

The role of forestry in the socio-economic development of Poland's agricultural region (input-output analysis)

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■ Abstract

The study was undertaken in the region of the Białowieża Primeval Forest (Białowieża, Browsk, and Hajnówka Forest Districts – FDs), which has a total area of 52 thousand hectares and is situated in the agricultural zone of north-eastern Poland. The study used an input-output (I-O) analysis to explore: 1) the type and strength of relationships between forest management and its socio-economic environment, and 2) the role and significance of forestry in the development of the region. The forest sector (FDs) employed 452 people, with salaries totalling USD 1.6 million/yr. FDs supplied the socio-economic environment with the generated cash flows (taxes and dues) amounting to USD 4.8 million/yr, enabling creation of 413 jobs outside forestry. FDs supplied goods and services for the amount of USD 5.2 million/yr, mainly revenues from the sale of 120,000 m³ of harvested wood. The wood-processing industry employed 1,111 people, and was also a source of taxes and dues amounting to USD 1.7 million/yr. Fifteen jobs were created per 1,000 m³ of harvested, sold, and processed wood: 2 in FDs, 4 in the firms providing goods and services, and 9 in the recipients of goods and services. Simultaneously, this was a source of taxes amounting to USD 26.0/yr, of which USD 11.0 thousand/yr was paid by FDs, USD 1.4 thousand/yr by the environment of suppliers, and USD 13.6 thousand/yr by the environment of recipients.

■ Key words

Forestry in Poland, socio-economic development, input-output analysis

■ Introduction

Polish forests cover 9,139 thousand hectares, of which 7,298 thousand hectares (79.8%) belong to the State Treasury, including 7,006 thousand hectares (76.7%) administered by the “State Forests” National Forest Holding (SFNFH) [Rocznik Statystyczny GUS 2004]. The “State Forests” embraces 428 forest districts with an average area of over 16 thousand hectares and employ 25,272 people. 56 staff on average works in a forest enterprise. 31 million m³ of timber were harvested in the State Forests in 2004 generating revenues amounting to USD 1,270,520 thousand, or to about USD 2,968 thousand on average per forest enterprise. The total costs oscillated around the level of USD 1,250,765 thousand [Sprawozdanie finansowe PGL LP 2004]. The forest-and-wood sector gives employment to 80 thousand people throughout the country, mainly to the population living in rural areas and small towns. In addition to production forests focused mainly on the production of raw materials, there is a large area of forests playing protective functions. In total, protective forests cover 3,224 thousand hectares (46.02% of the total forest area), including among other: water protective forests – 1,383 thousand hectares, protection zones in and around towns – 636 thousand hectares, and industrial impact zones – 501 thousand hectares.

An attempt at extending the Białowieża Primeval Forest to include the area of 52 thousand hectares belonging to three forest districts (Białowieża, Browsk, Hajnówka) managed by the SFNFH was the genesis of the research carried out with the use of an I-O analysis procedure. The proposed status change for those forest districts would entail a significant restraint on the current forest management functions. The introduction of nature conservation to such a vast forest area would bring negative consequences for the staff of SFNFH and forest service departments (ZUL), as well as for the personnel of local wood processing plants and for all other business entities having economic ties with forest management. Such economic consequences would also affect local communes’ budgets and the state budget financing the activities of all national parks in Poland.

The undertaken studies were intended to assess the exact value of cash (monetary, financial) flows incoming and outgoing from the above mentioned forest districts. It was assumed that such cash flows would stop functioning in the socio-economic environment and in forest districts as soon as the areas of those forest districts would be placed under nature conservation through incorporating them into the Białowieża Primeval Forest.

The main outcome of giving up the commercial use of SFNFH forests in the Białowieża Primeval Forest would be a radical change in the level and structure of forest resource utilization which undoubtedly would have a negative effect on the economic, social and family life of many inhabitants of the region and, in particular, on the job market. It is worth mentioning, that the authors of the study did not have in mind the loss of jobs only to foresters, but first of all to a group of employees of the forest service departments and to the wood processing sector associated with forestry business. Moreover, the reduced economic activity in the region would generate a deficit in local governments’ budgets, thus increasing payments out of the state budget necessary to support the enlarged Białowieża Primeval Forest.

