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Assessing the Economic Situation of Small-Scale Farm Forestry in Mountain Regions: A Case Study in Austria

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Austria is one of the few countries with a long tradition of monitoring the economic performance of forest holdings. The national Farm Accountancy Data Network also addresses some forestry-specific issues, given the high significance of farm forestry in this country. However, it is not possible to assess the profitability of small-scale farm forestry in mountainous regions based on a representative sample. In this paper, we demonstrate how information gaps can be overcome by means of economic modeling and present results of this approach for mountain forestry for the first time. In spite of the unfavorable conditions of an alpine setting, forestry tends to be of special significance for the viability and resilience of family farms in these regions. Sustainable forest management that safeguards the ecosystem services provided by forests relies mostly on the profitability of timber production. Thus, the economic development of farm forestry is a key factor in achieving targets 15.1 and 15.4 of the United Nations Sustainable Development Goals in mountain regions.

Keywords: *Forest accountancy data network; Farm Accountancy Data Network; small-scale farm forestry; mountain forestry; sustainable forest management; family farming; ratio analysis; value chain analysis; Sustainable Development Goals; Agenda 2030.*

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Introduction

Forests are considered to play a significant role in sustainable mountain development (Price and Butt 2000). Austria is a mountainous and highly developed central European country with a landscape dominated by the Alps and by forests. Forests cover almost half (47.6%) of the total area of the country, and this percentage is rising steadily (BMLFUW 2015). Although there is a long-term trend toward larger holdings, small-scale family farming still predominates, with family labor accounting for 82.9% of the workforce employed in agriculture and forestry (BMLFUW 2016a). While the significance of the primary sector is steadily declining in terms of value-added production (1.4% of the total economy in 2014), it is highly relevant to the management of the landscape and the provision of ecosystem services. The viability and resilience of small private farms are thus key issues in rural development.

Most Austrian family farms manage both agricultural area and forests. However, in the context of this paper, the notion of farm forestry includes all privately owned forest managed by the proprietor's family, irrespective of any agricultural property or activities. Slightly more than half of Austria's forest area (50.2%) belongs to private holdings with less than 200 ha of forest. Holdings of less than 50 ha account for 32.8% of the forest area and 85.8% of the number of holdings (BMLFUW 2015). A challenge for extension services dealing with private small-scale forestry is the mobilization of timber resources. Whereas holdings larger than 500 ha show a utilization rate of 105.6% of the increment (the annual production of timber due to tree growth), the utilization rate for holdings below 200 ha amounted to only 73.7% of the increment (BFW 2016). Demographic and economic developments increase the danger of abandonment and threaten the sustainability of ecosystem services in ecological, social, and economic terms (Hogl et al 2005; Živojinović et al 2015). Hence, United Nations (UN) Sustainable Development Goal 15, targets 15.1 and 15.4, which list forest area as a proportion of total land area and the conservation of mountain ecosystems' capacity to provide benefits, are goals in forestry in Austria, especially in less-favored, mountainous areas.

Although Austria produces an "overproportional contribution to both 'mountain' and 'alpine' research per

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capita" (Körner 2009: 100), investigations into the economic situation of farm forestry in mountainous regions are scarce. Within a farm forestry accountancy data network, accountancy and often additional data of individual enterprises in a sector (eg farms) are collected and analyzed annually. Thus, these networks have been proposed as a means for investigating the socioeconomic situation and monitoring the economic performance of small-scale family enterprises (Niskanen and Sekot 2001). Austria is one of the few European countries with a long tradition of such monitoring (Hyttinen et al 1997). Forestry-specific information is sampled by 2 accountancy data networks, the Farm Accountancy Data Network (FADN) and the Small-Scale Forestry Network (SSFN). Consequently, there is a substantial data pool on small-scale farm forestry available for secondary analysis (Sekot 2000, 2001).

However, it is not possible to assess the profitability of small-scale farm forestry in mountainous regions based on a representative sample. The concept of small-scale mountain farm forestry is itself ambiguous. Small-scale forestry in Austria is usually associated with an upper limit of 200 ha. The European Union classified mountain areas as "less favored" in terms of economic development, characterized by a "considerable limitation of the possibilities for using the land and an appreciable increase in the cost of working it" (EC 1999: article 18). However, this is not an operational definition that can be used to categorize small-scale forestry farms as mountainous or nonmountainous, so classifications must be based on surrogates such as production regions (AWI 2016).

This paper reports on an exercise that derived information on the economics of mountain farm forestry by using economic modeling to interpret multiple datasets, some with larger samples and some with smaller samples but more detailed information about them. We believe this technique can be used in other contexts as well to generate new information and overcome crucial gaps in existing knowledge. Our results are presented here for the first time.

