

# Analyzing Institutional Successes and Failures: A Millennium of Common Mountain Pastures in Iceland

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## 1. Introduction

Throughout their history, the island economies of the North Atlantic have relied to a large extent on common property resources both in agriculture and in the fisheries.\* It is well established that the sharing of resources need not always lead to a full-scale dissipation of wealth, the *tragedy of the commons*, when certain conditions are met.<sup>1</sup> However, it is also well known that communities often fail to establish institutions for restricting entry to the commons, and, even when they exist, these institutions are often fragile structures, vulnerable to pressures from population growth, technological change and shifts in political power and processes.<sup>2</sup> Therefore, it is of considerable interest to examine the evolution of property rights to natural resources in the North Atlantic communities, such as Iceland, Greenland and the Faroes, and to investigate whether institutions did emerge in these societies that effectively regulated entry and prevented the dissipation of their natural resources. The present study is concerned with the law and economics of Icelandic agriculture, specifically with the institutions that for more than a thousand years have regulated the use of the country's extensive common mountain pastures.

Icelandic agriculture dates back to the rapid settlement of the country in the ninth century A.D.<sup>3</sup> In their ships the settlers brought with them cattle, sheep, horses,

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<sup>1</sup>For instance, see E. Ostrom, *Governing the Commons. The Evolution of Institutions for Collective Action*, Cambridge University Press (1990).

<sup>2</sup>For the problems of contracting for property rights in various environments, see G.D. Libecap, *Contracting for Property Rights*, Cambridge University Press (1989).

<sup>3</sup>Medieval texts say that the settlement of the country was completed in 60 years from about 870 to 930 A.D. See J. Benediktsson, "Landnám og upphaf allsherjarríkis." [The Settlement and the Origins of the Commonwealth.] In S. Lindal (ed.), *Saga Islands I*, Hid íslenska bókmenntafélag (Reykjavik, 1974). For an account in English of the early history of Iceland, see J. Jóhannesson, *A History of the Icelandic Commonwealth*, transl. by H. Bessason, University of Manitoba Press (1974).

goats, pigs, geese, chicken and dogs, and found that the local environment invited the raising of livestock rather than the cultivation of fields. The conditions for grazing were ideal, and, as there were no wild mammals, except the fox, the herds could graze unattended in mountain pastures during the summer months.<sup>4</sup> In Iceland the farmland and home pastures are primarily in locations all around the coast. Rising above the farmland are the mountain pastures, while a third of the country's 103,000 square kilometers is wilderness with no vegetation.<sup>5</sup> The mountain pastures are sometimes continuous green areas but often include cliffs, rocks, sands and wasteland interspersed with vegetation, and, therefore, the grazing animals often must roam far and wide.<sup>6</sup>

The early settlers appear to have claimed land as far as the wilderness of glaciers, sands and lava in the interior, and initially appropriated the mountain pastures that in Icelandic are called *afréttir* (singular *afréttur*). In fact, some mountain pastures always have remained exclusive private property, but generally the ownership of the *afréttir* evolved into communal property. No documentation, however, exists that throws light on how the pastures were divided among the different communities.<sup>7</sup>

In spite of considerable scholarly interest in the question of the commons, the institutional arrangements of the *afréttir* in Iceland have not been studied by economists, as far as we know. It is almost trite to argue that reliance on common property arrangements may end in a tragedy, and Icelandic society certainly had its share of tragedies. Long-term economic decline, probably beginning in the thirteenth century, hit bottom in the eighteenth century, when the Icelanders came close to extinction.<sup>8</sup> Furthermore, at the beginning of the twentieth century the country's green areas are conservatively estimated to be one half of their size at the time of the settlement in the ninth century, and the annual production of vegetation is estimated to be only one third of the ninth century level.<sup>9</sup> Historians have blamed centuries of economic decline on foreign rule, adverse external trade relations, volcanic eruptions, pests and plagues, and cooling climate, but the role of the system of property rights in agriculture has received little attention.<sup>10</sup>

<sup>4</sup>See vol. 3 in T. Thoroddsen, *Lýsing Íslands, Landbúnaður á Íslandi I-II* [A Portrait of Iceland: Icelandic Agriculture I & II] (1919, 1921). Thoroddsen's two volumes are still the best available history of Icelandic agriculture.

<sup>5</sup>*Ibid.*, pp. 1–30.

<sup>6</sup>*Ibid.*, pp. 175–213.

<sup>7</sup>*Ibid.*, p. 184.

<sup>8</sup>The economic history of the country is reflected in the average height of the population: "From the age of the settlement down to the 16th century stature remained more or less constant, or about 172 cm. In the 18th century it fell to 167 cm, and about the middle of the 20th century it rose again to 176.8. In other words in a period lasting 400 years at the outside, or in the course of 16 generations, the mean stature of the population first falls about 5 cm and then rises 10 cm again, a variation of 1 cm a generation on the average." p. 44 in J. Steffensen, "Stature as a Criterion of the Nutritional Level of Viking Age Icelanders," in K. Eldjárn (ed.), *Árbók hins íslenska fornleifafélags, fylgirit* [Yearbook of the Icelandic Archeological Society, Supplement], 1958.

<sup>9</sup>See pp. 32–33 in S. Fridriksson (1986), "Factors Affecting Productivity and Stability of Northern Ecosystems," in Ó. Guðmundsson (ed.), *Grazing Research at Northern Latitudes*, Plenum Publishing, New York.

