

Understanding hydrological and ecological controls on methane flux in Lake Erie estuarine mineral-soil marsh



Gil Bohrer¹

**Yang Ju¹, Justine Missik¹, Jorge Villa²,
Ethan Kubatko¹, Kelly Wrighton³**

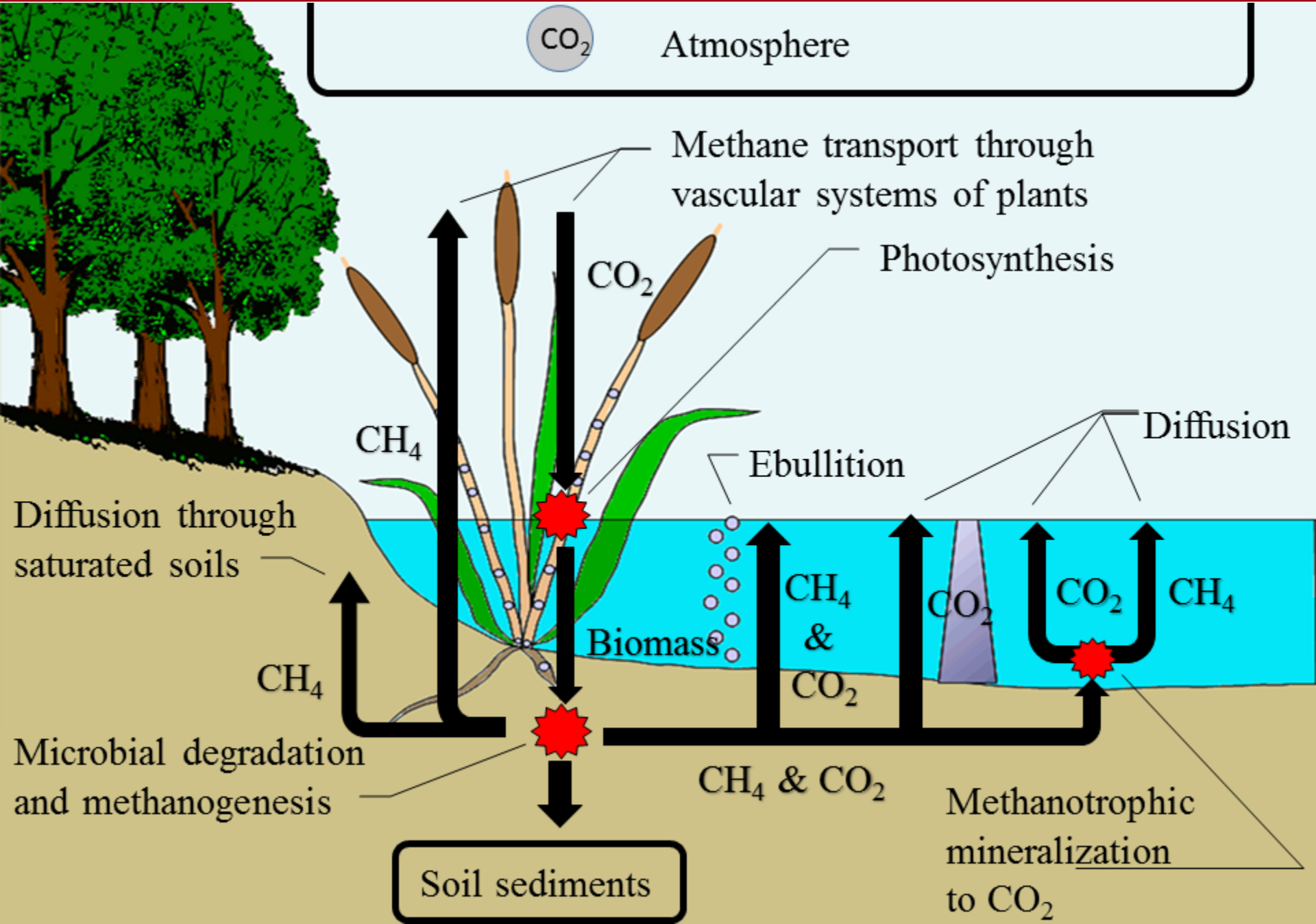
¹The Ohio State University, Civil Environmental & Geodetic Engineering

