

Net primary production and decomposition in oligotrophic mires in the Southern Taiga of Western Siberia

Продукция и разложение растений в олиготрофных болотах южно- таежной подзоны Западной Сибири

Golovatskaya E.A.

Institute of monitoring of climatic and ecological
systems SB RAS

golovatskaya@imces.ru

- Peatlands covering only 3% of Earth's land area, they hold the equivalent of half of the carbon that is in the atmosphere as CO_2 .
- Most peatlands are located in the boreal and subarctic Northern Hemisphere, where the climate is warming faster than anywhere else on the Earth.
- The carbon accumulation rate of peatlands is determined by the balance between the amount of carbon sequestered in the net primary production (NPP) and the amount of carbon lost to the atmosphere by decomposition of dead organic matter.
- Rates of net primary production in peatlands are generally small, as are rates of net ecosystem exchange of CO_2 and soil respiration.
- Thus, the accumulation of organic matter in peatlands is generally ascribed to slow rates of decomposition associated with cool temperatures, anoxic conditions, and functionally limited decomposer communities.

Peatland of West Siberia

Total area
- 592 440 km²,

Total weight of peat
- 148 Gt

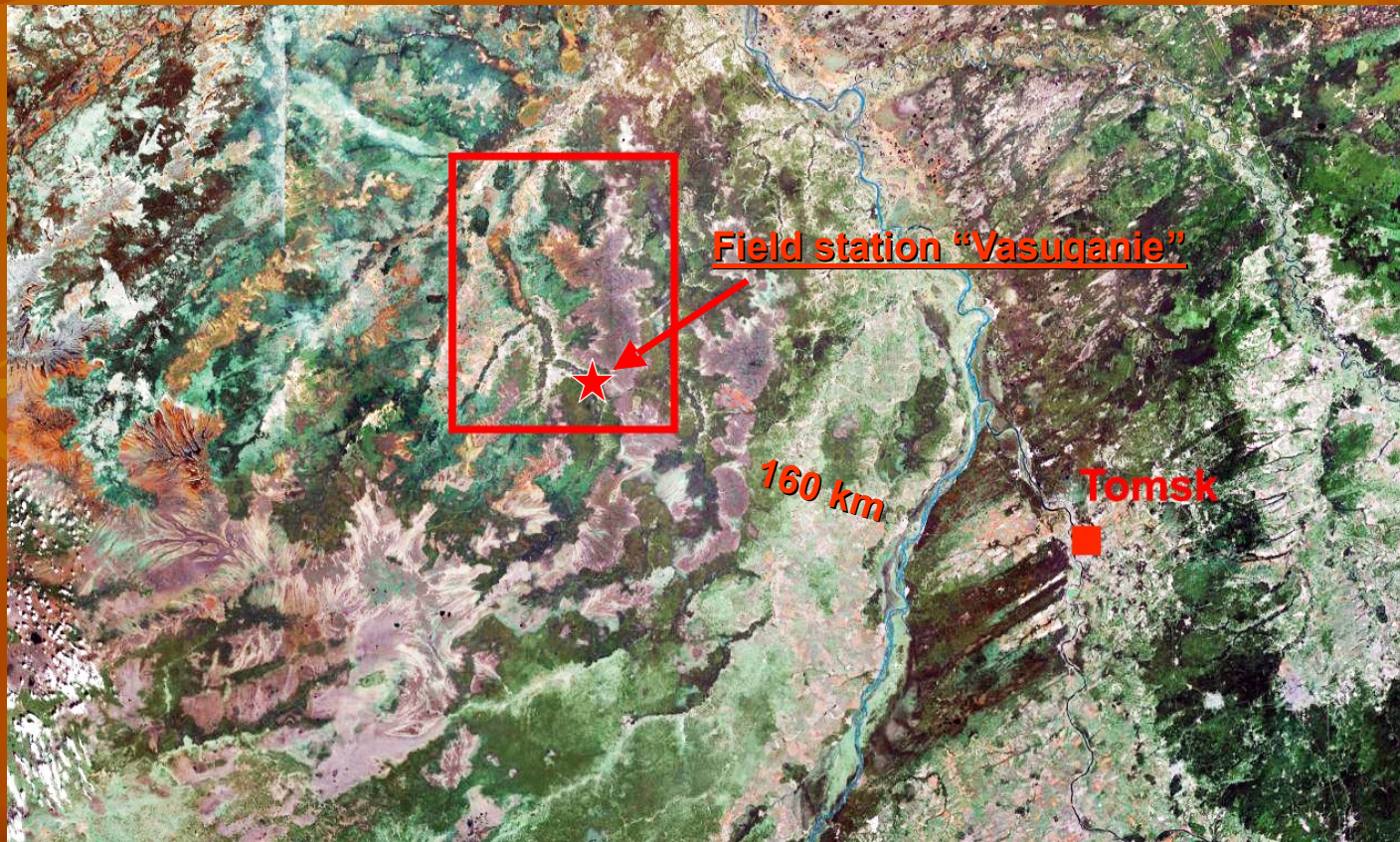
Peat carbon pool
- 70 Gt C



Sheng, Y., L. C. Smith, G. M. MacDonald, K. V. Kremenetski, K. E. Frey, A.A. Velichko, M. Lee, D. W. Beilman, and P. Dubinin (2004),
A high-resolution GIS-based inventory of the west Siberian peat
carbon pool // Global Biogeochem. Cycles, 18,
GB3004, doi:10.1029/2003GB002190.

Site description

The study area is located between the Iksha and Bakchar rivers (56°58'N 82°36'E) at the territory of the Bakcharskoe bog (bog area 1400 km²) and is characterized by regular changes of oligotrophic bog ecosystems: pine–shrub–sphagnum community, a similar community with oppressed (low) tree stand, ridge-hollow complex and sedge–sphagnum open bog.



The observation has been conducted on the oligotrophic and eutrophic mires at the field station “Vasuganje” (IMCES SB RAS, Tomsk region, Western Siberia).

Vegetation at the observation points are:

**Ryam – pine-shrub-sphagnum
ecosystem**



**Fen sedge-sphagnum
ecosystem**



Methods

Biological productivity:

Net primary productivity and vegetation storages was measured by clipping method.

The aboveground biomass was measured by clipping 50x50 cm quadrates.

The belowground biomass was determined by the excavation of 10 x 10 cm pits at each quadrate.

