# Identification, characterization, and functional assessments of isolated wetlands

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# ISTC project #4079 Identification, Characterization, and Functional Assessments of Isolated Wetlands of the Former Soviet Union

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- Institute of Chemical Biology and Fundamental Medicine SB RAS, Novosibirsk
- Sukachev' Institute of Forest SB RAS, Krasnoyarsk
- US Environmental Protection Agency, Cincinnati, USA

# Isolated wetland size

- Small sized wetlands are difficult to delineate at satellite images.
- Small wetlands are more vulnerable to external influence (climate change, water table lowering, pollution, antropogenic impact) than big stable peatlands with huge water and carbon storages.

## Size Does Matter: The Value of Small Isolated Wetlands

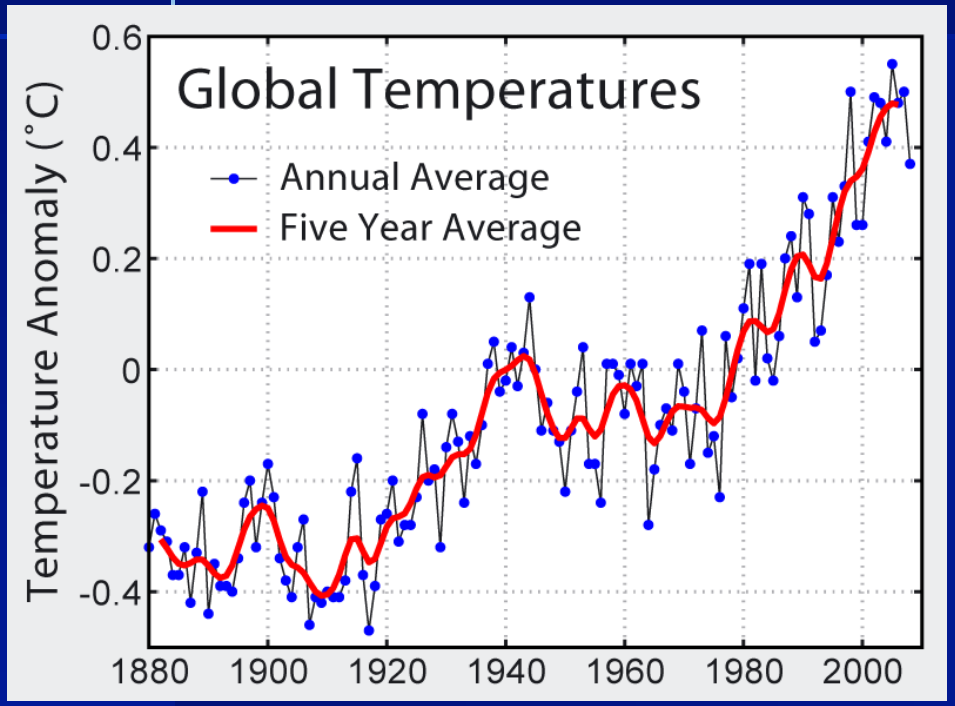
*While the regulatory landscape values larger wetlands over smaller ones, the ecological landscape presents a different view. Research in Carolina bays shows that small isolated wetlands play a crucial role in the biodiversity of wetland-dependent species, especially for amphibians.*

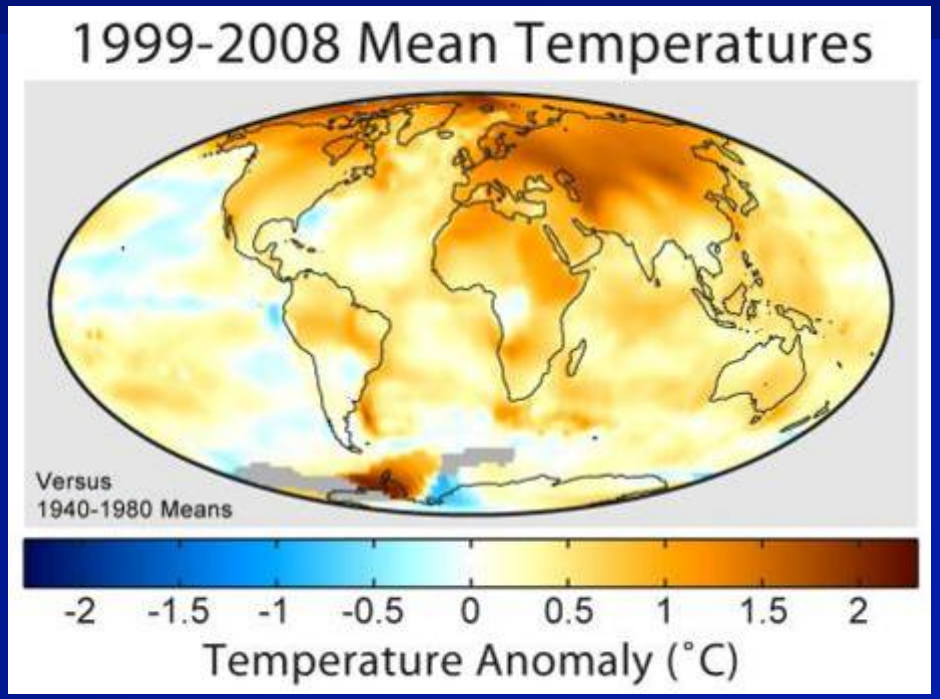
by Raymond D. Semlitsch

# Anthropogenic impact

- Oil and acid pollution of soils during oil well exploitation
- Accident oil pollution
- Gas flares emission
- Disturbances in hydrological regimes at linear industrial objects building
- Increase of fire dangers at bog draining

