"FOREST USE AND REGULATION AROUND A SWISS ALPINE COMMUNITY (DAVOS, GRAUBUENDEN)"

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Forests were vital in the traditional economy of the Alps, providing wood for fuel and other domestic purposes, agriculture, and construction. The sale of wood also provided an important source of income in many communes into the mid-20th century,[1] Forest use has been regulated in the Swiss Alps by some Communes for at least seven centuries. Cantonal regulation in most mountain cantons began in the first half of the 19th century, and federal regulation began with the passage of the Forest Police Law in 1876. This law, revised in 1902, remains the basis for the management of the forests of the Swiss Alps.[2]

This paper traces the use and regulation of the forests of Davos, in the Canton of Graubünden (Grisons), in eastern Switzerland, concentrating particularly on the 19th and 20th centuries. Like the majority of the communities of the Swiss Alps, Davos has a service economy with vestiges of agriculture. However, tourism in Davos both has a longer history, and has developed to a greater extent, than in most communities. Davos is not typical of Grisons, or the Swiss Alps in general, in a number of other ways. In particular, the current proportion of private ownership - 84 percent - is much higher than the average. Also, past demands on the forests have been especially high because of demands associated with the mining of local metal ores.

EARLY REGULATION; MINING AND AGRICULTURE

Davos' ore deposits have been exploited at least since the 14th century.[3] In 1496, the first *Bannbrief* was issued by the Commune *(Gemeinde)* of Davos. This prohibited or limited certain or all uses in specific areas of forest (*Bannwald)*

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[1] Leibundgut H. (1956) Das Problem des Gebirgshilfe. Schweizerische Zeitschrift fur Forstwesen 107: 297-310.

[2] Price M.F. (1988) Legislation and policy for the forests of the Swiss Alps. Land Use Policy 5: 314-328.

[3] Pfister M. (1978) Davos. Haupt, Bern.

owned by the Commune.[4] Increased demands were placed on the forests in the mid- to late 16th century, when the first recorded major mining boom, mainly for iron, took place. The resulting deforestation may have been the impetus for the first regulations limiting clearing, issued by the Commune in 1595, By 1695, the Commune had stated its responsibility for protecting all private forests and had issued *Bannbriefe* to cover most of the forests above settlements.[5] Yet, as elsewhere in the Alps, such measures had doubtful success, since demands for wood were high and policing was inefficient at limiting either logging or grazing, which limited forest regeneration.[6]

Sales of wood decreased substantially in the 17th century. It is not clear whether this was because communal regulation was having some effect, or because the growing stock had become so depleted that supply was barely more than local demand.[7] During the 17th and 18th centuries, Davos was a wealthy community, dependent on both agriculture and trade. However, by the beginning of the 19th century, the agricultural sector was declining, and much of the traffic on which the community depended had been diverted elsewhere; access was only possible on horseback or foot.[8] At this time, the economy changed again when a new mining boom for lead and zinc started, leading to new demands on the forests. From 1807 onwards, mining companies leased many areas of private forest for a 50-year period and began limited clear-cutting to provide timber both for props, sluices and other mining infrastructure, and also for a zinc smelter, completed in 1816

[4] Günter T.F. (1980) Die Walder der Landschaft Davos. Unpublished Diplomarbeit, Geographisches Institut, Universitat Zürich.

[5] Günter, note 4.

[6] Tromp H. (1980) Hundert Jahre forstliche Planung in der Schweiz. Mitteilungen EAFV, Birmensdorf 56: 253-267.

[7] Günter, note 4.