Material

The preconditions for investigating farm forestry in Austria are quite favorable because there is a long tradition in using accountancy data networks to monitor the economic performance of farms, including pure forest holdings. In addition, several official statistics, like the Agricultural Census and the National Forest Inventory, deliver related datasets regularly. The FADN and the SSFN have existed for decades. In principle, this is a great advantage for analyzing small-scale forestry, in which harvesting practices are often highly volatile (Schwarzbauer et al 2012). Significant results rely on averages derived from long time series. However, the related datasets are not consistent in terms of data content or availability for the periods under investigation. Consequently, our analyses were limited to data that were readily available and sufficiently consistent, as described in the following sections.

Agricultural Census and National Forest Inventory

The Agricultural Census, carried out every 10 years, is a key source of information about the structure of agriculture and forestry in Austria, including details about ownership, land use, labor, and livestock. The latest census referred to the fiscal year 2010 and gathered information from 173,317 farms (ÖSTAT 2013). The National Forest Inventory collects information about the state and development of Austrian forests. The last inventory took place in the period 2007–2009. It provides information on tree species, annual increment, and growing stock (inventory of the standing timber given in m^3) (BFW 2016).

Farm Accountancy Data Network

Within the European Union, national FADNs serve as instruments for "evaluating the income of agricultural holdings and the impacts of the Common Agricultural Policy" (EC 2016). The Austrian FADN uses quota sampling, and its data can thus be considered representative of Austria as a whole. The sample frame includes 97,700 farms, which make up 61.9% of all farms, 58.7% of all agricultural and forestry enterprises, and 76.3% of the total standard output (standardized monetary farm output per year) (BMLFUW 2016a: 258). Almost every farm in the sample (93.3%) owns some forest land. In view of the great significance of farm forestry in Austria, the sampling frame exceeds European requirements and encompasses all agricultural and forestry holdings with a standard output of € 8,000–350,000 (€ 1 ≈ US$ 1.1) and a maximum of 200 ha of forest land (Hyttinen and Kallio 1998). The Austrian FADN also includes forestry-specific extensions, with the main features being forest area, volume of timber harvest, forestry revenues, and family working days devoted to forestry. However, it does not provide a comprehensive delimitation of inputs or costs, so that the profitability of forestry cannot be assessed. Our analysis of FADN data is based on yearly reports for 1995–2014 (LBG 1996–2015) describing a sufficiently consistent dataset that includes farm-level averages for a range of standard categories.

Small-Scale Forestry Network

The SSFN is a forestry-specific purposive subsample of the FADN with data on the forestry-related costs and revenues of farms managing between 5 and 200 ha of forest land (Hyttinen and Kallio 1998). The SSFN encompasses about 110 sampling units, which are

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definitely biased towards bigger forest holdings, so that it cannot deliver representative results for small-scale forestry (Sekot 2001; Toscani and Sekot 2015). In spite of its statistical limitations, the network is a valuable source of information with results that have at least an indicative character, especially regarding trends over time. SSFN data encompass fiscal years 1991 to 2015 in electronic form and thus cover about a quarter of a production period, which is on average about 100 years in Austrian forestry. The results presented herein were computed from the primary data stored at the University of Natural Resources and Life Sciences, Vienna, with the basic data being collected and provided by LBG Österreich GmbH and not publicly available (LBG 1992–2016). Due to the high volatility of harvesting activities in small-scale farm forestry, results have to be interpreted prudently, as they may reflect unusual circumstances, such as salvage felling or responses to high timber prices (Schwarzbauer et al 2012). In the long run, however, capacity limits have to be considered in terms of sustainable timber production. Regional levels of sustainable yield can be derived from the National Forest Inventory and are consistently available from 2001 onward (Sekot 2011).

Methods

Information at farm and regional level from different datasets was used to assess the production conditions and economic situation of mountain forestry in Austria. This paper presents data from the FADN, SSFN, Agricultural Census, and National Forest Inventory, as well as models proposed by Toscani and Sekot (2015) that estimate figures describing the economic situation of the forestry branch of each farm within the FADN, as shown in Figure 1. Regions were differentiated based on the "main agricultural production area" (MAPA) categories established by the Austrian federal agricultural agency (AWI 2016).

In the FADN, data from 2183 individual farms were available for primary analysis for fiscal year 2014. The FADN does not specify whether individual enterprises and their forests are mountainous. However, it does provide related information regarding the farms' MAPA, an assignment of the territorial unit according to the nomenclature of territorial units for statistics (NUTS: EUROSTAT 2016b), elevation in meters above sea level, category of elevation, and the "mountain farm score," a ranking system for evaluating the production conditions as dependent on a mountainous setting (Tamme et al 2002). As each farm within the FADN is assigned an individual weight reflecting the properties of quota-sampling, it is possible to compute representative results for a broad range of aggregates.