# Climate change

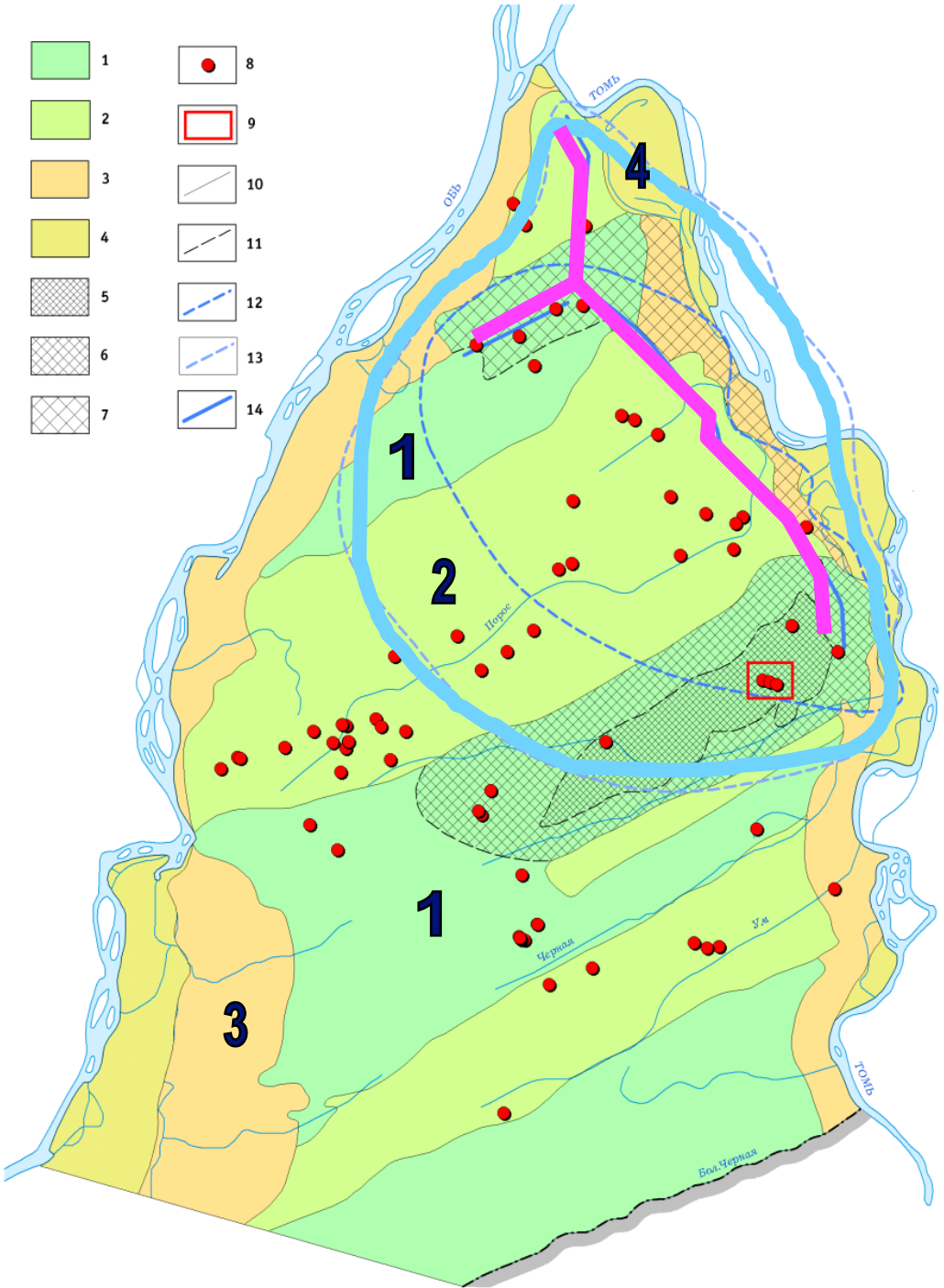



- Most intense warming in the continental areas Northern Hemisphere.
- Changes in hydrological cycle due to changes in precipitations.
- Ecosystem boundaries (Forest – Mire interface) is essentially changes under climatic impact.



*IPCC 2011*




# Landscape structure

1 – ancient river valley;

2 – denudation-accumulation plain;

3 – fluvial terrace,

4 – floodplain.

