

EGU26-6932, EGU General Assembly 2026
HS10.3 -Peatland hydrology: Groundwater and surface water
from tropical to subarctic latitudes
Room 3.29/30 on Friday, 8 May 2026, 11:45

Tree-ring analysis on the alder tree growth in a river meandering restoration site of the Kushiro Mire, Hokkaido, Japan



Hitoshi MIYAMOTO

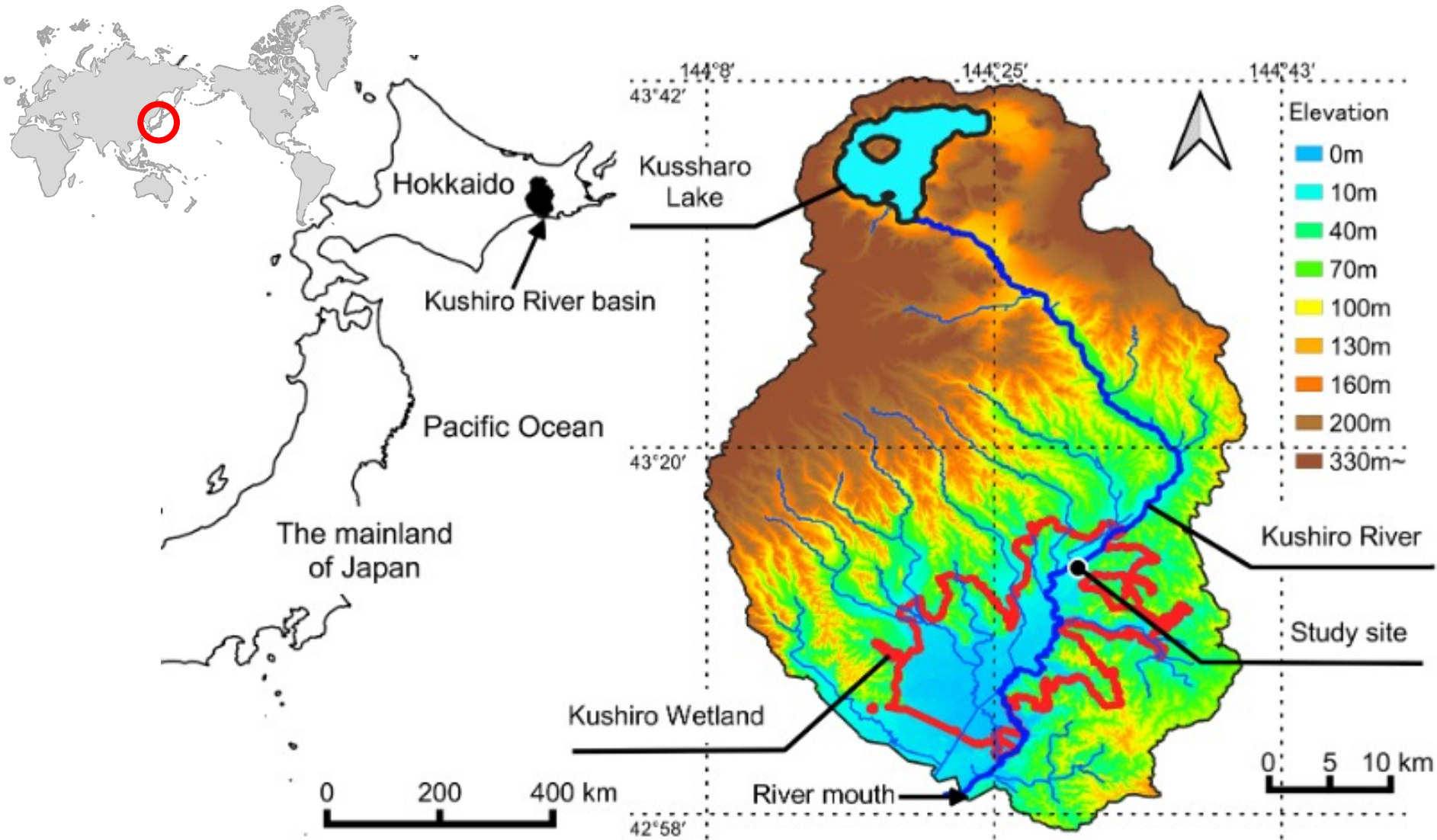
Yudai NEMOTO

Shibaura Institute of Technology, Japan



Tetsuya Oishi
Civil Engineering Research Institute
for Cold Region, Japan

Kushiro Wetland, Hokkaido, Japan



The Locations of the Kushiro River basin, Kushiro Mire, and the study site area.

