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# Swedish Forestry, Forest Pasture Grazing by Livestock, and Game Browsing Pressure Since 1900

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## ABSTRACT

Growing numbers of wild ungulates are increasingly seen by concerned authorities in Europe as posing serious management problems, which include increasing browsing pressure by moose (*Alces alces*) and roe deer (*Capreolus capreolus*) in Swedish forests. Recent investigations by the Swedish Forest Agency identify high browsing pressure as the main reason for a recent decline in regeneration of Scots pine (*Pinus sylvestris*), one of the two main commercial species in Swedish forestry. The high browsing pressure is also having a negative impact on biodiversity. Thus, voices within the forest community claim that browsing pressure has never been so high. This paper examines that claim from a historical perspective by comparing livestock grazing in forest pastures a century ago with contemporary game browsing, and identifying the main factors driving both the livestock exodus from Swedish forests during the first half of the twentieth century and the rapid increase in deer populations during the second half. Finally, testing the claim that browsing impact has never been so high, past grazing and present browsing are theoretically sized up and compared. Estimates of live weights and numbers of large herbivores in 1902 and 2012 are used. The result indicates that the claim might possibly be lacking in historical context.

## KEYWORDS

Grazing forest pasture, deer browsing, Swedish forestry, forest management, forest history

## INTRODUCTION

In Sweden today, browsing pressure from moose (*Alces alces*) and roe deer (*Capreolus capreolus*) is a subject for debate and political concern. In 2012,

Sweden's moose-management system was changed, and a new policy was implemented to establish a knowledge-based, adaptive moose-management system with intended capacity to balance different societal interests on an ecosystem level. This included balancing hunters' desires for a high moose population against commercial forestry's wishes to reduce browsing, and both public and governmental interest in reducing vehicle-moose collisions (5,000/year) and negative effects of the moose on biodiversity and agriculture. The aim of the policy is to foster a sense of ecological stewardship among hunters and landowners aided by an improved monitoring system that calls for local participation in inventories as well as decisions.<sup>1</sup>

Hunting rights are based on land ownership in Sweden. Fifty per cent of the forested land is controlled by private owners, 25 per cent belongs to limited companies and the remaining quarter is controlled by public owners (the state, municipalities and the church). The division of forest land between different owners has been remarkably stable during the twentieth century and our entire investigation period (described below).<sup>2</sup>

The current problem in Swedish forests from a forestry perspective relates to browsing damage to the apical shoots of Scots pine (*Pinus sylvestris*) seedlings by cervids (deer). As well as impairing the increment and commercial value of young pine stands, repetitive browsing can kill individual seedlings and saplings. Scots pine is one of the two main commercial timber species in Swedish forestry, but the increasing browsing pressure during the last fifteen to twenty years has led to a steady decline in areas planted with it. Thus, voices within the forestry community claim that browsing pressure has never been so high, and the pine is being replaced by regeneration with the other main commercial species, Norway spruce (*Picea abies*), which is less susceptible to browsing but produces less valuable timber.<sup>3</sup>

Recent investigations by the Swedish Forest Agency (SFA) identify high browsing pressure as the main reason for land owners not planting pine. Browsing pressure is also stated to have a negative impact on biodiversity since palatable tree species are preferentially eaten and replaced by unpalatable species that then gain ecological advantages. The SFA further states that wild ungulate browsing is not comparable with historical forest grazing by

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1. S. Lindqvist, C. Sandström, T. Bjärstig T. and E. Kvastegård. 'The Changing Role of Hunting. From Subsistence to Ecosystem Stewardship?' *Alces* 50 (2014): 35–51.
  2. L. Lönnstedt, 'The structure of forestry', in U. Jansson (ed.) *Agriculture and Forestry in Sweden since 1900: a Cartographic Description* (Stockholm: National Atlas of Sweden, 2011).
  3. M. Wallgren, J. Bergquist, R. Bergström and S. Eriksson, 'Effects of timing, duration, and intensity of simulated browsing on Scots pine growth and stem quality', *Scandinavian Journal of Forest Research* 29(8) (2014): 734–746. <http://dx.doi.org/10.1080/02827581.2014.960896> and C. Fries, J. Bergquist and L. Svensson, *Förändringar i återväxtkvalitet, val av förnyingsmetoder och trädslagsanvändning mellan 1999 och 2012*. Rapport 2. (Jönköping: Skogsstyrelsen, 2013).

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livestock, as livestock and game generally have different feeding patterns (See below). The views of the SFA are echoed by academics. Growing numbers of hoofed game are also increasingly regarded as a management problem by concerned authorities elsewhere in Europe, although usually more for agriculture than forestry.<sup>4</sup>

The perception that browsing pressure is at an all-time high in Swedish forests is the point of departure in this paper. The aim is to give a historical perspective to the browsing pressure debate, since this is not the first time Swedish forests have harboured large numbers of large herbivores. According to statistics from 1902 there were roughly 528,000 horses (*Equus ferus*), 2,576,000 cattle (*Bos taurus taurus*), 1,195,000 sheep (*Ovis aries*) and 69,000 goats (*Capra hircus*), in what was administratively seen as the Swedish countryside. The vast majority of these animals spent the first half or all of the grazing season (1 June – 31 October) on forested land. The past and present are bridged in the following text by a narration on efforts by the Swedish forest community (see below) to eradicate livestock from forest pasture from 1920 to 1955, although posterity has shown that developments within agriculture and urbanisation were the main factors responsible for the exodus of livestock from forests (see below). This is a story that has been mainly forgotten in contemporary forestry and society at large, while the increasing numbers of deer have benefited from an increasingly effective game management regime since the early twentieth century, among other practices and policies aimed at increasing game numbers.<sup>5</sup>

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4. J. Bergquist, C. Kalén and H. Berglund, *Hjortdjurens inverkan på tillväxt av produktionsträd och rekrytering av betesbegärliga trädslag – problembeskrivning, orsaker och förslag till åtgärder*: Rapport 9 (Jönköping: Skogsstyrelsen, 2011); C. Kalén and J. Bergquist, *Skogliga inventeringsmetoder i en kunskapsbaserad älgförvaltning*. Meddelande 3 (Jönköping: Skogsstyrelsen, 2011). On biodiversity and forest pasture with livestock, see also W. Axelsson Linkowski, *Utmarksbete, främst skogsbete, och dess effekter på biologisk mångfald*. CBM:s skriftserie 40 (Uppsala: Naptek, Centrum för biologisk mångfald, 2010); P. Angelstam, P.E. Wikberg, P. Danilov, W.E. Faber, K. Nygren, W.B. Ballard and R. Rodgers, 'Effects of moose density on timber quality and biodiversity restoration in Sweden, Finland and Russian Karelia' in Papers from the 35th North American Moose Conference and Workshop. Grand Portage. Minnesota. USA, 15–20 May 1999 (2000) 36: 133–145; L. Edenius, M. Bergman, G. Ericsson and K. Danell, 'The role of moose as a disturbance factor in managed boreal forests'. *Silva Fennica* (2002) 36: 57–67; DN Debatt. 'För att påverka naturen krävs minst 4000 vargar', *Dagens Nyheter*, 30 Jan. 2014; DN Debatt. 'Kronhjortar i vargområden kan minska jaktkonflikterna', *Dagens Nyheter*, 3 Aug. 2014; G. Austrheim, E.J. Solberg and A. Mysterud, 'Spatio-temporal variation in large herbivore pressure in Norway during 1949–1999: has decreased grazing by livestock been countered by increased browsing by cervids?' *Wildlife Biology* 17(3) (2011): 286–298; and M. Apolloni, R. Andersen and P. Putman, *European Ungulates and their Management in the 21st Century* (New York: Cambridge University Press, 2010).
  5. W. Flach, H. Juhlin-Dannfelt and G. Sundbärg, *Sveriges jordbruk vid 1900-talets början: Statistiskt kartverk* (Göteborg, 1909), pp. 255–258.; Ö Kardell, 'Vallning, bete, mjölkning och hägnader kring sekelskiftet 1900: En kontextuell skiss', *Svenska landsmål och svenskt folkliv* 2006: 49–77; Ö Kardell, 'Cows and Forests: Swedish Environmental History',

However, attention is also paid to the development of the moose population and the changing and ambivalent views on the moose within the forest community during the same period and beyond. Finally, to further facilitate a comparison of past and present from a different perspective, browsing pressure is theoretically estimated and expressed as the live weight of domestic livestock on forest pasture in the early twentieth century as compared to the live weight of moose and roe deer in the twenty-first century.

### SETTING THE SCENE

Before presenting the sources, and in order to stage the narration profitably, it is necessary to present the intended story in terms of change within a specific framework. In other words, which key factors in forest pasture and livestock grazing did change – and why – as compared to constant factors? This is mainly due to the fact that it is the views voiced by the Swedish forest community (see below) that are used in the narrative. It is their preconceptions and apprehensions which are presented, not a balanced list of pros and cons on the subject at hand, either concerning forest pasturage of livestock or game browsing pressure in Swedish forests.

