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HYDROLOGICAL REGIME AND GROWTH OF PINE STANDS IN CONDITIONS OF DRAINAGE RECLAMATION SYSTEMS

A retrospective analysis of the formation and development of drainage reclamation in Volyn Polissya was carried out. The growth of pine plantations within the controlled drainage system and under the control was simulated. The data of samples and materials of the database of plantations growing on drained and control plots were used for modelling of height dynamics and changes in stocks with age. Dynamics of heights and stocks are described by the models of the polynomials of the second degree and the exponent equations. It was established that by the middle of the 3rd age class, the height of plantations on drained areas exceeds the height of plantations under the control of 2.1 m. Starting from the 3rd age class, pine stands on drained areas sharply increase the growth and at the age of quantitative ripeness, the difference in heights reached 3.0 m. Pine plantations in land reclamation areas pass into the upper class of productivity. The difference between the average heights in the 5th age class is 2.7 m. The effect of drainage is traced after 30 years, when the root system penetrates deeper horizons. The growth of roots on the control sites close to the surface of the water table is inhibited. At the same time, the soil saturated with oxygen stimulates the growth processes of the wood plants between the drainage channels, which lead to an increase in the productivity of the plantings. Comparative analyses of changes in planting stock shows that in the fourth age class the stock of pine stands on drained areas exceeds 15 %, and at the age of quantitative maturation this difference reaches 21 %, which makes 89 $m^3 \cdot ha^{-1}$ and is a significant argument for the use of drainage reclamation in the wetlands of Volyn Polissya. The analysis of the hydrological regime of the drainage system "Strashevo" for the 14-year period showed that the water table during 2010–2017 sharply decreased reaching a stable value of 124–140 cm, whereas by 2009 it had fluctuated within the limits of 61–83 cm. The prolonged and significant decrease in water table leads to the declining of plantations, therefore, to ensure optimal hydrological regime of forest areas it is necessary to sluice channels or reconstruction of the drainage system in the system of bilateral action.

Keywords: reclamation; drainage channels; water table; pine stands; productivity; height.

Introduction. Free encyclopaedia interprets the hydrological regime as a natural change in the hydrological elements of the water object in time, due to physical, geographical and, primarily, climatic conditions of the basin (Free Encyclopedia, n.d.). Hydrological regime includes *perennials* (years with increased or lowered water content), *annual* or *seasonal* (flood, middle of summer, inundate) and *daily* fluctuations of water level of a water object. The hydrological regime of rivers, lakes, reservoirs, and wetlands is distinguished depending on the type of water object.

The natural hydrological regime often changes substantially under the influence of human economic activity. The use of drainage reclamation has the greatest impact on the hydrological regime of wetlands, because it radically changes the water-air regime of the roots-saturated soil layer over a long period of time. Therefore, the study of changes in the hydrological regime in time is necessary to find out the growth processes of wood species, increase the biological stability and productivity of forest stands.

Most scientists (Kostyakov, 1925; Tyulenev, 1926; Prokopowicz, 1926 et al.) explain the positive effect of drainage reclamation by the fact that during the drainage process root systems are released from excessive soil moisture, thereby increasing the area of plant nutrition. The Chief of the Western Expedition on the drainage of wetlands J. I. Zhilinsky believed that drainage is a positive factor, since water from the marshes will flow to the rivers rather than evaporate (Zhilinsky, 1899). The point of view of I. I. Zhilinsky was supported by a prominent hydrologist and climatologist E. V. Oppokov, who proved the absence of a year between drainage and wateriness of the rivers on the basis of conducting many years of observation (Dokuchayev, 1876).

However, the founder of soil science V. V. Dokuchaev adhered to other views. He believed that the bogs in Polissya were the main source of river filling, and their draina-

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ge would lead to the shallowing of rivers and their streams (Oppokov, 1909).

Reclamation works on the drainage of Volyn Polissya began to take place in the pre-revolutionary period. The first drainage channels began to run in Polissya and in separate areas of the Carpathian and Transcarpathian regions. During the work of the Western Expedition on the drainage of the Volyn marshes (1873–1898), the Zamyslovtsy Canal was constructed. It allowed the drainage of about 10,000 hectares of wetlands (Tolstoy, 1990; Kuksin, 1991).

