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The impact of agricultural fertilizers and pests on agricultural wealth in pine forests

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Abstract. Reduced water quality, increased erosion, and the loss of vital animal habitat are all consequences of overfishing. Furthermore, the use of pesticides and herbicides during the wood harvesting process might harm non-target species and contribute to the loss of biodiversity. The health of the forests in the Southeast of the United States is also threatened by invasive pests and illnesses like the southern pine beetle and emerald ash borer. The loss of biodiversity and general health of forests can result from these pests' severe effects on forest ecosystems. Diseases and invasive pests can have a financial impact by devaluing forest products like wood. To address threats to the health of the forests in the Southeast region of the United States, several federal, state, and municipal policies and initiatives have been implemented. By lowering air and water pollutants that may damage forests, the Clean Air Act and the Clean Water Act are two federal laws that have had a major influence on the health of forests. Furthermore, threatened species that rely on forest ecosystems are safeguarded under the Endangered Species Act. The state's forest resources are under the Georgia Forestry Commission's care and protection. The Commission offers landowners technical support and direction on sustainable forestry techniques, as well as programs for pest control and forest health monitoring. One program that has been effective in encouraging sustainable forestry practices in the Southeast of the US is the Forest Stewardship Initiative. The program offers landowners who wish to use sustainable forestry methods on their property a number of advantages. One of the main advantages of the forest management program is that it offers landowners technical help. Advice on preserving animal habitat, planting and maintaining trees, and stopping soil erosion are a few examples of this assistance. Additionally, landowners can receive guidance on obtaining and preserving sustainable forestry accreditation. Along with technical support, the program offers financial incentives to landowners that adopt sustainable forestry.

Key word: Biological diversity , Forest health , Agricultural pests , pollution , Sustainable forests

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Introduction: Despite the great importance of forests for the existence of life on the planet, their range is sharply reduced. They are cut down for agricultural fields, pastures, for fuel, building materials, paper, etc. During our historical era, almost the entire European continent and vast expanses of Asia were laid bare. Now the unique tropical forests of South America and Africa are being intensively cut down. Even if a person wants to restore these forests – he will not succeed: strong rainforests quickly wash away humus-rich soil, and rainforests can only grow on such soil. In the forests, there is intensive felling of trees, tree falls, clutter of the forest; damage to tree species by fungal, bacterial and viral diseases. Now all over the world, people who are concerned about the future of the planet are not only sounding the alarm: they are planting forests, caring for them, carrying out reforestation work on clearings, and striving to improve the ecological culture of all people in using forest resources. By cutting down forests, a person thinks that he is expanding his living space, but it turns out the opposite: during its history, as a result of erosion and desertification, humanity has lost as much land as is currently occupied by agriculture. But that might not have been the case! Our area is no exception in terms of forest loss.

The objective of our research is to determine the ecological state of the pine forest in the village of Verebskoe.

1. **Ecological significance of the forest** Forests cover about 30% of the Earth's land surface. They ensure the sustainable development of the biosphere. They are called the lungs of the planet, as they are the source of oxygen in the atmosphere. And without oxygen, there would be no such magnificent life on Earth [1]. One beech tree releases up to 1.7 kg of oxygen in 1 hour, so it can meet the oxygen demand of 64 people in 1 day .Plants pass through a huge amount of water. They take it by its roots from the soil and evaporate it into the atmosphere from the surface of the leaves , which in biology is called transpiration [2] [1] . During the summer, about 2000 m3 of water evaporates from 1 ha of wheat field; 8,000 m3 of cabbage field. The evaporation produced by trees humidifies the air and softens the climate, so in summer the air temperature in the forest does not rise so much [3] . The forest has an important climate-regulating value :- the forest serves as a shelter for a huge number of animals and plants.

- The forest retains dust, purifies water when it evaporates . reduces noise , reduces the harmfulness of toxic chemical pollutants. One beech tree can process more than 2 kg of toxic gas in 1 hour, and in 1 day it evaporates 400 liters of clean water [4].