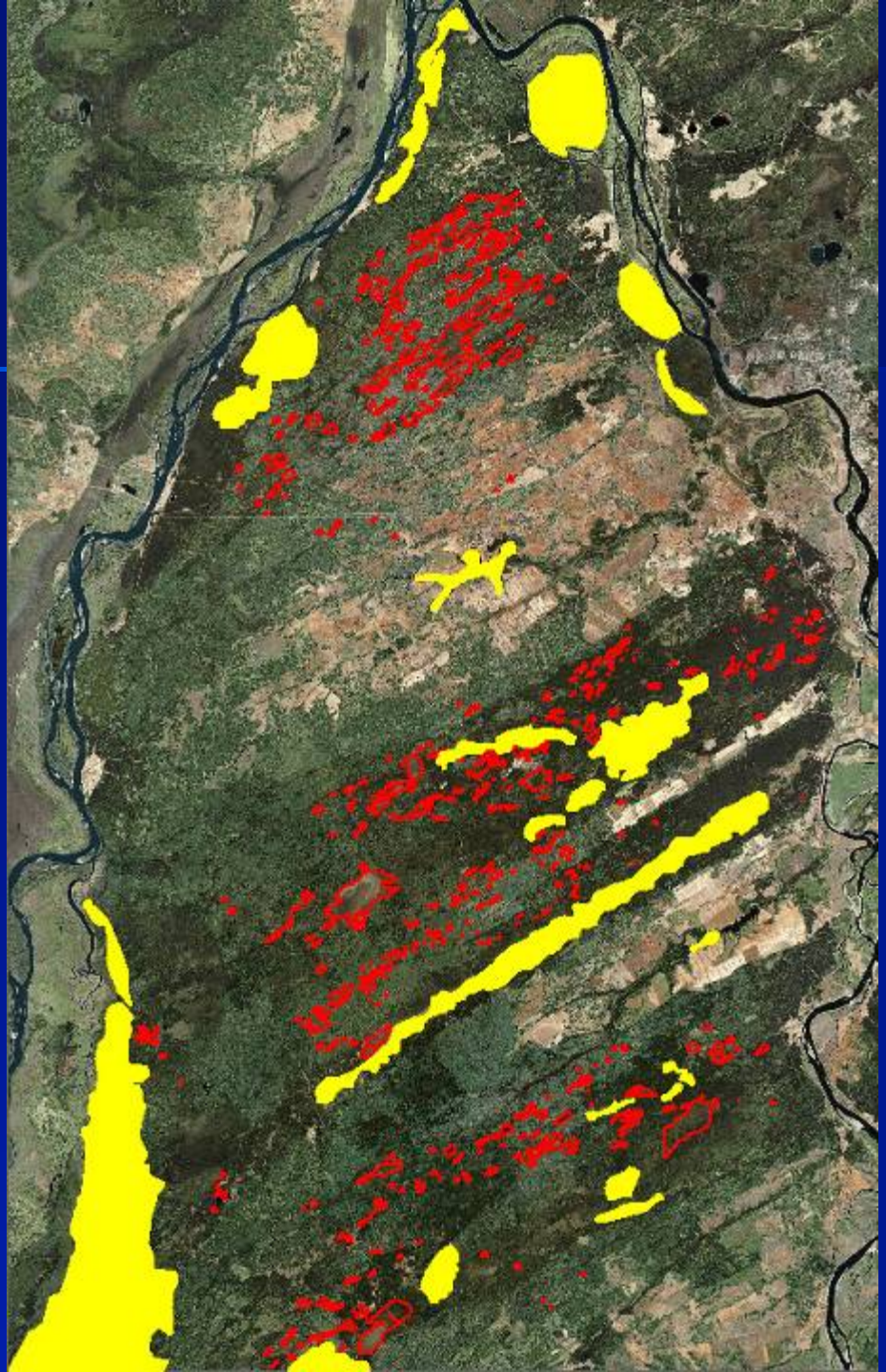
Water wells line

Depression in aquifer

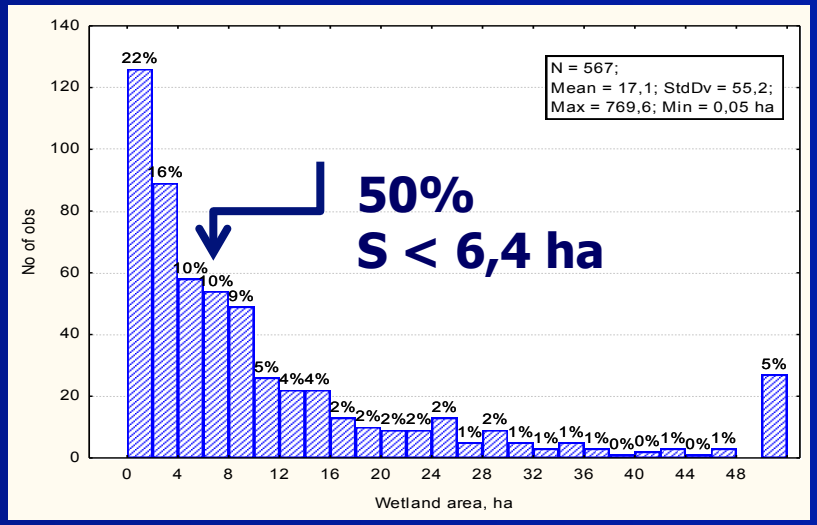
177 water wells

250 000 $m^3$ water daily

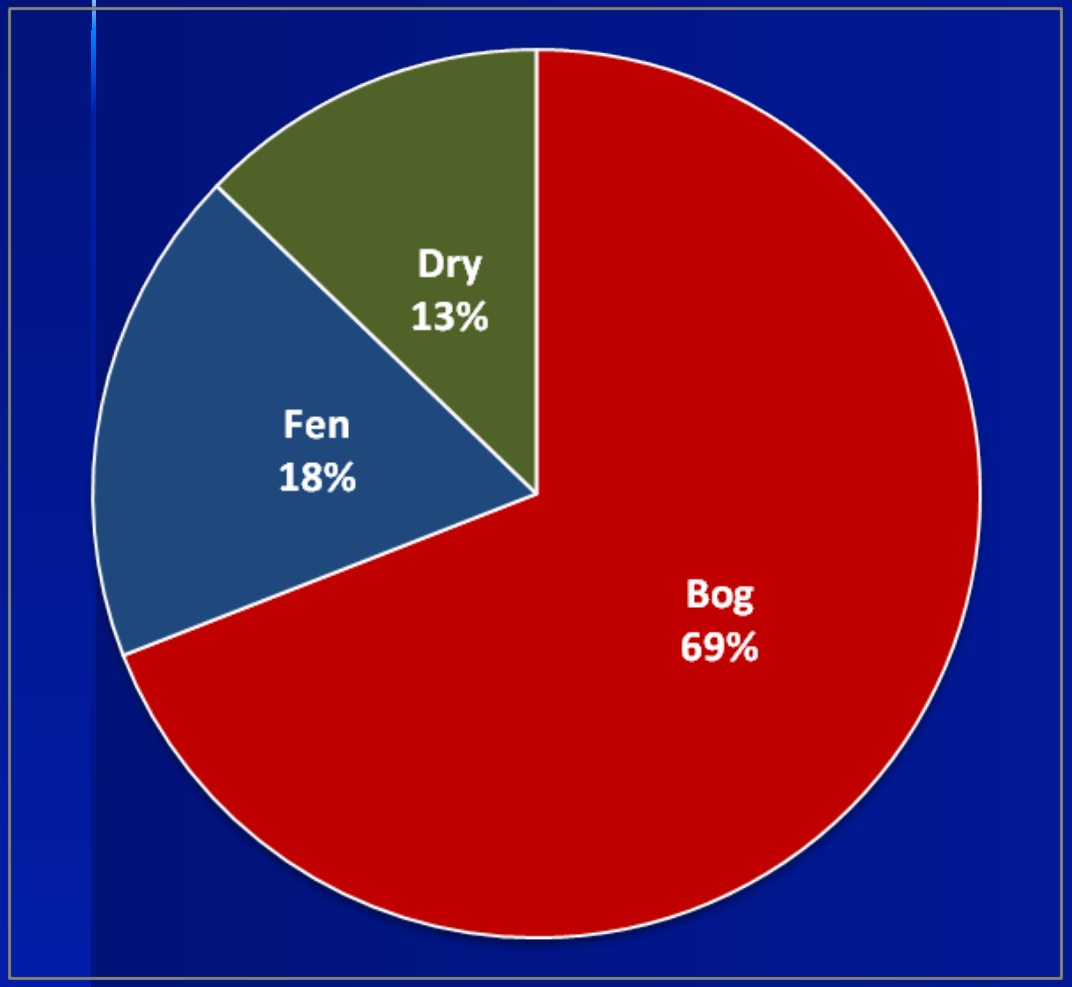
*A. G. Dyukarev, N. N. Pologova State of Natural Environment in the Tomsk Water Intake Area // Contemporary Problems of Ecology, 2011, Vol. 4, No. 1*



