# ON THE PHENOLOGY OF LARGER FUNGI IN RAISED BOGS: FIRST YEAR PERMANENT PLOTS MONITORING RESULTS

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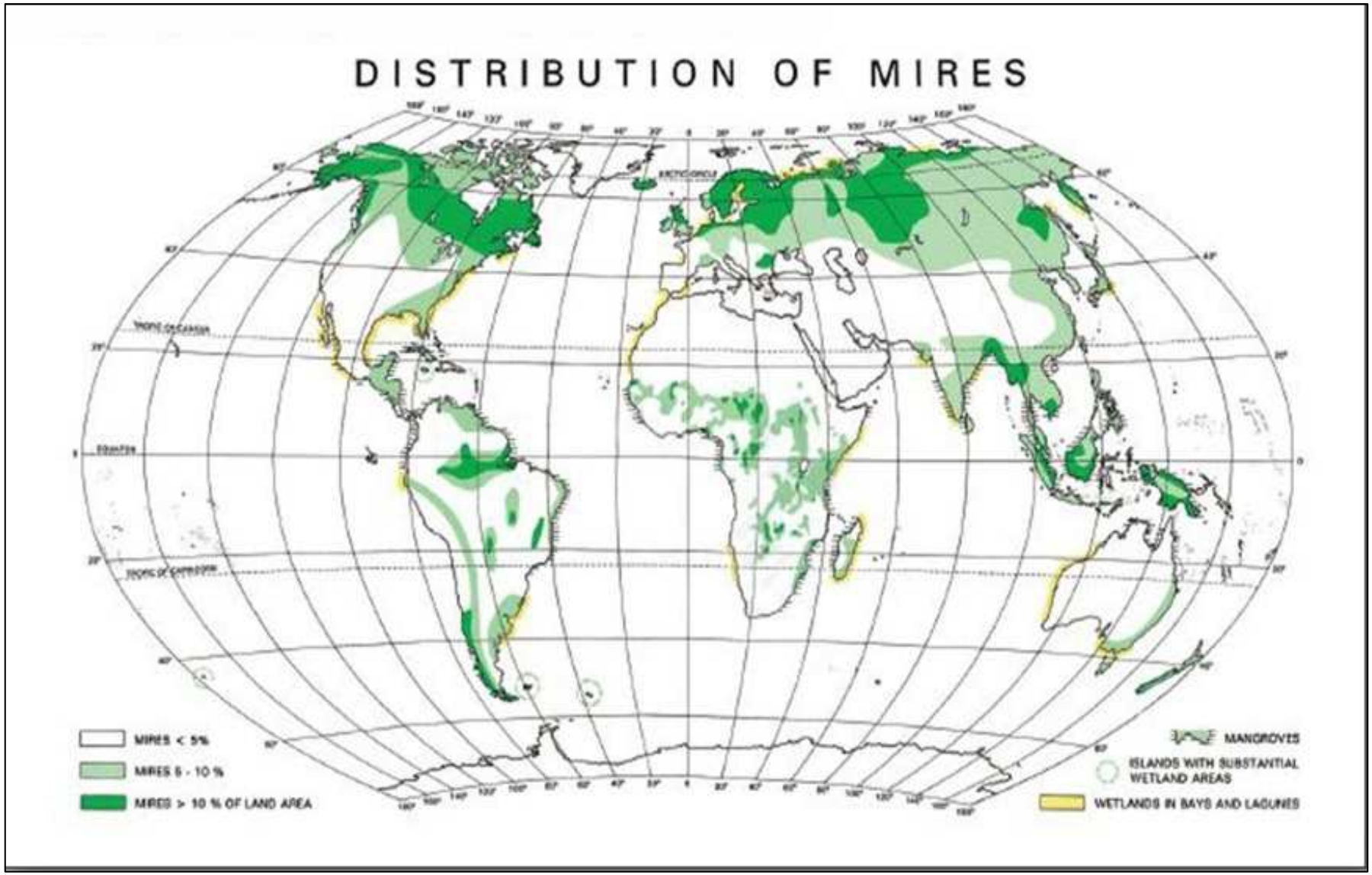
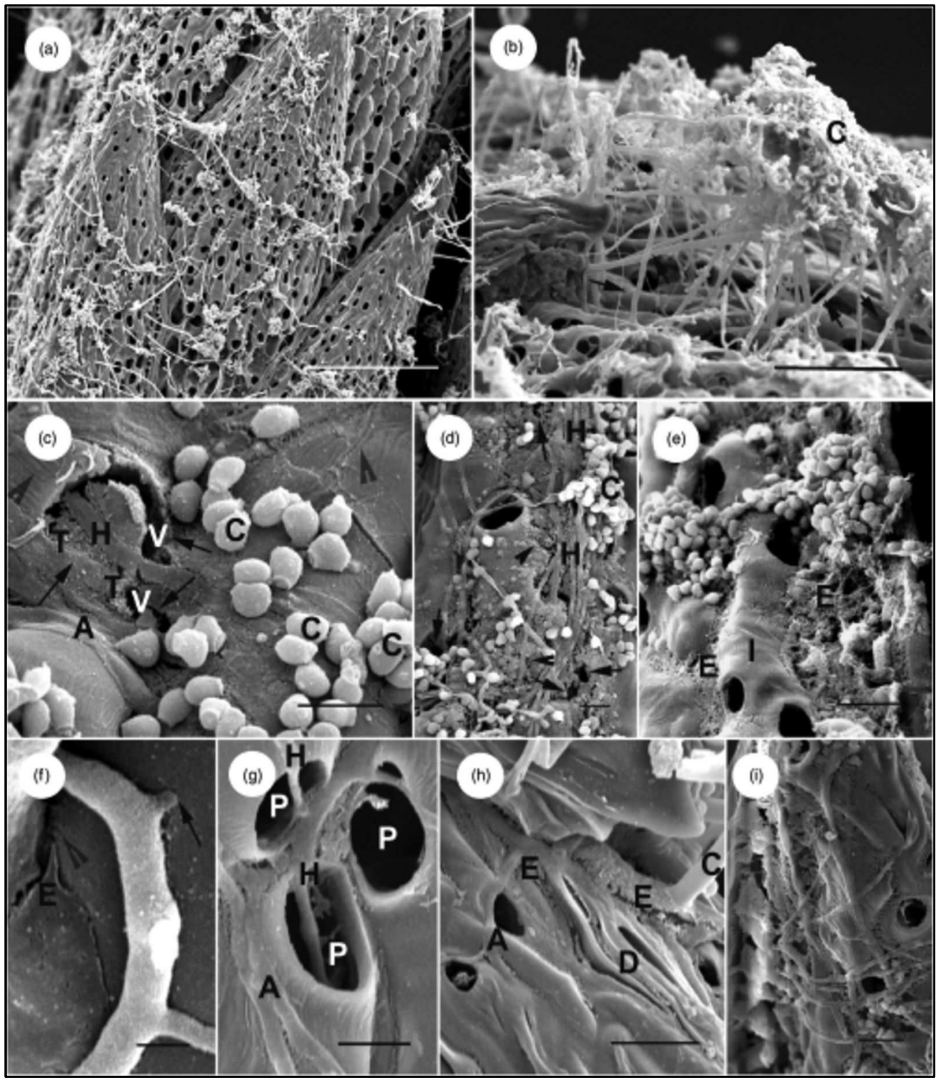
# Peatlands and their distribution:




