

The Opportunity Costs of Forest Conservation in a Local Economy

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Costs generated by nature conservation are repeatedly under discussion. Most often the costs of conservation are estimated as aggregate figures at the national or regional level or alternatively, for a forest owner. In this study they were examined at the local level, in the forestry dependent municipality of Iiomantsi in Eastern Finland. The estimations of lost net revenues (stumpage income less silvicultural costs), wages, entrepreneurial income and profits, employment and value added were based on alternative forest management plans calculated for conservation areas. The annual losses as regards employment during the first decade were estimated to be 5.7–20.4 jobs. Later, the employment effects were estimated to be 2.4–6.3 lost jobs. Although the value added lost during the first decade was estimated to be at maximum only 3.4% of the present total value added of the municipality, the share of the value added of forestry was estimated to be higher than the mere protected forest land share would indicate. The use of conservation areas for forestry would create a moderate increase of employment in forestry, i.e. 3.8–14%, during the first decade, but it would later stabilise at a much lower level. Employment impacts at the municipal level were estimated as very small (at maximum 0.9%), but on the other hand, for some villages even single jobs may matter. The main reasons for the minor impacts were the high mechanisation rate of logging and the major flow of stumpage income outside the locality.

Keywords nature conservation, local economy, economic impacts, cost of conservation

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1 Introduction

The primary reason for nature conservation is the need to secure the existence of rare and valuable species and habitats. Therefore, the extent of conservation needed is considered in the first place on ecological grounds. Nevertheless, changes in forest resource allocation due to nature conservation always include economic aspects, relating to benefits and costs of the altered resource allocation.

The economic benefits of nature conservation are mainly non-marketed goods, non-use values like existence and bequest values (e.g. Kriström 1990, Hoen and Winther 1993, Lockwood et al. 1993). The use values of nature conservation relate to recreational possibilities and functional benefits like biodiversity. Nature conservation also includes benefits creating money flows and employment as, for example, nature-based tourism has shown.

Unlike the benefits the costs of nature conservation are generally considered to be concrete and easily observable. They mainly consist of the opportunity costs of the land in other use. In Finland it means mainly losses in forestry and sometimes in peat production. When considering forestry, the opportunity cost of conservation can be estimated with the net present value of lost wood production. If, instead of strict protection, some forestry activities are allowed, the opportunity cost is the net decrease in the present value of wood production (e.g., Johansson and Löfgren 1985). However, the assessment of lost wood production is not straightforward since there is always a range of alternatives in timing and intensity of cuttings.

The losses due to conservation include jobs and wages, in addition to lost stumpage income. The impacts on employment are especially important in remote areas, where it is difficult to find jobs that equally substitute for forestry work. The impacts of conservation on the number of jobs may be minor when compared to the overall employment at national or regional level and is thus easily considered insignificant. However, from a local point of view, even a single job may matter and the increased unemployment may have severe impacts on the local community.

Furthermore, as a result of reduced demand in

production and consumption nature conservation has indirect and induced effects. Indirect effects refer to input-output relationships between the industrial sectors of the economy, whereas the induced effects stem from the response of household consumption to the increase in household income (Armstrong and Taylor 1993). The extent of indirect and induced effects varies depending on the characteristics of the economy. In small and open local economies direct effects are significant, whereas at the regional and national levels also indirect and induced effects carry importance.

In Finland approximately 10% of the total land area is under strict protection (Finnish Statistical Yearbook of Forestry 2000). However, conservation areas are to a remarkable extent located in the northern part of the country as 27% of the land area of Lapland, the northernmost province of Finland, is under conservation. In comparison no more than 3% of the land area is protected in other provinces. Also in some municipalities in Eastern Finland the share of conservation is notable. Conservation areas are mainly located in areas of poor timber productivity: of productive forest lands 2.6% is preserved in Finland (Finnish Statistical Yearbook of Forestry 2000).

