

DIRECTIONS FOR EFFECTIVE USE OF FOREST RESOURCES IN UKRAINE

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Abstract. Purpose. The aim of the article is determination and substantiation of directions of rational use of forest resources in Ukraine. **Methodology of research.** The theoretical and methodological basis of conducted research is the provision of economic theory, sustainable development, environmental economics and economics forest exploitation. The following methodological tools and techniques were used to achieve this goal: methods of analysis and synthesis (to identify problems of the relationship for using potential of forest resources with factors of influence on their reproduction, the studying essence of the term "forest resources"); monographic – to study the experience of forming rational use of forest resources and wood waste; systematic approach (in substantiating the use of instruments for regulation forest exploitation); scientific abstraction (in the study of capabilities to ensure the process of rational reproduction of forest resources); graphic (for visual images of some analytical observations). **Results.** Theoretical approach to forest regeneration as a major task in forest management, which includes the integrated use of all available organizational and technological measures to facilitate its natural regeneration has been formulated. It has been established the regularity of ensuring the efficient use of waste wood in places of billets, identified and systematized its forms for future use. The methodical approach to assess the effect of using wood waste for fuel production and related products during processing on the harmonization of economic and environmental interests in the area of forest exploitation has been formulated. **Practical implications.** The obtained results are the basis for solving practical problems of integrated management of forest resources in Ukraine, waste of forest felling in the places of timber harvesting and also for development of the system of measures to improve the ecological and economic mechanism of development of nature protection territories and formation on this basis effective policy of nature use according to the national interests of Ukraine. It will promote increasing the economic efficiency and the reasonableness of decisions related with priority directions of natural resource policy in terms of transformation of the national economy. **Value/originality.** It has been established the application of fuel wood in the production of bio-fuels through the establishment of plantations of fast-growing woody species for industrial forest growing for energy purposes.

Key words: forest complex, forest resources, forest exploitation, forestry, wood waste, forest billet, plantations of fast-growing woody species.

JEL Classification: Q23, Q42, Q5

1. Introduction

The forest complex of Ukraine is an important part of the national economy and has decisive importance for its social and economic development. The forest sector is a part of the world economy, therefore, development tendencies of the domestic market for forest products and services should be considered in the context of global trends. The global trend is the steady increase in demand for wood, food and technical resources as well as social and environmental properties of the forest. Thus, in the last half of the twentieth century the growth rate of demand for social and environmental protection properties of the forest outpaced growing demand for forest resources. Therefore,

ensuring sustainable development of the forest sector is the main task of the forest policy in Ukraine. Forest resources that are the natural means of production always are covered by extensive or intensive type of reproduction. Today, efforts for intensify of the forest sector of the economy can not be combined with the extensive development of the forest resource base, which will inevitably led to further aggravation of contradictions between society and forest. Therefore, the solution of contemporary economic, social and environmental challenges should be linked within a single intensive reproduction process.

The problems of rational use and reproduction of forest resources in scientific studies were conducted

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by such scholars: P.H. Vakuliuk, Yu.I. Haida, O.A. Hirs, A.M. Deineka, R.H. Dubas, Yu.Y. Kahaniak, A.Y. Kovalevych, V.I. Parpan, P.R. Putsenteilo, I.M. Syniakevych, V.V. Usenia, O.I. Furdychko, M.A. Khvesyuk, M.V. Shchuryk, R.M. Yatsyk.

Along with this, proper attention in scientific works of these authors, publications of other scientists is not given to the economic aspects of production taking into account the ecological component that in the context of sustainable development of Ukraine is becoming more important and requires further research in this area.

The aim of the article is to identify and substantiate areas of rational use of forest resources in Ukraine.

2. Modern role of forest resources

It is known that forest resources are the product of nature that are formed during the growth and development of forests and forest exploitation is the removal of the natural properties of forests for the needs of mankind. In recent years, the forests of the planet were regarded as one of the global factors of sustainable human development and ecological safety of its existence. Approximately 90% of all stock of organic substance is concentrated in the forests. Forests play particular role in nature and life of society. Being a multipurpose resource, they ensure the preservation of natural complexes and objects that have special environmental, scientific, cultural and recreational value and create the biological diversity of living and inanimate nature. Value of forests is great, because they form the gully in the basin of the rivers, control part of the runoff and protect soil from erosion. Also forests provide moisturizing effects on farmland; they are the custodian of moisture and also reinforce riverbeds, preventing their random walk, restraining strength of the wind, weaken the loss of water from evaporation, serve as habitat for wildlife and have sanitary and hygiene value. Growing forests is necessary not only for timber and other forest products, but also to form the normal conditions of human life on the Earth, preserving the environment. The use of mineral properties and functions of forests has developed historically, as the development of human society. Protective and social functions of forests acquired the economic value. Scientific and technological progress, the growth of urban population has caused additional stress that affect both at human health and the state of forests. Thus, the value of forests as places for recreation of the population more increases. It causes a particular orientation of forestry development in many industrial countries with high density of population. The intensive recreational use of forests often has a negative impact on the condition of plantings.