■ Characteristic of the study site

The Podlaski region, in which the Białowieża Primeval Forest is situated, is a typical agricultural zone featuring the least developed industrial infrastructure, where 37% of the population earn their living in farming. Agriculture, forestry and fishery account for 13.7% of the generated gross value (Poland's average in 2004 being 3.3%). The people's income belong to the lowest in the country and revenues from income tax from natural persons (PIT) per capita in this region represent 65% of Poland's average. The Podlaski region's share in Poland's GDP is lowest in the country and amounts to 2.3%. Its value per capita accounts for 72% of Poland's average. The area shared by the three forest districts is inhabited by about 50 thousand people, living mainly in rural areas.

The total area of the above three forest districts amounts to 52.4 thousand hectares, of which 50 thousand hectares are covered with forests including 12 thousand hectares of protective forests and 3.3 thousand hectares of reserves. Nearly half of the area is covered by fertile forest habitats. In the species composition, pine dominates (15 thousand hectares), followed by spruce (13 thousand hectares) and birch (11.5 thousand hectares). A high proportion of stands of age class 4, and older, covering 31.2 thousand hectares is a distinctive feature of the Białowieża Primeval Forest. The timber resource of one hectare of the afforested area amounts to 269 m³ of merchantable timber, and the average annual increment is 3.7 m³/ha. The annual yield of merchantable timber slightly exceeds 120 thousand m³, or 4 m³/ha. 294 workers are employed in forest districts cooperating with forest service departments, which give 5.6 worker/1000 ha of total area. The average volume of annual timber yield per worker amounts to 431 m³.

The forest districts of Białowieża, Browsk and Hajnówka belong to the Regional Directorate of State Forests in Białystok, where every thousand hectares of afforested area creates 13 jobs on average, both on the side of receivers and suppliers associated with forest management. On the other hand, every 1 thousand m³ of harvested timber contributes to the creation of more than 2 jobs. In other words, forest management production worth USD 285.7 thousand generates 37 jobs in the business entities associated with forestry [Zajac *et al.* 2004].

■ Research method

The I-O analysis developed by the American Nobel Prize winner W. Leontief (1931) is an ideal tool for determining the economic aspects of every type of business activity, in this case – of forest districts of the Białowieża Primeval Forest. This method is based on the analysis of historical data; it does not use hypothetical assumptions, but is a precise and objective tool. It allows not only for evaluating the impact of forestry on regional development, but also for determining the extent of connections between forest management and other sectors of the economy. The links between forest management and the environment can be presented in terms of cash flows:

- 1) outgoing from forest districts to the environment (the rest of the regional economy) and representing the value of purchased goods and services, the value of purchased labour and the value of taxes and dues,
- 2) incoming to forest districts from the environment for the sold forest management services and products, and other revenues including subsidies.

In the classical approach to the methods, the two above-mentioned cash flows (“to” and “from” forest districts) can be presented in the form of a matrix limited to one line and one column (Table 1). The column illustrates all branches of the economy from the environment of forest districts, which are providers of goods and services, and recipients of cash flows. The line represents all receivers of forest goods and services for which forest holdings obtain a defined cash flow.

TABLE 1
I-O diagram for forest districts in the Białowieża Primeval Forest with 17 branches of the economy marked with letters A,B, ... Q (Gołos *et al.* 1999)

Suppliers	Receivers					
	Section A	Section B	...	Section Q	End consumer	Global production
Section A	X_{AA}	X_{AB}	...	X_{AQ}	C_A	X_A
Section B	X_{BA}					
...	...					
Section Q	X_{QA}					
Pay-roll	V_A					
Added value	S_A					
Global production	X_A					

In the presented matrix, elements X_{AA} , X_{AB} , ... X_{AQ} stand for the amount of cash which in 1998 flowed to the forest districts under study for the goods and services sold by those forest districts to individual branches of the economy. If we add to this the forest districts' revenues from the production sold to end consumers C_A , we shall obtain global production value X_A of the examined forest districts.

$$X_A = X_{AA} + X_{AB} + \dots + X_{AQ} + C_A$$

An identical equation applies to the sum of elements X_{AA} , X_{BA} , ... X_{QA} determining the amount of cash expended for the purchase of goods and services necessary for forest production coming from individual sections (after adding payroll expenses V_A and taking into consideration value S_A).

