"How the middle Ob' peatlands developed and their role in the carbon cycle"

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Yugra state university (Khanty-Mansiysk city, Russia)

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æ

# Introduction Who I am

- Evgeny A. Zarov
- Scientific researcher of the Yugra state university, UNESCO chair



Publication of WoS/Scopus: **18** Total number of publications: **77** 

- ResearcherID: T-1703-2017
- GoogleScholar profile: https://scholar.google.ru/citations? user=SGpNGIYAAAAJ&hl=ru&oi=ao

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Carbon in the peat Cycle Impact of peatlands

SCIENTIFIC QUESTION

## Introduction Education

Higher education:

- Saratov State Technical University
- Utrecht University (Utrecht, the Netherlands)



UNIVERSITY OF HELSINKI



University of Manitoba Trainings:

- Helsinki University (EddyUH: a software for eddy covariance flux calculation. Helsinki, Finland )
- University of Manitoba (Climate Change. Vinnipeg, Canada)





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### West Siberia Location and borders



Total area:2 421 100 sq.km Equal to 10! Great Britains How the middle Ob' peatlands developed and their role in the carbon cycle"

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#### Main ecosystems



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#### Main ecosystems





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#### Main ecosystems

Bio-climatic zones and distribution of permafrost in Western Siberia



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### West Siberia World waterlogging area



Global peatland distribution derived from PEATMAP. (Xu et al., 2018. PEATMAP: Refining estimates of global peatland distribution based on a meta-analysis. Catena.) How the middle Ob' peatlands developed and their role in the carbon cycle"

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#### Siberian waterlogging area



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#### Distributions of West Siberian peatlands

(Peregon, et al., 2008. Map-based inventory of wetland biomass and net primary production in Western Siberia. Journal of Geophysical Research: Biogeosciences.)

**Peatlands** are *wet* ecosystems in which net primary production (NPP) has exceeded decomposition over thousands of years, and as a result organic matter, rich in carbon, has accumulated over time, and peat is formed

(Wieder, & Vitt. 2006. Boreal peatland ecosystems.)

In Russian tradition peatlands are characterized by active processes of peat accumulation and peat deposits more 30 cm

(Tyuremnov. 1976. Torfyanie mestorozhdeniya (Peat deposits).)

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SCIENTIFIC QUESTION

# What is peatland?

# Big Vasyugan peatland (Bolshoe Vasyuganskoe boloto)



The total peatland area is  $53\ 000\ km^2$ It is more then Switzerland or the Netherlands How the middle Ob' peatlands developed and their role in the carbon cycle"

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# What is peatland?



Relationship between climate (temperature and precipitation) and major peatland complexes

(Wieder, & Vitt. 2006. Boreal peatland ecosystems.)

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# What is peatland? Vegetation









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# What is peatland? Vegetation



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### What is peatland? Hydrology







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Depend on the source of water influence distinguish:

- Ombrogenous peatlands rain and snow water (A)
- Geogenous peatlands ground and surface water (B)





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### What is peatland? Different stages of peatland development



## What is peatland?



Waterlogging started 11.5-9 cal ky BP in early Holocene ages. After the glacier dissappeared.

(Smith et al. 2004. Siberian Peatlands a Net Carbon Sink and Global Methane Source Since

the Early Holocene)

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What is peat? Peat accumulation factors Carbon in the peat

Impact of peatlands

SCIENTIFIC QUESTION

# What is peat?

**Peat** - organic rock containing no more than 50 % of minerals and formed by wetland plants in conditions of high humidity and a lack of oxygen.

(Tyuremnov. 1976. Torfyanie mestorozhdeniya (Peat deposits).)





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#### Fresh peat contains:

- plant debris
- humus
- mineral compunts (ash)
- water
- gas (oxygen, methane, carbon dioxide) in peat pores

#### Main peat properties:

- high porosity
- full of organic matter
- full of humic and fullic acids
- huge carbon content (~ 50-60 %)

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Carbon in the peat

Cycle Impact of peatlands

SCIENTIFIC QUESTION

- climate temperature and wetness
- wetland vegetation
- geomorphology
- hydrology
- slow litter decay processes

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Carbon in the peat Cycle Impact of peatlands

SCIENTIFIC QUESTION

# Cycle



#### Carbon flow directions:

- uptake
  - photosynthesis
  - nocturnal breathing
- release
  - gas emission
  - dissolved outflow

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SCIENTIFIC QUESTION

- carbon cycle (1/3 of soil carbon and 2/3 of athosphere carbon) (Beilman et al. 2009. Carbon accumulation in peatlands of West Siberia over the last 2000 years)
- global warming (carbon dioxide and methane emission) (IPCC. 2018)
- water storage (994 km<sup>3</sup> stored in WS peatlands) (Bolota Zapadnoi Sibiri. 1976. (Peatlands of West Sberia.))
- biodiversity (unique habitat)
- biogeochemical filtring

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Carbon in the peat Cycle

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# SCIENTIFIC QUESTION

#### Future climatic changes

- Creating of the peatland development model
- Parameterization of the peatlands impact on the environmental

#### Exact evaluation of the:

- peat volume
- carbon storage
- carbon sequestration rate

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## SCIENTIFIC QUESTION

## My research Aims and questions

- define the peatland development stages
- calculate with high resolution the amount of stored carbon in the peatland
- estimate the rates of peat and carbon accumulation
- define the amount of dissolved organic carbon loosing with runoff
- create a model of peatland hydrology

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### My research Sampling and analysis



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# My research







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# SCIENTIFIC QUESTION

## My research Peatland stratygraphy



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SCIENTIFIC QUESTION

# My research Different peat cores



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1. Sphagnum				21.	21. C. limosa			
2. Sph. capillifolium				22.	22. C. rostrata			
3. Sph. riparium				23.	23. C. lasiocarpa			
4. Sph. lindbergii				24.	24. C. cespitosa			
5. Sph. fuscum				25.	25. C. juncella			
6. Sph. angustifolium				26.	26. C. globularis			
7. Sph.magellanicum				27.	27. Scheuchzeria			
8. Sph. papilosum				28.	28. Bogbean			
9. Sph. balticum				29.	29. Fem			
10. Sph. majus				30.	30. Horse-tail			
11. Sph. jensenii				31.	31. Cotton grass			
12. Sphagnum hollow oligotrophic				hic 32	32. Shrubs			
13. Sph. squarrosum				33	33 Salix			
14. Sph. fallax				34	34 Birch			
15 Sph centrale				26	24 Ein			
16 Cale assessments				35.	55. Fil			
<ol><li>Sph. warnstorfii</li></ol>				36.	36. Pine			
17. Sphagnum mesotrophic				37.	37. Unknown remains			
18. Sph. teres				38.	38. Mineral soil			
19. Brown mosses				39.	39. Gyttja			
20. Sedges				40.	40. Rush			

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- microlandscapes
- vegetation
- climatic condition
- mineral supply



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## My research Peat types and its properties



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## My research Ridge-hollow complex



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## My research Peat growing



Average rate of peat accumulation 0.72 mm per year

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## My research Peat growing vs carbon accumulation



Average rate of peat accumulation **0.72 mm** per year Average rate of carbon accumulation **36.829 g** per  $m^2$ per year How the middle Ob' peatlands developed and their role in the carbon cycle"

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# Thank you for listening!

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