As mentioned above, half of Swedish forested land throughout the twentieth century was, as now, controlled by private owners. For the whole duration of our investigation period this meant that fifty per cent of Sweden's forests were included, property wise, within farms. All farms, up until the end of the 1960s or the early 1970s, pursued mixed husbandry with both arable crops and farm animals in combination. All farms, without exception and irrespective of size, had cows, which usually had to be kept supplied with pasture of one kind or the other during the grazing period. Combined, these facts mean that the hostile views on forest pasture by livestock expressed by the Swedish forest community were directed towards forest land which was not under company – or state – control.<sup>6</sup>

The most important ideological constant is that Swedish forestry, as all scientific forestry worldwide, saw forest pasturing of livestock as detrimental

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*Journal of Interdisciplinary History* 43(2) (2012): 275–287; R. Bergström and K. Danell, 'Game management: a period of organization and conservation', in H. Antonson and U. Jansson (eds) *Agriculture and Forestry in Sweden since 1900: Geographical and Historical Studies*. (Stockholm: KSLA, 2011). On the moose, see also S. Wennberg DiGasper, *Natural Resource Management in an Institutional Disorder: The development of adaptive co-management systems of moose in Sweden*, 'Doctoral Thesis 2008:52'. (Luleå, 2008), pp. 91–138.

6. C. Martiin, 'Following trails of cattle through the landscape: dairy cows were key players in changes to land', in Antonsson and Jansson (eds) *Agriculture and Forestry in Sweden since 1900: Geographical and Historical Studies* (Stockholm: KSLA, 2011), pp. 198–200; and M. Morell, 'Livestock and animal production', in U. Jansson (ed.) *Agriculture and Forestry in Sweden since 1900: a Cartographic Description* (National Atlas of Sweden: Stockholm), p. 87.

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to forestry production or forestry as a whole. Furthermore, scientific forestry regards forests and forested land as an area devoted to a single purpose; the production of marketable cubic metres of different sorts and sizes. All other uses of forested land are to be regarded as suspicious or possibly detrimental to forestry production until proven otherwise.<sup>7</sup>

This general idea of a specific, single use of a certain type of land, was in the Swedish case in some ways embedded in government policy, at least since the laga skifte Statute (see below), of 1827 and onwards. The Statute was directed towards the destruction of the principle that land could be held, and used, in common by villages for a number of different agricultural purposes all staged within the same area. For the (mostly liberal) nineteenth century state as a fiscal and juridical entity, it was thought easier to manage and develop agriculture, and thus the country, if each patch of land had its individual and designated owner, whether it was a private person, a limited company or the state.

Change, however, occurred in two different fields; demography and agriculture. Sweden industrialised comparatively late (see below). By 1900 only one fifth of Swedes lived in towns and municipalities. By the mid-1950s, half the population resided in towns. Agriculture-wise, this meant that a steadily increasing proportion of the citizenry did not produce their own foodstuffs but rather bought them. Agriculture, however, had already seen change during the late nineteenth century. The so-called transport revolution (steam engines on rail and ships) had forced Swedish farmers to redirect their husbandry towards animal production by the last decades of the century in order to meet a growing international market, especially for butter and pork. The flight from the countryside during the first half of the twentieth century led to the creation of a domestic market as well, especially for milk, butter and pork. This meant that milk was by far the most important product in Swedish agriculture from the beginning of the twentieth century up until the mid-century.<sup>8</sup>

The number of cows was kept quite even during the same period but, due to selective breeding, they more than doubled in size and were better fed and thus had a higher yield of milk by mid-century than at the beginning. This was an effect of commercial milk production and dairy farming. In order to raise output, dairy cows were provided with better fodder, which led to increased production of fodder on arable land and a more intensive use of certain grazing lands; these are the *managed pastures*.<sup>9</sup>

7. For the Swedish case, see C.L. Obbarius, *Lärobok i Skogs-Vetenskapen. Första delen. Skogs uppdragande* (Westerås, 1845) and L. Falkman, *Om Swenska skogarnas nuvarande tillstånd och deras inflytande på landets framtid* (Stockholm, 1852).

8. Morell 'Livestock and animal production', 86–87 and Martiin 'Following trails', 200–201.

9. It should be noted that all cows were milked during the first half of the 20th century since there was no distinction between dairy farming and beef production in Swedish agriculture. H. Juhlin-Dannfelt, *Lantbrukets historia. Världshistorisk översikt av lantbrukets och*

To rationalise pasture, agricultural science recommended that a certain area of the arable land of a farm was set aside permanently for pasture. It was to be sown with grass – ley – and fertilised. In this way it was possible to create a high yielding pasture patch, able to support the farm's livestock throughout the whole grazing period. At the same time, dependency on less productive and non-fertilised pastures – like forest land – was cut off. This new approach to pasturing – ley on cropland – was known at the time (from about World War One until the mid-century ) as managed pastures.

By the 1950s, a high-yielding cow was not able to support herself (metabolically) on a forest-pasture. It was too time-consuming to get sufficient amounts of the sparsely available fodder compared to the area that had to be covered while grazing.<sup>10</sup>

Despite having supplied a quite lengthy framework setting the scene for the narration, there is still a need – after presenting the sources – to pay heed to some aspects of agricultural history regarding nineteenth century land partitioning, the right to common pasture on forest land and the forest community's achievements prior to the 1920s, in order to make the story intelligible for a reader with little or no previous experience of either Swedish agricultural history or forest history. I therefore ask for a continued patience before the real story begins.

## SOURCES

The Swedish Forestry Association (the SSF), formed in 1902 as an NGO, and a forerunner established in northern Sweden in 1883 (which remained separate until 1965), published articles related to its activities in various outlets, including, from 1914, the SSF periodical *Skogen* (the Forest). The contemporary source material for this paper was mainly retrieved from a thorough search of *Skogen's* columns from 1914–1955; these are regarded by the author as providing representative views of the Swedish forest community, rather than the SSF, since not all expressed views derive from editorials in the periodical. Therefore, they are treated as expressions of the Swedish forest community hereafter. The source material from *Skogen* has been supplemented with a survey of documents left by the 1927 Parliamentary Committee formed to revise the Fencing Act of 1857 (see below), housed at the National Archives (Riksarkivet) in Stockholm. In addition, livestock statistics were obtained from a statistical atlas (1909) on Swedish agriculture based on official statistics from 1902. Game statistics (moose and roe deer) for the 2012/2013 winter

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*lantmannalivets utveckling* (Stockholm: J. Beckmans bokförlag, 1925), pp. 714–717, 762–763, 766–767 and 770–776 and Martiin, 'Following trails', 200–2001.

10. S. Larsson, N. Olsson, F. Jarl and N.E. Olofsson, *Husdjurslära del II. Näringslära – Fodermedlen – Ufodring – Vård* (Stockholm: LT:s Förlag, 1951), p. 195.

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population (after hunting) were kindly supplied by Dr. Jonas Kindberg of the Svenska Jägareförbundet (The Swedish Association for Hunting and Wildlife Management), the Association charged with the official collection of game statistics since 1938.<sup>11</sup>

## LAND PARTITIONING, THE FENCING ACT 1857 AND PASTURE

The laga skifte Statute in Sweden, in force from 1827, changed the mix of individual and commonly held land within the villages to individual holdings with specified owners. This was a gradual process, village by village, which took about a hundred years to complete. Other important physical features of the former villages affected by the laga skifte Statute were the fences. An underlying aim of the Statute was that the newly established divisions should be enclosed and protected by fences. This clashed with the old order, in which fences were only legally required around arable land and meadows. By the mid-nineteenth century, calls for a revised Fencing Act were raised. The new Fencing Act was presented in 1857. It recognised that stock owners were liable for trespass and damage to neighbouring properties but it also required fences to be established and maintained along the boundaries between properties created through laga skifte, and boundaries between villages, regardless of whether land had been partitioned in them. The net effect of the Act was that it forced fencing to be raised in places in the landscape that had never been previously fenced.<sup>12</sup>

However, the laga skifte Statute included a significant clause for the density and frequency of fences on forested land that also contained pasture. A village community could decide, in connection with land partitioning, that the newly created divisions on forested land could be grouped together, thus forming a collective forest pasture. In such cases no fences had to be erected along the new property boundaries crossing forested land. The exception was also recognised in the Fencing Act of 1857, which only required mandatory fences along the former village boundaries through forested areas. For the rest of the nineteenth century and well into the first three decades of the twentieth century these clauses provided firm foundations for a judicial perception that owners of all properties that previously formed a village subjected to land partitioning had forest pasturing (grazing) rights in 'unenclosed' forests, i.e. forest land with no fences along property boundaries. The difference between unenclosed and enclosed forest land is demonstrated in Figure 1.

11. Flach, Juhlin-Dannfelt and Sundbärg, *Sveriges jordbruk*; <http://jagareforbundet.se>

12. Ö Kardell, *Hägnadernas roll för jordbruket och byalaget 1640–1900*. 'Acta Universitatis Agriculturae Sueciae. Agraria 445, / Skogs- och lantbrukshistoriska meddelanden nr 31' (Stockholm: KSLA, 2004); and Ö Kardell, 'Hägnadssystemens fysiska placering i landskapet och deras förändring över tiden', *Bebyggelsehistorisk Tidskrift* 47 (2004): 85–92.

