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Assessing economic pressure on the forest fund of Maramureș County – Romania

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ABSTRACT: Romania is also included among the European Union countries where deforested areas have radically increased in recent years, with mountain areas being the most affected. The pressure on the forest fund was analysed in the Maramureș County, as one of the most deforested counties of Romania. In view of assessing the forest area evolution, forested and deforested areas have been calculated for the period 2001–2012, using the Global Forest Change 2000–2012 database provided by the Department of Geographical Sciences, Maryland University. The economic pressure quantification was monitored by developing a database on economic activities based upon the loggings carried out in the period 2001–2012. This database comprises the number of companies, their turnover, profit and the number of employees for the economic sectors causing pressure on the forest fund. The outcomes show a dramatic increase in deforested areas, amounting to over 16,500 ha in the Maramureș County. Nearly 5,000 ha have been deforested in Borșa, the commune with the largest deforested areas in the period 2000–2012, causing major imbalances to the local ecosystem.

Keywords: deforested areas; forested areas; forestry economics; territorial management; territorial systems

In the last decades, Romania has registered an alarming increase of deforested areas, the scale of this phenomenon generating strong reactions from the civil society who believe that excessive cutting of forests is an issue of the national security.

The forest may bring multiple benefits to society at an economic, social and environmental level, therefore it may have multiple functionality where timber production can be supplemented by environmental protection and recreation (Turner 1989; Price et al. 2003; Tempesta, Marangon 2008). Although the benefits of forest areas are obvious from socio-economic and environmental aspects, global deforested areas extend from year to year. Hence, the reduction of forest areas has currently become one of the highest challenges for decision-makers, given the enormous pressure exerted by economic sectors which require increasing volumes of timber. The complexity of deforesting effects leads to ever more expensive territorial management strategies.

By the products provided, the forest fulfils multiple functions, such as the economic, environmental, as well as the social function. The abovementioned functionality determines the significant

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role of forest areas, globally, in the fight against pollution, poverty and for environmental protection. This role is acknowledged by a series of official documents, at the global (UNCED 1992, 2012; FAO 2014) and European Union level (European Commission 2008). According to these documents, the extension of deforested areas is an issue of general interest, requiring strong actions to reduce their effects. However, globally, the ratio between the forested and deforested area remains an on-going concern, with continuous efforts to maintain forested surfaces at the higher value possible (potentially constant) (Chakravarty et al. 2012; Gao et al. 2013; Boucher 2014).

In this context, the study of deforested area evolution, specifically of the causes determining the said evolutions becomes particularly important for the local communities where the forest is a significant player from an economic perspective (Turner 1989; Zhang et al. 2005; Gios 2008; Goio et al. 2008; Paletto et al. 2012).

The Romanian forest area is estimated to account for approximately 29% of the country's total surface, being well under the European Union average, namely 40% (European Commission 2008). Nowadays, given the growth of certain economic businesses, Romania faces great pressure on the forest fund, therefore an increasing volume of raw materials is required. Lately, legally and illegally logged areas have been extended as a consequence of the exercised pressure, particularly by economic factors (Romanian Court of Accounts 2013). As a direct consequence, forested areas are reduced, and the negative effects on the natural and socio-economic environment are multiplied. Therefore, the forest fund management becomes an increasingly imperative matter of public interest (Juutinen et al. 2014) which may positively affect the environment and local economies, if carried out in a performing manner (Daniels et al. 1991; Zhang et al. 2005; Pir Bavaghar 2015).

MATERIAL AND METHODS

The research methodology consisted of two components: the dynamics of forested areas and the dynamics of the relevant indicators for the economic sectors that put pressure on the forest. This approach underlined two main aspects: the evolution of the forest areas and the extent that deforestation wood found in the local economy, in the economic sectors that affect the forest ecosystems.

The general trend of development of forest areas has been considered for a long period of time,

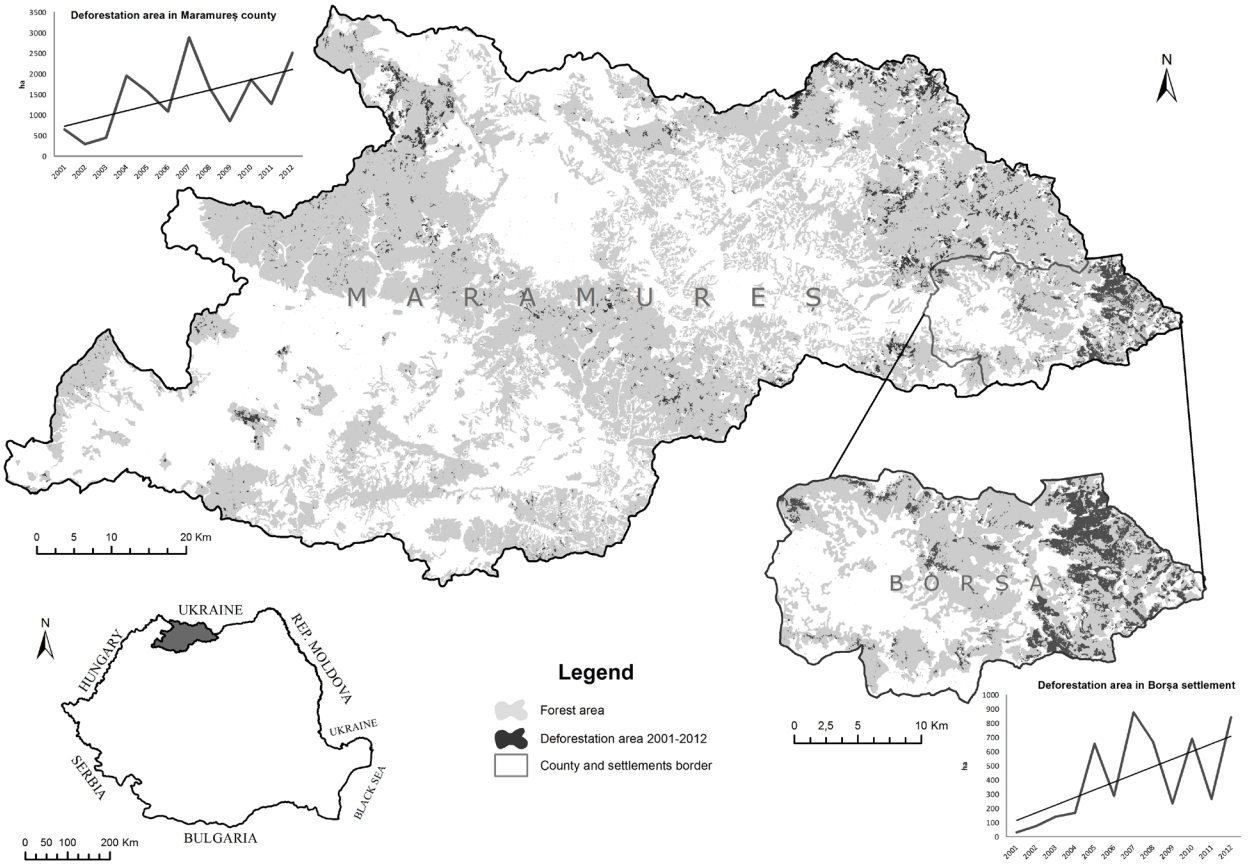

Fig. 1. The deforested area of the Maramureș County (Hansen et al. 2013)

2000–2012 to identify some patterns of evolution. After 2000 there is a contradictory situation, when official data show an increase in forest areas, but legal and illegal deforestation has gathered pace, and has come to be considered a matter of national security. In order to clarify the situation other data sources of information were used than those offered by the National Institute of Statistics.