During the period of 1899–1908, the land reclamation works on drainage was carried out in insignificant amounts, and since 1909 the land reclamation works on drainage began to be given more attention. Land reclamation was carried out by zemstvo and land management commissions. In the pre-revolutionary period, reclamation works were carried out on an area of 454 thousand hectares (Shainin, 1990; Bozhok, 1976).

Beginning from the second half of the twentieth century the drying reclamation in the area of the enterprise was carried out on large volumes on the area of 10,000 ha of forest plots. The deployment of drainage works in the 60^{th} of the last century required the development of a scientific basis for drainage. In 1965 a collection was published devoted to the drainage and development of bogs in the Polissya zone of Ukraine. One of these publications, which covered the history of the Sarny Research Station, was the work of I. O. Khmara (1965). The history of drainage of the lands of the Zhytomyr region has published a significant volume by the article P. T. Bozhok (1976). On multi-year statistical material, the author analyzed the dynamics of drainage works, distinguishing their periods of activation and collapse. Only ten years (1966–1976) in the Rivne region, drainage systems were constructed and reconstructed on an area of 169.000 hectares. Subsequently, the land reclamation works were carried out in larger volumes and to date, the area of drained lands has been brought to 374.400 hectares, which is 11 % of the land reclamation fund of the region.

The problems of environmental change in Polissya related to drainage works are devoted to the works of N. I. Tyulenev (1926), V. E. Alekseevsky, Yu. I. Bakhmachuk (1992) et al.

Since the beginning of large-scale forest-reclamation works more than half a century has passed, and in the past 15–25 years almost no works on the care and operation of drainage systems has been carried out, which has led to the re-watering of previously drained lands (Alekseyevsky, & Bakhmachuk, 1992).

According to (Ustskiy, Mykhailychenko, & Rumyantsev, 2016), the results of studying changes in the hydrological regime on the condition of forest plantations are ambiguous. The research of forest ecosystems state has shown that after drainage reclamation in wet types of forest vegetation, the moisture level is reduced, while the trophicity increases by 1–2 units of the scale of the Alekseev-Pogrebnyak edatic grid (Ustskiy, Mykhailychenko, & Rumyantsev, 2016). At the same time, no significant changes were observed in very wet pine forests on the poor and podzol soils.

The purpose of the research is to trace the changes in the hydrological regime of reclamation forest areas during the reconstruction of the drainage system, to determine the causes of a sharp fluctuation of groundwater levels, to determine the impact of drainage on the state and productivity of pine plantations in the conditions of Volyn Polissya.

Material and methods of research. The research was carried out in pine stands of the II-VII classes of the age, which grow on the drainage reclamation system "Strashovo" of the State Enterprise "Sarny Forestry" of Volyn Regional Forestry.

State Enterprise is located in the central part of Volyn Polissya. Vegetation period is 156 days; average annual rainfall is 624 mm. Climatic factors that negatively affect the growth and development of forest vegetation include early autumn and late spring frost. The predominant types of soils are soddy-podzolic, sandy and clay-sandy varieties; along the lowland there are peat-gley soils, which have a peat layer on the surface.

The predominant forest type in the Sarny Forestry is the moist pine site, which covers an area of 10428.5 hectares (24.5 %) of forest lands, then fresh pine forest – 6129.3 hectares (14.4 %) and fresh pine completed site – 5274.2 ha (12.4 %). Dry pine sites are occupied 2799.9 hectares (6.6 %).

By degree of humidity, most of the soils refer to raw – 35.8 % and moist – 30.5 %. The share of lands with excessive humidity accounts for 26.9 % of the area covered with forest vegetation. The swamps cover an area of 1433.2 hectares. The territory of the Sarny Forestry is located in the Sluch and Goryn river basin.

The area of the lands of the forestry fund of the state enterprise "Sarny Forestry" is 49561 hectares, of which 73.6 % are exploitation forests. The coniferous species occupy an area of 31040.9 ha (72.9 %), hardwood – 1383.7 ha (3.3 %), softwood – 10126.8 ha (23.8). The predominant species is pine (*Pinus silvestris* L.), which covers an area of 30,762.9 hectares (72.3 %). The distribution of the main forest species in the age groups is not optimal. Thus, young plantations make up 21.1 %, middle-aged stands – 61.7 %, pre-mature plantings – 7.9 %, mature and over mature stands – 9.3 % of forest covered area.