²University of Louisiana at Lafayette

³Colorado State University



Pathways of methane emission

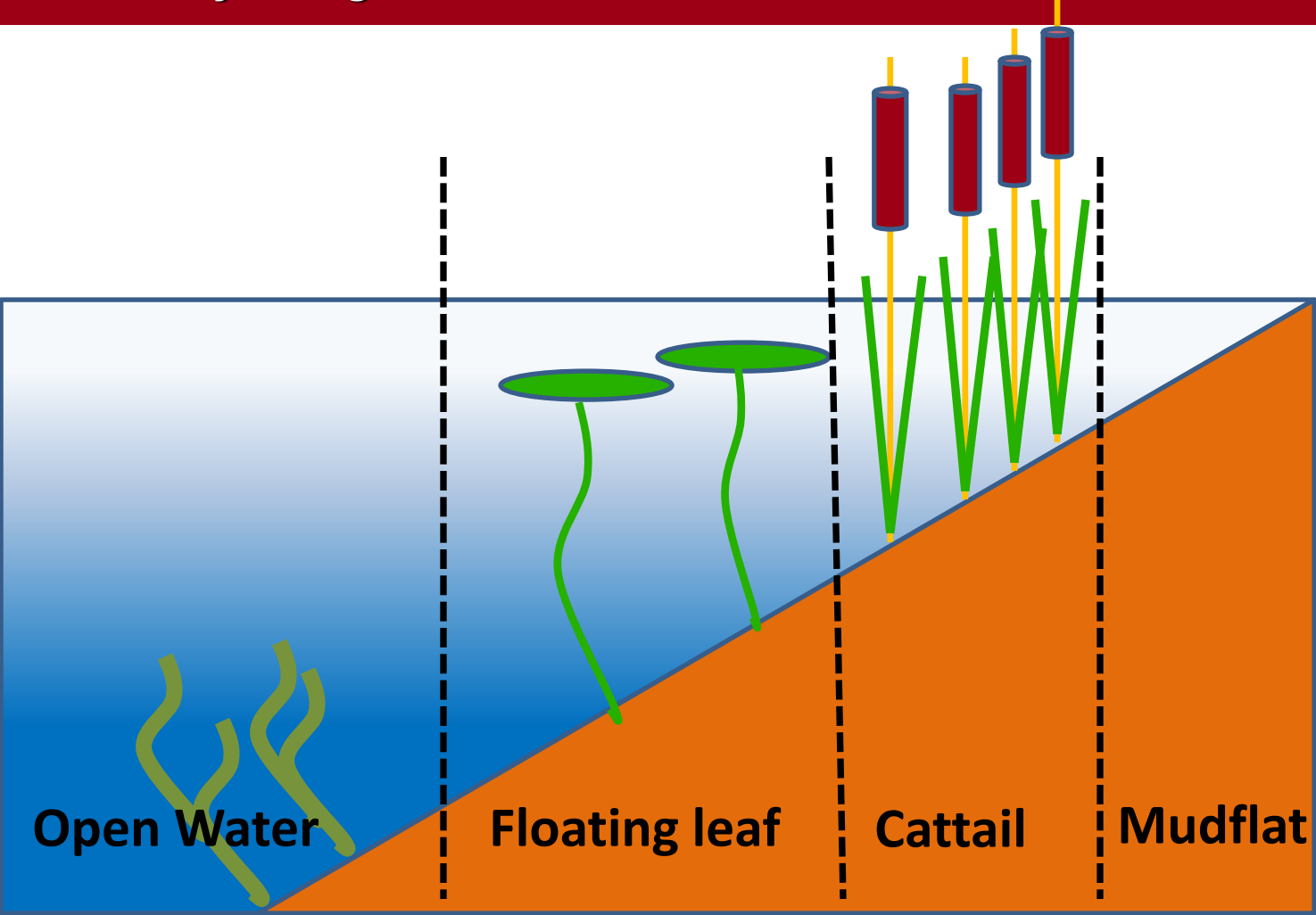




Patch-level heterogeneity – Distinct ecohydrological patch types



Patch-level ecohydrological structure



Depth

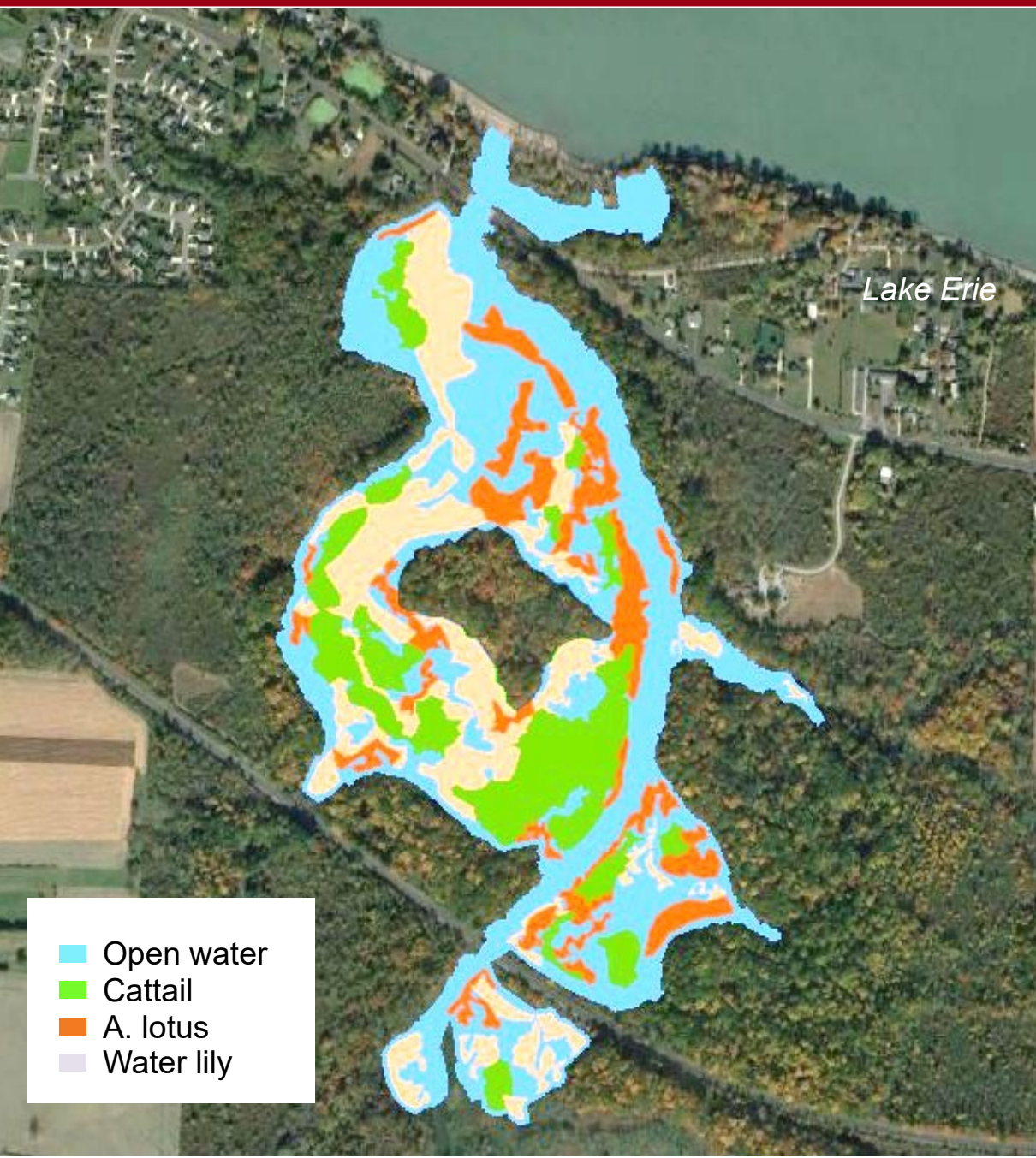


Oxygen



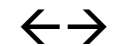