In the SSFN, 2772 master balance sheets from 198 different farms document the fiscal years 1991–2015. For this analysis, results were computed in terms of averages per farm, per hectare of forest land, and per cubic meter of harvest. Whereas the yearly averages of ratios represent weighted results, averages across any specific period were calculated as arithmetic means of these yearly figures. From fiscal year 2012 onward, the income from forestry for the enterprises of the FADN can be estimated using specific models. The delimitation of inputs between forestry and agriculture can be achieved by applying simple ratios or linear dependencies derived from the SSFN to forestry-specific information available for each sampled farm in the FADN (Toscani and Sekot 2015). The respective models were updated and applied to all 2183 units of the FADN for the fiscal year 2014, so that forestry income could be estimated for each farm, and various aggregates (such as mountain versus nonmountain farms) could be computed. Average forest area per farm, and the relation to the average farm size for the whole of Austria and per MAPA were derived from 2010 Agricultural Census data. Information about the distribution of tree species, growing stock, and annual increment was derived from the National Forest Inventory, where the latest data available are for 2007–2009.

Monetary values are given in this article in euros (€ 1 = US$ 1.1095; EUROSTAT 2016a), deflated to 2015 values based on the national consumer price index (ÖSTAT 2016c). In view of the limited availability of primary data, the statistical quality of the networks, and the exploratory nature of the investigation, data analysis was limited to a descriptive approach, and no statistical tests were applied. The indicative results are provided in terms of average ratios, reflecting various combinations of the original data.

Results

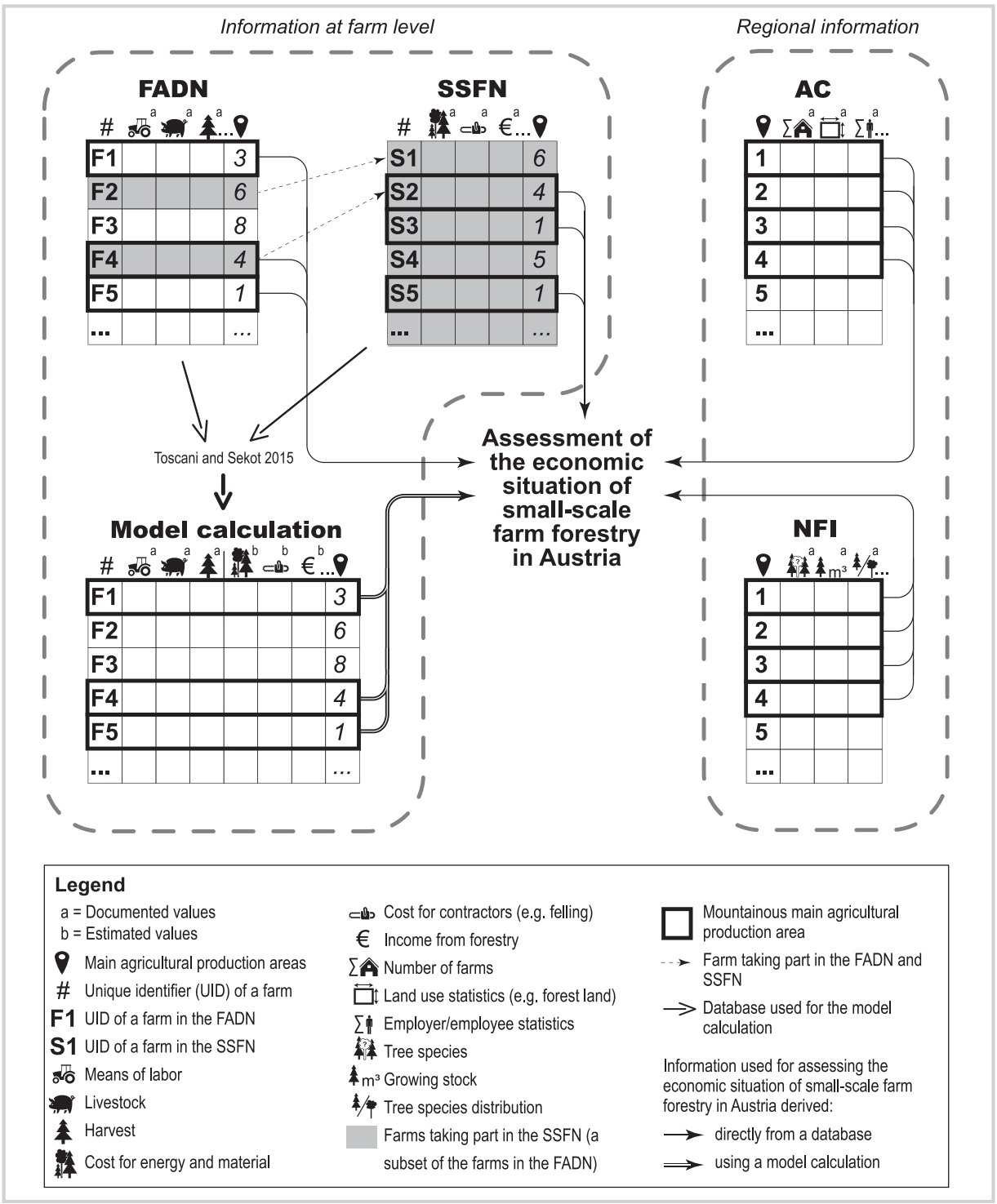
General information on forestry in mountainous regions of Austria

Of the 8 MAPA in Austria (Figure 2), 4—the High Alps, Northern Alps, Southeastern Alps, and Northern Highlands—are mountainous, and the first 3 are also part of the Alpine region. This analysis focuses on those 4 MAPAs.