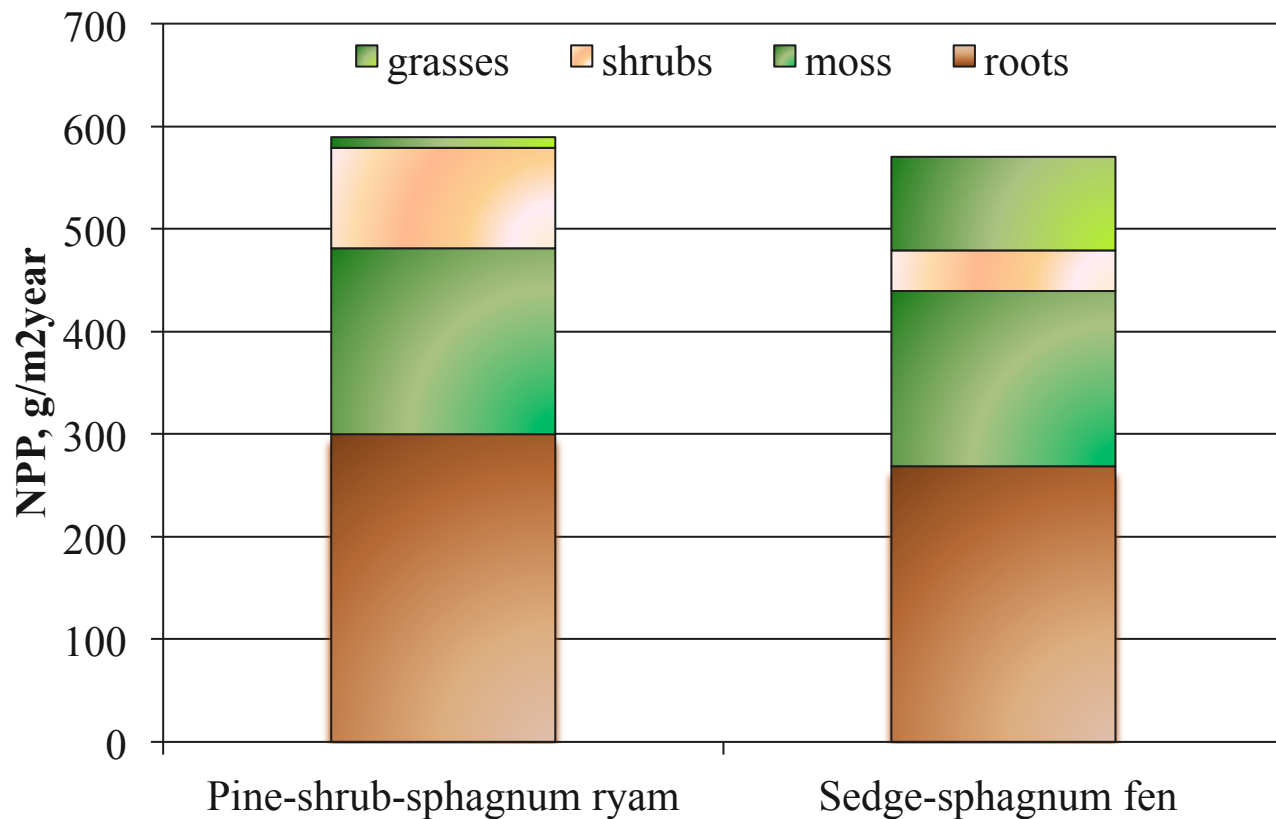
Decomposition of plants was studied using the litterbag technique.

Decomposition rates were calculated from mass losses for different vegetation species.



