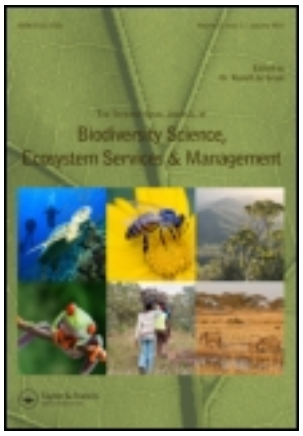

International Journal of Biodiversity Science, Ecosystem Services & Management

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tbsm21

Long-term land-use and landscape dynamics in Budalen, central Norway

Thyra Solem [a], Egil Ingvar Aune [a], Marc Daverdin [a], Kristian Hassel [a], Per Sjögren [a], Lars Stenvik [a], Aud M. Tretvik [b], Dag-Inge Øien [a] & Gunnar Austrheim [a]

[a] Museum of Natural History and Archaeology, Norwegian University of Science and Technology, NO-7491, Trondheim, Norway

[b] Department of History and Classical Studies, Norwegian University of Science and Technology, NO-7491, Trondheim, Norway

Version of record first published: 30 Nov 2012.

To cite this article: Thyra Solem , Egil Ingvar Aune , Marc Daverdin , Kristian Hassel , Per Sjögren , Lars Stenvik , Aud M. Tretvik , Dag-Inge Øien & Gunnar Austrheim (2012): Long-term land-use and landscape dynamics in Budalen, central Norway, International Journal of Biodiversity Science, Ecosystem Services & Management, 8:4, 351-359

To link to this article: http://dx.doi.org/10.1080/21513732.2012.723639

International Journal of Biodiversity Science, Ecosystem Services & Management
Vol. 8, No. 4, December 2012, 351–359

Taylor & Francis
Taylor & Francis Group

Long-term land-use and landscape dynamics in Budalen, central Norway

Thyra Solem[a], Egil Ingvar Aune[a], Marc Daverdin[a], Kristian Hassel[a], Per Sjögren[a], Lars Stenvik[a], Aud M. Tretvik[b], Dag-Inge Øien[a] and Gunnar Austrheim[a]*

[a]*Museum of Natural History and Archaeology, Norwegian University of Science and Technology, NO-7491 Trondheim, Norway;*
[b]*Department of History and Classical Studies, Norwegian University of Science and Technology, NO-7491 Trondheim, Norway*

Humans have used resources in mountain landscapes for thousands of years, but the intensity and continuity of different land uses and the corresponding landscape changes are not well understood. This study examined long-term interactions between land use and landscapes in Budalen, central Norway, by using a multidisciplinary approach. Palaeoecological investigations at three sites in a north-south transect along the length of the valley indicate mowing and livestock grazing from AD 1500 to 1600. No clear signs of human-induced vegetation shifts are indicated at earlier time stages at the two southern sites. No archaeological findings support land use prior to AD 1500. Written sources give evidence for haymaking at AD 1600 and a more intense land use with summer farming followed in the eighteenth century. Land-use impact had a longer continuity at the northernmost site where furnaces for iron production and other human artefacts are dated as early as 180 BC–AD 25. These archaeological findings closely correspond to an opening of the woodland. We conclude that the intensity, diversity and continuity of land use decreased with increasing distance from permanent settlements in the lowland. The wooded grasslands probably dominated the Budalen valley also before humans started to use the land.

Keywords: archaeology; ecology; haymaking; long-term ecology; prehistoric and historic iron industry; summer farming; transhumance; vegetation history

Introduction

Land use has been an important driver for change in biodiversity and cultural heritage throughout history also in more marginal areas for human impact such as mountain environments (Körner and Osawa 2005; Thompson et al. 2005; Emanuelsson 2009; Josefsson et al. 2010). In Scandinavian mountains where humans have been present for several thousand years, land use has involved a set of different activities such as hunting and trapping, small-scale industrial production (e.g. tar, iron and charcoal) and transhumance (mountain summer farming) (Almås 2004). These land-use types and their intensity have varied over time, as well as between mountain regions in Norway (Hjelle et al. this issue; Sjögren and Kirchefer this issue; Speed et al. this issue). Land use is thus a complex environmental variable with complex effects on biodiversity and cultural heritage. Understanding long-term ecological changes associated with different land uses is thus of prime importance for conservation biology (Willis and Birks 2006; Birks this issue).

In this study, we examine land-use activities in a subalpine mountain valley, Budalen in central Norway (Figure 1). Mountain summer farming has been the main land use during the latest centuries, and the present landscape appears as a cultural mountainous landscape (Olsson et al. 2000). Farms in the lower part of the valleys with limited land areas for pastures and fodder production moved their livestock to higher altitudes during the summer season, and seasonal farms for dairy production were established for utilisation of environmental resources in the mountains. Maintenance of the lowland agro-ecosystems was thus dependent on supplementary resources provided by this transhumance system (Reinton 1955). However, other land uses are documented prior to summer farming. The main aim of this study is to elucidate the prehistory of this summer farming landscape and assess the relative importance of land use on the landscape (i.e. a more large scale areal unit including both natural and cultural elements). We use a multidisciplinary approach drawing on archaeology, history, plant ecology and palaeoecology, combining earlier work and new investigations. The following questions are addressed: (1) how long have humans affected this landscape?, (2) how intensive were the different land uses and what were their spatial extents? and (3) how has land use affected plant community composition and structure through time?