- The forest supplies wood, fuel, paper, rubber, berries, mushrooms, nuts, medicines, etc. The destruction of forests leads to soil drainage , shall owing of rivers, and increased water and wind erosion [3]. The destruction of forests can cause a global environmental catastrophe! In ancient times in the Mediterranean, vast areas of deforested land turned into deserts [5]. The forest is one of the main regulators ecological balance of the biosphere! The creation of new woodlands is the most powerful means of protecting the environment from anthropogenic pollution and restoring the disturbed balance in nature [1].

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1.1 Forest composition.

Depending on the composition of the forest-forming tree species, forests can be pure, i.e. homogeneous (spruce, pine, oak, birch, etc.) and mixed. Mixed forests include coniferous-broadleaf (for example, spruce-oak) and other forests consisting of two or more tree species (for example, spruce - birch, birch-aspen, oak-aspen.) They are distinguished from pure forests by a large variety of trees growing in them. In addition to trees in the forest, there are shrubs, shrubs and grass cover [6]. The height of trees, shrubs, shrubs, and grass stands varies. Therefore, the so – called vertical structure of the plant community-phytocenosis-is distinguished in the forest. The vertical structure of the phytocenosis is expressed in its tie ring. The number of tiers in different forests varies [5]. They are counted from top to bottom. In our forests there are from one to three tree tiers, one to two tiers of shrubs, from one to three tiers of grasses and shrubs, and on the surface of the soil there is often a moss or lichen tier. The largest number of tiers of broad-leaved forests, the smallest in coniferous. Tie ring can be not only above ground, but also underground [1]. Score based on different root system propagation depth. The root systems of trees with a strong taproot have the greatest depth (for example, pine growing on dry, sandy soils, mosses and lichens have the least depth. The animals of our forests are not permanently attached to any tier. Land animals (for example, birds, rodents, insects and their larvae, etc.) change their unstable position (ground and underground) during the day, year, and life, spending a longer time in one or another tier than in others. The life of underground animals (worms, microorganisms, etc.) is mostly associated with certain depths of the soil [4].

1.2 Method of determining the age of trees.

The age of trees is determined by counting the annual rings on the cut or stump. The age of coniferous trees is determined by the number of tiers of side branches.

1.3 Methodology for determining the forest bonus.

You can use a ruler to determine the height of the tree. To do this, hold the ruler at arm's length in front of the eye, move away from the measured tree by 10 -30 m and fix the upper end of the ruler to the top of the tree. The height of the tree is calculated by the formula

A*B

X= - - - - - - - + h, where but

A - distance from the observer to the tree (measured with a tape measure).

A - distance from the observer's eyes to the ruler.

B - the distance on the ruler between the sighting lines. his the distance from the ground to eye level.

2. The barrel diameter(D) is measured at a height of approximately 1.3 meters and is calculated using the formula:

D= - - - where C is the circumference of the barrel measured with a tape measure

Table 1. Determining the forest bonus based on the height of trees and their age [5].

Tree age	Average tree height	I class	II class III	IU class	U class
10years	5m	4m	3m	2m	-
50years	19m	16m	13m	10m	7m
100years	29m	25m	22m	18m	14m
150years	33m	29m	25m	21m	16m

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1.4 Method of determining the transpiration intensity during the growing season of a pine forest.
The moisture consumption for a pine stand is determined based on the schedule (reference book). We also set the amount of moisture consumption for transpiration evaporation from the grass and shrub cover and crown.
- Calculate the volume of water that evaporates from the pine forest area of 1000m2.To do this, the area from which evaporation occurs is multiplied by the height of the column of moisture that is released during transpiration.

