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PRODUCTION PROGRAM OPTIMIZATION – RESPONSIBLE MANAGEMENT METHOD OF LOGGING

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Abstract:
Aggression of any kind on the environment and especially uncontrolled exploitation of forests has generated mixed reaction among the public and politicians, but especially in the academic sphere where actually were fired early warning signs of the effects of these actions. Reduction of Earth's forested areas was discussed by specialists as continuous and highly accelerated, especially in the last century when reserve "green gold" of mankind has halved. As a result, the conservation of forests and prevention of environmental degradation have become great concerns of each nation, but the need for global action required the transformation into strategic objectives of regional and international bodies. They have designed policies and measures generally available and have created favorable framework implementation in the Member States and beyond. One of the projects that came to life and expanded worldwide was the sustainable development today, basically there are no area where the activity is not subrogated to achieve a balance between the components of economic, social and environmental. From this perspective forestry and forestry exploitation is the place where really have achieved sustainability. Achieving this requirement becomes an obligation, both for woodland owners and operators seeking to obtain profit from logging. Compliance and ensuring responsible management are certainly prerequisites of sustainability in this sector. Scientific planning of production is a method of management responsible. This study takes into account, on the one hand, highlighting the effects generated by uncontrolled deforestation and the importance of sustainable forest exploitation, and on the other hand, presenting the need to use scientific methods to practice responsible management.

Key words: responsible forest management, production plan, logging, wood, deforestation, sustainable forestry, conservation, regeneration of forest management method, linear programming.

JEL classification: C61, Q23, Q56

1. INTRODUCTION

Over the centuries, the forest has become a source and an important commodity used both wood as firewood (energy source) and for the production of a wide range of products (eg, beams, planks, boards based on wood fibers, furniture, DIY materials and construction, packaging, stationery, kitchen accessories, paper, etc.). Amplification of wood consumption and intensified exploitation of timber globally generated on the one hand, environmental impacts, and, on the other hand, concern among citizens, especially among specialists (Bryant et all, 1997; Mygatt , 2006) whose concerns were oriented towards highlighting the need to protect forests. As a result, the wood, this "renewable materials" (Iacob, 1999), "functional, ecological, aesthetic and biodegradable" (Palaghianu, 2007), although it contributes to increasing "welfare state of the individual" (Blaug, 1992), should be operated in such a way that it is possible to achieve a "social optimum, on the objective efficiency" (Negrei, 1995).

To comply with environmental conservation in Romania, this orientation is related to sustainable forest management (Law 46/2008, Art. 5) being possible under the conditions of submission of efforts from individuals and especially companies having as their object of activity logging. Accessibility and availability of wood and wood products for long periods thus depends on maintaining biodiversity, the maintenance of regenerative capacity of the forest. These requirements can be achieved through learning "system management action plans drawn up by the ministry" (Stăncioiu, 2009), focusing on law abidance and optimization exploitation of forest fields by economic agents. Regarding this last aspect, the present paper will show a mathematical model of production planning program that can help management of companies doing logging to achieve economic efficiency at optimal cost, and thus to realize savings. Optimizing production can

provide, on the one hand, effective protection of the environment (pollution reduction and biodiversity loss) and on the other hand, a better allocation of financial assets due to lower environmental costs. The discussion is based on the use of linear programming method, and the solutions are obtained by using software module Quantitative Analysis for Management (Suciu and Luban, 1994).

2. MATERIALS AND METHODS

Using mathematical methods in production is a very interesting and timely topic. Equally exciting is the theme of the influences acting in the environment through forestry. Combining the two brings into question how sustainable forest management is closely related to the social responsibility of operators in this sector of the economy. Without claiming exhaustion of the scientific understanding of the subject and wanted by the author, this material will briefly highlight some of the findings of the various specialists in the field and design the solution obtained as a result of the production plan at SC COMFOREST SA using the linear programming.