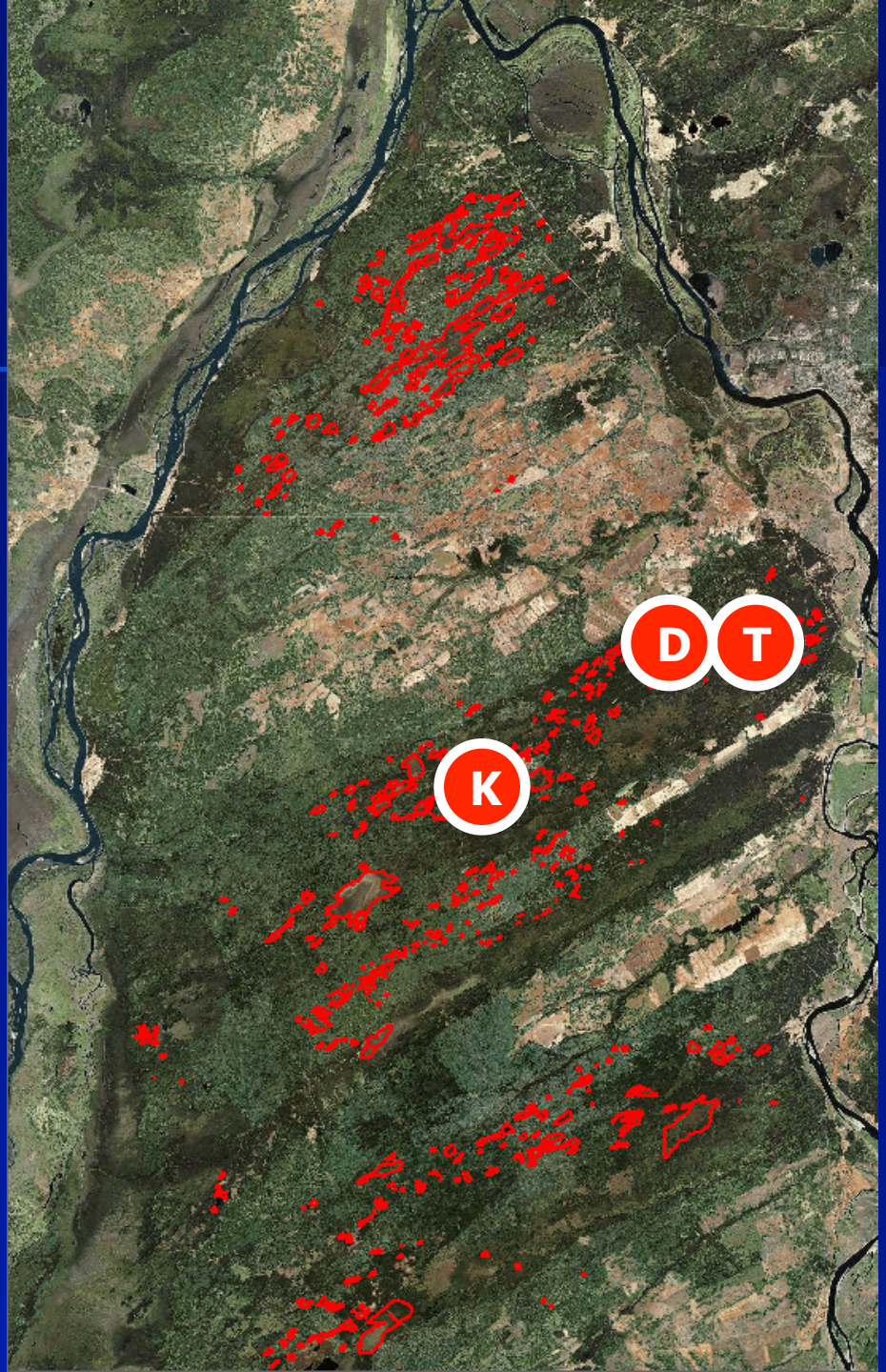
**567 - isolated wetlands**
**Total area – 9 714 ha**
**2,51 %**



# Isolated wetland classification






- Site “T” – “Timiryazevskoe” wetland
- Site “K” – “Kirsanovskoe” wetland
- Site “D” – Dry peatland