Control objects were chosen far beyond the dehumidifiers, where the plantings were not exposed to drainage reclamation. To investigate the effect of drainage on the growth and development of pine stands in drained areas, hydrological transects were laid within them, wells were laid for measuring the level of ground water table during the growing season, and 14 temporary samples were laid down according to the generally accepted methods of forest measurement (Yaschenko, Korus & Turich, 2006).

Results and discutions. Creation of drainage systems has led to an increase in arable land in the region, and the reclamation of the forest stands directly linked to drainage systems on agricultural land. The main water intakes in the area of the enterprise are the Sluch and Goryn rivers, then the Pripiat and the Dnieper. Selected plantations are close in composition, grow in similar forest plant sites (wet and fresh pine sites) and differ in the biometric indices and sanitary conditions (Table 1).

Data Table 1 indicates a significant effect of drainage on the growth and productivity of pine plantations. For the sake of visualization, simulation of heights dynamics and changes in stock of plantations with age was developed. For simulation of heights, the data of test areas and materials of the database of plantations that grow on drained and outside the territory were used. Dynamics of heights of pine plantations growing within the drainage system and on the control are described respectively by the model of the polynomial of the second degree (1) and the exponent equation (2).

Table 1. Forest-biometric characteristic of pine stands in the conditions of drainage system "Strashevo"

Number of samples	Stand composition*)	Variant of experience	Age, years	Average		Site index	Density	Stock, $m^3 \cdot ha^{-1}$		Stock of density 1.0, $m^3 \cdot ha^{-1}$
				D, cm	H, m			dry part	growing trees	
1	7Ps3Bp	Experience	29	12,4	12,9	I	0,85	15	186	236
2	7Ps1Q2Bp	Control	25	9,1	9,6	I	0,71	20	121	199
3	7Ps3Bp	Experience	31	13,3	13,4	I	0,68	20	122	209
4	8Ps2Bp	Control	35	14,8	12,1	II	0,79	10	159	214
5	10Ps+Bp	Experience	48	20,2	18,5	I	0,74	35	252	388
6	8Ps2Bp	Control	49	17,6	17,4	II	0,65	10	214	345
7	8Ps2Bp	Experience	57	24,2	22,8	I^a	0,7	25	308	476
8	10Ps+Bp	Control	57	19,1	20,3	I	0,65	15	264	429
9	8Ps2Bp+Pt	Experience	64	27,5	28,3	I^b	0,71	20	403	596
10	8Сз2Бп+Ос	Control	63	26,1	24,4	I^a	0,72	30	286	439
11	10Ps+Bp	Experience	73	29,5	28,5	I^a	0,64	20	352	581
12	10Ps+Bp	Control	72	28,4	26,4	I^a	0,66	15	323	512

*) Ps – Pine (*Pinus sylvestris* L.); Bp – Birch (*Betula pendula* Roth.); Aspen – (*Populus tremula* L.).

Graphic interpretation of the obtained models is shown in Fig. 1.

$$y = -0{,}0011x^2 + 0{,}480x,\ R^2 = 0{,}975, \quad (1)$$

$$y = 0{,}3702x^{0{,}9967},\ R^2 = 0{,}960, \quad (2)$$

where x – age of stands, years; y – height, m.

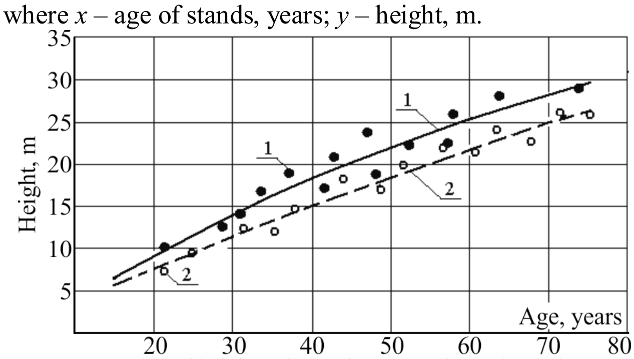

Fig. 1. Dynamics of heights of pine forest stands on the drainage system (1) and on the control (2)

Fig. 1 indicates that by the middle of the third age class, the height of plantings on drained areas exceeds the height of plantations at a control of 2.1 m. Starting from the third age class, pine trees on drained areas dramatically increase the growth and at the age of quantitative ripeness the difference in heights reaches 3.0 m. Pine plantations in land reclamation areas pass into the highest site class. The difference between the average heights in the 9th age class is 2.7 m.