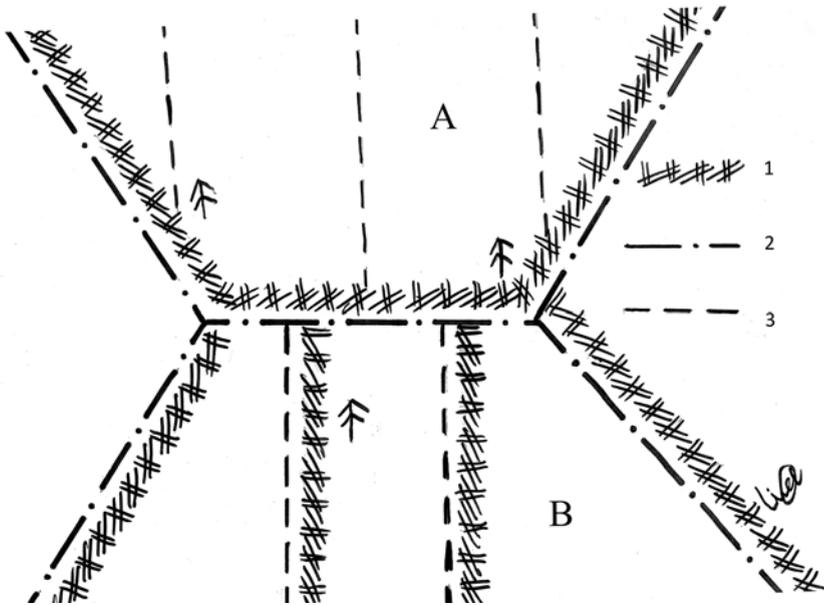


Figure 1. Illustration (by Linnéa Kardell) of the difference between unenclosed and enclosed forest land: A, Unenclosed; B, Enclosed; 1, Fence; 2, Former village boundary; 3, Property boundary.

The judicial definition of unenclosed forest land as a collective pasture was to become a thorn in the side of the forest community, once their perceptions of intensive forest management – ‘good forestry stewardship’ – (see below) were extended in the 1920s to embrace all forest land in Sweden, including private forest land.

#### THE SWEDISH FOREST COMMUNITY AND THEIR EARLY TWENTIETH-CENTURY VIEWS

At the turn of the twentieth century, forestry had become the leading Swedish industry in terms of export revenues (sawmilling), due to exploitation of vast forests in northern Sweden from 1850 to 1900. Forestry was seen as an industry that could transform Sweden into a modern and industrialised country; thus it received strong support from the government as well as from industrialists. As early as 1883 the embryo of what was to become the leading forestry lobbying group was established, as an NGO, by foresters and industrialists in the northern part of the country – Norrlands skogsvårdsförbund. In 1902 the Swedish Forestry Association (Svenska Skogsvårdsföreningen, the SSF) was formed on a national basis. They organised industrialists, foresters and

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forestry scientists to develop an expanding Swedish forestry sector. The SSF was chaired from 1917–1936 by Arvid Lindman, an admiral, industrialist, politician and Swedish prime minister in the periods 1906–1911 and 1928–1930.<sup>13</sup>

At the time, it was realised by the forest community that forestry could not be expanded further within sawmilling. Instead, ‘god skogsvård’ (good forestry stewardship) was required, recognising needs to ensure that annual cuts did not exceed annual growth for sustainable production, and to improve management practices, notably by including thinning to generate pulp wood. To accommodate sustainability, there was a need for a National Forest Inventory (NFI). Further, the forest community envisaged developments in forestry legislation, based on the 1903 Forestry Act which imposed compulsory regeneration after logging, and working in the same general direction.<sup>14</sup>

Forest legislation that prohibited cutting young or middle aged trees in any other way than through thinning had been issued in 1923, in conjunction with the development of a pulp industry on the coast of Norrland, the northernmost two thirds of Sweden and the area which held (and still holds) most company- and state-owned forest land. By 1915, southern Norrland supported an industry that generally extended its geographic reach into northern Norrland after WWI. The crucial bid for sustainability – cutting no more than the annual growth increment – had likewise been a step-wise development. In 1908 a parliamentary committee was established to investigate the possibilities and draft methodology for a future NFI. Parliamentary funds were issued for a trial inventory of a single county in 1910. The results and a complete plan for an NFI were presented in May 1914, the idea was raised again after the war and a tax-funded NFI began in 1923.<sup>15</sup>

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13. It should be noted that from the mid-1930s private forest owners – farmers – started to form Forest Owner Associations, some of which are still in existence today. These associations in turn enlarged the circle of the Swedish forest community gradually. After WWII the forest community had changed into the modern forest sector. However, to use the term forest sector is anachronistic before the 1930s, which is why forest community will be used throughout the paper. See further S. Lundell, ‘Family forestry in transition: times of freedom, responsibility and better knowledge’, in Antonson and Jansson (eds) *Agriculture and Forestry in Sweden*; *Skogen* 1928: 186, J.L. Ekman. ‘Konkurrensen om trävarumarknaden’; L. Kardell, *Svenskarna och skogen. Del 2. Från baggböleri till naturvård*, 11–12. (Jönköping: Skogsstyrelsens förlag, 2004); T. Josefsson, and L. Östlund, ‘Increased production and depletion: the impact of forestry in northern Sweden’s forest landscape’, in Antonson and Jansson (eds) *Agriculture and Forestry in Sweden*.
  14. Conference presentation by Örjan Kardell at ‘History of Technology and Science Days 2013’, March 20–22, Umeå University, Sweden. The 1903 Forestry Act came into force in 1905. See K.-G. Enander, ‘Forestry policy in the 20th century’, in Jansson (ed.) *Agriculture and Forestry in Sweden*.
  15. Enander, ‘Forestry policy in the 20th century’; L. Kardell, *Svenskarna och skogen*, pp. 73–75 and 107–109; *Skogen* 1929: 302–303, ‘Skogsindustrierna inför Socialiseringsnämnden’; *Skogen* 1924: 6–9, Henrik Carbonnier. ‘Taxering av Sveriges samtliga skogar’; and *Skogen* 1924: 105–108, Arvid Lindman, ‘En riksskogstaxering är nödvändig’.

## THE FOREST COMMUNITY AND FOREST PASTURE 1920–1955

It seems – at least in hindsight, and from the columns of *Skogen* – that after progress towards ‘god skogsvård’ was firmly in motion the forest community turned to new tasks to support the development of all Swedish forests, including the fifty per cent covering land that was (and is) controlled by farmers or other private owners. Forest pasture was once again presented as a serious inconvenience to forestry but with an important difference. For the first time there were scientific (agriculture) possibilities to solve the problem. The Swedish Association of Pasture and Ley (Svenska betes- och vallföreningen) was invited to delegate one of two main speakers to present its members’ knowledge and suggestions at the annual meeting of the SSF in March 1922. The Association was formed in 1916 with the main goal of reducing the area of forest land in pasture, and received state grants from 1919. The gathered forest community was assured that it was possible to separate stock animals and forests in a way that would be beneficial to both farming and forestry.<sup>16</sup>

The following year (1923) saw judicial changes concerning unenclosed forest land. The 1923 Forestry Act allowed the Forest protection boards (Skogsvårdsstyrelser), inaugurated in 1905 on a county level and in charge of both advice and law enforcement concerning forestry, to demand that individual owners should perform regeneration on unenclosed forest land pastures, even though they were collectively grazed.<sup>17</sup>

Similar questions to those raised in 1914, regarding the need for a major revision of the Fencing Act, were raised again in the Swedish Parliament in 1925. A Committee was set up in 1927 and a draft proposal for a new Act was presented in 1928. Meanwhile, in 1927, a government grant was issued, directed towards owners of so-called incomplete agricultural holdings. The intention was that farms with limited holdings should receive a subsidy to organise improved, managed pastures. Funds, applications and professional

16. *Skogen* 1923: 241–264, Tor Jonsson, ‘De nordiska ländernas skogsproduktion och dess framtida utvecklingslinjer. I. Sverige’; *Skogen* 1924: 6–9, Henrik Carbonnier, ‘Taxeringen av Sveriges samtliga skogar’; *Skogen* 1925: 68–91, Gunnar Andersson, ‘Det svenska skogsbrukets nuvarande ställning’; *Skogen* 1928: 549–554, Anders Wahlgren, ‘Huvuddragen av skogsvårdens utveckling i Sverige under den tilländalupna tiden av detta århundrade’; *Skogen* 1930: 453–457, Tor Jonsson, ‘Några synpunkter på bondeskogsbrukets ekonomi.’; *Skogen* 1930: 481–487, Tor Jonsson, ‘Några synpunkter på bondeskogsbrukets ekonomi. II’; *Skogen* 1931: 75–76, Editorial, ‘Premiering av mindre skogsbruk’; *Skogen* 1922: 309–326, H. Hegardt, ‘Betesdriftens förhållande till skogsskötseln’; *Skogen* 1922: 345–362, Mauritz Carlgren, ‘Skogsbete och skogsvård i Norrland’; *Skogen* 1922: 362–367 contains the discussion that followed on the two lectures. See also *Skogen* 1923: 90–95, Lennart Wählstedt, ‘Skogsbete och skogsvård i Norrland’.

17. *Skogen* 1927: 219–220, Editorial, ‘Betesfrågan’. See also *Skogen* 1929: 595–596, Editorial, ‘Skogsvård och politik’.

