

## FOREST MANAGEMENT AS AN ELEMENT OF ENVIRONMENT DEVELOPMENT

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### Abstract

The implementation of goals of modern forestry requires a simultaneous consideration of sustainable development of forests, protection, needs of the environment development, as well as maintaining a balance between functions of forests. In the current multifunctional forest model, rational forest management assumes all of its tasks as equally important. Moreover, its effects are important factors in the nature and environment protection.

The paper presents legal conditions related to the definitions of forest management concepts and sustainable forest management. Authors present a historical outline of human's impact on the forest and its consequences for the environment. The selected aspects of forest management (eg. forest utilization, afforestation, tourism and recreation) and their role in the forest environment have been discussed.

**Keywords:** forest management, sustainable forest management, afforestation, cutting methods, regeneration, urban forests

### 1. INTRODUCTION

The history of mankind is inseparable linked to forests [13]. Falińska [2004] not only described transformations of vegetation in space and time, but also their relation to humans. She indicated that, at first, a human being was one of many components of living nature, and one's contribution to transformation was not greater than other components because one used to function like animals. Only certain types of human

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activity have caused losing the original character of nature. The crucial moment started when the man began to use fire.

In case of forests, their transformation took place through various forms of human activities, some of the most important were collecting, hunting, pastoral life, agriculture, industrialization and urbanization. During the Stone Age, forests were a source of food (wild animals meat, mushrooms, fruits, herbs), clothing (mainly leather), tools (bone and wood), fuel and a shelter from meteorological conditions and enemies. As time passed, the human being gradually began dependent on forest. The plant cultivation and animal husbandry started to displace activities like hunting, fishing and harvesting mainly because of their uncertain results. Such significant change required arable land, the most fertile soils were mostly covered with forests, what resulted in a deforestation. Simultaneously, the usage of wood stock has been increasing due to the need for ships, roads, bridges, buildings and fortifications. From the 17th to 19th centuries, the development of mining and railroading, application of a new technology of paper production and the chemical useage of wood in the textile manufacture influenced on creating new ways of wood exploitation. As the population increased, there was a demand for more lands [7]. At the same time, the well-grounded kind of fear of disappearance of forests occured. As a consequence, first attempts to bring order and planned economic activity with an aim to provide a permanent access to wood raw material began. It was the beginning of forest management [13]. It must be admitted, that it had a monocultural character for decades, as it was primarily oriented on the raw material and distributing profits. A multifunctional forest management was noticed in the 90's of the XX<sup>th</sup> century what led to the change of objectives of forest management. Nowadays, from the point of view of forestry issues, spatial conflicts resulting from the intensification of urbanization and the development of technical infrastructure within forest areas are the most remarkable. Moreover, air pollution (as the consequence of the urbanization pressure), intensified development of tourism and recreation, human pressure re-sulting in the degradation of forest habitats and stands are also considered as conflicts [30]. At the beginning of the 90s, on account of reasons such as bad forest conditions, level of internal and external threats, economic problems that arised from inability of achiving adopted forestry goals some 'problem areas' were identified [17]. The aim of this paper is to present how selected activities implemented, at the present time, on forest management may affect the environment.

## **2. LEGAL BASIS**

Forest management is regarded as a forest activity connected with management, protection, maintaining and increasing forest resources, as well as game management; it includes harvesting timber, resin, Christmas trees, stump wood, bark, needles, game and forest floor fruit, selling those products, as well as the fulfilment of other, than productive, forest functions [Art. 6.1. of the Forest Act of 1991]. It is realized according to the following rules: universal forest protection, maintaining forest sustainability, continuous usage of all functions of forests, increasing forest resources [Art. 8. of the Forest Act of 1991].

By comparison, sustainable forest management is the activity which shapes forest structure and use forests in a way and at a rate that maintains their biological richness, high productivity as well as regeneration capacity, vitality and potential to fulfil, now and in the future, all essential ecological, economic, and social functions at local, national and global level, without causing damages to other systems functions [Art. 6.1. of the Forest Act of 1991]. It is conducted according to a forest management plan or an abridged forest management plan taking into account the need to preserve forests, their protection objectives and beneficial effect on climate, air, water, soil, human well-being, natural balance and production, on the basis of rational economy of wood and minor forest utilization [Art. 7.1. of the Forest Act of 1991].