However, as before the forest remains a source of wood production. The conclusion about the contribution of forest industry in total gross income of the country we make exactly on volume of received wood. Management of forests in Ukraine is possible based on the organization of the highly developed system of forestry that provide increasing of environmental and resource potential of

forests, meet the needs of society in forest resources on the bases of scientifically proven rational, sustainable and multipurpose development of forests, conservation of biological diversity. This aim can only be achieved through forest management as one of the important tools of forest management. The role of forest management should increase under market economy conditions, because for sustainable development is necessary to conduct long-term forecast calculations of forest dynamics and volumes for possible uses for each type of forest resources.

It is necessary to distinguish forest management as a science, theoretical basis and forest management as practical activity. But both sides are interconnected, influence each other and give a complete picture about the forest regulation.

3. Use of forest resources

According to the Forest Code of Ukraine, forest lands are divided into:

a) forest, covered with forest (tree and shrub) vegetation; do not covered with forest vegetation that are subject to forestation (log, conflagration, woodlands, wasteland, etc.) and occupied by forest roads, clearing, fire protection ruptures, etc.

b) non-forest: occupied by buildings related to forest management, tracks of power lines, product pipelines and underground utilities, etc; occupied by agricultural land (arable land, perennial plants, hayfields, pastures, provided for the needs of forestry); occupied by marshes and ponds within land parcels of forest fund that are provided for the needs of forestry (Forest Code of Ukraine, 1994).

Recently, the problems of forest are becoming more complex. Requirements for forest management that must meet the current social, environmental and economic standards were increased.

Threats of damage to forest by fires, pests and diseases and other unfavorable factors have increased. Particular attention should be paid to issues that are related with counteraction to the illegal forest exploitation. In the aggregate with possible climate change it may lead to a significant transformation of woods, weakening their social and ecological potential. Forestry sector increasingly faced with the need to fully response to changing in environmental requirements, the globalization of markets, increasing competition of products and technologies. Insufficient investment activity in the forest sector demonstrates the need for optimizing the structure of production and exports of forest and paper products.

Characteristics of the forests as a natural phenomenon serves to fully display all their components, in particular in the form of ecological system that is consist of a set of herbaceous, shrubs and woody plants, moss, litter, soil, animals and microorganisms that are combined by metabolism and the flow of energy and information with one another and with other components of nature – air, atmosphere, water, rocks and also with society.

The close scientific contact between biological (forestry literature) and economic researches is carried out at this

stage of the assessment; “transfer” of scientific results from biology (forestry literature) is also carried out for further their use in the process of economic evaluation.

The concept “use of forest resources” means the use of all types of forest wealth. It is considered in the context of two areas: economic and legal. From an economic perspective “use of forest resources” is an organization of activity aimed at extracting and effective use of the properties of forest resources. But from a legal point of view is a legal institution. The process of forest exploitation is regulated by forest legislation. The following kinds of forest exploitation and its resources are allowed in commercial purposes at this moment: timber harvesting; food forest resources, medicinal plants; keeping hunting economy; implementation of hunting; implementation of recreational activity; processing of forest resources.

It is necessary transition to intensive ways of using the forest resources in modern conditions, which includes achieving the point where they cease considered as a “gift” of nature and turned into products of social reproduction. The economic needs of society are the decisive force that provides a new phase for expanded reproduction of intensive type. Intensification for use of forest resources is their social reproduction at the expense of which is productivity growth of forest environment and thus meet the needs of the national economy and the population in forest resources.

Urgent problem is the use of logging waste at enterprises of timber industry complex of Ukraine. At certain stages of production of timber raw wood because of the low value of the commodity is not used or is lost as waste (Putsenteilo, Svyntukh, 2013).

The task of intensifying towards two elements of the forest resources: forest environment and productivity of plantations should be resolved in different ways. If productivity of plantations is embodied in forest stands that are withdrawn and converted into a regular social product, the forest environment is included into this process differently. The intensive use of the forest environment involves the preservation of existing and mobilization of new natural forces that act in the role of the systems of natural machines in the interests of productivity growth of forest environment and conservation of natural relations for reproducing forest ecosystems.

