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Protected area management bodies are increasingly required to address economic development alongside the original goal of conservation. This is especially true for United Nations Educational, Scientific and Cultural Organization (UNESCO) biosphere reserves, which are expected to function as models for sustainable development. Economic development has been achieved in many places through nature-based tourism. Sale of products labeled as coming from protected areas is considered promising in this respect too, especially in Europe, but their economic impact has not been assessed so far. This study estimated the gross added value generated by labeled products from the UNESCO Biosphere Reserve Entlebuch—a rural, mountainous region in Switzerland. After a management-guided phase of building up credibility, identity, and innovations, labeled products generated a remarkable gross added value of US$ 5.8 million in 2014, 13 years after the product label was introduced. This corresponds to 4% of the jobs in agriculture and forestry and 1% of all jobs in the region. Given potential synergies with biodiversity, tourism, individual well-being, and other assets, labeled products can be true advantages for protected areas and their managers.

Keywords: *Forestry; agriculture; labeled products; regional economy; added value; UNESCO; biosphere reserve; Switzerland.*

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Introduction

Besides preserving biodiversity, protected areas are increasingly recognized for generating economic benefits to the people in or near them (Borrini-Feyerabend et al 2013). Protected areas have generated considerable economic impacts: tourism in national parks worldwide has been estimated to yield an economic impact of US$ 600 billion per year (Balmford et al 2015). Generating economic development to sustain local livelihoods is a widely shared goal among protected areas (Dudley et al 2013)—especially for United Nations Educational, Scientific and Cultural Organization (UNESCO) biosphere reserves, which have been assigned the role of model regions for sustainable development (UNESCO 2015). UNESCO's current action plan (UNESCO 2016) calls for biosphere reserve management to promote sustainable-economy initiatives inside the reserves.

Data on the impact of biosphere reserves on regional economies are scarce, focused on European countries, and limited to the effects of tourism. Tourism generates a yearly added value of € 5–204 million (US$ 7–275 million) in 6 German biosphere reserves (Job et al 2013) and US$ 4.3–6 million in 2 Swiss biosphere reserves (Knaus and Backhaus 2014). In a biosphere reserve in Mexico, whale watching generates a turnover of roughly US$ 3 million per year (Brenner et al 2016). Other studies have investigated potential alternative land uses and their economic profitabilities (eg Mehta and Leuschner 1997), but without estimating their possible economic impacts in the regions concerned.

Conceptual approaches to more thoroughly estimating the impacts of protected areas on regional economies exist (Mayer and Job 2014), but comprehensive analyses are lacking. This can be explained by the absence of regional economic statistics, the inaccessibility of economic data on private enterprises, the effort required to conduct comprehensive surveys with consumers or enterprises, and the range of biosphere reserves' economic consequences. Existing studies have therefore mostly focused on economic aspects that are easier to assess, primarily tourism (Mayer and Job 2014).

Besides tourism, which is a popular option in all types of protected areas, the development of alternative food networks represents an approach to stimulating the regional economy (Marsden et al 2000). These offer

