[Japan-Russia Scientific Forum] Online Workshop
“Japan-Russia Collaboration for Ecosystem Monitoring”

Russian-Japanese collaborative study of ecosystem monitoring in eastern Siberia

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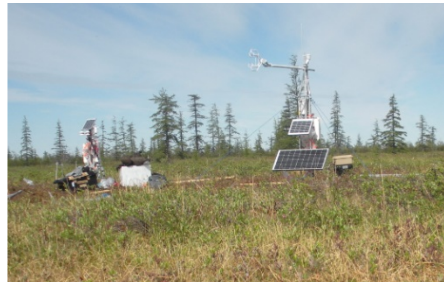
Forest/Tundra observation stations in eastern Siberia

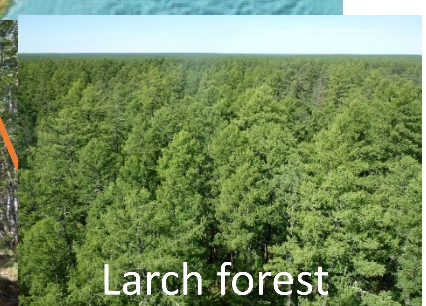
Kodac (70°37′N 147°54′E) 2013- [RU-JP]



Kytalyk (70°49′N 147°29′E) 2003- [RU-EU]

Spasskaya Pad (62°15′N 129°37′E) 1998- [RU-JP-EU]

	Forest	Tundra
Annual mean temp. (°C)	-8.3	-13.1
JJA mean temp. (°C)	17.5	8.3
Annual prec. (mm y^{-1})	236	207
JJA prec. (mm)	109	77
Canopy height (m)	20	—



Elgeeii (60°01′N 133°49′E) 2009- [RU-JP]

Forest hydrometeorology observation system

Ecosystem flux (32m)

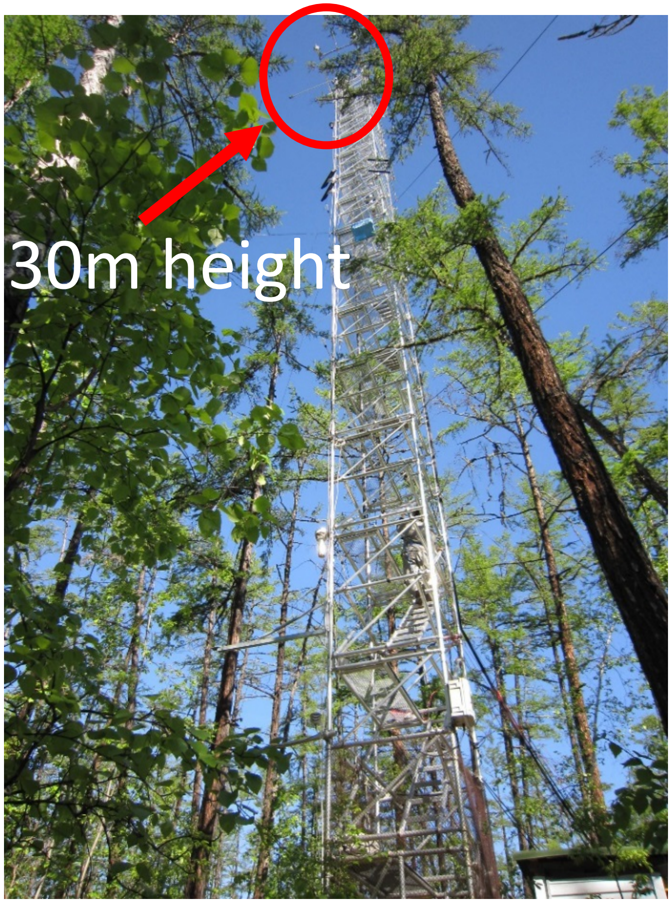
Understory flux (3m)

Tree transpiration (sap flow)