***Joosten et al.,*** 2002, Wise use of mire and peatlands…

# Role of fungi in peatlands:




***Rice et al.,*** 2006, In vitro decomposition of Sphagnum…

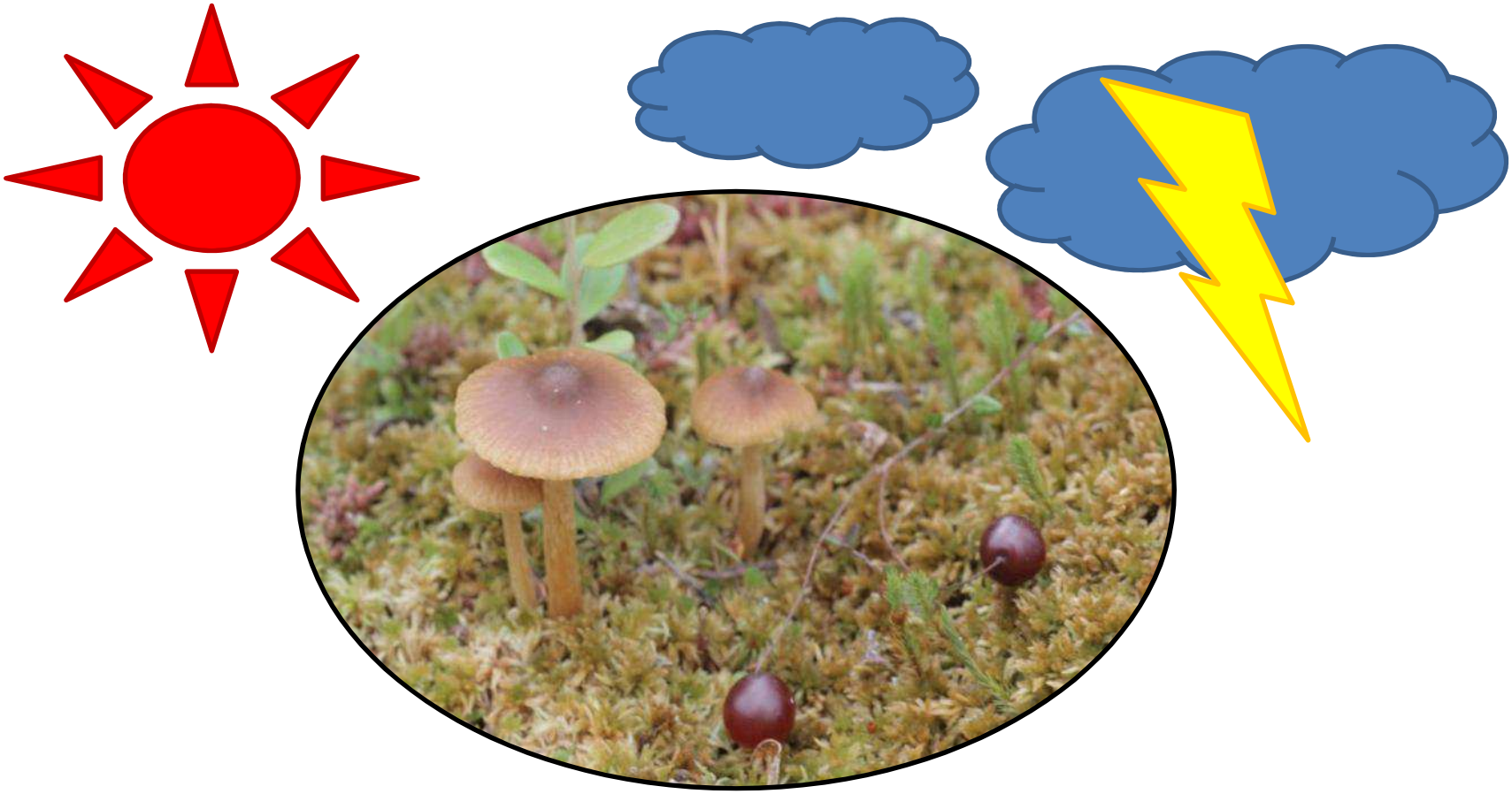
- Saprotrophs
- Parasites
- Symbionts