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advice in individual cases were to be handled by the Rural Economy and Agricultural Societies in each county.<sup>18</sup>

The 1928 draft proposal was circulated to agriculture and forestry official administrations at county and national levels. It received an immediate negative response. Several discontented respondents stated that the proposal had the same drawbacks as the 1857 Act. It mixed two judicial principles, the liabilities for stock animals and fences, which were considered separate (and conflicting) by their critics. Naturally, the proposal received substantial attention in *Skogen*, where it was seen as legislation that would maintain collective pasture on unfenced forest land. A new proposal based exclusively on liability for stock animals was seen as the only possible solution for the future. Such a suggestion was viable since agricultural science already had an answer to the pasture problem, which would also make it technically possible to eradicate forest pasture in the near future.<sup>19</sup>

The Committee resumed work in 1929, by requesting information on the abundance of unenclosed forest land and the extent to which it was grazed. Similar requests followed in 1931 for information on progress towards the adoption of scientifically recommended pasture – managed pastures (ley on arable land) in individual holdings. In the northern part of Sweden seventy to a hundred per cent of the forest land was unenclosed, while five to thirty per cent was the norm further south. In the far south all forest land was enclosed. Generally all unenclosed forest land in Sweden was used for pasture to some extent.<sup>20</sup>

The information provided by the Rural Economy and Agricultural Societies did not show this north-south geographical pattern for unenclosed forest land. A compilation of the stated figures show, on average, that one to four per cent of the holdings had completely adopted managed pastures, and around eleven per cent had adopted managed pastures partially, the highest reported proportion being around 25 per cent.<sup>21</sup>

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18. *Riksdagens skrivelse den 18 mars 1925, nr 78*. This was basically a renewed demand to the government that it should take action on the parliament proposal *Riksdagens skrivelse den 29 augusti 1914, nr 190*, and appoint a committee to investigate the possibilities for a revised Fencing Act and *SOU 1928:24*.

19. *Justitiedepartementet. Konseljakt 1933–02–10. Ärende nr 91. Vol II*. Riksrådet i Marieberg, Stockholm, *Skogen 1928*: 556–557, ‘Ny lagstiftning om ägofred och stängselskyldighet’; *Skogen 1928*: 627–628, Editorial, E. Lundh, ‘Förslaget till ägofredslag ur skogsbrukets synpunkt’ and *Skogen 1928*: 641–645, ‘Skogsvårdsstyrelserna och ägofredslagstiftningen’.

20. *Kungl. Maj:ts proposition Nr 107. Bilaga B. Bihang till riksdagens protokoll 1933. I saml. Nr 107*, pp. 204–213. It should be noted that the Swedish counties in the southern third of the country differ considerably in forest content.

21. *Kungl. Maj:ts proposition Nr 107. Bilaga C. Bihang till riksdagens protokoll 1933. I saml. Nr 107*, pp. 214–230. It should be noted that the committee asked the Rural Economy and Agricultural Societies to provide information related to different sizes of holdings. The figures given in the section above are estimates compiled by the author.

The combined information shows that mixed farming in Sweden was still dependent on forest pasture, to varying degrees, but change was underway. Owners of perhaps as many as fifteen to twenty per cent of all holdings had changed their pasture as recommended, at least partially, within five years of the state grant's introduction.

Parliament passed a new Fencing Act in 1933, which retained the woeful and contentious judicial definition of unenclosed forest land as well as liability for fencing. *Skogen* summarised the new proposal in late autumn 1932. In 1933, the upcoming vote in parliament was presented as perhaps the only general support forestry could count on that year, in the precarious economic conditions of ongoing global recession. Once the new law was passed, with some changes compared to the proposal, the contents were explained in a surprisingly sedate and orderly tone by *Skogen*. In addition to the world depression, §§ 12–19 in the new Act went a long way towards explaining the lack of indignation within the forest community. These allowed for something the law called 'betesreglering' (regulating pasture), a two-step process that offered a theoretical opportunity to do away with unenclosed forest land, once and for all, albeit gradually. Step two involved an application to the county from individual shareholders (proprietors) of unenclosed forested land. A single application was sufficient to start 'betesreglering', irrespective of whether the other shareholders consented.<sup>22</sup>

The official in charge of the process was then responsible for assigning areas (after a survey) within individual properties that should be enclosed for pasture, either on arable land or (if this was not possible) in forested areas to be cleared. However, if the shareholders so decided, nothing prohibited setting aside an enclosed area of cleared forest land for joint collective pasture, as long as it was managed as pasture and not as an area with dual purposes. In this way a large proportion of former unenclosed forest land could be managed in the future solely as forest.

However, due to the economic recession, debate about improved forest pastures was also influenced by factors other than judicial developments. During the fifteen years following introduction of the 1927 subsidy parliament was offered various suggestions regarding the sizes, amounts and geographical extent of improved forest pasture. These included suggestions to include improved pastures in the list of relief works organised by the government to counter the

22. *Skogen* 1932: 479, 'Ny lag om ägofred'; *Skogen* 1932: 505–507, Editorial, 'Det nya förslaget till lag om ägofred'; *Skogen* 1933: 1–2, Editorial, 'Ett nytt år' [The proposal]; *Skogen* 1933: 103–104, Editorial, 'Proposition med förslag till lag om ägofred'; and *Skogen* 1933: 145, 'Riksdagens motioner' [The new law]; *Skogen* 1933: 301–302, Editorial, 'Den nya lagen om ägofred'; *Skogen* 1933: 323–324, Editorial, 'Från riksdagens bord' and *SFS* 1933:269. See also T. Sjöfors, *Lagen om ägofred* (P.A. Norstedt & Söner: Stockholm, 1934) pp. 57–83 and 212. Sjöfors was the appointed secretary of the committee. His book is a commented edition of the law; *Skogen* 1933: 361, 'Skogsvårdsstyrelserna och den nya ägofredslagen' and *Skogen* 1934: 1–2, Editorial, 'Vid årsskiftet'.

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recession. A subsidy for 'betesreglering' was called for and the Association for Pasture and Ley asked for an official inquiry on the economic setbacks that pasture on forest land had caused from a forestry perspective.<sup>23</sup>

A short paragraph in *Skogen* in 1947 announces that the Minister of Agriculture had promised a new inquiry on the Fencing Act (which reported in 1949 and 1951) since the effect of 'betesreglering' did not meet expectations. The process was seen as too complicated. It should be noted that none of the items describing these events reached editorial status in the columns, all were short paragraphs. *Skogen* was henceforth silent concerning a revised Fencing Act.<sup>24</sup>

In 1955 *Skogen* presented its last item on forest pasture: 'Forest pasture on the retreat in Norrland'. This ended an era from 1920–55 in which it presented around 300 items on forest pasture and related matters (establishment, costs and maintenance of managed pastures on arable land, and similar matters for both enclosed and improved pastures on former forest land), including 198 in the decade between 1929 and 1939. However a new herbivore was gradually attracting attention in *Skogen* – the moose.<sup>25</sup>

## THE MOOSE – 'THE NOBLEST ADORNMENT OF OUR FORESTS'

Moose harvests declined during and after WWI, probably due to illicit hunting, and did not return to pre-war levels (3,000 animals p.a.) until 1927. By 1932 numbers had nearly doubled to 5,700. The moose population, at the time, was mainly concentrated in the counties on both sides of the sixtieth parallel, transecting Sweden just north of the capital, Stockholm. Although this area is in the southern third of Sweden where private farmers dominate, it features quite large tracts of forest land that belonged to former iron works since the seventeenth century (providing charcoal), and areas dominated by large, manorial

23. *Skogen* 1930: 92, 'Statsbidraget till betesförbättring'; *Skogen* 1930: 231, 'Intensivare skogsvård i Norrland'; *Skogen* 1934: 509–510, Editorial, 'Anslag till ävägabringande av betesfred på skogsmark'; *Skogen* 1934: 555, 'Kulturbeten å enskildas skogar'; *Skogen* 1940: 91–92, Editorial, 'Norrländska skogsproduktionsutredningen'; *Skogen* 1945: 23, 'Norrländska skogsproduktionsanslaget tillämpningsområde föreslås utvidgat'; *Skogen* 1945: 387, 'Beteskurs' and 'Beteskurs för skogsvårdsstyrelsernas tjänstemän'; *Skogen* 1932: 340, 'Betesläggningar som nödhjulsarbeten'; *Skogen* 1933: 100, 'Statsarrendatorerna föreslå beredskapsarbeten'; *Skogen* 1933: 247, 'Anläggande av kulturbeten'; *Skogen* 1933: 317, 'Ingen beteskultur med arbetslöshetsmedel'; *Skogen* 1937: 480–82, 'Nya framstötter för skogsbetets avskaffande'; *Skogen* 1938: 60, 'Betesfrågan skall ytterligare utredas'; *Skogen* 1939: 405, 'Skogsbetets avveckling'; *Skogen* 1944: 155–158, Olof Tirén, 'Norrländska produktionsanslaget främjar en god sommarutfodring'; and *Skogen* 1944: 371, 'Systematisk undersökning av skogsbetet'.

24. *Skogen* 1947: 307, 'Den nya skogsvårdslagen'; *Skogen* 1949: 116, 'Lagen om ägofred revideras'; *Skogen* 1949: 264, 'Dagens hug-skott'; and *Skogen* 1951: 271, 'Ägofredslagstiftningen'.

25. *Skogen* 1955: 160–161, 166, Olof Tirén, 'Skogsbetet på avskrivning i Norrland'.

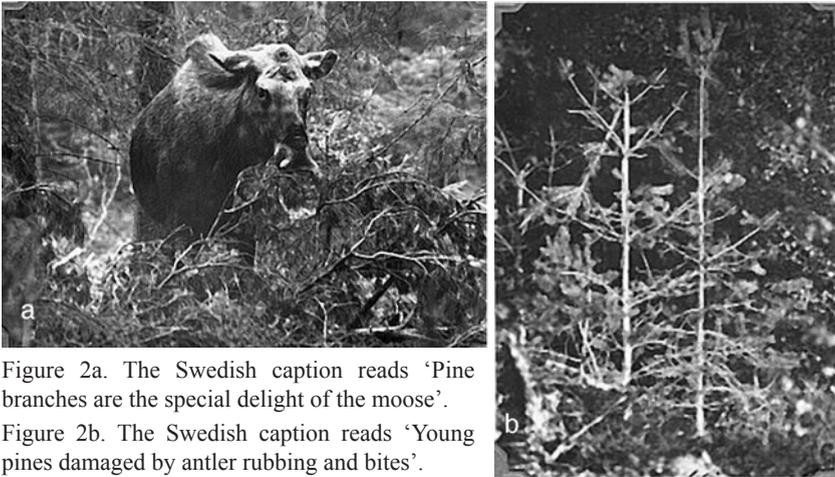


Figure 2a. The Swedish caption reads ‘Pine branches are the special delight of the moose’.