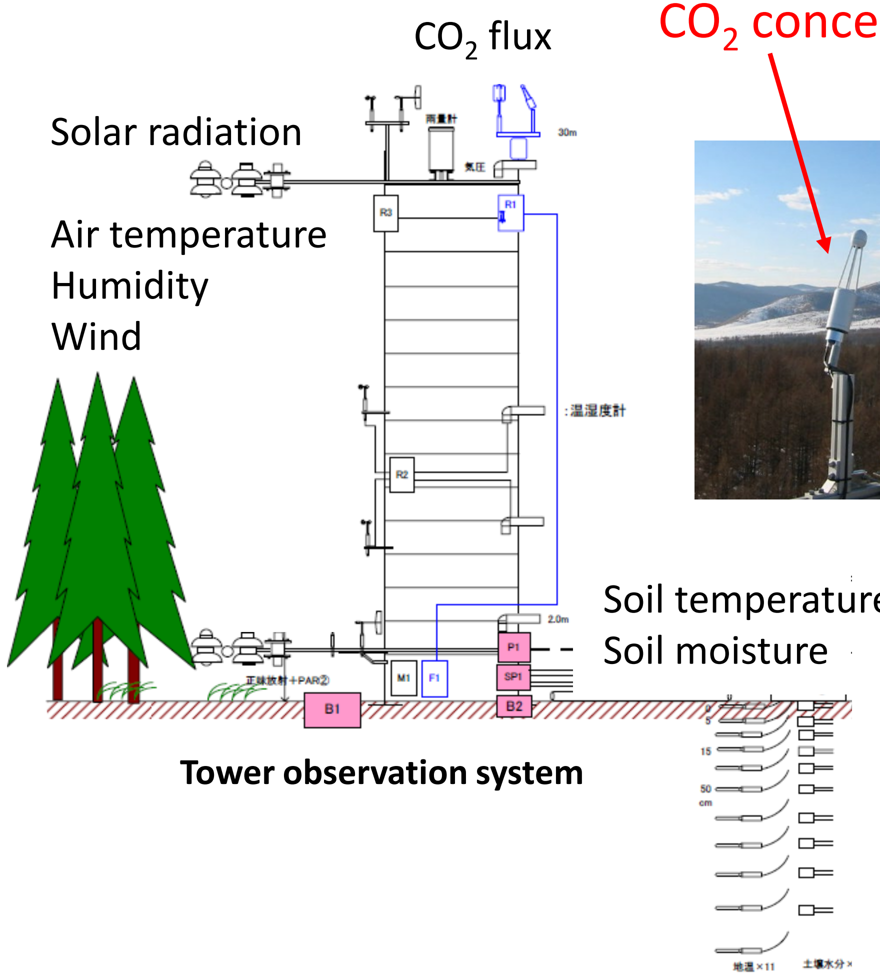
Leaf measurement

Biomass measurements

Monitoring of ecosystem scale fluxes



Observation tower



Tower observation system

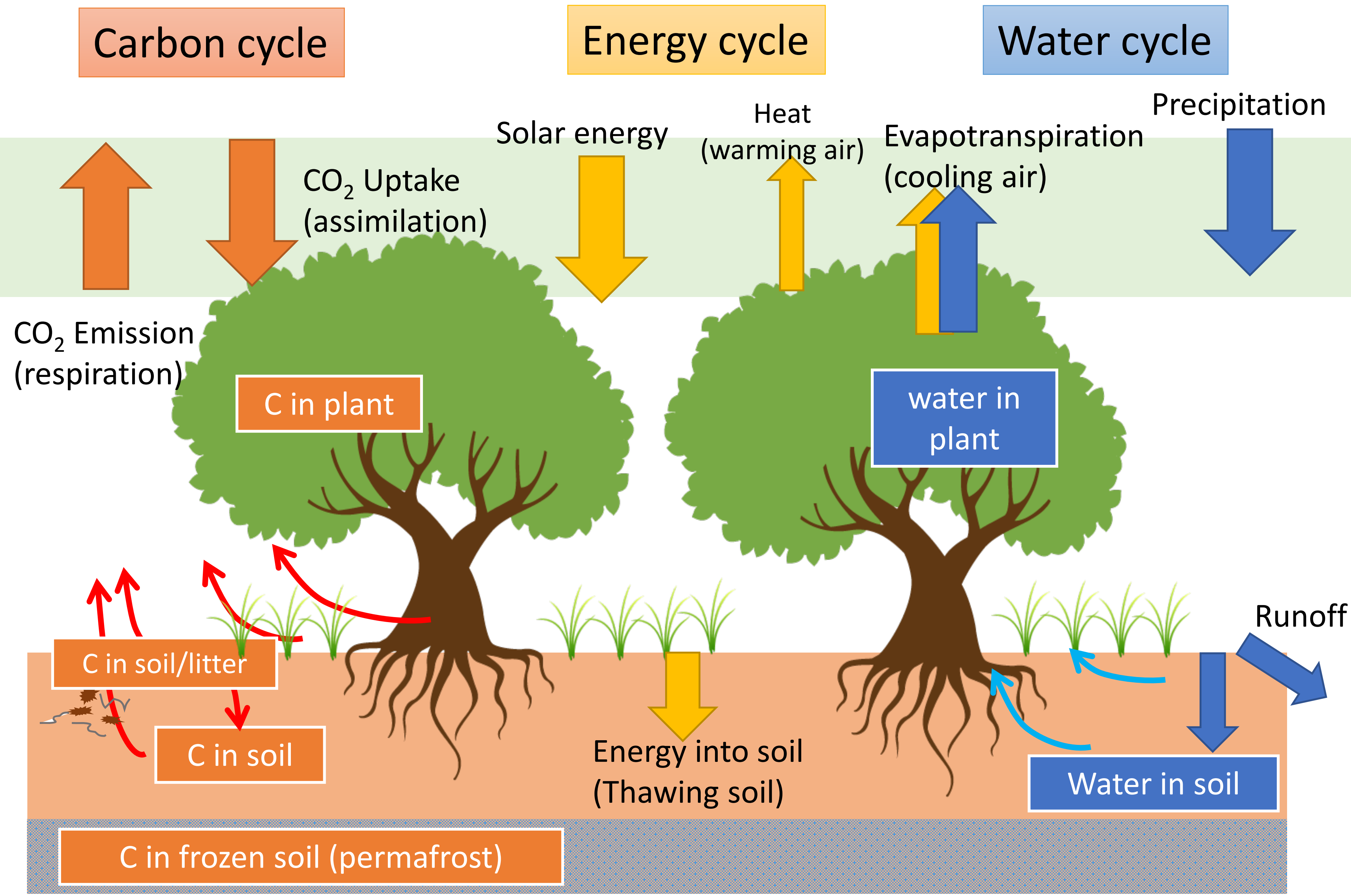
CO$_2$ concentration

wind speed

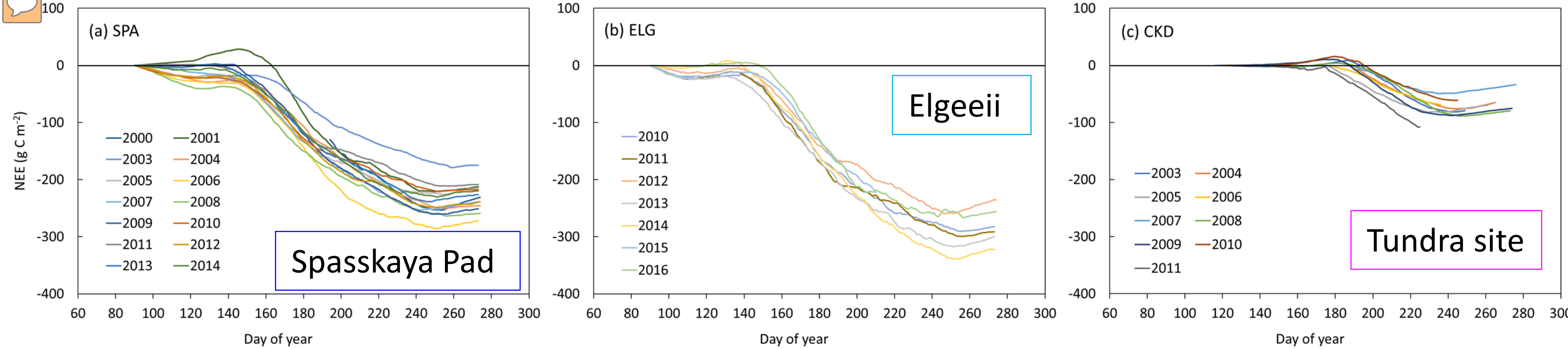
Eddy covariance method

Measuring CO_2 concentration and vertical wind speed
to calculate CO_2 exchange between forest and atmosphere

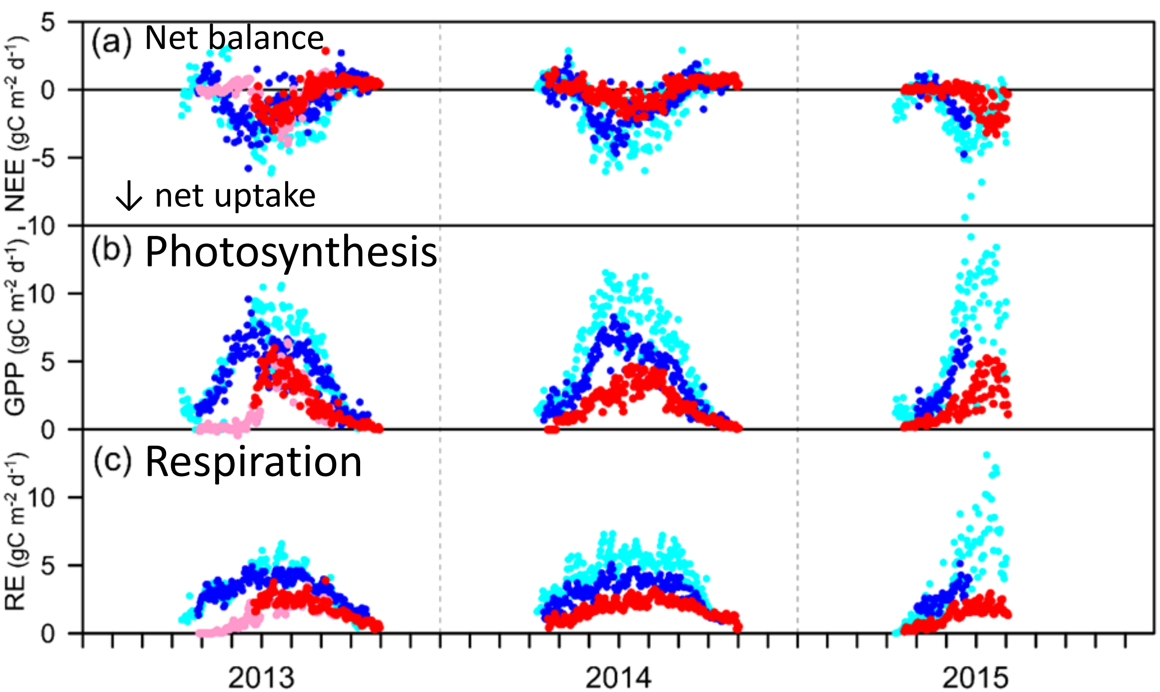