At the national and regional levels in Finland, various biodiversity protection programmes for commercial forests have been examined with their respective conservation costs evaluated. The estimates of costs within a single programme can even vary greatly. Although it is difficult to directly compare different studies, one can note that some of the estimates are relatively small while others are rather large. An example of the former is the study by Hildén et al. (1998), where they estimated the costs of the implementation of the Natura 2000 programme within Finland. The net present value of lost stumpage earnings was estimated to range from 241 to 796 million FIM, which was less than 0.6% of the total capital value of stumpage income. Direct employment effects were estimated to be a total of 140 jobs lost in the whole country, 30 of these from forestry. This research was based on the expansion of the existing conservation network by 27 000 hectares of forest land.

At the other extreme is a study by Jaakko Pöyry (1996) that estimated the costs of old

growth forest conservation (256 000 hectares) in Northern and Eastern Finland. In this case it was estimated that conservation would lead to a loss of 2300–3700 jobs, 60% of which would come from Eastern and Northern Finland. The present value of the lost harvest potential was estimated to be 1.4 billion FIM. In response to this study by Pöyry, Niskanen and Ollikainen (1996) presented remarkably lower estimates. They criticised the method used in the division of sectors into national and regional sectors, as well as assumptions made concerning income, like stumpage income from state-owned forests. Niskanen and Ollikainen also emphasised that substitute actions and adjustment processes always emerge, which, in the long run, lead the economy back to its long-term development path. They also pointed out the possibility of government intervention to relieve the local burden.

The most recent Finnish study of the economic impacts of forest conservation was done in 2000. Study examined the potential impacts of forest conservation in Southern Finland (Leppänen et al. 2000). Researchers examined an increase in the conservation network so that the total was up to the level of 10% of the land area. It was estimated that this would cause an annual decrease of 1.4 billion FIM in value added as well as a marked decrease in employment.

One reason for the differences in the estimation of the impacts caused by conservation stems from the assumptions concerning market adjustments. For example Mäki et al. (1997) concluded that the long-term effects of conservation programmes could be significant to the Finnish timber markets by increasing the level of timber prices and by leading to an accumulated decline in the annually exchanged timber volumes. A well-known example of conflict due to the difficulties of reaching an agreement on the costs of conservation is the case of the spotted owl in the United States: the original estimates of employment losses ranged from 12 000 to 147 000 jobs (Sample and Le Master 1992). Costs of forest conservation have also been studied by van Kooten (1995) in British Columbia, Kriström (1990) in Sweden, and Lockwood et al. (1993) in Australia. The studies by Kriström and Lockwood, however, concentrate mainly on the benefits of conservation.

Although in Finland several studies have been conducted on the effects of conservation at the national or regional levels, there are few studies from the point of view of local economy. The northern and eastern parts of Finland, where conservation areas are mainly located, have largely been dependent on the utilisation of timber. Technological advances in harvesting since the 1960s have led to drastic cuts in labour demand in these regions. As a consequence of the mechanisation of harvesting and monostructure of production, the regions now suffer from structural unemployment and migration (Eskelinen 1999). At the same time with the rationalisation of harvesting conservation network has expanded as well, which has further decreased the possibilities to adapt to the changes. In small local economies unemployment caused by a change easily remains permanent, as substitute jobs do not exist. Increased unemployment causes migration and at the lowest level, in the villages, it may lead to depopulation.

In one of the first studies concerning the effects of conservation on a local economy Kakkuri (1983) gave rough estimates for the lost cutting possibilities of conservation areas in the Ilomantsi municipality. He regarded it possible to compensate for the losses by tourism, although he did not give estimates for lost jobs or reduced income, and only short-term costs were taken into account. The above mentioned study by Jaakko Pöyry (1996) presented rough estimates for the cutting removal lost due to conservation of old growth forests also at the municipal level. However, local employment effects were not estimated. The employment effects of the establishment or extension of three National Parks were presented by an expert committee formed by the Ministry of Agriculture and Forestry (*Metsänsuojelun ja työllisyyden...* 1996). The estimated effects on employment ranged from 8 lost jobs to 3 created jobs depending on the size, location and attractiveness of the area. However, total impacts on the local economy were not estimated.