The results of the research carried out using the above-mentioned method are presented in this publication in two different variants. In the first variant, the criterion used is the direction of cash flows with the division, by the temporal length of their impact, into the internal circle marked E (population, public and business entities of all the communes situated within the limits of the Białowieża Primeval Forest), and the external circle marked O (all the public and business entities from outside the Białowieża Primeval Forest communes having some connections with forest districts). Taking the above division into consideration, there are possible two directions of cash flows:

- from the socio-economic environment of forest management to forest districts,
- from forest districts to the socio-economic environment of forest management.

In the second variant, the results can be presented as broken up by the type of the impact of forest management on various spheres of public life. In this way, we can divide cash flows which have influence on the region's economic aspects and the closely related social aspects including, first of all, the creation and maintenance of jobs associated with the forest-and-wood sector. The above mentioned two ways of analysing obtained results are presented in the work using the I-O method applied to forest districts of the Białowieża Primeval Forest as examples.

■ Research results

Forest districts of the Białowieża Primeval Forest as purchasers of goods and services – structure of cash flows outgoing from forest districts to the socio-economic environment

The business activity of the forest districts of the Białowieża Primeval Forest requires from them continuous procurement of necessary goods and services, as well as payment of the related dues and taxes. This is illustrated in Figure 1 which shows that the amount of USD 4,832 thousand flowed to the socio-economic environment (circle E+O) of which up to USD 2,773 thousand (57.38%) flowed to circle E, represented by the institutions and population of the communes situated within the limits of the forest districts of the Białowieża Primeval Forest under study.

In the cash flows going to the environment, section A – Forestry has the dominant share. Forest districts of the Białowieża Primeval Forest expended a total amount of USD 2,658 thousand (55.01%) in its favour, of which USD 2,241 thousand (46.38%) went to the internal circle (E). The composition of major expenses in favour of the Forestry section (USD 2,658 thousand) is as follows:

- 1) remuneration for forest enterprise staff – USD 1,297 thousand (circle E),
- 2) fees for services of forest service departments – USD 794 thousand (circle E),
- 3) payment for purchases from other forestry units – USD 371 thousand, of which USD 137 thousand (circle E) and USD 234 thousand (circle O),
- 4) mark-ups for maintaining the superior structure and fees for forest management services – USD 174 thousand (circle O).

The second place was assigned to the section “Public administration” which received an amount of USD 1,479 thousand (30.61%) from the forest districts under study, of which USD 327 thousand went to the internal circle. The cash flow feeding the above mentioned section is composed of, among others:

- 1) insurance premium payments for forest enterprise staff – USD 728 thousand (circle O),
- 2) forest tax – USD 308 thousand (circle E – local government budgets),
- 3) income tax on forest enterprise staff salaries – USD 282 thousand (circle O),
- 4) VAT – USD 105 thousand (circle O),
- 5) The State Fund for the Rehabilitation of Disabled Persons (PFRON charge on salaries of forest enterprise staff) – USD 31 thousand.