Applicable to other GHG (H_2O, CH_4) and heat flux.

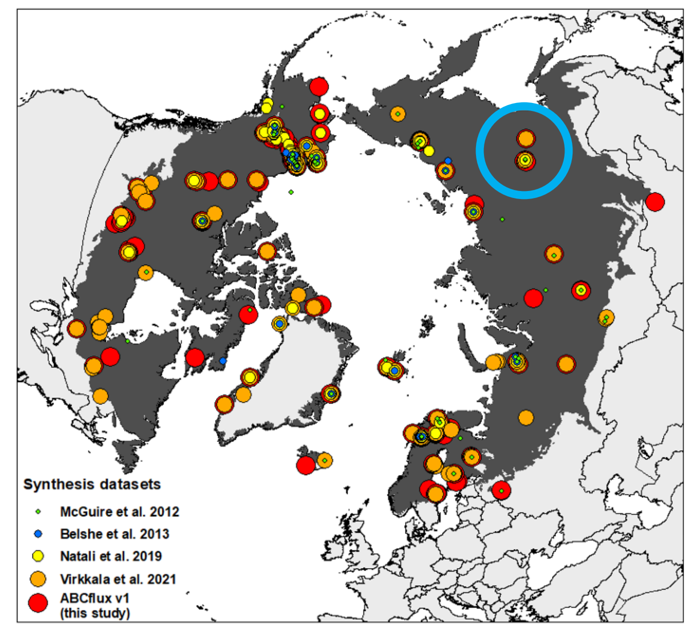


Carbon cycle
Energy cycle
Water cycle
CO2 Uptake
(assimilation)
CO2 Emission
(respiration)
Solar energy
Heat
(warming air)
Evapotranspiration
(cooling air)
Precipitation
C in plant
water in plant
C in soil/litter
C in soil
Energy into soil
(Thawing soil)
Runoff
Water in soil
C in frozen soil (permafrost)



Cumulative carbon accumulation in eastern Siberia (Maximov et al. 2019)