Methods

Study area

The Budalen study area (10°33′–10°41′ E and 62°42′–62°48′ N) is delimited by a landscape conservation area (33 km^2) at 600–900 m a.s.l. (Figure 1). Most of the area falls within the northern boreal vegetation zone (Moen 1999). The vegetation is mostly semi-natural grasslands

*Corresponding author. Email: gunnar.austrheim@vm.ntnu.no

ISSN 2151-3732 print/ISSN 2151-3740 online

http://dx.doi.org/10.1080/21513732.2012.723639
http://www.tandfonline.com

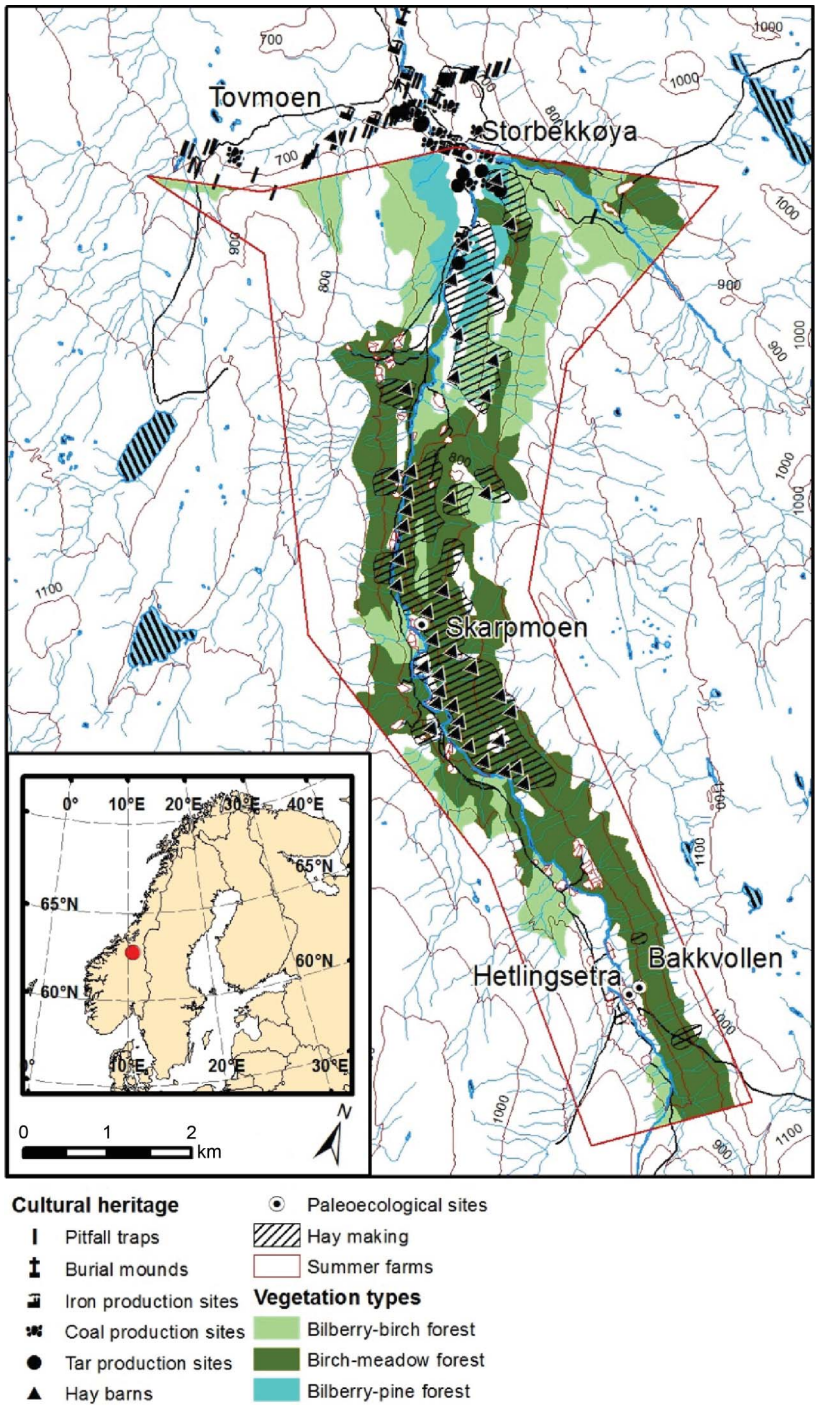

Figure 1. The study area: Budalen landscape conservation area. Sites for the palaeoecological investigations are indicated. All main vegetation types below the treeline are indicated by different colours. Cultural heritage are indicated by symbols. Haymaking areas in use during the twentieth century are shaded.

(SW-facing slopes) and heathlands (NE-facing slopes) with an open birch woodland and patches of mires (Austrheim et al. 1999; Olsson et al. 2000). The mountain climate gives a limited growing season (mean temperature > 6°C) of 140–160 days (Påhlson 1984).

Summer farming has been an important part of the mixed agricultural system in Budalen until the mid-twentieth century. However, the type and intensity of summer farming have changed over time (Olsson et al. 2000; Tretvik 2011). A total of 79 summer farms are situated within the study area and 13 of these were still in use with cows for dairy production in 2011. The summer farms are mostly found within the commons (state owned) and their use of natural resources (game, firewood, land for grazing and haymaking) are regulated by locally based management boards (Olsson et al. 1995; Berge and Stenseth 1998). The mixed land uses laid the ground for the designation of Budalen landscape conservation area in 2001 with the

aim to protect the special natural and cultural landscape associated with the summer farming activities.

Archaeology and cultural history

Investigations of prehistoric and historic iron production in Budalen have been going on in several stages since 1979 (Stenvik 1982, 1989, 1991; Espelund and Stenvik 1993; Espelund 2005). In the current project, the archaeological investigation was extended with tracking and radiocarbon dating charcoal and tar kilns in addition to a search for possible early settlements throughout the valley. Historical investigations are based on both written and oral sources (Sømark 1989; Hovstad et al. 1992; Rød 1994; Tretvik 2005, 2009, 2011). The aim was to establish knowledge about uses of outfield resources during the latest centuries from an environmental perspective, i.e. how humans affected nature and *vice versa*.