Kushiro Wetland – history & biodiversity

✓ Formation & Designations

3000–4000 years ago: Present wetland (mire) formed.

1980: Registered as Japan's first **Ramsar Convention** site.

✓ The Crisis (20th Century)

Over 60 years, **the wetland area shrank by 30%** due to **river straightening and agricultural development**.

Resulted in drying out and loss of biodiversity.

✓ **Nature Restoration** (21st Century)

2003: Kushiro Wetland Nature Restoration Council.

2007–2011: River Meander Restoration.

Ongoing: Sediment control and forest management.

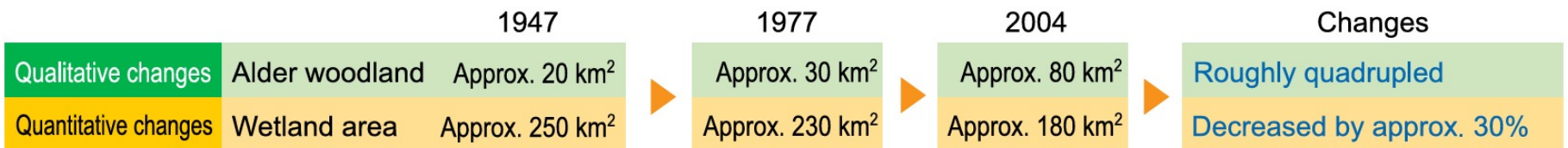
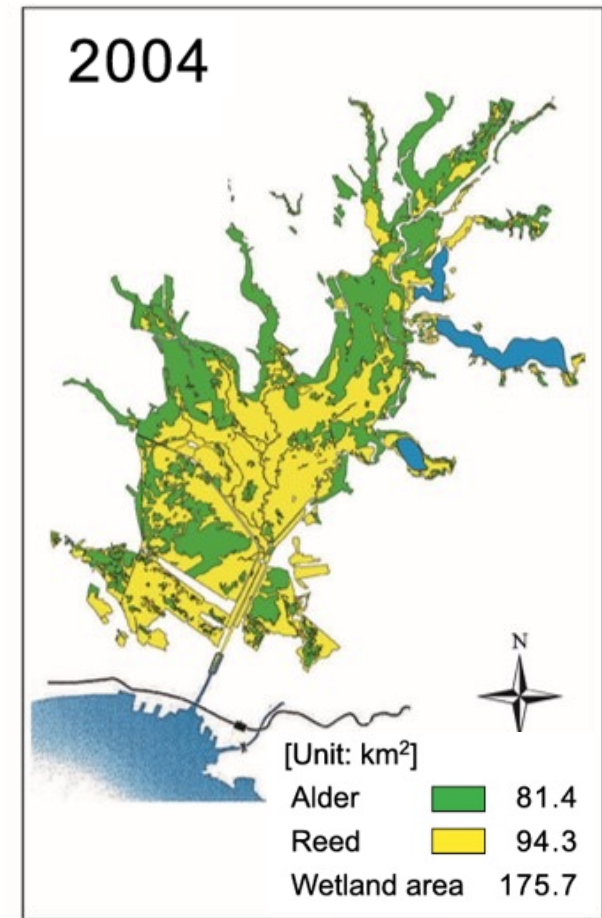
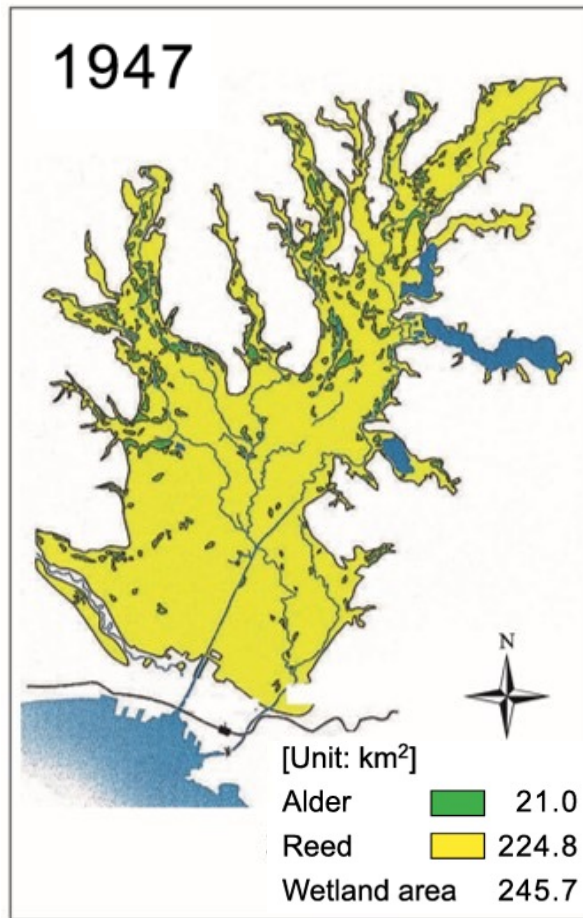
✓ Symbolic Fauna (Animals)