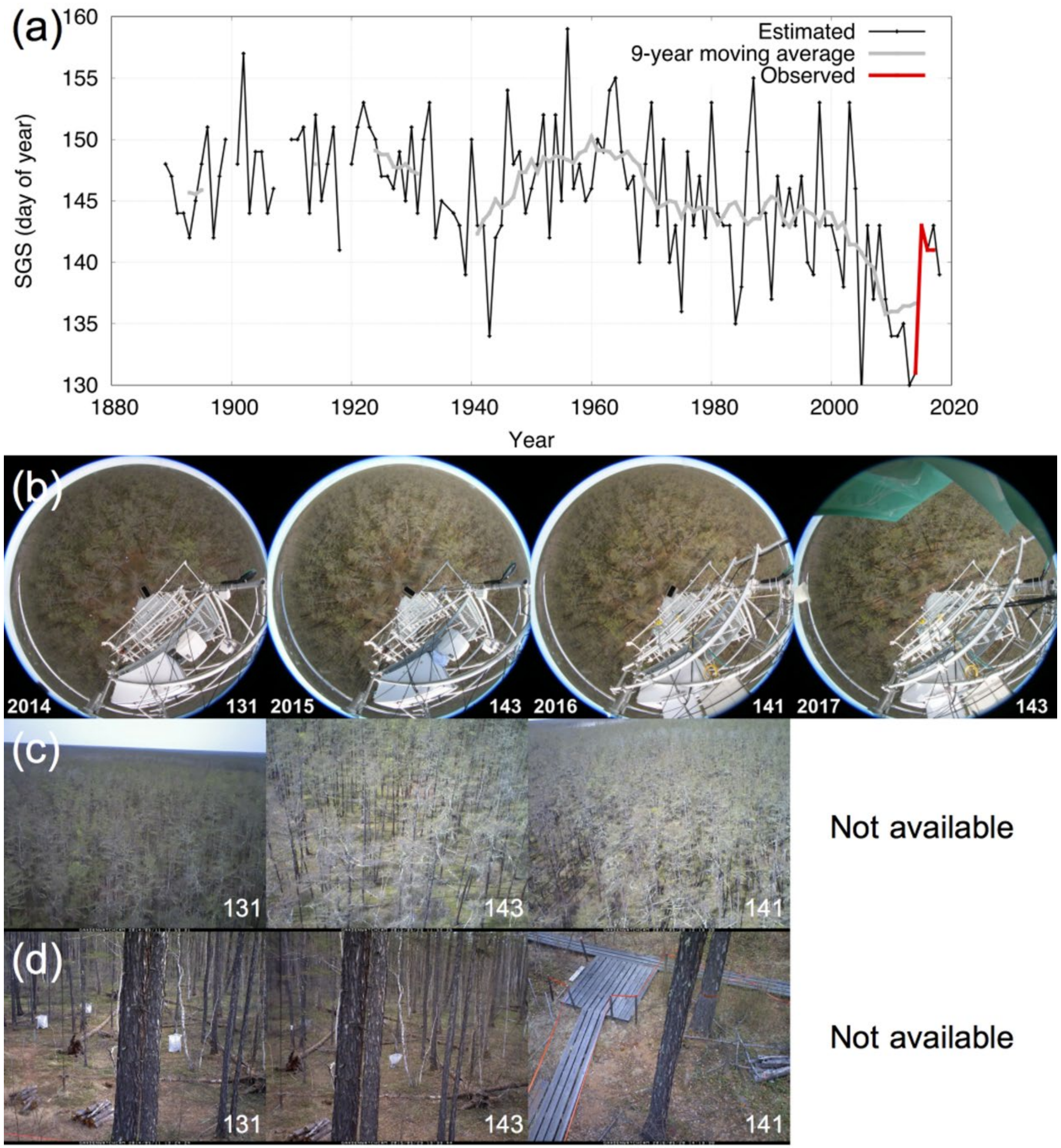


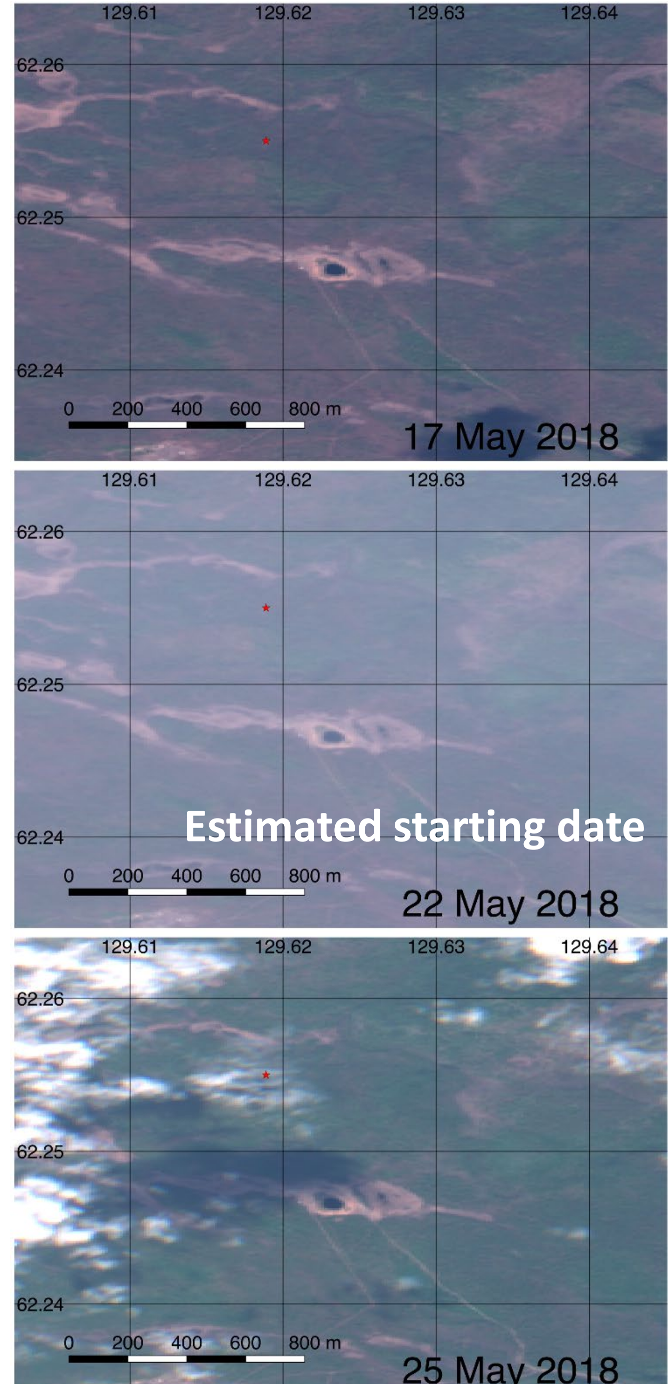


Seasonal variation of CO_2 fluxes in eastern Siberia
(Tei et al. 2020, Polar Science)

● Forest (SPA) ● Forest (ELG) ● Tundra (CHK) ● Boundary (KOD)

Arctic-Boreal CO_2 Flux database
(Virkkal et al 2021.,)





Modeling start/end date of plant growing season based on phenological images and true color SENTINEL-2 satellite images at Spasskaya Pad (Nagai et al 2020, Polar Science)

