10 Social data: what exists in reporting schemes for different land systems?

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Introduction

Social science is, in its broadest sense, the study of society and the manner in which people behave and influence the world around us. It tells us about the world beyond our immediate experience and can help explain how our own society works (Economic & Social Research Council, 2022). In this chapter, we consider social science data as a way of adding additional explanatory variables to trends and changes seen in environmental data.

Direct inclusion of social data in long-term environmental monitoring programmes is relatively rare, but in some cases, monitoring and socioeconomic data are combined in the phase of analyzing the data. However, the lack of social data is a weakness for many monitoring programmes, perpetuating the Cartesian separation between nature and culture. It limits the potential for robust analyses of socioecological system dynamics to explain observed variability and causation of change as well as to predict future change. Often the most successful studies linking social and environmental data tend to be at a sub-national scale or have a fairly narrow spatial, temporal, and/or thematic remit.

This chapter presents a series of case studies from a range of different countries, describing how social data have been incorporated into environmental studies. On the whole, these demonstrate the fairly narrow remit of this type of work, although some do offer suggestions for increasing the incorporation of social data into national-level monitoring, perhaps offering hope for the future.

Examples of the collection of social science data in relation to ecological monitoring from the UK are presented but illustrate the limited nature of this work. An example is given from Loweswater, in the English Lake District, where transdisciplinary science was undertaken at a small scale. This demonstrates an approach that could perhaps be expanded to national scales in some scenarios.

In Sweden, some attempts are being made to incorporate social data into monitoring, particularly in the realm of tourism, forestry scenario analysis, and the interaction between forestry and reindeer husbandry. The latter case demonstrates disparate social and ecological issues.

In Iceland, many environmental issues are caused by sheep grazing. Here, historic records are available, including written records, old aerial photos, and maps.

We also present a case study from Vietnam, an example of a low-income country where data regarding agricultural production and demography are reported annually.

Finally, the notion of *freelisting* is presented. Freelisting is an ethnographic tool that can be employed within interdisciplinary fields.

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Case studies

The UK

Social data within national environmental monitoring schemes

As with most other countries, in the UK the collection of social data has traditionally been rare in many existing national long-term environmental monitoring programmes, such as the UK Countryside Survey (2022) or the National Forest Inventory (Forest Research 2022). Whilst some work has been undertaken to link social and ecological data in quantitative analyses, typically in short-term (1–5 years) to medium-term (5–12 years) research-driven projects aligned to these surveys, it is limited in spatial coverage and topical range. In stable, long-term (>10 years) national survey programmes, social data collection and integration with environmental parameters is not common practice among expert government agencies or stakeholder organizations. There are a number of examples where it may have been explored as an afterthought, or an "added-extra", as in Potter and Lobley (1996), who introduced a socioeconomic questionnaire into the UK Countryside Survey, following the 1990 edition of the survey, to shed light on farming practices. However, this type of work has not become a regular component of the survey, thus far.

Across England, from 2009 to 2019, the English conservation agency, Natural England, ran the Monitor of Engagement with the Natural Environment (MENE) survey (Gov.UK 2022c). It collected data about outdoor recreation, pro-environmental behaviours, and attitudes towards and engagement with the natural environment. It has now been renamed the People and Nature Survey, going forward. Whilst it is encouraging to see this type of data being collected in a national scheme, it does not necessarily offer much opportunity to integrate the data with other national monitoring schemes (such as the UK Countryside Survey, for example).

Agricultural surveys and agri-environment schemes

Often, social data that do exist are commonly collected in relation to the management of agricultural land, again carried out separately to long-term environmental monitoring schemes. There is an annual June Survey of Agriculture and Horticulture across the UK, carried out by the government, which collects detailed information, via a questionnaire, on arable and horticultural cropping activities, land usage, livestock populations, and labour force figures. The information includes long-term trends or detailed results for different types of farm, farm size, or geographical area (Gov.UK 2022b). In England, this is complemented by regular Farm Practices Surveys, looking at how English farming practices are affected by current agricultural and environmental issues, such as greenhouse gas mitigation and soil management. The content of the survey is agreed on each year in consultation with users to ensure the information collected remains relevant to current issues (Farm Practices Survey 2022a).