[8] Bernard P.P. (1978) Rush to the Alps. East European Quarterly/Columbia University Press, New York.

and operating until 1848, when the boom ended.[9] While no data are available for the quantities of wood harvested during this period, logging was effectively unregulated, taking place up to the timberline.[10]

Graubünden's first forestry regulations date back to 1822, when the Canton empowered itself to arbitrate complaints about deforestation. In 1827, the export of wood was prohibited, and the Canton took over competence for harvesting permits from the Communes. The Canton passed its first complete set of forestry regulations in 1839.[11] These, *inter alia,* required each Commune to appoint a bailiff. However, the Davosers refused to do so, regarding the regulations as a great infringement on their rights. They continued to harvest large volumes of timber for sale, and there was little regeneration in the forests. New cantonal forest regulations, passed in 1858, placed all forests under cantonal jurisdiction. In 1861, these regulations were accepted by the Davosers, who appointed a forester and established a communal forestry commission. Yet, eight years later, the forester was fired and the commission disbanded. Severe floods followed the next year, and the wisdom of cantonal regulation was finally accepted by the Davosers in 1873.[12]

CANTONAL AND FEDERAL REGULATION; TOURISM'S EARLY GROWTH

By the 1860s, tourism had begun to develop as an important part of Davos' economy. Tourists first came to the area in the early 19th century, but not in any number until 1858, when a carriage road was completed to Landquart, in the Rhine valley. Most of the first visitors came to improve their

[9] Jorger K. (1984) Davos, kurz und bundig. Buchdruckerei Davos AG, Davos-Platz.

[10] Günter, note 4.

[11] Rageth B. (1983) Die Forstdienstorganisation im Kanton Graubünden. Schweizerische Zeitschrift fur Forstwesen 134: 509-515.

[12] Günter, note 4.

health; Davos became known early as a health resort for people with rheumatism and tuberculosis.[13] The first hotels and sanatoria were built in the 1860s, and there was a construction boom in the 1870s in spite of the European economic depression. The growth of tourism was linked to rapid population growth: between 1870 and 1888, the population increased from 2,002 to 3,891. As a result, demands on the forests for construction timber and fuel increased, particularly after facilities for winter sports began to be developed from 1869.[14]

The importance of forests in the Swiss alpine economy had been noted by Swiss foresters since the early 19th century.[15] A seminal report, published in 1861, pointed out that the forests were critical for ensuring reliable water supplies and minimizing avalanches, rockfall, and floods and, furthermore, that deforestation was an aesthetic concern.[16] Recognition of these values of the forests was presumably instrumental in the Davosers' acceptance of cantonal, and then federal, regulation in the 1870s. Small plantations were developed, and the afforestation of avalanche paths started, in the 1870s and 1880s. In the 1890s, logging permits were only issued to those who respected the regulations and were prepared to reforest logged areas and prevent domestic animals from grazing them.[17] Yet heavy demands on the forests persisted, deriving particularly from another construction and population boom stimulated by the completion of the railroad from

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[13] Bernard, note 8.

[14] Keller P. and U. Kneubühl (1982) Die Entwicklungssteurung in einem Tourismusort. Schlussberiht zum MAB Projekt 4.183. Geographisches Institut, Universitat Bern.

[15] Schuler A. (1984) Sustained-yield forestry and forest functions, as seen by Swiss foresters in the nineteenth century *In* H.K. Steen (ed.) History of sustained-yield forestry, Forest History Society, Durham: 192-201.

[16] Tromp, note 6.

[17] Günter, note 4.

Landquart to Davos in 1890. By 1900, the population had grown to 8,089 and 2,100 beds were available.[18]

Thus, by the early 20th century, the commune's economy was becoming increasingly reliant on tourism. Employment in the agricultural/forestry sector was only slightly higher than that in the service sector. The traditional pattern of land use had been disrupted as land prices rose with demands for construction in the limited area of valley land. Because of the increased demand for milk, intensive dairying took over from cattle-breeding and arable farming, and more trails were built through the forests both to bring milk down from the *Alps* (high pastures) in the summer and for hiking.[19]

THE TWENTIETH CENTURY: TOURISM DOMINANT

Analysis of the implementation and effects of forest management policies until the 1980s is complicated by the predominantly private ownership of Davos' forests. A total of 77 percent of the forest area is owned by private individuals, most of whom have two or three parcels with an average size of 3 ha each. Both in these private parcels and on the 7 percent of the forest area owned by private corporations, no inventories or plans were made, timber was principally cut for personal use, and harvested volumes were not recorded. The remainder of the forests are owned by the Commune. Management plans for these forests, including data on timber reserves and previous harvesting and afforestation, have been prepared since the early years of this century.[20] Yet, while comprehensive information on the use or structure of the forests is lacking, a coherent picture has been reconstructed from forestry and other studies, management plans, and interviews.