Vegetation history

Pollen analysis provides the long-term perspective on vegetation change. The pollen content in peat cores acts as an archive of past vegetation, while surface pollen in moss samples deal with the more recent ones. Peat cores from three different sites along a north–south transect were collected (Figure 1) and subjected to pollen analysis. Storbekkøya is situated in the northern part of the area, and one core was placed close to the earlier iron industry there. The core from Skarpmoen 7 km further south in the central part of the valley is taken from a mire harvested for hay. Two peat cores were taken from the southernmost part of the valley (Bakkvollen and Hetlingsetra). Three percentage pollen diagrams are presented (Figures 2a–c) with 1000 land pollen analysed for each level. In addition to pollen, non-pollen palynomorphs (NPP) deals with spores of fungi belonging to the *Pyrenomycetes*, the spore types included represent coprophilous genera (Eriksson 1992; Van Geel et al. 2003; Solem 2011a). A fixed number of *Lycopodium clavatum* spores was added to all pollen samples (Stockmarr 1971) in order to calculate pollen accumulation rate (PAR: grains cm^{-2} $year^{-1}$; Figures S1, S2, and S3). The time scale is based on ^{14}C dating and calibrated to calendar years BC and AD (for more details, see Solem 2011a, 2011b).

Plant ecology

The flora in Budalen has been examined by Ouren on a regular basis since 1930 (Ouren 1952; T. Ouren, unpublished). Studies by Austrheim et al. (1999) and Olsson et al. (2000) focused on diversity and composition of plant communities associated with outlying pastures, former haymaking fields, cultivated (fertilized and partly ploughed) enclosures and effects of land-use changes. In this study, we monitored red-listed plant species in relation to vegetation types and land use. A more general survey of bryophytes in semi-natural habitats was performed as their distribution in semi-natural habitats was poorly known prior to our study (Øien et al. 2011). The mapping of red-listed species was carried out using stratified sampling within wooded grasslands. Eighty-nine survey plots (approximately 5 m^2) were evenly distributed in the study area (five plots per km^2). Occurrence of red-listed species, bryophyte diversity, dominating vegetation type and species of vascular plants, slope, exposition, land use and shrub encroachment was recorded at each plot. No red-listed bryophytes were recorded in the wooded grasslands. We could not find any relations between bryophyte diversity and slope, exposition, land use or shrub encroachment (Øien et al. 2011).

Results

Archaeology and cultural history

Iron production might have started as early as Pre-Roman Iron Age (180 BC) at Storbekkøya (Figure 1) with four to five furnaces operating simultaneously (Stenvik 2011; for dating, see Table S1). The amount of slag suggests that more than 30 tons of iron was produced. The furnaces were fired with pine wood only, and the consumption of wood is calculated to 1450 m^3. Two other sites from Early Iron Age with extensive iron production and pine consumption have been found within the same area (Stenvik 2011). In addition, at least nine iron production furnaces from Late Iron Age and Medieval Period were found around Storbekkøya at the border of the protected area. These later furnaces were fired with charcoal, which we found adjacent to some of the furnaces. Charcoal was probably produced locally in these periods, but the kilns are small and not visible today as they were not dug into the ground as pits. Charcoal pits are numerous in southern Norway, but are more rarely found in central Norway. A second period with charcoal production is dated to the eighteenth and nineteenth centuries when charcoal was produced for copper smelting in the neighbouring valley Endalen and in the Røros area. These charcoal kilns are huge, 10–15 m in diameter and easy to find because of the walls and ditches around them. At least 17 charcoal kilns from this period have been recorded close to Tovmoen (Figure 1) (Stenvik 2011).

In the northern part of the valley, bordering the protected area, a huge system of pit falls probably used for moose trapping was recorded. A wooden piece belonging to an inner construction of a pit has been dated to AD 125–320 (P. Rønne unpublished). A systematic search for prehistoric settlement sites further south in the valley gave no results. More than 15 kilns for tar production were found in areas with pine forest, which is limited to the northern part of the valley (Figure 1). Only pine wood was used in this production. Although some of the wood used for tar production is dated to AD 1200–1400 (Table S1), the production probably started in the sixteenth century.

According to written sources, haymaking and cultural influence associated with such activity go back at least