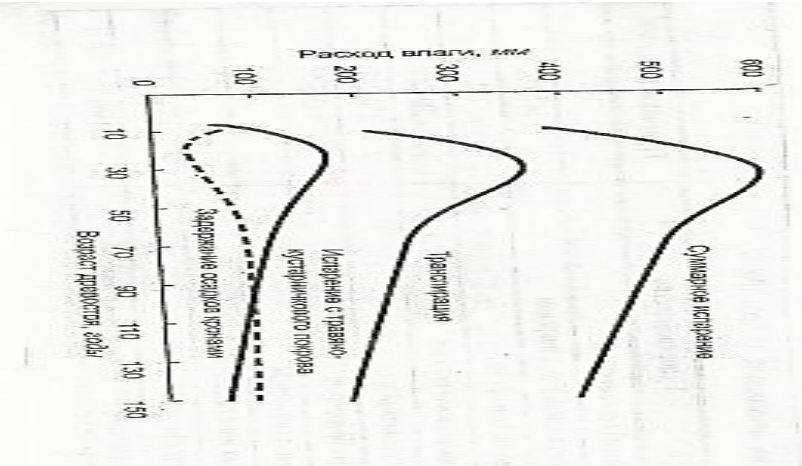

Figure 1. Graph of moisture consumption.

2. **Study of the Vereb pine forest.** The forest-forming species of the pine forest is pine an ordinary one. This is a fast-growing and heat-loving tree that lets in a lot of light. The forest grows on turf podzolic soil. On the soiled soil, the pine tree develops a tap root and a strong horizontal root system. Thanks to this, the trees are very wind-resistant. Usually there is no shrub layer, and only in less closed pine stands there is buckthorn, juniper, hazel. In the grass cover, the most characteristic are: common sour, double-leaved mayonnaise, one-sided chamomile, medicinal veronica. Quite often there is a round-leaved pear tree, lingo berry, mosses, lichens. The forest is disturbed by deforestation, and therefore birch trees multiply in their stand, and grasses and various grasses (meadow – forest species predominate) multiply in their stand, and in some places there are thickets of ferns.

2.1 Study of the influence of the environment on the growth of trees in the forest.

2.1.1 Influence of sunlight on the intensity of tree life in the forest.
Lack of sunlight leads to the shading of trees by each other, the death of some of them and the formation of dead wood. The greatest death occurs during the period of their maximum growth and crown development. For scots pine, this age is equal to 40 years in our studied forest.

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2.1.2.Influence of soil and climatic conditions on the growth of forest trees-forest bonitet.

Table 2. Bonus of the pine forest

Tree age	I class	II class	III class
10 years	5 m	4 m	3 m
20 years	11m	8m	11 m 8 m 6 m
30 years	16 m	14 m	9 m
40 years	20 m	16 m	12 m

The growth and development of trees are influenced by soil fertility and humidity, light, heat, and topography. The better soil and climatic conditions, the taller the trees, the larger their crowns and the thicker their trunks. From the table data, it can be seen that trees with a Class I bonus grow in the best conditions I(trees are tall, spreading crown, thick trunk). A certain amount of wood also corresponds to each class of forest Bonitet for a particular tree age, which makes it possible to determine the favourable time of felling. It was found that most of the dead wood in the first class of forest Bonitet as it [7]. The number of trees is much higher than in other classes, so there are more dying trees in it.

3. **Determination of moisture consumption in a pine stand.**
   We compare the values of moisture consumption for transpiration, evaporation from the grass and shrub cover and crown. Note from which source more of the water purified by evaporation enters the atmosphere. We determine to what age the pine trees ' transpiration increases and then falls.
   Explanations of why the evaporation rate from the grass and shrub cover increases as the pines age, and the water retention by the crowns decreases. The moisture consumption for a pine stand with an age of 10 years is determined according to schedule **Table 2**.
   Transpiration-240mm. Evaporation from the grass and shrub cover -100 mm . Precipitation retention by crowns-50 mm . The total evaporation is 390 mm.