Another area where social data have been collected from land managers is in the area of agri-environment schemes (AESs). AESs offer farmers financial incentives to improve the conditions for semi-natural species dependent on less-intensive agriculture, such as insects and plants, and are implemented in several parts of the world with the goal of reversing biodiversity losses (McCracken et al. 2015). AESs are costly and have had variable success (Ansell et al. 2016). In an attempt to evaluate the role of the farmers' attitudes in relation to AES, McCracken et al. (2015) take a qualitative approach, proving a powerful link between biodiversity outcomes and farmer motivations. In addition to traditional counts of biodiversity (such as plant censuses and invertebrate richness) undertaken on a series of farms, interviews were completed with farmers to understand their experience and engagement with the AES. These qualitative data were given quantitative scores to enable analysis of the ecological data alongside the social data. Results revealed that farmer experience went a long way in determining habitat quality outcomes.

In the UK, the Department for the Environment and Rural Affairs (DEFRA) funds a range of other research relating to farmer attitudes and AESs (Mills et al. 2013), including research related to the introduction of a new post-Brexit scheme, the Environmental Land Management Scheme (ELMS). In Wales, the Welsh Government funded a large modelling and monitoring programme between 2013 and 2016 (the Glastir Monitoring and Evaluation Programme), which included a Farmer Practices Survey element; however, this was not closely linked to the field survey.

Environmental problems – water quality at Loweswater

Quite often, a need to collect social science information arises when a particular problem occurs, rather than being part of a longer-term monitoring programme. An example of this was at Loweswater in the English Lake District in 2004, where a pollution problem was identified in relation to runoff from farmland into the lake, causing toxic algal blooms indicating poor water quality. The scientific data collected were complemented by knowledge of local issues and tensions, current farming practices, and economic pressures collected from 13 farms in the Loweswater catchment (Waterton et al. 2006). This project was part of the Rural Economy and Land Use (RELU) programme, an interdisciplinary programme incorporating social science perspectives into research to enable better action to be taken to address environmental issues. The combination of an interdisciplinary, stakeholder-inclusive scientific approach and the positive stance towards understanding and managing the problem of pollution in Loweswater taken on by the farmers presented an opportunity to identify effective approaches to catchment management. Such approaches had already been pioneered elsewhere globally (for example, through the UNESCO Hydrology for the Environment, Life and Policy [HELP] programme; UNESCO 2022).

Sweden

The National Inventories of Landscapes

In recent years, the National Inventories of Landscapes in Sweden (NILS) has been trying to accommodate social aspects in its system of variables for monitoring (Allard 2017; Ståhl et al. 2011). The programme ran from 2003 to 2019 in the original form, after which the focus switched to monitoring habitats for the Natura 2000 reporting to the European Union (EU).

One of the initial thoughts was to provide data for researchers in the fields of recreation in nature and tourism, and variables were added to the survey, although the main focus of the survey was on ecology and the 16 national environmental quality objectives (Swedish Environmental Protection Agency [EPA] 2013). The programme was promoted at national conferences, such as the European Tourism Research Institute (ETOUR) at Mid-Sweden University. Another way to pursue the social aspect of the inventory was for co-applicants to provide additional funding in this field of research; for example, using remote sensing in the search for tracks from off-road driving (motorbikes or terrain vehicles) in mountainous terrain or researching older, inhabited settlements and their abandonment in the remote areas of the mountainous zone using stereo aerial photos from the 1950s.