<sup>10</sup>The drop in temperatures "happened most frequently during the 13th and 14th centuries and during the so-called little ice age in the period between 1600 and 1900." S. Fridriksson, *supra* at note 9, p. 32. "In these periods the average air temperature may have been 1.5 to 2°C lower than it is today in good years, which may have caused a 50% drop in primary production of the grassland compared with the yield as it had been in good years." *Ibid.*, p. 35.

In this paper we limit our attention to the structure and consequences of property rights in the communal mountain pastures. We are concerned with the following questions:

- (1) Why were the *afréttir* used communally and not divided into exclusive plots for each user?
- (2) Was the environment of the Icelandic farm districts likely to encourage collective action, and how were the *afréttir* regulated?
- (3) Are the rules governing *afréttir* an example of a tragic solution to the commons problem rather a first-best or second-best solution?

We proceed in our examination by first briefly introducing certain theoretical concepts before turning to each of the questions above. The theoretical analysis draws on recent work by Ostrom (1990), Field (1986) and others.<sup>11</sup> The empirical part is based on various published documents, such as the old law codes, records of deeds and judgements, regulations from various periods, a computer search of the Icelandic Sagas, studies by historians and by experts on agriculture, climate and vegetation and, finally, personal interviews in Iceland with agriculturalists, natural scientists and historians.

We find (a) that joint utilization of the mountain pastures is economically rational when allowance is made for transaction costs (costs of exclusion and internal governance), (b) that the social and economic environment of Icelandic farm districts was suitable for collective action, and there is evidence, extending back through the entire history of the country, of elaborate rules for preserving the jointly used *afréttir* and (c) that open access problems in the common mountain pastures are not an important explanation of centuries of economic decline in Iceland.

## 2. A Note on Theory

The economics of property rights and, generally, the economics of institutions involve several levels of analysis. A useful initial approach, which I have referred to as the *naïve model*, ignores the supply side and only considers the demand for property rights.<sup>12</sup> The naive approach suggests that institutions that restrict access to a common property resource tend to emerge when there are net aggregate gains to the community from internalizing the external effects that are associated with open access.<sup>13</sup> The theory predicts that, given measurement and enforcement costs (transaction costs), an institutional structure will emerge that maximizes the value of the resource. The theory also suggests that overuse and dissipation of a valuable resource will occur when the costs of measurement and enforcement exceed the potential gains from restricting access.

A complete model of institutions requires that we add a supply side to the naive model and, thereby, introduce issues concerning the provision of property rights. Property rights are the output of political processes (and also of subtle social processes that are not well understood) and depend not only on the distribution of

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<sup>11</sup>See E. Ostrom *supra* at note 1, and B.C. Field, "Induced Changes in Property Rights Institutions," (1986) Research Paper, Department of Agricultural and Resource Economics, University of Massachusetts, Amherst. Also see B.C. Field, "The Evolution of Property Rights," (1989) 42 *Kyklos* 319.

<sup>12</sup>T. Eggertsson, *Economic Behavior and Institutions*, Cambridge University Press (1990), pp. 249–277.

<sup>13</sup>H. Demsetz, "Toward a Theory of Property Rights," (1967) 57 *American Economic Review* 347.

power and on the institutions for collective action in the community of users but, in many instances, also on the interests, choice set and institutions of an external authority. For example, it has been suggested that property rights designed by external authorities, remote from the actual and potential users, are less likely to be efficient in the neoclassical sense than rules set by the users themselves.<sup>14</sup>

In sum, the full model of institutions is based on three constructs:

- the preferences of the relevant individuals,
- their opportunities, and
- the system (and processes) of collective action.

Finally, it should be emphasized that the redistribution of wealth is an important consideration in a full theory of institutional change: New property rights always alter the distribution of wealth, and high transaction costs often render it impractical for those who gain from new institutions to compensate the losers. In many groups unanimity (or near unanimity) is required to alter basic property rights, and, when transaction costs are high, only new institutions that make (almost) no one worse off will be considered.<sup>15</sup>

### 3. The Economic Logic of Afréttir

The mountain pastures in Iceland, the afréttir, are a case of joint utilization of a natural resource. Why is it that a natural resource is sometimes divided among individual owners and users, and sometimes shared by two or more independent economic units? If we ignore for the moment the question of both political processes and redistribution, the structure of ownership is best explained with three types of production functions: the production (or transformation) function of conventional price theory, the exclusion function and the internal governance function.

Let us consider cost minimization in terms of the three production functions and briefly illustrate the relevant relationships with reference to a formal model that is due to Field (1986).<sup>16</sup> The cost of exclusion simply refers to the cost of excluding outsiders from the resource (for instance, the cost of fencing and monitoring borders), and the return on exclusion for the insiders takes the form of greater output per unit of input in regular production. Internal governance cost is the cost of preventing free-riding by the insiders who are prone to overuse the resource and dissipate the rent from it. The return on internal governance is the greater net output that results when overexploitation is prevented.

In other words, to minimize the cost of producing any level of output from the natural resource involves a threefold allocation problem: the allocation of the variable input(s) (a) to regular production, (b) to exclusion and (c) to internal governance. As always, costs are minimized when the marginal return on the variable input is equal in all uses.

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<sup>14</sup>See E. Ostrom *supra* at note 1, and G.D. Libecap *supra* at note 2. The rules governing afréttir in Iceland were not imposed by an external authority; they appear to be homespun, although presumably reflecting foreign models.

<sup>15</sup>See R.D. Roberts *supra* at note 11.

<sup>16</sup>See B.C. Field *supra* at note 11.