The dynamics of changes in the stocks of pine stands growing within the drainage system and on the control characterize respectively models 3 and 4, and their graphical interpretation is depicted in Fig. 2. It should be noted that the researched stands are multiplied, close to the modal ones. Therefore, to obtain the laws of stock build-up, the value of the latter was transferred to the density of normal stands.

$$y_1 = -0{,}058x^2 + 14{,}934x - 175{,}24,\ R^2 = 0{,}963, \quad (3)$$

$$y_1 = 7{,}9003\, x^{0{,}9722},\ R^2 = 0{,}951, \quad (4)$$

where: x – age of stand, years; y_1 – stock of stands, $m^3 \cdot ha^{-1}$.

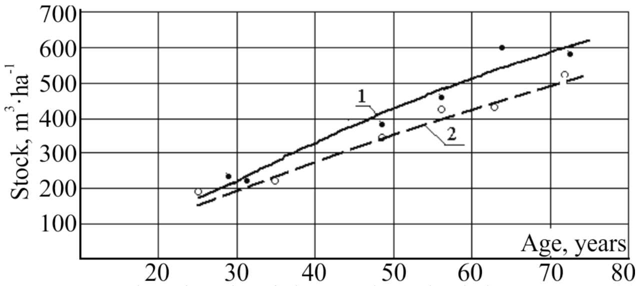

Fig. 2. Dynamics of stocks of pine stands on the drainage system (1) and on the control (2)

The effect of drainage can be traced after 30 years, when the root system penetrates deeper horizons. It's inhibited the growth of roots on the control sites close to the surface of the water table. At the same time, the soil, saturated with oxygen, stimulates the growth processes of the tree plants between the drainage channels, which lead to an increase in the productivity of the plantings. Comparative characteristics of changes in planting stock are presented in Table. 2.

In the fourth age class the stock of pine stands on drained areas exceeds 15 %, and in the age of quantitative maturation, this difference reaches 21 %, which makes 89 $m^3 \cdot ha^{-1}$ and is a significant argument for the use of drainage reclamation in the wetlands of Volyn Polissya.

Table 2. Comparative characteristic of the dynamics of pine plantations growing on drained areas and on the control

Age, years	Stock of stands, $m^3 \cdot ha^{-1}$		The difference in the stock of stands on the drained system and control	
	on drained areas	on control plots	$m^3 \cdot ha^{-1}$	%
20	100	145	-45	-31,0
30	221	216	5	2,3
40	329	285	44	15,5
50	426	354	72	20,4
60	512	423	89	21,0
70	586	491	95	19,2
80	648	560	89	15,9

At the same time, nowadays, there has been a decrease in ground water level throughout the Polissya, which, according to scientists, is one of the reasons for the massive and partial decline of forest stands (Sarny Forestry, 2014).

It was significant changes in the climate in the region for the last two decades. This usually affects the hydrological regime of forest areas. The data for the period 2004–2017 on the change in the hydrological regime and water table of the drainage system "Strashovo" are reflected in the table 3.

The analysis of data (Table 3) shows that the level of water table drops sharply from 2011, reaching a stable value of 124–140 cm. If the water table in 2006 was 61 cm, then in 2016 the average annual water table reached 140 cm. That is, the difference is 79 cm.

Table 3. Hydrological regime of forest plots of pine plantations of drainage system "Strashovo"

Years	Water table, cm							Average annual water table, cm
	IV	V	VI	VII	VIII	IX	X	
2004	71	n.d.	n.d.	n.d.	n.d.	94	n.d.	82
2005	62	49	54	74	45	75	87	64
2006	57	66	60	58	58	48	81	61
2007	73	86	81	49	75	88	93	78
2008	51	n.d.	n.d.	76	65	34	45	54
2009	61	86	73	83	95	92	90	83
2010	83	99	110	87	115	123	75	99
2011	124	140	145	89	152	151	115	131
2012	160	130	110	114	110	129	n.d.	124
2013	164	137	122	127	146	167	119	140
2014	143	133	131	128	143	120	119	131
2015	145	132	145	129	147	125	128	136
2016	149	139	141	141	138	129	n.d.	140
2017	140	168	142	149	130	129	115	139

Since the water table decreases, which, in turn, leads to the drying of plantations, it is necessary to apply the sluice of drainage channels. A progressive moment is the reconstruction of drainage systems in a two-way system, or the so-called drainage and humidifying systems, which for the intensive growth of plants during the vegetation period provide an optimal hydrological regime of forest areas.