An example of involvement of society on higher levels is the development of the National Land Cover Data, Nationella Marktäckedata (NMD; Swedish Environmental Protection Agency 2022), for version 2, with a long period of work involving the administrative boards of counties and municipalities, each looking out for the specialties of their own regions. A number of national authorities were also involved, to be part of the development into a map that would be of use for as many purposes as possible, such as statistics on green spaces in urban areas or planning where to build new housing areas. The Swedish Civil Contingencies Agency is another example, because they are responsible for fire mitigation and planning, a very real problem in a country relying on forestry as one of the main foundations of their economy. The collaborative work resulted in a new version with 48 classes instead of the previous 25 (see Figure 10.1). Lastly, the local involvement came in the shape of a competition, "Hack for Sweden", where one of the topics was combining the land cover map with social well-being in the form of recreation in the landscape. The winning solution was the creation of an app where you can choose, for example, the type of forest you want and find the nearest space to visit. The prize was funding to develop this app further (NewSeed IT Solutions 2002).

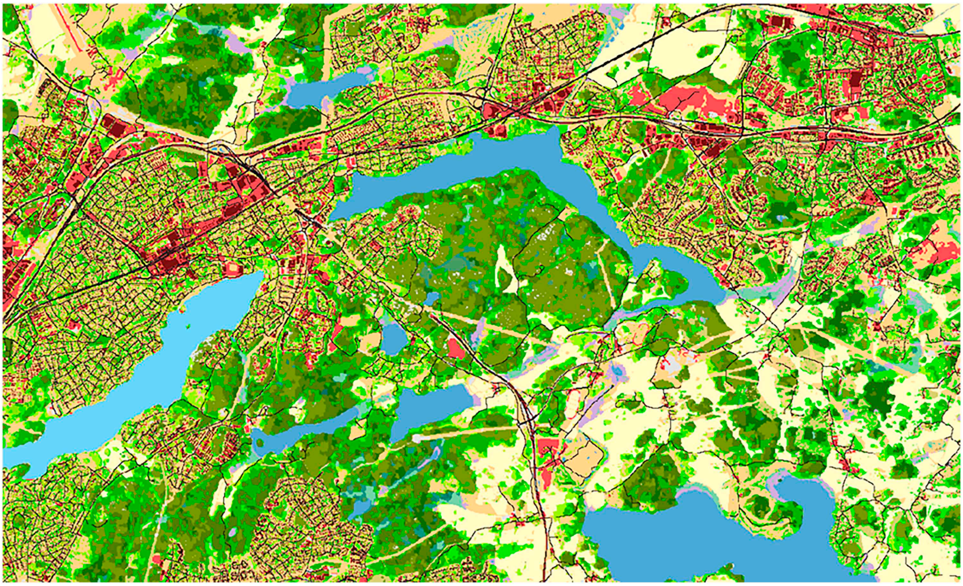

Figure 10.1 A section of the Swedish land cover mapping (under development), an open-source database from the area of Kristianstad, in southern Sweden. To be as useful as possible, the development for version 2 involved nearly 50 people from 25 different authorities and universities. The result of this work ended up in a version including 48 land cover classes instead of the previous 25.

Source: Swedish Environmental Protection Agency (2022).

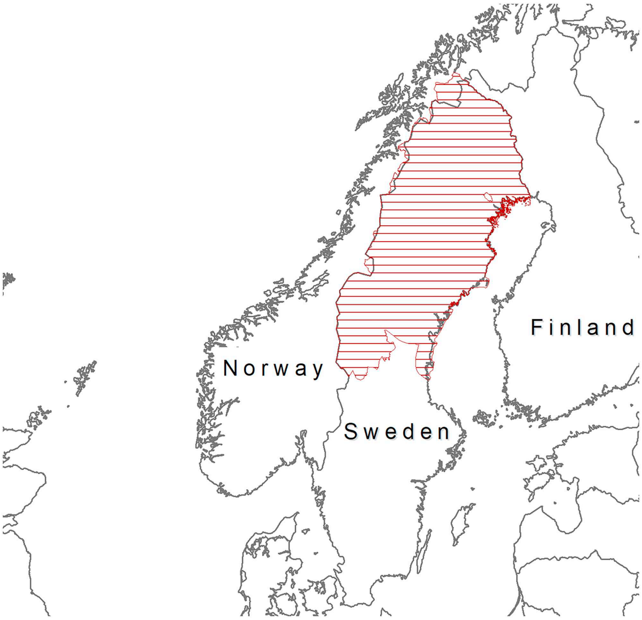

Figure 10.2 The area (in red) used by the Swedish reindeer herding communities (RHCs) according to the Sami Parliament (2022).