FIGURE 1 Map of the BRE. (Map by F. Knaus. © ETH Zürich and UNESCO Biosphäre Entlebuch; Data and print permission © Swisstopo [JD100042 and JA100120])
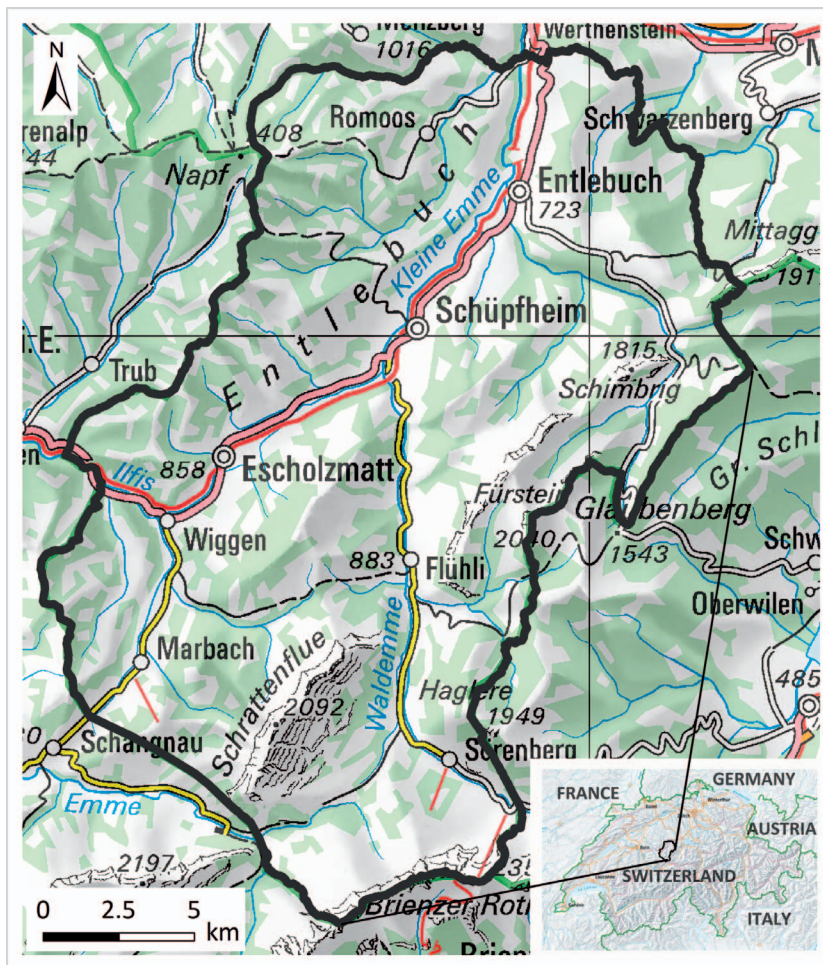
alternatives to industrial food production, distribution, and consumption, creating a more direct link and greater trust between producer and consumer. Developing such networks includes establishing new products, sales channels, and marketing structures (Marsden et al 2000). These networks are considered important and innovative approaches to promoting sustainable local added-value chains in rural regions (Knickel and Renting 2002; Renting et al 2003). Such an approach can be implemented in biosphere reserves by certifying local products with a label that guarantees their regional origin, sustainability of production, or both (Knickel and Renting 2002; Boesch et al 2008). It is especially suitable for biosphere reserves in mountainous areas, many of which have poorly developed economies with a strong agricultural component and may therefore profit from diversification (FAO 2011). Labeling of products within such an approach can be understood as a form of payment for ecosystem services (Ghazoul et al 2009).

Few studies have analyzed the impact of labeled goods on regional economies. In a partial exception, Kraus et al (2014) showed that the label of the Rhön Biosphere Reserve in Germany helped strengthen selected local added-value chains. However, this study did not indicate the regional monetary effects of all labeled products and therefore could not depict the importance of the labeled products in relation to the wider regional economy. Hence, it is not clear how much potential products from a protected area have to stimulate a regional economy.

To help fill this gap, a study was carried out in the Biosphere Reserve Entlebuch (BRE) in Switzerland (Figure 1 and Box 1) to estimate the crucial elements of such an assessment:

1. The added value created through the raw material extraction branches, forestry and agriculture, and related manufacturing branches from the BRE;
2. The added value created through BRE-labeled products in these branches; and
3. The resulting impact of the BRE-labeled products on the regional economy.

Box 1: The UNESCO BRE

The BRE, established in 2001, represents alpine peatlands and karst mountain systems in the world network of biosphere reserves. It is located in the canton of Lucerne, Switzerland, and covers 396 km² of mostly prealpine and alpine mountain chains, forests, meadows, and small settlements (Figure 2). It is home to 17,000 inhabitants and 6000 jobs and is considered one of the most rural parts of Switzerland. About 34% of the workforce is employed in production of raw material (first sector, dominated by agriculture and forestry), 26% in small and midsize manufacturing enterprises (second sector, with important shares in dairy and wood product enterprises), and 40% in the services (third) sector (Lustat 2014), a distribution in which the third sector has a smaller portion than in the rest of Switzerland (BfS 2016c). The BRE, which promotes sustainable development in the region, has an interdisciplinary management team of 12 people. The yearly budget is US$ 2.8 million.

More information is available at www.biosphaere.ch.