Results derived from the Agricultural Census indicate the extent to which regional characteristics differ from each other and from the Austrian average (Table 1). In the Alpine regions (the High, Northern, and Southeastern Alps), the average total forest area per holding and forest area percentage of holdings clearly exceed the Austrian average. The share of forest holdings also indicates a higher significance of forestry in the Alps. Conversely, all 3 indicators are below average in the fourth mountain MAPA, the Northern Highlands. The greatest discrepancy is in forest area per holding, which is an expression of a different ownership structure in the Northern Highlands.

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FIGURE 1 Relation between the databases used in the study.



The data from the National Forest Inventory provide specific characteristics of small-scale forests (< 200 ha) at the regional level (Table 2). In the High Alps, the low share of commercial forests and thus higher share of protection forests underpin the significance of protective forest functions. The conditions of high elevation are also reflected by the share of coniferous species and the low productivity (in terms of both current annual increment

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FIGURE 2 Austria's main agricultural production areas.

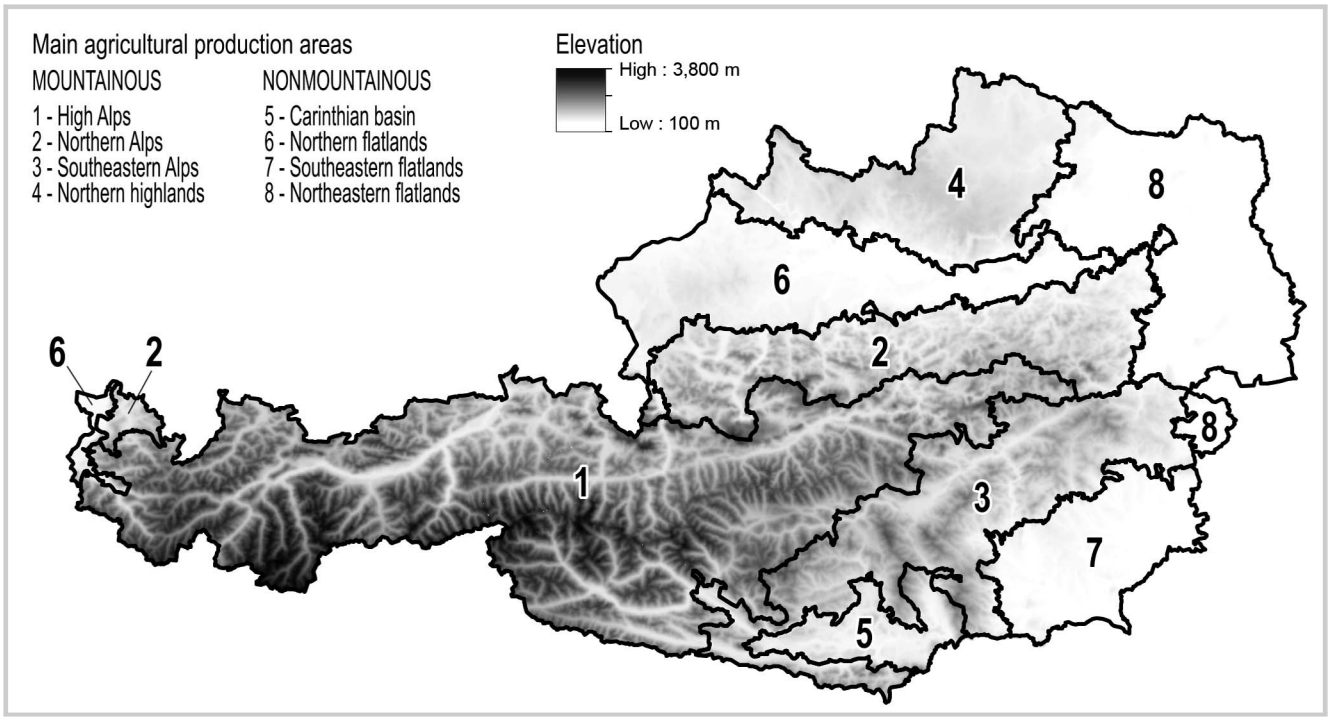


TABLE 1 Characteristics of agricultural holdings—averages for mountain regions and for Austria as a whole, 2010.

