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STATE OF WIND FALLEN WOODSTANDS IN BELARUS AND PROBLEMS OF ITS DEVELOPMENT

In the article the analysis of fallen and broken by the wind woodstands of Belarus Republic is made, the basic problem questions of their development are defined. Criteria of an estimation of efficiency of various technologies and machine systems application for logging of fallen and broken by the wind forests are resulted.

Introduction. Every year around 7 million hectares of forest plantations disappears in the world, one of the reasons for this are the natural disasters – windfalls and fallen wood.

Strong hurricane winds cause substantial damage forestry, since besides the significant economic losses associated with the liquidation and recovery of forests, and the ecological situation is worsened due to violations of the forest ecosystem (soil, tree stands, all the layers of vegetation, fauna, and so on). However, due to further climate change it is expected that the frequency and intensity of forest fires, storms and hurricanes will be increased.

Taking into account the scale of the power, reduced time to eliminate the consequences, logging crews of the concern “Bellesbumprom”, military units and others are involved to work on fallen and broken by the wind forests. Impassable fallen and broken by the wind forests are the most difficult objects to develop, often associated with significant injuries and fatalities, even when a skilled labor force is used.

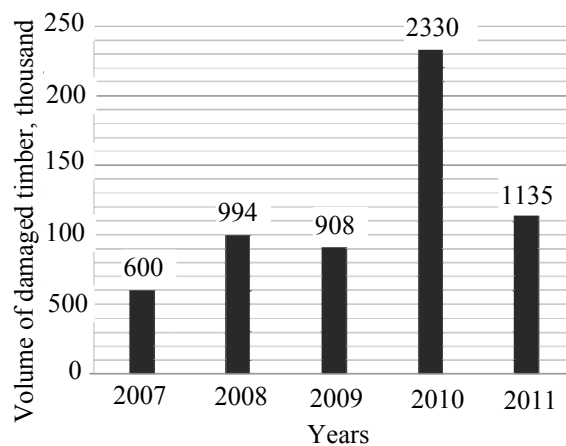
In the Republic of Belarus in order to well-timed and quality execution of the organization of liquidation work to deal with windfalls and windbreaks, to fulfill the main tasks of timber production in the Ministry of Forestry, it is necessary to develop and implement energy saving technologies to develop fallen and broken by the wind forest cutting areas on the basis of the modern domestic and foreign advanced system machines, which require to perform an objective evaluation of clearcuts and explore the problems of their development.

Main part. State of fallen and broken by the wind forests.

In Belarus, the annual volumes of timber damaged by hurricanes range from 500 to 2,300 thousand m³. The volume of timber damaged by the hurricanes has been estimated over 5960 thousand m³ for 2007–2011 (Figure).

In 2010, the hurricanes damaged forests in 76 forest enterprises. In the development of the damaged areas 5,800 people were employed, 1,712 units of machinery were engaged. The expenses of the Ministry of Forestry of the Republic of Belarus amounted to 62.8 billion rubles, revenues – 49.3 bil-

lion rubles, 15.2 billion rubles was allocated as subsidies and assistance from the national budget. Production rates for the development of fallen and broken by the wind forests decreased to 30–50%. In 2011, the amount of damaged wood was 1.135 thousand m³, which corresponds to 14% of the annual estimated cutting areas.



Dynamics of forest damage
in the Republic of Belarus caused by windfalls

For an objective analysis of the effectiveness of advanced process of development of fallen and broken by the wind forest cutting areas one should know the factors that affect the extent and nature of damage to the stands and the stability of different tree species to the conditions of their growth.

In practice, the distinction is made between the concept of “windfall” and “windbreak”. In the case of windfall the trees are uprooted, and with windbroken trees wind breaks the stick at the top. The extent of this impact, in addition to wind power, depends on the anatomical structure of the stick, the nature of root system, the pretreatment of trees to the opposition of the wind, and in winter to the stick frost penetration. Rocks with well-developed layer of phloem suffer less from windbreak. Winter windbreaks and windfalls are especially dangerous when the stick is frozen and becomes brittle. Windfall in the forest opens the way to wind penetration deep into the forest, causing new windfalls.

Tree species have different mechanical resistance to wind. For example, spruce on podzolic soils has a shallow root system, it is a windfall species, and usually wind turns the wheels of roots outside. But in deep soil spruce well maintains the flow of wind, even in open areas. Pin has rather deep roots, it is a windfall species, and the wind often cannot turn it out to the root, and breaks the stick. While in shallow soils wind sometimes uproots pine as well as spruce. Hardwood oak is quite stable, with its deep root system. Birch is usually a windfall species, and aspen is a windbreak species because of its fragile wood.

Mature trees, which grew in the forest, but then, after logging, have turned out in the open areas, are also susceptible to windfalls. Such trees can no longer adapt to the new conditions. Trees affected by fungal diseases are more likely to suffer from wind-falls. The most vulnerable trees are mature and overmature stands.