Figure 2b. The Swedish caption reads ‘Young pines damaged by antler rubbing and bites’.

Figures 2a and b. Photos published in *Skogen* 1932: 563(a) and 564(b) by Stig Wesslén, a documentary and wildlife film-maker, early advocate of wildlife conservation and forester. His surviving collection of negatives is held by Åjtte. Svenskt fjäll- och samemuseum, Jokkmokk, Sweden.

agricultural estates. The forests in these lands are mainly managed solely as forests, supervised by employed foresters who also have game-keeping duties. These managed and well protected forests hosted the highest densities of moose and saw the greatest increase in their numbers from 1927 to 1932; clear-cutting was used most frequently in these areas (resulting in the highest frequencies of young, even-aged pine stands in the country) and concerns about damaging browsing pressure from the moose were initially voiced in this area.<sup>26</sup>

In 1932 the forest community was presented, for the first time, with an item in *Skogen* including photos of moose in the wild, rather than painted or bagged specimens, and browsing young pines (Figures 2a and 2b). The author, Stig Wesslén, notes: ‘The moose can cause considerable harm during its rambles. In young stands, during winter, they feed mainly on needles of the lushest young pines, of which they seriously afflict the top as well as the branches’. However, he was of the opinion that the damage inflicted by moose – as long as moose

26. *Skogen* 1933: 58–59 and 65, Anders Olsson, ‘Om älgstammen i Sverige under de senaste tjugo åren’. The counties are: Värmland, Örebro, Västmanland, Uppsala, Södermanland and Östergötland; H. Juhlin-Dannfelt, *Lantbrukets historia: Världshistorisk översikt av lantbrukets och lantmannalivets utveckling* (Stockholm: J. Beckmans bokförlag, 1925), pp. 785–89; *Skogen* 1930: 611–612, Editorial, ‘Älgjaksfrågan’; and *Skogen* 1933: 333–334, Gustaf Lundberg, ‘Inför jaksäsongen’.

## SWEDISH FORESTRY BROWSING PRESSURE SINCE 1900

density is moderate – is not as severe as it might initially appear and could be corrected by thinning once the stand has reached twenty to thirty years of age.<sup>27</sup>

Four years later, the browsing damage debate began to intensify. The 1933 Fencing Act was in force and forest pasture area had been considerably reduced in the southern third of Sweden (see above), as the forest community was well aware. The first real browsing assessment, based on empirical data, was reported in *Skogen*. It showed evidence of damage in nine per cent of the total area of a Forest Common, and claimed that damage was so severe in seven per cent of the area that only ‘inferior’ forests could be expected in the future. Young pines and young birch (*Betula spp.*) were the most damaged. A supportive article reported that livestock had certainly not caused browsing damage observed in a forested area that specialised in producing aspen (*Populus tremula*) and birch wood for making matches, since scientific pasture had been established in both forest types. The clearly identified browsers were moose and roe deer (of the aspen), so from then on deer browsing damage was regarded seriously in economic terms by the forest community.<sup>28</sup>

That year, a further reference to pasture and browsing appeared in an item describing an intensively managed company owned forest in Östergötland county, where the chief forester reflected in an interview that: ‘If it is right to clear the forests of cows, I have to tell you, plainly speaking, that the moose should go too’. This was largely due to damage caused to young pines, but he also stated that it is not morally defensible to exterminate the moose completely, or even cull the moose population too severely.<sup>29</sup>

During the years preceding the outbreak of WWII quite an animated discussion developed in *Skogen*’s columns concerning a subject eventually dubbed ‘the moose damage question’. This discussion covered a range of topics within the broader field of moose browsing. One topic discussed was why moose feed preferentially on pine and why they do not browse evenly over the total forest area. A second topic concerned forestry practices that might deter moose or inhibit browsing, either mechanically or biologically. A third was the economic aspect of moose (and roe deer) damage. It was stated that costs of wild ungulate browsing in forests, due to reductions in forest production, far exceeded revenues that moose harvests could raise in meat value, which reduces moose hunting to the level of a sport, not an industry. It was also noted that if livestock

27. *Skogen* 1932: 563–565, Stig Wesslén (author and photographer), ‘Högvalt’. Stig Wesslén was a documentary and wild life film-maker and an early advocate for wildlife conservation. He was educated as a forester. The quotation is on page 564: ‘Det är icke en ringa skada, älgarna kunna göra under sina strövtåg. I ungsogar äta de vintertid huvudsakligast barren av de frodvuxnare tallplantorna, varvid de synnerligen svårt toppa såväl stam som grenar’.

28. *Skogen* 1936: 217–218, A. Krogh, ‘En älgskadetaxering’; and *Skogen* 1936: 272, John Sederholm, ‘En älgskadetaxering’.

29. *Skogen* 1936: 403–405, Pablo, ‘En dag i Finspong-skogarna’; the quotation, p. 405, read: ‘Om det är skönt att få bort korna från skogen, så måste jag säga, att man strängt taget skulle ha bort älgarna också.’

was largely banned from forests (in the southern third of Sweden) it seemed perverse to favour moose and roe deer unduly. Based on moose harvesting statistics a density of 6.2 moose per 100 km<sup>2</sup> was suggested as a viable population, which together with changes in hunting regulations would allow for a moose population that could be managed by hunting in the future. Finally, it was suggested that the moose population in Norrland could grow significantly from present numbers without risking serious browsing damage.<sup>30</sup>

## POST-WAR FORESTRY AND THE MOOSE

Following WWII the forest community was morally bolstered by the fact that Swedish forestry still generated nearly half of Swedish export revenues, as it did at the turn of the century. The community launched a new concept, called 'modern skogsbruk'; modern forestry. Modern forestry was based on clear cuts and regeneration by planting, mechanisation and use of chemicals (defoliant and insecticides), and supported by the 1948 Forestry Act which prohibited selective logging. Seedlings were sourced from a parallel long-term tree improvement programme. By the end of the 1960s, all planted seedlings were raised from seed from genetically selected parents. Many new nurseries, and seed-tree plantations, were needed. During the following fifteen years enormous tracts of state- and company-owned forest land in northern Sweden, which previously had been selectively logged, were clear-cut and seeded or planted.<sup>31</sup>

Moose received scant attention during the war in *Skogen's* columns, but in the following decade discussion on the moose became more scientific. Its

30. *Skogen* 1936: 478, 'Ett medel mot älgskadorna å ungsbogen'; *Skogen* 1938: 111–112, B. Enar Gardell, 'Om älgens skadegörelse'; *Skogen* 1938: 399–400, Ruben Carlsson, 'Skogsvård-jaktvård. Ett konfliktläge'; *Skogen* 1939: 25–27, Martin Enander, 'Älgskadornas reglering'; *Skogen* 1939: 142–143, Allan Petré, 'Vad kostar våra älgar?'; *Skogen* 1939: 175–176, Wilhelm Kugelberg, 'Älgarna, skogen och åkern'; *Skogen* 1939: 237, Martin Enander, 'I älgskadefrågan'; *Skogen* 1939: 273–274, Folke Bromée, 'I älgskadefrågan'; *Skogen* 1939: 316, P. A. Håkansson, 'I älgskadefrågan'; and *Skogen* 1939: 406–407, H. von Eckerman, 'I älgskadefrågan'.
31. *Skogen* 1941: 57–60, 'Skogsträdens förädling. I'; *Skogen* 1941: 81–83, 'Skogsträdens förädling. II'; *Skogen* 1945: 74–77, Holger Jensen, 'Om elitfröplantager'; E. Lisberg Jensen, 'Modern clear-felling: from success story to negotiated solution', in Antonson and Jansson (eds) *Agriculture and Forestry in Sweden*. Compare with *Skogen* 1939: 159–161, Editorial, 'Skogsbrukets rationaliseringsbehov'; *Skogen* 1939: 437–439, S.V. Söderqvist, 'En ökad och förbättrad skogsproduktion är målet'; *Skogen* 1943: 87–89, Editorial, 'Sveriges skogar efter kriget'; *Skogen* 1944: 48, 'Bättre stöd åt norrlandsskogarna'; *Skogen* 1944: 211–212, Editorial, 'Åtgärdsinventering i lappmarken'; *Skogen* 1945: 169–170, Editorial, 'Skogsodling – fröanskaffning'; *Skogen* 1947: 139–140, Editorial, 'Skogsmarkens rationella utnyttjande'; *Skogen* 1948: 29–30, 'Skogsproduktionen otillfredsställande – reproduktionsarbetet bör intensifieras'; *Skogen* 1948: 51, 'Hushållningen med vårt skogskapital'; *Skogen* 1948: 79–80, 'Skogsvårdsföreningens årsmöte'; *Skogen* 1948: 155–156, Wilhelm Ros, 'Ökad plantproduktion'; and *Skogen* 1948: 232–233, Gösta Hahr, 'Sådd eller plantering av tallskog'.