The study differentiates between extraction of raw material (first sector) and manufacturing (second sector) to illustrate the varying impacts labeled products have on the different business types in these sectors. The third sector (services) is not considered, because it is only marginally affected by labeled products.

Methods

We used statistical data from the national and cantonal levels to estimate turnovers and intermediate inputs and complemented these with data obtained from interviews, statistical databases, and other studies. In cases of missing data, we made logically derived assumptions that are explained. Based on the gathered data, we calculated regional added value for agriculture- and forestry-related products and BRE-labeled products to estimate the impact of the labeled products on these branches in the region.

Gross added value

As an indicator for the size of the regional economic branches, we used added value, a measure of the appreciation in value of goods obtained through a production process that involves personnel, infrastructure, and intermediate inputs, which is used for salary payments and distribution of earnings (eg dividends). As in most studies, we worked with the gross added value (GAV), which differs from net added value in that it does not consider depreciation. We included government subsidies, because they are triggered by the production activities and are highly relevant for the branches covered by this study, representing about 30% of the total turnover in agriculture in 2015 (BLW 2016).

To calculate the GAV for the region, we first estimated the total gross turnover of all enterprises (including farms). Subtracting value-added tax (VAT) from gross turnover yielded total net turnover. Intermediate inputs were deducted from and subsidies added to that value, yielding the direct GAV. (Investments are usually also subtracted, but because we did not have detailed information about them, they were not considered in this calculation.)

Direct GAV, however, does not provide the full picture related to the economic impact of labeled products. Intermediate inputs originating inside the region, and salaries from jobs inside the region that are also spent in the region, can lead to additional demand for local goods, which can further increase the GAV induced by labeled products. To take these effects into account, we used multipliers developed in earlier studies (described later) to arrive at total GAV both for labeled products and for the considered branches overall.

Direct GAV, first sector

The direct GAV for first-sector agriculture and forestry enterprises was calculated using the turnover for all such enterprises in the canton of Lucerne as estimated by the National Statistical Office (BfS 2014). This number was adapted to the BRE perimeter by multiplying it by 0.18 for farms and by 0.13 for forestry enterprises, reflecting the percentage of these enterprises' full-time jobs that lay within the BRE (Portmann [Lustat], personal communication). Forestry enterprise structures in the canton of Lucerne are comparable inside and outside the BRE, but farms within the mountainous BRE yield on average a 30% lower income than those outside it (Lustat 2014). The turnover for farms was hence reduced by 30% in our calculations.

From these results, the VAT (2.5% for agricultural goods and 8% for forestry products) was subtracted, yielding net turnover. From that amount, intermediate inputs were deducted and farming subsidies were added. Intermediate inputs were set at 60% of the net turnover for agriculture and 45% of the net turnover for forestry, based on general statistical data for Switzerland (BfS 2014). Farming subsidies, which are not included in this data, were obtained from the Federal Office for Agriculture (Morand, personal communication) and the Department of Agriculture and Forestry of the canton of Lucerne (Stadelmann, personal communication). Total net turnover minus intermediate inputs plus subsidies yielded the direct GAV for agriculture and forestry.

FIGURE 2   Schüpfheim, the main settlement of the UNESCO BRE, with the first alpine chains in the background. (Photo courtesy of and © UNESCO Biosphäre Entlebuch)

Direct GAV, second sector

For second-sector agricultural enterprises (such as butchers and dairies), GAV was assessed in the following ways:

- For meat production, total turnover in butcher shops estimated by Vogel (2010) was used. These data were older than our other data, which came from 2014, so the numbers were adjusted based on the change from 2009 to 2014 in animal numbers on farms (−3.5%) and purchasing power parity (−3%) (BfS 2016a, 2016b).
- Data for dairy production within the BRE were obtained for 2014 from Treuhandstelle Milch (Streit, personal communication). The total turnover was calculated using standard consumer prices for each product category (BLW 2014) and then reduced by 30% to reflect that a major part of the production is not directly sold to consumers but to cheese retailers paying lower prices (Hofstetter, personal communication).
- Turnover of additional products originating in small enterprises (eg pasta and tea) was assessed in interviews with 2 enterprise managers. Agricultural products from individual farms (eg marmalade and syrup) technically

belong to the second sector but were contained in the first-sector data (BfS 2014) and thus were not considered again.