Reindeer husbandry in Sweden

The topic of reindeer husbandry in Sweden encompasses a range of environmental, social, and cultural issues. The Sami are an indigenous people in Northern Europe in what is today Norway, Sweden, Finland, and Russia. In Sweden, Sami history, culture, traditions, legal rights, local economy, and well-being are closely connected to reindeer husbandry (Sami Parliament 2022). Sami people have an exclusive right to herd and graze their reindeer (*Rangifer tarandus*) within the reindeer husbandry area (RHA), which constitutes a large part of northern Sweden (Figure 10.2).

There are two major systems of reindeer husbandry. Mountain reindeer husbandry is dependent on summer pastures in the alpine region, whereas winter pastures are situated in the boreal region close to the Gulf of Bothnia. Forest reindeer husbandry relies on both summer and winter pastures in the boreal region in the eastern part of the RHA. In both reindeer husbandry systems, summer grazing includes a variety of plants, grasses, lichens, and fungi, whereas winter grazing mainly consists of lichens. Lichen availability is therefore considered a bottleneck resource for reindeer and thus reindeer husbandry (Sandström et al. 2016). In the 1970s, it became apparent that other land uses, mainly forestry, negatively impacted lichen pastures. Although there are monitoring data on lichens from the Swedish National Forest Inventory (NFI) dating back to the 1950s, there have been very few estimates on the status and trends of ground lichens in the RHA. However, in a recent paper, it was found that lichen-abundant forest had decreased (since the 1950s) by 70% (Sandström et al. 2016). The Swedish Environmental Quality Objective 14, “A Magnificent Mountain Landscape”, states that a high reindeer grazing pressure is required to keep the landscape open, at the same time acknowledging that the objective is dependent on corresponding grazing opportunities in the forest region (Swedish EPA 2019). However, the government response so far has focused on facilitating consultations between RHCs and other land users, rather than to get involved in regulating or monitoring the lichen availability.

In Sweden, some social data are collected with respect to reindeer husbandry. These data are presented on the webpage of the Sami Parliament (2022) and include basic information regarding the number of reindeer, the composition of the herd, number of reindeer owners and their gender, produced reindeer meat in kilograms, and the value of reindeer meat in Swedish krona. There is an apparent ecological correlation between number of reindeer and available lichen winter pastures, but the authorities do not explore this correlation. According to the Reindeer Husbandry Act (Swedish Code of Statutes [Svensk Författingssamling] 1971) the county administrative boards are responsible for deciding the maximum number of reindeer for each RHC. This number should be decided based on the carrying capacity of the grazing lands but also consider other interests and land users. However, without reliable monitoring data, there is a risk that maximum permitted reindeer numbers will be reduced instead of addressing, for example, the loss of grazing lands due to competing land users (Horstkotte et al. 2022; Sarkki et al. 2022). Despite the decrease of lichen-rich forests, reindeer numbers have remained relatively constant over time. This has been attributed to different forms of adaptation (husbandry practices, mechanization, supplementary feeding, etc.). However, the RHCs are left with the responsibility to govern their pastures more or less independent of the government or government agencies. This has resulted in a situation where the RHCs have opted for a voluntary programme of mapping and monitoring their grazing lands on their own (see chapter 17).

Nevertheless, reindeer husbandry would undoubtedly benefit if the social and cultural aspects of reindeer husbandry were included in national environmental monitoring programmes. Such monitoring programmes could, for example, seek to answer the following questions (all of which are important to understanding future prospects for reindeer husbandry): how has lichen amount and distribution changed over time? What is the relationship between forest conditions, climate, and reindeer population sizes? What is the relationship between reindeer population sizes and the prospects of a continuous reindeer husbandry? What kind of habitats are important for reindeer husbandry (year-round), and are they monitored?