The aim of this study is to estimate the range of opportunity costs caused by existing nature conservation in a small forestry dependent municipality. More specifically, the study aims to estimate the extent of lost wood production, direct employment effects and the amount and structure of

related income flows so as to draw conclusions on their importance and distribution to the local economy.

2 Data and Methods

2.1 Study Area

The study area is the municipality of Iiomantsi, located in the Eastern Finland, in the province of North Karelia. In 2000, the municipality had 7100 inhabitants. Iiomantsi has traditionally been dependent on forestry and agriculture. In 1998 the share of primary production of the industrial structure (based on employment) was 14.3%; the share of secondary production 19.1%, and the share of services 64.2% (unknown 2.4%) (Iiomantsi – EU:n itäisin kunta s.a.). The unemployment rate was typically high for a traditionally forest resource-based community in Eastern Finland, i.e. 23% in 2000. The wood processing industry is rather undeveloped, with only small-scale sawmills and wood processing firms being located in the municipality. Iiomantsi is one of the municipalities where the debate on the relation between conservation and employment has become permanent (e.g., Rannikko 1997).

The area of strictly protected forests and peatlands in Iiomantsi is 20000 hectares, which is 7.2% of the total land area of the municipality. The figure consists of areas where forestry or any other activities bearing an effect on nature are not permitted. It includes two national parks, one nature park and several mire and old-growth forest protection areas, which, by one exception, are included in the Natura 2000 conservation programme. All in all the area consists of 13 separate nature conservation areas, the largest of which is 6400 hectares and the smallest 20 hectares, most areas being from 300 to 1000 hectares. The Forest and Park Service, the state forest organisation manages 77% of the conservation areas, 21% is owned by private people and 2% by companies. Although the relative share of protected areas is rather high, the proportion of productive forest land (annual increase at least 1 m³/ha) of the total conserved area is only 33%. This is 3% of the total amount of productive forest land in the

municipality. Out of the conserved productive forest land 89% is state-owned.

2.2 Data

In Iiomantsi the main alternative use for conservation areas is forestry and potentially in some cases peat production. Until 1999 there were several active peat production areas in the municipality, all of which were run by Vapo Ltd. The company also owns several untouched areas which are reserved for peat production. However, in 1999 peat production was interrupted in Iiomantsi for an unspecified length of time. The main reasons for that were the present unfavourable energy taxation on peat burning, distinct location and the absence of a peat power plant in the municipality. Because of these reasons the present probability of renting or buying new mires is very low. As a consequence peat production was not considered a potential alternative for conservation in Iiomantsi, i.e. the present opportunity costs of peat production were estimated to be either zero or so negligible that they were excluded from this study.

The losses caused by nature conservation were estimated by calculating the cutting possibilities of the study area. Detailed stand compartment level inventory data was available for 88% of the productive forest land and was provided by the Forest and Park Service and Stora Enso Ltd. The compartment level data is based on a detailed field inventory and is of recent origin or has been updated. Data may thus be considered very accurate.

For the rest of the area (12% of the productive forest land) the forest data was acquired using a satellite image based land cover and forest classification system developed by The National Land Survey of Finland (NLSF). The system is based on Landsat Thematic Mapper (TM) Images, masks digitized from 1:50000 topographic maps and National Forest Inventory data (Vuorela 1994). The pixel size used is 25 m² × 25 m². Using satellite image interpretation the shares of different tree species were acquired, both on mineral soils and on mires, with 5–6 volume classes divisions. The compartment level data needed for the calculation of the alternative forest man-

agement plans was developed using the detailed inventory data, which was available for the main part of the study area.

The National Land Survey of Finland has not estimated the accuracy of the classification system on areas of different sizes. For the multi-source forest inventory developed at the Finnish Forest Research Institute, Tomppo et al. (1998) have estimated that the RMSE (root mean square error) of the volume is approximately 20% on the areas of 100–1000 hectares. The accuracy of the estimates improves as the total area under interpretation increases. As the satellite image based interpretation unavoidably includes some inaccuracies the results of this analysis were improved by aerial photograph interpretation. A local forest technician, who was experienced in aerial photograph interpretation and familiar with the forests being studied, performed this analysis. This improved the accuracy of the data and the results of the interpretation may thus be considered more reliable than for a standard case.