Temperature variation

Research site – Old Woman Creek (OWC) NERR

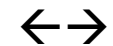


Wetlands are highly heterogeneous

Ecosystem Structure



Hydrology



Carbon functions

Multi-scale observations



Soil Cores

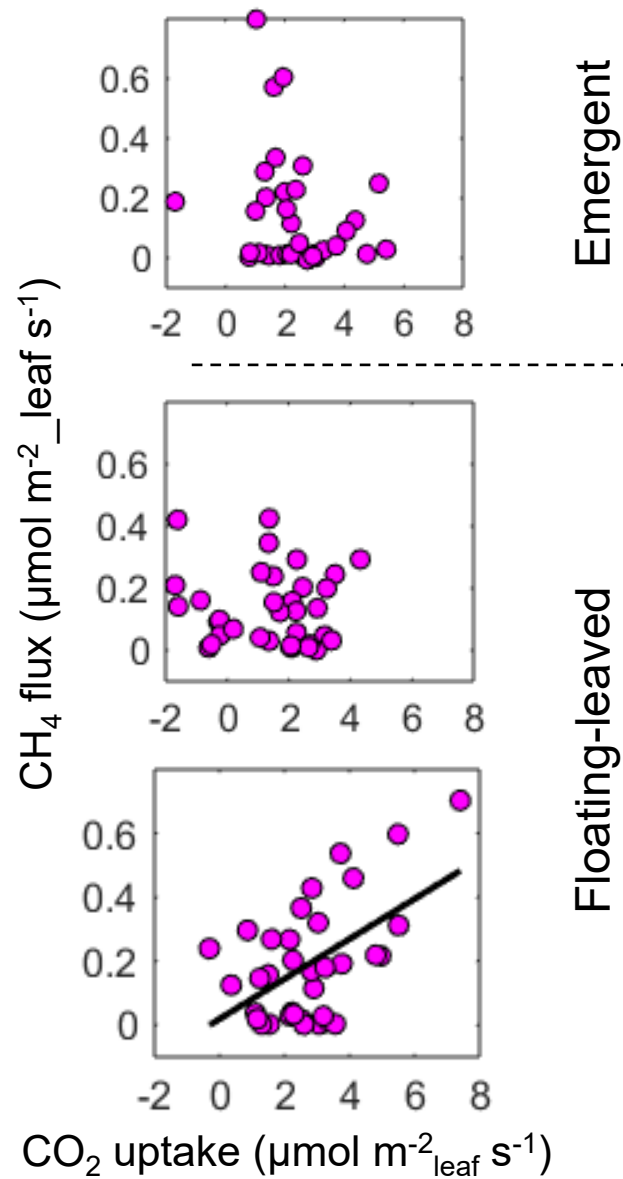
Peepers



1 - 60 cm
Weeks - Months