Monitoring as a basis for scenario analysis

Modelling scenarios can be an important tool for landscape analysis and can incorporate different types of data, including social data. Analysts may use monitoring data for several purposes. The state and trends of biodiversity indicators are an important basis for analyzing policy related to management or conservation of ecosystems. However, using monitoring data for scenario analysis also may add important insights when assessing policy options. This is particularly the case if we use monitoring data as part of broad analyses where socioeconomic impacts are considered as well.

Analysts may specify different scenarios and use monitoring and other data to predict the likely consequences in terms of ecosystem services under each scenario. Based on the results, decision makers may implement the policies that are assessed to lead to the scenario with the "best" future output of services. Compared to only assessing the state and trends, scenario analyses thus add important information for decision makers, because it is fundamental to know not only about the past and present but also about the likely future developments given different policies.

In this case example, we describe how the Swedish Forest Agency and the Swedish University of Agricultural Sciences conduct scenario analyses as an input to policy processes related to the management of Swedish forests. In these analyses, monitoring data from the Swedish National Forest Inventory (NFI; Fridman et al. 2014) are used in the Heureka system (Wikström et al. 2011) together with separately collected socioeconomic data.

Forest scenario analyses of the kind outlined above have been conducted for a long time in Sweden. In the most recent Forest Scenario Analysis (Skogliga Konsekvensanalyser, SKA 22; Swedish Forest Agency 2022), important study features involve the future outputs of ecosystem services from Swedish forests given different policy options for the forest management. At the heart of the analysis lies the trade-offs between future timber outputs, greenhouse gas fluxes, and habitat conditions. Because these issues are closely interlinked, it is important to study them within a unified scenario framework rather than making separate analyses addressing each of the services individually (The Swedish Forest Agency 2021, 2022).

The SKA22 project uses Swedish NFI monitoring data as an important input. These data are collected from several thousand field plots annually, distributed across Swedish forests to obtain a statistically correct baseline input regarding the state of the forests (Fridman et al. 2014). The measurements on each plot involve a large number of characteristics important for deriving indicators linked to, among other things, timber, carbon, and biodiversity. The Heureka system has a module specifically tailored for incorporating NFI data as a basis for regional and national forest scenario analyses. The system uses these data together with models for the development of forests to predict the future outcome of ecosystem services, given management options specified by the analyst. Each management option thus reflects a specific scenario for the future development of the forests.

To specify the management options and to provide socioeconomic data to Heureka that are not available from the NFI, the Swedish Forest Agency carries out a separate preparatory socioeconomic analysis. During this analysis, outlooks for relevant socio-economic parameters are made not only for Swedish conditions but also in a general international context because Swedish forestry is closely linked to international forestry developments.

The outlook for SKA22 identifies an increased demand for Swedish wood products; a need for adapting forest ecosystems to climate change, especially to avoid disturbances; and expectations to increase carbon sequestration and to halt biodiversity loss. There are also ongoing policy processes nationally, regionally (EU), and globally towards "more of everything". The scenario setup therefore ranges from business-as-usual (BAU) to more biodiversity, climate adaptation, increased growth, and a combination of these (The Swedish Forest Agency 2022).

The scenario analysis in Figure 10.3 shows larger trade-offs in the long-term perspective compared to the mid-term. It also shows larger effects for economy and biodiversity than for climate change mitigation. A strict focus on any single target (diversity, climate, or growth) would most likely generate larger societal conflicts compared to combining them, which, on the other hand, would not generate that much of a difference compared to the business-as-usual scenario.