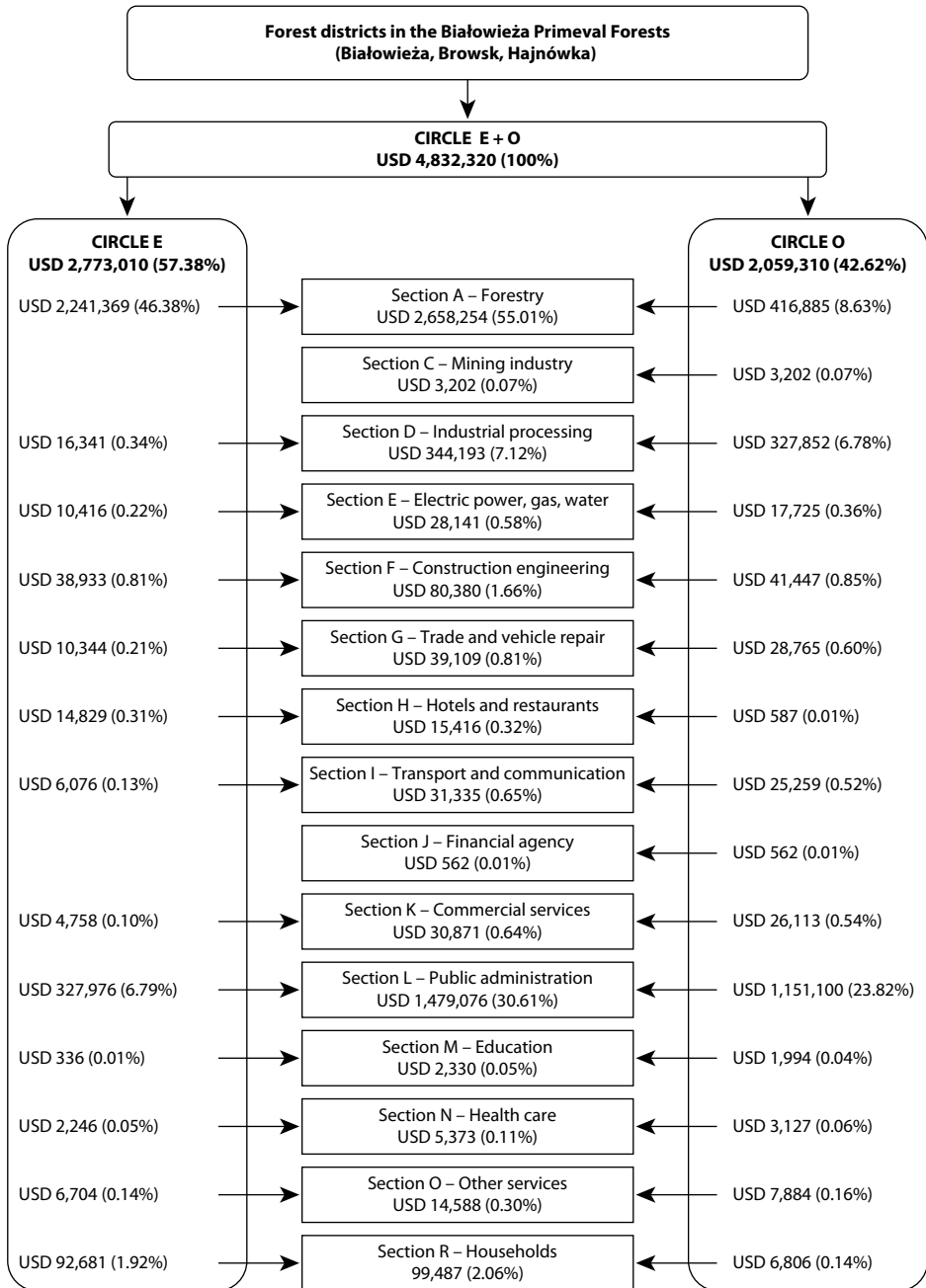


Fig. 1. Cash flows outgoing from the forest districts in the Białowieża Primeval Forest to the socio-economic environment by circle and section

The third place in the expenditure composition went to the section “Industrial processing”, for which the forest districts of Białowieża Primeval Forest expended a total amount of USD 344 thousand (7.12%). This applies particularly to the purchase of products, such as: clothing, office materials, solid and liquid energy carriers, office equipment and computers, as well as mechanical vehicles. It is worth noticing that a majority of these expenditures went to business entities from external circle (O) and amounted to USD 327 thousand (95.05%).

The fourth place went to “Households” (private person services: cleaning-up, waste removal, etc.), whose value derived exclusively from circle E and amounted to USD 99 thousand.

The last recipient of cash flows from forest districts in excess of 1% is “Construction engineering”, from which forest districts of the Białowieża Primeval Forest purchased goods and services for a value of over USD 80 thousand, nearly half of it from circle E and another half from circle O.

Summarizing the expenditures of forest districts related to forest management, it should be emphasized that of the total amount of USD 4,832 thousand, taxes and dues amounted to USD 1,465 thousand (30.3%). Of this sum, over USD 1,105 thousand went to the State Budget, i.e. to the external circle (O), while USD 360 thousand – to commune budgets of the Białowieża Primeval Forest.

Forest districts of the Białowieża Primeval Forest as sellers of goods and services – cash flow from the socio-economic surrounding of the Białowieża Primeval Forest

The forest districts under study are linked with the socio-economic environment also through the incoming cash flows from the sale of products, rendered services and intra-sectoral subsidies. Figure 2 shows that forest districts received a total amount of nearly USD 5,170 thousand, of which USD 2,698 (52.19%) came from the internal circle (E) and USD 2,471 thousand (47.81%) from the external circle (O).