Net Primary Production

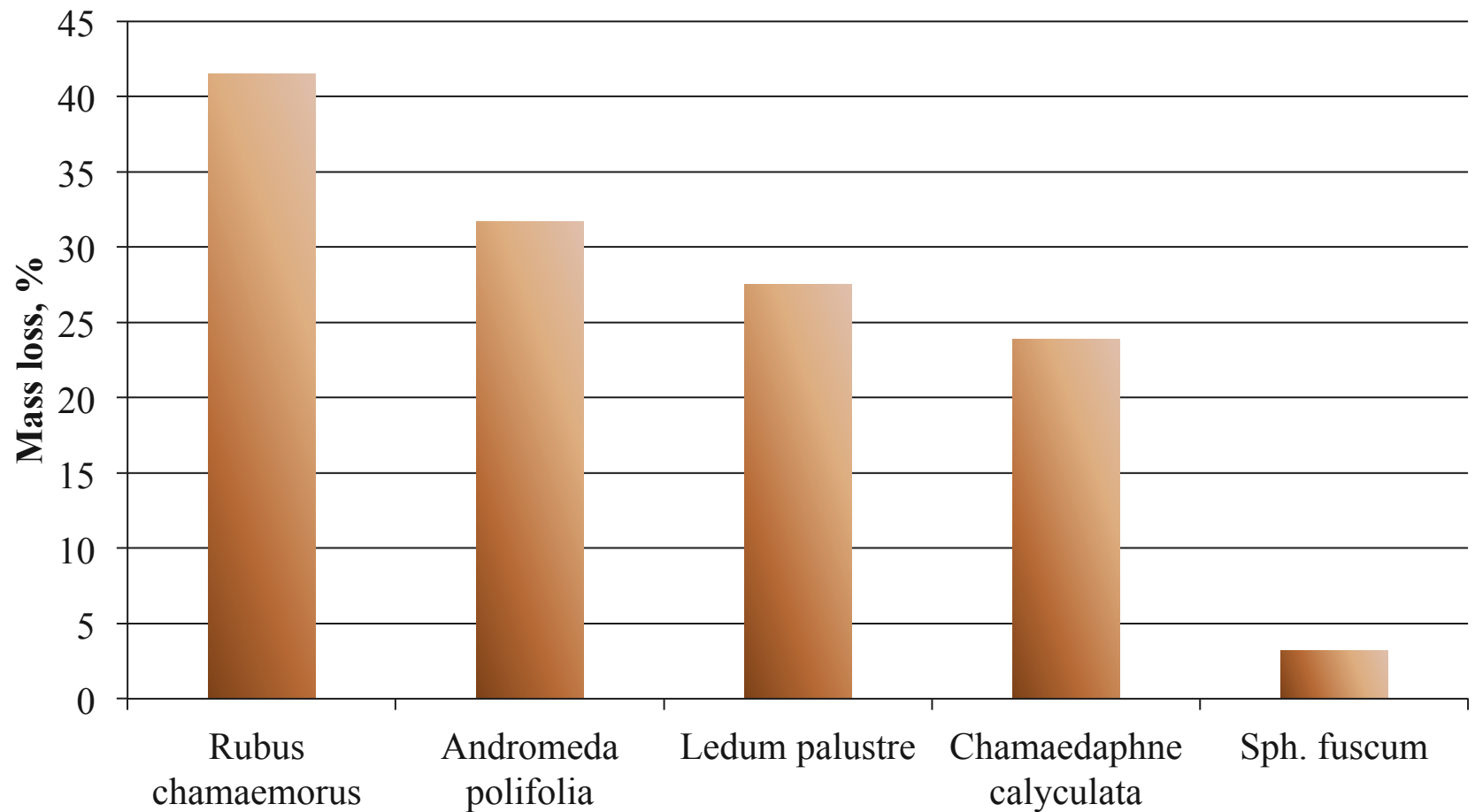
- Net primary production (NPP) is an indicator of carbon accumulation in the form of vegetation matter.
- NPP for low ryam and sedge-sphagnum fen are equal to 587, and 571 g m⁻² yr⁻¹. The main part of production at studied ecosystems is consist of by roots of herbs and shrubs (47–51%) and sphagnum mosses (30– 31%). Shrubs give 17 % to NPP at low ryam. The contribution of herbs is more significant at sedge-sphagnum fen (16 %) but the proportion of shrubs is about 7%.