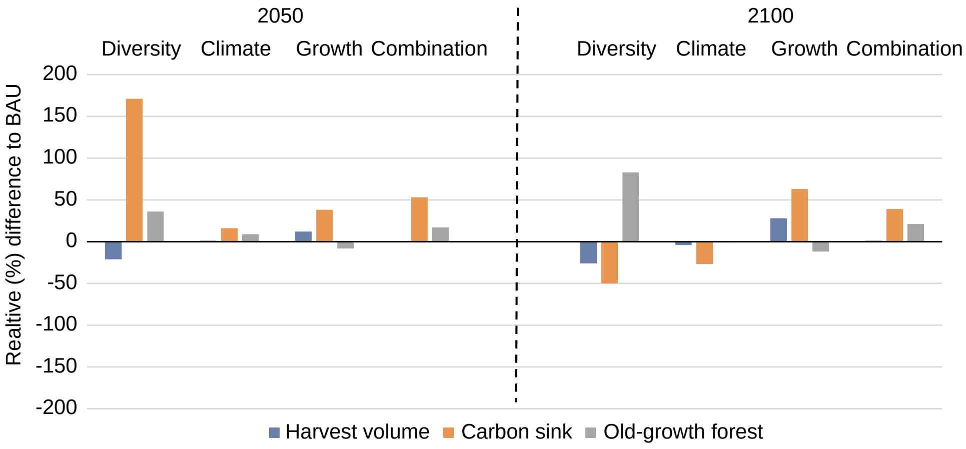

Figure 10.3 Scenario analyses in the project SKA 22, investigating possible outcomes in harvest volume, carbon sink, and area of old growth (virgin) forest in Sweden by the years 2050 and 2100, depending on different policy trajectories in Sweden, relative to business as usual (BAU). The scenarios show the outcome, should the policies demand focus on: diversity, climate, growth, or a combination of these.

Source: Swedish Forest Agency (2022).

Iceland

In some cases, historic records can give a valuable insight into the social elements of landscape change.

In Iceland, inventories of social data since first settlement (783 AD) relevant to environmental change over time have been made, searching down stratigraphic layers of soil, written records, old aerial photos, and maps. In the last millennium, together with shifts in demography and ownership of common grazing land for sheep, the use of common rangelands has resulted in severe degradation of areas of vegetated land over time (Gísladóttir 2001; Gísladóttir et al. 2010; Erlendsson et al. 2014; Sigurmundsson et al. 2014, 2021). In recent centuries, the remaining birch woodlands have also been much depleted, due to increases in numbers of sheep, in contrast to the forests of the island from the time of the settlements in the ninth century (Erlendsson et al. 2014). Figure 10.4 shows a highly degraded pasture, with only small remnants of vegetation, and Figure 10.5 shows a part of Thingvellir, the ancient parliament place, which is protected from grazing and is a representation of the original vegetation of the island. In Iceland, much effort is placed on soil research and the possibilities for the soil to retain surface water, because the very thin layer of soil can degrade quickly when the vegetation cover is degraded, and the underlying pumice stone will then not be able to hold surface water and the restoration of a viable soil layer will be very difficult. Because Iceland is situated on the Mid-Atlantic Ridge, there is also the added hazard of repeated volcanic eruptions (e.g. Arnalds 2015; Sigurmundsson et al. 2021). Vegetation cover and functioning ecosystems are the key to climate change mitigation but also provide carrying capacity (food and habitat) for grazing animals, so efforts to reverse the degradation of soils and vegetation by reducing stocking levels can lead to conflicts of interest and difficult choices for policymakers (Ágústsdóttir 2015; Halldórsson et al. 2017).

Figure 10.4 Grazing land at Tröllkonuhlaup in Iceland. Much of the area is heavily grazed and the soil is bare in many places.

Credit: Photo by Anna Allard.

Socioeconomic and production data – the case of Vietnam

In many low-income countries with centrally planned economies, governments assess and monitor agricultural production and other social, economic, and landscape-related parameters for purposes of governance; for example, as a basis for five-year plans and development strategies. One example is Vietnam, where strategies and policies firmly direct the resource management at central and local levels (Figure 10.6).