The cash flow from the sale of timber raw material had a dominant share in the revenues of forest districts amounting to USD 4,499 thousand (80.91%), of which USD 4,057 thousand came from the section “Industrial processing” (wood processing industry, pulp and paper industry) and USD 441 thousand from the section “Households” (sale of timber, including fuel wood, to private persons). In the case of plants processing wood, cash flows of higher values came from circle E – USD 2,325 thousand (57.32%). From the external circle, that is from outside of the communes of the Białowieża Primeval Forest came a cash flow of USD 1,732 thousand (42.68%). The division of cash flow is similar to that in the case of private recipients – USD 345 thousand (78.23% of the value of cash flow) are funds from the inhabitants of the communes in the Białowieża Primeval Forest area.

Of the remaining amount of revenues equalling USD 670 thousand, subsidies under the section “Forestry”, deriving in total from the external circle, constitutes the largest share amounting to USD 624 thousand. The other sections supply forest districts with a small cash flow of nearly USD 46 thousand, of which USD 27 thousand come from circle E.

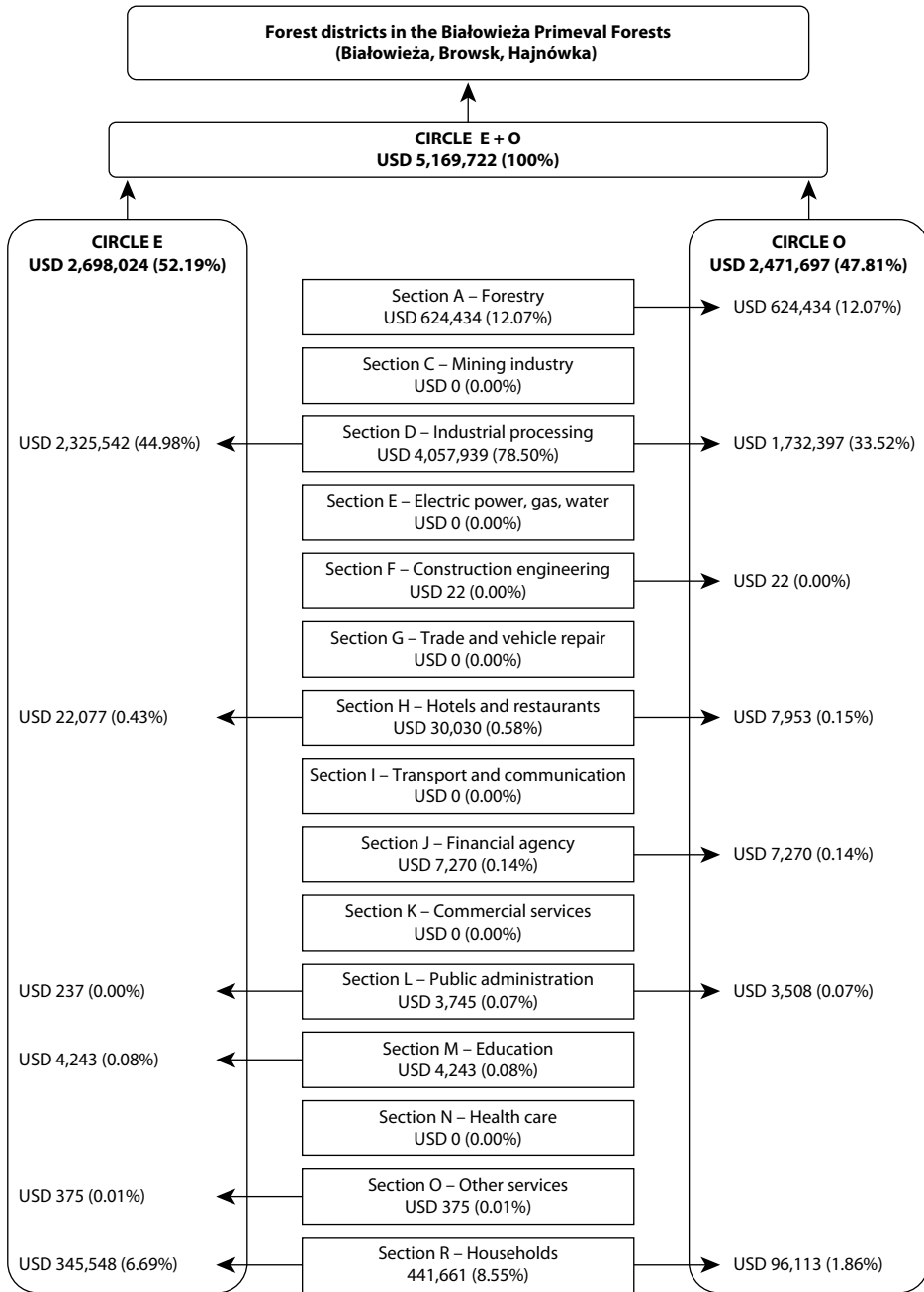


Fig. 2. Cash flows incoming to the forest districts in the Białowieża Primeval Forest from the socio-economic environment by circle and section