Conclusions. Hydrotechnical melioration is a powerful means of increasing the productivity of forest plantations, since in the beginning of the growing season root plant systems are released from excessive moisture, which leads to an increase in the feeding area of tree species. Since the time of the forest reclamation in Polissya, the productivity of forests has increased on average on the one class of productivity.

The analysis of the hydrological regime of the drainage system "Strashovo" during the 14-year period showed that the water table sharply decreases, reaching a stable value of 124–140 cm for the last 6 years, whereas during 2004–2009 it varied within 61–83 cm.

Prolonged and significant decrease of water table leads to the drying of plantations, therefore, in order to ensure optimal hydrological regime of forest areas, it is necessary to use sluice of channels or reconstruction of the drainage system in a two-way system.

By modelling the growth of pine plantations it was found that by the middle of the 3rd age class the height of plantations on drained areas exceeds the height of plantations at the control of 2.1 m. Starting from the 3rd age class, pine stands on drained areas dramatically increase the growth and in the age of quantitative ripeness the difference in heights reaches 3.0 m. Pine plantations in land reclamation areas pass into the highest class of productivity. The difference between the average heights in the 9th class of age is 2.7 m.

Перелік використаних джерел

Alekseyevsky, V. (Ed.), & Bakhmachuk, Yu. (1992). *Environmental aspects of land reclamation in Volyn*. Lutsk – Kiev: Lybid. 235 p.

Bozhok, P. (1976). Development of works on drainage of land in Zhytomyr region. *Scientific works of the Ukr. Agr. academy*, *173*, 3–12.

Dokuchayev, V. (1876). Probable restriction of the rivers of the European plain. In *the book. Meeting of the St. Petersburg rural masters*, 7. St. Petersburg.

Free Encyclopedia. (n.d.). Wikipedia. Retrieved from: https://uk.wikipedia.org/wiki/Гідрологічний_режим.

Khmara, I. (1965). Brief works of the Sarny Research Station on the development of the Marshland of the Polessya zone of the USSR. Kyiv. *Harvest*, 3–10.

Kostyakov, A. (1925). The prospects of land reclamation in the USSR (European part). Moscow. *The publication of the State Planning Committee of the USSR*. 269 p.

Kuksin, I. (1991). Polissya research party E. Oppokova. *Reclamation and water management*, *2*, 57–58.

Oppokov, E. (1909). On the Hydrological Role of Marshes. *Agriculture and Forestry*, *9*, 37–57.

Prokopowicz, M. (1926). *Meljoracje w Polsce wraz z odnosnem ustawodawstwem oraz ustawa wodna*. Torun. 339 p.

Sarny Forestry. (2014). Project of the organization and development of forestry of the state enterprise "Sarny Forestry". Irpin. *Ukrderzhlisproekt*. 206 p.

Shainin, L. (1990). Land-reclamation legislation and policy in Russia at the turn of the XIX–XX centuries. *Reclamation and water management*, *11*, 59–60.

Tolstoy, M. (1990). From the History of the Water Economy of Russia. *Reclamation and Water Management*, *4*, 58–59.

Tyulenev, N. (1926). History of occurrence, tasks, program and the first achievements of Rudnia-Radovelskaya Marsh Experimental Station. *Publ. by Korosten land department. Issue I*. 65 p.

Ustskiy, M., Mykhailychenko, O., & Rumyantsev, M. (2016). Influence of drainage reclamation on radial growth of pine and oak stands in the conditions of Zhytomyr Polissya. *Scientific bulletin of UNFU, 26*(4), 142–147. https://doi.org/10.15421/40260422

Yaschenko, P., Korus, M., & Turich, V. (2006). Estimation of the effect of melioration on the change of biometric indices of pine forest stands of Shatskyi National Park. *Scientific Bulletin of UNFU*, *16*(1), 19–26.