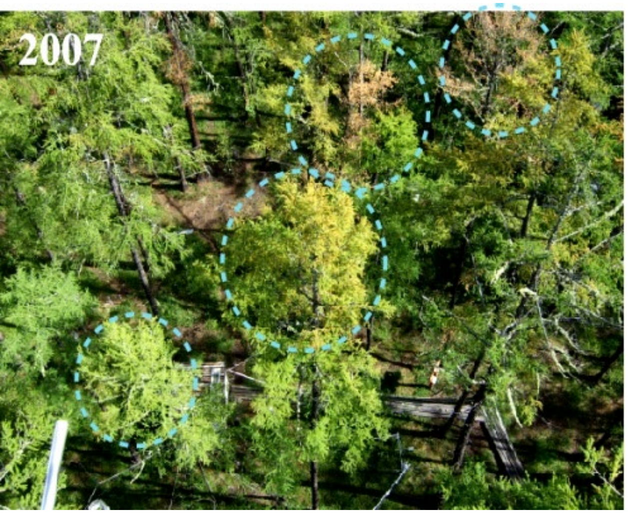
Too much water affects ecosystem

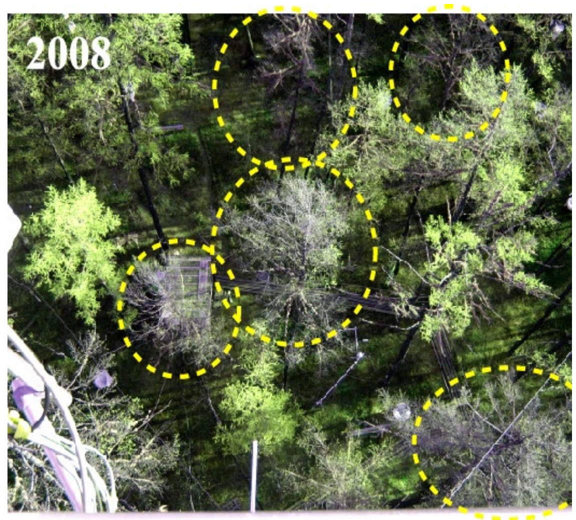
Sparse larch forest in taiga-tundra boundary area (Chokurdakh)
Extreme flooding in summer of 2017 (due to anomalous snow runoff) Tei et al (2020)

Mature larch forest in middle of taiga region (Yakutsk)
Extreme wetting of active layer in 2005-07 due to perennial wet years