2.1. LITERATURE

2.1.1. FORESTS AS A SOURCE OF LIVELIHOOD AND PROFIT

Forest, an important component of the environment was and still is inseparable from human existence. It is a resource that contributed to the development of man as "being three-dimensional" (Dobrotă, 1995), meeting his most somatic and economic needs. Continued growth and diversification of human needs, according to Iacob (2005) has "accelerated the pace of taking goods from nature." After Botnari (2011), this was done "without always have rational reasons related to market requirements." As a result, at least in terms wooded areas of the world there has been a sharp deterioration especially because of massive deforestation. Adams (2012), citing FAO (2010), argues that "deforestation was the highest rate in the 1990s, when every year, the world lost an average of 13 million hectares." Forest degradation is a "consequence of thoughtlessness in operation" (Iacob, 2005; Cuza, 2012), especially the greed of some of the owners, economic agents, and individuals willing to "quick enrichment" (Doniţă and Radu, 2013) most often illicit.

Linked to the economic interest shown by people on the goods that can be obtained on account of of the forest, Radian (1872) argued that the forest "gives two kinds of products: tangible and intangible." He appoints the category of materials: "food", "clothing", "wood", and from that of the non-material "that maintain the balance in nature." The forest is a complex ecosystem of the planet, "renewable supplier of goods and services" (Moţiu, 2009, Cuza, 2012; Nechiforel, 2012), the "existence about 400 million years" (Brad, 2008). It offers a wide range of useful products, the central place is occupied by wood. In relation to human society, the forest "maintains ecological, climatic and hydrological balance" (Slavilă, 2010). Thus, according to Golinelli (2013), forests re used for "production of oxygen", "water treatment", "soil fertility", "safety and protection", "energy source", "wealth of knowledge", "pantry food "," house of biodiversity, "etc.

The relationship man - forest is undeniable and transcends in prehistory. Barcan (2007) argues that "organic connection between human beings and the wood as" primordial matter "occurs at" all levels, from the pragmatic to the symbolic". Since the dawn of civilization, man as organic component of the forest ecosystem (Botnari, 2011), taking the existence in this relationship capitalized forest goods available in every way. But the evolution of humanity and its consumption has generated the shifting of relationship between man and forest "forest society relationship" (Palaghianu, 2007). In economic terms its expression is translated into cost and profit. In ecological terms the new relationship is on the one hand, a strong source of environmental degradation and therefore of life, and on the other hand, a source of social responsibility.

2.1.2 DEFORESTATION AND THEIR MOTIVATIONS

For centuries man has destroyed substantial areas of forest mainly to expand land for agricultural occupations (Giurăscu, 1976). With the evolution of knowledge and technologies deforestation has intensified the process culminating in the judgment of Botnari (2011) in "phase of industrialization and urbanization." Throughout the period concern for forest conservation manifested differently from state to state, keeping pace with human development. However, management of forest resources was made by applying legal rules and science of managing forests raised to the level of "doctrine" (Gottwrid von Mozer 1799). In formulating arguments about the content of science, forest policy as well as those related to the role and importance of forests many other authors contributed: Radian (1872), Endres (1922), Weber (1927), Hell, (1944) and Baitin (1954). Birth of "consciousness forest" is placed by Sombart (1931) "150 years before the outbreak World War I" as quoted Milescu (2008), but its development and maturation takes place in the past decades, when, due to excessive deforestation "worldwide entered into unprecedented environmental crisis "(Chakravarty et al., 2012).

Felt concern about global deforestation is growing and keeps the fight to save forests. To be good fighters in this area users must know why forests are destroyed. After assessment made by Chakravarty et al. (2012) some of the available literature "distinguishes two types of reasons for deforestation: direct and indirect." In the category of direct incentives are given "expansion of agricultural land", "orchards and other plantations", "exploitation for firewood", "overgrazing", "fire", "mining", "urbanization / industrialization and infra-structure" "air pollution", "wars and military actions", "tourism". In the other category, indirect motivations are highlighted: "colonialism", "exploitation by industrialized countries", "debt burden", "poverty and overpopulation", "transmigration and colonization schemes", "land rights", "economic causes (conversion value of land, fiscal policy, markets) "," undervaluation of forests "," corruption and politics. " The study conducted by Chakravarty et al. (2012) claims that if for direct motivations there are not problems to identify, measure and show, for indirect motivations, those that are actually true underside of deforestation in the scientific world there is enough "disagreement" as a result the possibility of lower quantification. In support of these allegations, and without claiming to be the only authors with similar views there are cited in the right direct motivations Panayotou (1990), Barbier et al. (1994), Caviglia (1999), and the right of indirect Mather (1991), Contreras-Hermosilla (2000), Humphreys (2006), Sands (2005).