Let us assume that the identical  $N$  members (individuals or firms) of a community of potential users of a natural resource, which measures  $R$  physical units, agree to divide  $R$  into whatever number,  $m$ , of equal plots (commons) that will minimize aggregate costs and maximize the community's net wealth. Then the number of insiders on each plot,  $n = N/m$ , can be expressed as a function of governance cost, exclusion cost and a vector representing all other variables, including conventional production costs. In equation (1), a change in  $E$  or  $G$  represents a parametric shift in the exclusion and governance cost curves.<sup>17</sup>

$$n = F(E, G, A) \quad (1)$$

and

$$\frac{\delta n}{\delta E} > 0, \frac{\delta n}{\delta G} < 0.$$

First, note that  $n$ , the degree of exclusivity, depends in part on the regular production function of neoclassical economics. In fact, if there are no exclusion and internal governance costs, then  $n$  (the number of firms jointly using each subdivision of  $R$ ) and  $m$  (the number of commons) are determined solely by the economies of scale in production.<sup>18</sup> Let us assume here that we have constant returns to scale.

If we also assume that the cost of exclusion is a function of the total length of the borders of  $R$ , then it is clear that the total exclusion cost reaches the maximum level when  $R$  is divided into  $N$  units with one firm in each and is at the minimum level when there is only one firm and all  $N$  individuals join together. Let us now consider the implications of shifts in the exclusion function. Other things equal, an upward shift in the cost of exclusion lowers the marginal return on exclusion activities below the marginal returns on the variable input in production and internal governance. In the Field (1986) model, a new equilibrium is established by shortening the borders, which implies that now  $R$  is divided into larger commons and  $n$  is larger than before. Similarly, an innovation that lowers the costs of exclusion (such as low-cost electric fences) moves the solution in the direction of exclusive individual ownership.

Finally, consider the question of internal governance and assume that the cost of preventing any given loss of output from excessive utilization is a direct function of  $n$ , the number of insiders. Again, an upward shift in cost of internal governance lowers the marginal return on the variable input allocated to monitoring excessive use by the insiders, and equality of marginal returns is established by reducing  $n$ , the number of insiders that use each plot.

We are now ready to consider the logic of ownership in the *afréttir* in terms of the costs of exclusion, internal governance and production. The discussion is restricted to the grazing of sheep in the mountain pastures, which has been their most important use. For several reasons exclusion costs for individual plots in the *afréttir* would be high. First, individual plots would have to be large. The vegetation is often scattered, and the herds of each farmer require a relatively large area to feed on during the summer. Furthermore, as the subarctic vegetation of the highlands is sensitive to

<sup>17</sup>Note that we present here only a brief and simplified version of the formal model found in Field (1986) *supra* at note 11.

<sup>18</sup>Note that it is assumed that  $N$ , the total number of firms (or individuals), is a constant.

climatic changes, grazing conditions vary from one year to another, which requires mobile grazing. Second, the cost of monitoring the area would be high. As the flocks did not require protection against wild animals, the monitoring of borders could not be an inexpensive byproduct of shepherding.

Third, in historical Iceland the cost of fencing in the highlands was prohibitive because of the length of the borders, the rugged terrain and the lack of material for fencing.<sup>19</sup> However, nature itself often formed natural enclosures with rivers, lakes, wasteland, mountains and glaciers, but in most cases such natural fences enclosed vast areas, sometimes the highland pastures of several farm districts.<sup>20</sup> Therefore, we conclude that the high exclusion cost in the *afréttir* indicates that  $n$ , the number of insiders in each *afréttur*, should be relatively large, other things equal. However, it should be noted that high exclusion costs in themselves do not rule out that a large *afréttur* with a natural enclosure be privately owned by a rich farmer, the church or even the crown, and the grazing rights sold to a number of independent farmers.

The internal governance of an *afréttur* involves efforts to protect the grazing capacity of the resource by regulating the time of usage and the number of sheep, and by controlling other uses that would reduce the output of vegetation. In the case of joint usage, there is also the internal governance problems of protecting the property right of each farmer in his variable input, the sheep, as the animals mingle in the pastures. In the following section that deals with the regulation of the *afréttir* we argue that, provided the farm districts were capable of collective action, the technical problem of internal governance in the *afréttir* was relatively uncomplicated and the corresponding costs low, which also suggests a large  $n$  and a large number of commoners.

Consider now the production costs of using the *afréttir*. The driving of the sheep into the mountains in summer and back again in the fall, and especially the search for the animals in the vast pastures, are activities that involve positive economies of scale; aggregate costs are lower when the farmers of a district join in these activities, rather than when they are performed in isolation. Further, the joint movement of the flocks of a whole district to and from the *afréttir* would minimize trampling and trespassing on private farmland.

Finally, we note that the relatively low return on fencing in Icelandic agriculture gave rise to various spillover problems that could be handled at a relatively low cost by collective action. For instance, unless some measures were taken, external costs would be imposed on farmers whose unfenced farmland bordered on an *afréttur*, as the animals could easily stray over onto their land. Costly spillover effects could also be expected if some farmers in a district did not drive their sheep into the *afréttir* in

<sup>19</sup>For instance, native wood for fencing was not available. In early Iceland, some sod and stone fences were erected but mostly to protect home fields. The law code *Jónsbók* of 1281 states that farmers who do not fence have no valid claims for compensation when their in-fields are invaded by their neighbors' livestock. It is interesting to note that farmers protested this clause in the Assembly (Althing) when *Jónsbók* was accepted as law and managed to get the clause abolished in 1294 (except they still had to enclose their storages of fodder). See Thoroddsen *supra* at note 4, p. 99 (1919).