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[18] Bernard, note 8.

[19] Keller and Kneubühl, note 14.

[20] Teufen B. (1985) Wirtschaftsplan für die Walder der Landschaft Davos. Kreisforstamt 18 Davos, Davos-Platz; Günter, note 4 .

Until the outbreak of the first World War, tourism continued to grow; 1.1 million people visited in 1913, and 4,100 beds were available in 1915.[21] A primary concern of the Commune and the cantonal forest service was to protect roads, railroads, and settlements from avalanches, rockfall, and floods, The first major reforestation project started in 1903, and others began in 1907, 1909, and 1919; 103 ha were planted. Most were in areas of communal forest, some of which had been privately-owned and bought or expropriated by the Commune. From 1920, the projects combined reforestation with the construction of avalanche or flood control structures, subsidized up to 80 percent by the federal and cantonal governments.[22]

During the inter-war years, tourism remained dominant in the economy although the number of visitors fluctuated greatly. These years were characterized by slow growth, and even decreases, in population, particularly in the 1930s when the unstable international situation led to a severe decline in the demand for tourism.[23] In 1925, the Commune divided the communal and private forests of Davos into three districts, each overseen by a district forester (*Revierförster)*. For the next four decades, private owners felled their own timber, or employed contractors. Winter was the main logging season; the logs were skidded out over the snow by hand or with horses. Until the 1930s, harvested timber was used for construction and fuelwood in roughly equal proportions.[24]

A number of authors have prepared estimates of average yields *(m^3 /ha)* for different periods in this century.[25] While

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[21] Bernard, note 8.

[22] Günter, note 4.

[23] Keller and Kneubühl, note 14.

[24] B. Teufen, Davos-Platz, pers. comm., 1987.

[25] Hefti R. and U. Bühler (1986) Zustand und Gefahrdung der Davoser Waldungen. Schlussbericht zum schweizerischen MAB-programm 23, Bundesamt fur Umweltschutz, Bern; Günter, note 4; Teufen, note 20.

these estimates appear consistent for the area as a whole, it must be recognized that they hide considerable differences in the spatial distribution of harvests, which tended to relate closely to the accessibility of particular stands. From 1932 until 1945, average yields from communal and private forests were approximately the same, and most harvested wood, particularly sawtimber, was sold. Probably only 15 to 25 percent was used directly by the owners of the land on which trees were cut. During the war years, tourism (including accommodation for refugees and the wounded) experienced a resurgence, leading to increased harvests and sales.

With restrictions on the travel of potential foreign guests and the introduction of chemotherapy as a cure for tuberculosis, the demand for tourism declined from 1948 to 1957. During this period, the sanatoria were converted to 'sport-hotels,' and a period of major expansion of both downhill skiing facilities and accommodation began, lasting into the mid-1970s. Nevertheless, the downturn in the economy in the 1950s led to a decrease in the population. From 1957, the annual number of visitors increased until 1973, with a concomitant growth in population. Subsequently, there has been little change in either the population or the annual number of visitors, most of whom - up to three-quarters - come in winter.[26]

From the late 1940s through the 1970s, average yields from communal forests were greater than from private forests, notably because of mandatory harvesting *(Zwangsnutzungen)* in communal forests to remove trees brought down by avalanches and windstorms. From the mid-1960s, overall harvests declined, and the proportion of sales of timber from private forests decreased.[27] These trends can be tied to a group of interacting factors, typical of trends that have taken place

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[26] Keller and Kneubühl, note 14.