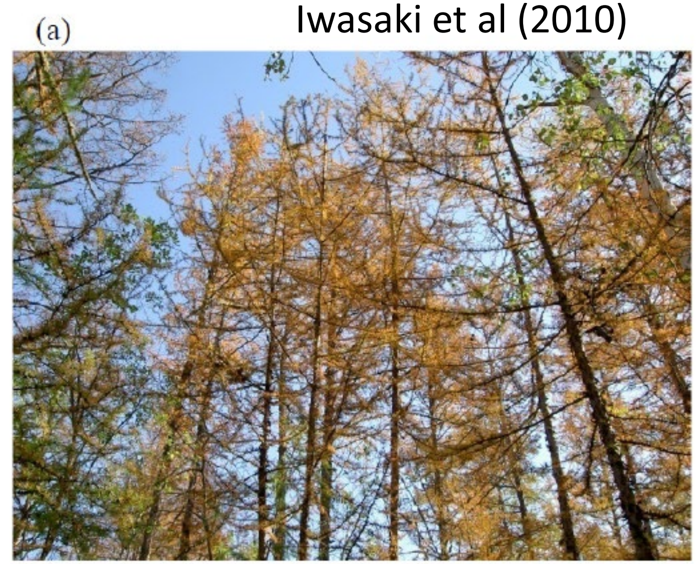
Larch dieback due to soil saturation

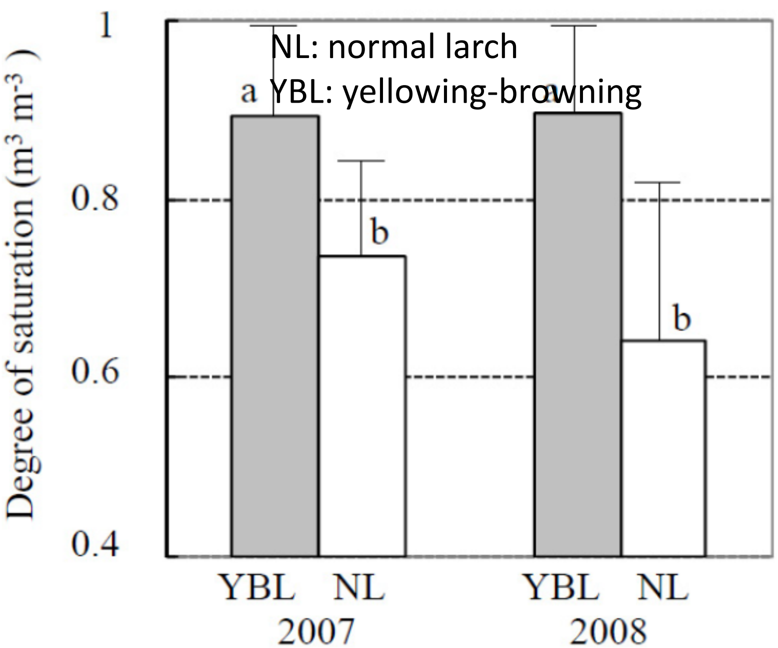
Iijima et al (2014)





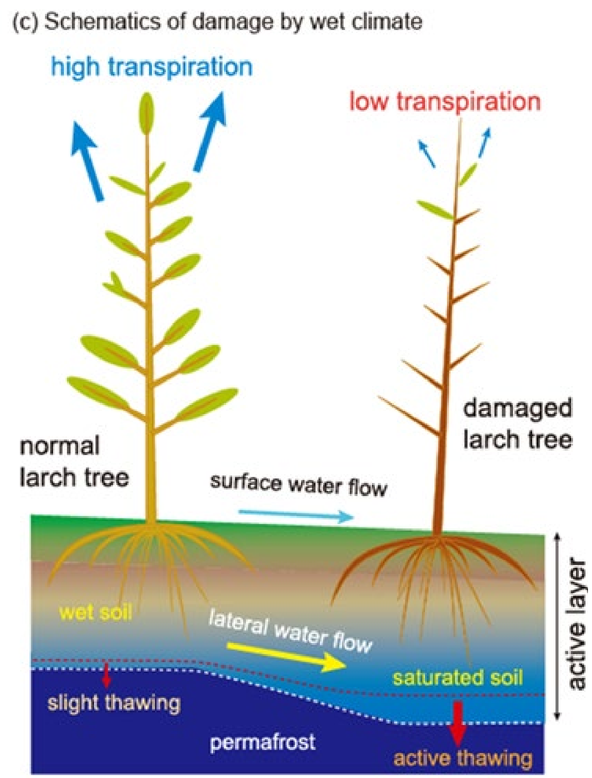
Iwasaki et al (2010)





Larch trees on saturation soil suffered.

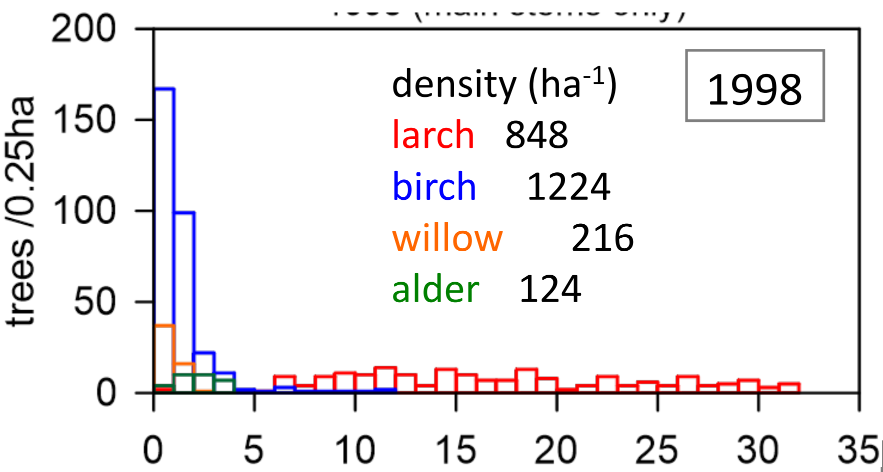
Iwasaki et al (2010)

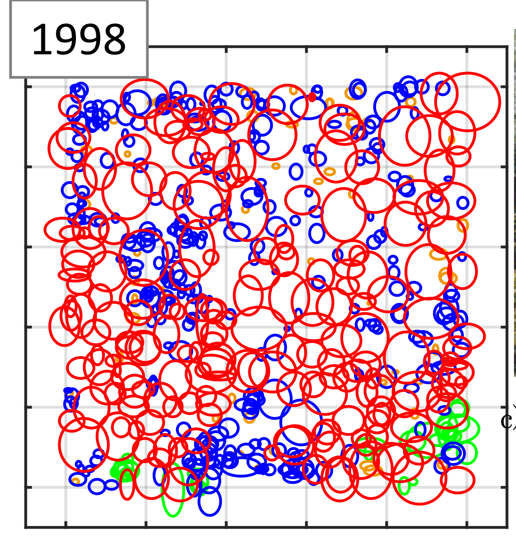


Mature larch trees suffered by saturated water due to deeper seasonal thawing.