The Global Forest Change 2000–2012 database provided by the Department of Geographical Sciences, Maryland University, was used to assess deforested areas. This database illustrates the analysis output of 654,178 Landsat 7 ETM+ (University of Maryland, Maryland, USA) images, by which the global evolution of forest surfaces was monitored in the period 2000–2012 (Hansen et al 2013).

Starting from this analysis, with the GIS (ArcGIS 9.X; ESRI, Redlands, California, USA) platform, the deforested area and forested land areas have been computed for Romania (including the Maramureș County and its corresponding territorial administrative units) for the period 2001–2012 (Fig. 1). The economic pressure on the forest fund was quantified via the analysis of economic activities depending on the use of forest resources within the analysis period of 2000–2012. The resulting database comprises: the number of companies, their turnover, profit and the number of employees for the following NACE codes – Classification of Activities in the National Economy: 0220 – Logging, 0240 – Support services to forestry, 1610 – Sawmilling and planing of wood, 1621,1622,1623,1624 and 1629 – Manufacture of wood products, 4673 – Wholesale of wood, construction materials.

In methodology the R Software was applied. With the statistical data, some histograms have been constructed for the economic activities, considered to put pressure on forest ecosystems, and also some plots showing the relation between companies and profit from the above-mentioned activities. Using this methodology, the way in which the contribution of the wood exploitation industry could be found in the local economy, is better underlined.

RESULTS

The evolution of the forest area for the period 1800–2012 has a tendency to decrease as a result of pressure from growing economic sectors consuming wood (Fig. 2). After 2000, official data show an increase in forest areas, a situation difficult to understand given that deforestation has taken legal and illegal proportions. The analysis of query data from Landsat 7 ETM+ images explains this situation. Official information is confined to areas with forest destination, regardless of whether or not the forest. The analyses of detailed information provided by Landsat 7 ETM+ images showed a significant increase in deforested areas (Fig. 3), many of which are not registered in official data. The detailed research conducted in the Maramureș County and Borșa commune has demonstrated this.

At the Maramureș County level, the evolution of deforested areas follows the same general upward trend (by 1,415 ha·yr^{-1}), however, emphasizing the existence of two period (Fig. 1) with the same characteristic at the general level (prior to the crisis the annual rate of deforestation was 1,264 ha·yr^{-1}, and after the crisis the annual rate was 1,625 ha·yr^{-1}). The analysis of the deforested area evolution within the Maramureș County towns illustrates that the Borșa commune ranks first as the largest deforested area in the analysed interval, namely 4,930 ha. For the Borșa commune (Fig. 4) the evolution of deforested areas follows the same trend as the regional and national pattern.

The analysis of statistical data on the evolution of economic sectors which put pressure on the forest shows a dramatic increase in the number of companies engaged in the logging of wood in Maramureș (Fig. 5). The economic crisis affects all economic sectors, especially services to forestry. The evolution of the number of companies in Borșa

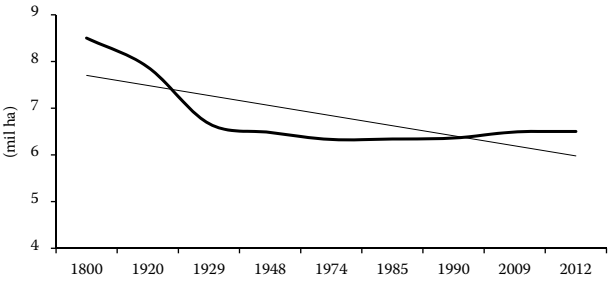

Fig. 2. The evolution of the forest area in Romania during 1800–2012 (National Institute of Statistics)

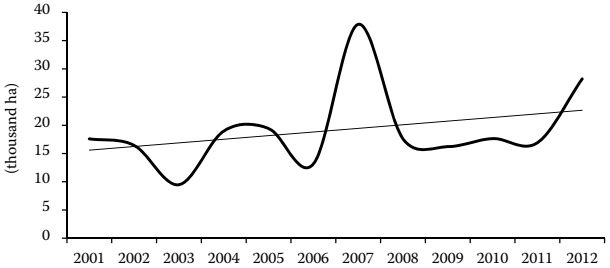

Fig. 3. Evolution of deforested areas in Romania during 2001–2012

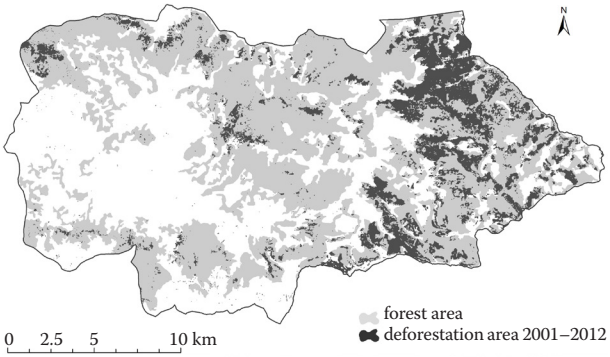

Fig. 4. The deforested area of Borșa (Hansen et al. 2013)

commune shows a situation similar to that of the Maramureș County. All economic sectors register a significant growth, the economic crisis causing oscillations (Figs 6a, d, e) or decreases (Figs 6b, c).

Significant increases are recorded in the wholesale of wood (Figs 5e and 6e) and in the cutting of timber, which indicates a growing pressure on the forest.

Although the number of companies engaged in logging has increased during the period analysed, the number of employees in the same sector decreased (Figs 7a and 8a) because of the introduction of modern machinery. Thus, the primary wood processing, production of logging used as unprocessed collection and production of wood used for energy production, collection, processing of forestry residues, and the production of charcoal are growing, but they need fewer employees.

The sharp drop in the number of employees after 2007 in services to forestry (Figs 7b and 8b) shows a reduction in expenditure for the inventory of forest advisory services on forest management and services for the prevention and fighting of forest fires. It should be noted that 2007 is the year in which and the largest amount of wood was removed from the forests of Romania (Fig. 4). In the woodworking field there were increases in the county (Fig. 7d) and in Borșa (Fig. 8d).

In the reviewed period the highest increases were registered in the trade in wood, both at the level of Maramureș County and Borșa commune with spectacular increases (Figs 7e and 8e). These increases are explaining the growing quantities of timber entering the market.