Angle et al. 2017. *Nat. Comm.*
Rey Sanchez et al., 2018. *Ecol. Eng.*

Species-specific stomata control of CH₄ flow through plants

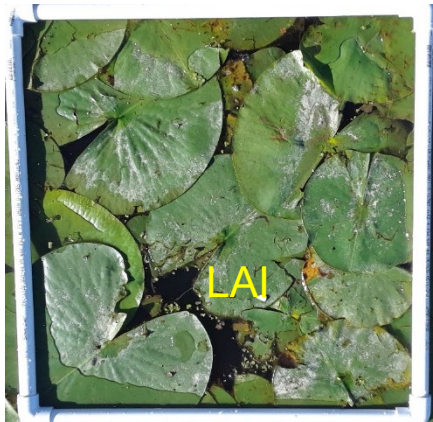


Villa *et al.*, (2020). *Limno. & Oceano*.

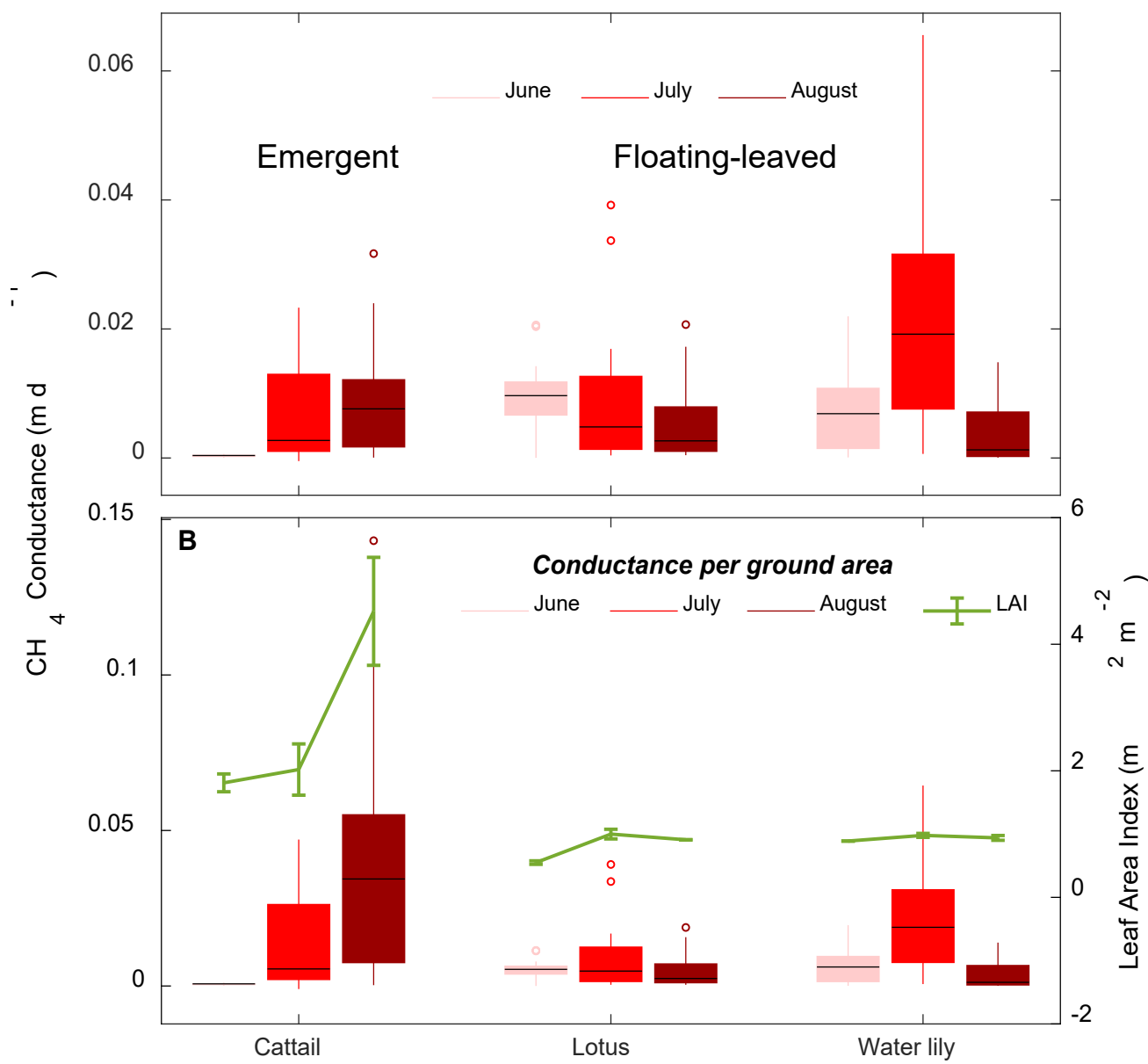
Conductance to CH₄ transport shows intra-seasonal patterns, in some species