*Major studied fungal groups*:

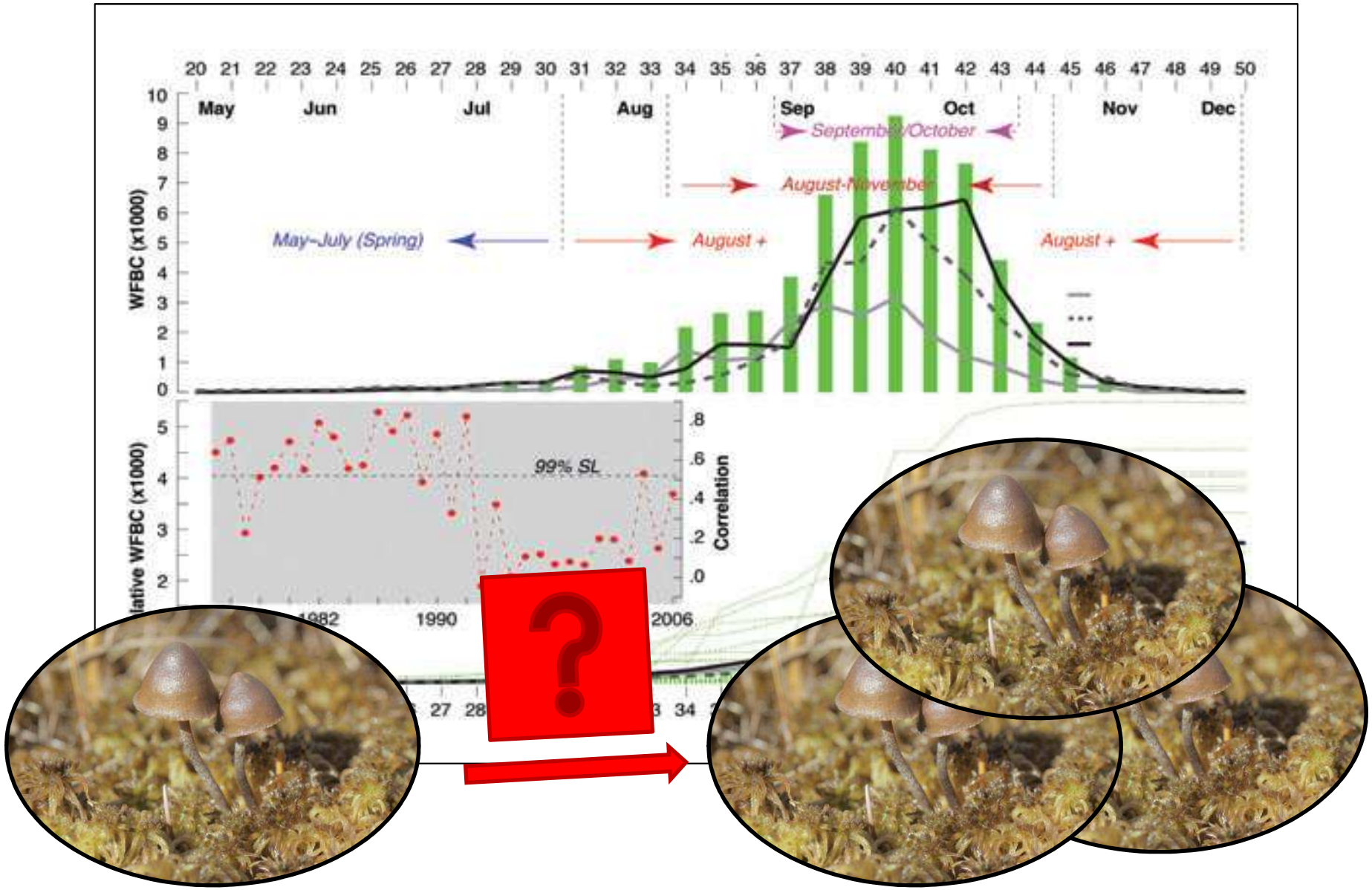
- Micromycetes in peat layer
- ECM species with bog trees
- Ascomycetes on plant litter
- Lignicolous on wood
- Macromycetes
- Yeasts
- Chytridiomycetes
- Water hyphomycetes, etc.