The taxes and dues paid by the wood processing industry for the purchase of timber is an additional effect accompanying the most important cash flow received by forest districts of the Białowieża Primeval Forest. The total charges related to the above amounted to USD 1,708 thousand, of which USD 1,397 thousand went to the State Budget, while USD 311 thousand – to the budgets of the communes in the Białowieża Primeval Forest.

Economic and social aspects of forest management in the forest districts of the Białowieża Primeval Forest

The economic aspects of any kind of business activity include first of all production volume, value of production sold, and value of purchased means of production. All the above-mentioned factors decide about the extent and strength of economic ties, in this case – between forest management and other business entities in the region. Among many indicators, the following deserve special attention:

- 1) for each cubic meter of harvested timber, the forest districts of the Białowieża Primeval Forest purchased, in the environment, goods and services for the amount of USD 38,
- 2) forest management carried out on an area of 52,387 hectares required purchases of goods and services amounting to nearly USD 92/ha,
- 3) in the three forest districts, over 127 thousand m³ of timber raw material worth USD 4,160 thousand were harvested in 1998,
- 4) over 72 thousand m³ of timber worth USD 2,428 thousand were purchased by receivers from the area of the Białowieża Primeval Forest communes,
- 5) The State Budget received USD 1,106 thousand in revenues from taxes and dues related to business activity, of which:
 - 66.1% of the amount (USD 730 thousand) included obligatory insurance premium payments (ZUS),
 - 21.4% (USD 237 thousand) – income tax from natural persons (forest enterprise staff),
 - 9.5% (USD 106 thousand) – VAT,
 - 3.0% (USD 33 thousand) – PFRON premium payment.
- 6) the budgets of the Białowieża Primeval Forest communes received an amount of USD 360 thousand related to the activity of forest districts, of which:
 - 81.6% (USD 294 thousand) – as forest tax,
 - 12.5% (USD 45 thousand) – as share in income tax from natural persons (forest enterprise staff),
 - 5.1% (USD 18 thousand) – as tax on real estate and transport means,
 - 0.6% (USD 2 thousand) – as other forest enterprise charges,
 - 0.2% (USD 0.6 thousand) – as agricultural tax.

In total, the forest-timber sector paid an amount of USD 2,503 thousand to the State Budget and USD 671 thousand to the budgets of the Białowieża Primeval Forest communes. Therefore, it can be assumed that 1,000 m³ of timber raw material is a source of taxes amounting to USD 26.0 thousand, of which USD 11.0 thousand are paid by forest districts, USD 1.4 thousand – by forest service departments, and USD 13.6 thousand – by receivers of forest goods and services (wood-processing industry).

The social aspect of forest management is first of all reflected in jobs in forestry and in all sectors of the economy which are related to the demand on forest production or supply for forest management. On the basis of the conducted research, the following can be concluded:

- 1) 267 people were employed in the forest districts under study,
- 2) the remuneration paid to forest enterprise staff induced a total number of 91 jobs in both the area of Białowieża Primeval Forest communes and in their farther and closer environment,
- 3) the extent of work in the forest districts of the Białowieża Primeval Forest enabled creation of 185 full-time positions for forest workers employed in forest service departments,
- 4) the cash flows which forest districts earmarked for the purchase of goods and services created directly 322 jobs, of which 144 in the territory of the Białowieża Primeval Forest communes,
- 5) the processing of the wood harvested in forest districts created jobs for 1,111 people, of which 657 worked in the territory of the Białowieża Primeval Forest communes,
- 6) the unlimited access to forest floor vegetation and mushrooms enabled the commune inhabitants to collect fruits, mushrooms and herbs for the value of USD 458.2.

The above analysis shows that every 1,000 m³ of produced, sold and processed wood creates a total number of 15 jobs – 2 jobs for forest districts, 4 for the suppliers of goods and services, and 9 – for the receivers of forest goods and services.