Red-crowned Crane, Siberian Salamander, Japanese Huchen.

✓ Representative Flora (Plants)

Sedge tussock, Reed, Sedge, **Alder**, Kushiro-hanashinobu

Changes in wetland vegetation

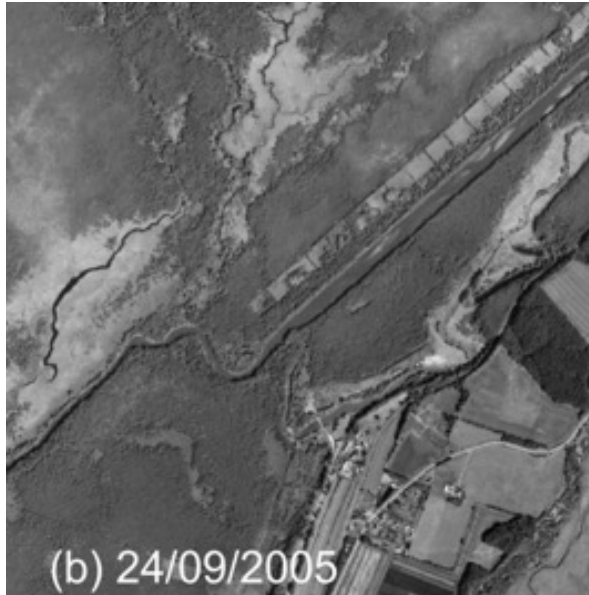


Nature restoration: river re-meandering

Social development in the river basin significantly impacts natural environments and landscapes.



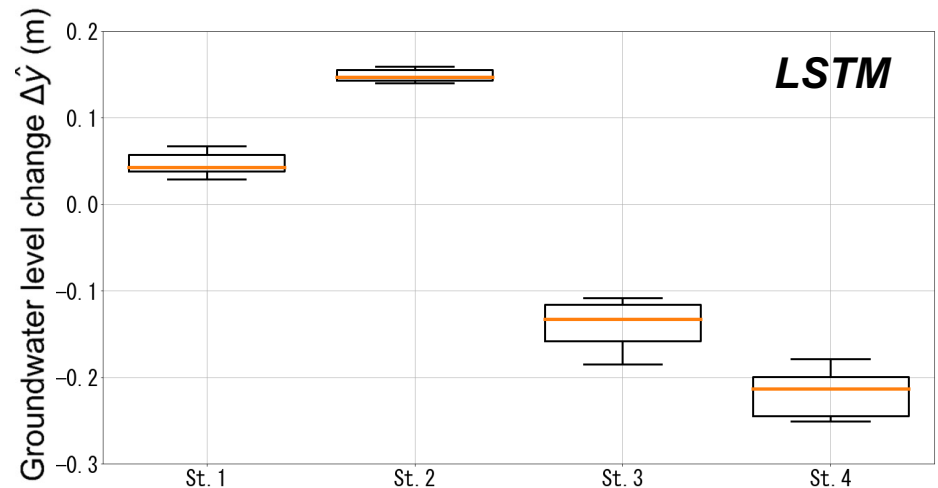
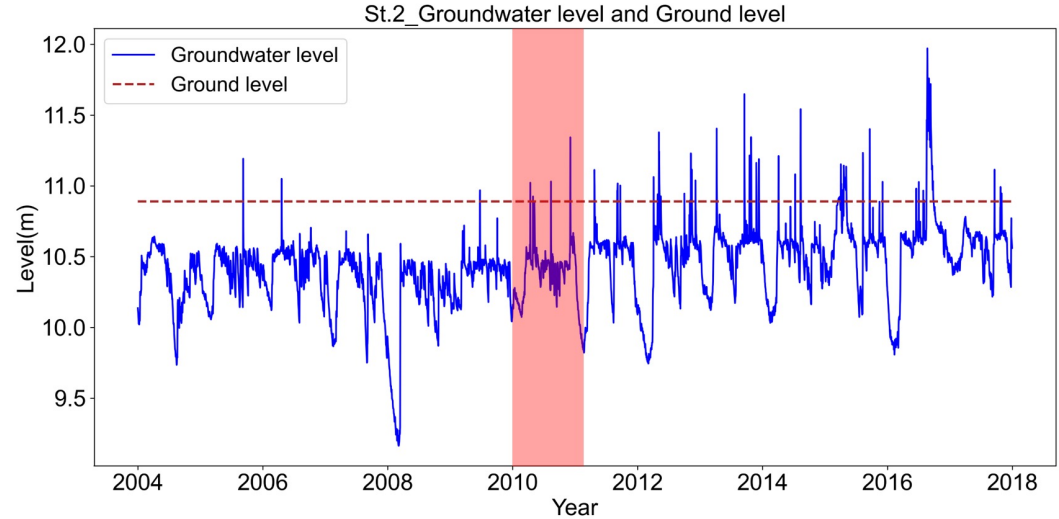
Nature restoration has been implemented to balance *social development* and nature conservation.