For forestry-related second-sector products, interviews were conducted with staff from 3 forestry enterprises (out of 3), 3 sawmills (out of 15), and 3 carpentry workshops (out of 25). The number of interviewees was limited by the strong reluctance or inability of most enterprises to disclose their financial data. Interviewees were asked to provide data on total turnover, intermediate inputs (regional and nonregional), share of products produced with the BRE label, and distribution channels. Based on information from the forestry enterprises, the share of wood processed inside the BRE could be defined. To calculate wood chip-related turnover, a standard price (WVS 2014) was multiplied by the share of the regional cut wood volume (Felder, personal communication) used for chips. For the turnover in sawmills (first level in the second sector), the information on the share of intraregional intermediate inputs relative to the sawmills' total turnovers were used to scale up the known regional log inputs to the total regional turnover (Figure 3). For carpentry (second level in the second sector), the share of

FIGURE 3   Calculation of wood-related turnovers based on data obtained from interviews.
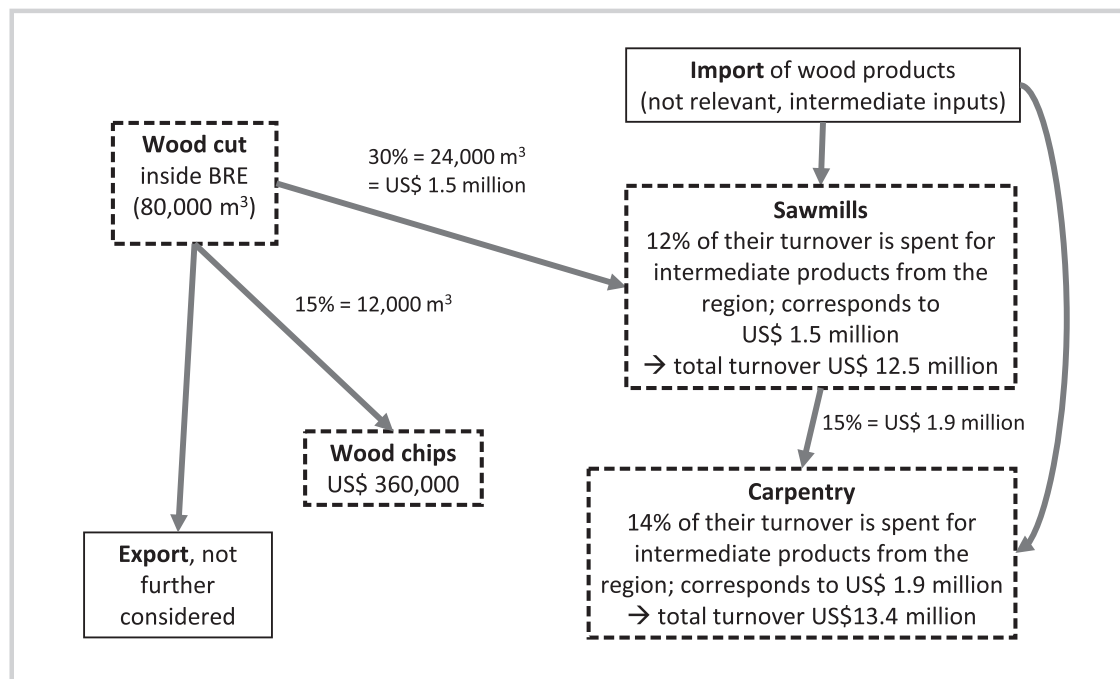
intraregional intermediate inputs relative to the workshops' turnovers were used to extrapolate the intraregional sales of sawmills to the total regional turnover for carpentry (Figure 3). The 3 components were added to reach the full turnover in the second sector for forestry products. From this, the intraregional intermediate inputs of carpentries were deduced to avoid double count of turnovers within the second sector.