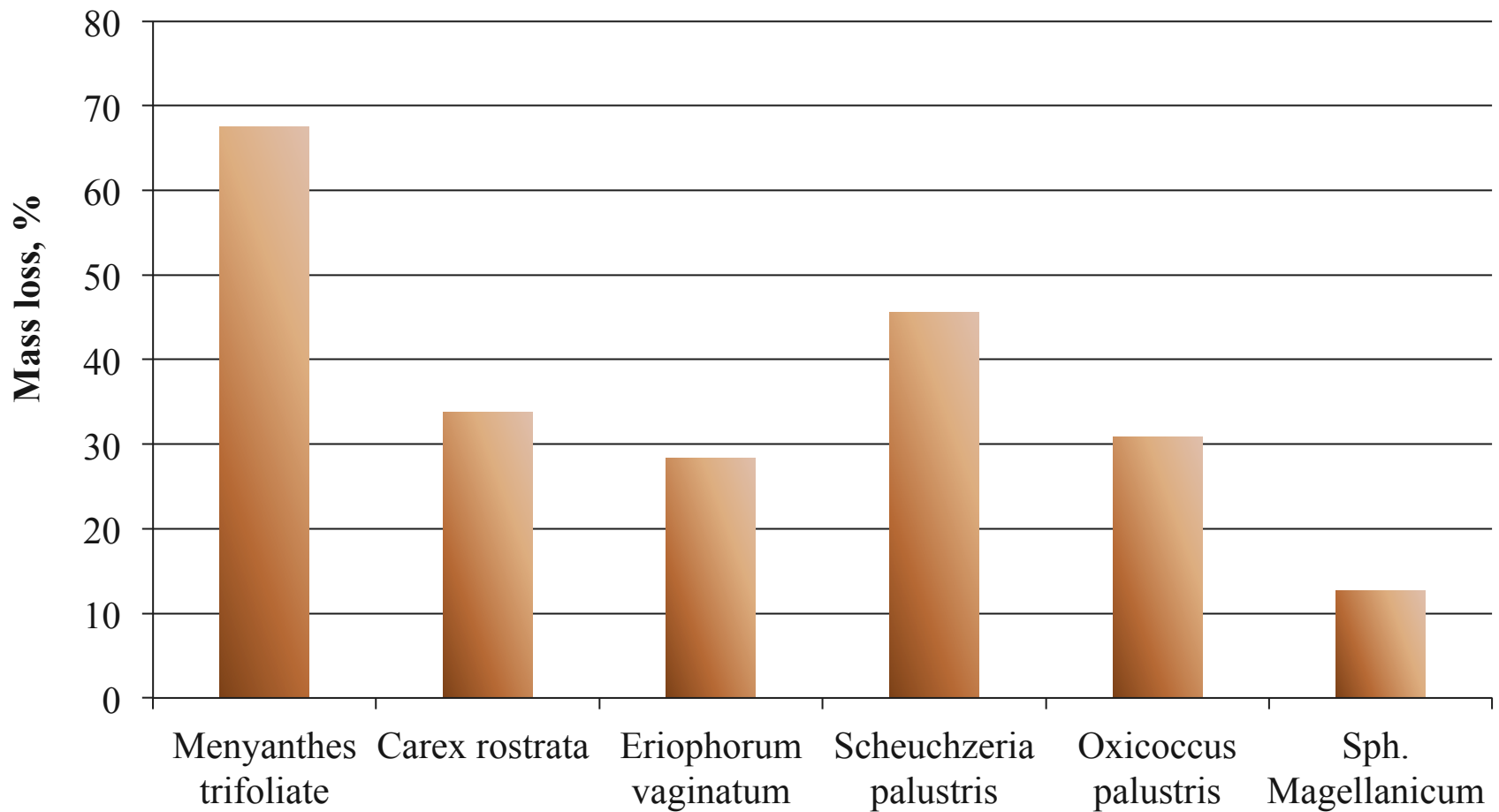
Initial Carbon (C), Nitrogen(N) and Ash (A) concentrations in plant matter

	C, %	N, %	C/N	A, %
Mosses	39,7	0,5	77,7	2,0