# Site "T"

- TR – pine-shrub-sphagnum community – oligotrophic bog

- TF – open sedge-sphagnum fen

# Site "K"

- KR – pine-shrub-sphagnum community – oligotrophic bog

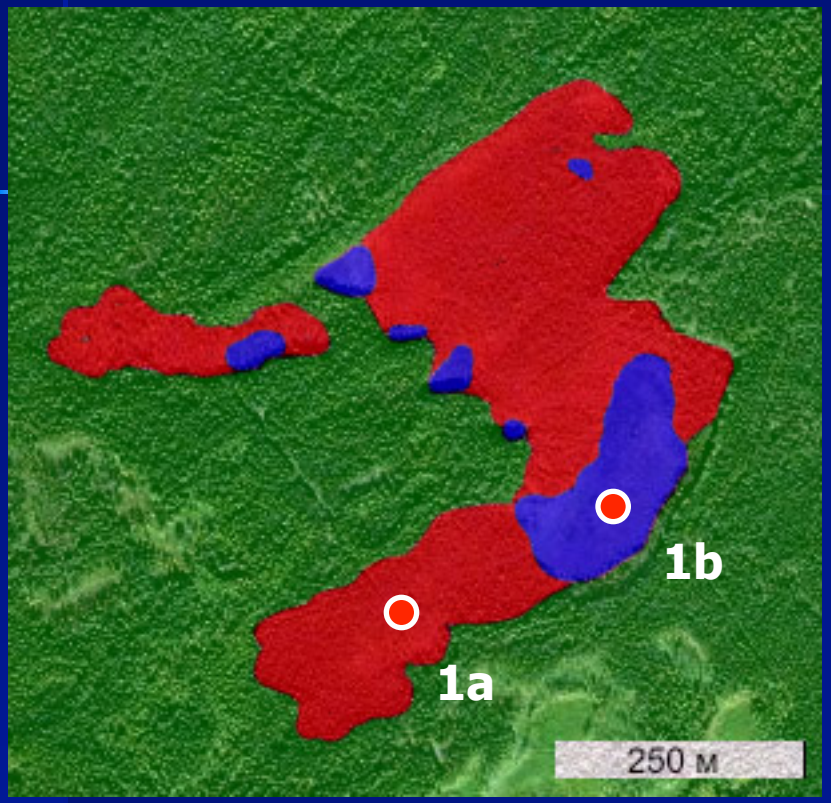
- KF – open sedge-sphagnum fen

# Site "D"

- **Dry peatland**

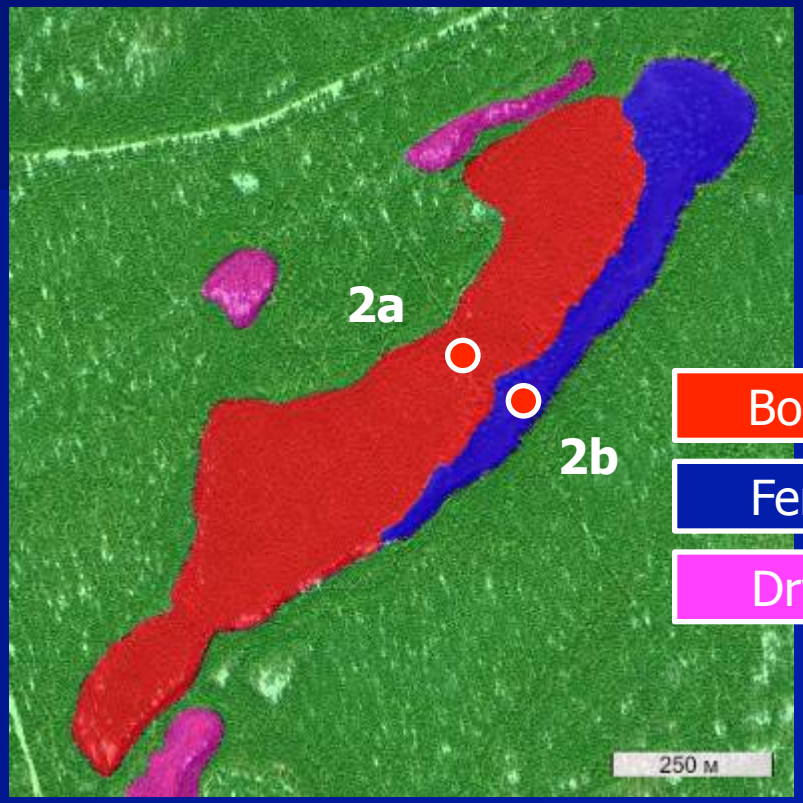
Peatland with low level of bog waters and compacted peat. Surface vegetation transformed. Fire dangerous area.

# Site "T"




- TR – pine-shrub-sphagnum community – oligotrophic bog. 420 cm, $C^{14}$ age – 5880 yr.
- TF – open sedge-sphagnum fen. 320 cm, $C^{14}$ age – 4000 yr

# Site "K"

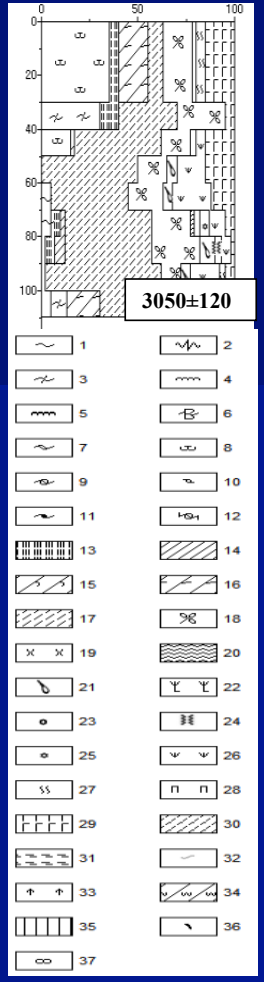



- KR– pine-shrub-sphagnum community – oligotrophic bog. 310 cm, $C^{14}$ age – 5300 yr
- KF – open sedge-sphagnum fen. 100 cm, $C^{14}$ age – 3050 yr

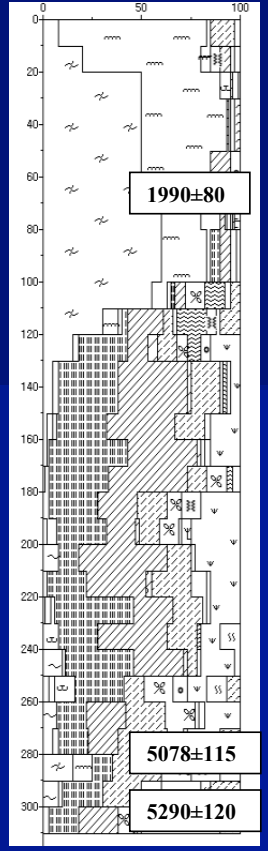
# Peat sampling

# Peat stratigraphy

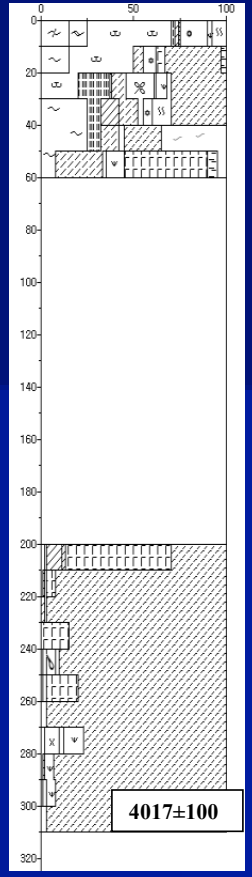
1- сфагны, 2 Sph.fuscum, 3 – Sph. angustifolium, 4 – Sph. magellanicum, 5- Sph. papilosum, 6- Sph. balticum, 7 – Sph. majus, 8 - Sph. cuspidatum, 9 – Sph. fallax, 10 – Sph. nemoreum, 11 Sph. obtusum, 12-Sph. sect. Acutifolia, 13 - Scheuchzeria palustris, 14 - осоки, 15 – C. limosa, 16 – C. rostrata, 17 – C. lasiocarpa, 18- Menyanthes trifoliata, 19 – Equisetum, 20 – Eriophorum vaginatum, 21 – Calla, 22 - Pinus sylvestris, 23 - Oxicoccus palustris, 24 – злаки, 25 - Comarum palustre, 26 – травы, 27 – Phragmites australis, 28 - Theliptheris palustris, 29 – гипновые мхи, 30 – Drepanocladus, 31 – листовой опад, 32 – водоросли, 33 – кустарнички, 34 – Warnstorfia, 35 – древесина, 36 - Meesia triquetra, 37 - Pleurozium schreberi