2.3 Alternative Forest Management Scenarios

Forest management plans were compiled and calculated by using MELA99 software, which is a forestry model and an operational decision support tool for integrated forest production and management planning. The optimising algorithm in MELA is based on linear programming. A detailed description of the system can be found e.g. in Siitonen et al. (1996).

At the beginning of the planning process numerous treatment schedules were simulated for each stand. The planning period was 90 years, which was divided into 10-year sub-periods. Two different optimisation problems, i) maximum cutting potential and ii) maximum sustained yield, with two discount rates, 3% and 5%, were set up for the conservation areas. For both optimisation problems the net present value (NPV) of timber production at the beginning of the planning horizon was set as a variable to be maximised. For the maximum cutting potential scenario (i) no sustainability constraints were given; this led to the proposed immediate harvest of stands when they met regeneration or thinning criteria

and thus produced an estimate of the maximal harvesting possibilities for the study area. Violation of silvicultural regimes and Finnish Forest Law was prevented by simulating only feasible management schedules subject to these forest management regimes. In practice the silvicultural regimes acted as a constraint to harvesting. For the maximum sustained yield scenario (ii) the NPV at the end of the planning period (90 years) was required to be equal or greater than the NPV at the beginning of the planning period. Both cutting removals and net revenues during the planning period were required to not decrease. This scenario created a more conservative estimate of the lost cutting potential.

The average silvicultural and logging costs as well as the stumpage prices for the state-owned forests of North Karelia from 1997–2000 (Finnish Statistical Yearbook of Forestry, 1998–2000) were used for the calculations as far as they were available. The average stumpage prices for pine, spruce, and birch logs were 282, 238, and 275 FIM/m³ respectively and for pulpwood, 93, 133, and 95 FIM/m³ respectively. The cost estimates for mechanised harvesting, forest haulage, and manual felling were based on productivity estimates (m³/hour) produced by MELA based on Finnish studies of forest operations and on average costs per hour of harvesting, haulage and manual felling (405, 276 and 140 FIM/hour).

2.4 Employment and Income Calculations

The optimisation produced estimates of the annual cutting removal (m³/year), required silvicultural operations (ha/year), net revenues (FIM/year), and the labour input needed for the harvesting and silvicultural work. In MELA99 the labour input needed is estimated using functions based on Finnish forestry work-studies (e.g., Kuitto et al. 1994, Metsäpalkkauksen kehittämisen projektityöryhmän... 1995, Rummukainen et al. 1995). Compartment specific characteristics are included in the functions, and thus, the estimates produced are considerably more accurate than if average productivity estimates were used. Both manual and mechanised cuttings were allowed in the calculations, but the more economical method for a specific compartment was always chosen. In

addition to the labour input needed for harvesting or silviculture, the estimates also included a component for supervision of the work. Costs due to possible needs for additional forest road construction were not included in the calculations.

The employment by long-distance transport was estimated by using an average annual transportation volume for a timber truck, which in 2000 was 35 900 m³/truck (Finnish Statistical Yearbook of Forestry 2001). The number of drivers per timber truck was assumed as two, which coincides with the efficient use of the truck. Labour income from silvicultural work and cutting was estimated by using average annual earnings, 125 300 and 116 700 FIM/employee. For the estimation of the net profit in mechanised cutting, forest haulage, soil preparation and long-distance transport the total turnovers of the activities in question were estimated. In estimating the total turnovers, the following average unit costs were used: 23.60 FIM/m³ for the final felling and 48.20 FIM/m³ for the thinning, 16.8 FIM/m³ and 21.80 FIM/m³ for forest haulage (Örn 2001), 771 FIM/ha for soil preparation (Strandström 2001) and 30.9 FIM/m³ for long-distance transport (Örn 2001). As a net profit of forest machine contractors 7.5% of the total turnover and 6.5% for timber truck entrepreneurs were used (Väkevä 2001).