<sup>20</sup>A dramatic example of a natural enclosure is the mountain range Breidamerkurfjall in southeastern Iceland. To get there the sheep had to be driven over snowcapped mountains as the *afréttur* is surrounded by glaciers. *Ibid.*, p. 192.

the summer but let their flocks graze on their unfenced home pastures during the summer, as the sheep might invade the fields of their neighbors.

In sum, the theory suggests that the joint use of the mountain pastures (rather than individual plots) is consistent with the minimization of costs, particularly if the farm communities can overcome the problems of collective action and establish effective institutions for internal governance and the control of spillover effects. We now proceed to examine briefly the basic pattern of utilization of the *afréttir* and then, in the following section, turn to a more detailed examination of the institutions that regulated their use.

The Icelandic Sagas, which deal with events in the ninth to the eleventh centuries but were written one to three hundred years after the events they describe, are the earliest sources of information about the organization of sheep raising in Iceland. Sheep raising is also mentioned in passing in the *Sturlunga Sagas*, which contain contemporary accounts of the civil war in the thirteenth century, and in the *Bishop Sagas*, but the most important source are the extensive law codes of the Icelandic Commonwealth (930–1262 A.D.) preserved in two main manuscripts, called *Grágás* (which translates “Gray Goose”).<sup>21</sup>

When they lost their independence in the thirteenth century to Norway (and later to Denmark), the Icelanders received new laws in 1281.<sup>22</sup> The new law code of 1281 was amended in 1294, 1305 and 1314, and is referred to as *Jónsbók*. *Jónsbók* only made modest changes in the laws of *Grágás* relating to the *afréttir* and served, with some amendments, as the legal framework in this area into the twentieth century.<sup>23</sup> The laws of *Jónsbók* regarding the *afréttir* were finally all preempted with special legislation, no. 42/1969.<sup>24</sup>

*Grágás*, the ancient law code of the Commonwealth, refers to the *afréttir* as property jointly owned by two or more individuals and proceeds to enumerate regulations that (in our terminology) relate to exclusion, internal governance and spillover effects.<sup>25</sup> In the Icelandic Sagas fleeting references to the organization of sheep farming confirm that already in the first centuries of Icelandic history the alternative use of home pastures in the winter and mountain pastures in the summer, and the celebrated search of the mountains for the animals in the fall, had become an essential part of the country’s farming practices.<sup>26</sup> The accounts in the Icelandic Sagas, how-

<sup>21</sup>For the definitive editions, see V. Finsen, *Grágás I–III*, Copenhagen (1852, 1879, 1883). The main manuscripts of *Grágás* are called *Konungsbók* (*Codex Regius*) and *Stardarhólsbók*. A copy of the Finsen edition is available from Odense University Press, 1974.

<sup>22</sup>We omit to mention the law code *Járnsíða* that served the Icelanders only from 1271 to 1281.

<sup>23</sup>For the standard edition see Ó. Halldórsson, *Jónsbók*, Odense University Press (1970). It includes the amendments of 1294, 1305 and 1314. For instance, the *Jónsbók* laws of the *afréttir* were modified by the new Law of Local Government (*Sveitarstjórnarlögin*) of May 4, 1872.

<sup>24</sup>Lög um *afréttarmálefni*, fjallskil o.fl. Nr. 42/1969. *Stjórnartíðindi A* (Official Gazette A), 1969, pp. 346–57.

<sup>25</sup>*Grágás supra* at note 21, Vol. I, Part 2, p. 113–22 (1852).

<sup>26</sup>The Icelandic Sagas also refer to the practice of driving the flocks from the mountains to a public fold, where the sheep were distributed to their owners. For instance, see *Svarfjæla saga* in *Íslendinga sögur* [The Icelandic Sagas], Svart á hvítu, Reykjavík (1987), p. 1801. For a computer search of the Sagas for references to sheep farming, I used a special program developed by Örnólfur Thórsson and associates at the University of Iceland.

ever, offer little detail of the exact structure of property rights in the afréttir. Sources from the thirteenth century onward suggest that, over time, many of the afréttir (but not all) had become the communal property of or were managed by one or more local farm communities, called *hreppur* (singular *hreppur*), but no documentation exists that describes the transfer of rights from private individuals to the hreppur.<sup>27</sup>

The hreppur is an ancient organization of self-government for the primary rural community. The origins of hreppur are not known, but they already existed in 1096, when the tithe was introduced in Iceland. *Grágás* requires that all communities have their hreppur, and each hreppur must be a community of at least 20 adjacent farmers in good standing.<sup>28</sup> In *Grágás*, and later in *Jónsbók* of 1281, hreppur are assigned the task of collecting the tithe and maintaining the poor, but the law does not mention that the hreppur oversee the afréttir. However, this is probably an omission because the 1294 and 1305 amendments of *Jónsbók* give the hreppur an active role in regulating the afréttir system, and later court documents confirm that they exercised this authority.<sup>29</sup>

In recent centuries district authorities have published detailed rules governing afréttir in their area. For instance, in 1792 a lengthy regulation was issued for the afréttir in a county of western Iceland, Borgarfjardarsýsla.<sup>30</sup> The *Local Government Legislation* of 1872 required that regulations for afréttir be formally drawn up and published by all districts. These regulations, embodying ancient customs, are found in the *Official Gazette* of the years following.<sup>31</sup>