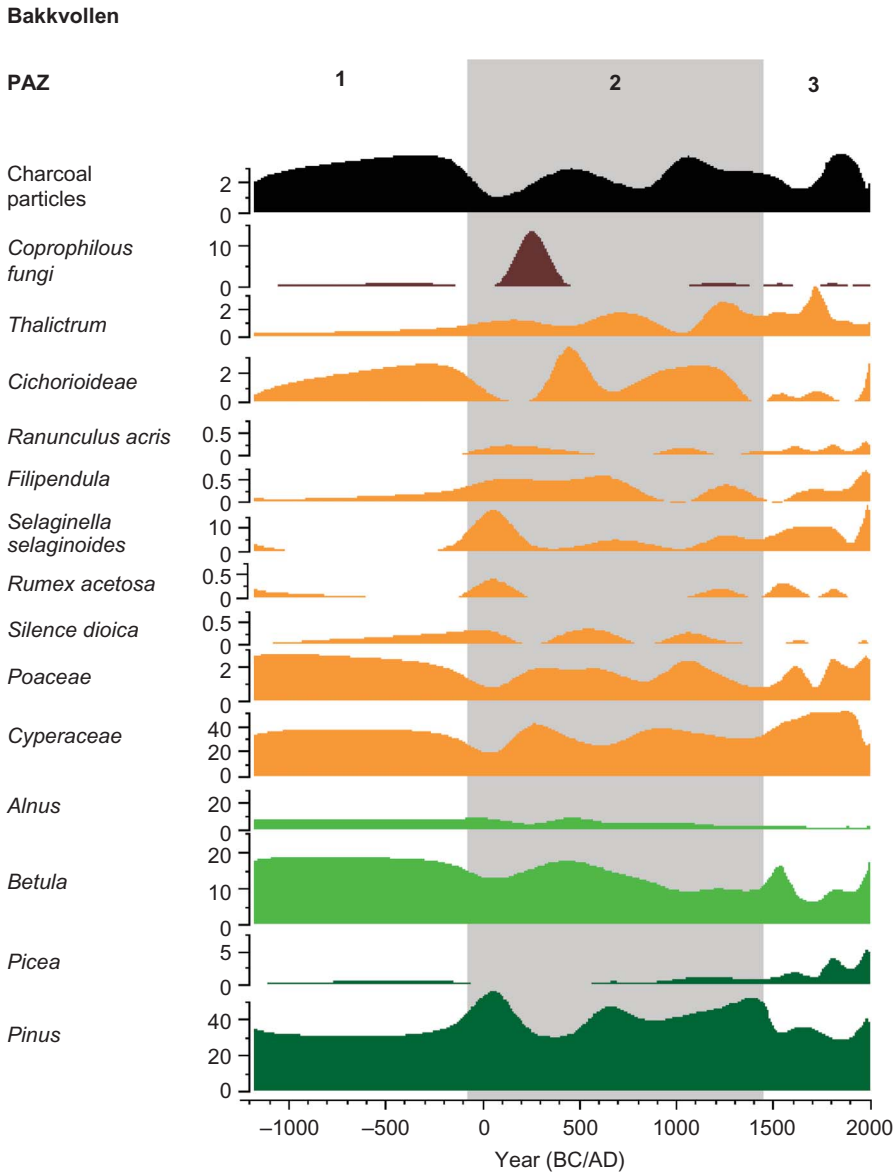

Figure 2. Percentage pollen diagrams of selected species from the three study sites in Budalen: (a) Bakkvollen, (b) Skarpmoen and (c) Storbekkøya. Grey shading indicates pollen assemblage zones (Solem 2011b).

400 years, some 200 years before the establishment of summer farms (Tretvik 2011). Around 13% of the landscape conservation area was mowed in the first part of the twentieth century (Olsson et al. 1995). The early established summer farms can be dated to the mid-eighteenth century (Tretvik 2011), and the number increased rapidly from the end of the eighteenth century. In the early twentieth century, 75 summer farms were recorded. The total number increased to 79 during the first half of the century.

During the centuries of summer farming, the consumption of fuelwood was high, and a ban on logging was initiated in the southern part of the valley in the early twentieth century. Fuelwood consumption for the processing of milk was estimated to 0.5–0.75 cord per cow per season (Reinton 1955). In addition, fuelwood was used during hunting and trapping seasons. Pine and birch were also used as building materials for houses in the summer farms and in the hay fields. The number of livestock grazing in the outlying land has been high throughout the twentieth century (Olsson et al. 2000), but herbivore pressure decreased as mowing ceased and livestock were allowed into the productive grasslands in the 1950–1960s.

Vegetation history

The two most remote sites south in the valley (Bakkvollen and Hetlingssetra; Figure 1) show no clear signs of human-induced vegetation shifts before AD 1450. Only results from Bakkvollen are presented here. Grass *Poaceae*, sedges *Cyperaceae* and the small herb *Thalictrum alpinum* profit from mowing (Aune et al. 1996; Moen et al. 1999), and the PAR pollen curves of these species indicate mowing from AD 1450 and onwards. Also charcoal particles

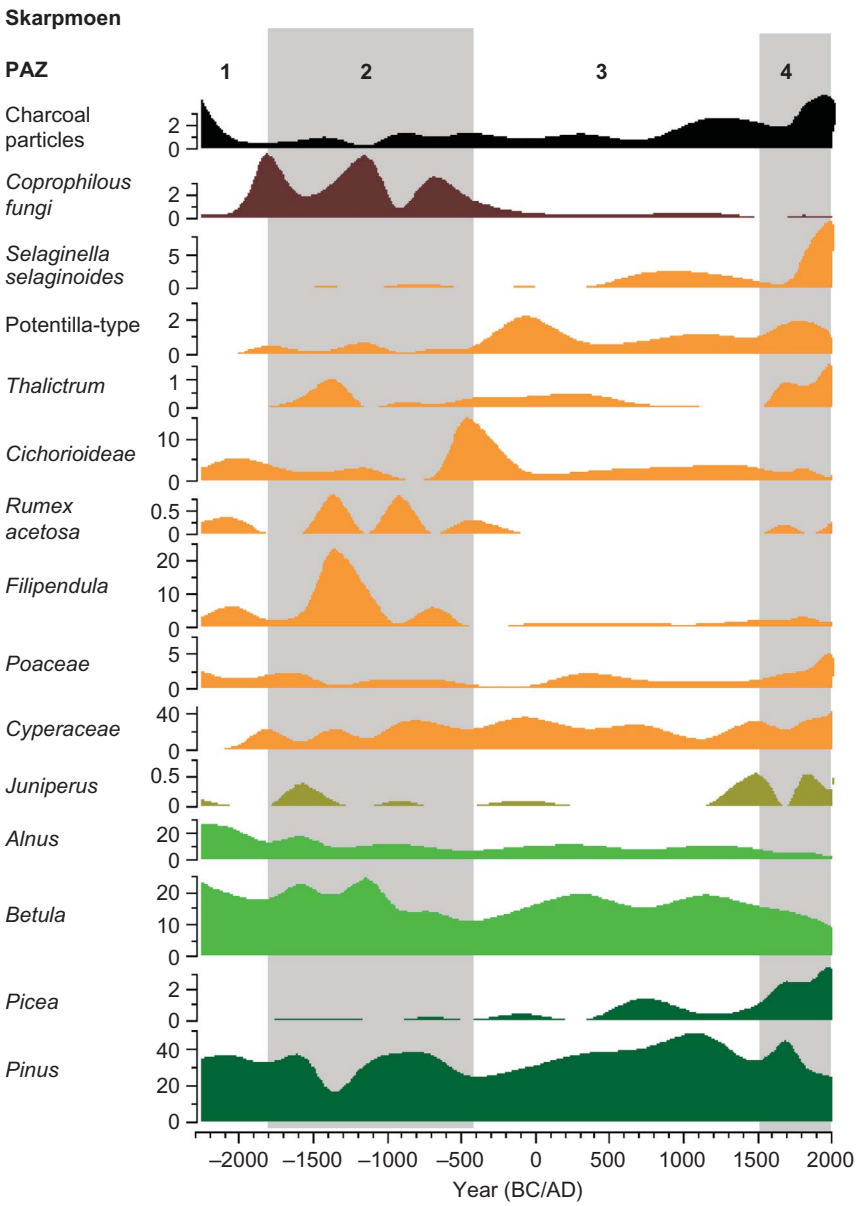

Figure 2. (Continued).

increase and emphasize the presence of people. Large herbivores appear to have been abundant here at ca. AD 200–250 as evaluated by the presence of dung fungi and a trampling effect (cf. Sjögren et al. 2007) that compressed the peat at both the investigated mires at this time (Figures 2a and S1). The peat compression at ca. AD 100 is demonstrated in Figure S1. The compression effect renders both these ages somewhat dubious since trampling by a herd of animals is apt to disturb the stratigraphy. Both mires consist of continuous sedge/grass peat, where a compression layer was difficult to observe directly in the peat core. Pine does not grow in this part of the valley today. The pine pollen curve suggests a tunnel effect of the wind along the valley bringing pine pollen from the northern lowland areas.