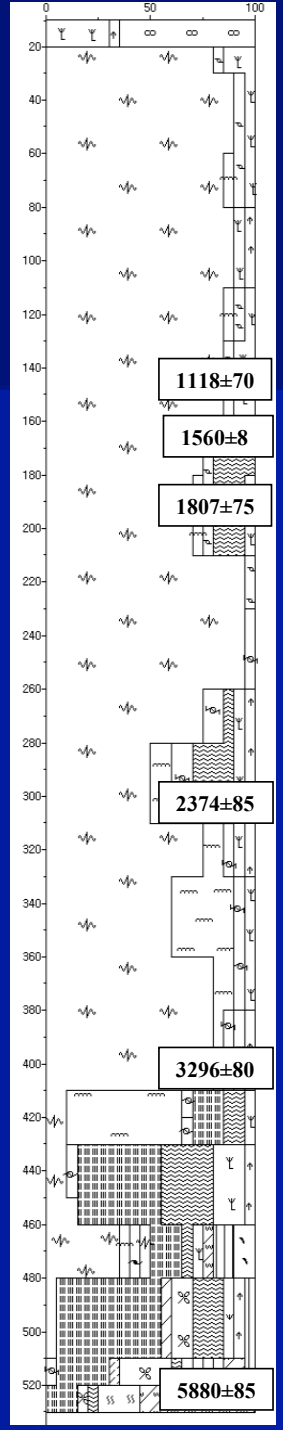

KF




KR

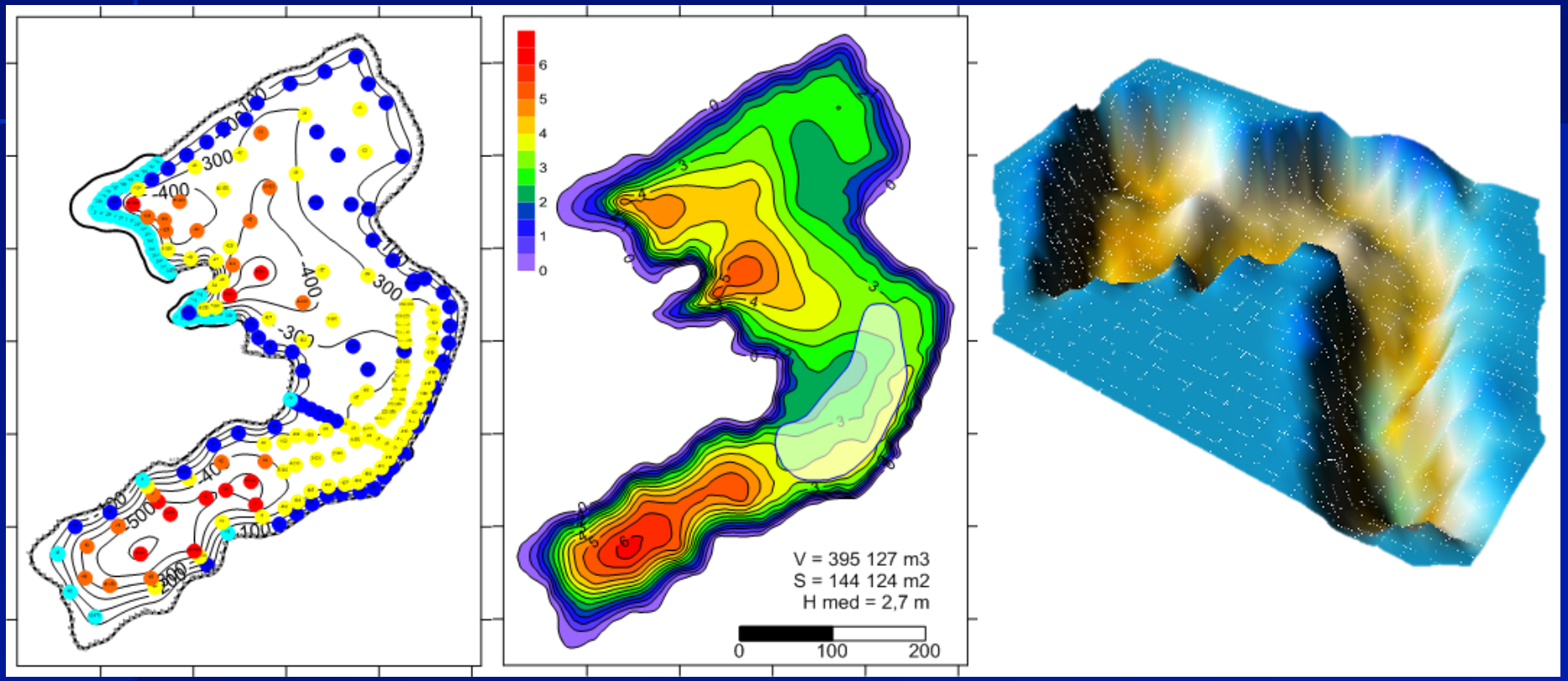



TF




TR

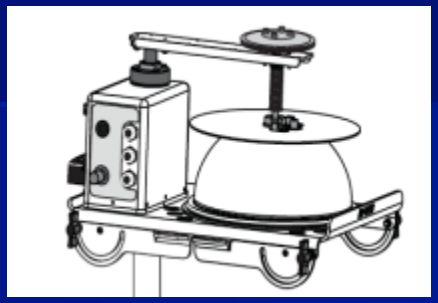
# Site “T”. Peat depth map.




- 240 depth sampling
- Maximal depth – 8 m
- Median depth – 2,7 m
- Peat storages – 395 127 $m^3$

# Carbon dioxide and methane emission

$H_2O$
$CO_2$



- **Li-Cor LI–8100A (Li-Cor Biogeoscience, USA)** Automated Soil CO2 Flux System with Transparent Long-Term Chamber LI-8100-104

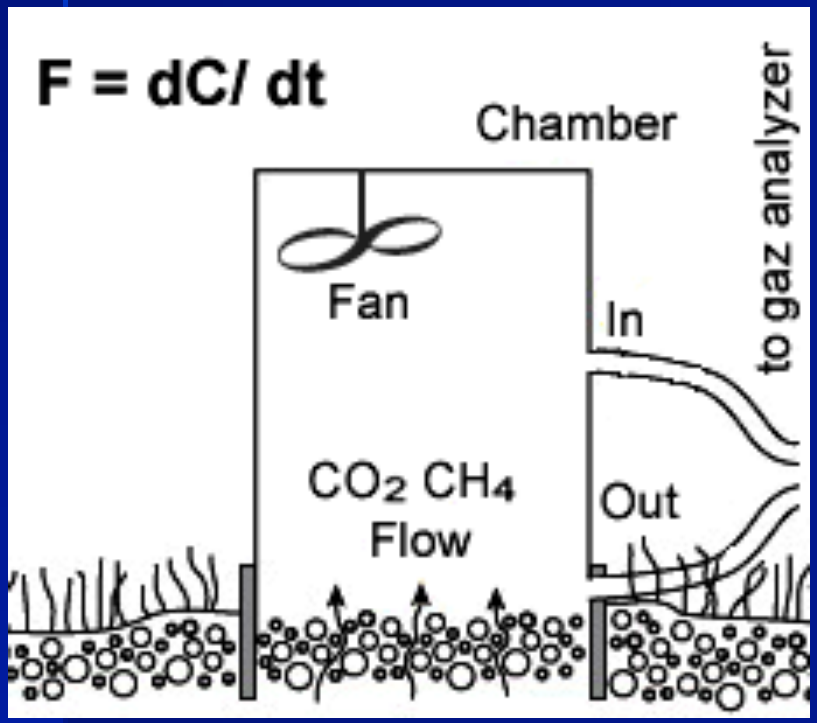
$CO_2$

- Infra-red gas analyzer **OPTOGAZ-500.4 (OPTEC, Russia).** Static dark chamber method with

$CH_4$

- Air sampled from the chamber was analyzed by **SHIMADZU GC-14b** gas chromatograph at flame-ionization detector. Methane emission was calculated from concentration rise within the chamber.