The evidence shows clearly that the Icelandic afréttir have been used jointly by independent economic units throughout the country's history, but the evidence also shows that the afréttir are not a case of open access; the use of the resource system

<sup>27</sup>Thoroddsen *supra* at note 4, pp. 184–5 (1919). Historians stress that initially the ownership rights of the hreppur over the afréttir were not clear. See p. 30 in L. Björnsson, *Saga sveitarstjórnar á Íslandi I* [The History of Local Government in Iceland], Almenna Bókafélagid, Reykjavík, (1972). Gudmundsson (1981, p. 69) argues that initially the afréttir were owned jointly by the farmers of the local community and managed on their behalf by the overseers of the hreppur. In time this distinction became blurred, and eventually it became common for the hreppur to augment the size of the local afréttir by purchasing additional pastures, for instance, from the church that was a big landowner. G.F. Gudmundsson, *Eignarhald á afréttum og almenninum. Sögulegt yfirlit* [Ownership of Mountain Pastures and Commons. A Historical Survey], Sagnfræðistofnun Háskóla Íslands, Reykjavík (1981).

<sup>28</sup>Björnsson *supra* at note 27, pp. 11–32. The legislative body of the Commonwealth could, in exceptional cases, allow fewer than 20 farmers to form a hreppur. *Grágás supra* at note 21, Vol. I, Part 2, p. 171 (1852). In the Census of 1703, the hreppur numbered about 163, and the country's population was 50,358. The average population of a hreppur was some 309 persons and about 80% of the hreppur had a population of 100 to 500 individuals. During the Commonwealth the number of hreppur is estimated at about 150. Björnsson *supra* at note 27, p. 93, and p. 126.

<sup>29</sup>Björnsson *supra* at note 27, p. 66, and various volumes of J. Sigurdsson et al. (eds.), *Diplomatarium Islandicum: Íslenskt fornbréfasafn I–XVI*, S.L. Möller, Copenhagen & Félagsprentsmidja, Reykjavík (1857–1952).

<sup>30</sup>See vol. VI, pp. 16–27 in *Lovsamling for Island I–XXI* [Laws of Iceland], Copenhagen (1853–1889).

<sup>31</sup>For instance, in the *Official Gazette*, section, B, there is in 1885 a regulation for the afréttir in the hreppur between the rivers Thjórsá and Hvítá in the county Árnessýsla. The regulation constitutes 96 paragraphs and covers 20 pages in the *Gazette* (pp. 93–113). These rules are remarkably similar to the laws of *Grágás* and *Jónsbók*, except that they are more elaborate and also cover new areas.

has been regulated by small communities of farmers. We now turn to an examination of the nature of these regulations.<sup>32</sup>

#### 4. The Regulation of Afréttir

The provision and enforcement of rules for preserving a jointly used resource, such as the afréttir, have the characteristics of a public good, although the resource itself is not a public good.<sup>33</sup> Therefore an explanation of the structure of the property rights in common resources that emerges in alternative situations must be based on a comprehensive theory of collective action that so far is not available. In a major research project, Ostrom (1990) has examined common-pool resource problems in countries throughout the world.<sup>34</sup> She finds that the users of common-pool resources frequently have been successful in overcoming the temptation to free-ride and act opportunistically and have organized themselves to solve the commons problem, but in other instances cooperation has failed and resources have been wasted on a large scale. Ostrom seeks to account for the factors that contribute to a successful resolution of the common-pool problem, and, at the risk of simplifying her complex theoretical framework, it can be said that she considers factors that affect both the demand for institutions and their supply, and associates the emergence of effective institutions with positive net benefits for the individuals involved.

Ostrom's major insights relate to the determinants of the supply side. Several factors are seen to lower the cost of collective action for small communities that rely on common-pool resources. They include:

- (1) a clearly defined and stable set of actual and potential users, and a high visibility of users, implying low monitoring costs;
- (2) low discount rates used by potential appropriators, implying continuity, limited

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<sup>32</sup>It should be noted that many afréttir have always been exclusively owned, for instance, by rich farmers or the church, but often rented to the farmers of the district who used the pastures communally. (Unfortunately, we have no records of the extent and evolution through time of private ownership.) It is not unreasonable to expect that an exchange between the owner and the users of the afréttir is vulnerable to holdups from either side. However, the relationship was apparently governed (at least in some cases) by enforceable long-term (implicit) contracts. For instance, in a legal case from 1584, two farmers in a district in northwestern Iceland sued other farmers of the region for not driving their sheep to the afréttir owned by the two farmers, who thereby lost their revenue from the *lamb toll*. The former users of the afréttir claimed, in turn, that the output of vegetation on the afréttir was unsatisfactory, and they had, therefore, decided to take their sheep elsewhere, to another privately owned mountain pasture where they duly had paid the lamb toll. The justice ruled against the users, as the law requires farmers to continue using their *customary* afréttir. The judgement also refers to a failure by the dissatisfied farmers to find the proper channel for their complaints and have the quality of the afréttir measured by a third party. See vol. II, pp. 50–52 in *Althingisbækur Islands I–XV* [Records of the Icelandic Althing], Reykjavík (1912–1982).

<sup>33</sup>Pasture land, *per se*, is not a public good because the consumption possibilities by one individual depend on the benefits enjoyed by others. For individual users, however, the provision and the enforcement of rules for governing common pastures is a public good.

<sup>34</sup>In her study of common-pool resources (CPRs), Ostrom "focused entirely on small-scale CPRs, where the CPR is itself located within one country and the number of individuals affected varies from 50 to 15,000 persons who are heavily dependent on the CPR for economic returns." Ostrom *supra* at note 1, p. 26.