In the central part of the valley (Skarpmoen), the increase of pollen curves for grasses, sedges and *Thalictrum alpinum* from AD 1500 to 1600 indicate that mowing started at that time (Figures 2b and S2). The amount of dung fungi spores is high from ca. 1800 BC and decreases at ca. 500 BC (calculated age). This indicates the continued presence of grazing animals during this time span.

At the northernmost pollen site Storbekkøya, the pollen curves do not indicate any vegetation shift for approximately 1500 years, from 2000 to 500 BC (Figures 2c and S3). Part of the peat is missing which the radiocarbon dates separately prove (Table S3), and the curves presented (Figure 2c) are somewhat misleading at this time interval. The peat accumulation started when alder *Alnus* dominated the vegetation, and the oldest peat is from the alder forest itself, containing numerous microscopic fragments of alder wood. *Filipendula*, *Rumex acetosa* and *Ranunculus acris* were also present in the alder forest. A major vegetation

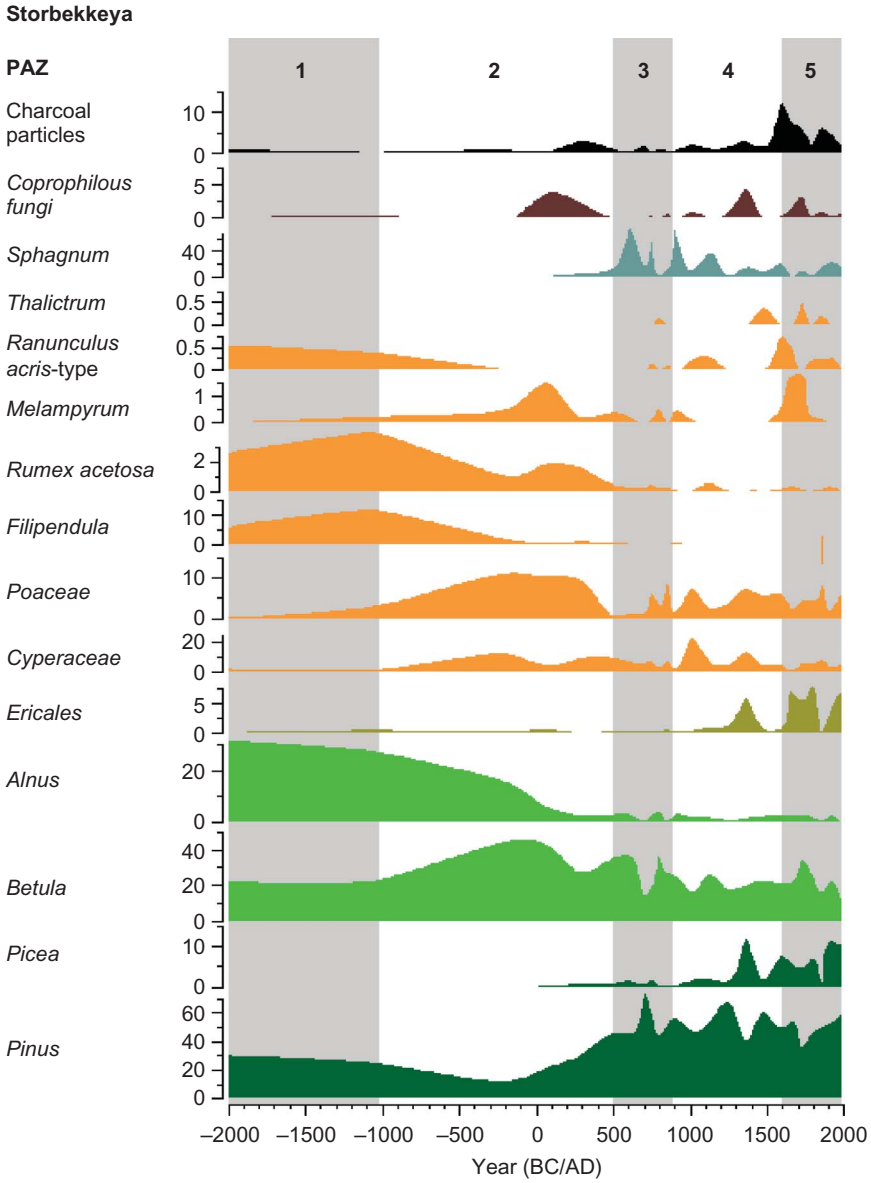

Figure 2. (Continued).

shift appears at ca. 500–300 BC. The decline of the alder pollen curve is regional for central Norway and climatically induced (Hafsten 1987). Pine pollen decreases while grass pollen increases. This indicates more open vegetation. The amount of coprophilous fungi spores further indicates grazing at that time. An increase in the charcoal curve at ca. AD 300 reflects increased activity of people. The composition of plants forming the peat also changes as peat mosses *Sphagnum* start to dominate. PAR values (grains cm^{-2} $year^{-1}$) show a decline of both pine and birch from ca. AD 400 (Figure S3), and the percentage pollen curves are somewhat misleading. Pollen from plants that indicate grazing (e.g. *Ranunculus acris*) occurs from AD 800 and the composition of the dung fungi suggests that livestock were present (Solem 2011a, 2011b). A further increase of grazing indicators and an additional increase of charcoal particles from ca. AD 1600 indicate that some kind of agricultural land use affected the vegetation even to a point where cereal growing (barley) with associated weeds (e.g. *Spergula arvensis*) at least occasionally was tried out (not included in the pollen diagram). An overview of the dominating vegetation at the three sites before and after the main shift in land use at the fifteenth century is presented in Table S2.