The analysis of turnover reveals growing pressure on forests of the Maramureș County. Forest stands cut at the level of the county and the administrative unit showed a pronounced growth

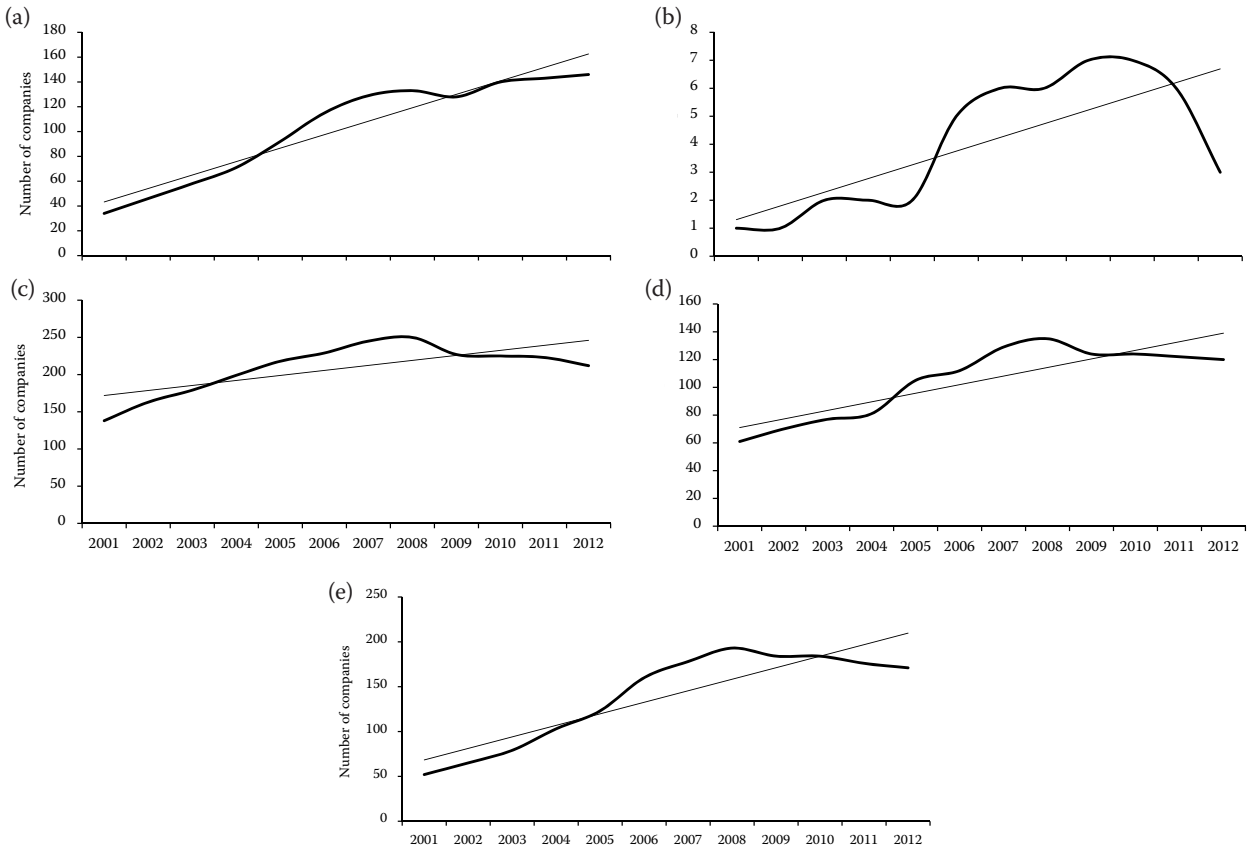

Fig. 5. Evolution of the number of companies in the fields causing pressure on the Maramureș County forest fund (project UB1375/BorgDesign): 0220 – Logging (a), 0240 – Support services to forestry (b), 1610 – Sawmilling and planing of wood (c), 1621, 1622, 1623, 1624 and 1629 – Manufacture of wood products (d), 4673 – Wholesale of wood, construction materials (e)

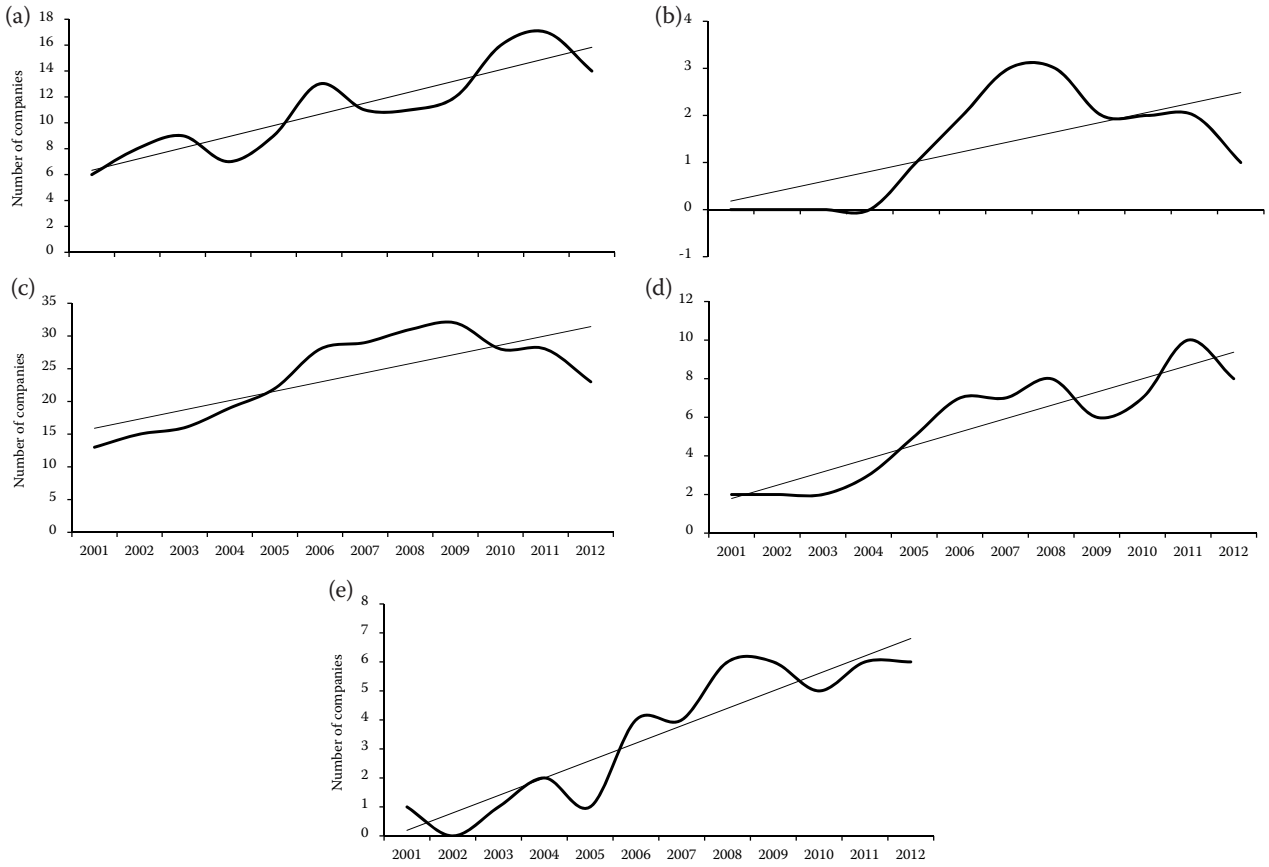

Fig. 6. Evolution of the number of companies in the fields causing pressure on the Borșa commune forest fund (project UB1375/BorgDesign): 0220 – Logging (a), 0240 – Support services to forestry (b), 1610 – Sawmilling and planing of wood (c), 1621, 1622, 1623, 1624 and 1629 – Manufacture of wood products (d), 4673 – Wholesale of wood, construction materials (e)

of this indicator for logging (Figs 9a and 10a) and timber trade (Fig. 10e).

There can be seen an increase in turnover for economic sectors of wood processing (Figs 9c, d, and 10c, d), which is a positive sign for the local economy, knowing that only a small part of revenues from logging remains there.

The evolution of turnover in services to forestry shows a collapse of this sector after 2007 (Figs 9b and 10b) when specific services did not receive any money.