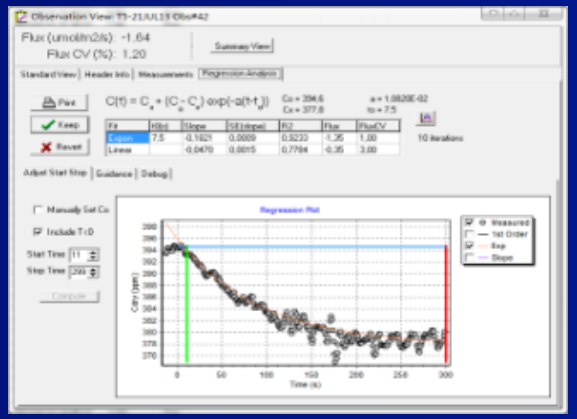
# $CO_2$ and $CH_4$ emission measurement




- Static dark chamber method
- dt = 30 min

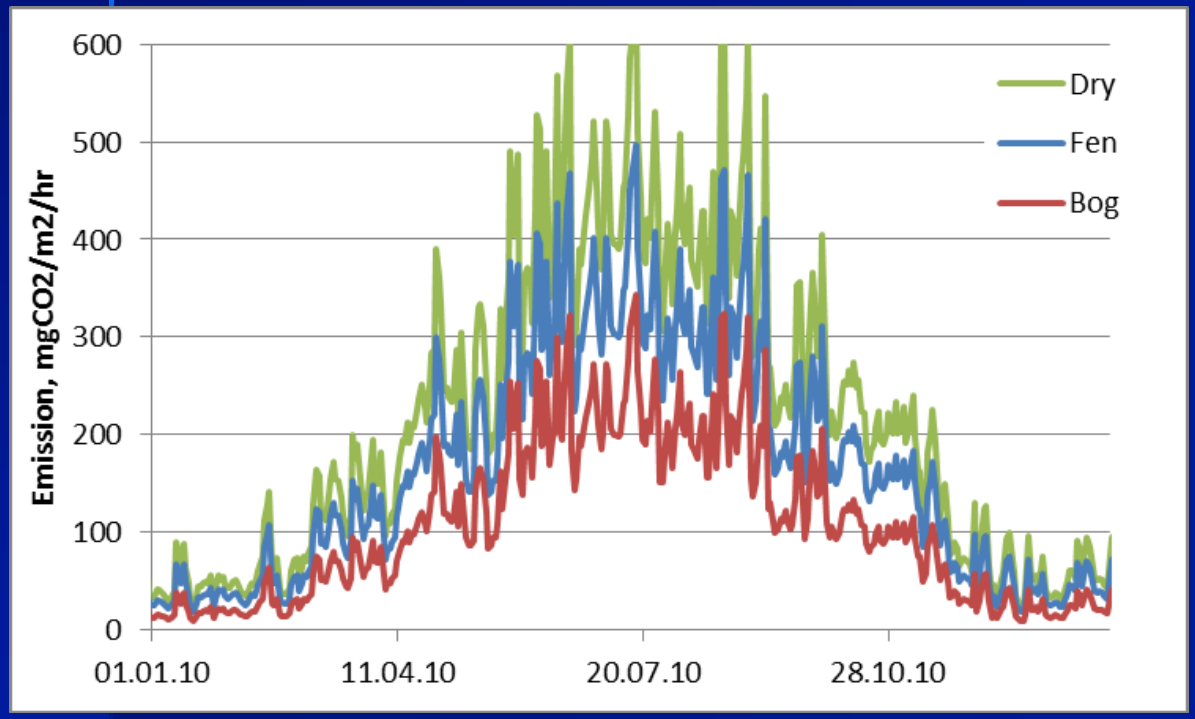
- Twice per month
- May – October
- 2008 – 2012