	High Alps	Northern Alps	Southeastern Alps	Northern Highlands	Austria as a whole
Cultivated area per holding (ha)	55.5	56.0	40.0	26.6	36.3
Forest area per holding (ha)	36.0	41.7	28.0	11.6	19.7
Forest area, % of total cultivated area	64.8	74.5	70.0	43.4	54.2
Forest holdings, % of total holdings	29.6	33.4	48.6	26.6	26.9

Source: Agricultural Census 2010 (ÖSTAT 2016b).

TABLE 2 Characteristics of small-scale (< 200 ha) forestry—averages for mountain regions and for Austria as a whole from recent published data.

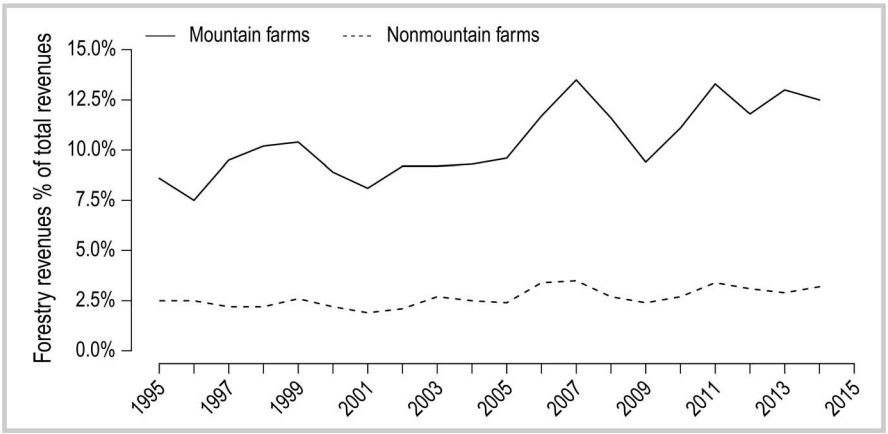
	High Alps	Northern Alps	Southeastern Alps	Northern Highlands	Austria as a whole
Commercial forest, % of total forest area	74.1	94.2	93.9	98.3	89.0
Elevation of forest land (m above sea level)[a)]	1301	805	997	637	932
Coniferous species, % of total forest area	85.3	60.5	83.2	78.5	72.2
Trees in age classes > 100 years old, % of total forest area	28.1	18.7	12.8	11.4	16.9
Growing stock (over bark, m^3/ha)	260	329	338	363	315
Current annual increment (over bark, m^3/ha)	6.7	8.5	10.1	11.8	9.0
Annual allowable cut (under bark, m^3/ha)	5.39	5.61	6.54	7.05	6.11

Sources: Sekot (2011); National Forest Inventory 2007/2009 (BFW 2016); EEA (2017); Geoland (2017).

[a)] Calculation is based on European Environment Agency (EEA) forest land classifications (EEA 2017) and a digital terrain model for Austria with a resolution of 50 × 50 m (Geoland 2017).

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FIGURE 3 Forestry revenue's share of total revenue for mountain and nonmountain farms in all MAPAs, 1995–2014. (Data source: LBG 1996–2015)



and annual allowable cut); the latter in turn explains the share of trees more than 100 years old as an indication of rotation period. The Northern Alps are characterized by a higher relevance of broadleaved species. The data for the Northern Highlands indicate comparatively favorable conditions for timber production, which is also indicated by the below-average mean elevation of forest land, high annual increment, and above-average growing stock.

Specific potentials of the FADN

During the last 20 years, the significance of forest revenues for farms with less than 200 ha of forest land has increased considerably (Figure 3) within the FADN. The share of forestry revenues increased slightly for FADN farms as a whole (from 2.5% in 1995 to 3.2% in 2014); it was higher, and underwent a greater increase, on farms classified as mountainous (from 8.6% in 1995 to 12.5% in 2014). Table 3 compares forestry's role in farming across Austria. Mountain farms and mountainous regions (High Alps, Northern Alps, Southeastern Alps, and Northern Highlands) have forestry revenues—and shares of forest area in total land holdings—that are well above average. Especially in the High Alps, labor productivity in forestry exceeds that in agriculture by far—where the results for mountain farms are obviously driven by the Alpine regions, where most of these farms are situated.

Small-scale farm forestry in mountain areas as characterized by the SSFN

The SSFN data show a substantial long-term increase in harvesting intensity in mountainous production regions (Figure 4). The amount of harvested timber required for financing forestry-related cash requirements (the so-called "cash point") has doubled as well (from 0.89 m^3/ha in 1991 to 2.24 m^3/ha in 2015). In-house consumption remained more or less stable in the same period, averaging 0.77 m^3/ha. The increase in harvests is likely to be driven by economic requirements, but also the high level of sanitary fellings required after calamities, especially in the last decade. Calculations made for this study based on SSFN data indicate that, on average during the last 15 years, timber harvesting in the Alpine regions (High Alps, Northern Alps, and Southeastern Alps) has exceeded sustainable levels (as indicated by regional quotas) by

TABLE 3 Significance of forestry at the farm level in the different mountain regions, for mountain versus nonmountain farms, and for Austria as a whole, 1995–2014 (average values).