All over the country, data on status and change in, for example, agricultural production and demography are reported annually in a standardized format from local communes through districts and provinces to the central state level for the purpose of governance and monitoring of national plans and targets. Additionally, the area distribution of land use classes and some aggregated socioeconomic parameters are reported; for example, household income, poverty rate, and human health status. Such data are usually based on questionnaires. They can sometimes be quite detailed, but often they are not sufficiently consistent and unbiased for reflecting long-term changes and trends (Ohlsson et al. 2005, see more on this topic in chapter 3).

In a publication by the General Statistics Office of Vietnam (Text box 10.1, Figure 10.7), annual data collected from the agriculture, forestry, and fishery sectors during 1975–2000 in the 61 provinces of Vietnam were presented (a series of some older reference data for 1960–1975 was also included). The publication illustrates what type of standardized data

Figure 10.5 Land area protected from grazing at Thingvellir, Iceland, showing the arctic birch forest that once covered most of the land.

Credit: Photo by Anna Allard.

were collected within the government structure of Vietnam. When interpreting the data, one needs to be aware that production data are reported based on annual plans and targets issued by the government. They are therefore to some degree a reflection of government ambitions and not an objective assessment of the local situation (Ohlsson et al. 2005).

Freelisting: an ethnographic field method to monitor the diversity of biocultural knowledge

To understand and record place-based knowledge of local environments, in particular of environmental resources – wild, semi-domesticated, and domesticated – and their utilities and management, there are a series of ethnographic tools employed within interdisciplinary fields such as cultural anthropology, human ecology, and human geography. Typically used to study small-scale economies in the Global South where smallholder agriculture and horticulture dominate, these tools document what is commonly known as *traditional ecological knowledge* (TEK); related terms are *Indigenous knowledge*, *folk taxonomies*, and *ethnoecology* (e.g. Balée and Nolan 2019).

These qualitative fields of inquiry add to other approaches to monitor diversity; for instance, by supplementing species inventories with locally recognized varieties and by documenting the practices and management systems that contributed to their evolution.

Figure 10.6 Intensified agriculture combined with market economic policies since 1990 has released land and promoted plantation of forest and cash crops by households and enterprises in Vietnam.

Credit: Photo by Mats Sandewall.

They are based more on different sets of practical, functional, and morphological characteristics than quantitative systematization. A major focus of inquiry lies in the structure, characteristics, and variability of the adaptive, place-based knowledge systems themselves, as well as how these relate to different cultural knowledge domains (such as *plants* or *soils*). The term *cultural salience* of a domain is often used, which means the degree to which members of a particular culture hold a domain to be of particular importance (the rich taxonomic vocabulary to describe different kinds of snow and ice among Inuit communities is a classic example), and although this is related to economic significance, cultural importance should not be reduced to economic value (Austin et al. 2015; Balée and Nolan 2019).

Among several tools of data collection, freelisting is a qualitative interviewing technique that has recently grown in popularity. It is a tool for rapidly exploring how groups of people think about and define a particular domain and is well suited for engaging communities and identifying shared priorities (Keddem et al. 2021). The domains are defined by the data collector – for instance, *types of vegetation*, *edible root plants*, or *crop varieties* – and collects the inside view (or *emic* view) of the people living and working in a particular environment. The strength of this method is that it elicits unimagined, spontaneous responses that can be collected, analyzed, and quantified, and results from these analyses can be incorporated into mixed-methods studies in different populations

Text box 10.1: Forest reporting from Vietnam

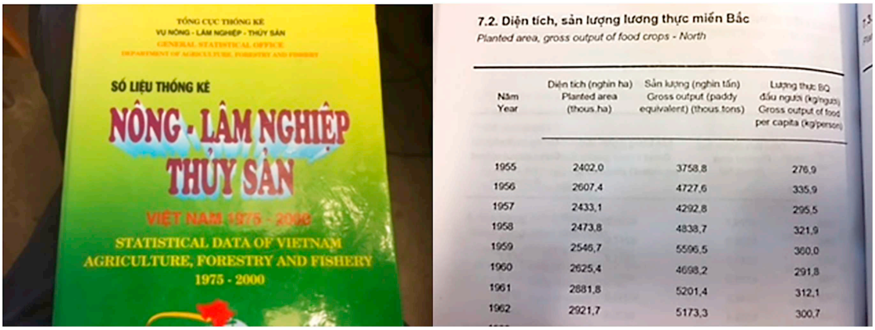

Figure 10.7 In Vietnam, data on status and change in, for example, agricultural production and demography were reported annually in a standardized format. Additionally, the area distribution of land use classes and some aggregated socioeconomic parameters were presented.