From the gross turnovers, VAT (2.5% for agricultural goods and 8% for forestry products) was subtracted to produce net turnover. Intermediate inputs for agricultural products (65% of the net turnover; BfS 2014) were deducted from the net turnover. Intermediate inputs for forestry products were set at 61% of the net turnover (Rigling and Schaffer 2015). It can be assumed that these shares vary between regions, but more precise information could not be obtained. We did not use data from interviews, because only a few interviewees were able to provide precise data. Part of the intermediate input originates within the region, especially raw materials such as milk, meat, and logs. We assumed that all inputs from inside the region were covered by the calculations for the first sector, so we subtracted the full percentages (65% and 61%) from the calculations for the second sector. Because there are substantial subsidies in the dairy sector, the subsidies were added for this industry (Streit [Treuhandstelle Milch], personal communication) to produce the direct GAV for the second sector.

Direct GAV, BRE-labeled products

The total turnover generated through BRE-labeled agricultural and forestry products was estimated based on data from interviews with farmers and staff of enterprises. The results were extrapolated to the full sample of producers based on data from and expert estimations by the head of the distribution center, Biosphäre Markt (see Box 2), and the staff member responsible for labeled products at BRE. These 2 interviewees had the best overview of the sales volumes of labeled products in general. From the gross turnover, the VATs of 2.5% and 8% were subtracted. Intermediate inputs for the manufacture of labeled and nonlabeled regional agricultural and forestry products were taken from the regulations governing the labeled products (Markenkommission Echt Entlebuch 2014), which require at least 80% of the resources and two thirds of the added value to originate in the region. So far, usually more than 80% of the resources originate in the region (Steffen, personal communication). Hence, the intermediate inputs, were split into nonregional (20%) and regional (45% for agriculture and 41% for forestry products) resulting in total intermediate inputs identical to those for the manufactured products presented earlier. The regional shares were classified as gross first-sector turnover of BRE-labeled products. From this, the VAT and then the intermediate input of 60% or 45% of the net turnover were deducted to obtain the first-sector GAV induced by the labeled products.

FIGURE 4   A selection of labeled products sold in supermarket chains in Switzerland. (Photo courtesy of and © UNESCO Biosphäre Entlebuch and Coop Schweiz)

Calculation of total GAV

To calculate total GAV, a multiplier was applied to the direct GAV that represented both regional intermediate inputs and employment effects for the first sector. For agriculture, Flury et al (2007) suggested a multiplier of 1.4 for rural areas like the BRE with a small number of second-sector enterprises. For forestry, a multiplier of 1.5 has been suggested for the entire Swiss industry (first and second sectors) (EBP 2014). Because timber-related businesses in the BRE are producing rather basic products, the multiplier was reduced to 1.4.

For second-sector enterprises, the multiplier was defined so that it only accounted for added value created by employment effects and intermediate inputs inside the BRE that did not originate in farming and forestry enterprises. Given that these intermediate inputs are

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Box 2: Protected area product label *Echt Entlebuch*

The BRE introduced the product label *Echt Entlebuch* (genuine Entlebuch) in 2001. To qualify for the label, unprocessed goods (eg milk) need to originate by 80% from within the BRE. For processed goods (eg sausages), this applies to both main and side ingredients. In addition, two thirds of the added value created by the product must be generated in the region.

Within 14 years, the brand *Echt Entlebuch* was used by more than 300 labeled products manufactured by more than 60 producers, including cheeses, cold cuts, marmalades, pasta, biscuits, strawberry wine, and wooden doors (Figure 4). Since 2013, the company Biosphäre Markt has advertised, sold, and distributed most of the labeled products. The owners of this company are the producers of the labeled products and the BRE. As a result of this professionalization, a growing number and volume of products are distributed within bigger supermarket chains in Switzerland (Biosphäre Markt 2014).

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expected to be quite low for the BRE, this multiplier was confined to the employment effects. Multipliers for second-sector employment effects are not available in the literature. In tourism-related GAV studies, a typical corresponding multiplier is 1.31 (Knaus and Backhaus 2014). Given that this multiplier includes more service (third sector) enterprises, which yield an approximately 10% higher GAV per job (Regiosuisse 2011), a multiplier of 1.25 was defined for the second-sector branches related to farming and forestry.

Impact of the BRE-labeled products on the regional economy

To estimate the impact of labeled agriculture and forestry products on the regional economy, total first- and second-sector regional GAV was determined and compared to the GAV generated by the labeled products. As a second approach, the number of workplaces created by the sale of labeled products was estimated, based on data on average GAV per job. Because most labeled products are produced in the second sector, the average GAV per job was set at US$ 87,500 (Regiosuisse 2011).