# The scope of present study:

to reveal **macromycetes fruiting dynamics** in ombrotrophic bog
in relation to weather parameters
using long-term monitoring  plots.



# Climate change and fungal fruiting:



# Literature review:

*E. Arnolds, 1981*:

- Periodicity
- Fluctuations
- Successions.

*L. Kotilova-Kubicova et al., 1990*:

- The onset of fruiting
- Abundance of fruit bodies and fruiting duration
- Growth of individual fruit bodies.

**Important weather parameters**:

- Precipitation
- Humidity (air, soil, litter)
- Mean, min and max temperatures (at surface; -5 cm)
- Soil heat flux, etc.

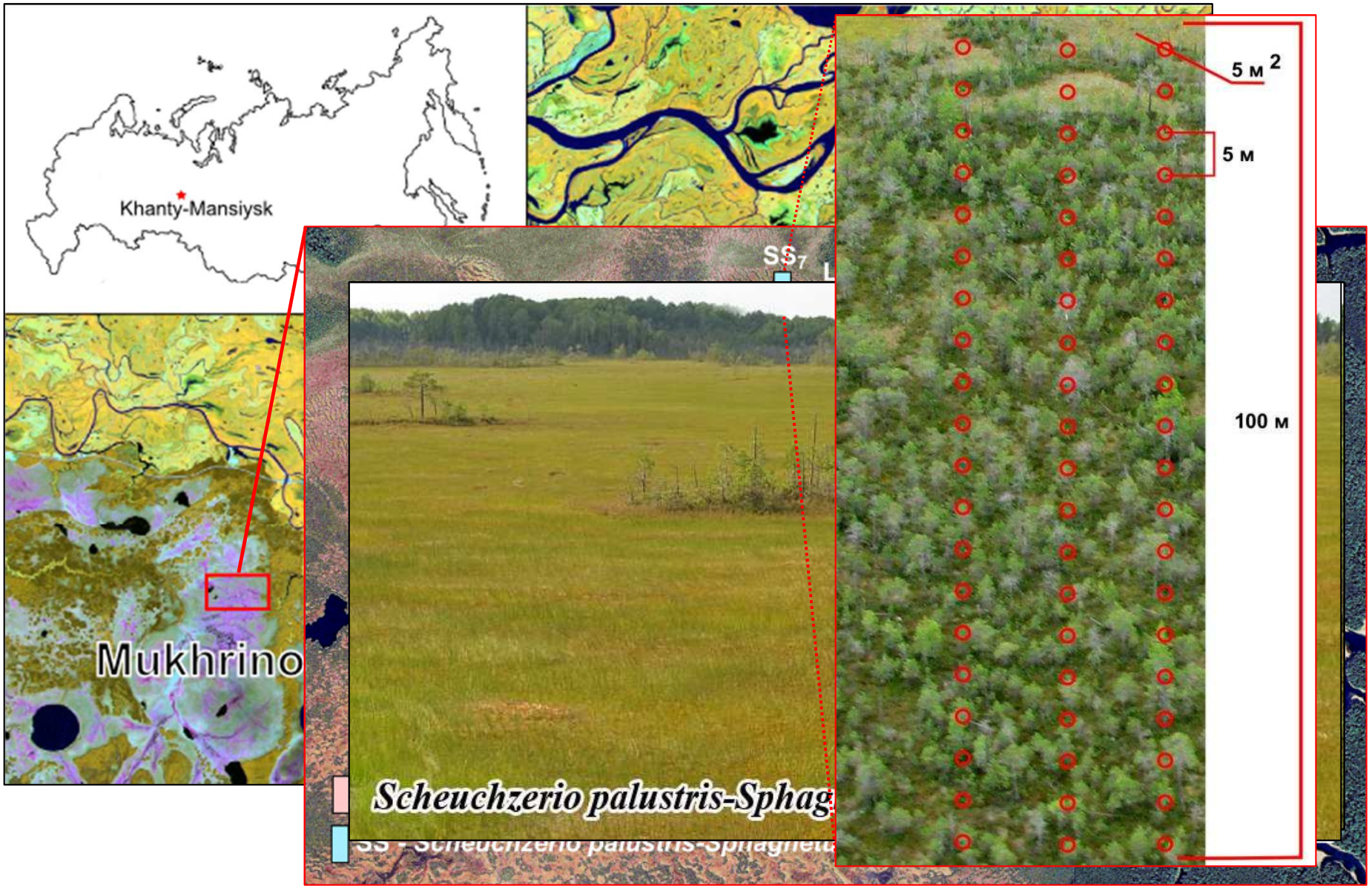
# Importance of fungal fruiting phenology:

- For some applied disciplines (commercial mushroom picking, cultivation of edible and medicinal mushrooms, etc.) fruiting dates and factor are directly required
- For representativity of floristic and mycocoenological studies
- Studies of species biology and population dynamics
- Long-term monitoring of ecosystem response to climate change.

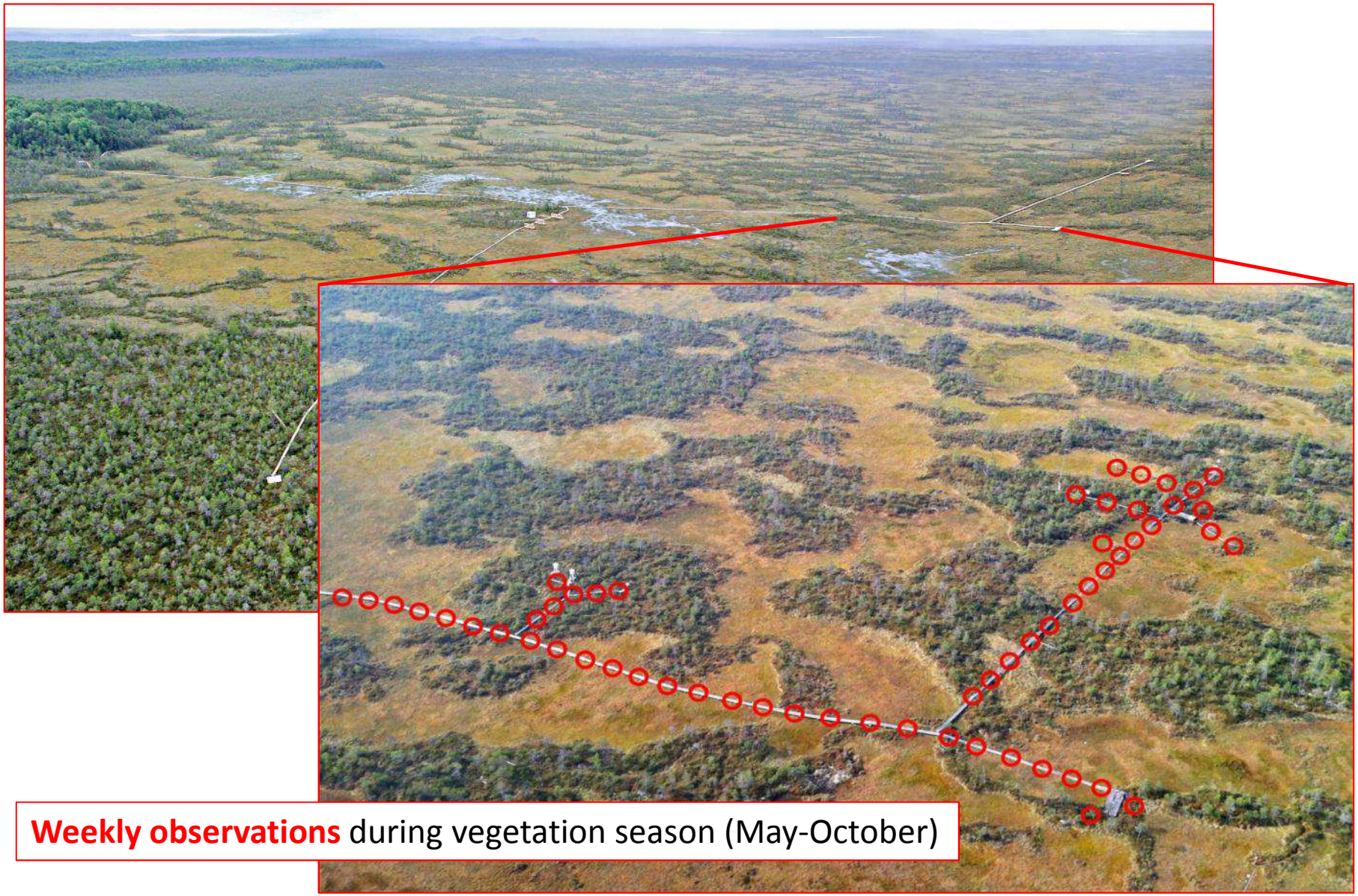
# Drawbacks of fungal phenology based on fruiting:

- Fruiting structures mark presence of the species in the environment, but their absence does not say the opposite
- Biomass of mycelium hidden in the substrates is an order of magnitude larger than the mass of fruiting structures
- *But:* along with other methods (*molecular, fluorescent microscopy*, etc.) direct observation of fruiting structures phenology could be an additional helpful tool.

# **West Siberia**, **Middle Taiga** zone, 20 km SW of Khanty-Mansiysk



**Total observation area** = 1385 $m^2$ ; 277 micro-plots x 5 $m^2$



**Weekly observations** during vegetation season (May-October)

# Measured WEATHER parameters since ±2010:

***Related to fungal fruiting:***

- **Temperature**: 2 m, soil surface, -2 cm to -50 cm (x 8 ps.)
- **Precipitation** (1 ps.)
- Bog **water level** (piezometers, x 10 ps.)
- **Soil humidity** (-5 cm to -40 cm, 1 ps.)
- **Air humidity** (2 m)
- **Soil heat flux** (x 3 ps.)

***Other:***

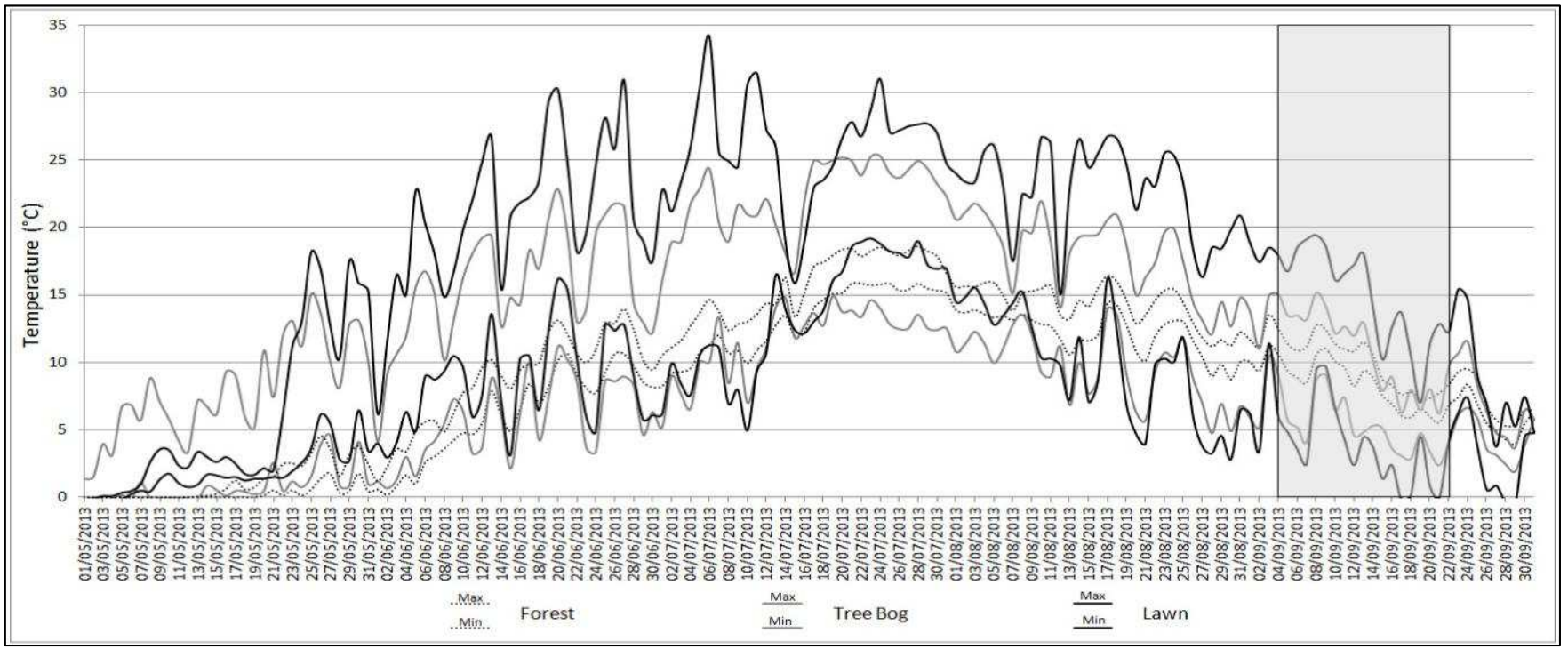
- Wind speed and direction
- PAR and net solar radiation
- Atmospheric pressure
- Snow depth
- Snow precipitation
- $CO_2$, $CH_4$ emissions