Forest exploitation is carried out by harvesting and use of wood products. The main resource is wood, bark and wood chips. It also includes harvesting bark, spruce and pine quotes. The main direction of industrial forest exploitation is timber harvesting. The emergence of environmental problems in the areas of mass works is associated with this direction. Harvesting of wood can lead to such consequences as: replacement of indigenous forests by secondary, which in turn is less valuable, and sometimes less productive. Felling of forests is the cause of economic changes in the regions of disappearance of the forests. The most negative manifestations are observed in those cases where the amount of felling exceeds the amount of the forest that grows per year (felling of wood).

However, unfavorable phenomena are considered defect that occurs during felling of logging by rates from growth rates of wood. This leads to reducing productivity of forests, its aging and diseases of trees. Forest management is interested in that forest exploitation would not be devastating. It should not exceed the productive forces of the forest. If the magnitude of use does not exceed the annual growth of forests, such use can be called sustainable. Correlation of magnitude of forest felling and magnitude of growth is general theoretical solution of the problem on regulating forest exploitation.

Proportionality of these quantities is the basis on which forestry of the country is based. The equipment and technology of logging on logging works carries out negative impact on the forest fund. Developed rational methods and methods of logging on the basis of various complexes of machines are violated in this article. Timber cutting works are conducted on the least costly way, without taking into account preserving the environment.

The mass destruction of trees, young stock and seedlings is the basis of future forest stand. The pursuit of loggers for high productivity of the work without regard to violations of technological regulations and weak control over them by the forest authorities leads to a prolongation of restoration terms of forests clearings, modified sawmills of softwood that promotes the emergence and spread of forest fires. The last do not only destroy vegetation cover, but also leads to burnout of the most fertile humus layer of soil, which further significantly slows forest recovery processes and for many years deduce these areas from productive land. Majority of plantations that passed by felling and fires are damaged and low value tree species.

The amount of forestry production in Ukraine in 2014 was 7739.9 million hryvnias that almost on 23% more than in 2013. The production of logging from the total volume was 7181.9 million hryvnias or nearly 93%. 18.3 million m³ of wood was harvested by forestry enterprises of Ukraine. Wood energy was accounted for 10.1 million m³, including wood for heating 5.5 million m³ (State statistics service of Ukraine, 2014).

Harvesting of secondary forest products is carried out by forest enterprises. In 2014 2.9 thousand tons of wood juices, 2.3 thousand tons of berries, 2.1 thousand tons of cane, 1.6 thousand tons of hay, 165.2 tons of mushrooms, 126.9 tons of medicinal plants, 34.3 tons of nuts, 7.6 tons of wild fruits, 7.3 tons of green wood, 4.2 tons of bark, 357.5 thousands of pieces of Christmas trees were harvested by them (State statistics service of Ukraine, 2014).

Today, interest in the use of wood as alternative fuel increased due to rising gas prices.

One of the main reserve sources of local fuel that can be used for the needs of the fuel and energy complex are forest resources and wood of waste wood industry. Deep wood processing and use of all products (technological wood chips, twigs and pine needles) is necessary due to the increasing of cost price of harvesting and transportation of wood and increasing the price on timber.

The resources of fuel wood include: fuel wood that are harvested during felling of the main and intermediate use of forests; logging residues; wood waste; wood that are not filling a long time; wood of fast-growing species; wood from cleaning of green spaces and care for them in settlements; tree and shrub vegetation outside the forest fund.

The peculiarity of reproduction of forest resources is that attracting new resources instead of used is constantly implemented in production. Rationality of forest exploitation is reduced to economical introduction in the economic turnover and rational exploitation of forest objects. The modern forest exploitation provides self-reproduction of this nature.

Reforestation is an important objective in forest management, which includes carrying out measures on forest regeneration on clearings, wastelands, glades and other former areas which were under forest, involving planting, seeding of the forest and promoting its natural regeneration.

Thinning and selective sanitary cuttings are due to the reconstruction of the young plantations, eliminating of clutter of logging sites and felled areas that are caused by fires, defeat of insect pests and unsystematic felling of forests by loggers.

This forest reproduction that was effective at earlier stages of development of the national economy cannot ensure rational relations between society and forests in modern conditions. It is limited in terms of preservation and development of all system of forest resources, including forestry and environmental protection.