Fig. 11 documents the real image of logging activities at the county level. So, these figures better show the pressure exerted on forest ecosystems. The distribution of profit (a) shows the persistence of the smaller profits from logging activities, the same distribution in the case of employees (b) and turnover (d), except the companies (c), where the concentration is for medium-sized enterprises.

Regarding the relation existing between the companies and the profit from logging activities (Fig. 12), it can be observed that small companies are related with small profits and only for bigger companies the profits are higher. For the entire period, the 1610 NACE code seemed to be the most profitable, except the year 2002, when the 1621 NACE code was the most profitable, and 2008 and 2009, the years after the Global Economic Crisis when the 4673 NACE code developed a more adaptive capacity.

Borșa as a local system is characterized by the same higher concentration (frequency) of smaller profit (a), employees (b), companies (c) and turnover (d) in their distribution (Fig. 13). In the distribution of profit, it can be observed that the frequency is the highest in values above 500,000 lei (lei is the plural for leu, the Romanian National Currency, 1$ USD = 4.1 lei). For the number of employees the frequency is higher for the NACE codes with enterprises of no more than 50 employees and with the turnover above 1,000,000 lei.

For Borșa, the relation between companies and profit shows the same distribution, but for the entire period the places are shared between two NACE codes 0220, which keeps the 1st rank in 2001, 2002, 2004 and 2011 and the 1610 NACE Code, whose 1st rank is isolated both in 2003 and 2012, and then for the entire period from 2005 to 2010 (Fig. 14).

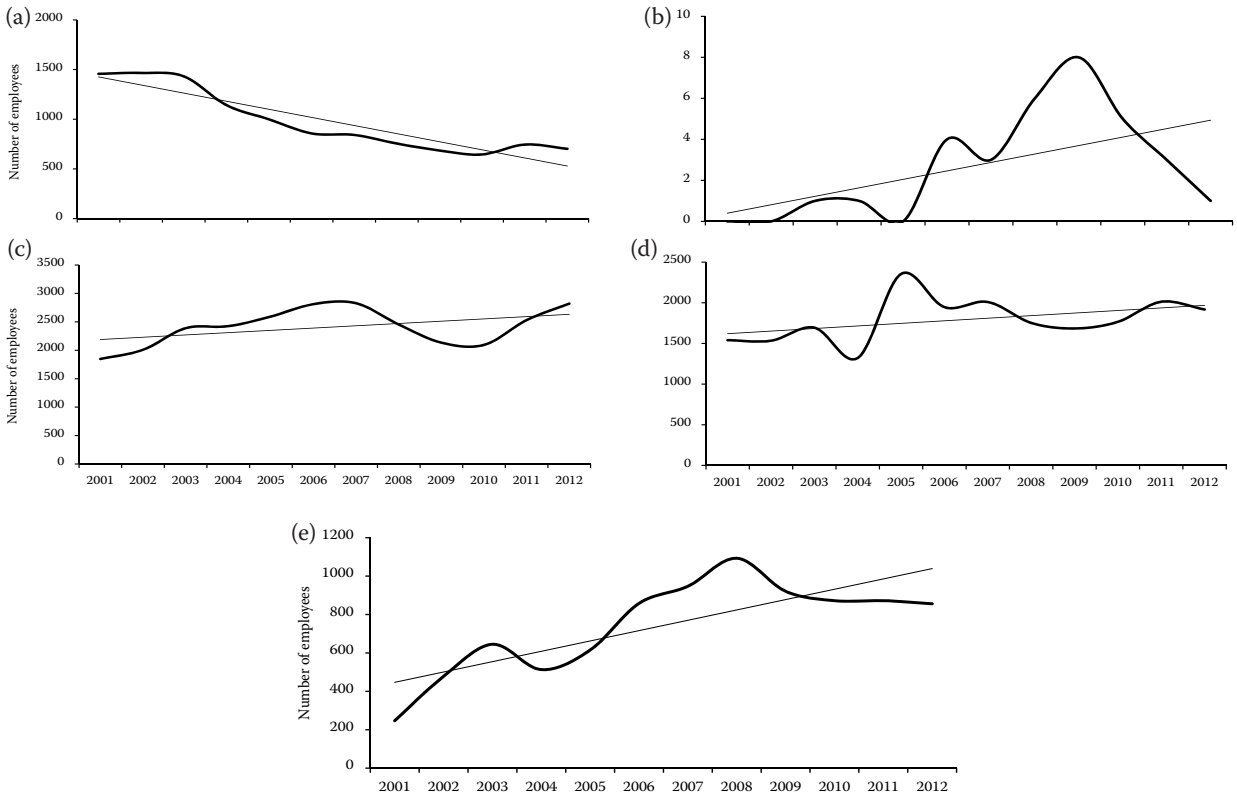

Fig. 7. Evolution of the number of employees in the fields causing pressure on the Maramureş County forest fund (project UB1375/BorgDesign): 0220 – Logging (a), 0240 – Support services to forestry (b), 1610 – Sawmilling and planing of wood (c), 1621, 1622, 1623, 1624 and 1629 – Manufacture of wood products (d), 4673 – Wholesale of wood, construction materials (e)