The greatest moisture consumption in pine stands reaches 30 years of age. Transpiration of pine trees increases to 40 years of age, and then falls. Evaporation from the grass and shrub cover increases as the pines age, and water retention by the crowns decreases [8]**.**

4. **Determination of transpiration intensity during the growing season of a pine forest.**
   We calculate the volume of water that is evaporated by a mossy pine tree from an area of ^{1000m2}. For this. The area from which evaporation occurs is multiplied by the height of the column of moisture(water), which is released during transpiration and in 228 mm / year. If we convert millimetres to meters, we get 0.228 meters. Calculate the volume of transpired water:

   ($1000^{м1000m2}$* 0.228 m = $228m3^{3}$)

The volume of water evaporated by a pine forest from an area of ^{1000m2} for 1 year is $228m3^{3}$.

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5. **Determination of the degree of carbon dioxide absorption by the forest.**
On a sunny day, 1 hectare of forest absorbs about 240 kg of carbon dioxide and emits about 200 kg of oxygen.
For a year, 1 ha of forest absorbs about 50 kg of dust, releasing valuable substances for humans-phytoncides that can kill pathogenic microbes. Per day, 1 ha of forest produces 3 kg of phytoncides, and 30 kg of phytoncides is enough to destroy harmful microorganisms in a large city.
Per day, 1 person under normal conditions absorbs an average of 600 g of oxygen and inhales 750 g of carbon dioxide.
We calculate the mass of absorbed carbon dioxide, released oxygen, and phytoncides per day for a 10-hectare pine forest.
For 1 day pine forest
It will absorb carbon dioxide:
240 kg / ha * 10 ha = 2400 kg
It will release oxygen:
200kg \ ha * 10ga = 2000kg
Selects the following phytoncides:
3 kg \ ha * 10 ha= 30 kg .The number of people who will have enough oxygen released (2000 kg) will be equal to:
2000 kg : about 6 kg = 3333 people
pine forest humidifies the air, reduces the harmfulness of toxic chemical pollutants, increases the concentration of oxygen in the air.

6. **Non-communicable diseases of the pine forest.**
6.1.1 Fungal diseases.
Such tree diseases occur when the bark is damaged by humans, animals, falling trees, or unfavourable climatic conditions [9].

Figure 2. *One of the trees damaged due to unfavorable environmental conditions*

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- drying of branches (lack of moisture)
- freezing of branches (severe frosts)
- yellowing and spotting of needles and leaves (presence of toxic substances)
- death of pine trees.(presence of toxic substances in large quantities).

6.1.2 . Influence of pests of forest trees inhabiting the territory of the Brasov sky forestry in the Leningrad administration.
6.1.2.1. Common pine sawfly.

Figure 3. *Diprion pini (Linnaeus, 1758) sawflies*

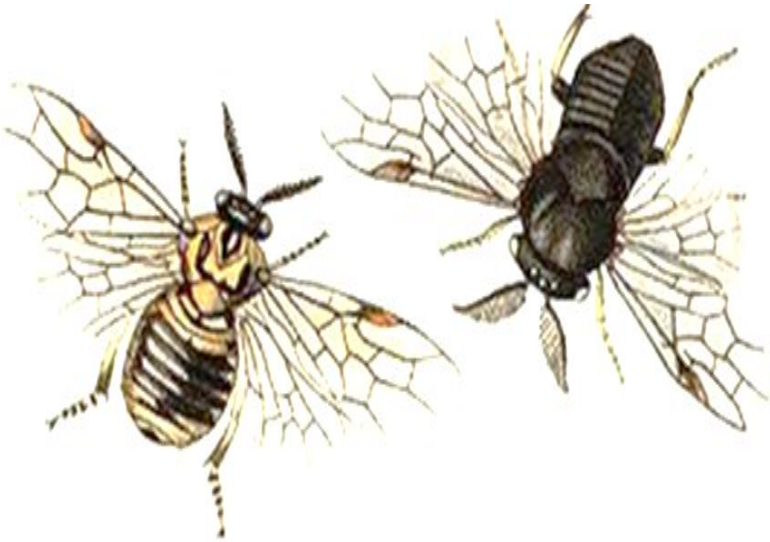

Figure 4. *Common pine sawfly*

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Table 3. Scientific classification

