



## Estimation of raised bogs peat moisture

J. A. Kharanzhevskaya

Siberian Scientific Research Institute of Agriculture and Peat, Russia, Tomsk, Gagarina st. 3  
Phone: (3822) 533390, e-mail:kharan@yandex.ru

### Summary

The purpose of the research was to study the moisture ratio of peat deposit in natural and drained condition, detection of changes of water characteristics of bogs after forest reclamation. Despite some changes of water - thermal balance of the peat deposit of Site 1 places are not different in peat moisture. The reason is weak influence of drainage of peatland "Vasyuganskoe". That's why it's important to use measures for drainage system restoration and achieving objective of forest reclamation. Peat deposit moisture is defined by a lot of hydro-meteorological factors, structure of peat deposit and type of peat and its botanical composition. That's why additional research is necessary for development of science-based models for assessment of space and time dynamics of moisture. Comparison of moisture characteristics of peat deposit of forest reclamation areas with natural raised bog showed no changes of peat moisture of antropogenically changed bog.

**Key index words:** peat moisture, raised bog, forest reclamation, Western Siberia

### Introduction

It's very important to carry out complex studying of consequences of drainage transformation of bogs nowadays. The aim of such research is to create ecologically sound landscape which territory can be used effectively. Such necessity exists nowadays because water-logging process of Western Siberia continues and about 30 thousand hectares of agricultural land come out of use every year (Maslov 2005). Drainage influences on all the elements of landscape that's why studying its efficiency is, first of all, an ecological problem. It's necessary to define all the consequences of the influence on nature. It's evident that to carry out reasonable drainage it's important not only to know characteristics and regimes of bogs in natural condition, to foresee their transformation but also to study their condition after melioration (Zaidelman F.R., 1975).

Peat moisture and level of bog water are main factors of drainage influence on bog areas. So, the purpose of the research is studying of moisture ratio of peat deposit in natural and drained condition, detection of changes of water characteristics of bogs after forest reclamation. Moreover, one more purpose is correlation and regression analyses to determine functional relation and their use when there are no materials of stationary observance during development the basis of wise use of peatland in Western Siberia

Bogs are the integral part of Western Siberia. The main peculiarity of bogs is their high and stagnant humidity. The total content of humidity in peat - peat moisture is the indication of the raised bog water regime. In fact content of moisture in peat deposit is determined by a number of environmental factors as well as by a type and structure of peat. The aim of the work is to study the peat moisture content in deposit of bogs in natural and drained condition. A lot of Russian).and foreign scientists (Romanov V.V.,

1961; Shebeko 1965; Chechkin 1970; Lishtvan et al., 1985; Eggelsman 1996; Yazaki *et al.* 2006) studied peat moisture, they developed a number of approaches to studying and defining peat moisture of natural and drained bogs. However nowadays similar researches are not carried out in Western Siberia.

### Materials and Methods

The territory represents the north-east branches of Vasyuganskoe bog and is located on Ob-Irtysh watershed. According to bog zoning of Western Siberia (Ivanov 1976 and others) refer to zone of oligotrophic bogs. The study of peat moisture was conducted on peatland "Vasyuganskoe" and also on natural raised bog. In 1973-1979 years in northern part of peatland was drained on the area of 4000 hectares with the purpose of forest reclamation. A water intake is Ikksa River. Drainage design norm is 0,6 m. Researches were carried out on three basic Sites. Site 1 is located in natural part of the peatland that is not touched by drainage. Site 2 represents the draining part of the peatland that is located 1 km from Site 1. Site 3 is located on the territory of natural raised bog that is located 30 km to north of peatland "Vasyuganskoe". All Sites of observation are set in the most typical: pine-shrub-sphagnum phytocenosis (low riam).

The structure of peat deposit has following features. The peat deposit of Site 1 with the depth of peat deposit over 270 cm has enough homogeneous structure and up to 200 cm is presented by, below - transitional sedge and wood sedge peat. The peat deposit of Site 2 is also presented up to 200 cm by Sphagnum fuscum peat, below a structure composes with transitive moss and grass peat (depth of deposit is 250 cm). A structure of the peat deposit of Site 3 more non-uniform: Sphagnum fuscum peat up to 100 cm, then there are layers on 50 cm with the Sphagnum medium



peat and pine cotton grass Sphagnum peat, the layer of 200-250 cm is presented by a sedge type of peat (depth of deposit is 300 cm).