Plant ecology

In the biodiversity studies, six former (2006) and three present (2010) red-listed herb species (Kålås et al. 2006, 2010) were found within 14 of the 89 surveyed plots associated with no or limited shrub cover (Figure S4). These species also occur in red-listed nature types (Lindgaard and Henriksen 2011; Table S4).

Discussion

Past land use has been an important factor for determining the present vegetation composition and structure, and the natural and cultural heritage associated with it (Emanuelsson 2009). Yet the long-term perspective on land-use and landscape dynamics is often not well examined and/or taken into account as a scientific basis for understanding the present landscape (Birks this issue). In this study, we have examined the long-term land use and change in landscape and vegetation patterns for a mountain valley, Budalen in central Norway. The multidisciplinary approach serves to delimit the time scale and intensity of different land uses (see an overview in Figure 3). The spatial distribution of land-use activity (Figure 1) shows a gradual decrease in activity and continuity with distance from permanent settlements in the main valley.

Land use and landscape in prehistory (prior to the fifteenth century)

When the inland ice disappeared, the early hunters can be traced by their use of fire already ca. 9000 BC (Solem 2011a). Findings of dwelling sites in surrounding mountains indicate seasonal occupancy during reindeer hunting in Early Stone Age (Alsaker 2005). However, no structures within the valley are dated prior to 180 BC. A pit fall in the vicinity of the Bakkvollen pollen site is not dated, but a compression of the peat due to trampling by herds of animals and dung deposition at approximately AD 100–250 may indicate large herbivore activity (Figure S1). The large-scale pit fall system in the northern part of the valley dated to AD 125–320 also indicates hunting throughout the valley at that time.

Skarpmoen in the central part of the valley had a high accumulation rate of coprophilous fungi spores over several hundred years from ca. BC 1800 to ca. BC 500. We suggest that the spores represent migrating reindeer and possibly moose as these herbivores would be expected to prefer the productive SW-facing wooded grasslands. The dung fungi disappeared at the time when iron production (and pit fall trapping) started a few kilometres further north at Storbekkøya. A late Neolithic settlement with husbandry cannot totally be excluded, but so far there is no archaeological evidence for this.

The land-use impact is more clear and diverse at the northernmost site at Storbekkøya where furnaces for iron production and several other human traces are dated as early as 180 BC. The iron production occurred in three phases: Roman Iron Age, Late Iron Age/Medieval Age and at one site from around AD 1600. The extent of iron production suggests that people were living at the sites for several months each year, and house grounds adjacent to the furnaces are documented (Stenvik 1991; Espelund and Stenvik 1993). The archaeological findings correspond closely to an opening of the woodland composed of pine and birch (Figure S3). Pine was used in the furnaces, whereas birch was used for household purposes. Peaks of dung fungi most likely indicate livestock, since living at the production sites made a degree of husbandry necessary. Wild ungulates were most probably kept away by the human presence. After the first phase of iron production, the amount of pine and birch increased again, but open areas with grasslands were still present and the light-demanding juniper increased (Figure S3). An intensive period of tar production at ca. AD 1400 corresponds with a reduction in pine and birch.

Land use and landscape from the fifteenth century until present

The diversity of land use is highest from AD 1500 and onwards (Figure 3). In the southern part of the valley (Bakkvollen and Hetlingsetra) pollen deposits indicate that the mires were mowed around AD 1500–1600, although more recent historical investigations (twentieth century) do not indicate haymaking in the southern part of the valley except for a few small patches (Olsson et al. 1995;

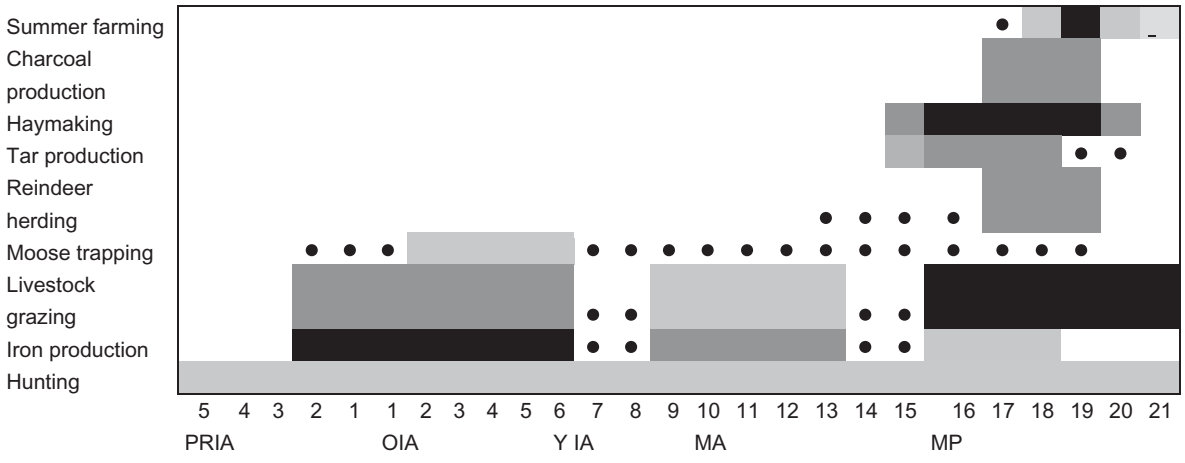

Figure 3. An overview of land-use types and intensity in the Budalen valley. The colours of the lines indicate intensity: black line: intensive land use, grey line: moderate and light grey line: low. Broken line denotes possible activity and open box indicates no human impact. PRIA, Pre-Roman Iron Age; OIA, Older Iron Age; YIA, Younger Iron Age; MA, Middle Age; MP, Modern Period.

Figure 1). The summer farms in the southernmost part were established from the 1780s as well as new summer farms in the northernmost part (Tretvik 2011).

Mires and wooded grasslands around Skarpmoen were mowed from ca. AD 1500 as suggested by the pollen records. The decrease in spores from coprophilous fungi reflects that grazing livestock were kept away from haymaking areas. This is also confirmed by farmers who took part in the haymaking in the mid-twentieth century. Haymaking in the valley ceased completely in the 1960s (Olsson et al. 1995).