- alternative opportunities and a high return on investment in reputation, implying low gains from cheating; and
- (3) comparable interests in the resources by the relevant individuals or homogeneity.<sup>35</sup>

In the case of *afréttir* most of the factors that contribute to a satisfactory resolution of the commons problem seem to be present. Both the resource and the potential group of users are clearly defined. The *afréttir* were of critical importance for the farm community, which was extremely stable, as was the technology used until the nineteenth century. Alternative opportunities were few, the farming families had to live with each other for generations, the *afréttir* had no highly valuable use other than as meadows for grazing and all the farmers were involved in similar activities. Finally, potential users were compulsory members of a local governance institution, the *hreppur*, which was fairly autonomous and a flexible instrument for supplying and enforcing rules.

It would be surprising, therefore, to find that the *afréttir* had been unregulated commons with open access. In fact, we find that they have always been regulated by a detailed body of rules, and cooperation among the users has supplied the collective goods of exclusion, internal governance and internalization of spillover effects. Let us consider each of these collective goods in turn.

#### *Exclusion*

The need to restrict entry to the *afréttir* by outsiders was recognized already in the law codes of the Commonwealth (930–1262), and the laws concerning the *afréttir* were replicated with relatively minor changes in *Jónsbók* of 1281 and remained partly in effect into the nineteenth and twentieth centuries. *Grágás* proclaims the exclusive rights of a group of individuals to an *afréttur* and states that outsiders require the permission of all the owners of an *afréttur* before they can use it for grazing. Violations were punishable with a fine.<sup>36</sup> An individual who wanted to trade his grazing rights in an *afréttur* to an outsider had to call for an evaluation of the aggregate grazing capacity of the pastures and the establishment of individual shares. He was then free to use the share (or the stint) himself or to sell it in part or wholly to outsiders.

As both the *afréttir* and the home pastures generally were not fenced, the exclusive rights of farmers with land bordering on an *afréttur* had to be protected from intrusions by the unsupervised grazing herds of the mountain pastures. The law books show a great concern for this issue. They require that the flocks be driven into the

<sup>35</sup>The list is not exhaustive. See Ostrom *supra* at note 1, Chapter 6.

<sup>36</sup>*Grágás supra* at note 21, Vol. I, Part 2, pp. 113–15 (1852). Surviving court documents show that the legal system enforced exclusive rights to the *afréttir*. For instance, a judgement rendered at Hjarðarholt in 1592 concerns the complaint of three *hreppar*, which shared an *afréttur*, that farmers from other *hreppar* had invaded their mountain pastures. The judgement favored the plaintiffs. *Althingisbækur supra* at note 32, vol. II, p. 334.

The rule that an outsider must get permission from all owners of an *afréttur* before he can use it was also enforced. For instance, see a ruling by Thórdur Guðmundsson, justice for southern and eastern Iceland, in a case from 1596 where the plaintiff was the church in Reykholt. In his judgement the justice quotes a paragraph from *Jónsbók* corresponding to the passage from *Grágás* that we mention above. *Althingisbækur*, vol. III, pp. 420–421.

middle of the afréttur (and not left near the borders).<sup>37</sup> Furthermore, the law enumerates various legitimate responses that are open to owners of adjacent land, when flocks of animals from an afréttur invade their property. Also, those who own farmland next to an afréttur have the right to graze their flocks in the afréttur all year long (except for 2 weeks in the summer), presumably as a form of compensation for trespassing.

Sometimes the afréttir of different communities merge and have no natural boundaries. Various customary rules have evolved to cope with problems that arise in such situations; for instance, the problem of handling wayward animals from neighboring afréttir when the sheep are rounded up in the fall.<sup>38</sup> Note also that the virtual absence of fencing made it costly for a farmer to protect his fields and home pastures from the wandering sheep of his neighbors, particularly in the summer. The law demanded, therefore, from *Grágás* onward, that all farmers drive their sheep into the afréttir for the summer or face penalties. Only in exceptional cases, and with the permission of the local authorities, could a farmer be exempted from this rule.

#### *Internal Governance*

The internal governance of the afréttir involves two important issues: the preservation of the grazing capacity of the afréttir from overuse by the insiders, and the protection of exclusive individual property rights to the sheep when flocks belonging to a substantial number of different owners mingle unattended in the mountain pastures. We discuss overgrazing in some detail in the last section of the paper, but at this point we note that the law has been conscious of the problem of overgrazing since *Grágás*. According to *Grágás* and later *Jónsbók*, any insider in an afréttur could call for an independent evaluation of the grazing capacity of the pasture. The criterion for optimal usage of an afréttur appears to predate, with modest success, the marginal revolution in economics: the arbitrators were instructed to find the maximum number of sheep that could use the pastures without affecting the average weight of the flock—“let them find that number, which in their judgement does not give fatter sheep if reduced but also fills the afréttur,” says *Grágás*.<sup>39</sup> Once the maximum number of animals has been determined, each user of the afréttur was given a quota on the basis of the value of his farm. A farmer who exceeded his quota paid for each additional sheep a penalty to his fellow users that was twice the rent to an outsider for using the pasture, according to *Jónsbók*.

The basic method for enforcing the property rights of the individual farmers in their sheep, when the flocks were rounded up in the fall, relied on marks on their

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<sup>37</sup>This requirement is still present in the regulation for Borgarfjardarsýsla from 1792. See footnote 30. Note that the requirement could not be taken literally in the case of vast afréttir that spanned half the way across the country. See Thoroddsen *supra* at note 4, pp. 198–99 (1919).