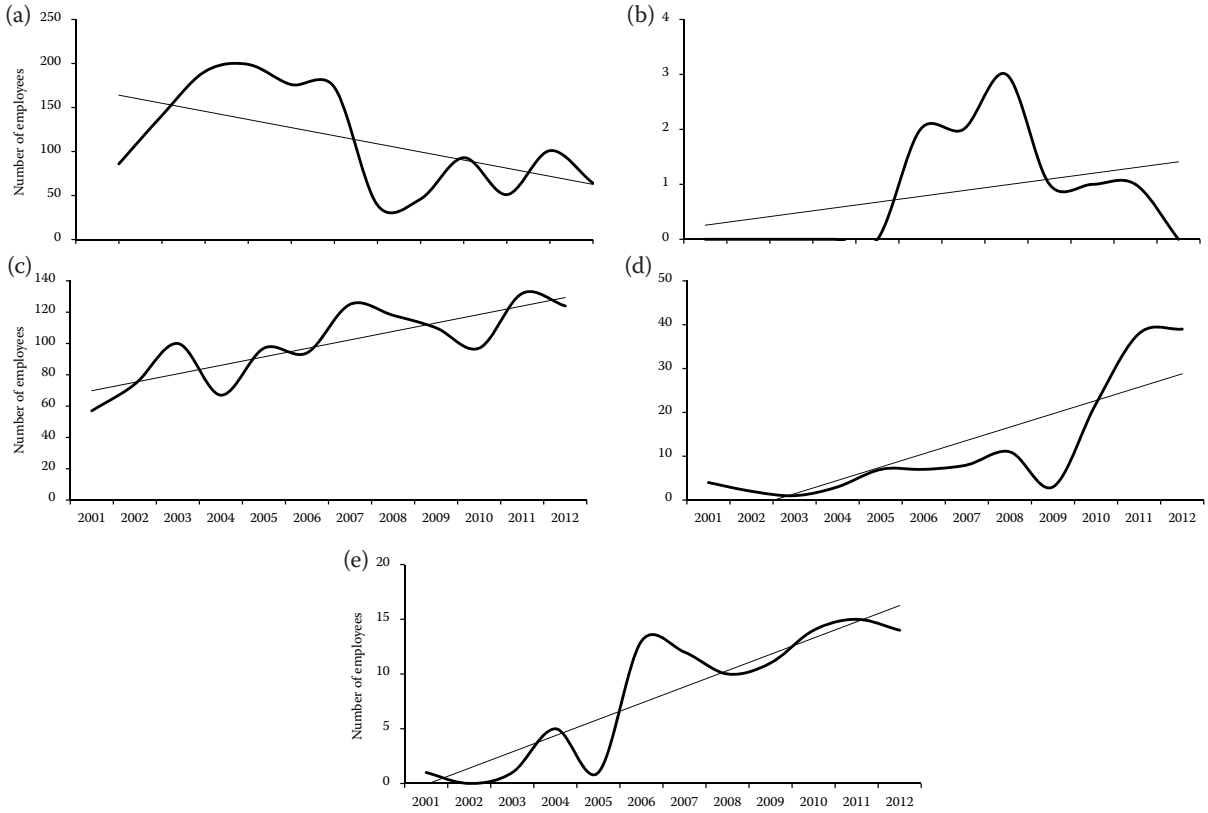

Fig. 8. Evolution of the number of employees in the fields causing pressure on the Borşa commune forest fund (project UB1375/BorgDesign): 0220 – Logging (a), 0240 – Support services to forestry (b), 1610 – Sawmilling and planing of wood (c), 1621, 1622, 1623, 1624 and 1629 – Manufacture of wood products (d), 4673 – Wholesale of wood, construction materials (e)

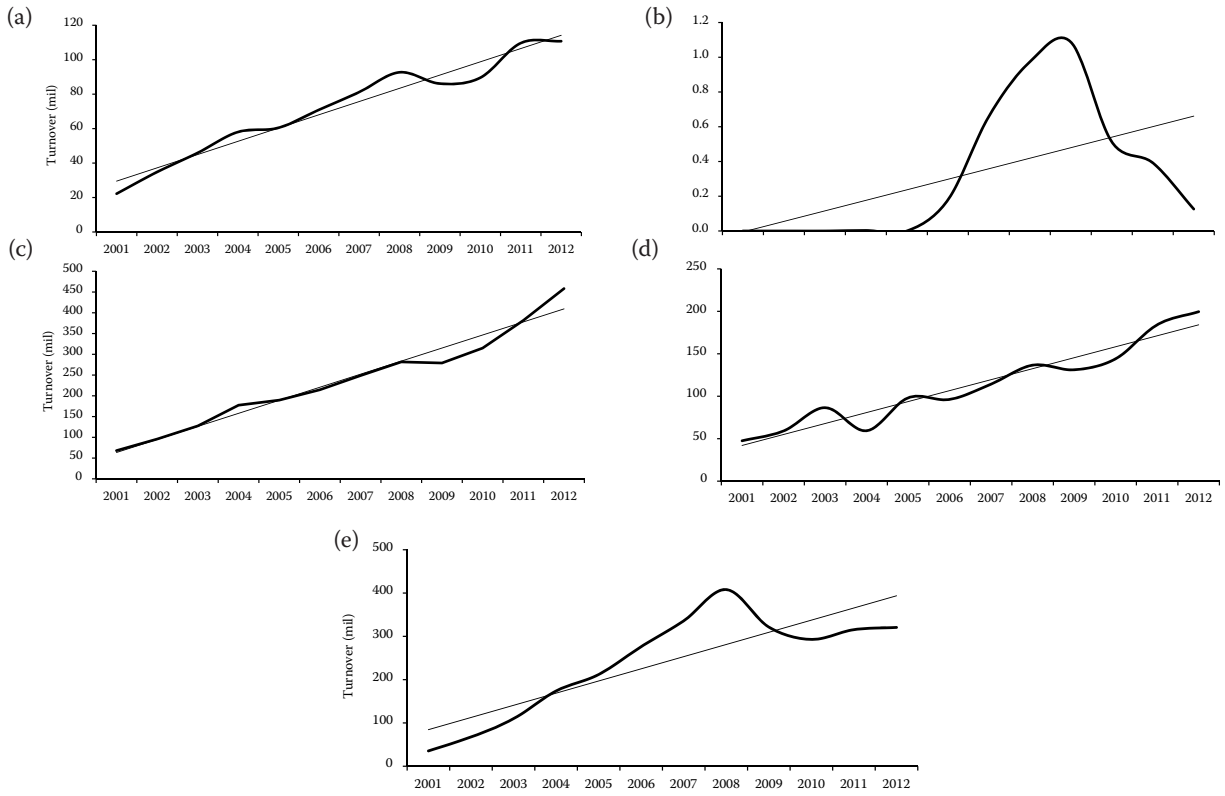

Fig. 9. Evolution of the turnover in the fields causing pressure on the Maramureș county forest fund (thousands Euro, project UB1375/BorgDesign): 0220 – Logging (a), 0240 – Support services to forestry (b), 1610 – Sawmilling and planing of wood (c), 1621, 1622, 1623, 1624 and 1629 – Manufacture of wood products (d), 4673 – Wholesale of wood, construction materials (e)

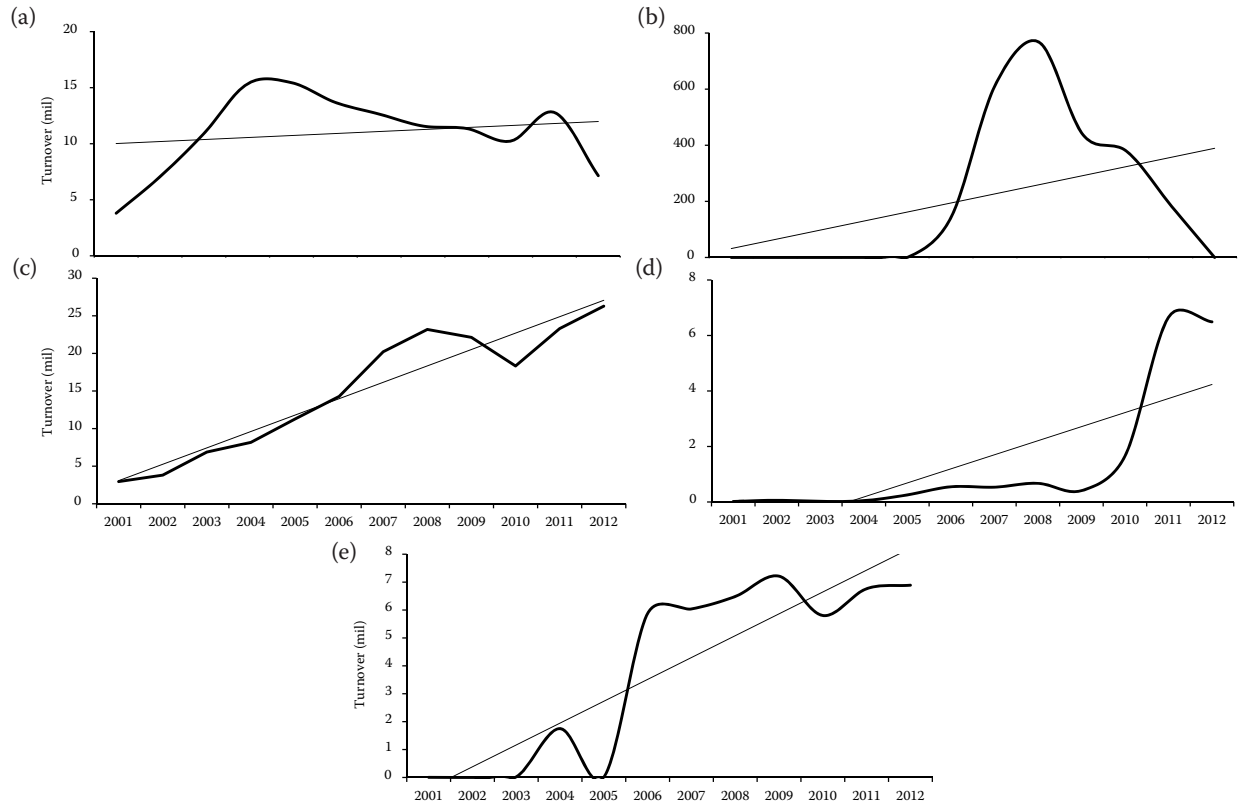

Fig. 10. Evolution of the turnover in the fields causing pressure on the Borșa commune forest fund (thousands Euro, project UB1375/BorgDesign): 0220 – Logging (a), 0240 – Support services to forestry (b), 1610 – Sawmilling and planing of wood (c), 1621, 1622, 1623, 1624 and 1629 – Manufacture of wood products (d), 4673 – Wholesale of wood, construction materials (e)