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annual dietary patterns were described and quantified and its browsing was shown to differ from cattle grazing in forests. Cows feed at grass level, so all new seedlings are included in their diet, while moose browse the vegetation at knee height. Moose population numbers, based on winter inventories, rather than shooting statistics, were presented. In terms of forestry management, several pre-war ideas of reducing browsing on pine by supplementary feeding the moose with other kinds of fodder, and by modifications in management practices, were tested and evaluated. Electric fencing and chemicals were brought into the discussion. Scientific research on ways to minimise browsing was called for and initiated. In 1947, the first government-appointed committee on moose damage in forests was formed. They concluded that more research was needed and that the moose population should be managed by planned hunting (which called for changes in the hunting regulations).<sup>32</sup>

Between 1945 and 1953 the winter moose population nearly doubled from 47,000 to 84,000 animals, and they pushed further north in increasing numbers (Figure 3). Consequently, Norrland forestry companies presented a statistical-based damage report in economic terms for the first time in 1954.<sup>33</sup>

Between 1960 and 1980 the moose population trebled, to an estimated winter population of 325,000 animals. This 'moose explosion' culminated in 1982 with 174,709 bagged animals, and was sparked by the implementation of clear-cutting as the dominant forest management method in all forests of Sweden, as stipulated in the Forestry Acts of 1948 and 1979. Clear-cuts provide bountiful food larders for hoofed game due to changes in floral composition induced by the favourable light conditions of the open stands.<sup>34</sup>

32. *Skogen* 1941: 217–218, M. Juhlin Dannfelt, 'Älgarna och den sydsvenska lövskogen'; *Skogen* 1942: 334, 'Elektriskt viltstängsel'; *Skogen* 1944: 12–14, Folke Bromée, 'Älgen som fiende till skogs- och lantbruket'; *Skogen* 1944: 27, 'Älgstammens framtid'; *Skogen* 1944: 34, 'Bidrag till elektriska älgstängsel'; *Skogen* 1944: 93–95, Vilhelm Kugelberg, 'Viltvård-jaktvård. I'; *Skogen* 1944: 108–109, Vilhelm Kugelberg 'Viltvård-jaktvård. II'; *Skogen* 1945: 13, P. 'Älgjakten 1944: 9.662 älgar'; *Skogen* 1945: 61, 'Älgskador på växande skog'; *Skogen* 1945: 117, Editorial, 'Skogsskötseln och det vilda'; *Skogen* 1945: 65, 'Inventering av älgstammen.'; *Skogen* 1945:159, 'Älginventering redovisar 40.000 djur.'; *Skogen* 1945: 229–230, Editorial, 'Älgen och skogen'; *Skogen* 1946: 100–101, Gunnar Ullén, 'Tallungskogen och älgskadorna'; *Skogen* 1947: 71–72, Editorial, 'Älgskador på växande skog'; *Skogen* 1948: 37, 'Älgens skadegörelse'; *Skogen* 1949: 318–319, Axel Olsson, 'Älgskador på skog och deras förebyggande'; *Skogen* 1950: 53, 'Älgskadefrågan'; *Skogen* 1950: 185–187,198, Gustaf Lundberg, 'Älgskador på skog och deras praktiska förebyggande. I.'; *Skogen* 1950: 212–213, Gustaf Lundberg, 'Älgskador på skog och deras praktiska förebyggande. II.'; *Skogen* 1953: 212–213, 217, Hans Hedlund, 'Halle- och Hunneberg'; *Skogen* 1954: 181–182, 'Älgen och skogen'; *Skogen* 1954: 301, Editorial, 'Skogen, jorden och det vilda'; and *Skogen* 1955: 307–316, 'Halle- och Hunneberg'.

33. *Skogen* 1954: 181–182, 'Älgen och skogen'; *Skogen* 1954: 401, 'Älgjakt lönar sig inte'; *Skogen* 1955: 19, Björn Hagström, 'Älgjakt lönar sig icke'; and *Skogen* 1955: 51, A.E. Malm, 'Älgjakten år 1954'. See also *Skogen* 1950: 53, 'Älgskadefrågan' and *Skogen* 1955: 307–316, 'Halle- och Hunneberg' for calculations on damage costs.

34. L. Kardell, 'Har vi sett några resultat av ett sekels viltskaddebatt?' *Skog & Forskning* 2000(2): 28–34; H. Essen von, 'Game conservation and hunting', in U. Jansson (ed.)

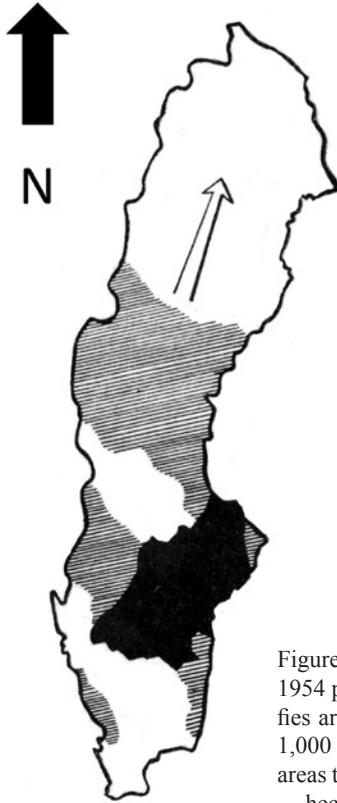


Figure 3. Map of Swedish moose distribution in 1954 published in *Skogen* 1955: 51. Black signifies areas that included at least three moose per 1,000 hectares in 1945. Scored sections signify areas that included at least three moose per 1,000 hectares in 1953. Illustrations A.-E. Malm.

The first academic research report on moose damage was presented in 1958. It refuted the pre-war notion that browsing damage could be avoided if moose were supplied with kinds of fodder other than pine. It further suggested that the best way to minimise browsing was to control moose populations. In addition to the 1947 committee, the second half of the century saw the formation of three more parliamentary committees devoted to browsing/grazing damage on forests and crops, which presented findings in 1964, 1979 and 1990, respectively. All three advised regulated hunting as the best method for controlling browsing damage. Fox mange hit Sweden in the 1980s, creating even better conditions for the roe deer. By the early 1990s the southern third of Sweden supported roe deer populations of between 200 to 300 animals per 1,000 hectares. This development put the species in the limelight for the forest community, since the roe deer browsed not only pine, but also spruce.<sup>35</sup>

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35. H. Westman, 'Älgens skadegörelse på ungsbogen', 'Kungliga skogshögskolans Skrifter Nr 28' (Stockholm, 1958); L. Kardell, 'Har vi sett några resultat av ett sekels

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As indicated in Figure 4, Swedish forests, once again, faced a massive impact from large herbivores as they did in the early twentieth century. So, can livestock grazing and deer browsing be compared?

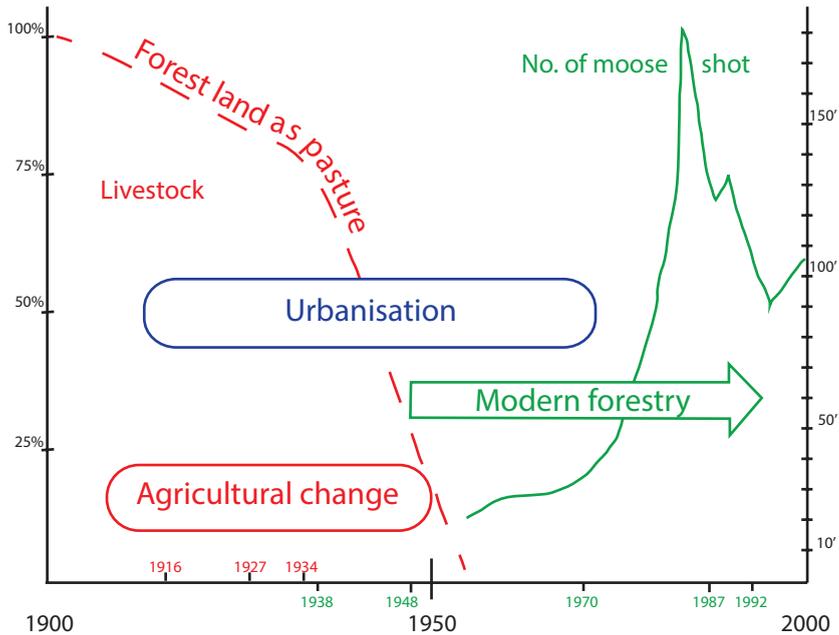


Figure 4. Summary of developments so far.

The exodus of livestock from Swedish forests is illustrated by the red broken line, signifying the estimated decline in use of forest pasture. Years in red signify dates of institutional changes that impacted the exodus. Similarly, the green continuous line illustrates the rise in moose numbers (number of moose shot). Years in green signify dates that were important for moose management. The livestock exodus was caused by agricultural change and urbanisation. Moose numbers were aided by the introduction of modern forestry in 1948. Sources (for moose statistics): Wennberg Digasper, *Natural Resource Management in an Institutional Disorder* and von Essen, 'Game conservation and hunting'.

viltskaddebatt?'; *SOU 1964:11*. Älgfrågan. Jordbruksdepartementet; *SOU 1979:52*. Viltskador. Jordbruksdepartementet; *SOU 1990:60*. Skada av vilt. Jordbruksdepartementet; J. Bergquist, *Influence by Ungulates on Early Plant Succession and Forest Regeneration in South Swedish Spruce Forests*, 'Acta Universitatis Agriculturae Sueciae. Silvestria 55' (Umeå, 1998); and von Essen, 'Game conservation and hunting'.