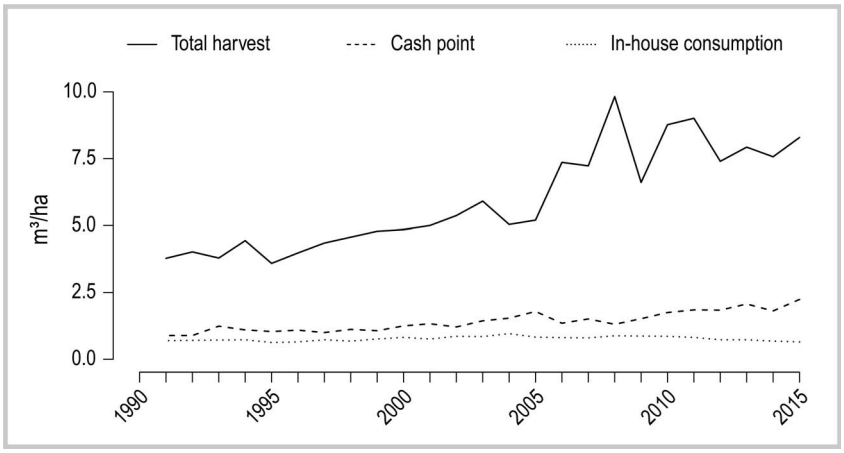
	High Alps	Northern Alps	Southeastern Alps	Northern Highlands	Mountain farms	Nonmountain farms	Austria as a whole
Forest area, % of total cultivated area	36.0	48.4	51.8	26.0	40.5	16.9	30.8
% of family labor devoted to forestry	7.0	11.2	11.6	9.4	9.3	5.6	7.5
Forestry revenues, % of total revenues	10.8	10.5	14.7	5.5	10.4	2.7	5.9
Agriculture/forestry ratio 1[a)]	17.1	8.3	10.3	3.4	9.5	3.5	6.5
Agriculture/forestry ratio 2[a)]	0.4	0.8	0.5	1.4	0.6	1.8	1.0
Agriculture/forestry ratio 3[a)]	0.3	0.5	0.4	1.1	0.5	1.4	0.8

Source: LBG (1996–2015).

[a)] Agriculture/forestry ratios: 1 = input of family labor per hectare; 2 = return per unit of family labor, including subsidies; 3 = return per unit of family labor, not including subsidies.

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FIGURE 4 Time line of selected key figures in mountainous production regions (the High Alps, Northern Alps, Southeastern Alps, and Northern Highlands), 1991–2015. (Data source: LBG 1992–2016)

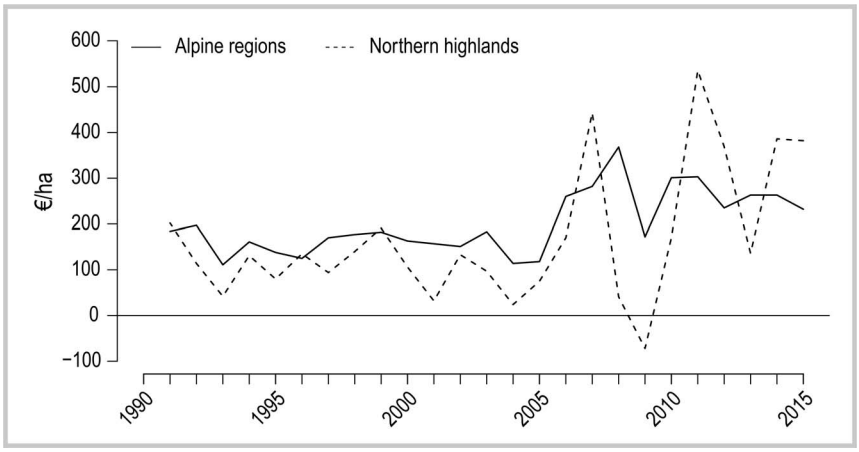


15.0%. The excess ranged from 7.6% in the High Alps to 144.0% in the Northern Highlands. In addition to indicating unsustainable harvest levels, these findings also support the assertion made earlier of a bias in the SSFN sample toward farms heavily engaged in forestry.

The recent volatility of cash flows (Figure 5) reflects the combined effects of variations in harvest levels and changes in timber prices and cash outlays. Table 4 summarizes the averages for ratios characterizing the production conditions and compares results for the mountain MAPAs with those for the SSFN average. Alpine areas are characterized by bigger but less productive units. The smaller units in the Northern Highlands are more productive but also more devoted to fulfilling in-house consumption needs. This corresponds to the high share of fuelwood of total harvest. In the Northern Alps, the share of fuelwood is influenced by the significant share of broadleaved species, which are more often used as fuelwood in Austria.