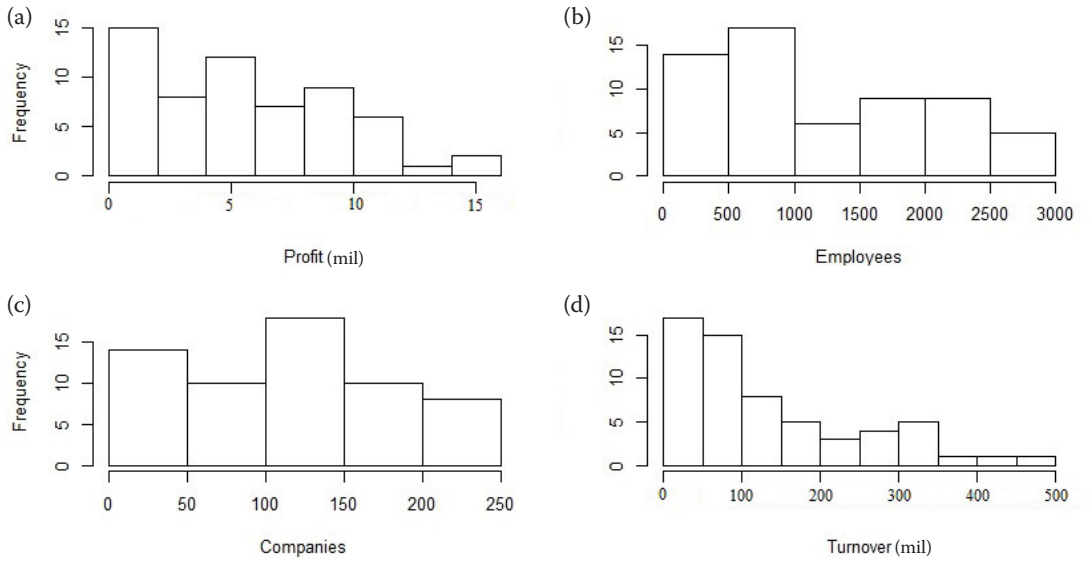

Fig. 11. Logging activities in the Maramureș County: Distribution of profit (a), employees (b), companies (c), turnover (d)

DISCUSSION AND CONCLUSIONS

The expansion of deforested areas may cause slightly significant imbalances at the territorial system level, particularly in those based on forest resources from an economic perspective. The consequences of these imbalances may be significant and may negatively impact local communities from the growth perspective.

Research has revealed alarming increases in deforested areas throughout the entire period examined, grubbed-up areas are much larger than those record-

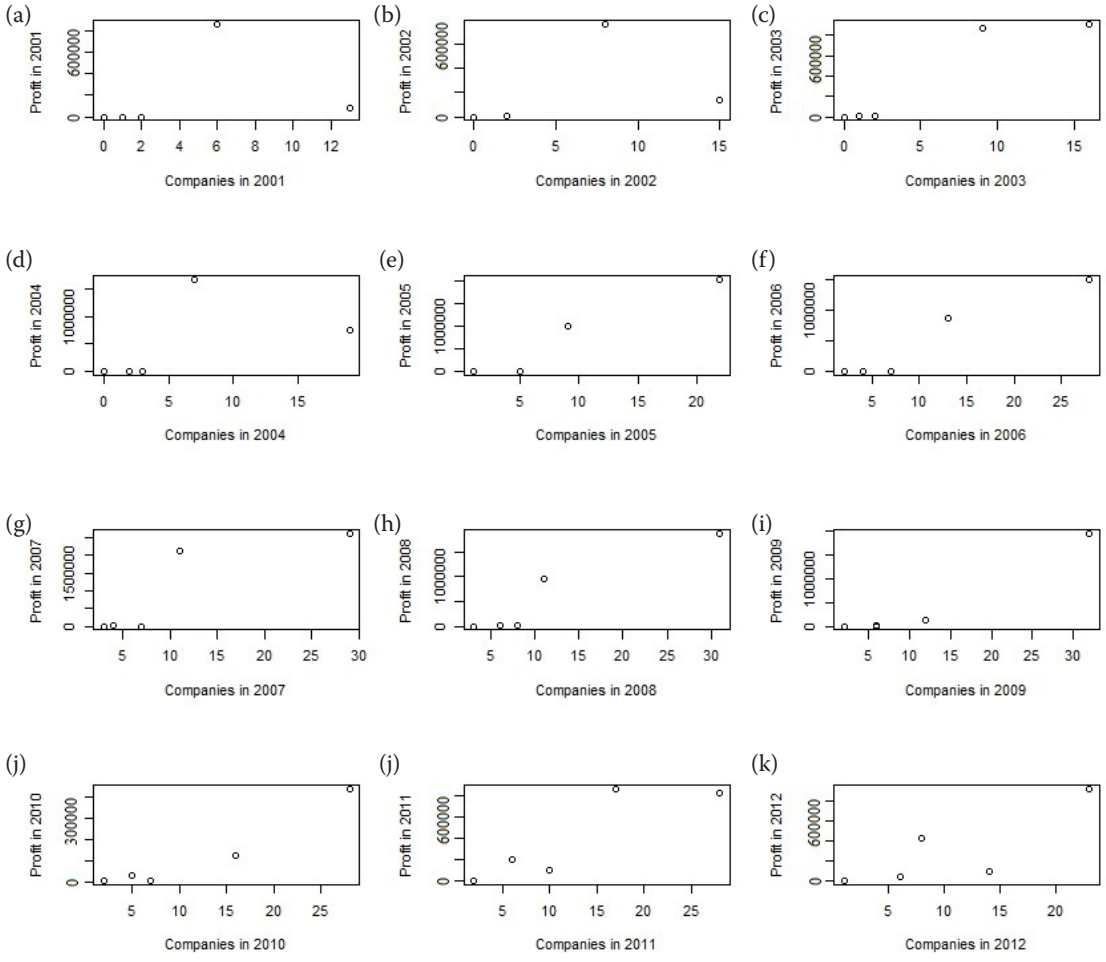

Fig.12. Relation of companies vs. profit from logging activities in the Maramureș County (2001–2012)