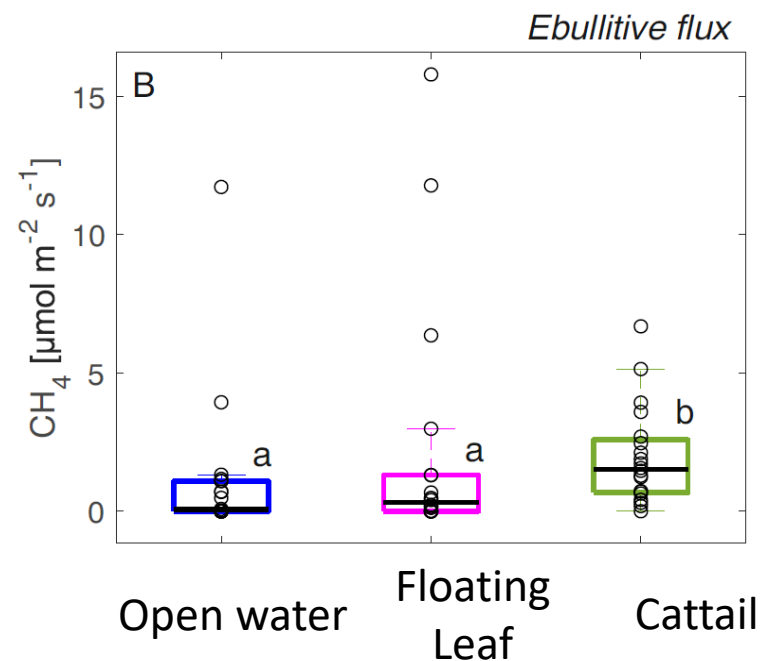
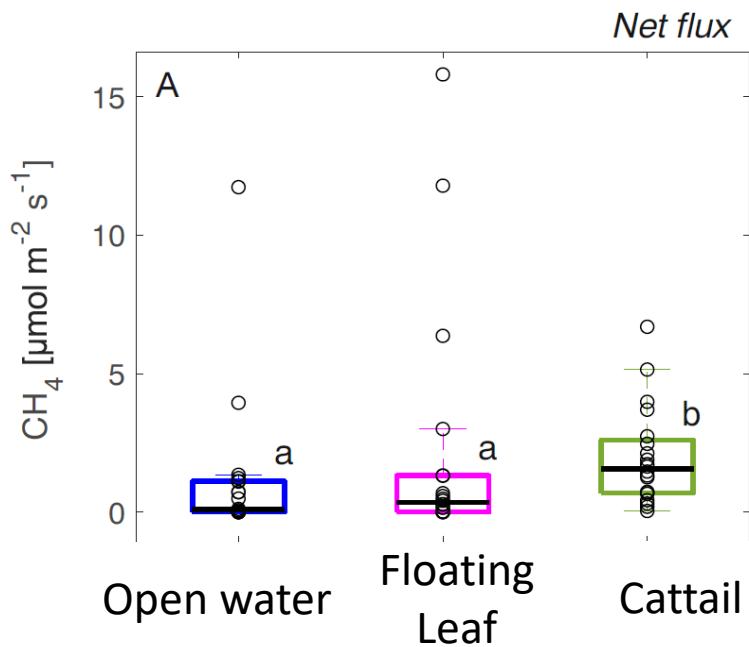
Emergent – Cattail