## HISTORIC PASTURE VERSUS CONTEMPORARY BROWSING

The purpose of the following section of the paper is not to answer the question of whether current game browsing in Swedish forests is too high or not. The calculations below should be regarded as a coarse estimate arguing that historical livestock grazing in forests is important to recognise when the contemporary matter of game browsing is discussed. In order to argue the case, however, it is necessary to 'size up' the phenomena, in one way or another.

The intended computation faces one major and overall problem which severely limits the possibilities for precision. True information on the actual acreage of the forests that were pastured by livestock is lacking, represented by the red broken line in Figure 4 (above) and the fact that the Parliamentary Committee on the Fencing Act had to collect additional information when resuming work in 1929. Swedish agricultural statistics, at the time, were mainly concerned with acreages of arable land, meadows and what was produced on that land: cereals, root crops or fodder. However, they also give livestock numbers for the different species involved. Therefore the most obvious path left to us is to compare the number of livestock at the turning of the twentieth century with the current number of game present (moose and roe deer).

However, if this is done, what is it that is really compared? Could the computation give any advice on the current browsing pressure by game at all? Or is a computation, without acreages and essentially built on population numbers, futile? The answer is both yes and no and therefore must be addressed here, before the computation is carried out. The species involved, both livestock and game, have different feeding patterns which means that several species of large herbivores are able to share a forest habitat. They forage on different sections of the available forage species: graminoids, herbs and woody species. Further, all animal species in the intended computation, except the horse, are ungulates or ruminants. According to their differing foraging patterns – what they preferentially feed upon when foraging – ungulates could be differently grouped in feeding types: concentrate selectors, intermediate types and grass/roughage eaters.<sup>36</sup>

Concentrate selectors are picky feeders that consume high quality diets of selected species of woody perennials. Of the species computed, moose and roe deer follow this method. At the other end of the spectrum we have the grass/roughage eaters, in the computation represented by cows and sheep. They feed quite indiscriminately among grasses and herbs in the floral composition, cattle being more of a true 'grazer' than the sheep which is more 'rough' within the feeding type. In between these two extremes there is a third group – intermediate types that are less picky than the concentrate selectors but more

36. Austrheim, Solberg and Mysterud, 'Spatio-temporal variation in large herbivore pressure in Norway'; and R.R. Hofmann, 'Evolutionary steps of ecophysiological adaptation of ruminants: a comparative view of their digestive system', *Oecologia* 78(4)(1989):443–457.

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choosy than grass/roughage eaters. While foraging they tend to focus on a mixed diet that includes woody species, graminoids and herbs. This group is represented by goats in the computation. The horse, finally, is no ruminant and forages mainly on grass since its wild ancestors originated from the steppe. All in all, this means that different compositions of large herbivores have different impacts on the floral composition in the habitat and thus that their respective impact on biodiversity differs considerably, even if two different herbivore groupings could be shown to consume the same amount of fodder (the energy needed to sustain their combined biomass metabolically) within a certain habitat.<sup>37</sup>

Seen from a forestry perspective in contemporary Sweden, this means that pine seedlings planted at a clear-cut risk repeated browsing during a consecutive number of years until they are beyond the reach of the moose (three metres). Repetitive browsing impairs growth, affects the technical qualities of the future log produced and in some cases, especially if browsing occurs during the initial year of planting, the survival rate of the seedlings is impacted too. By way of comparison, at the turn of the twentieth century, selective logging was practiced by all categories of forest owners. For forest regeneration, selective logging relied heavily on seedlings that germinated from seeds dropped by the trees left after cutting. If a selectively logged forest was pastured by livestock, especially by cattle, all germinating seedlings chanced annihilation by being accidentally swept away and included among foraged grasses and herbs. This was a potential risk for fifty per cent of the forested land at the time. Furthermore, this is the historic context which pushed *Skogen* (above) to comment on the fact that cows feed at grass level while moose browse the vegetation at knee height. Today, on the other hand, all clear cuts face the risk of game browsing, irrespective of ownership.<sup>38</sup>

Finally, being a historian and not a wildlife biologist, the following computation will just consider the live weights of the numbers and an estimated mix of livestock compared to contemporary numbers of moose and roe deer. Even though the comparison by itself cannot provide the answer to the all-time-high browsing claim of the Swedish forest community, it provides wildlife ecology with reasonably correct, historical data on livestock sizes (live weights) during the early twentieth century. The comparison is thus a theoretical exercise in order to size up the entities concerned in a comparable unit (metric tonnes), which is deemed more clarifying than presenting plain numbers of different species. However, a more elaborate comparison could be imagined, with a regional north and south outlook, aimed at measuring the herbivore pressure

37. Hofmann, 'Evolutionary steps of ecophysiological adaption' (Figure 2 in this work is especially instructive for the intended computation); and Austrheim, Solberg and Mysterud, 'Spatio-temporal variation in large herbivore pressure in Norway'.

38. Wallgren, Bergquist, Bergström and Eriksson, 'Effects of timing, duration, and intensity of simulated browsing'.

indirectly by estimating the metabolic biomass of all large herbivores (kg/km<sup>2</sup>) where past and present acreages of pastured forests would be given equal values. That is, the area of forest land which is owned by private persons in contemporary Sweden, since neither the state or forest companies kept livestock. Such a comparison would, however, still carry the same inaccuracies concerning the actual acreage that was pastured by livestock, but it would be possible to adapt the comparison according to contemporary regional densities of game.<sup>39</sup>

The comparison between past and present (below) will be carried out presuming that there were no effects of game browsing in the early twentieth century. In Sweden up until 1789 deer hunting was a royal prerogative which only the privileged nobility and gentry were able to partake in. A new law was passed that year which allowed peasant proprietors (freeholders) to bag cervids on their own land. This led to a rapid decline in the populations of moose and roe deer. By 1820 the roe deer was nearly extinct. A score were left at a manorial domain in the province of Scania, in the southernmost tip of Sweden. The moose declined as well. By 1860 a remnant of the moose population was protected in the iron works district – Bergslagen – by foresters who also had game-keeping duties; exactly in the same area where the moose damage question debuted (see above). This means that hardly any wild large herbivores were present in forests owned by the peasantry during the second half of the nineteenth century. Furthermore, modern investigations on the interplay between livestock and cervids in a given grazing area show competition and competitive displacement as active factors where deer are bested by cattle. In 1900 official statistics show that 1,800 moose were bagged. It is safe to assume that the majority were culled on state- and company owned land. There are no contemporary statistics available for roe deer, but Dr. Kindberg suggests that their numbers were very limited. Therefore, livestock grazing forested areas generally had very little competition from game. For livestock, numbers are lowered (Table 1) to account for the fact that deer browse all year round, while livestock were stabled and fed inside for seven months of the year. Further, since the narrative is concerned with the Swedish forest community's views on forest pasture by livestock and contemporary deer browsing, the comparison will be guided by expressed views – estimates – on the extent of forest pasture, which the Community committed to writing.<sup>40</sup>

39. Compare with the method used by Austrheim, Solberg and Myserud, 'Spatio-temporal variation in large herbivore pressure in Norway'.

40. U. Nyrén, *Rätt till jakt. En studie av den svenska jakträtten ca 1600–1789* (Göteborg: Göteborgs universitet, 2012), p. 55–57 and p. 108–155; G. Cederlund and O. Liberg, *Rådjuret. Viltet, ekologin och jakten* (Spånga: Svenska jägareförbundet, 1995), p. 21–22; S. Björklöf, *Älgen i vår historia och vardag* (Stockholm: Tiden, 1994), pp. 91–96; K.M. Stewart, R.T. Bowyer, J.G. Kie, N.J. Cimon and B.K. Johnson, 'Temperospatial distributions of elk, mule deer and cattle. Resource partitioning and competitive displacement', *Journal of Mammalogy* **83** (2002): 229–244; J.A. Jenks and D.M. Leslie Jr. 'Effect of domestic cattle

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In 1907 the forester Carl Björkbom wrote, in a publication against grazing livestock on forest pasture, that official statistics (1905) gave the total number of all horses, cattle, sheep and goats as 4,245,873 animals. He estimated that out of this number, about two million animals were pastured on forest land during summer. Among those were ‘probably all sheep and goats and at least 500,000 cattle’.<sup>41</sup>

Following Björkbom’s notions on the extent of forest pasture, using the statistical data (1902) from the 1909 atlas presented above to fill in the numbers of sheep and goats in Table 1 below, we will find that we lack 236,000 animals to reach the estimated two million. This number will be assigned to horses as compared to a total number of 528,000 horses in the countryside, since ethnological records indicate that the majority of the horses in the northern two thirds of Sweden were pastured on forested land. As Björkbom expressly states that *at least 500,000 cattle* are pastured in forests this figure will be assigned for cows. Cows are the largest group of the cattle presented in the 1902 statistics – 1,773,000 compared with the total number of 2,576,000 head – cows, heifers, oxen and bulls. Livestock numbers, however, are reduced in order to adapt the figure to a grazing period of five months ( $5/12 = 0.42$ ) and thus making numbers comparable to deer that browse all year round.<sup>42</sup>

Table 1. Number of large herbivores used in the calculations

Species	Total number	Reduced number of livestock
Horse	236,000	99,120
Cow	500,000	210,000
Sheep	1,195,000	501,900
Goat	69,000	28,980
Moose	300,000	–
Roe deer	240,000	–

The table shows the reduced number of livestock – total numbers reduced with a factor of 0.42 – in 1902 used in the calculations and the number of roe deer and moose in 2012. Sources: Björkbom, *Om skogsbetet* (p. 27); Flach, Juhlin-Dannfelt and Sundbärg, *Sveriges jordbruk* (pp. 255–258); and Kindberg pers. corr.