Historical changes in the study site of *Kushiro Wetland* from aerial images

Study site: groundwater level changes

✓ *Groundwater level recovery*



(Yamaguchi et al. *Water*, 2023)

Original
state



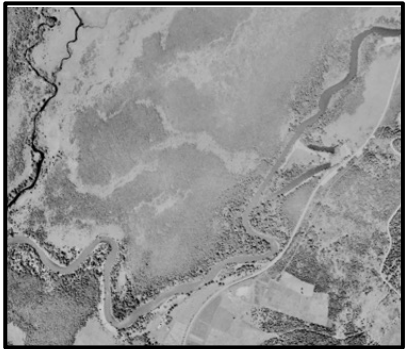
1980s
Straightening



2010s
Nature
restoration



Current state



1948



1977



2013

Study site: UAV snapshot in 2018

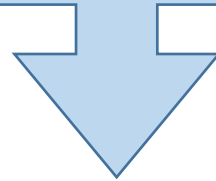


(UAV Snapshot/Hitoshi Miyamoto, July 12, 2018)

Research objectives: alder tree growth

- ✓ Does the nature restoration really *suppress alder tree expansion*?

- ✓ This research collected *tree-ring core samples* from alder trees growing around the restored river meander area.



- ✓ To measure *tree age* from the number of tree rings and *growth rate* from the annual ring width.
- ✓ To assess *the hydrological effects of river restoration on alder growth*.

Field survey

- ✓ *Eight alder tree-ring survey sites with* tree-ring conditions were expected to differ.
- ✓ At each site, *5-6 trees with* a typical growth condition.

✓ Survey items

• Alder Tree:

● Increment core

- Tree height
- Diameter at breast height
- Number of stems

• Soil:

- *Water content ratio*
- *Organic matter content*
- *Soil pH*

• Topography:

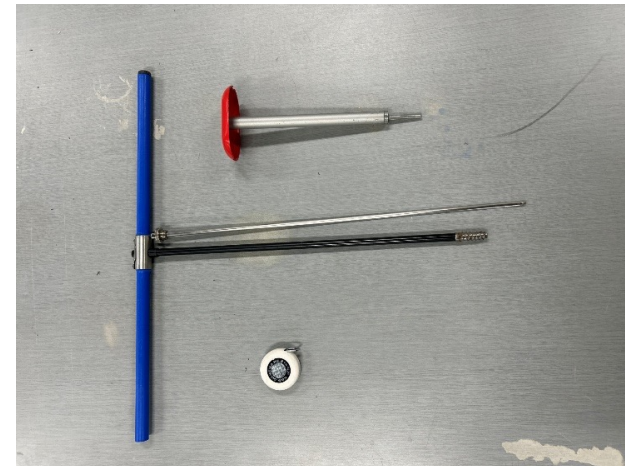
- *Geographic position*
- *Water depth*
- *Sedge tussock height*



(41 points in total: Date : Oct.31-Nov. 2, 2023)