All economic activities in forests must respect a specific legal framework that determines a strict limit of economic activities [18]. Provisions on forest management and sustainable forest management are included in a number of legal acts. Apart from mentioned the Forest Act [1991], the following acts are in force: the Act on Access to Information on the Environment and its Protection and Environmental Impact Assessment [2008], the act on Environmental Protection Law [2001], the Act of Nature Conservation [2004], the Act on Spatial Planning and Development [2003], the Fire Protection Act [1991], the Act on Protection of Agriculture and Forest Land [1995]; documents like the the National Environment Policy [1997], the Forest National Policy [1997], and the Regulation of the Minister of the Environment, Natural Resources and Forestry on detailed rules and procedures for the acknowledgement forests as protective and detailed rules for management of them [1992]. Furthermore, there are some internal regulations of the General Director of the State Forests in aspects related to forest management, including the Instruction for Forest Management [2012], the Principles of Silviculture [2012] and the Instruction for Forest Fire Protection [2012].

### 3. INCREASE OF FOREST RESOURCES

During the uprising of the Polish statehood, an indicator of the forest cover amounted to 80% [30]. Before the partitions of Poland, according to different sources, it could have amounted to between 31 and 52%. However, the most possible share was 37% [29]. The partitions of Poland, the I<sup>st</sup> and the II<sup>nd</sup> World War have caused a decrease of this share up to 20,7%.

According to Stępień [2005], in a range of landscape, many unfortunate changes occurred as a result of forest fragmentation (the State Forests *National Forest Holding* owns 30 thousands of smaller forest facilities, non-state forests 1,5 mln of hectares and the same amount of owners). There was the disappearance of primeval forests and backwoods, as well as the limitation of wildlife and flora, what resulted in the low level of biological resistance of forests. As a consequence of a post-war afforestation, the indicator of the forest cover amounted to 26,4% in 1967, while at present its share is up to 30%. In conclusion, comparing to 1945, the forest area increased by 40%. However, the dynamics of changes in the Polish forest cover was characterized by high fluctuations, mainly due to a socio-political variability and economic conditions [28]. Nowadays, the basis of afforestation activities is the "National Forest Improvement Program" [KPZL], which was developed by the Forest Research Institute and accepted

by the Council of Ministers on 23 June 1996. It was modified in 2002. The main goal of the KZPL is to increase the forest cover of the country to 30% by 2030, and 33% by 2050, as well as to provide an optimal space-time arrangement of afforestation [16]. The Forest Act [1991] also indicates afforestation (in an area dimension) and increasing the forest productivity through realisation the forest management plan as ways of enhancement of forest resources. For afforestation may be designed the following types of grounds: wastelands, lands located near rivers, streams, lakes and other water reservoirs, lands located on watersheds, dunes, quicksand, steep hills, bluffs, post-exploitation areas. Grounds dedicated to afforestation are designed in a local spatial development plan or in a decision on building and land development. While, the obligation of the land afforestation is superimposed on chief foresters (in case of the State Forests) and other landowners or perpetual usufruct right to land holders. The increasing forest productivity should take place in a manner defined in the forest management plan, in accordance with legal acts and sustainable forest management, taking into account all social expectations regarding the protection of the environment and the rational management of natural resources [5]. As a result of presented forest management, it may be assumed that by the end of 2020, the amount of timber resources and the average age of stands (up to 63-64 years) will maintain its increasing trend. Additionally, the share of conifer species will decrease and the intensity of harvesting will slowly increase up to 36-38 million m<sup>3</sup> in 2020 [36]. In comparison, Poznański [2011] estimated that in 2020 the amount of primary forest usage will amount to 31,67-37,48 mln m<sup>3</sup> net per year, the average stand's age will increase to 61-62 years and the average of growing stock of merchantable timber estimated in forest inventory will increase up to 247-250 m<sup>3</sup>/ha. At the same time, it was forecasted by Poznański [2011] that potential capabilities for economic use of forests will increase in years 2010-2020, so that final cuttings may have a share up to 25% of total area of the State Forests and the total volume increment.