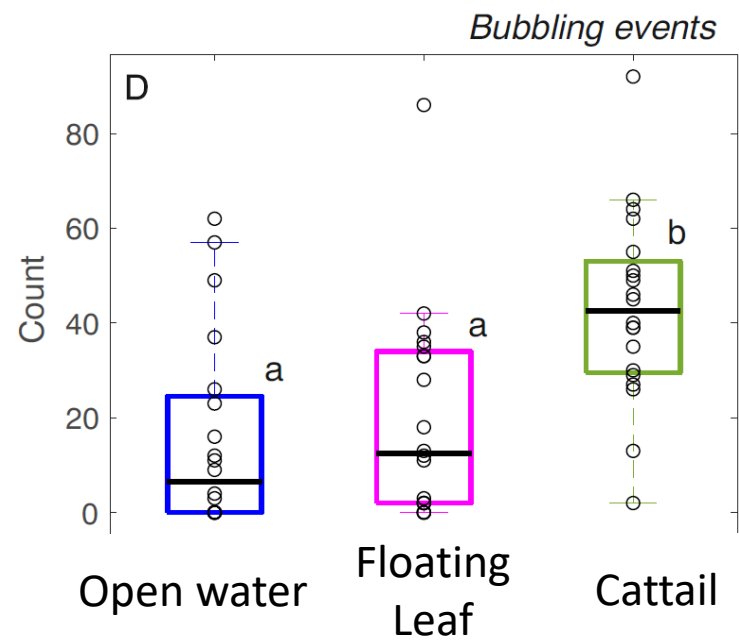
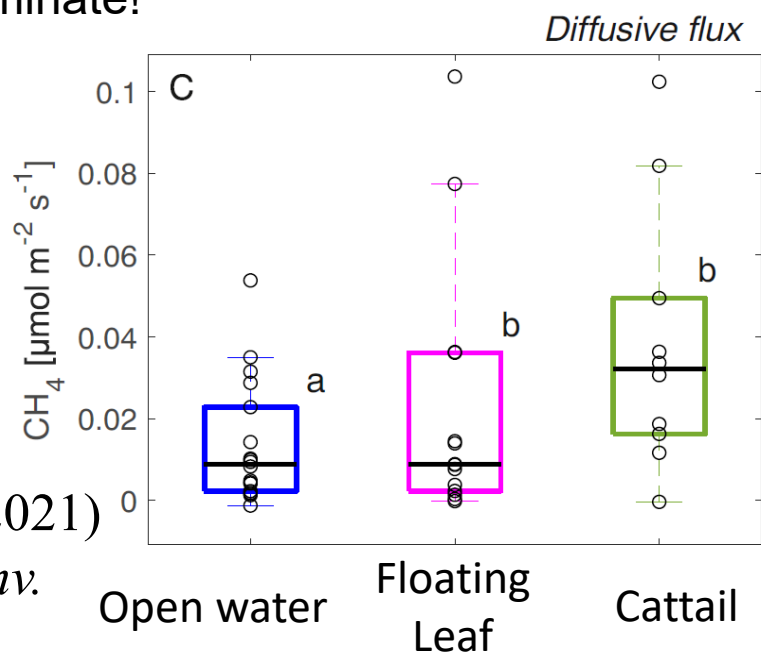
Floating-attached – Lily, Lotus