Also at Storbekkøya, livestock grazing was extended from ca. AD 1500. Pollen records take the livestock husbandry in Budalen even further back in time than the historical evidence does. The activity in that period might have been different from the summer farming with milk production and processing as we know it from later periods, but livestock grazing and haymaking prevented the recruitment and growth of trees and shrubs as indicated by the pollen diagrams. This shift is also associated with increase in microscopic charcoal particles and spores of fungi connected to animal dung.

Written sources verify Sami reindeer herding throughout the valley from the seventeenth century. This transhumance ceased due to conflicts with the agricultural land use and was forbidden by law in AD 1901 (Tretvik 2011).

Conservation biology

The red-listed vascular plant species associated with open grasslands (Figure S4) are all small- to medium-sized herbs with an expected low competitive effort in successional grasslands. The long-term mowing, grazing of livestock as well as wild herbivores most likely increased the abundance of these species. The current patterns of bryophyte diversity cannot be explained by land use or shrub encroachment. However, the low diversity and frequency of obligate epixylic species (living on decaying logs) and species growing as epiphytes are striking and probably best explained by the heavy exploitation of the forest in the valley during the iron production and later due to land use associated with summer farming (Øien et al. 2011).

Conclusions

This long-term study has revealed a strong prehistoric impact on the landscape and vegetation at the northernmost site (Storbekkøya) that most likely affected the resources available during the latest centuries such as open grazing land and pine wood. The intensity and continuity of past land use decreased with increasing distance from permanent settlements – north to south. No major human-induced shifts in vegetation composition is evident from the two southernmost sites (Bakkvollen and Skarpmoen) prior to AD 15–1600. Thus, wooded meadows probably dominated most of the valley also before humans started to use agricultural resources in the outlying land, but tree (birch) density and the vascular plant species composition likely varied with land-use type and intensity.

Supplementary material

Supplementary material relating to this article is available online.

Acknowledgements

We are grateful to Gunhild Setten and two anonymous referees for comments on previous versions of this article. This study was funded by the Research Council of Norway (Project no. 190044/S30), Directorate for Nature Management, Directorate for Cultural Heritage and The Norwegian Agricultural Authorities, Sametinget and Sør-Trøndelag County.

References

Almås R. 2004. Norwegian agricultural history. Trondheim: Tapir Academic Press.

Alsaker S. 2005. Steinalderen. Trøndelags Historie bind 1. Trondheim: Tapir Akademisk Forlag.

Aune EI, Kubíček F, Moen A, Øien D-I. 1996. Above- and below-ground biomass of boreal outlying hay-lands at the Sølendet nature reserve, central Norway. Norwegian J Agr Sci. 10(2):125–152.

Austrheim G, Olsson G, Grøntvedt E. 1999. Land-use impact on plant communities in semi-natural subalpine grasslands of Budalen, central Norway. Biol Conserv. 87(3):369–379.

Berge E, Stenseth NC. 1998. Law and the governance of renewable resources. Oakland (CA): ICS Press.

Birks HJB. 2012. Ecological palaeoecology and conservation biology: controversies, challenges and compromises. Int J Biodivers Sci Ecosyst Serv Manag. 8(4):292–304.

Emanuelsson U. 2009. The rural landscapes of Europe: how man has shaped European nature. Stockholm: Swedish Research Council Formas.

Eriksson OE. 1992. The non-lichenized pyrenomycetes of Sweden. Lund (Sweden): SBT-förlaget.

Espelund A. 2005. Bondejern i Norge. Trondheim: Arketype forlag.

Espelund A, Stenvik LF. 1993. Ironmaking during the Roman Iron Age in mid-Norway. The bloomery site Storbekken I in Budalen. An archaeometallurgical study. In: Espelund A, editor. Bloomery ironmaking during 2000 years III. Trondheim (Norway): NTH Press. p. 123–147.

Hafsten U. 1987. Vegetation, climate and evolution of the cultural landscape in Trøndelag, central Norway, after the last ice age. Norsk Geografisk Tidsskrift. 41(2):101–120.

Hjelle K, Kaland S, Kvamme M, Lødøen TK, Natlandsmyr B. 2012. Ecology and long-term land use, palaeoecology and archaeology - the usefulness of interdisciplinary studies for knowledge based conservation and management of cultural landscapes. Int J Biodivers Sci Ecosyst Serv Manag. 8(4):321–337.

Hovstad B. 1992. Jordbruk og husdyrbruk. In: Singsåsboka, bind 1, del 2. Singsås (Norway): Singsås bygdeboknemnd. p. 37–162.

Josefsson T, Olsson J, Ostlund L. 2010. Linking forest history and conservation efforts: long-term impact of low-intensity timber harvest on forest structure and wood-inhabiting fungi in northern Sweden. Biol Conserv. 143(7):1803–1811.

Kålås JA, Viken Å, Bakken T, editors. 2006. Norwegian red list. Trondheim: Norwegian Biodiversity Information Centre.

Kålås JA, Viken Å, Henriksen S, Skjelseth S, editors. 2010. The 2010 Norwegian red list for species. Trondheim (Norway): Norwegian Biodiversity Information Centre.

Körner C, Ohsawa M. 2005. Mountain systems. In: Millennium Ecosystem Assessment, editor. Ecosystems and human well-being: synthesis. Washington (DC): Island Press.

Lindgaard A, Henriksen S, editors. 2011. Norsk rødliste for naturtyper 2011. Trondheim (Norway): Artsdatabanken.

Moen A. 1999. National atlas of Norway. Vegetation. Hønefoss (Norway): Norwegian Mapping Authority.

Moen A, Nilsen LS, Øien D-I, Arnesen T. 1999. Outlying haymaking lands at Sølendet, central Norway: effects of scything and grazing. Norsk Geografisk Tidsskrift. 53(2/3):93–102.