Grasses	43,2	1,4	33,4	4,2
Shrubs (leaves)	49,4	1,2	41,2	2,6

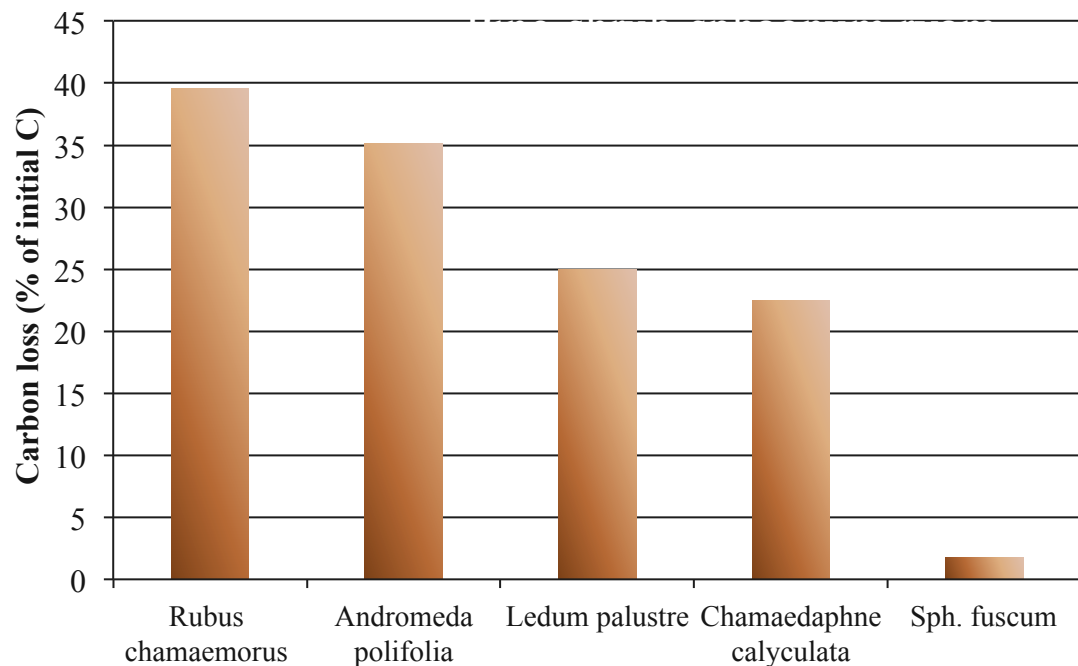
Mass loss of plant matter in pine-shrub-sphagnum community



