Carbon storage dynamics in *Sphagnum* peatlands along the southern limit of their distribution (West Siberia)

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**Introduction**

Wetlands have been the carbon sink over the last 10,000 years although they have the potential to become net sources of C to the atmosphere under a global warming and acidification of some part of boreal zone in Northern Eurasia [Gorham, 1991]. Considerable change in the rate of particulate organic carbon (peat) storage is expected in the areas adjoining different climatic zones which are now characterized by an unstable annual weather conditions (Fig.1). Carbon storage dynamics has never been well estimated.

The objectives of this work are: 1) to clarify the long-term trend of Carbon storage in Sphagnum wetlands on their southern limit in western Siberia; 2) to reveal factors affecting on this process.

**Material and methods**

In our study, the detailed ground-based investigations (soil/peat and geobotanical) were conducted and the results extrapolated using remote sensing techniques (Landsat ETM+, Resurs Satellite images have been interpreted using MapInfo6.5).

Two types of interaction (ecotones) between forest and wetland were revealed within the studied area.

One is represented by gradation of forest ecosystems, from amorphous deciduous to pine wetland forests. Another ecotone is formed by similar series of ecosystems, complemented with reed communities, which are well marked on the satellite images (Fig.2).

**Ecosystem types:**

a - small-leaved forest with *Calamagrostis* and grasses

b - small-leaved forest with *Koeleria*

c - small-leaved forest with *Calamagrostis* and Carex

As shown in Fig. 3-4:

1) Peat profiles are mostly formed by oligotrophic (moss) species in forest ecotone, usually suggesting “high-speed” peat accumulation; reed-forest ecotone is characterized by lasting initial Carex-stage that could indicate decelerated C-storage.

2) Dramatic increase of ash content and decomposition of sediments in upper peat layers confirm peat mineralization both on the periphery of basin and main wetland tract in reed-forest ecotones.

3) There are no reliable variations in pH values were found between forest and reed-forest ecotones.

**Site description**

Study area located on the northern border of optimal “solar radiation/moistening” ratio in ordinary and arid-years, and excessive moisture content in “humid years” in 5-years recurrence.

There is 11-yrs recurrent sequence of droughts revealed in climate of southern part of western Siberia. Droughts often registered early in the beginning of decade [Slyadnev, 1972].

**Results and discussion**

Peat storage dynamics is different in two types of ecotones, strongly affected by topography. The “forest” ecotone was formed on the flat land surface with limited water drainage. Chemical and peat core analysis (stratigraphy) shows the permanent formation of wetland, i.e. “Permanent” carbon storage in “forest ecotone” (Fig. 3.4).

“Reed-forest” ecotone is situated on undulate relief providing the path for water flow from the periphery of wetland basin. This causes the recurrence of drying and wetting of upper peat layers, resulting in the fluctuation in the carbon-storage capability of the area (i.e. “intermittent” carbon storage). On the periphery of wetland basin, turf layer over peat deposits indicates the peat degradation. Within the 50cm of peat deposits, two well-decomposed sediment layers of different species were found. Such variation is most likely due to a former turf covered by peat sediments during a flooding period.

**Conclusions**

-C-storage processes have been progressive over the Holocene, although there were reliable differences in its rate revealed for different ecotones. -Under equal climatic conditions, the trend of carbon storage in wetlands is determined by internal factors (features of rock material and topography).

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**References:**


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**Fig.1 Study area**

![Image of study area](image1)

**Fig.2. Forest/wetland ecosystems and their position on the transect**

![Image of ecosystems](image2)

**Fig.3. Stratigraphic profiles:**

Comparison of 50-cm peat sediments. A - forest, and B - reed-forest ecotones

C - turf, D - peat.

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2) Dramatic increase of ash content and decomposition of sediments in upper peat layers confirm peat mineralization both on the periphery of basin and main wetland tract in reed-forest ecotones.

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**Fig.4. Structure and properties of peat sediments**

Based on the results of ground-based observations, the areas on the satellite images were classified into different types of ecotones described earlier (Fig.5).

The final layout, prepared in the scale of 1:200K, shows the ratio between the areas with permanent and intermittent carbon storage dynamics to be 3:1.

**Fig.5. Result of LANDSAT7 image classification**

![Image of image classification](image5)