Patch specific ebullition rates

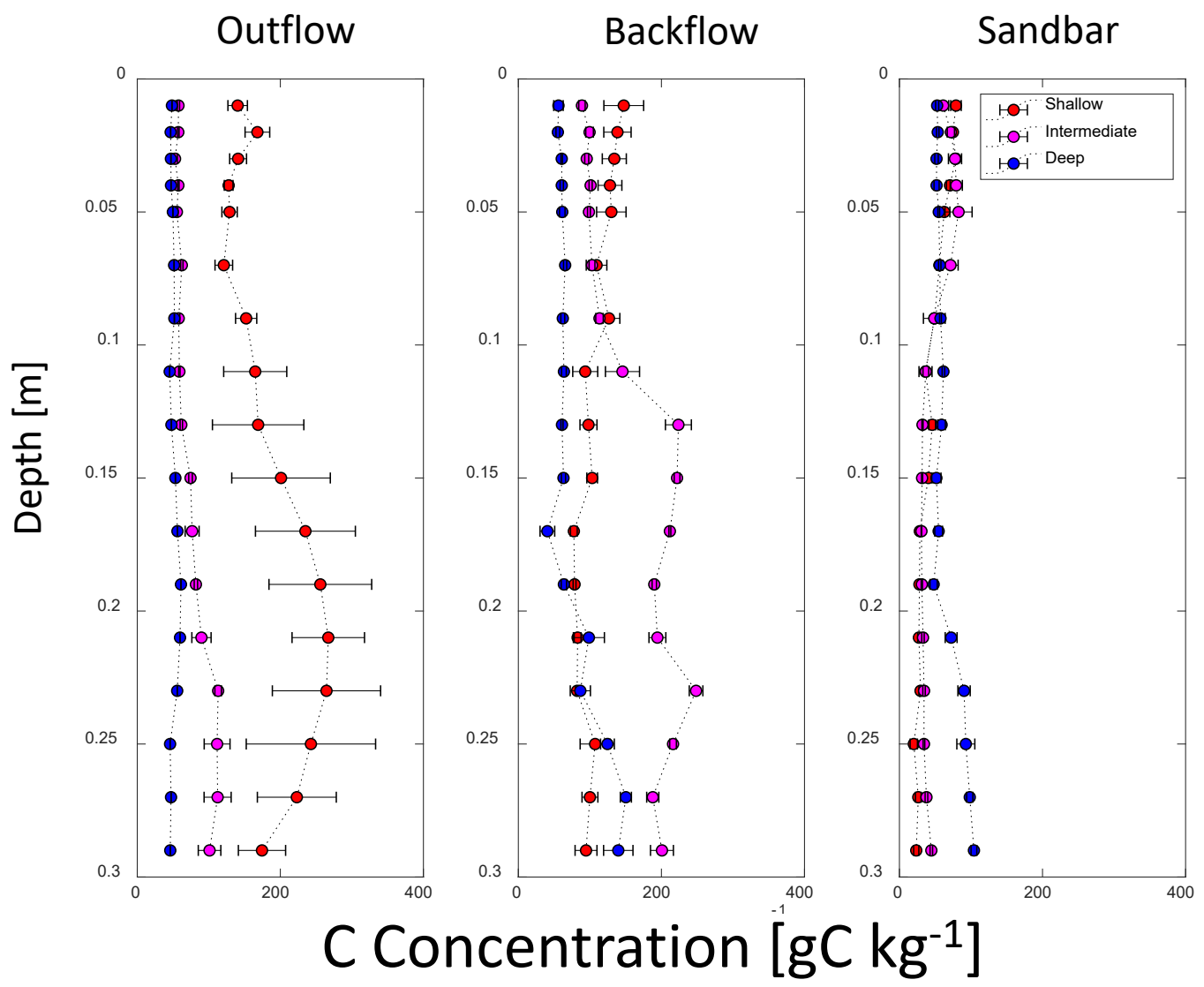


Bubbles dominate!