Results

Total regional GAV from agriculture and forestry

For agriculture, the total gross turnover for the canton of Lucerne was estimated at US$ 976.5 million, with US$ 123.0 million produced inside the BRE. (All results are indicated in US dollars, which are treated as equal to Swiss francs; the exchange rate was 1.00 to 1.01 on 31 December 2014, according to the currency-exchange website www. xe.com.) For forestry, the total gross turnover was estimated at US$ 37.6 million for Lucerne, with US$ 4.9 million obtained inside the BRE. These figures translate into a total first-sector GAV of US$ 131.2 million for agriculture and US$ 5.0 million for forestry in the BRE, taking into account regional intermediate inputs and salary effects (Table 1).

For agriculture-related manufacturing, the gross turnover in meat production amounted to US$ 21.4 million, in dairy products amounted to US$ 33.1 million, and in all other products amounted to US$ 2.2 million for a total of US$ 56.7 million. For forestry products, 15% of the total cut logs are transformed into wood chips and 30% are processed in sawmills in the region. The rest is exported out of the region without further processing. Wood chip production creates a gross turnover of US$ 360,000; for sawmills, it amounts to US$ 12.5 million; and for carpentry workshops, it amounts to US$ 13.4 million. Because 15% of the turnover in carpentries stems from sawmills inside the BRE (Figure 3), this share (US$ 1.9 million) was subtracted from the carpentry turnover to avoid double count of turnovers within this sector. For forestry products, the gross turnover added up to US$ 24.4 million. These figures translate into a total second-

TABLE 1   Direct and total GAV for agriculture and forestry inside the BRE (US$ millions).

Sector	Calculations	Agriculture	Forestry
First	Total gross turnover	123.0	4.9
	− VAT	3.1	0.4
	Total net turnover	*119.9*	*4.5*
	− Intermediate inputs	71.9	2.0
	+ Subsidies	45.7	1.1
	Direct GAV	*93.7*	*3.6*
	Total GAV (direct GAV × 1.4)	**131.2**	**5.0**
Second	Total gross turnover	56.7	24.4
	− VAT	1.4	2.0
	Total net turnover	*55.3*	*22.4*
	− Intermediate inputs	35.9	13.7
	+ Subsidies	5.3	0
	Direct GAV	*24.7*	*8.7*
	Total GAV (direct GAV × 1.25)	**30.9**	**10.9**
Total	**Total GAV**	**162.1**	**15.9**

TABLE 2   Direct and total GAV of BRE-labeled agricultural and forestry products (US$ millions).

Sector	Calculations	Agriculture	Forestry
First	Total gross turnover	1.9	4.2
	− VAT	0.1	0.3
	Total net turnover	*1.8*	*3.9*
	− Intermediate inputs	1.1	1.8
	Direct GAV	*0.7*	*2.1*
	Total GAV (direct GAV × 1.4)	**1.0**	**2.9**
Second	Total gross turnover	4.2	0.22
	− VAT	0.1	0.02
	Total net turnover	*4.1*	*0.2*
	− Intermediate inputs	2.7	0.1
	Direct GAV	*1.4*	*0.1*
	Total GAV (direct GAV × 1.25)	**1.8**	**0.1**
Total	**Total GAV**	**2.8**	**3.0**

sector GAV of US$ 30.9 million for agriculture and US$ 10.9 million for forestry (Table 1).

Total GAV from BRE-labeled products

A total gross turnover of US$ 4.2 million was estimated for second-sector agriculture products (Table 2), US$ 2.0 million through Biosphäre Markt and US$ 2.2 million through producers who sell their products directly, resulting in a total GAV of US$ 1.8 million. These products induce an additional total GAV of US$ 1.0 million in the first sector and hence an overall total GAV of US$ 2.8 million. For forestry-related second-sector businesses, the total gross turnover of labeled products was estimated at US$ 0.22 million, resulting in a total GAV of US$ 0.1 million. For forestry products, the first sector was more prominent, primarily because of labeled logs that create a gross turnover of US$ 4.2 million and a total GAV of US$ 2.9 million. Both sectors lead to a combined total GAV of US$ 3.0 million for forestry products (Table 2). Altogether, the BRE-labeled products generated a total GAV of US$ 5.8 million.