<sup>38</sup>For instance, in parts of the district Árnessýsla. Thoroddsen, *supra* at note 4, p. 191 (1919). A good example of these customs is found in the regulations for the afréttir of hreppar in Árnessýsla from 1895 that reflect ancient customs. *Stjórnartíðindi B* [The Official Gazette of Iceland, section B], pp. 85–121 (1895).

<sup>39</sup>*Grágás supra* at note 21, vol. I, Part 2, p. 115 (1879) [my translation].

ears.<sup>40</sup> Each owner of sheep was required to mark all the members of his flock in the same way before it was sent to the afréttur. Each ear is given a separate mark, which can give rise to a large number of combinations, and the authorities kept careful records of the marks. Some marks were more special than others; the Crown ear-marked its sheep by cutting off both ears, a dangerous mark in the hands of the unscrupulous, as the possessor of such a mark could steal sheep and easily remark the animals without leaving traces of their former marks.<sup>41</sup>

### *Economies of Scale*

The use of vast, unfenced mountain pastures suggests important economies of scale in driving the animals up to the mountains in early summer and in searching the afréttir and driving the flocks down again in the fall, but to realize these gains collective action is required. Furthermore, as the sheep often have to be driven through private farmland on the way to and from the afréttir, trespassing and trampling is minimized if all users of each afréttur join forces.

*Grágás* and *Jónsbók* required the farmers to drive their flocks to the afréttir in a given week in June and round them up and drive them back before a specific week in September.<sup>42</sup> In 1281, when the law codes of *Jónsbók* were confirmed by the Assembly (Althing), demands were made that each district be allowed to set its own dates on the basis of local circumstances. These demands were met in the Amendments of 1294 and the right to set the dates given to the overseers of the hreppar.<sup>43</sup>

Rounding up the sheep, often in formidable mountain terrain of a vast scale, and driving them back to the farm district can be a major task. In large and rugged afréttir the first search might take a week or ten days, and there were usually at least two sequential search expeditions.<sup>44</sup> The sheep were driven to a fixed place in each district, a public fold, called a *rétt*, and distributed to their owners according to the marks on the ears.

Rounding up the sheep from the afréttir and distributing them to their owners constitute a highly structured activity based on ancient custom, overseen by the management of hreppar and by specially appointed individuals. In the more recent centuries the duties of each sheep owner were spelled out in a special document, the

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<sup>40</sup>Ear marks are mentioned already in *Heidarvígssaga*, which many consider to be the oldest of the Icelandic Sagas, probably written in the early thirteenth century (dealing with events of the tenth century). In the Saga, Styr, the main character is enjoying a meal at the home of a neighbor and is served the head of sheep, a traditional Icelandic dish. "And, as they sit at the table, one of Styr's men takes the head in his hand and remarks how enormously fat the sheep is. Styr turns and looks at the head and says: "This is an astoundingly great head but do others see what I see, there are no marks on the ears?" [my translation]. *Íslendinga sögur supra* at note 22, p. 1344.

<sup>41</sup>Thoroddsen *supra* at note 4, pp. 330–33 (1919).

<sup>42</sup>The law allowed the farmers to leave their animals behind in the afréttir for the winter, but in most cases that was not a practical consideration.

<sup>43</sup>Thoroddsen *supra* at note 4, pp. 205–6 (1919).

<sup>44</sup>Descriptions of the customs and adventures of roundups in the afréttir in all districts of the country, in the late nineteenth and early twentieth century, written by the farmers themselves, are available in five volumes. B. Sigurjónsson (ed.), *Göngur og réttir I–V*, Nordri, Akureyri (1948–1952).

*mountain bill*, which was circulated in the district.<sup>45</sup> Each individual who owned some minimum number of sheep was required to provide one or more persons with supplies, and/or there was a toll to be paid.<sup>46</sup> The arrangements have been compared with military conscription: Each search group was assigned a leader, in the south of the country called *fjallkóngur* (mountain king), who was given authority comparable to the authority of a military officer.<sup>47</sup> Early judgements show that some farmers were not satisfied with their share in the costs of the roundups or even tried to free-ride, but they could be taken to court and fined.

#### 4. *The Afréttir: A Tragedy?*

The history of agriculture in Iceland is a sad story of long-term economic decline extending from the thirteenth century (or earlier) and into the nineteenth century.<sup>48</sup> The decline is correlated with a drastic reduction in the country's vegetation, which, over time, shrank both in terms of area and productivity. A leading Icelandic botanist maintains "that it is very likely that the primary production of Icelandic vegetation during the 15th century had dropped to half of the amount it was around the time of the settlement."<sup>49</sup>

A drastic reduction in plant production was likely to affect the size of the population, which relied heavily on animal products, which in turn were directly related to the output of the natural grassland. Fridriksson (1972) has made a bold attempt to estimate the maximum population that the country's vegetation could support from the time of the settlement until the nineteenth century, when new technology and new industries rescued the population from the Malthusian bind. Fridriksson concludes that at the time of the settlement the surface area of vegetation was sufficient to support about 70,000–80,000 individuals, but the carrying capacity of the land declined with time, and, at the beginning of the 18th century, the usable crop of the pasture and the hay crop could, in an average year, support only about 55,000 individuals.<sup>50</sup> These figures are roughly consistent with the estimated actual population.