Selected main economic ratios per hectare of forest are presented in Figure 6. "Cash flow" is substantially less than family income, which also includes the estimated value of in-house consumption of timber and does not take into account the cash outlay for the owner's social insurance. The average income for SSFN families exceeds the average cash flow by 34%. The significance of in-house consumption in terms of the difference between family income and cash flow is characteristic for the Northern Highlands. Family income, payroll costs, and taxes together make up the value added at the level of the individual farm/forest holding. In the SSFN, this value is on average 7% higher than family income. Value added at the sector level is the sum of value added from forest holdings, contractors, and forest nurseries and exceeds value added at the holding level by another 7%. These numbers are of interest for value chain and sector analysis and can be assessed on the basis of recorded costs for contractors and forest plants on the one hand and assumptions regarding turnover ratio and cost structures of providers on the other (Sekot 2007).

FIGURE 5 Cash flows, for 1991–2015, in 2 selected MAPAs, in 2015 values. The negative cash flow in the Northern Highlands in 2009 shows that less money was earned than spent in forestry due to a lower level of harvest. (Data source: LBG 1992–2016)



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TABLE 4 Ratios characterizing the production conditions of small-scale farm forestry (< 200 ha)—averages for mountain regions and for the whole sample, 1991–2015.

	High Alps	Northern Alps	Southeastern Alps	Northern Highlands	SSFN average
Forest area per holding (ha)	60.0	72.2	61.0	12.8	47.1
Harvest (m^3/ha)	4.7	5.3	6.7	8.7	6.0
Broadleaved wood, % of total harvest	4.6	29.8	5.5	7.6	7.7
Fuelwood, % of total harvest	18.0	33.8	15.4	42.1	19.8
In-house consumption, % of total harvest	14.2	10.4	11.2	33.7	13.9
Sale revenue, % of total revenue	82.8	87.3	87.6	70.7	84.9
Cash point, % of harvest	27.6	23.5	23.7	29.8	24.6
Productivity of family timber-harvesting labor (m^3/h)	0.8	0.5	0.8	0.4	0.7

Family income from mountain forestry

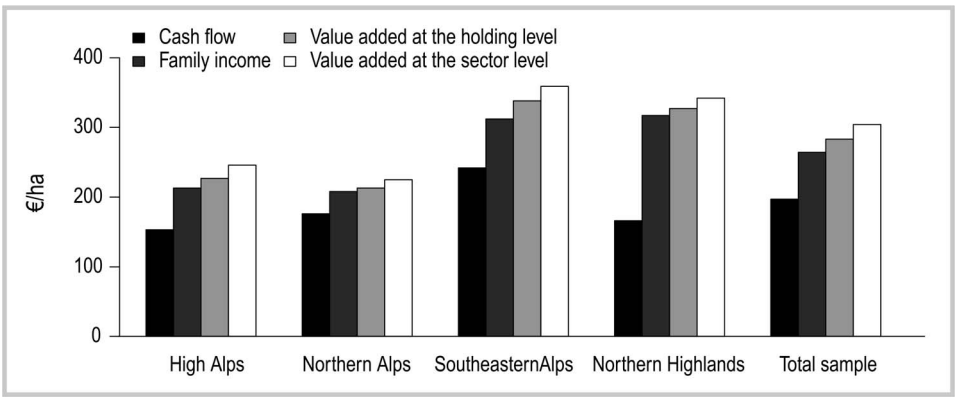
Documentation of family income from mountain forestry is scarce in the databases consulted for this study. The SSFN contains detailed information on a small sample, while the FADN has a larger sample but less detailed information. To overcome this problem, a model calculation (Toscani and Sekot 2015) can be used to estimate the missing elements of full cost accounting for farm forestry. Combining the estimated values from this model calculation with farm-level information makes it possible to calculate key figures for various regional aggregates such as the MAPAs. Farm-level income from forestry is the most important information that can be derived from this exercise; the results of our modeling exercise are presented in Table 5. It is possible to derive results in a similar way for any aggregates of categories—for example, the mountainous and nonmountainous production regions.

Discussion and conclusions

The 2 Austrian accountancy networks on small-scale farm forestry continuously augment an important pool of economic data (Sekot 2006). Sufficiently consistent time series of 20 or more years document developments. Hardly any other European country has more favorable conditions for assessing the economics of small-scale farm forestry on the basis of existing datasets (Hyttinen et al 1997; FVA 2010). Only Baden-Württemberg in Germany has a similar accountancy network specific to small-scale farm forestry that allows a comparative analysis of mountainous regions (Sekot 2000; FVA 2017). The published data from the Austrian networks used in this study are suitable for secondary analysis only, and the SSFN sample is not suitable for either statistical inferences or parametric tests. Any interpretations of differences between categories remains speculative and can at best mark the starting point for more in-depth analysis. Sound international comparisons, too, require prudence and expert knowledge (Sekot et al 2011).

