towards a more balanced view on the potentials of locally-based monitoring. *Biodiversity and Conservation*, 23, 237–239.

Magnussen, E. (2013). *Hunting of Hare in the Faroe Islands in 2012 (in Faroese). Haruveiðan í Føroyum 2012*. Tórshavn: University of the Faroe Islands.

Magnussen, E. (2014). *Hunting of Hare in the Faroe Islands in 2013 (in Faroese). Haruveiðan í Føroyum 2013*. Tórshavn: University of the Faroe Islands.

Magnussen, E. (2015a). *Hunting of Hare in the Faroe Islands in 2014 and Other Information of Faroese Hare (in Faroese). Haruveiðan í Føroyum 2014 og annað tilfar um føroysku haruna*. Tórshavn: University of the Faroe Islands.

Magnussen, E. (2015b). Facebook was the key to collecting data for the Faroese hare hunt (in Danish). Facebook var nøglen til indsamling af data for den færøske harejagt. *Jagt & Jægere*, 6/7, 6–9.

Magnussen, E. (2016). *Hunting of hare in the Faroe Islands in 2015 (in Faroese). Haruveiðan í Føroyum 2015*. Tórshavn: University of the Faroe Islands.

Mustonen, T. (2013). Oral histories as a baseline of landscape restoration – Co-management and watershed knowledge in Jukajoki River. *Fennia*, 191, 76–91.

Mustonen, T. (2014). Power discourses of fish death: Case of Linnunsuo Peat Production. *AMBIO*, 43, 234–243.

Mustonen, T. (2015). Communal visual histories to detect environmental change in northern areas: Examples of emerging North American and Eurasian practices. *AMBIO*, 44, 766–777.

Nuttall, M. (2009). Living in a world of movement: Human resilience to environmental instability in Greenland. In *Anthropology and Climate Change: From Encounters to Actions*, S. A. Crate & M. Nuttall (eds.). California: Left Coast Press, pp. 292–326.

Nordic Council of Ministers (2015). *Local Knowledge and Resource Management. On the Use of Indigenous and Local Knowledge to Document and Manage Natural Resources in the Arctic*. Copenhagen: Nordic Council of Ministers.

Plieninger, T. & Bieling, C. (2012). Connecting cultural landscapes to resilience. In *Resilience and the Cultural Landscape – Understanding and Managing Change in Human-shaped Environments*, T. Plieninger & C. Bieling (eds.). Cambridge: Cambridge University Press, pp. 3–26.

Post, E., Forchammer, M. C., Bret-Harte, M. S., Callaghan, T. V, Christensen, T. R., Elberling, B., Fox, A. D., Gilg, O., Hik, D. S., Høye, T. T., Ims, R. A., Jeppesen, E., Klein, D. R., Madson, J., Mc Cuire, A. D., Rysgaard, S., Schindler, D. E., Stirling, I., Tamstorf, M. P., Tyler, N. J. C., van der Wal, R., Welker, J., Wookey, P. A., Schmidt, N, M. & Aastrup, P. (2009). Ecological dynamics across the Arctic associated with recent climate change. *Science*, 325, 1355–1358.

Riedlinger, D. & Berkes, F. (2001). Contributions of traditional knowledge to understanding climate change in the Canadian Arctic. *Polar Record*, 37, 315–328.

Sejersen, F. (2003). *Greenlands Nature Management (in Danish). Grønlands Naturforvaltning*. Copenhagen: Akademisk Forlag.

Tengö, M., Hill, R., Malmer, P., Raymond, C.M., Spierenburg, M., Danielsen, F., Elmqvist, T. & Folke, C. (2016). Weaving knowledge systems in IPBES, CBD and beyond – lessons learned for sustainability. *Current Opinions in Environmental Sustainability*. In press.

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Case 4 Citizen Science – Harnessing the Expertise of Farmers to Monitor Biodiversity in Austrian Meadows

Brian J. Shaw

Context

In the European Union, many farmers and other land managers receive payments to manage their land for the protection and enhancement of biodiversity alongside their production objectives. Monitoring of biodiversity on these lands is essential to understand the effects of their management and to ensure value for money. An Austrian initiative piloted a 'citizen science' scheme where farmers themselves observed and reported biodiversity.

Citizen Science is a broad term used to describe how members of the public take part in scientific research. This is often done on a volunteer basis with people collecting and submitting data or knowledge to researchers. This provides a benefit to the researchers who can access data and information from the field that would otherwise be expensive and time consuming to get, and to the citizens who can learn more about the topic at hand and scientific research in general.

Aims

The objective of the project is to gather information about the effects of land management practices tailored towards the promotion and protection of biodiversity, which will help policy makers design better funding programmes for nature protection. Furthermore, through involving farmers in the monitoring of their own land and farming practices, the project hopes to facilitate education and appreciation among the farming community for such management practices.

How It Works

The initiative started in 2007 with fifty farmers trained to recognise and count about 160 plant species in their meadows, which were then reported back to a database using an online system. From this data, and by considering management practices on the farms, a picture of the relationship between biodiversity and land management emerged. Farmers also reported that through this training and observing, they gained a deeper understanding and appreciation for the biodiversity on their land as well as the effects of their management on it.

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Since then, the project has expanded to seven hundred farms and now includes the monitoring of birds, spiders, insects and mammals. School children make farm visits and are also taught about the project and the relationship between biodiversity, land-use and agriculture. Sister observation projects have been set up on alpine meadows where the managers of seasonal grazing count orchids and other rare plants, and in Austrian forests where forest managers and owners have been trained in biodiversity related aspects of their forests and report data to the Federal Forest Office.

The information that is collected provides crucial data on the dynamics of biodiversity in different landscapes in Austria. The techniques used by farmers, foresters and ecologists have been tested, adapted and refined over the life of the project to collect the most interesting data in a convenient way. Furthermore, the management techniques of observers have been adapted to preserve and enhance biodiversity as they became more aware of the ecology of their land. Observation techniques and principles are now being taught in twelve agricultural colleges across Austria, and a wide range of educational materials and easily understandable information tools have been made available to the public wanting to learn more and to participate in the monitoring of biodiversity.

Further Reading

www.wiese.biodiversitaetsmonitoring.at/index.php/en/

Figure c4 Training farmers to monitor their meadows helps develop better biodiversity protection strategies. Photo: Umweltbüro Klagenfurt.