# Peatland vegetation photosynthesis measurements Li-Cor LI–8100A Automated Soil CO2 Flux System

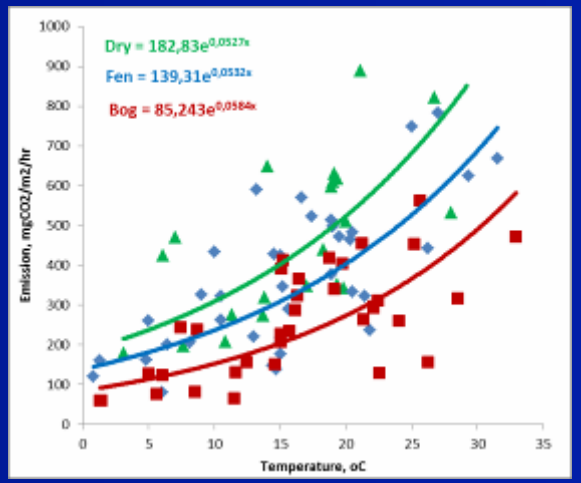


# Methane sampling

# Seasonal variations of $CO_2$ emission

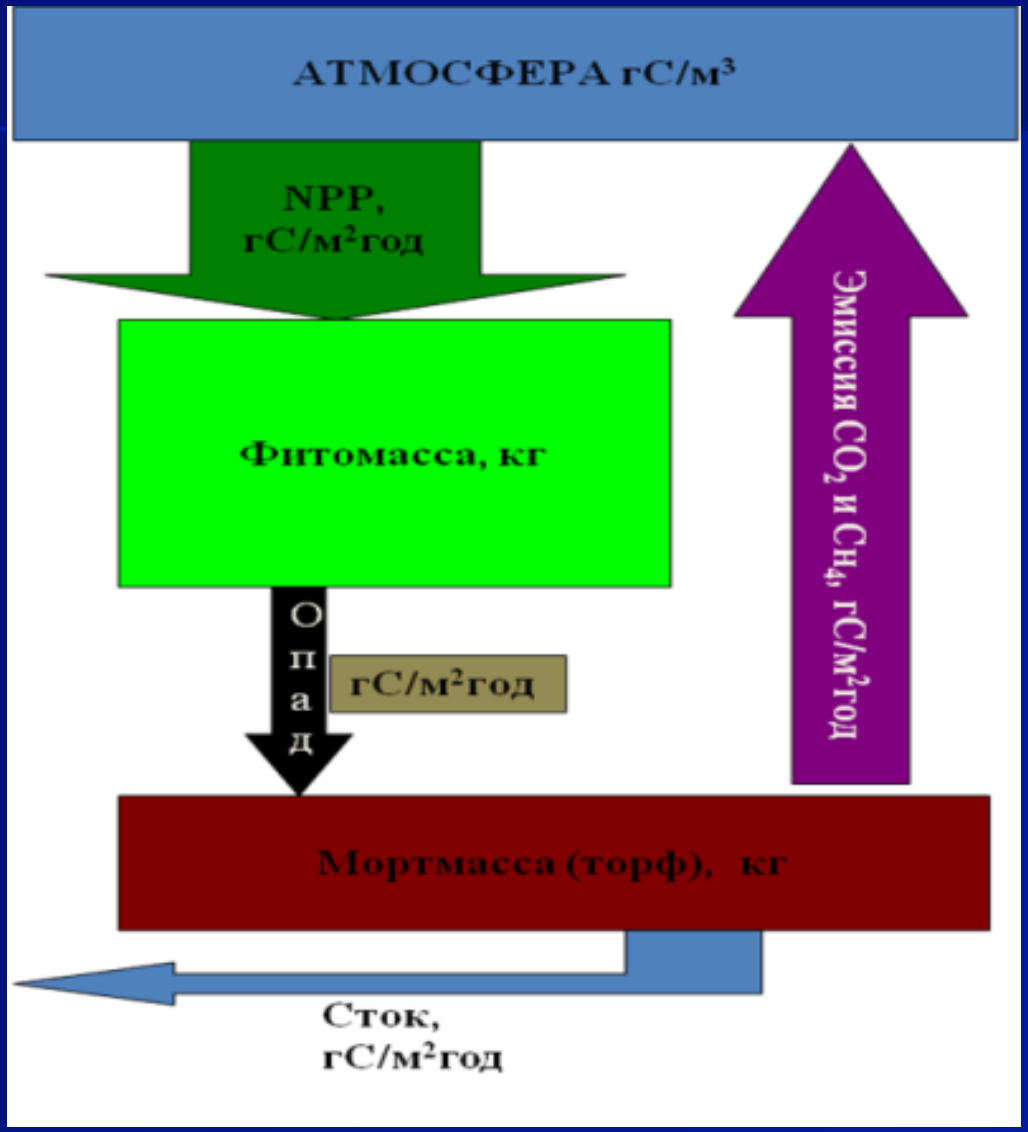



Reconstruction from air temperature dependence
F = a exp (b T)

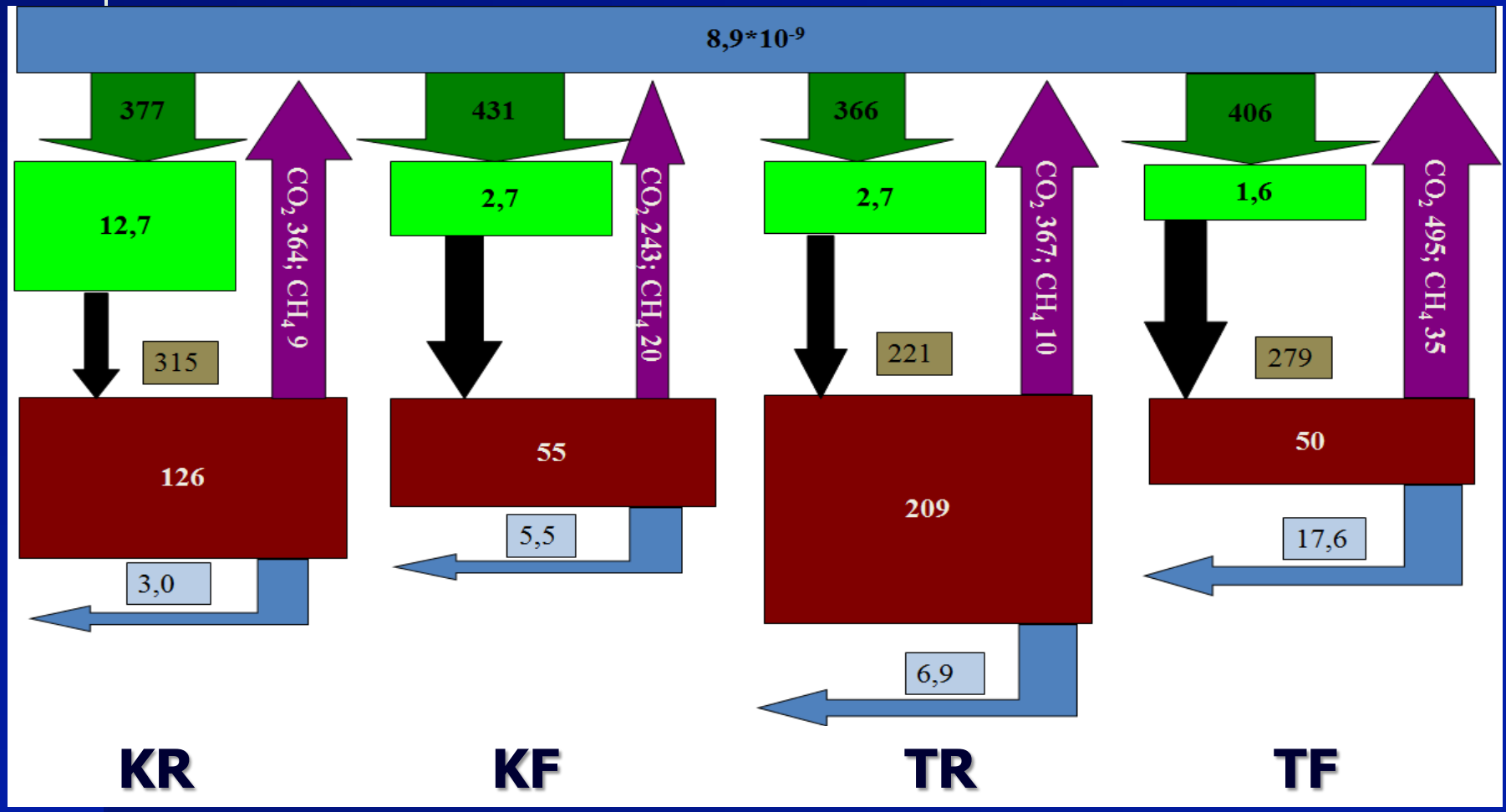



**Q10**
Fen =1.70 Dry = 1.69
Bog = 1.79

# Carbon cycle scheme



# Carbon turnover at studied peatlands




Спасибо за внимание!
Photo Charles R. Lane