Kingdom:	Animals
Type:	Arthropods
Class:	Insects
Squad:	Hymenoptera
Family:	Pine sawflies

This species is widespread in all pine forests, damages mainly scots pine, prefers sparse stands. Adult hymenoptera (imago) is ovoid-oval, light yellow, with a variable black pattern in different individuals. The male (7-8 mm) is black, the antennae are black, feathery from the bottom. Female (7-10 mm) pale yellow, body strongly convex, broad, massive. Antennae yellow, saw tooth. The first generation of adult hymenoptera flies in late April or early May; the second generation flies in July-August. They are kept in nests (20-100 individuals each), feeding on shoots until July. From the needles, only the middle vein remains, which turns brown and twists. Adult insects destroy the bark, completely needles. Larvae of the second generation are the most numerous.

6.1.2.2. *Red pine sawfly*

Red pine sawfly-Neodiprion sertifer (Geoff.) Damages: mainly scots pine, causing the greatest damage to crops up to 30 years of age. Adult hymenoptera clearly show sexual dimorphism. The male has a slender body (6-8 mm), mostly black, shiny [10]. The female (7-9 mm) is reddish-red. The head is darker. The wings are yellowish. In the coniferous-deciduous and taiga zones, the summer season begins at the end of August and ends in September; in the forest - steppe and steppe zones, it begins at the end of September and continues in October. This hymenopteran destroys pine needles [2] [10].

Figure 5. *Red pine sawfly*

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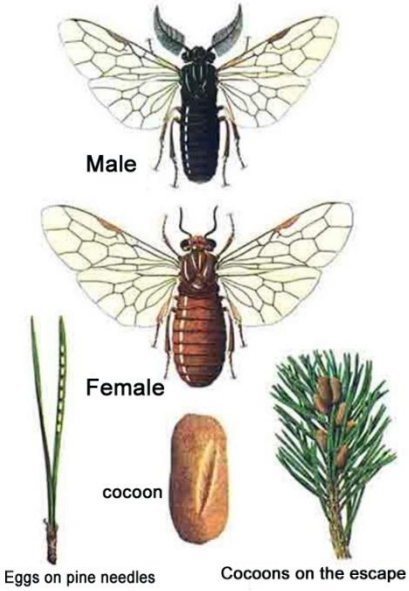

Figure 6. *Male and female red pine sawfish with eggs and growth*

6.1.2.3. Bark beetle typographer.

Figure 7. *Adult bark beetles that overwintered under the bark of spruce*

It mainly damages common spruce and pine, and settles in the thick and transitional bark of spruce, pine, and other coniferous trees. The beetle is brown, shiny, hairy. Male first settlers gnaw out the entrance holes and mating chambers hidden in the thickness of the bark. The beetles ' growth coincides with the budding of birch trees. Young beetles undergo additional nutrition, gnawing through random passages under the bark and damaging the tree's bast.

6.1.2.4. Black pine barbel.

It damages especially scots pine, occasionally spruce and larch. The beetle is black (11-28 mm) with whitish and ochreous hairs. The head and chest are rarely dotted. Elytra with 2-3 indistinct bandages. The antennae of the male are 2-3 times larger, the females 1-2 times longer than the body length. Years coincide with the flowering of linden and hazel (from mid-June to September). Beetles feed on bark, bast and sapwood. At the beginning of August, they go into deeper layers of wood, making an oval entrance hole with a cross section of 7X4 mm and a stroke up to 20 cm long.