One of perspective ways of using fuel wood is the production of bio-fuel by establishing plantations of fast-growing tree species. Fast-growing species: birch, aspen, alder, willow, poplar are perspective for industrial forest growing in energy purposes in the climatic conditions of Ukraine.

So, growing of fast growing tree species on fuel and energy plantations by the intensive technologies allows you to get to 20-25 years of age plantings 150-250 m³ of timber from 1 ha (State Agency of Forest Resources of Ukraine). In forest conditions of Polissia 25-year-old plantations of fast growing tree species, prototypes of energy plantations, including plantings of gray alder have productivity more than 200 m³ / ha. Productivity of 20-year crops of poplar amounts to 233 m³ / ha (Kovalevych, Usenia, 2013).

A perennial forest cultural practice indicates that an important condition for accelerated growth of plantation crops are used for their creation of large-sized and also micro-clonal reproduction of selection planting material.

Therefore, the main direction for reproduction of forest resources is the intensification of all total forest production activity by improving equipment and technologies (artificial forest growing) that allow combining functions of forestry and forest use in a single process, when elements of forming a particular consumer cost and elements of forest reproduction will merge organically.

4. Wood is efficient source of energy

Rational utilization of wood waste will give the possibility to reduce damage for the environment and will become a reliable source of cost savings, obtaining additional revenue through the implementation of new kinds of products. Large volumes of processed timber entail obvious problem of waste disposal from this type of industry. Thus, wood is the most efficient source of energy (except natural gas) to generate heat and at the same time it is the most ecologically clean product for thermal power plants.

Fuel briquettes are the most technological type of solid bio-fuels. It is deeply redesigned and ecologically clean kind of fuel. You can produce them from different kinds of biomass, sufficient energy value and excellent physical properties that allow effectively grinding material is inherent for them.

The most common types of raw materials for the production of solid bio-fuels are:

- wood (waste of logging, sawmill and wood processing);
- agricultural residues (husks of sunflower, husk of buckwheat, millet, etc.; straw, cane, litter for domestic animals and birds); turf; solid waste; sewage sludge.

Wood residues and damaged wood are mainly used in regions with developed timber industry complex as raw materials for production of pellets and briquettes. Fuel granules and briquettes are produced in regions with developed crop from waste plants: straw, husk of sunflower, corn waste. Livestock enterprises considered used "litter" for animals and birds (usually sawdust mixed with dung) as raw materials.

Today briquettes are one of the most ecologically clean kinds of fuel. They are widely used for a long time in European countries. Fuel briquettes differ from each other by composition of composites, density, strength, color of coloration, respectively, heat of combustion.

It is generally dried and pressed raw material in the form of cylinders with a diameter of 6, 8, 10 mm and a length of 5-40 mm and which has a number of valuable properties (energy, environmental). This raw material is a certain solving of modern problems of alternative energy supplying.

Briquettes from waste wood have a number of advantages in comparison with traditional kinds of fuel:

- ecological purity;
- accessibility;
- high calorific value;
- low ash content of harmful substances;
- possibility of full automation of the combustion process;
- restoration of initial raw material;
- the possibility of secondary use of waste (ash as fertilizer).

Wood pellets as heating fuel received extensive worldwide distribution thanks to the peculiarities of the combustion process.

The amount of heat (calorific value) of wood pellets are slightly lower in compared with traditional fuels (coal, oil, shale, etc.), but at the same time, the amount of harmful

substances at burning of pellets is very insignificant. Continuously growing popularity of granulated bio-fuel in the world is caused by the number of indisputable advantages in compared with initial material:

- reduction of warehouses by 50% due to the greater bulk weight;
- reducing expenses for transportation;
- burning in the boiler is more efficient than the combustion of initial raw material;
- the supply of fuel to the burners can be quite easily automated;
- burners for granules are easily installed in boilers instead of the exhaust burners for liquid fuel with preserving of the high level of automation.

Production technology of granules includes a number of operations that can be divided into three main stages:

- previous preparation of raw materials;
- obtaining granules;
- operations with ready granules.

Starting materials for the production of granules is significantly differ in particle size, bulk and specific gravity, moisture content, particle strength, chemical composition of raw materials. Therefore, its own technological scheme which may be as simplified and complicated is developed for each type of raw material.