Dr. Kindberg, at the Svenska Jägareförbundet, informs that 96,400 roe deer were bagged during 2012, signifying a total population of 300,000 roe deer.

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on the condition of female white-tailed deer in southern pine-bluestem forests, USA’, *Acta Theriologica* **48** (2003): 131–144; and mail from Dr. Kindberg 29 Oct. 2014. For roe deer distribution, in various times during the 20th century, please compare with maps provided by von Essen, ‘Game conservation and hunting’. Note, however, that they show only the distribution without any references to actual densities.

41. C. Björkbom, *Om skogsbetet*, ‘Skogsvårdsföreningens folkskrifter 9’, (Stockholm, 1907) p. 27..
42. Ö Kardell, ‘Vallning, bete, mjölkning och hägnader kring sekelskiftet 1900’.

Similarly, 95,937 moose were shot, signifying a total population of 240,000 moose. As a rule of thumb, wildlife ecologists assume that bucks and bulls comprise about 25 per cent of the winter populations of roe deer and moose, respectively.<sup>43</sup>

The next dataset considered comprises the live weights of each species of large herbivore included in the comparison, as shown in Table 2 below. In early twentieth century Sweden, most livestock were indigenous breeds, apart from cattle held at manors or large estates. Cattle weights used in the calculations therefore represent native breeds of cows only. Similarly, the live weights for sheep, goats and horses are for indigenous breeds. The 1902 statistics only give the total number of sheep and goats without specifying sex and age. Female weights are therefore used for the entire 1902 population of livestock since it is a known fact that in domesticated herds of livestock – where breeding is controlled by humans – males are present in insignificant numbers. For instance, the number of bulls in the 1902 statistics comprise only a few per cent of the total number of cattle.<sup>44</sup>

Table 2. Live weight of large (adult) herbivores (kg)

Species	
Horse	500
Cow	200
Sheep	40
Goat	30
Moose	
	<i>Bull</i>
	370
	<i>Cow</i>
	336
Roe deer	
	<i>Buck</i>
	25
	<i>Hind</i>
	23

The table shows the individual live weights assigned for different kinds and sometimes sexes of large herbivores used in the calculation. All livestock weights are for indigenous breeds. Sources: Hallenborg (*Lärobok*: 103–104 cows and 77 horses); Westerlund and Johansson (*Husdjurslära*, 245–246 sheep and goats); *Jägar skolan* (45 moose) and Cederlund (*Lär känna rådjuret*: 3 roe deer).

Live weights of moose – bull and cow – were calculated from data on carcass weights in a hunting textbook published by Svenska Jägareförbundet and are presented as mean values since it is known fact that body weights tend to

43. Letter 29 Oct. 2014, Dr. Kindberg.

44. J.F. Hallenborg, *Lärobok i husdjurskötsel för landtbruks- och landtmannaskolor: Första delen* (Stockholm: F. & G. Beijers Bokförlagsaktiebolag, 1893); and A. Westerlund and I.Johansson, *Husdjurslära: Del I* (Stockholm: LT:s Förlag, 1950).

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increase with latitude within a species distribution. In our case the more northern the distribution is, the heavier the animal gets. Similarly mean values have been computed for roe deer – buck and hind.<sup>45</sup>

Since no information is available on the age ratio (adult –juvenile) within the moose and roe deer populations, nor for sheep and goats for the 1902 statistics, all live weights presented in Table 2 represent adult animals only. It is to be kept in mind that the composition of both livestock and game populations is regulated by human activity; in the case of livestock, breeding and slaughter; for game, hunting. In the latter case Swedish hunters are given ratios of juvenile and adult moose allowed for culling.

The datasets in Table 1 and 2 have been combined and provide the estimated comparison of historic forest pasture versus contemporary game browsing, expressed as the live weight of large adult herbivores (livestock in 1902 and game in 2012), as shown in Table 3.

Table 3. The estimated impact of historic forest pasture grazing compared to contemporary game browsing expressed as the combined live weight of large adult herbivores in 1902 (livestock) and 2012 (moose and roe deer).

Year	Combined live weight of large herbivores (metric tonnes)
1902 (Adult livestock)	112,505
2012 (Adult game)	109,250

Justifiable objections could be raised against the simplifications and limitations made for the calculations in Table 3. However, the results enable a theoretical assessment of the relative magnitude of the current supposedly all-time-high browsing pressure in Swedish forests. The data indicate that browsing pressure by deer in 2012 was almost equal to forest pasture grazing by livestock in 1902. The difference is only about 3,000 metric tonnes.

In all probability the overall picture would have changed if it had been possible to present reasonably correct regional figures on the areas of forested land being grazed by livestock in the early twentieth century. At the time, corporate- and state-owned forest land dominated the acreage in the northern two thirds of Sweden. The reverse picture is true for the southern third of Sweden. Here, the farmer-owned proportion of forest land was dominant. This is also reflected in the distribution of cattle in the early twentieth century. In the 1902 statistics, the total of 2,576,000 cattle was unequally distributed between the southern third of Sweden and the northern two-thirds; 2,040,000 head in the southern third compared to only 536,000 in the two northern thirds.

45. *Jägarskolan: Svenska jägareförbundets kursbok för jägarutbildningen*, N. Hermansson, J. Boëthius and M. Ekman (eds) (Stockholm: Proprius förlag, 1983); and G. Cederlund, *Lär känna rådjuret: En artmonografi från Svenska Jägareförbundet*, N. Hermansson, H. Wedin, J. Boëthius and M. Ekman. (eds) (Stockholm: Svenska Jägareförbundet, 1987).

The result – the calculation and the early twentieth century distribution of cattle – indicates, however, that the forest community might have been too quick in dubbing browsing pressure as being at an all-time high in Swedish forests. Their view is lacking in historical context and is therefore only applicable to the development of game browsing specifically.

This in turn reflects the influence of changes in forest management practices over time: in 1902 selective logging dominated to a large extent, but in 2012 clear cutting was the preferred harvesting and regeneration method (and had been since the mid-twentieth century). Thus, the overall result of the comparison fits well with the following two statements on grazing forest pasture by livestock made in 1907 and 2011.

The above-mentioned forester Carl Björkbom stated that:

The damage caused by pasturing livestock in the vast forest expanses of Norrland is hard to register except in limited areas. In southern and middle Sweden [equivalent to the southern third of Sweden in this investigation], where the amount of livestock is proportionally higher compared to the acreage and where forest cultivation is more frequently used [regeneration by seeds or plants after clear cutting], the damage caused by pasturing livestock is more easily detected.<sup>46</sup>

The other statement derives from an atlas concerning the development of Swedish agriculture and forestry since 1900, published in 2011, from the section dealing with forest production, i.e. the continuous growth increment of Swedish forests:

The biggest growth increases have come in the southern parts of the country where, at the beginning of the last century, large areas of forest were heavily dominated by forest grazing. Since then these woodland pastures have been successively converted into highly productive forests.<sup>47</sup>

The 2011 atlas does not draw any combined conclusions based on the parallel developments of Swedish agriculture and forestry since 1900. How the conversion of forest pasture into highly productive forests was executed (or enabled) is never explained. This warrants attention, and thus is addressed here.

46. C. Björkbom, *Om skogsbetet*. The quotation on p. 17 read: ‘Den skada, som beteskreaturen göra i Norrland är svår att konstatera annat än på begränsade områden. I södra och mellersta Sverige, där kreaturens antal är proportionsvis större i förhållande till arealen och där skogsodlingar mera allmänt förekomma, är den skada som beteskreaturen göra lättare att påvisa.’

47. G. Kempe, ‘Forest production’ in U. Jansson (ed.) *Agriculture and Forestry in Sweden*, p. 143.

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## CONCLUSIONS

In hindsight, it would be tempting to place the Swedish forest community's concept of modern forestry, supported by the Forestry Act of 1948, in a vacuum created by the gradual exodus of livestock from forests, which more or less ended by the mid-1950s. No one in the forest community could probably have foreseen the explosion in deer numbers, triggered by the successful implementation of modern forestry in all Swedish forests during the second half of the twentieth century, in combination with an increasingly effective game management regime. At the time, the forest community, in all probability, was more or less convinced that grazing forest pasture by livestock was on the brink of obsolescence, of no consequence for the future.

The decades following the livestock exodus from forests signified a most unusual ecological change for Swedish forests, where for the first time there was minimal forage impact from large herbivores. The so-called moose explosion in many ways filled the vacant space left by the livestock exodus, and thus supports such an interpretation of a remarkable, brief ecological state.

It should be noted that agricultural science and market forces created the path for the livestock exodus – not the Swedish forest community, nor the 1933 Fencing Act. The exodus was boosted by commercial milk production and rapid urbanisation during the first half of the twentieth century, which engendered a rising domestic market for dairy produce. As butter was the chief export commodity from Swedish agriculture, this development helped to highlight the importance of high quality fodder all year round; managed pastures and high-yielding cows.

It should also be kept in mind that the so-called moose damage question was initiated at a time when moose and roe deer populations were marginal, compared to recent times, and originated in the only geographical area where clear-cutting followed by regeneration by seed or planted seedlings was more frequently used, well before the concept of modern forestry was introduced. Most importantly, the moose damage debate does not seem to have impacted on the forest community's decisions or resolve to implement modern forestry.

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