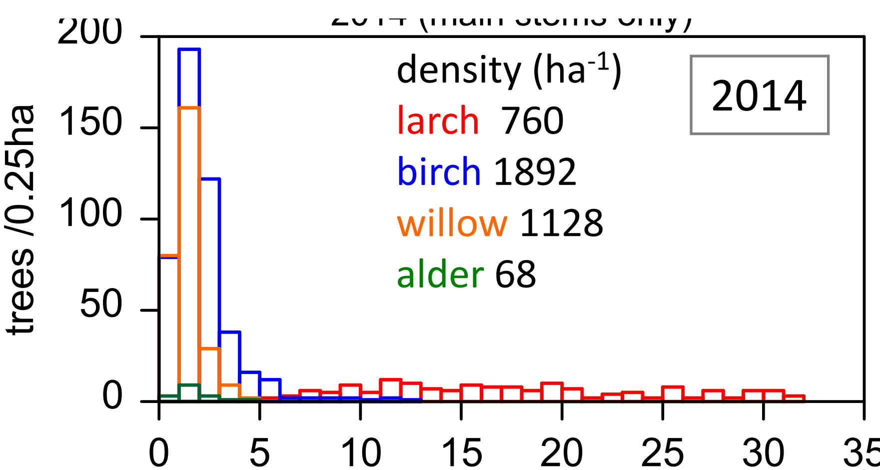
(Iijima and Fedrov 2019)

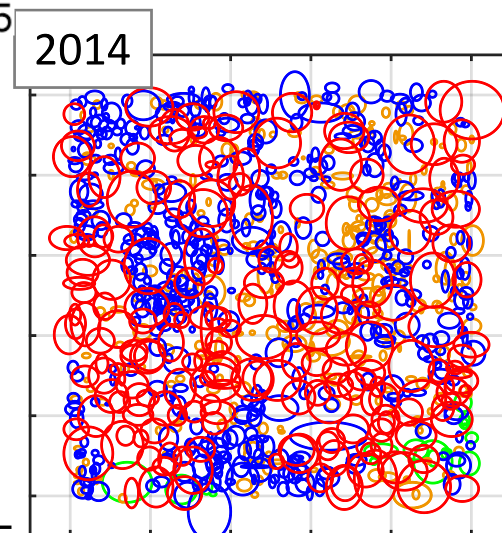
Vegetation changes



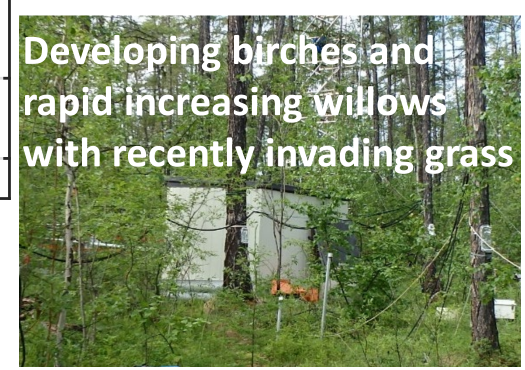


c) in August, 1997





d) in June, 2009



in July, 2014

Tree height distribution, crown spatial distribution in 50x50m plot.

- Small changes of mature larch trees
- Increase and growth of birch and willow trees of mid-under storley.

Kotani et al (2019)