Provided the original farm-level data are accessible, there is a considerable potential for more specific investigations using classifications based on farm characteristics to define and delimit aggregates. For instance, reference could be made to the subunits of the

FIGURE 6 Average regional economic ratios, 1991–2015, in 2015 values. "Value added at holding level" is the sum of family income, payroll costs, and taxes. "Value added at the sector level" is the sum of value added from forest holdings, contractors, and forest nurseries. (Data source: LBG 1992–2016)



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TABLE 5 Average family income from forestry in selected categories, derived from modeling at the farm level and compared to national averages, 2014.

	Amount as a percent of the national average				
	Forest farms[a)]	Mountain farms[b)]	Northern Highlands farms	Farms in Styria[c)]	Farms at 500–1000 m elevation[d)]
Income per cubic meter of harvest	103.8	108.5	90.9	110.0	105.7
Income per hour of family labor	145.9	120.0	61.5	141.5	114.9
Income per hectare of forest	85.2	104.4	119.4	108.9	109.4

Source: LBG (1996–2015).

[a)] "Forest farms" is 1 of 6 farm categories used in the Austrian FADN.

[b)] Farms associated with "mountain farm scores."

[c)] Styria is 1 of 9 provinces of Austria with a high share of mountain farms. Selection is based on the nomenclature of territorial units for statistics (NUTS) level 2, where the province of Styria is defined by the code AT22.

[d)] This is a tentatively defined category to illustrate the potential for the context-specific delimitation of aggregates based on farm characteristics that are recorded on a continuous scale.

MAPAs. At present, 87 such subunits exist, which are in turn municipalities (ÖSTAT 2016a). Of these, 44 are in the 3 alpine regions, and another 6 are in the Northern Highlands, so that there are 50 subregions in mountain areas, which would allow more specific analyses.

Recent developments considerably improved the value of the Austrian accountancy data networks for economic analysis. Since 2012, it has been possible to estimate profitability of forestry for a range of representative aggregates based on the FADN. Regarding the SSFN, calculating a cash point and estimating value-added production are innovative extensions of standard reporting. The computation of value added is straightforward at the level of the individual holding, due to the availability of recorded information, but at the sector level, it requires some assumptions. For mountain research, it would be interesting to derive regional figures as well. However, this would necessitate additional information on leakages and multiplier effects (Klemperer 2003), which is not yet available in Austria.

Mountain forestry is often believed to be less profitable than forestry in pre-alpine regions (Sekot 2000). However, our analysis found an increase in the significance of small-scale farm forestry in mountain areas, for example, an upward trend in the share of forestry revenues in 1995–2014 (Figure 3). Especially in alpine regions, forestry appears to be an attractive alternative for engaging family labor with well above average family income from forestry (Table 5). The Northern Highlands are economically distinct from the Alps, but the 3 Alpine regions also differ considerably. Differences between regional averages underpin general hypotheses of forestry in Austria, for example, that where more forest area is available, the share of in-house consumption of total harvest is less.

Although forest resources are often considered a green bank account for family farms, their significance for farm resilience has not yet been investigated in detail. Research on farm resilience has barely hinted at the role of forestry (Darnhofer 2010; Darnhofer et al 2016). In consideration of the goal of viable rural communities and development in mountainous areas, the ongoing decline in profitability of mountain farms, the trend toward natural and artificial reforestation of alpine pastures, and the income-earning potential of forest management using family labor, more research is needed. The 2 Austrian monitoring systems from which data were used in this study provide information on small-scale farm forestry only. Hardly any information is available yet on the increasing share of so-called "new" forest owners who are not running a farm themselves but just inherited or bought the property (Hogl et al 2005). This is a knowledge gap of increasing significance that should be addressed in regional analyses.

Sustainable forest management is seen as an essential component for reaching UN Sustainable Development Goal 15, targets 15.1 and 15.4, by counteracting the trend toward abandonment driven by demographic and economic developments in mountain regions. The Forestry Act and the Mountain Forests Protocol of the Alpine Convention are the 2 main pillars of the legal framework guiding forest policy in Austria. The Forest Strategy 2020+ aims to design policies for sustainable forest management that reconcile the multiplicity of interests and demands for forest resources and services (BMLFUW 2016b). The time frames for strategic goals (2020) and visions (2030) are attuned to the UN Sustainable Development Goals.

Our results highlight the increasing significance of forestry to the viability of small farms in disadvantaged, mountainous regions of Austria, as stated by Sinabell (2016). In-depth knowledge of economic conditions on mountain farms and their lines of business (differentiation between agriculture and forestry) is needed to support decision-making at the farm and regional levels. The Austrian example can serve as a reference for investigating the economics of small-scale farm forestry and their contribution to sustainable mountain development. Whereas establishing a farm forestry accountancy network will not be feasible in many cases, an extension of the

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FADN to include the total farm economy could provide valuable insight into the role of family farming for regional development. Results of secondary data analyses like those presented here may well contribute to improving the theoretical framework and thus help improve the design of efficient primary investigations.

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