The obtained wood waste can be supplied to special enterprises that engaged in manufacturing of briquettes in industrial scale or can be processed immediately. In this case, you should adhere to the requirements concerning preparation of raw materials:

- low humidity (to reduce energy consumption for manufacture of briquettes);
- comminuting, must be evenly shredded into particles about the same size, which greatly affects the quality of the output products. The stage of preparation of raw materials that leads to two directions of its using is absent in small granulators: or using another constant source of raw materials, or each time downloading mass into granulator, rearranging its mode of operation (Instructions for pellet boilers and fireplaces);
- compulsory optimization of temperature regime of production because natural lignin does not exhibit gluing properties until the mixture of raw materials will not heated to a certain temperature, but keep in mind that high temperatures can damage the equipment (Instructions for pellet boilers and fireplaces).

Obligatory equipments for production of briquettes are (Lotosh, 2007):

- 1) comminuting and drying equipment (in most cases such equipment is missing in mobile briquette presses, so you should select this equipment separately).
- 2) granulators that due to the lack of permanent filling of output raw materials should choose small volumes and capacity, such as mobile briquette press 3-5 m³ / h of output raw materials with output of finished products – 500-700 kg;
- 3) briquette boiler, which can also be used for receiving bio-fuels, demand for which is constantly growing.

5. Conclusions

So, in order to provide the most sustainable and efficient management of forests, should apply measures for the forestry development of our country.

The design and development of new technological processes that can lead to a significant reduction, and eventually complete elimination of losses in logging, processing and use of forest resources takes the critical place in the modern world. In this regard, tasks for nature protection from pollution related with deficiencies in the area of logging and use of forest resources play the important role.

The modern development of low energetic on the basis of wood fuel use is one of the most important directions which provide reduction of the share of energy imports, increasing energy efficiency of the economy. Successful implementation of bio-energy projects with the use of forest wood resources can only be based on the principles of economic benefits and ecological security that are only possible in the implementation of effective modern technologies of wood biomass, its logging, transportation and processing, environmental protection.

Along with the problem of unsustainable use of forest resources, there are other, equally important. Illegal deforestation belongs of course to such problems. Over the last decade, a huge number of facts of illegal logging were fixed by law enforcement authorities. Thus, the problem of ecological crime at this moment is very serious and has tendencies to develop in the near future. Unfortunately, organization and the fight against criminality in forestry is at rather low level that requires amplification of steps in this direction.

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НАПРАВЛЕНИЯ ЭФФЕКТИВНОГО ИСПОЛЬЗОВАНИЯ ЛЕСНЫХ РЕСУРСОВ В УКРАИНЕ

Аннотация. **Целью статьи** является определение и обоснование направлений рационального использования лесных ресурсов Украины. **Методика.** Теоретической и методологической основой проведенного исследования являются постулаты экономической теории, устойчивого развития, экономики природопользования, экономики лесопользования. Для достижения поставленной цели применялись такие методические средства и приемы: методы анализа и синтеза (для выявления проблем взаимосвязи использования потенциала лесных ресурсов с факторами влияния на их воспроизводство, исследовании сути понятия “лесные ресурсы”); монографический – для изучения опыта формирования рационального использования лесных ресурсов и отходов древесины; системного подхода (при обосновании применения инструментов регулирования лесопользования); научной абстракции (при исследовании возможностей обеспечения процессов рационального воспроизводства лесных ресурсов); графический (для наглядного изображения отдельных аналитических наблюдений). **Результаты.** Сформулирован теоретический подход к лесовосстановлению, как важнейшей задачи в ведении лесного хозяйства, которое включает в себя комплексное использование всех имеющихся организационно-технологических мероприятий, способствующих его естественному обновлению. Установлена закономерность обеспечения эффективности использования отходов древесины в местах заготовки, выявлены и систематизированы ее виды для дальнейшего использования. Сформулирован методический подход к оценке эффекта от использования отходов древесины для производства топлива и сопутствующих продуктов при переработке по гармонизации экономических и экологических интересов в сфере лесопользования. **Практическое значение.** Полученные результаты являются основой для решения практических проблем комплексного управления лесными ресурсами Украины, отходов рубки леса в местах заготовки древесины, а также для разработки системы мер по совершенствованию эколого-экономического механизма развития природоохранных территорий и формирования на этой основе эффективной политики природопользования в соответствии с национальными интересами Украины, что будет способствовать повышению экономической эффективности и обоснованности решений, связанных с приоритетными направлениями природоресурсной политики в условиях трансформации отечественной экономики. **Значение/оригинальность.** Обосновано использование топливной древесины в производстве биотоплива за счет создания плантаций быстрорастущих древесных пород для промышленного лесовыращивания в энергетических целях.