As a result, concern about deforestation, ozone, food security, global warming, the accumulation of chemicals in the soil, and the need for sustainable legacy for future generations, have contributed to the current interest in sustainable forestry.

2.1.3 SUSTAINABLE FORESTRY

The way in which the forest develops is appreciated by Chirita et al. (1981) as being intrinsically linked to "the way they are understood and addressed concepts of forest." Getting a cohesive concept, on forest management unit is a lengthy process that involves, as asserted by Milescu (2008) consideration of "models of rationality" that must combine constructive theory of "classical utility" with the "behaviorist" as well as with "evolutionary" as Simon (1983) opines. Such a result is the system established by FAO forest policy (1987), adopted by most countries containing guidelines to ensure the development and sustainable management of forests.

The sustainable development project has emerged as a result of the confrontation growth and the need to protect the environment, to achieve social equity intra-generational and inter-generational. It was initiated in 1972 at the Conference on the Human Environment in Stokolm and came alive in Rio de Janiero in 1992. In these debates, as claimed by Bakari, (2014), "environmental problems introduced new elements such as" sustainability "," green economy "and" environmental justice ", thus extending the scope of sustainable development.

Through its multidimensionality, sustainable forestry found the exact spot where the two needs are really in conflict. Harnly (2004), in agreement with Ness (2003) locates the emergence of the concept of "sustainable forestry" during the 80s, amid the presentation effects of deforestation as more aggressive to planet and humans. In fact, after Ness (2003) sustainable forestry is "alternative plantation and forest monoculture clearcutting", a "system based on natural processes, which maintain the ability to produce wood forests, continuous and stable efficiency" (Harnly 2004) . Such an approach includes limited use of biocides, maintaining biodiversity, increased regeneration capacity, ensuring the leisure and entertainment etc.

2.1.4 SUSTAINABLE EXPLOITATION OF FORESTS

In the internal and international markets timber is a very demanding commodity. In recent decades, considers Moţiu (2009), production of wood-based varieties, as their consumption recorded significant increases. Bontea (2011), reinforces the importance of the woodworking industry and furniture presenting it as "vital sector, sustainable, innovative and environmentally friendly." His arguments are supported by reports in the field of the year 2008, a "turnover of about 221 billion euros, with 2.4 million employees in more than 365 000 enterprises, mostly SMEs". Increase timber production is confirmed by Beard (2013) in the report of Wood Resources Quarterly (2/2013). Focusing on the use of wood as a natural renewable raw material, Bontea (2011) argues that the woodworking sector "has a positive balance in terms of sustainability, it is being in the forefront of the development of a green economy, which is one of the major objectives EU future ".

All wood quantity is the result of current market activity logging. To ensure the requirements of timber and other forest products, local level, but especially for industrial, businesses specializing in forestry exploitation must conform to legal, social and ecological restrictions. Preparing forest for harvesting is done based on forest management represents multiannual plans that provides fixing elements which determine forest succession over time of production: exploitability revolution possibility, age classes, composition, arrangements, treatment etc. In Europe, forests, whether state-owned or belonging to other owners that are subject to the forest and found the best public interest law. In these circumstances revenue earned from the exploitation of the forest is subject to application and enforcement of development plans which are essentially tools of forest management.

According to the European Commission, "due process, different sustainability has a strong link to the impact of logging on the environment. Illegal logging is a serious offense that can have serious environmental, social and economic difficulties, threatening biodiversity, contributing to deforestation, accelerating climate change by increasing emissions of greenhouse gases (GHG) and reducing forest carbon reservoirs, endangering rights existence of forest-dependent people, depriving governments and therefore the company revenue and creating unfair competition in global markets and European "(EC, 2010).

2.1.5 SUSTAINABLE FOREST MANAGEMENT

Well-known often-used English term "management" usually translates organizing, directing, guiding actions, administrative rule. "Gestion" comes from the French and has the same meaning, but its use in Romanian, is done mainly to describe resource accounting. In the absence of universally accepted conventions, terms, in both meanings are found both in expressions and in the academic practitioners sometimes creating confusion. For this scientific approach, management is responsible when resources are used sustainably.