# Microclimatic differences between treed bog, sphagnum lawn and the forest:

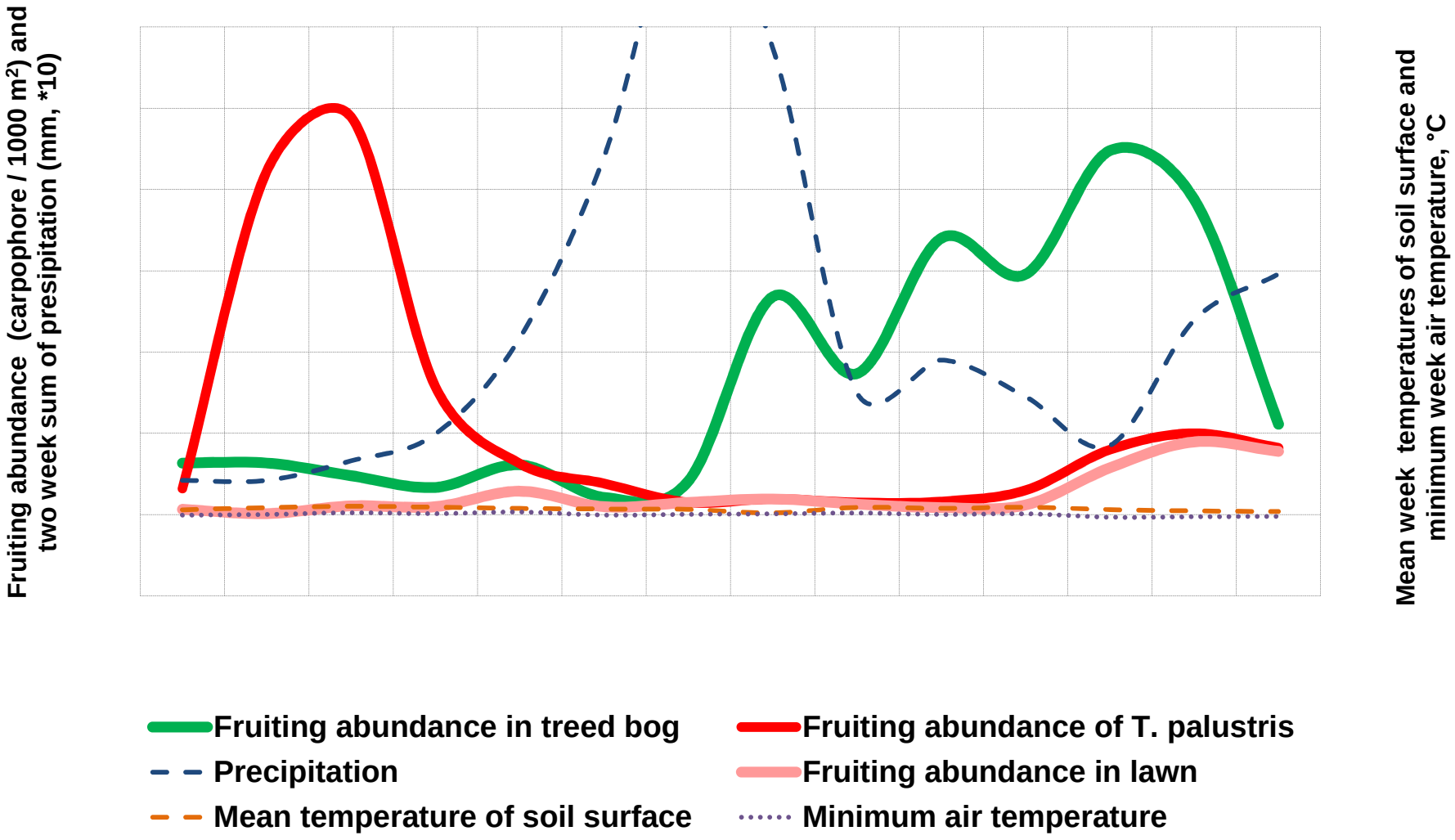
| | Parameter | Treed bog | Lawn | Forest |
|---|---|---|---|---|
| **Soil surface** | Daily mean temperature, °C | 8.8 | 9.0 | 7.7 |
| | Mean temperature range, °C | 13.9 | 8.9 | 5.5 |
| | Number of hours with T>5 °C | 2770.0 | 2972.0 | 2842.0 |
| **Soil at 5 cm depth** | Daily mean temperature, °C | 7.5 | 8.9 | 9.6 |
| | Mean temperature range, °C | 6.0 | 8.1 | 1.5 |
| | Number of hours with T>5 °C | 2867.0 | 2862.0 | 2728.0 |