Tree-ring survey

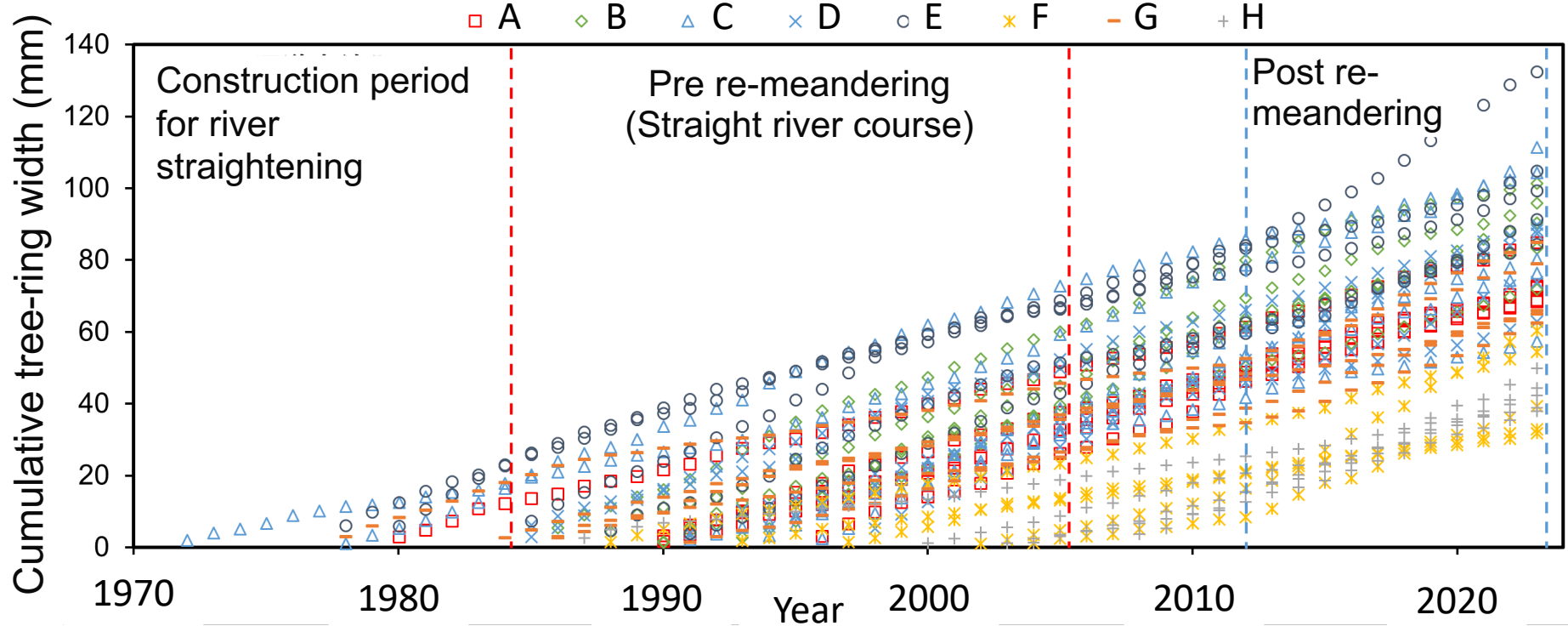
- ✓ Sampling *tree-ring cores* using an increment borer
 - Increment cores at breast height (about 1.3 m)



Increment Borer (Haglöf Sweden AB)



Tree ring analysis: age and growth curve



The growth curves of all alder trees in the eight survey sites.