In addition to direct employment and income effects, an increase or decrease in an economic activity has indirect and induced effects on a local economy. Traditionally used methods for the estimation of multiplier effects are the input-output analysis, economic base models and econometric models (Glickman 1977). Methods mentioned are poorly applicable in small economies, because of the lack of municipal level statistics. Also, the need for estimating the indirect effects is remarkably lower at a municipal level than at the regional or national levels due to leakages to other economies. Especially in the case of forestry, indirect effects are minor because the need for input from other sectors is small and demand is directed mainly to producers outside the region. In Finland and in Eastern Finland the production multipliers of forestry are 1.12 and 1.05 according to Vatanen (1997) and 1.1 and 1.06 by Ruotsalainen (1989). The impacts of woodworking at the regional and national levels are higher, but they are often performed outside

the forest resource community, as is also the case in Ilomantsi.

Increased consumption due to increased income would probably have greater impact on the local economy of Ilomantsi. The estimation of this impact would require specific investigation of the economic relations in the municipality. However, since the estimated income increase was minor and a large portion of the stumpage income would leak out of the municipality due to the effects of state and company forest ownership, a more specific estimation of the induced effects was not seen necessary and multiplier impacts were excluded from the analysis.

3 Results

3.1 Total Cuttings and Net Revenues for Forest Owners

The results of the study are presented by beginning with total cuttings and net revenues lost due to conservation. After that the number of lost jobs and related wages, entrepreneurial income and profits are presented. Finally, all above-mentioned are brought together and the impacts on the local total value added as well as on forestry output and value added are presented.

Depending on the constructed management scenario the volume of cutting removals would range between 11 000 m³/year and 80 000 m³/year during the first three decades (Table 1).

Since the proportion of old forests is high in the study area, if the planning is done based on the maximum cutting potential scenario (i), the result would be very extensive harvesting during the first sub-period (10 yrs.). The percentage of old forests decreases markedly, and the volume harvested during the second sub-period is low, consisting mainly of thinnings. This alternative assumes a full-scale utilisation of harvest possibilities, which seldom exists in reality. However, it provides a view of the maximum limit for evaluation of the lost harvest possibilities.

Harvest levels for the sub-periods are constant for the maximum sustained yield scenario (ii) as stands, which have reached regeneration or thinning criteria are not instantly harvested,

Table 1. Total cuttings (m³/year) for the first three periods by management scenario and discount rate applied in the calculation.

Management scenario	Discount rate	2000–2009	2010–2019	2020–2029
i) Maximum cutting potential	5 %	80 500	11 400	11 600
ii) Maximum sustained yield	5 %	25 400	25 500	25 700
i) Maximum cutting potential	3 %	74 500	13 600	11 600
ii) Maximum sustained yield	3 %	25 000	25 000	25 000

Table 2. Net stumpage revenues (million FIM/year).

Management scenario	Discount rate	2000–2009	2010–2019	2020–2029
i) Maximum cutting potential	5 %	15.0	1.9	2.0
ii) Maximum sustained yield	5 %	4.7	4.8	4.8
i) Maximum cutting potential	3 %	14.0	2.5	2.1
ii) Maximum sustained yield	3 %	4.6	4.7	4.7

instead logging is scheduled according to sustainability constraints. At the regional and national levels, maximum sustained yield calculations are often seen as objectives for forestry, since they represent the maximum yield that can be achieved without threatening the sustainability of forestry, even though this level is seldom reached. However, on a smaller scale, like a private forest holding, a sustained yield calculation can easily be exceeded. Since the age-structure of the forests in the study area is very divergent compared to the commercial forests (i.e. the percentage of old forests is high), in reality harvests might well exceed the level of small-scale sustainability especially during the first decade. The scenario (ii) therefore yields a more conservative estimate of the lost harvest potential.

The net revenues (stumpage income less silvicultural costs) received are presented in Table 2. Nature conservation areas are at the present mainly state-owned and managed by the Forest and Park Service. If conservation areas were used for forestry, only the net revenues for resident private forest owners would clearly benefit the local economy. However, also a part of the revenues from state-owned forests would return to local economy for the maintaining of the existing state forest infrastructure in the municipality. The share of net revenues for private forest owners was esti-

mated to be less than 7% of the total net revenues during the first three decades in all scenarios.