Borecki i Stępień [2012] payed attention to two conceptions which influence the priorities of the process of forming the development directions of forest resources. The first of them, prefers a rule of the development in accordance with realities (age structure, forest resources stock). In comparison, the second concept favours region specificity in the process of establishing the strategic approaches for the development. The implementation of the first conception may result in an inappropriate age structure of stands and will not provide an even usage and considerable improvement of forest resources. The second idea requires to work out some diversified scenarios and to asses the capabilities of regional variants of development, for instance, a long term time horizon for harvesting systems (50-60 years). Foresters face the demanding task, the implementation of which may have a decisive impact on the forest environment.

#### **4. HARVESTING SYSTEMS**

Within managed forests a clearance of trees is a final activity of management tasks in stands. Over years foresters have been taking care of stands through forest tending and protecting them from abiotic, biotic and anthropogenic factors. As a consequence, there is an appropriate moment for cutting trees out and beginning the period of regeneration

on forest land. For the major share of the public, cutting trees out is often a stressful and exceptionable situation. Taking into account only this moment, it seems to be an act of an environmental destruction. Not considering the whole spectrum of activities related to the forest utilization, it is easy to forget about the productive function of forests.

Meanwhile, this operation is realized as a part of a selected cutting method (harvesting method), which leads to graduate changing of forest generations. The collection of rules of harvesting methods includes the following aspects: removing trees or stands at the same time and creating the best conditions to initiate and stimulate the growth of new generation of desired tree species, creating proper structure of stands, ensuring natural biodiversity and forest stability in constantly changing environment [37]. Decision about the type of the cutting method should consider a current state of stands, as well as to enable the facility for the planned stand type, which is appropriate for selected forest sites. Each cutting method is characterized by technical, spatial and time aspects which create ecological conditions.

Technical aspects of harvesting methods are diversified cutting styles (alternate-patch clear-cutting method, alternate-strip clear-cutting method, alternate-patch clear-cutting method, group selection method). Spatial components of it are shapes of the harvesting area (circular, elliptic, elongated). Time elements are related to the length of periods of cutting trees, regeneration and felling cycle [37].

When the harvesting is finished or it is in the process (shelterwood systems, group cutting systems) there is a proper time for forest regeneration, which is the process of initiating and developing of young forest generation on temporary harvested forest areas (clearcuts) or under the cover of old growths (shelterwood systems, group cutting systems).

When establishing the stand composition of the regeneration the following impacts should be considered: forest site, ecological requirements of trees, average elevation, climate. Outlines of planned regeneration activities should be elaborated and included in stand types, which are approved during the Preliminary Planning Commission, before the forest management plan is going to be realised.

In conclusion, cutting (harvesting) methods are the activity that have the biggest influence on the forest environment. It results in a decrease of old growths, as well as the appearance of young generations afterwards. The less share of clearcuts the bigger share of mixed stand in the Polish forests become. Thus, there is a decrease trend in the share of monocultures. It may be concluded that forests constantly undergo changes.

## **5. STAND CONVERSION**

Stand conversion (management tasks, whose aim is to adjust a stand composition to site conditions, as well as to modify an age or vertical stand structure), in practice, started along with the human activity within forests. It has been aimed at economic conditioned intensification of forest production for years [13], what was the reason for the stand conversion from natural mixed into pure coniferous forests. As a result, a pinetization and a monotypization occurred around the Europe. Nowadays, these forests are transformed into mixed or deciduous in order to strengthen their resilience [27].

Czuba [2006] stated that the stand conversion is an untypical endeavor for forest management because its main aim is not economical or not determined by a long-term strategy, but it results from mistakes which occurred in the silviculture or chance events. Despite this view, the literature on forest management is a series of publications relating to the presented problems [11, 12, 19, 20, 21, 22, 25, 26, 31, 32, 35]. From the legal point of view, forest owners are obliged to maintain forests in the state of balance, as well as to provide the forest conversion [42]. It may be concluded that according to Czuba [2006], forest conversion is not the aim of forest management, even though forest owners are committed to rectify mistakes resulted from previous decisions in the range of silviculture. In fact, it is one of the ways of implementation the objectives of sustainable forest management and increasing the forest productivity.

Stand conversion is limited by organizational and financial aspects. There is not only a need to provide workers, an equipment, seedlings and a knotted fence, but also to cover the costs of it. According to Stępień [2006], a process of planning of the stand conversion requires considering a lot of aspects (e.g. economic, financial, social) which are often contrary to each other. For instance, establishing the time for the start of stand conversion is dependent on such factors as: natural production conditions, final crop, features of present stands, economic conditions, silviculture conditions, organizational conditions.