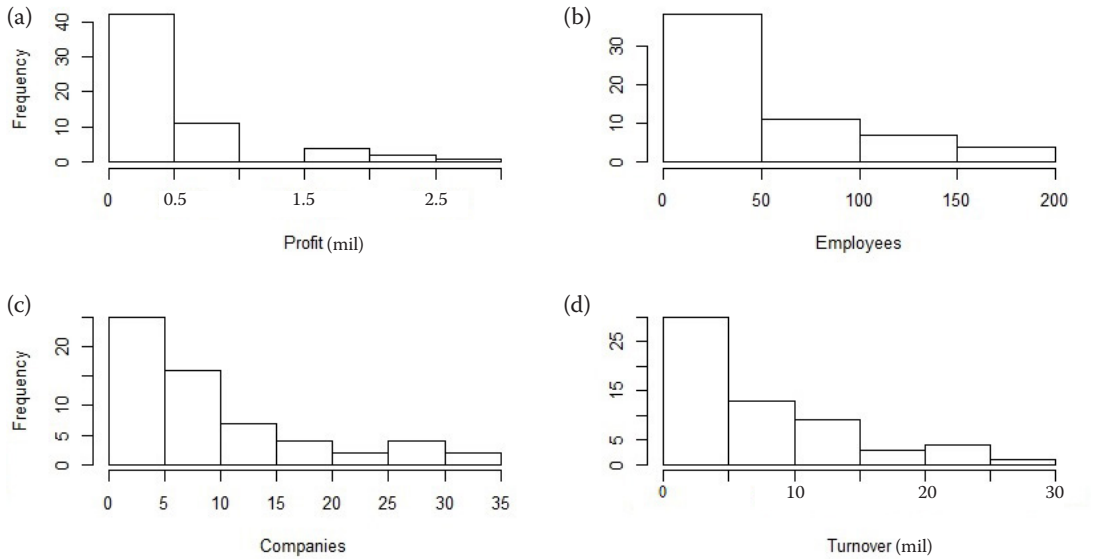

Fig 13. Logging activities in Borsa: Distribution of profit (a), employees (b), companies (c), turnover (d)

ed by state institutions. This shows an increase in illegally harvested forest areas. The analysis of economic sectors which put pressure on the local forests shows an alarming increase that compels decision makers to develop strategic planning documents (Gonzalez, Gonzalez 2015) to strictly stop the phenomenon.

Consequently, the identification of fundamental factors in amplifying or stimulating deforestation and their analysis have become very important both for the scientific environment, and particularly for the authorities, given the complexity of relations established between various systemic com-

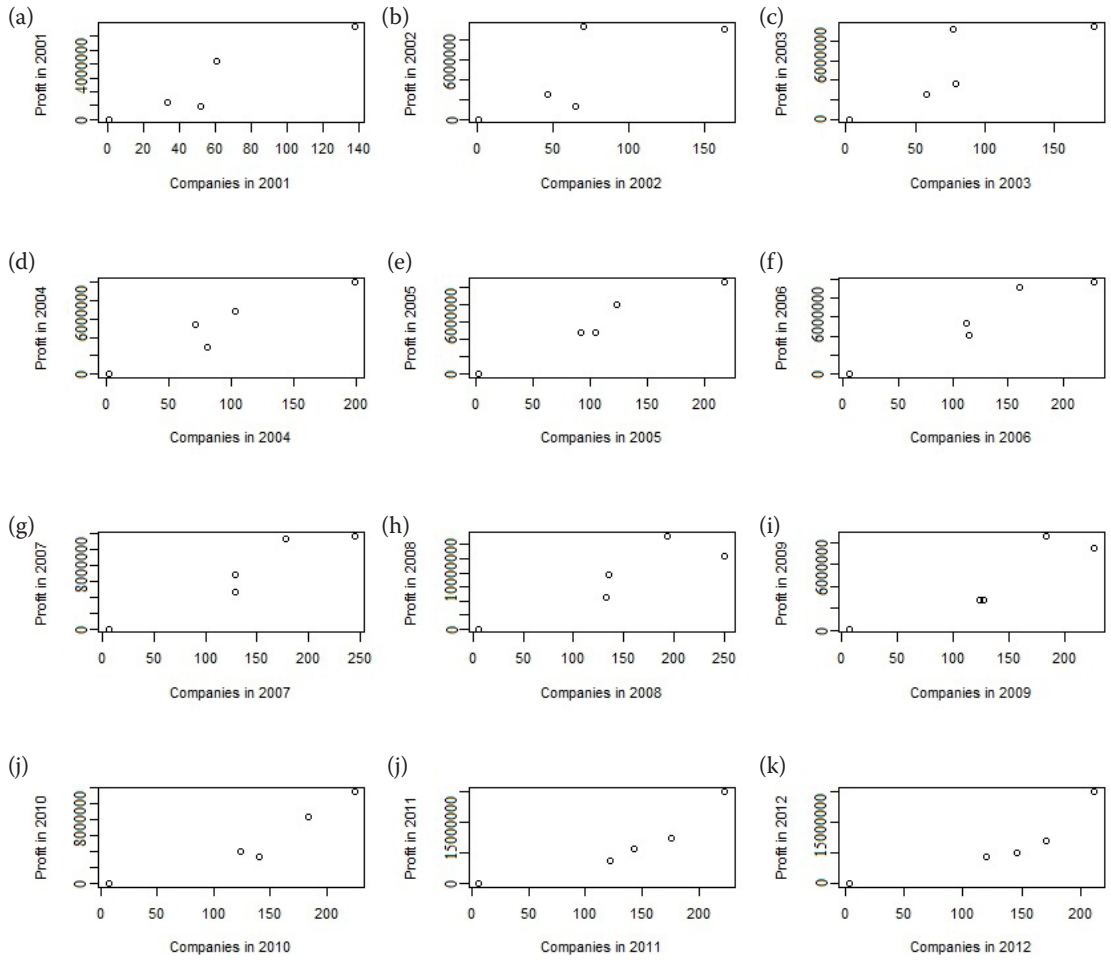

Fig.14. Relation of companies vs. profit from logging activities in Borșa (2001–2012)

ponents where the forest plays an important role (Sedjo et al. 1995; Chomitz, Kumari 1998; Peptenatu et al. 2013; Dang Phan et al. 2014; Murărescu et al. 2014; Prăvălie et al. 2014a, b; Vu et al. 2014). Among the causes that amplify the deforestation phenomenon we note: low revenues of the local communities, excessive growth of economic sectors by logging and timber processing that exceed the local support capacity, legislative gaps. In this context, the need to develop efficient territorial management strategies to reduce the imbalances generated by the forest mass logging, particularly illegal logging, becomes obvious. Large area deforestation will generate progressive effects on the local economic system; the most affected are territorial systems where tourism is a priority (Braghina et.al 2012; Peptenatu et al. 2012a, b, 2013; Petrișor 2015; Pintilii et al. 2016). They should particularly aim at reducing deforestation by limiting industrial logging (DeFries et al. 2010), by reforesting deforested areas or inadequate areas for agriculture (Zhang et al. 2000; Sanchez-Cuervo, Aide 2013), drafting stricter legislation on illegal logging, obtaining support from central and local public authorities for sustainable economic activities at a local level, as well as by involving authorities in the protection and management of the private forest fund. These strategies comprise a requirement for territorial systems with the functional profile based on the forest resources.

References

Boucher D. (2014): How Brazil has dramatically reduced tropical deforestation. Solutions, 5: 66–75.

Braghina C., Merciu C., Peptenatu D., Dobre R., Ianos I.L. (2012): Environment management in the mining areas functionally restructured. Case study – the Petroșani Depression, Romania. Journal of Environmental Protection and Ecology, 13: 2394–2403.