Impact of BRE-labeled products on the regional economy

In the first and second sectors, the regional economy produces a total GAV of US$ 162.1 million in agriculture and US$ 15.9 million in forestry (Table 1), of which BRE-labeled products contribute a total GAV of US$ 2.8

million for agriculture and US$ 3.0 million for forestry (Table 2). Thus, BRE-labeled products account for 2% of agricultural and 19% of forestry GAV. Most labeled agricultural products are processed and hence produced in the second sector; in that sector, the GAV of labeled agricultural products amounts to 6% of the total.

The total GAV of all labeled products corresponds to 66 jobs in agriculture and forestry in the first and second sectors in the BRE. This compares to a total of about 1800 jobs in agriculture and forestry and 6000 jobs altogether (Portmann [Lustat], personal communication). Hence, the jobs created by the labeled products amount to 4% of the jobs in agriculture and forestry and 1% of all jobs in the region.

Discussion

For the BRE, situated in a rural mountainous region of Switzerland, the contribution of labeled products to the regional economy is remarkable, amounting to a GAV of US$ 5.8 million. This represents twice the yearly budget of the BRE and underlines the high return on investment of well-managed protected areas (Watson et al 2014). It is of the same magnitude as the GAV created by tourism in the BRE (US$ 5 million; Knaus and Backhaus 2014) and in biosphere reserves in Germany (US$ 7–275 million; Job et al 2013) and hence illustrates the general economic potential of this approach.

In terms of the contribution of labeled products to the regional economy, agriculture and forestry have a rather modest and diverging impact. For agriculture, labeled

products contribute 2% to total regional GAV, whereas for forestry, the contribution is 19%. This can be attributed to several factors. In agriculture, the existing supply chains have been strongly developed, consolidated, and saturated over the last decades, which makes it difficult for new products to achieve high sales volumes (Steffen, personal communication). The labeled agricultural products are mostly innovative processed products like cheeses with special ingredients. As a result, the comparison of labeled-product GAV to second-sector agricultural GAV as a whole shows a considerably higher relative economic impact (6%) for labeled products. The difference between these relative shares indicates that in agriculture, the economically dominant and traditionally aligned first sector is not strongly and directly influenced by the labeled products. This stems from its main products, raw milk and meat, having no labeled products yet. It may also stem from the high subsidies in this sector, which remove pressure to develop alternative products and sales channels. In contrast, in the second sector, the contribution of the labeled products is remarkable. This is relevant for the first sector as well, because many processing activities, eg for syrups and marmalades, take place on a small scale directly on the farms. They likely safeguard the economic viability of certain farms and thus have an indirect effect on the larger first sector. Hence, as illustrated by Knickel and Renting (2002), a multitude of small GAVs produced at the farm level may have an important impact on the regional economy.

Furthermore, it is possible that the impact of the BRE-labeled products on farms was not thoroughly assessed, because we used generic multipliers for intermediate inputs. Kraus et al (2014), in their detailed, case-specific investigations, found higher intermediate inputs of producers of labeled products originating in the regional first sector, resulting in a potentially higher GAV in agriculture. Such a result is possible for the BRE-labeled products too, but this could not be assessed with the present study design.

Forestry's relative contribution of labeled products to the regional GAV is higher (19%). This stems from forestry's GAV generally being lower than that of agriculture and mostly derived from logs. All logs certified through the Forest Stewardship Council label, most of those produced in the region, also automatically receive the BRE label. The introduction of the Forest Stewardship Council label in the region dates back to an initiative of the BRE label committee and might have had an impact on sale volumes. However, the impact of the BRE label on log sale volumes is not obvious. The rather low impact of the label for forest products is illustrated by the small amount of products developed since the label was introduced (charcoal and wood products). They only amount to 3% of the GAV produced by the wood-related label. Thus, the contribution of the labeled products to the regional forestry-related GAV seems high given the

results, but a closer look reveals that it might be rather low.