Various data (annual and for each province) presented in the numerous tables of the summary publication from Vietnam include:

Indicators

- Demography (year, province): population, households, and labour in agriculture, forestry, fishery
- Land use (by year and province): agricultural land (rice, other crops, total), forestry, fishery
- Vehicles and machines used in agriculture, forestry, fishery.

Agriculture

- Cultivated areas, yields, gross economic output, crops planted (households and industrial), food production, fruit trees, number of pigs, cattle.

Forestry

- Gross economic output (afforestation, exploitation), forestry area (status 1997), area of afforestation, quantity of logged wood

Fishery

- Gross output (breeding, capture, total), gross output of fish, shrimps, breeding water products

Farms and households

- Number of farms (annual crops, perennial crops, livestock, forestry, fishery, mixed activity
- Farm labour (owners' family, hired regular, temporary hired.

and settings to contribute valuable understanding of needs and priorities in the community (Bernard 1994; Balée and Nolan 2019; Meireles et al. 2021).

Freelisting is a simple method to carry out. It is an interview technique by which respondents who represent a given social group list all items in a given semantic domain. The social group and the semantic domain are defined according to monitoring aims; for instance, tree species among forest foragers who share a language in a particular region. The sample size is recommended to be at least 15, but there is no upper limit. Freelisting rests on several assumptions, including:

- People tend to list the most familiar items in the domain first.
- Items listed first tend to be prototypical and locally significant, and their names are usually shorter.
- Individuals who have more knowledge about a domain tend to list more items.

Freelists are analyzed statistically – for example, using the software ANTHROPAC 4.983/x (Borgatti 1992) – to assess the diversity of domains within, and among, social groups, with a particular focus on evaluating the salience, or cultural importance, of domains and items. For a comprehensive introduction to freelisting and an example of application, see Balée and Nolan (2019).

Key messages

- From the examples presented from a range of different countries outlined in this chapter, it is obvious that social factors are extremely relevant in almost all instances of land use and management.
- However, attempts to investigate and quantify these social factors as part of long-term environmental monitoring are not common, although social data and monitoring data are sometimes combined in the analysis phase linked to monitoring programmes.
- The importance of taking an integrated approach towards the management of the rural environment and incorporating local knowledge as part of that process has been recognized for some time. In rural policymaking, it has been recognized that there is a need to work with those who manage, use, or own land and other rural resources to try and understand stakeholder perceptions and practices around rural issues, in addition to traditional scientific data collection (Harrison and Burgess 2000; Stuiver et al. 2004; Toogood et al. 2004; Hooper 2005).
- Whilst some attempts to achieve this exist and have been described in this chapter, it is often a costly and complex undertaking (especially at scale), and there is still a long way to go before social and environmental data are fully integrated in ways that can help to address socioecological change (for example, see Austin et al. 2015).

Study questions

1 Why do you think it was important to enrol local knowledge for the pollution monitoring in the Loweswater catchment area?
2 How can scenario analyses contribute to the integration of social data in monitoring, and how do results benefit from it?
3 Why is it important to use the traditional ecological knowledge and cultural salience of the local population, and what does that bring to our knowledge when we want to understand possible future outcomes?

4 Considering what you know about national ecological monitoring programmes across Europe, what ideas might you put forward to incorporate additional social science into these existing schemes?
5 Given limited resources in low-income countries, can you think of additional ways of collecting social science data in relation to environmental monitoring in a cost-effective way?

Further reading

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