There does not exist a direct enumeration of the Icelandic population at the time of the Commonwealth, but estimates based on a count of tax-paying farmers in 1095 and other information usually place it around 70,000–80,000. The first census was

<sup>45</sup>Björnsson *supra* at note 27, pp. 184–188 (1972); Thoroddsen *supra* at note 4, pp. 197–207 (1919).

<sup>46</sup>Some local regulations from the nineteenth century show that the most difficult areas to search were to be given to those representing rich farmers, except where the search required scaling cliffs, which was assigned to the fittest. Thoroddsen *supra* at note 4, p. 201 (1919).

<sup>47</sup>*Ibid.*, p. 201.

<sup>48</sup>*Ibid.*, (1919, 1922).

<sup>49</sup>Fridriksson *supra* at note 9, p. 33. Fridriksson estimates that the annual rate of erosion of fertile land in the last 1000 years has been about 20 square kilometers a year, in total about half of the area of vegetation in the country. In addition, also the average output of the remaining fertile land fell. See pp. 786–7 in S. Fridriksson, "Factors Affecting Productivity and Stability of Northern Ecosystems," (1972) 53 *Ecology* 785.

<sup>50</sup>Fridriksson makes clear that the tenuous relationship between fertile land and population "was subject to periodic distortion due to epidemics, affecting sometimes animals and sometimes men, and in both ways contributing to human depopulation." p. 792 in Fridriksson *supra* at note 49 (1972).

taken in 1703, and then the population numbered 50,358, but a small-pox epidemic in 1707–1709 left the country with only some 34,000 inhabitants.<sup>51</sup> A study by Bishop Hannes Finnsson, published in 1796, which examines the country's annals for evidence of famines, reports isolated years of hardship as early as in the middle of the eleventh century, famines of rising severity in the thirteenth and fourteenth centuries, and further deterioration in the seventeenth century, culminating in the disasters of the eighteenth century when the population was nearly erased.<sup>52</sup>

To what extent is this history of decline caused by the practice of the commons, the sharing of the country's mountain pastures? In the paper's second part we argued that the joint utilization of the mountain pastures in Iceland, an arrangement operating for more than a thousand years, was rational economically if we allow for transaction costs. In the previous section we first considered the decision environment of the farmers in terms of categories suggested by Ostrom (1990) and concluded that the environment was favorable for collective action to emerge. Furthermore, a search of historical data showed that, already in the Age of the Commonwealth, the farming communities had developed conventions and governance structures that should have prevented large-scale dissipation of wealth in the *afréttir*. In sum, our study suggests that the *afréttir* were a relatively efficient resource system and did not represent a case of serious overcrowding and rent dissipation.

In addition to the rules that governed the commons, indirect evidence suggests that, at least in some districts, the limited capacity to feed the sheep in the winter may have eased pressures of excessive summer grazing in the mountain pastures. As late as the first part of the twentieth century, the sheep were not primarily fed on hay in the winter but were left to graze on the farmland, and the hay from the relatively small fields was used as a last resort, when winter grazing became impossible.<sup>53</sup> Only in the twentieth century did new technology, which lowered the cost of cultivating the farmland and making hay, begin to relieve the oppressive constraint of winter grazing.<sup>54</sup>

Why then was there economic decline? We make the case that, once Iceland had been settled in the tenth century, erosion of the vegetation and economic deterioration was the only prospect facing the nation, given the natural environment of the country and the agricultural technology of the times.<sup>55</sup> Erosion of the sensitive veg-

<sup>51</sup>See p. 23 in G. Baldursson, "Population", in V. Kristinsson and J. Nordal (eds.), *Iceland 874–1974*, Central Bank of Iceland (1975).

<sup>52</sup>H. Finnsson, *Mannfaekkun af Hallaerum* [Fall in Population from Famine], Almenna bókafélagid, Reykjavik (1970). Orig. publ. 1796.

<sup>53</sup>Fridriksson (1972) estimates that in the early eighteenth century the country's total hay crop was equal to only 10% of the usable crop from the mountain and home pastures. In the eleventh century the proportion was only 5%, according to Fridriksson (due to a larger output from the pastures and smaller hay fields), p. 792 in Fridriksson *supra* at note 49.

<sup>54</sup>Fridriksson *supra* at note 49, pp. 793–796 (1972).

<sup>55</sup>McGovern et al. (1988) refer to a transported continental agricultural system at the edge of the climatic tolerance limit. p. 228 in T. McGovern et al., "Northern Islands, Human Error, and Environmental Degradation: A View of Social and Ecological Change in the Medieval North Atlantic", (1988) 16 *Human Ecology* 225. Our dire prediction does not allow for the possibility that economic decline could have been averted by a large-scale diversification into fishing (or perhaps other activities) in the Middle Ages.

etation in Iceland is directly related to deforestation, and deforestation was an unavoidable consequence of the only type of agriculture that was practicable in the country at the time. It is estimated that it took about 200–300 years of clearing, grazing, and charcoal-making to reduce drastically the country's extensive areas of scrub birch and willow and to introduce the treeless modern landscape. In this northerly terrain, the destruction of the woodlands released a relentless, long-term (and irreversible at the time) process of erosion of the soil that was accelerated by a cooling climate and frequent volcanic eruptions.<sup>56</sup>

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<sup>56</sup>S. Fridriksson, "Þróun lífríkis Íslands og nýttjar af því" [The Evolution of the Icelandic Ecosystem and its Utilization.] in *Íslensk thjóðmenning I*, F. Jóhannesson (ed.), Thjóðsaga. Reykjavík (1987).