[27] Teufen, note 20.

throughout the Alps,[28] The rapid expansion of the skiing industry meant that local people became less interested in forestry, as opportunities for winter jobs increased. Such jobs allowed forest-owning farmers to work on the ski hills during the day and still look after their cattle at night. As agriculture became more intensive, fewer poles were needed for fences, gates, and roofs, so that there was less thinning of the forest. The demand for fuelwood also decreased with the availability of oil as a competitive heating source; although lower-quality wood was increasingly sold for industrial uses when a profit could be made. However, since the early 1960s, wood prices have changed little while labor costs have increased sharply, so that it became uneconomic for private owners to employ contractors to work in their forests.[29] For the same reason, the Commune employed only two part-time district foresters from 1965 to 1971 and only one from 1971 to 1980. They were increasingly unable to fulfil their responsibilities, particularly as they had no logging equipment. Finally, as the main logging season changed from winter to summer, the lack of adequate road access in the forests became increasingly critical.[30]

FALL 1979 AND ITS AFTERMATH

In 1979, an early wet snowfall brought down approximately 120,000 trees in the Davos valley. This event rapidly led to public awareness that all was not well in the Davos' forests. In order to remove the fallen timber, much of which was of high quality, the Commune decided to employ two district foresters in 1980, and the cantonal forest service began an

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[28] Price M.F. (1987) Tourism and forestry in the Swiss Alps: parasitism or symbiosis? Mountain Research and Development 7: 1-12.

[29] Affolter E. (1985) Zunehmende Zwangsnutzungen: Holzmarkt und Holzverwendung aus der Sicht der Waldwirtschaft. Schweizerische Zeitschrift fur Forstwesen 136: 805-818.

[30] Günter, note 4; Teufen, note 20.

inventory of the forests.[31] This, and a subsequent study,[32] found that the forest was dominated by trees which had began their growth around the turn of the century, when enforced regulation of harvesting and grazing allowed a high proportion of trees to survive than previously. While thinning continued, until the middle of this century, new trees could still become established. However, the lower levels of use since the 1950s, particularly in the private forests, had led to increased competition for light and nutrients from older trees, shrubs, and high grasses, thus decreasing establishment and survival. Even where they had become successfully established, many young trees had been damaged by physical processes or browsing or debarking by game animals.

Based on the inventory, a stability analysis of the forests was undertaken.[33] This characterized 43 percent of the forest area as stable. These stands were primarily those which had a wide range of age classes, resulting from long-term intensive use, and thus were more common in the communal forests. A total of 34 percent of the forest area was characterized as moderately stable, with problems of regeneration. At timberline, this resulted mainly from browsing and climatic factors; lack of light was the critical factor in closed stands. The trees of these stands had slow growth rates and were highly susceptible to disease. In these stands, as in the moderately and very unstable stands of the remainder of the forest area, thinning was the primary activity required to improve stability. In some places, reforestation and protection from browsing were also required. To regain stability for the forests as a whole, a sustained annual yield of 14,000 m^3 was required: almost three times the average harvest between 1972 and 1982.

With these data in hand, the regional forester, supported by the head of the local tourist bureau, began a program to

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[31] Teufen, note 20.

[32] Hefti and Bühler, note 25.

[33] Teufen, note 20.

promote public awareness of the importance of Davos' forests for the community's future,[34] The program stressed that the harvesting and maintenance of the forests could not be driven mainly by short-term economic motives; a point brought home by the 1979 snowfall. This program led to a major change in the attitude of local citizens to the forests, encapsulated in a forest order (*Waldordnung)* passed in 1984.[35] This stated that all forests within the communal boundaries, both private and public, should be managed according to a single plan by three full-time district foresters.