In forestry and logging traditional management was focused mainly on the technical, environmental and economic aspects, these being the elements of economic and environmental components of activities. Current guidelines involve the consideration of a new component: the social one. As a result of responsible management is found at the confluence of the three

components. In order to had an indisputable weight as responsible management forest management system requires obtaining certification, but it is not mandatory. The emergence of the terms "sustainable management" and "responsible forest management" is closely linked to the concept of sustainable development. Responsible forest management certification requires compliance management with a set of international valuation standards. As a tool for responsible forest management certification is used the assessing degree of conservation of the forest which consists of identifying, mapping appropriate management of those forests showing high conservation values (PVRC).

2.2. MATHEMATICAL BACKGROUND OF PRODUCTION OPTIMIZATION

Rigorous planning of production program can provide to each trader a better exploitation of forest resources allowing both the profit motive and social and environmental duties. The purpose of action planning will be the decision of allocation of material, financial and human resources available to the company to meet deadlines and specifications assortment, quantitative qualitative set out in contracts with the partners.

The starting document in the execution of the production is the Enhancement Act (VPA). This includes the volume of timber assortments dimensional groups, generally expressed by log diameter at the thin end. The primary objective of optimizing production logging plan is to establish assortments that ensure maximum exploitation of wood resources available through VPA. The trader may follow either minimizing costs or maximizing profits.

The mathematical model needed to optimize the production program of a logging unit fits standard linear programming model. The main restriction:

- Amount varieties that will get should be equal to or greater than the volume of contracts

$x1j + x2j +... + xmj > pj \quad (j \in N)$, where:

pj = amount of assortment required, and N = (1...n) - multitude of varieties that can be obtained from dimensional varieties.

- The amount proposed varieties is equal to the volume written on the VPA.

$x1j + x2j +... + xmj = bi \quad (i \in M)$, where:

M = (1...m) - multitude dimensional varieties contained in APV.

bi = amount of dimensional assortment i ($i \in M$)

For this restriction write as many equations as many species and varieties are.

- The total quantity of industrial varieties must be equal to or less than the product of this index Iu (%) and the quantities available in the APV.

$xij \leq aij * bi \quad (i \in M, j \in N)$, where:

aij = the percentage showing how assortment of the J type may be obtained from the assortment i type.

- Terms of negativity:

$xij \geq 0$

The objective function aims to minimize production costs.

$Z = \Sigma\Sigma\ xij * cj,$

Where cij = production cost of the set j.

Solving such a model is based on primal simplex algorithm, manually or using computer (QM programs). In adopting the best decision in the program it can use three different methods: the "North West", "minimal cost" and "Vogel Approximation"

3. RESULTS AND DISCUSSION

Implementation of the model was performed in SC Comforest SA and had as support the contracts with various beneficiaries under which settled the main products that the company must supply monthly (table no.1).

The company has four operational auction parquet obtained from the Forestry Department. Of these the parquet IV has not beech wood. Accounting Department with forest engineer employee of the company based on APV sites and information gathered from the documentation of land set unit operating costs for varieties required current month on plots (table no.2)

Table no. 1 The distribution and annual output value

Assortment	UM	Quantity	Value (lei)
softwood logs	mc	10800	2.700.000
beech logs	mc	360	82.800
Veneer logs	mc	600	120.000
various logs-logs	mc	360	72.000
wood mine	mc	240	48.000
balls	mc	720	144.000
wood pulp	mc	3120	624.000
firewood	mc	240	48.000
Total value(lei)			3.838.800

Demand for wood, appears greater than the available, which is why it will not be satisfied for some items. (for log beech logs were set penalty charges amounting to 3,000 M lei).