3.2 Employment and Related Income Effects

The most significant direct benefit to the local economy from the use of conservation areas for forestry would be generated by increased employment due to logging, forest haulage, silvicultural work, and long-distance transport with the associated wages, entrepreneurial income, and profits. The employment effects are presented in Table 3 and Table 4.

If the extreme alternative, the maximum cutting potential, was realised, the total employment effect during the first 10-year period would be 18.1–20.4 jobs/year. However, this alternative would lead to a sharp decline in employment in the following decades, as the annual employment effect would decrease to 2.4–3.6 jobs. The implementation of the maximum sustained yield alternative would increase the annual employment by 5.7–6.3 jobs during the next three decades.

If the new jobs were all located in Ilomantsi the present total employment would increase during the first decade by 0.3–0.9%, when the potential decrease or increase in jobs from other sectors are not taken into account. However, since the

Table 3. Direct employment effects in a) logging and forest haulage, b) silviculture and c) long-distance transport (jobs/year).

Management plan	Discount rate	2000–2009			2010–2019			2020–2029		
		a	b	c	a	b	c	a	b	c
i) Maximum cutting potential	5 %	9.7	6.3	4.5	1.8	0.7	0.6	1.5	0.3	0.6
ii) Maximum sustained yield	5 %	2.4	2.0	1.4	3.4	1.3	1.4	3.6	1.3	1.4
i) Maximum cutting potential	3 %	8.6	5.4	4.1	2.2	0.6	0.8	1.5	0.4	0.6
ii) Maximum sustained yield	3 %	2.4	1.9	1.4	3.5	1.3	1.4	3.4	1.3	1.4

Table 4. Total direct employment effects (jobs/year).

Management plan	Discount rate	2000–2009	2010–2019	2020–2029
i) Maximum cutting potential	5 %	20.4	3.1	2.4
ii) Maximum sustained yield	5 %	5.8	6.2	6.3
i) Maximum cutting potential	3 %	18.1	3.6	2.5
ii) Maximum sustained yield	3 %	5.7	6.2	6.1

Table 5. Wages, entrepreneurial income and profits (FIM/year).

Management plan	Discount rate	2000–2009	2010–2019	2020–2029
i) Maximum cutting potential	5 %	2 871 000	434 000	355 000
ii) Maximum sustained yield	5 %	831 000	871 000	892 000
i) Maximum cutting potential	3 %	2 557 000	506 000	364 000
ii) Maximum sustained yield	3 %	814 000	871 000	863 000

operational area for forest machine contractors and especially for timber truck contractors is large, the increase would more probably be even less. When considering only forestry jobs (long distance transport excluded) the increase would be 3.8–14% during the first decade and later 1.6–4.3%.

When employment impacts are proportioned to the total area of conservation, comparisons with other studies are possible. In Ilomantsi during the first decade directly 0.9–3.1 jobs/1000 hectares of productive forest land would be created by using conservation areas for forestry. Later this would stabilise at a lower level, to 0.4–1.0 jobs/1000 hectares. Figures are close to the study of Hildén et al. (1998), according to which 1.1 jobs/1000 hectares of productive forest land are lost in

forestry in the whole country due to the Natura 2000 programme. However, figures presented by Jaakko Pöyry (1996) are higher: 7.3–12.6 jobs/1000 hectares of conserved land were estimated to be lost in Finland due to protection of old-growth forests. The figures by Jaakko Pöyry also include employment impacts on forest industry.

The estimated wages, entrepreneurial income and profits from logging, haulage, silviculture and long-distance transport are presented in Table 5. In total the income would range from 0.4 to 2.9 mill. FIM/year depending on the forest management scenario. At the maximum it would be 0.6% of the present taxable income in municipal taxation.