# Microclimatic differences between treed bog, sphagnum lawn and the forest:

Temperature range in soil at 5 cm depth :



# Fruiting dynamics in 2014 in relation to weather parameters:



# Periodicity in fruiting of different species:

| Species | 14 VI | 21 VI | 28 VI | 5 VII | 12 VII | 20 VII | 26 VII | 2 VIII | 9 VIII | 16 VIII | 25 VIII | 4 IX | 12 IX | 17 IX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pseudoplectania sphagnophila* | 18 | | | | | | | | | | | | | |
| *Arrhenia sphagnicola* | 16 | 23 | 23 | 16 | 19 | 2 | 1 | 1 | | | | | | |
| *Gymnopus dryophilus* | 7 | 9 | 4 | 3 | 1 | 1 | 1 | 3 | 3 | 1 | 5 | 6 | 10 | 2 |
| *Lichenomphalia umbellifera* | 14 | | 5 | | 2 | | | | | 4 | 1 | | | |
| *Tephrocybe palustris* | 35 | 418 | 472 | 153 | 54 | 39 | | 5 | 14 | 26 | 37 | 30 | 20 | 5 |
| *Arrhenia onisca* | | | 5 | 2 | 1 | 3 | | | | | | | | |
| *Galerina tibiicystis* | | | 3 | 7 | 24 | 5 | 18 | 12 | 4 | | 1 | 3 | 2 | |
| *Galerina cerina* | | | 1 | | | | 2 | 147 | 47 | 38 | 11 | 43 | 45 | 10 |
| *Galerina paludosa* | | | 2 | | 1 | | 1 | 1 | | | | 2 | 1 | |
| *Galerina sphagnicola* | | | | | 1 | | | 2 | | | 3 | 37 | 49 | 53 |
| *Gymnopilus penetrans* | | | | | | 2 | 1 | 1 | | 1 | 1 | | | |
| *Gymnopus androsaceus* | | | | | 14 | | 32 | 37 | 4 | 14 | 23 | 6 | 17 | 23 |
| *Suillus sibiricus* | | | | | | | 2 | 6 | 7 | 6 | | | | |
| *Thelephora terrestris* | | | | | 1 | | 1 | | 2 | 1 | 1 | 1 | | |
| *Ascocoryne turficola* | | | | | | | | 1 | 2 | 2 | 3 | 4 | 5 | 5 |
| *Cortinarius flexipes* | | | | | | | | 5 | | 3 | 3 | 4 | 2 | 1 |
| *Cortinarius* cf. *flos-paludis* | | | | | | | | 2 | 4 | 18 | 14 | 21 | 19 | 2 |
| *Galerina sphagnorum* | | | | | | | | 4 | 49 | 60 | 28 | 46 | 54 | 14 |
| *Cortinarius semisanguineus* | | | | | | | | 13 | 7 | 24 | 12 | 21 | 13 | 2 |
| *Sphagnomphalia brevibasidiata* | | | | | | | | 6 | 1 | 4 | 2 | 1 | 4 | |
| *Hebeloma incarnatulum* | | | | | | | | 5 | 15 | 15 | 11 | 7 | 6 | 3 |
| *Mycena concolor* | | | | | | | | 10 | 10 | 10 | 1 | 3 | 20 | 4 |
| *Cortinarius* cf. *albovariegatus* | | | | | | | | | | 3 | 8 | 45 | 53 | 20 |
| *Cortinarius huronensis* | | | | | | | | 1 | 13 | 50 | 44 | 72 | 32 | 8 |
| *Cortinarius* cf. *obtusus* | | | | | | | | | 4 | 39 | 94 | 160 | 100 | 25 |

# Thank you for your attention!

***Hypholoma elongatum*** (23.8.12)

: *Hypholoma elongatum*
fruiting
in extremely dry and
wet conditions

***H. elongatum*** (6.9.12)