Mass loss of plant matter in sedge-sphagnum fen

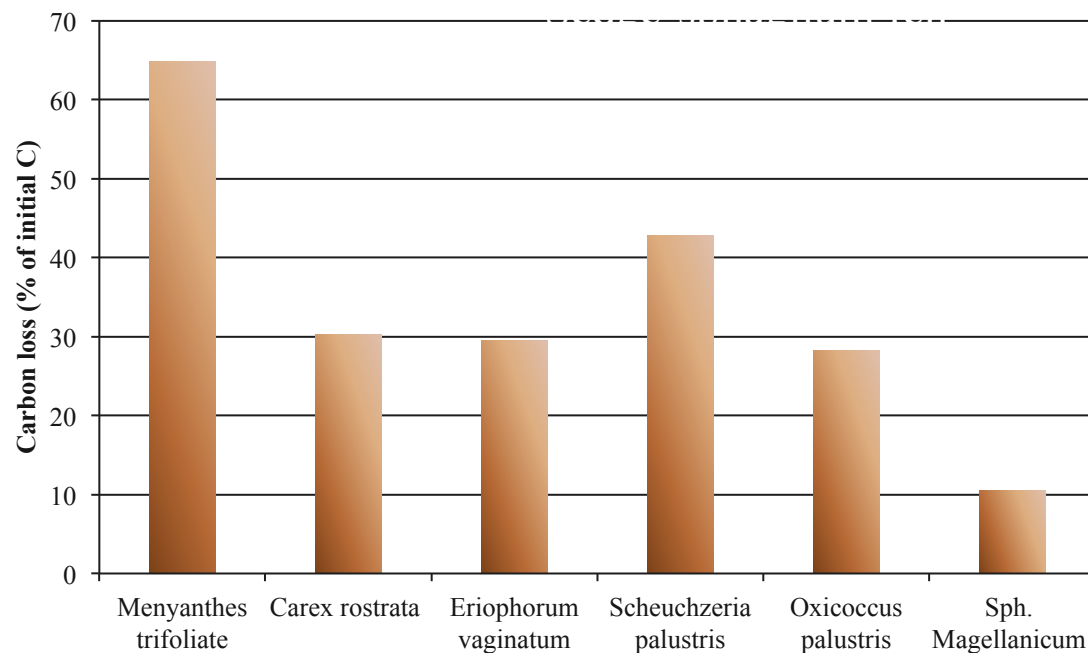


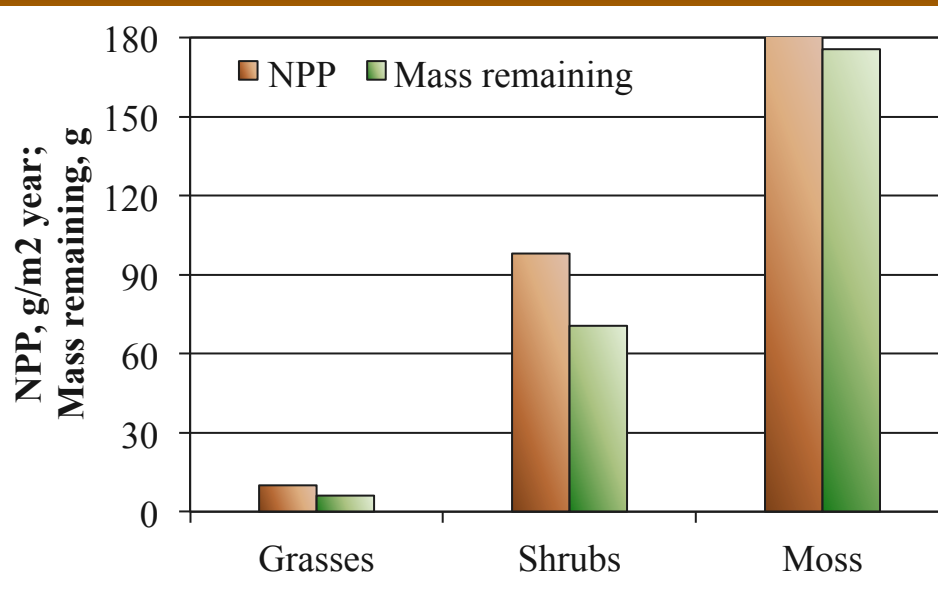
Changes in concentration of carbon in plant matter



Sedge-sphagnum fen

Pine-shrub-sphagnum ryam

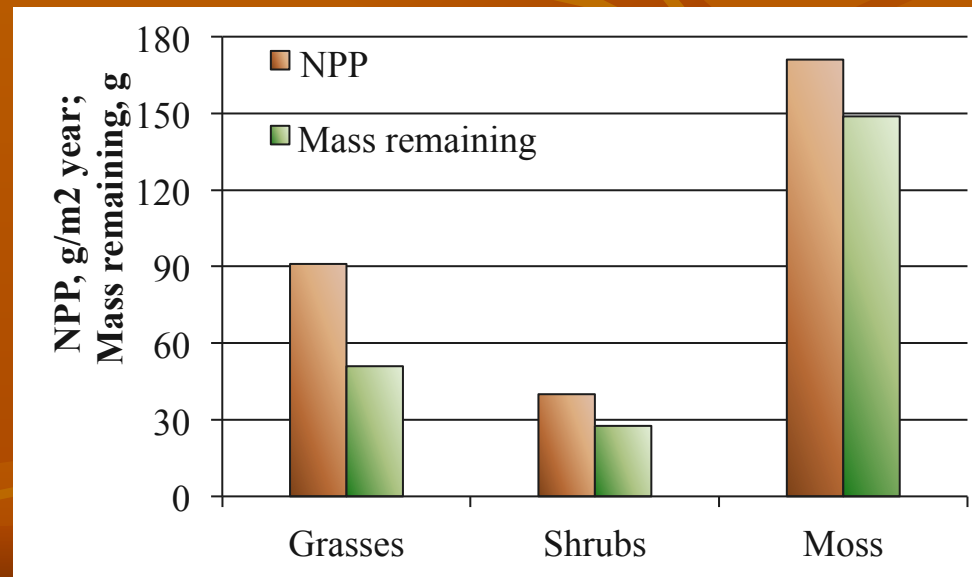




Pine-shrub-sphagnum ryam

Carbon balance of peatland ecosystems can be estimated using data on vegetation NPP and decomposition rates. Studied ecosystems have positive carbon balance.

During the first year decomposes only 13% from the annual productivity at low ryam, and 25% at sedge-sphagnum fen. Carbon accumulation in a form of peat is higher than carbon removing with carbon dioxide emission at plant remains decomposition.



Conclusion

- Despite the differences in composition of the vegetation the average values of NPP are similar at all oligotrophic ecosystems.
- The rates of decomposition of the plant matter depends on species of plants.
- The main peat-forming species are sphagnum moss.
- Carbon accumulation in a form of peat is higher than carbon removing with carbon dioxide emission at plant remains decomposition.

Thank you for the attention!



Western Siberia
Bakchar key area
Bakcharskoe bog