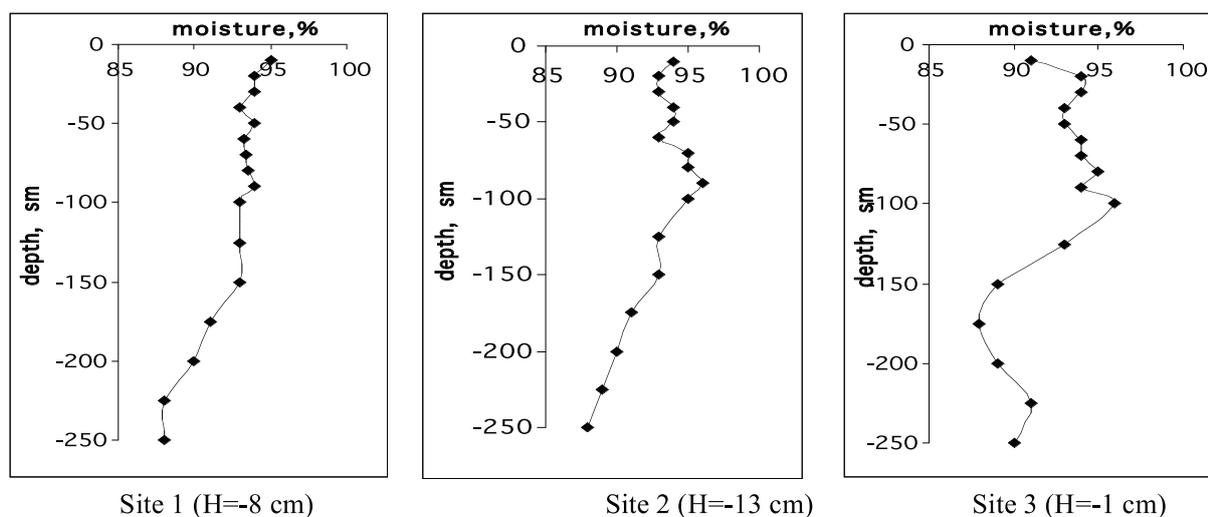
For the analyses peat was taken at full depth of peat deposit in layers of 10 cm and at the depth of more than 100 cm – in layers of 25 cm. The samples were drained till constant weight and then their moisture was defined.

## Results

Let's consider the change of peat humidity according to the depth of peat deposit. The study has shown that peat moisture decreased from surface to peat bottom. Minimum humidity 88-90 % is registered on the depth of 250 cm (Fig.1). Variation of moisture on the depth of peat deposit comprised: Site 1 - 7 %, Site 2 - 8 %, Site 3 - 6 %. As a result of homogeneous composition of peat deposit in Sites 1 and 2 (up to 200 cm the peat deposit consists of Sphagnum fuscum) gradual of moisture decrease up to the layer of 150 cm is observed. Then its abrupt decrease on the border with transitional and lowland types of peat is observed. At the same time maximum moisture 95-96 % in Site 1 was indicated in surface layer, and in Site 2 – in the layer the width of which is 90 cm. In surface layer of Site 3 up to 10 cm we observe the peat moisture 91 % that later

insignificantly increases up to 96% on the depth of 100 cm. In connection with the change the type of peat (medium and pine- cotton grass- sphagnum peat) on the depth of 100-200 cm abrupt decrease of moisture up to 89% is observed. Moisture of near-bottom layer of sedge peat comprised 90 %. Insignificant humidity increase on the depth of 100 cm is possibly connected with influence of season processes of humidity dislocation in peat deposit as well as with increase of density of peat deposit composition with the depth. Thus, the peat moisture is determined in most cases by botanical content, peat structure.