3.3 Impacts on Local Output, Value Added and Operating Surplus of Forestry and Timber Transport

To gain a comprehensive picture of the role of potential wood production originating from nature conservation areas in the forestry economy of Ilomantsi municipality, a comparison of all components of two production choices would be required. Unfortunately forestry accounts statistics at the municipal level do not exist and the only figure available is the value added of forestry of a larger region. In the following, an attempt has been made to conduct forestry and timber transport accounts for Ilomantsi municipality as a whole and similarly for the wood originating from nature conservation areas. The principles of national accounts for forestry (Statistics Finland, unpublished material) have been followed as much as the data allows. Total output, value added and operating surplus of forestry and long-distance transport of timber which would be created by the use of conservation areas by the maximum sustained yield scenario (ii) are presented in Table 6, as well as comparable figures concerning the whole municipality.

The figures for Ilomantsi were estimated by using the net stumpage earnings, the estimated output of harvesting of roundwood in the municipality and the structure of the total forestry output in Finland in 2000. As the figures for timber truck transport are not available even at the national level in the national accounts, they were estimated by using the structure of the total turnover of an average timber truck entrepreneur (Väkevä 2001), the structure of output of transport of goods in road traffic by national accounts, and the total amount of cuttings.

The comparison shows that if the conservation areas were used for forestry the present value added of forestry and long-distance transport of timber would increase by 6.6% if the maximum sustained yield scenario (ii) was realised. The realisation of the maximum cutting potential scenario would create app. 21% increase during the first decade. As the share of productive conservation forests of the total amount of productive forest land in Ilomantsi is 3%, the increase of value added would most likely be higher than the mere protected forest land share would indicate. The reason for that is

the age-structure of protected forests. Later the impact would be 2.7–6.6% of the present value added of forestry and timber transport.

The share of the net stumpage income from the value added for wood originating from conservation areas would be slightly higher than in the municipality on average. On the other hand the share of wages would be lower. Also for that the reason can be found in the high mean age of preserved forests. Consequently, a primary beneficiary of the use of present conservation areas for forestry especially during the first decade would be the forest owners, in practice the Forest and Park Service.

In 1999 the total value added of the Ilomantsi region was 816 mill. FIM and on the basis of the number of inhabitants the share of Ilomantsi municipality was app. 618 mill. FIM. The use of conservation areas for forestry would increase the local value added at maximum by 3.4% during the first decade. Later the impact would be app. 0.4–1.1% of the present value added. However, it is important to notice that the amount of money actually staying in the local economy would be remarkably lower than presented in the value added calculations. As conservation areas are mainly state-owned, a major part of stumpage income would flow outside the local economy.

4 Discussion

In recent years, the extent and means of forest conservation in Finland have caused significant discussion. Conflicts between local people and conservation authorities have been strongest in rural, forestry dependent areas, where people have feared the loss of their livelihood. However, the reasons for opposing conservation are not just economic, but there are also social and psychological aspects involved. The residents of remote rural areas have often felt they are forced to sacrifice for conservation benefits desired primarily on the national or even international level.

Increases in the productivity of logging operations that began in the 1960s have secured the competitiveness of Finnish forestry and the forest industry. This has been the main cause of a sharp decrease in employment from forestry in forest

Table 6. Output, value added and operating surplus (mill. FIM/year) in forestry and long-distance transport of timber in Ilomantsi (a) and in conservation areas of Ilomantsi (b) by the maximum sustained yield scenario (ii), 5 % discount rate.