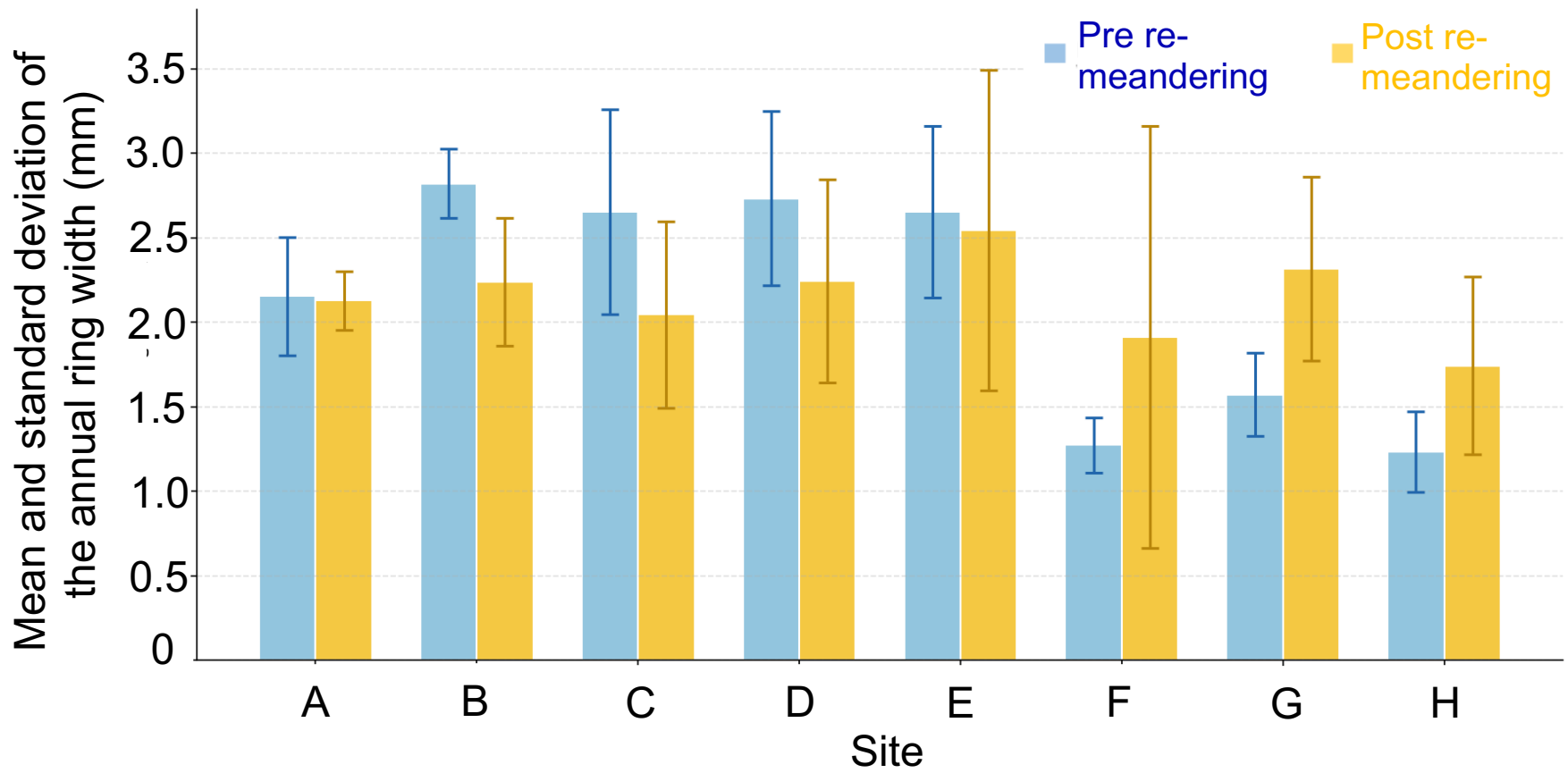
✓ Means and standard deviations of the alder tree age in the eight survey sites.

| | A | B | C | D | E | F | G | H |
|------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Age | 34.8 ± 5.2 | 34.6 ± 2.3 | 37.8 ± 9.5 | 34.4 ± 3.9 | 38.2 ± 4.8 | 27.2 ± 5.8 | 40.0 ± 4.9 | 23.6 ± 7.2 |