Øien D-I, Hassel K, Aune EI, Austrheim G. 2011. Biomangfold. In: Solem T, Stenvik L, Tretvik AM, Hassel K, Øien D-I, Aune EI, Sjögren P, Daverdin M, Kyrkjeeide MO, Austrheim G, editors. Natur- og kulturminner i Budalen landskapsvernområde. Arkeologiske, historiske, vegetasjonshistoriske og økologiske undersøkelser i DYLAN-prosjektet. NTNU Vitenskapsmuseet Rapport Botanisk Serie 5. Trondheim. p. 90–99.

Olsson EGA, Austrheim G, Bele B, Grøntvedt E. 1995. Seterlandskapet i Budalen og Endalen, Midtre Gauldal, Midt-Norge. Kulturhistoriske og økologiske forhold i fjellets kulturlandskap. Fylkesmannen i Sør-Trøndelag Miljøvernavdelingen rapport 2. Trondheim. p. 1–89.

Olsson EGA, Austrheim G, Grenne S. 2000. Landscape change patterns in mountains, land use and environmental diversity, mid-Norway 1960–1993. Landscape Ecol. 15(2):155–170.

Ouren T. 1952. Floraen i Budalen herred i Sør-Trøndelag. DKNVS Skifter. (1):1–101.

Påhlson L, editor. 1984. Naturgeografisk regionindelning av Norden. Stockholm (Sweden): Nordiska Ministerrådet.

Reinton L. 1955. Sæterbruket i Noreg I, sætertypar og driftsformer. Oslo (Norway): Institutt for sammenlignende kulturforskning, H. Aschehoug & Co.

Rød PO. 1994. Singsåsboka, gards- og slektshistorie, bind III. Singsås (Norway): Singsås bygdeboknemnd.

Sjögren P, Kirchhefer A. 2012. Historical legacy of the old-growth pine forest in Dividalen, northern Scandes. Int J Biodivers Sci Ecosyst Serv Manag. 8(4):338–350.

Sjögren P, van der Knaap WO, van Leeuwen JFN, Andrič M, Grünig A. 2007. The occurrence of an upper decomposed layer or 'Trockenhorizont', in the Alps and Jura Mountains. Mires Peat. 2(1):1–14.

Solem T. 2011a. Vegetation history of Ropphaugen in Budalen, Midtre Gauldal, central Norway, with additional informations from NPP (nonpollen palynomorph). DKNVS Skrifter. (3):1–13.

Solem T. 2011b . Vegetasjonshistorie. In: Solem T, Stenvik L, Tretvik AM, Hassel K, Øien D-I, Aune EI, Sjögren P, Daverdin M, Kyrkjeeide MO, Austrheim G, editors. Natur- og kulturminner i Budalen landskapsvernområde. Arkeologiske, historiske, vegetasjonshistoriske og økologiske undersøkelser i DYLAN-prosjektet. NTNU Vitenskapsmuseet Rapport Botanisk Serie 5. Trondheim. p. 90–99.

Speed J, Austrheim G, Birks HJB, Johnson S, Kvamme M, Nagy L, Sjögren P, Skar B, Stone D, Svensson, E, et al. 2012. Natural and cultural heritage in mountain landscapes: towards an integrated valuation. Int J Biodivers Sci Ecosyst Serv Manag. 8(4):313–320.

Stenvik LF. 1982. Verneplan for vassdrag. Arkeologiske kulturminner i Gaulavassdraget, Sør-Trøndelag. Rapport Arkeologisk Serie 3:1–151.

Stenvik LF. 1989. Tovmoen i Budal - et fysisk arkiv om utmarka langt bakover i tid. Spor. (1):4–7.

Stenvik LF. 1991. Lavteknisk jernframstilling i Trøndelag. Forskningsstatus og perspektiv. Arkeo-metallurgi. Rapport Arkeologisk Serie 1001–1. Red. Stenvik, LF. Trondheim. p. 9–31.

Stenvik LF. 2011. Arkeologiske undersøkelser i Budalen. In: Solem T, Stenvik L, Tretvik AM, Hassel K, Øien D-I, Aune EI, Sjögren P, Daverdin M, Kyrkjeeide MO, Austrheim G, editors. Natur- og kulturminner i Budalen landskapsvernområde. Arkeologiske, historiske, vegetasjonshistoriske og økologiske undersøkelser i DYLAN-prosjektet. NTNU Vitenskapsmuseet Rapport Botanisk Serie 5. Trondheim. p. 90–99.

Stockmarr I. 1971. Tablets with spores used in absolute pollen analysis. Pollen et Spores. (1):615–621.

Sømark J. 1989. Gard og grendeliv i Budalen. Gard og grend. Støren (Norway): Midtre Gauldal kommune.

Thompson DBA, Price MF, Galbraith CA. 2005. Mountains of Northern Europe: conservation, management, people and nature. Edinburgh (Scotland): The Stationary Office Ltd.

Tretvik AM. 2005. Grenda blir global: 1850 til 2005. Trøndelags historie bind 3. Trondheim (Norway): Tapir Akademisk Forlag.

Tretvik AM. 2009. Agriculture and reindeer herding in mid-Norway. Changing structures in the late nineteenth, and early twentieth century. In: Pinilla V, editor. Markets and agricultural change in Europe from the 13th to the 20th century. Turnhout (Belgium): Brepols Publishers.

Tretvik AM. 2011. Budalen: Nyare kulturhistorie. In: Solem T, Stenvik L, Tretvik AM, Hassel K, Øien D-I, Aune EI, Sjögren P, Daverdin M, Kyrkjeeide MO, Austrheim G, editors. Natur- og kulturminner i Budalen landskapsvernområde. Arkeologiske, historiske, vegetasjonshistoriske og økologiske undersøkelser i DYLAN-prosjektet. NTNU Vitenskapsmuseet Rapport Botanisk Serie 5. Trondheim. p. 21–64.

Van Geel B, Buurman J, Brinkkemper O, Schelvis J, Aptroot A, van Reenen G, Hakbijl T. 2003. Environmental reconstruction of a Roman Period settlement site in Uitgeest (The Netherlands) with special reference to coprophilous fungi. J Archaeolog Sci. 30(7):873–883.

Willis KJ, Birks HJB. 2006. What is natural? The need for a long-term perspective in biodiversity conservation. Science. 314(5803):1261–1265.