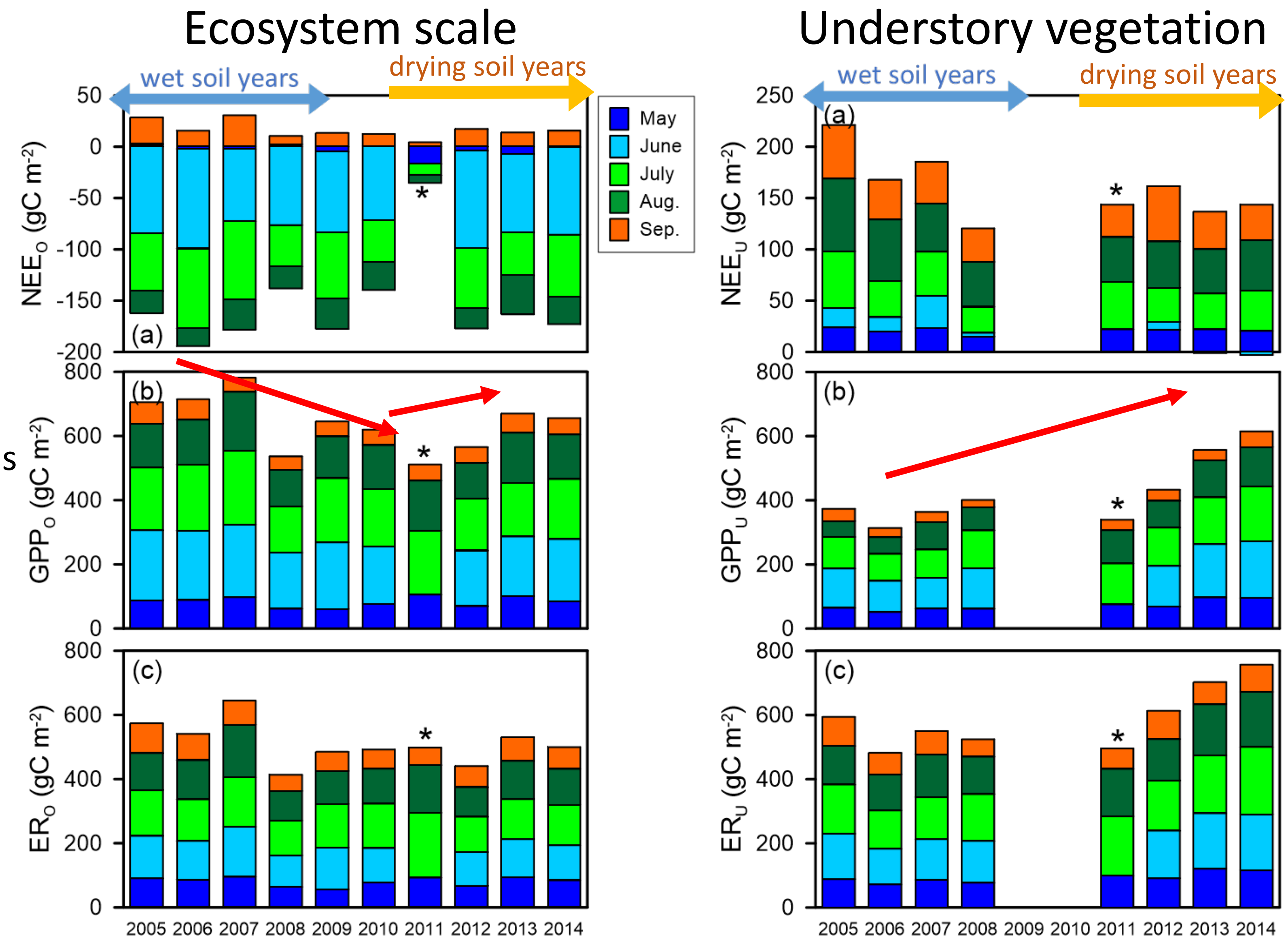
CO_2 exchange changes

**observation at June 2011 was unavailable*

Net CO_2 exchange (negative = uptake)

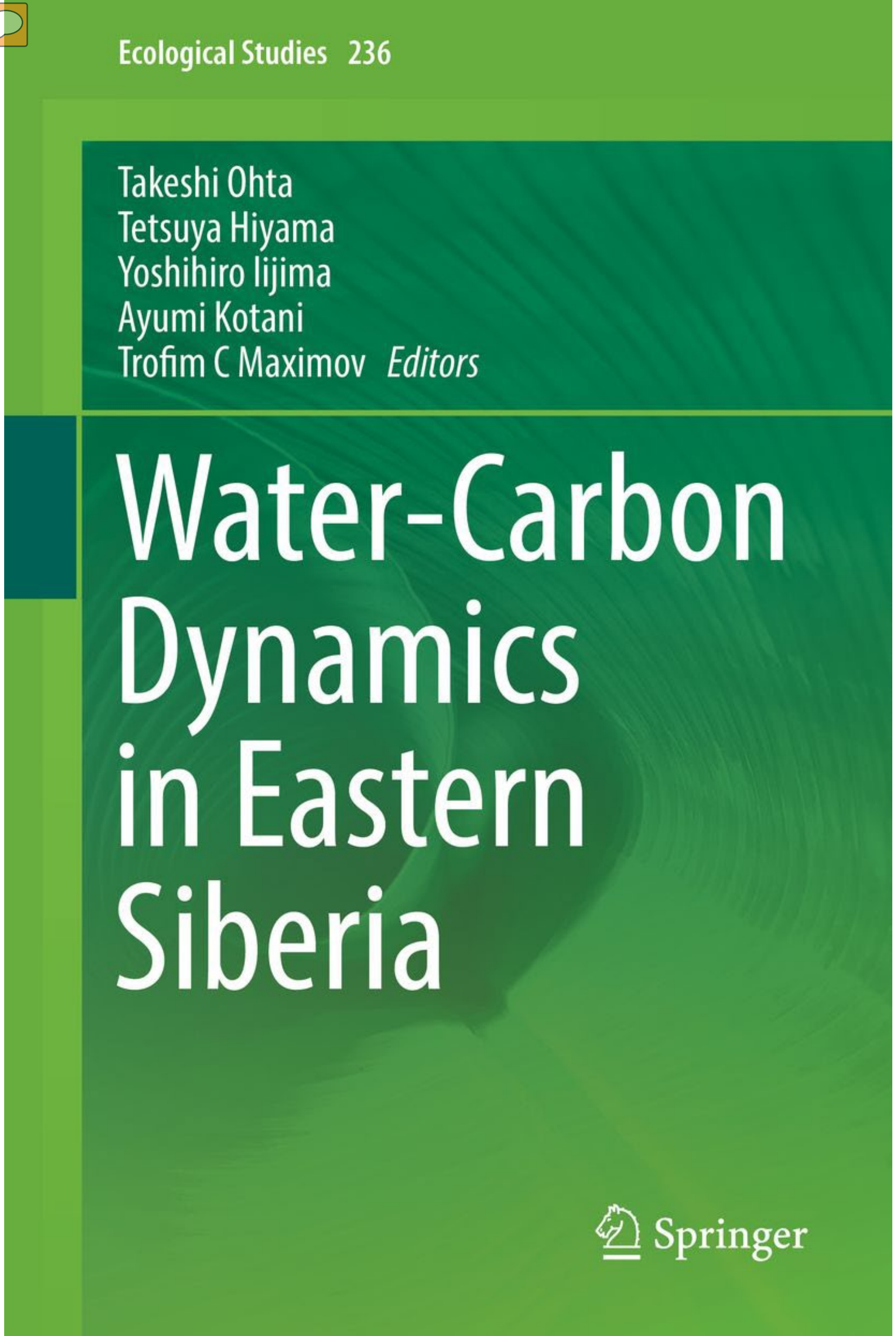
Photosynthesis (assimilation)

Respiration (emission)



Warm season CO_2 fluxes of ecosystem scale and understory vegetation

The decline in the larch contribution can be compensated for by understory growth, resulting in a relatively stable ecosystem-scale exchange rate during this study period.



- Processes of ecohydrology, permafrost hydrology, meteorology, and climatology in the context of water, energy, and carbon exchanges in the Arctic circumpolar region of eastern Siberia
- Unique water and carbon cycle system in the permafrost region in eastern Siberia
- Water-carbon dynamics influenced by the changing permafrost environment in recent decades

At present

Sep. 2019 new tower constructed by colleagues of IBPC

2020 new tower at Spasskaya Pad

New devices waiting for shipping at Nagoya (hope starting soon!)