Tree ring analysis: growth rate

✓ Comparison of the growth rates between pre- and post- river restoration

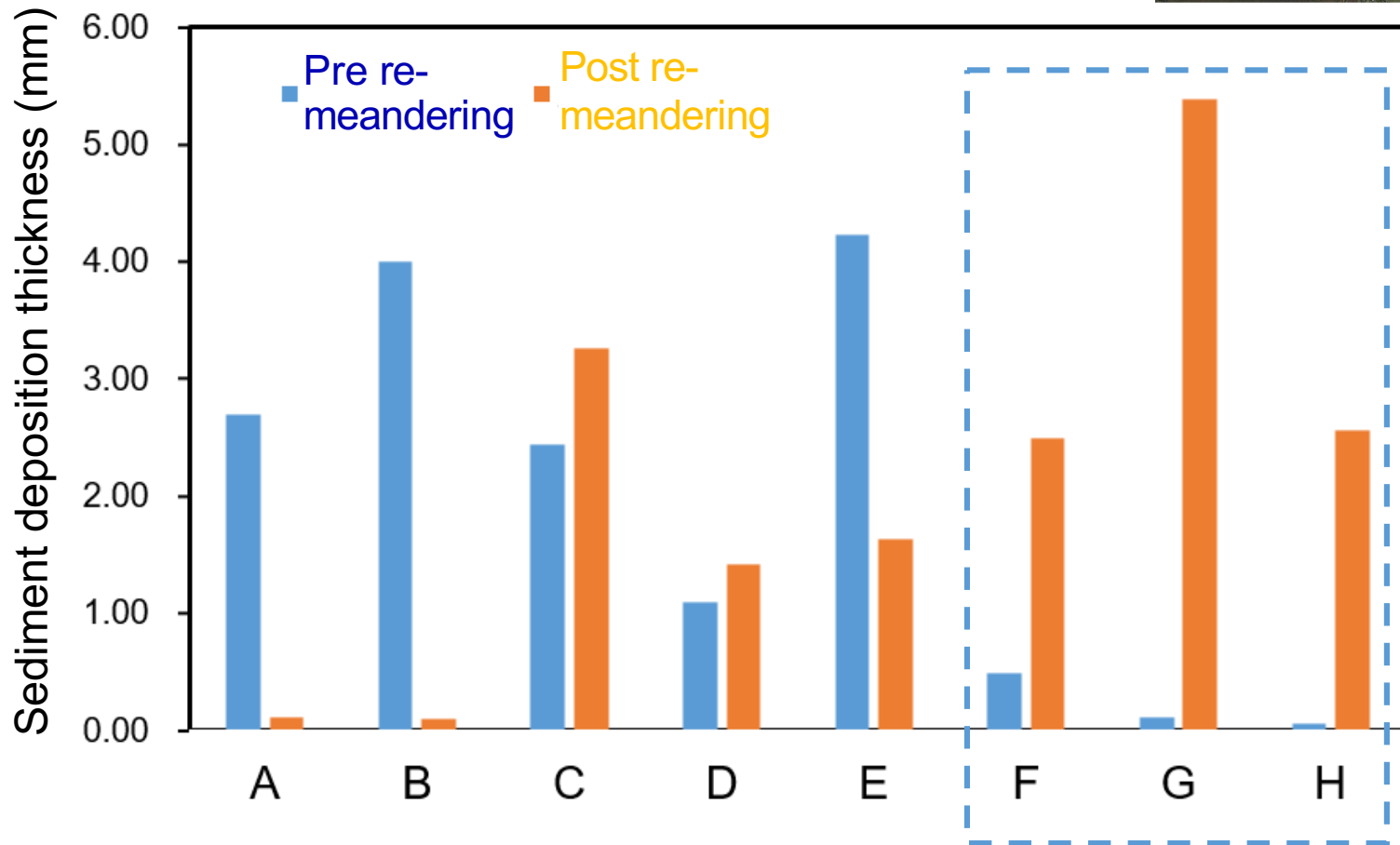
- Pre re-meandering: 1984-2005
- Post re-meandering: 2011-2023



Flood simulation: sediment deposition

- ✓ Changes in *sediment deposition thickness* before and after meandering restoration.

Study on quantifying the reduction of sediment load into the Kushiro Wetland via Meander Restoration (Ishida et al., 2018)



Take home message

- ✓ This study examined the effects of river restoration on alder growth in Kushiro Mire, Hokkaido, Japan.
- ✓ Downstream of the restored meandering river channel, *tree-ring growth decreased* following restoration compared with pre-restoration conditions.
- ✓ Near the former straight river channel *upstream, tree-ring growth increased* following restoration.
- ✓ Flood simulations before and after restoration indicated that *flood-induced sediments into the wetland could alter water content & nutrient distribution*, contributing to alder growth.
- ✓ Future studies will examine the effects of factors such as *water content ratio, water levels, and peat/soil characteristics*.

Thank you

科研費
KAKENHI

 **SIT** SHIBAURA
INSTITUTE OF
TECHNOLOGY

Acknowledgments: JSPS KAKENHI (JP25K07941)
Kushiro Development and Construction Department
Hokkaido Regional Development Bureau
Ministry of Land, Infrastructure, Transport, and Tourism, Japan

 **CERI**
COLD REGION