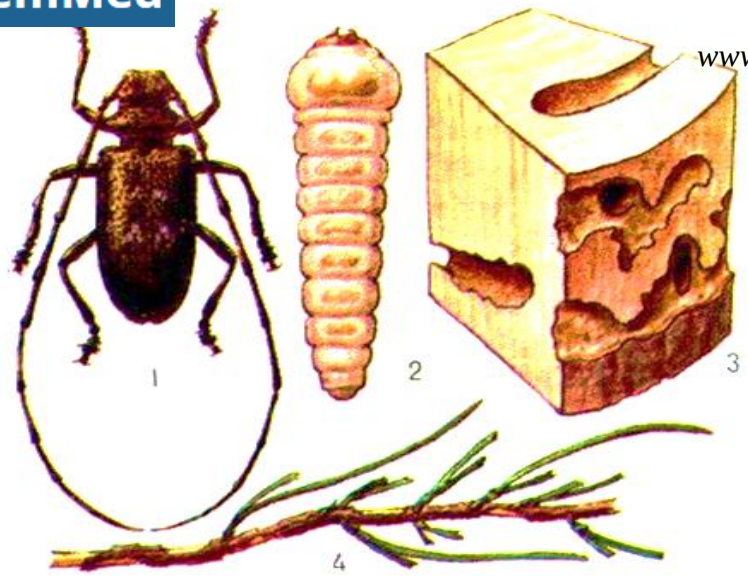

Figure 8. *Pine black barbel.*
1-beetle.
2-larva.
3-larval passages under bark and in wood.
4-pine branch damaged by beetles. stages

6.1.2.5. Gray long-whiskered moustache.

Damages pine, less often spruce. The beetle is flat (13-20 mm), light brown, elytra with two narrow dark bands. A male with antennae 2-5 times larger than the size of a female [2] [11]. female with antennae 1.5 times the length of the body. The flight of insects begins in April-May, and continues until autumn. Barbels gnaw out wide, irregular passages under the bark, slightly touching the sapwood and strongly corroding the subcortical space.

Figure 9. *Male Gray long-whiskered moustache stages*

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6.1.3. Infectious diseases.

On pines, the appearance of spots, ulcers, bloating and leaf fall are noticeable, branches dry out ,tarring occurs. The greatest number of diseases is found as a result of fungal damage. We determine that fungi begin to actively multiply inside trees, penetrating their leaves, branches, roots and trunks. Fungi feed on the contents of dead cells. Their harmful secretions poison healthy cells. Among these fungi, root rot is particularly harmful. At a time when the roots do not yet have solid covers, small wounds form on their surface. These wounds are penetrated by soil fungi, causing first damage to the root system, and then the death of the entire tree. The cause of pine disease is damaged, fallen and rotting trees, stumps.

Figure 9. A tree damaged as a result of an external fungal infection bacteria,

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conclusion

The forest has to be maintained in a hygienic state in order to prevent infections! There shouldn't be any fallen, broken, or decaying trees, stumps, or branches there. It shouldn't be inundated or contaminated by pollution from human activity. In order to maintain a dense crown of trees, healthy needles must be treated because they only survive on trees for three to nine years. Treatment of the fungus-affected needles is essential for the overall health of the tree since they are a source of infection for the healthy ones. During the investigation, Scots pine was the plant that created the forest on the Verebskoe village's land. Given the quantity of dead wood, the majority of it falls within the I class of forest benefit. The majority of dead wood falls under the I class of forest benefit since there are more trees there. Then, there are more dead trees in other classes. After thirty years of age, a pine stand begins to consume the most moisture. Pine trees transpire more until they are 40 years old, at which point it decreases. As the pines get older, less water is retained by the crowns, and more water evaporates from the grass and shrub cover. The presence of pine forests improves air humidity, lowers the amount of hazardous chemical pollutants, and raises the oxygen content of the atmosphere. In the forest under study, both viral and non-infectious diseases of pine trees have been identified, which cause the trees to die young. The forest's ecological condition has to be improved because of fallen, broken, and decaying trees, as well as stumps and branches that might infect new trees with diseases. Much of the pine forest grows on somewhat alkaline, sod-podzolic soil. Because trees shade one another, there is a lack of sunshine, which causes dead wood to accumulate. The five classes that make up the forest bonnet symbolize the various soil and climate variables that affect pine growth. It is believed that the inadequate hygienic state of the forest is the primary source of pine illnesses.

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