Zhilinsky, I. (1899). Essay on the work of the Western Expedition on the drainage of swamps (1873–1898). *Kiev Publishing house of the Ministry of Agriculture and State Enterprises*. 744 p.

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ГІДРОЛОГІЧНИЙ РЕЖИМ І РІСТ СОСНОВИХ НАСАДЖЕНЬ В УМОВАХ ОСУШУВАЛЬНИХ МЕЛІОРАТИВНИХ СИСТЕМ

Здійснено ретроспективний аналіз становлення і розвитку осушувальної меліорації у Волинському Поліссі. Змодельовано ріст соснових насаджень у межах регульованої осушувальної системи і на контролі. Встановлено, що до середини III класу віку висоти насаджень на осушених ділянках перевищують висоти насаджень на контролі на величину 2,1 м. Починаючи з III класу віку, сосна на осушених ділянках стрімко збільшує приріст й у віці кількісної стиглості різниця у висотах сягає

3,0 м. Соснові насадження на меліоративних ділянках переходять у вищий клас бонітету. Різниця між середніми висотами у VII класі віку становить 2,7 м. Порівняльний аналіз змін запасів соснових насаджень показує, що в IV класі віку запаси сосни на осушених ділянках перевищують 15 % від контролю, а у віці кількісної стиглості ця різниця сягає 21 %, що становить 89 $м^3 \cdot га^{-1}$ і є вагомим аргументом застосування осушувальної меліорації на надмірно зволожених землях Волинського Полісся. Аналізуючи гідрологічний режим осушувальної системи "Страшево" за 14-річний період, з'ясовано, що рівень ґрунтових вод упродовж 2010–2017 рр. стрімко знижується, сягаючи стабільної величини 124–140 см, тоді як до 2009 р. він змінювався в межах 61–83 см. Тривале і значне пониження рівня ґрунтових вод призводить до всихання насаджень, тому для забезпечення оптимального гідрологічного режиму лісових ділянок потрібно застосовувати шлюзування каналів або реконструкцію осушувальної системи у систему двосторонньої дії.

Ключові слова: меліорація; осушувальні канали; рівень ґрунтових вод; соснові насадження; продуктивність; висота.

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ГИДРОЛОГИЧЕСКИЙ РЕЖИМ И РОСТ СОСНОВЫХ НАСАЖДЕНИЙ В УСЛОВИЯХ ОСУШИТЕЛЬНЫХ МЕЛИОРАТИВНЫХ СИСТЕМ

Осуществлен ретроспективный анализ становления и развития осушительной мелиорации в Волынском Полесье. Смоделирован рост сосновых насаждений в пределах регулируемой осушительной системы и на контроле. Установлено, что к середине III класса возраста высоты насаждений на осушенных участках превышают высоты насаждений на контроле на величину 2,1 м. Начиная с III класса возраста, сосна на осушенных участках резко увеличивает прирост и в возрасте количественной спелости разница в высотах достигает 3,0 м. Сосновые насаждения на мелиоративных участках переходят в более высокий класс бонитета. Разница между средними высотами в VII классе возраста составляет 2,7 м. Сравнительный анализ изменений запасов сосновых насаждений показывает, что в IV классе возраста запасы сосны на осушенных участках превышают 15 % от контроля, а в возрасте количественной спелости эта разница достигает 21 %, что составляет 89 $м^3 \cdot га^{-1}$ и является весомым аргументом применения осушительной мелиорации на избыточно увлажненных землях Волынского Полесья. Анализируя гидрологический режим осушительной системы "Страшево" за 14-летний период, установлено, что уровень грунтовых вод в течение 2010–2017 гг. резко снижался, достигая стабильной величины 124–140 см, тогда как в 2009 г. он колебался в пределах 61–83 см. Продолжительное и значительное понижение уровня грунтовых вод приводит к усыханию насаждений. Поэтому для обеспечения оптимального гидрологического режима лесных участков необходимо применять шлюзование каналов или реконструкцию осушительной системы в систему двустороннего действия.

Ключевые слова: мелиорация; осушительные каналы; уровень грунтовых вод; сосновые насаждения; производительность; высота.