Table no. 2 Operating costs lei / types / parquet

	Saw beech logs	Softwood saw logs	Girder	Wood for pulping	Fire woods	Total available mc
Parquet I	160	144	110	121	135	200
Parquet II	180	153	119	126	141	400
Parquet III	174	150	121	133	144	200
Parquet IV	M	139	139	144	128	300
Total required (mc)	50	700	80	300	20	

Model's variables are xij (i = 1, 2, 3, 4, j = 1, 2, 3, 4, 5) HitPark amount assortment of type j that i can get the model restrictions prosecutor presents dub as a the system of equations (table no 3)

Table no. 3 The system of equations of the model restrictions

x11+x12+x13+x14+x15 = 200 mc	x11+x21+x31+x41 = 50 mc
x21+x22+x23+x24+x25 = 400 mc	x12+x22+x32+x42 = 700 mc
x31+x32+x33+x34+x35 = 200 mc	x13+x23+x33+x43 = 80 mc
x41+x42+x43+x44+x45 = 300 mc	x14+x24+x34+x44=300 mc
x51+x52+x53+x54+x55 = 50 mc	x15+x25+x35+x45 =20 mc

As shown in the system of equations, QM program used in solving this problem would "balance" supply and demand by introducing one fictional parquet - parquet V - whose unit costs are zero. The initial solution (Table no 4) determined by the NW has the following meaning:

Table no.4 The significance of the initial solution obtained by the NW method

Variable	Assortment	Quantity	Exploitation
X11	Beech logs	50	From parquet I
X12	Softwood logs	150	From parquet II
X22	Softwood logs	400	From parquet III
X32	Softwood logs	150	From parquet III
X33	Balls - manele	50	From parquet IV
X43	Balls - manele	30	From parquet IV
X44	Wood pulp	270	From parquet IV
X54	Wood pulp	70	from other businesses
X55	Firewood	100	from other businesses

Total production cost calculated for this solution is 162,400 lei and the value of the optimal cost (Table 5) is 150.640 lei, with the following structure types and parquetes. The optimal solution for minimizing the costs according to the NW method (Table no.5).

Table no.5 Value structure the optimal cost lei / assortment / Parquet

Parquetes	Assortment	Quantity (mc)	Cost (lei/mc)	Value(lei)
I	Softwood logs	120	144	17.280
	Girders	80	110	8.800
II	Softwood logs	80	153	12.240
	Wood Pulp	300	126	37.800
	Firewood	20	141	2.820
III	Softwood logs	200	150	30.000
IV	Softwood logs	300	139	41.700
V	Beech logs	50	0	0
Total:	-	2540	-	150.640

Demand for assortment "beech logs" calculated costs can not be satisfied for the 50 m asked by partners, being more advantageous the purchase from other companies.
Applying Vogel Approximation Method and minimal cost to the same data of the problem, it is found that the optimal solution is unique (Table no.6). As a result, the optimal production can be achieved in the costs calculated from the type and structure of Table 5.

Table no.6 The optimum solution depending on cost

Used method	Optimal total cost (lei)	Total initial cost (lei)
North-Western Corner Method (NW);	150.640	162.400
Minimum cost method from table	150.640	151.140
Vogel method	150.640	151.040

Achieve optimal solution can allow the management company to determine the best interventions in the parquets bought. For example, you can set paths that least affects biodiversity also can better track fuel consumption to reduce carbon dioxide emissions in the atmosphere can properly size and place the landfill of biomass etc. All these actions can be considered sustainable forestry efforts. Management responsible for the logging companies that are implies that around the wood offcuts should be harnessed. In the conditions of manufacture biomass pellets, linear programming method allows to take into account in determining the production plan also this assortment.

4. CONCLUSION

In order to obtain timber and other products offered by the forest operators and other persons acting legal or illegal, cause detriment to the environment. The concern is growing as the

statistics show continuous decrease of forest cover global, regional, and national. International forums have discussed since the last century to seek a consensus on achieving a balance between the needs of more and more diverse humanity and environmental degradation in the human quest for resources. Thus was born the concept of sustainable development which has become in this time range policy applicable to all countries of the world. By implementing sustainable development pursues activities of man including access to the resources of the earth for future generations. Putting into practice the requirements that allow this type of development involves a reconsideration of the manners of addressing all human actions. It's certainly a reconsideration the way in which to make the organization of society and its leadership, companies management, resources allocation methods etc. Solving the big problems of the world, ozone destruction, eradication of poverty and underdevelopment, environmental degradation, and many others is possible under the dome of sustainability and responsible actions of each individual. Therefore, the implementation of the responsible forest management of the administration as well as of the economic agents and the use of scientific methods for determining the consumption and production programs can be a solution to sustainable forestry.

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