Chakravarty S., Ghosh S.K., Suresh C.P., Dey A.N., Shukla G. (2012): Deforestation: Causes, effects and control strategies. In: Okia C.A.(ed.): Global Perspectives on Sustainable Forest Management. Rijeka, InTech: 1–28.

Chomitz K.M, Kumari K. (1998): The domestic benefits of tropical forests. A critical review. The World Bank Research Observer, 13: 13–35.

Dang Phan T.H., Brouwer R., Davidson M. (2014): The economic costs of avoided deforestation in the developing world: A meta-analysis. Journal of Forest Economics, 20: 1–16.

Daniels S.E., Hyde W.F., Wear D.N. (1991): Distributive effects of forest service attempt to maintain community stability. Forest Science, 37: 245–260.

DeFries R.S., Rudel T.K., Uriarte M., Hansen M.C. (2010): Deforestation driven by urban population growth and agricultural trade in the twenty-first century. Nature Geoscience, 3: 178–181.

European Commision (2008): The EU forest action plan 2007–2011. Available at http://ec.europa.eu/agriculture/fore/publi/2007_2011/brochure_en.pdf (accessed March 21, 2015).

FAO (2014): State of the World's Forests Enhancing the socioeconomic benefits from forests. Available at http://www.fao.org/3/cf470fab-cc3c-4a50-b124-16a306ee11a6/i3710e.pdf (accessed March 7, 2015).

Gao Z., Cao X., Gao W. (2013): The spatio-temporal responses of the carbon cycle to climate and land use/land cover changes between 1981–2000 in China. Frontiers of Earth Science, 7: 92–102.

Gios G. (2008): Multifunctionality and the management of Alpine forest. In: Cesaro L., Gatto P., Pettenella D. (eds): The Multifunctional Role of Forest – Policies, Methods and Case Studies. European Forest Intitute Proceedings, Padova, Apr 24–30, 2005: 47–54.

Goio I., Gios G., Pollini C. (2008): The development of forest accounting in the province of Trento (Italy). Journal of Forest Economics, 14: 177–196.

Gonzalez M.J.G., Gonzalez A.L. (2015): Strategic planning and change management. Examples of Barcelona, Seville and Saragossa (Spain). Bulletin of Geography. Socioeconomic Series, 29: 47–64.

Hansen M.C., Potapov P.V., Moore R., Hancher M., Turubanova S.A., Tyukavina A., Thau D., Stehman S.V., Goetz S.J., Loveland T.R., Kommareddy A., Egorov A., Chini L., Justice C.O., Townshend J.R.G. (2013): High-resolution global maps of 21st-century forest cover change. Science, 342: 850–853.

Juutinen A., Kosenius A.K., Ovaskainen V. (2014): Estimating the benefits of recreation-oriented management in state-owned commercial forests in Finland: A choice experiment. Journal of Forest Economics, 20: 396–412.

Murărescu O., Murătoreanu G., Frînculeasa M. (2014): Agrometeorological drought in the Romanian plain within the sector delimited by the valleys of the Olt and Buzău Rivers. Journal of Environmental Health Science and Engineering, 12: 152.

Paletto A., Ferretti F., Cantiani P., De Meo I. (2012): Multi-functional approach in forest landscape management planning: an application in Southern Italy. Forest Systems, 21: 68–80.

Peptenatu D., Pintilii R.D., Draghici C., Merciu C., Mateescu R.D. (2012a): Management of environment risk within emergency territorial systems. Case study – the influence area of the Bucharest City. Journal of Environmental Protection and Ecology, 13: 2360–2370.

Peptenatu D., Draghici C., Merciu C. (2012b): Characteristics of entrepreneurial profile in some emergent territorial structures in Romania. Actual Problems of Economics, 138: 448–458.

Peptenatu D., Sirodoev I., Pravalie R. (2013): Quantification of the aridity process in South-Western Romania. Journal of Environmental Health Science and Engineering, 11: 5.

Petrişor A.I. (2015): Using Corine data to look at deforestation in Romania: Distribution and possible consequences. Urbanism. Architecture. Constructions, 6: 83–90.

Pintilii R.D., Andronache I.C., Simion A.G., Draghici C.C., Peptenatu D., Ciobotaru A.M., Dobrea R.C., Papuc R.M. (2016): Determining forest fund evolution by fractal analysis (Suceava-Romania). Urbanism. Architecture. Constructions, 7: 31–42.

Pir Bavaghar M. (2015): Deforestation modelling using logistic regression and GIS. Journal of Forest Science, 61: 193–199.

Prăvălie R., Sîrdoev I., Peptenatu D. (2014a): Changes in the forest ecosystems in areas impacted by aridization in south-western Romania. Iranian Journal of Environmental Health Science and Engineering, 12: 2.

Prăvălie R., Sîrdoev I., Peptenatu D. (2014b): Detecting climate change effects on forest ecosystems in Southwestern Romania using Landsat TM NDVI data. Journal of Geographical Sciences, 24: 815–832.

Price C., Rametsteiner E., Guldin R. (2003): Substantive element "economic aspects of forests", including "trade". In: Buck A., Parrotta J., Wolfrum G. (eds): IUFRO Occasional Paper No. 15 – Science and Technology – Building the Future of the World's Forests, Planted Forests and Biodiversity. Contributions to the Third Session of the United Nation Forum on Forests, Geneva, May 26–June 6, 2003: 5–8.

Romanian Court of Accounts (2013): Summary audit report on "Patrimonial situation of forests fund in Romania during 1990–2012". Available at http://www.curteadeconturi.ro/Publicatii/economie7.pdf (accessed Apr 8, 2015). (in Romanian)

Sanchez-Cuervo A.M., Aide T.M. (2013): Identifying hotspots of deforestation and reforestation in Colombia (2001–2010): Implications for protected areas. Ecosphere, 4: 143.

Sedjo R.A., Wisniewski J., Sample A.V., Kinsman J.D. (1995): The economics of managing carbon via forestry: Assessment of existing studies. Environmental and Resource Economics, 6: 139–165.

Tempesta T., Marangon F. (2008). The total economic value of Italian forest landscapes. In: Cesaro L., Gatto P., Pettenella D. (eds): The Multifunctional Role of Forest – Policies, Methods and Case Studies. EFI Proceedings No. 55, Padova, Apr 24–30, 2005: 319–326.

Turner M.G. (1989): Landscape ecology: The effect of pattern on process. Annual Review of Ecology and Systematics, 20: 171–197.

UNCED (1992): United Nations conference on environment and development. Chapter 11. Available at https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf (accessed March 26, 2015).

UNCSD (2012): Report of the United Nations conference on sustainable development. Available at http://www.uncsd2012.org/content/documents/814UNCSD%20REPORT%20final%20revs.pdf (accessed Apr 3, 2015).

Vu T.H.T., Au H.T., Nguen D.L., Nguyen T.T.T., Phan T.A., Huoang H.A. (2014): Preparation of micro-nano-composites of TiO_2/carbon nanostructures, C-CNT macroscopic shaping and their applications. Journal of Experimntal Nanoscience, 9: 694–706.

Zhang J., Alavalapati J.R.R., Shrestha R.K., Hodges A.W. (2005): Economic impacts of closing national forests for commercial timber production in Florida and Liberty County. Journal of Forest Economics, 10: 207–223.

Zhang P., Shao G., Zhao G., Le Master D.C., Parker G.R., Dunning J.B., Li Q. (2000): China's forest policy for the 21st century. Science, 288: 2135–2136.

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