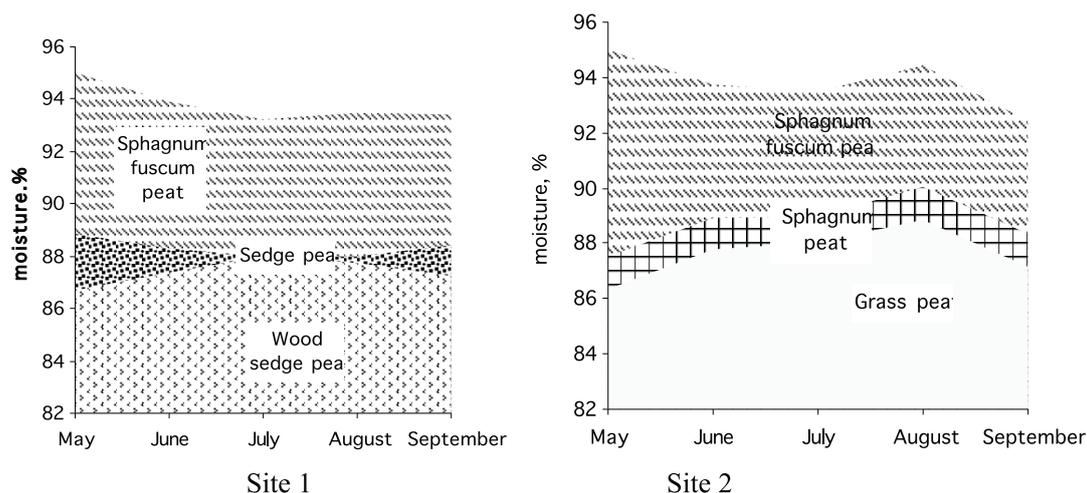
Detailed analysis of moisture gradient in the peat deposits of the investigated areas demonstrated that the correlation and regressional dependence of the peat moisture on the main hydrometeorological parameters (rainfall, air temperature, temperature of peat deposit, level of bog water) should be investigated (Tab.). During the analysis it was decided to hold the investigations of peat moisture according to a kind of peat and peculiarities of its structure. Therefore the layers according to a kind of peat were defined in the peat deposit of each area under study. It was the foundation for further data analysis. As a result of complex correlation analysis the following patterns were defined:



**Figure 1.** Change of peat moisture by the depth of peat deposit (H-water level)

**Table 1.** Matrix of correlation factors of peat moisture and hydrometeorological parameters (Site 3)

Peat type	Depth, sm	Bog water level	Temperature of peat deposit on the depth 0-100 sm	Temperature of peat deposit on the depth 100-150 sm	Air temperature	Precipitation
Sphagnum fuscum peat	0-100	0,32	-0,85	-0,51	-0,96	0,91
Sphagnum medium peat	100-150	-0,42	0,42	0,85	-0,23	-0,38
Pine cotton grass Sphagnum peat	150-200	0,97	-0,12	-0,75	-0,09	0,60
Sedge peat	200-250	0,98	-0,12	-0,74	-0,11	0,60
Grass peat	250-300	0,99	-0,12	-0,70	-0,17	0,62



**Figure 1.** Change of peat moisture by the depth of peat deposit (H-water level)

- Temperature of peat deposit is the main factor of peat moisture for Site 1.
- There is the dependence of the moisture of layer 0-200 cm with *Sphagnum fuscum* peat on the air temperature and layer 200-250 cm with sedge and wood sedge peat on the position of bog waters in Site 2.
- There is a high correlation of peat moisture and levels of bog waters for the layers of pine cotton grass *Sphagnum* peat, sedge and grass peat for Site 3 located in the natural raised bog. Moisture of the layer 100-150 cm with *Sphagnum* medium peat depends on the temperature of peat deposit at the suitable depth. Upper layer depends on the air temperature at the same time we should take into account that layers of bog waters were situated near the surface.

The change of peat moisture over time is the same in almost all areas of investigation (Fig.2). The rise of water level and moisture of peat deposit in spring changes into slow decay of levels and moisture decrease in June-July, and then rises because of precipitation. In spring the level of peat moisture is similar at almost all depths of deposit or the level of moisture of upper layer slightly increases. The change of moisture of the layers is simultaneous and corresponds to the changes of climatic characteristics. Because of the absence of violent autumnal rains the level of swamp waters and moisture of peat are minimal. On the average amplitude of seasonal fluctuations is not high over 8 %. On the average peat moisture compounds 90.3 %.

## Conclusion

Despite some changes of water - thermal balance of the peat deposit of Site 1 places are not different in peat moisture. The reason is weak influence of drainage of peatland “Vasju-

ganskoe”. That’s why it’s important to use measures for drainage system restoration and achieving objective of forest reclamation.

So, peat deposit moisture is defined by a lot of hydro-meteorological factors, structure of peat deposit and type of peat and its botanical composition. That’s why additional research is required for development of science-based models for assessment of space and time dynamics of moisture. Comparison of moisture characteristic of peat deposit of forest reclamation areas with natural raised bog showed no changes of peat moisture of antropogenically changed bog. So, in whole bog formation continues.

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