■ Recapitulation

1. Forest districts, forest service departments and wood-processing plants have directly or indirectly created 1,976 jobs, of which 1,253 are jobs created in the Białowieża Primeval Forest communes.
2. Every thousand m³ of harvested timber raw material under the Białowieża Primeval Forest conditions create 15 jobs.
3. In value terms, timber raw material worth USD 2,714 generates one job.
4. Taxes and dues included in the average price of 34.0 USD/m³ of timber harvested in the Białowieża Primeval Forest account for 33%, or USD 11.0.
5. 1 m³ of timber harvested and processed in the Białowieża Primeval Forest whose average value in the ready product amounted to USD 97.0 is encumbered with taxes and dues amounting to USD 26.0 (27.0%) of the final product value, of which:
 - 21.0 USD/m³ – are taxes and dues which constitute state budget revenues,
 - 5.0 USD/m³ – are taxes and dues which constitute commune budget revenues.

The presented results illustrate the amount of potential costs of extending the territory of the Białowieża Primeval Forest. Moreover, they clearly indicate the economic and social consequences of changing the character of forest resource protection from commercial to conservational to the Białowieża Primeval Forest communes and their inhabitants. The comparison of the current results with those of the I-O analysis performed for the

Białowieża Primeval Forest could provide a full view of the costs and benefits deriving from the planned changes.

In the above analysis, financial links were omitted between the forest enterprise of the Białowieża Primeval Forest and the environment related to all possible non-economic benefits and services (recreational, protective and other forest functions). Their inclusion would require a totally different approach, especially regarding the method of assessment or compilation of empirical material. The authors hope that in foreseeable future also those, non-market elements will be included in the cost and benefit analysis of a forest farm. This will enable more comprehensive analysis of the role forests play in the socio-economic life in our country.

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■ Streszczenie (Summary)

Znaczenie leśnictwa w społeczno-gospodarczym rozwoju regionu rolniczego w Polsce (analiza przepływów międzysektorowych)

Celem badań było ustalenie rodzaju i siły powiązań gospodarki leśnej z otoczeniem społeczno-gospodarczym oraz konsekwencji dla miejscowych gmin i ich mieszkańców w kontekście planowanego powiększenia obszaru Białowieskiego Parku Narodowego (BPN) o trzy nadleśnictwa (Białowieża, Browsk, Hajnówka). Badania przeprowadzono za pomocą metody analizy przepływów międzysektorowych (*input-output analysis*). Dotyczyły one rynkowych powiązań gospodarki leśnej (trzech nadleśnictw) z otoczeniem społeczno-gospodarczym. W badaniach pominięto natomiast powiązania nadleśnictw z otoczeniem związane ze świadczeniem pozaprodukcyjnych funkcji gospodarki leśnej, które nie są rejestrowane w dokumentach finansowo-księgowych.

Uzyskane wyniki badań wskazują na liczne powiązania gospodarki leśnej z otoczeniem społeczno-gospodarczym oraz na duże znaczenie leśnictwa w rozwoju obszarów wiejskich tego regionu. Świadczą o tym m.in. następujące wskaźniki:

Nadleśnictwa, zakłady usług leśnych i zakłady przerobu drewna stworzyły bezpośrednio i pośrednio ogółem 1976 miejsc pracy.

1. Każdy 1 tys. m³ pozyskanego surowca drzewnego w nadleśnictwach BPN tworzy 15 miejsc pracy.
2. W ujęciu wartościowym, pozyskany surowiec drzewny o wartości 2 714 USD generuje jedno miejsce pracy.
3. W przeciętnej cenie 34 USD/m³ drewna pozyskanego w nadleśnictwach BPN opłaty i podatki na rzecz budżetu państwa i gmin stanowią 33%, tj. 11 USD.
4. 1 m³ drewna pozyskanego i przerobionego w BPN, którego przeciętna wartość w gotowym produkcie wyniosła 97 USD obciążony jest opłatami i podatkami w wysokości 26 USD (27%) wartości produktu finalnego, w której:
 - 21 USD/m³ stanowią opłaty i podatki odprowadzone do budżetu państwa,
 - 5 USD/m³ opłaty i podatki trafiające do budżetów gmin.

Przedstawione wskaźniki syntetyczne obrazują istotne znaczenie lasu i gospodarki leśnej dla rozwoju gmin w otoczeniu BPN i lokalnej społeczności. Włączenie nadleśnictw do parku ograniczyłoby wpływ leśnictwa na rozwój obszarów wiejskich. Ocena skutków gospodarczych i społecznych tego przedsięwzięcia wymaga dalszych badań.