Operations included in the 1984 order include the removal of timber which is not removed or given away by forest owners; reforestation, forest maintenance, and protection against game animals on behalf of forest owners and communal reforestation projects; clearing along hiking trails in collaboration with the local tourist bureau; and assistance in the construction and maintenance of trails and structures for protection from landslides and avalanches. In 1985, the Commune voted to underwrite the costs of both these activities and the construction of forestry roads to provide access to private and public forests,[36] according to the management plan completed in the same year.[37] The plan's purpose is to improve the long-term stability of all of the area's forests, both by dealing with the backlog of activities resulting from low harvests in recent decades and by encouraging regeneration.

Strong communal support for forestry is further shown by the reservation of winter jobs for forestry employees in the

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[34] Teufen B. and J. Hess (1985) Davoser Wald - Wohin des Wegs? Kreisforstamt 18 Davos, Davos-Platz.

[35] Abstimmungsvorlagen zur Landschaftsabstimmung vom 25. März 1984: Landschaftsgesetz über die Organisation der Waldbewirtschaftung in der Landschaft Davos.

[36] Abstimmungsvorlagen zur Landschaftsabstimmung vom 9. Juni 1985: Landschaftsgesetz über öffentliche Werke und Beiträge an private Erschliessungen.

[37] Teufen, note 20.

skiing industry or the tourist bureau. Yet, while such guaranteed employment is vital to ensure efficient, high-quality forestry over the long term, seasonal workers from the Italian Tyrol still comprise half of the forestry workforce.[38] In addition, there have been problems in the essential activities involved in expanding the forestry access network. First, road construction and use can conflict with hiking; up to one million people hike on the dense network of trails each year. The trails are maintained by the employees of the tourist bureau, who number almost as many as the forestry workforce. Forestry activities are planned to minimize audible and visual impacts on hikers, even when this increases costs. At the same time, the tourist bureau is trying to educate hikers about the importance of forestry.[39]

A second group of problems relates to the construction of new roads across private land. The negotiation of the necessary contracts is a very time-consuming process, particularly because almost any new road will cross the land of many private owners. These preliminary negotiations can be further stretched out when private owners initially refuse to allow new roads to be built across their land. However, this problem has so far been minor, and can be solved by expropriation in the public interest, although this takes an additional two years.

Notwithstanding these problems, access has been increased sufficiently to allow harvests from 1985 to 1989 to approach the level defined in the 1985 management plan. It should be noted that much of the initial harvesting was to remove trees damaged in 1979, rather than concentrating on the unstable areas designated for high-priority action in the plan. In 1990, while the intended yield was again almost achieved, nearly all of the harvest was to remove trees damaged in a severe windstorm in February 1990.[40]

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[38] D. Bezzola, pers. comm., Davos-Platz, 1990.

[39] J. Gerber, pers. comm., Davos-Platz, 1987.

[40] Bezzola, note 38.

FORESTS AS A PUBLIC GOOD

In summary, the 1984 and 1985 regulations show public recognition that all of Davos' forests should be managed for the benefit of the entire community, with the public interest taking priority over private rights. Most local citizens now regard forestry activities less as a means for providing a short-term source of income and raw materials than as an investment in the long-term ability of their forests to provide both protective and recreational functions. Government subsidies are no longer relied on to ensure these long-term functions.

The 1985 management plan is the first to consider the area as a whole, emphasizing not only harvesting, but also maintenance to provide a greater diversity of both stand and age structure. Yet, in 1979 as in 1870, a natural disaster which caused considerable property damage was the stimulus to communal decisions for wise management of the forests. The results of the 1990 windstorm again underlined the instability of much of the forest area. It is to be hoped that the citizens of Davos, which is now the largest tourist resort in the Swiss Alps and an international commercial and conference center, will continue to be understand the need for, and support forest management. In a narrow, steep-sided alpine valley only accessible over passes prone to avalanches and rockfall, the forests are vital not only as part of the alpine landscape, but also for the protection of Davos and the transportation infrastructure on which it depends.