The issue of development of fallen and broken by the wind forest cutting areas. In practice, the development of fallen and broken by the wind forest logging sites in the Republic of Belarus and abroad is performed mainly by two systems of machines and equipment “gasoline-powered saw – forwarder” and “harvester – forwarder”.

Development of any of the wind forest logging sites complicates the process of logging, since the trees are under stress; they form slashing, eversion of roots, etc. They reduce the efficiency of the development of cutting areas. Therefore, the most experienced workers are attracted for such work.

The issues of concern during the development of wind forest cutting areas include:

- increased consumption of tires and chains (sometimes machine complex consumes 2 tires for 20 working hours);
- an extreme working conditions of the harvester head and manipulator (pulsatile, alternating loads), rupture of hoses and oil pipelines;
- hard working conditions of gasoline-powered saws operators (even when harvester felling is developed, 5–20% of trees is processed with chainsaw);
- reduced productivity (3–50%);
- increased injuries (25–40%);
- difficulties in transportation of wood because of high stumps, broken wood, increased hauling distances and other factors;
- the limited time of development of cutting areas to maximize the production of quality timber and create the conditions for reforestation.

Criteria for evaluating the effectiveness of development process of the fallen and broken by the wind forest cutting areas. For the purpose of an objective evaluation of the logging in the damaged areas the system should include a set of criteria taking into account the economic,

industrial, technical, environmental and social factors.

The main criteria for evaluating the effectiveness of the development process of the fallen and broken by the wind forest cutting areas are:

- terms of the development of cutting areas;
- accomplishment of planned rate for the volume of timber harvesting;
- maximum output of timber in terms of volume;
- maximum output of production in terms of cost (by variety, customer order, etc.);
- the degree of woody biomass use;
- no injuries;
- a complex production for leading mechanism;
- labour productivity;
- the level of mechanization of labour (percentage of application of specialized logging machinery and general machinery);
- correspondence to the conditions of work and rest required by ROV;
- correspondence to the forest certification;
- conditions for reforestation and biodiversity;
- the degree of damage to the forest ecosystem;
- maintenance of identification of wood products;
- environmental restraint of sites contaminated by radiation;
- the application of machine systems with minimal energy consumption (average power consumption per 1 m³ of timber, or 1 hectare of the developed area);
- the cost of the work (for the entire cycle, for operations, for 1 m³ of timber, or 1 hectare of the developed area);
- degree of equipment use at basic stages;
- coefficient of machinery availability.

To assess the effectiveness of the development process of the fallen and broken by the wind forest cutting areas it is necessary to determine values and ranges, to prioritize the proposed criteria, which, in the aggregate, will help to make informed decisions at the stage of the choice of technology and machinery.

Recommendations for effective use of machinery systems in various natural and industrial environments. Based on the analysis of the technologies and systems of machines applied in the Republic of Belarus and abroad for fallen and broken by the wind forest resources recommendations for the effective implementation of systems of machines in various natural and industrial conditions are developed. They will be supplemented in the course of field studies:

- for an objective analysis of the effectiveness of advanced process development of the fallen and broken by the wind forest cutting areas, it is necessary to know the factors that influence the degree and nature of the damaged stands, as well

as resistance of different tree species to the conditions of their growth;

- development of fallen and broken by the wind forest resources it is necessary to conduct according to assortment technology using two systems of machines and equipment “gasoline-powered saw – forwarder” and “harvester – forwarder”;

- on soils with low bearing capacity during the development of deciduous trees, gasoline-powered saws and skidders with rope-choker equipment and collecting rope up to 60 m length are used. Assortment storage is held at upper landing;

- the most experienced specialists with experience in the development of such plants should be involved;

- stands on the affected area are starting to develop by a harvester from the wind direction side;

- the most difficult parts, where the trees are woven or lie in different directions, the operator develops at the very end;

- because of heavy loads on the elements of machines and equipment in the development of cutting areas harvester should use the machines with limiting or near-term operation;

- biomass, from which it is impossible to get assortments because of its large concentration, should be used for production of wood chips;

- in winter, if the development of fallen and broken by the wind forest resources cutting area is in deep snow it should be transferred to the snow-free period;

- in the development of cutting area it is necessary to create conditions to minimize the potential windfalls and improve the sustainability of future stands or trees left for complete growth. For this reason cutting is prescribed downwind or upwind, and a strict sequence of operations should be established in advance.

Conclusion. In the study of these problems existing technology of development of fallen and broken by the wind forest resources cutting areas in the country and abroad are identified, concerns and directions for the solutions of these problems are offered. The analysis and statistical processing of the data of windfalls in the Republic are held, the size and degree of damage to forests, depending on the environmental conditions, the nature of damage and location of damaged wood are determined. Given the specific nature of the injury of stands, smarter ways of technological operations of various equipment, a set of flow charts using various machine systems and process flow diagrams using gasoline-powered saws with respect to the model (the most common) type of injuries stands are designed and, and the basic criteria are established for evaluating the effectiveness of various technologies and systems of machines. The recommendations for the effective application of machine systems during development of fallen and broken by the wind forest resources cutting areas in various natural production conditions.

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