On the other hand, establishing the length of the time of stand conversion is dependent on actual stand composition, stand composition planned after the stand conversion, the frequency of fructification years, the contribution of old growth in creating conditions for natural regeneration, the intensity of the elimination of growing stock [31].

The current Instruction for Forest Management [2012] recommends that a stand qualified for stand conversion should be aged over 20 years, with a stand composition partly compatible or completely incompatible with the forest site, characterized by a low quality or permanently damaged.

Stand conversion may be full (using an appropriate cutting method and the way of regeneration), partial (using an appropriate thinnings) or gradual - within stands where clearcuts are not required during the first decade, and the stand conversion period may last relatively long.

In general, planning the stand conversion and the way of its implementation is a legal obligation, as well as a complicated process which requires a lot of efforts and financial capital. Its implementation affects on the forest environment, and its stability and diversity, through modifications of stand composition, age structure and vertical stand structure.

## **6. TOURISM AND RECREATION**

In Poland, forests located within the administrative boundaries of cities and only 10 km from the administrative borders of cities with more than 50 thousand inhabitants are becoming more and more significant. In social awareness there is a belief that purpose of these forests is to maintain forest management aimed at leisure needs, instead of maximizing incomes from timber production, which could be an opportunity to achieve income supplying the city budget. Therefore, forest management within urban forests is

conducted in a different way. For instance, within these areas all thinnings (landscape, sanitary, regeneration, non-commercial) are limited as much as it is possible, and their realization is dependent on forest and landscape aesthetic, health and sanitary forest condition and safety of people on trails and roads. In case of regeneration, it is recommended to introduce not only native tree species, but also an admixture of exotic and decorative (larch, fir, red oak, maple, sycamore, white poplar, black poplar, elm tree) species [6, 8, 10, 14, 15, 23, 33, 34, 48].

## 7. CONCLUSIONS

The paper presents selected problems related to forest management that results from legal acts of varying validity from the national level to internal directives of the General Director of the State Forests. However, the Forest Act is absolutely imperative document, which highlights sustainable and multifunctional forests against the background of the economic income.

On the other hand, one must remember that forestry is a part of national economy closely associated with the forest utilization oriented to financial profits.

Actions taken by the State Forests *National Forest Holding* should balance objects of sustainable forest management and forest management. In both cases, they affect the forest environment. From the historical point of view, there is a substantial change in the move from a raw material approach of forest management to a multifunctional model. Presented aspects of forest management illustrate an influence of foresters on the forest environment by conducting stands structure, including species composition, age and size of trees in vertical and horizontal patterns, what results from forest functions. Ways of carrying out management tasks are based on an acquired experience and knowledge, and an appreciation of contemporary challenges related to the protection of nature and environment, as well as acknowledgement forest areas as a place for tourism and recreation. Local conditions are used to fit the principles of forest management, as long as it is possible. In Poland, the forest area, the growing stock of merchantable timber estimated in forest inventory, and the age of stands are constantly increasing. Furthermore, the share of deciduous species also sustains an upward trend, and forests are still an essential part of landscape and environment.

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## GOSPODARKA LEŚNA JAKO ELEMENT KSZTAŁTOWANIA ŚRODOWISKA

### Streszczenie

Realizacja celów postawionych współczesnemu leśnictwu wymaga jednoczesnego uwzględniania trwałego i zrównoważonego rozwoju lasów, potrzeb ochrony i kształtowania środowiska oraz zachowaniu równowagi w zakresie pełnionych przez lasy funkcji. W obowiązującym modelu lasu wielofunkcyjnego racjonalna gospodarka leśna uwzględniać ma wszystkie postawione jej zadania jako równorzędnie ważne, a jej efekty są ważnym czynnikiem ochrony przyrody i środowiska. W pracy przedstawiono związane z tym uwarunkowania prawne. Przypomniany został rys historyczny wpływu człowieka na las i jego konsekwencje dla środowiska. Przybliżono problem istnienia lasu jako składnika infrastruktury przestrzennej. Omówiono wybrane aspekty gospodarki leśnej i ich znaczenie dla środowiska leśnego.

Słowa kluczowe: gospodarka leśna, trwale zrównoważona gospodarka leśna, zalesienia, rębnie, odnowienia, przebudowa, lasy miejskie

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