The difference between agriculture and forestry illustrates 2 differing approaches to labeled products. In agriculture, there has been continual effort by many people to develop labeled products and establish sales channels. All activities in this process have made the producers reflect on the quality and identity of the products; hence, a steady evolution of the philosophy characterizing the products has taken place (Steffen, personal communication). Gaining a clear label profile, identifying with the label, and hence developing credibility among customers is essential for the long-term survival of the products on the market, because customers need to be able to make value judgments and build up trust in the products (Renting et al 2003). It is clear that such processes take time. The example of the labeled agricultural products in the BRE indicates that it takes at least 10 years to establish a label in a bottom-up process that represents a steady reconfiguration of existing alternative food networks, not an aggressive, high-budget marketing campaign. Given the increase in labeled products and their sales volumes in the BRE, it can be assumed that there has been a steady reinforcement of regional resource cycles (*sensu* Kraus et al 2014) and that the economic multiplier effects have been increased accordingly (Knickel and Renting 2002), leading to economic impulses in other branches as well.

In forestry, however, the efforts to create products and the number of people involved have been limited, mostly because of the small number of innovative local forestry businesses. Hence, the focus has been more on how to technically implement the labeling scheme than on how to create novel products and find alternative sales channels. This comparison illustrates that a key success factor for a biosphere reserve, or any other organization that aims to develop such a label, is to engage a maximum number of people and enterprises in participatory development of the label, its quality standards, and its identity. Building trust and constructive long-term cooperation is essential (Kraus et al 2014). Furthermore, the people involved need technical support in creating, selling, and marketing innovative products that provoke additional demand in alternative supply and sales networks. This should be facilitated by education, with a focus on various aspects of sustainable development for all people involved, including the customers who buy the product at a higher price (Kraus et al 2014).

Besides the economic impact of labeled products considered in this study, these products offer the opportunity for monetary and nonmonetary synergies. In general, the consumption of labeled products can enhance the sensation of authenticity and responsible action (by supporting the regional economy) for both local people and tourists (Sims 2009). When products are sold outside the region, they can be accompanied by

pictures and publicity material that advertise the biosphere reserve, which can increase tourism revenues. By implementing label criteria that require strict production standards (eg for organic or wildlife-friendly farming), goals for sustainability, biodiversity conservation, and ecosystem services provision can be reached (Ghazoul et al 2009). Furthermore, product labeling can provide opportunities for positive and constructive communication between protected-area managers and farmers and foresters. Hence, awareness of multiple opportunities while developing labeled products can lead to positive tangible and intangible effects for the whole protected area (Knickel and Renting 2002; Kraus et al 2014). Such secondary effects were not considered in this study but represent an interesting opportunity for further research.

Finally, calculations in this study were based on a number of assumptions. Hence, despite having used the most precise data available, substantial imprecision remains. This stems especially from the use of generic multipliers and intermediate-input shares, the risk of double counting GAV within the multilayered added-value chain, and the reliance on numbers provided by business managers, who have a vested interest in presenting their companies in the best light, which might include rounding numbers in a socially desirable way. Assessing the error in the final results is not possible, because we combined data from various sources and did not work with a quantitative sampling approach. Thus, our approach clearly cannot be used for monitoring. Improving the data quality would need a far more extended survey and the willingness of many farm and business managers to reveal their financial data, a

significant hurdle in this survey. These obstacles also indicate that replicating this study in any other biosphere reserve or protected area would be difficult. The general conclusions about how to successfully establish labeled products and use their synergistic potentials, however, are applicable to every regional project aiming at developing alternative food networks.

Conclusions

This study has shown that in a biosphere reserve, considerable GAV can be generated through labeled products. In the BRE, it accounts for about US$ 5.8 million, which corresponds to 4% of jobs in agriculture and forestry and 1% of all jobs in the region. It corresponds further to twice the annual budget of the BRE and hence represents an important economic multiplier of biosphere reserve management activities. A prerequisite to achieve such a result is a continual process of involving local farms and businesses in long-term cooperation on the creation of quality specifications and the identity and message the labeled products should convey. Sales channels are needed that enable close contact between producers and customers and allow trust to build. As a result, developing such products needs time and leaders to coordinate the required steps and educate all involved parties. Taking into account possible synergies with other branches of the economy, society, and biodiversity, labeled protected-area products can be a true asset for mountainous biosphere reserves and their management.

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