	a	b	b/a (%)
1) Output in forestry and long-distance transport of timber at basic prices	113.3	7.46	6.6%
– harvesting of roundwood	91.6	5.97	
– silviculture	7.3	0.46	
– other forestry activities	2.4	0.25	
– long-distance transport of timber	12.0	0.78	
Intermediate consumption, at purchasers' price	15.5	1.02	
2) Value added, gross at basic prices	97.8	6.44	6.6%
– harvesting of roundwood	85.8	5.58	
– silviculture	4.7	0.29	
– other forestry activities	1.3	0.18	
– long-distance transport of timber	6.1	0.40	
Consumption of fixed capital	17.2	1.13	
3) Value added, net at basic prices	80.6	5.31	6.6%
– harvesting of roundwood	70.5	4.58	
– silviculture	4.7	0.29	
– other forestry activities	1.3	0.18	
– long-distance transport of timber	4.1	0.27	
4) Wages and salaries	11.1	0.62	5.5%
– harvesting of roundwood	4.9	0.20	
– silviculture	3.0	0.19	
– other forestry activities	2.2	0.16	
– long-distance transport of timber	1.0	0.07	
5) Employers' social contributions	2.9	0.16	5.6%
– harvesting of roundwood	1.3	0.08	
– silviculture	0.8	0.03	
– other forestry activities	0.6	0.02	
– long-distance transport of timber	0.3	0.02	
6) Other subsidies on production	1.3		
– harvesting of roundwood			
– silviculture			
– other forestry activities			
– long-distance transport of timber			
7) Operating surplus in forestry and long-distance transport of timber	68.1	4.53	6.6%
– harvesting of roundwood	64.5	4.29	6.7%
– net stumpage earnings	56.6	4.14	7.3%
– income from delivery sales	2.1		
– other harvesting activities	5.7	0.16	2.7%
– silviculture	0.9	0.06	6.1%
– other forestry activities	–0.1		
– long-distance transport of timber	2.8	0.19	6.5%

resource dependent areas in Northern and Eastern Finland, where real substitutes for forest work are rare. At present the unique patches of old-growth forests located in Eastern and Northern Finland are regarded as a part of a national or European heritage, with a special emphasis on their role as a refuge for biodiversity. They have also recently

come to represent an important part of the green image of the Finnish forest industry. However, for the local populations of many forest resource dependent areas the changes have brought economic losses. They have had no more real influence on the decisions to conserve forest areas than they earlier had on the decisions to increase the

level of mechanisation in forestry operations. This at least in part explains the significant opposition to conservation from rural areas.

If the present conservation areas of Iiomantsi municipality were opened to production forestry, the impact on the local economy would be minor at the beginning of 2000s. Only during the first decade would the effect on employment be more notable. This impact on employment would however be temporary, as during the second and third decades the effects would decrease. The harvesting of conservation areas could have major long-term effects on the local economy only if the availability of resources stimulated growth in local woodworking industries.

The low impacts on employment at the local level are caused by the current high productivity of mechanised logging, as well as the relatively minor share of productive forest land that is included in the protected areas. According to Vatanen (2001) the employment potential for manual logging is eight-fold greater than for mechanised logging. The impact of conservation is therefore only minor when compared to the impacts of mechanisation. It should, however, be noted that without mechanisation logging could be unprofitable or at least stumpage income would be remarkably lower.

The forests presently conserved in Iiomantsi are mainly state-owned, which would cause the flow of stumpage income outside the region, although, on the other hand, they also maintain the existing state forestry infrastructure. Further, multiplier effects are minor in the case of forestry, as the demand for locally produced inputs is low. As a consequence the wages, entrepreneurial income and profits of forestry operations and long-distance transport would form the main benefits to the local economy.

Although the impacts on the economy as a whole would be diminutive, the opposite may hold true when the perspective is at a lower administrative level, at villages. In villages even minor changes could be crucial to the vitality of the community. This is what is sometimes called “the geography of small numbers”. It is also important to note that the importance of lost employment opportunities varies between regions. In the wealthier regions where substitute jobs are available, the loss of a few jobs has little to no significance. However,

in areas with permanent high unemployment, like Eastern and Northern Finland, there is no substitute work available even in neighbouring areas. As labour is likely to be imperfectly mobile between regions and professions, people easily remain permanently unemployed or need to seek work outside the region.

In Iiomantsi, as in several other municipalities in Eastern Finland, the combination of a monostructure of production, distant location, and decreased public sector financing along with the relatively quick changes in forestry to mechanisation have led to a high level of unemployment. At the same time the expansion of the conservation network in the municipality has made the situation somewhat worse. However in the long term, when compared to these other problems forest conservation in the municipality can be seen as only marginally contributing to unemployment.

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