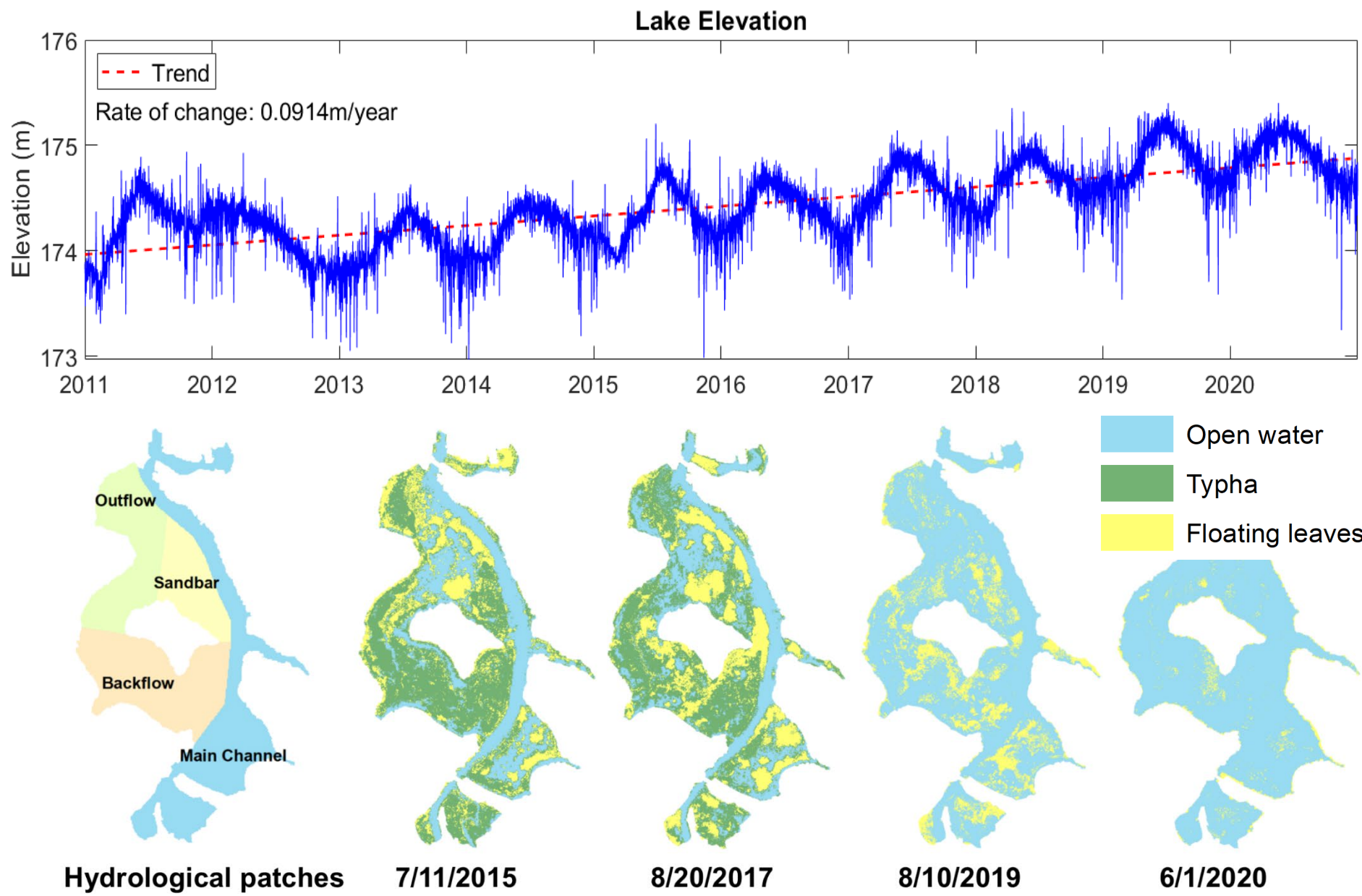


Villa et al (2021)
Sci. Total Env.

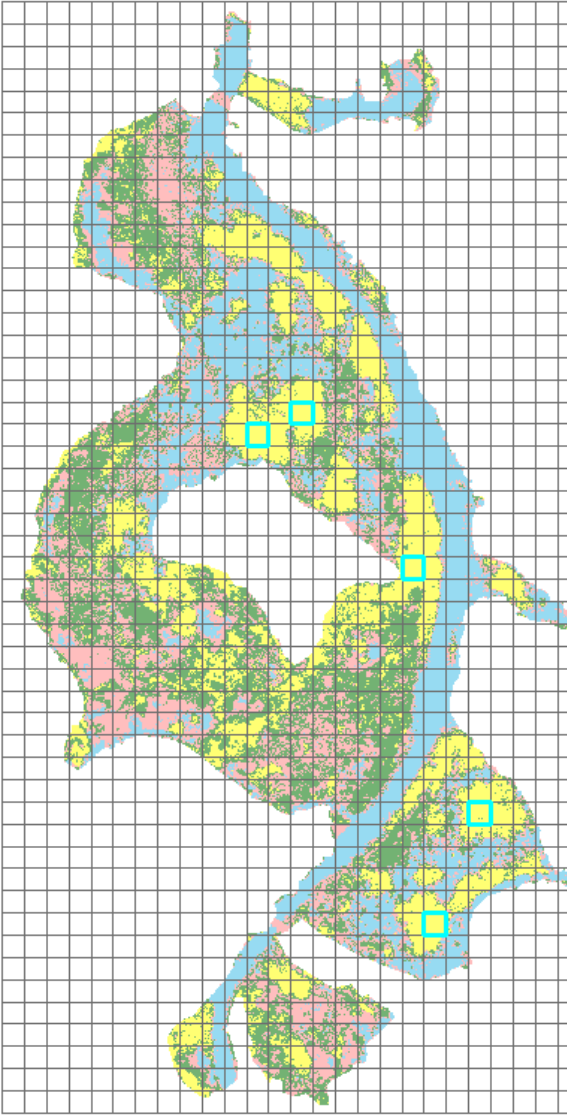
Patch-level sequestration history



Climate change – Lake Erie elevation rapidly increasing



Classification of vegetation patch from HLS NDVI

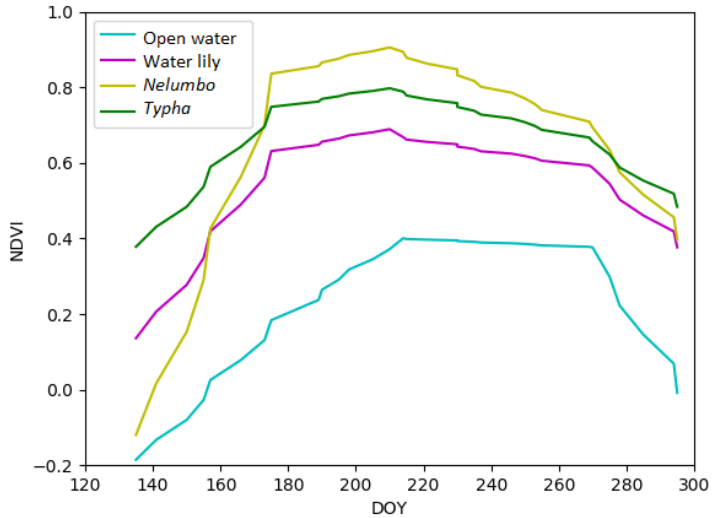


WorldView-3



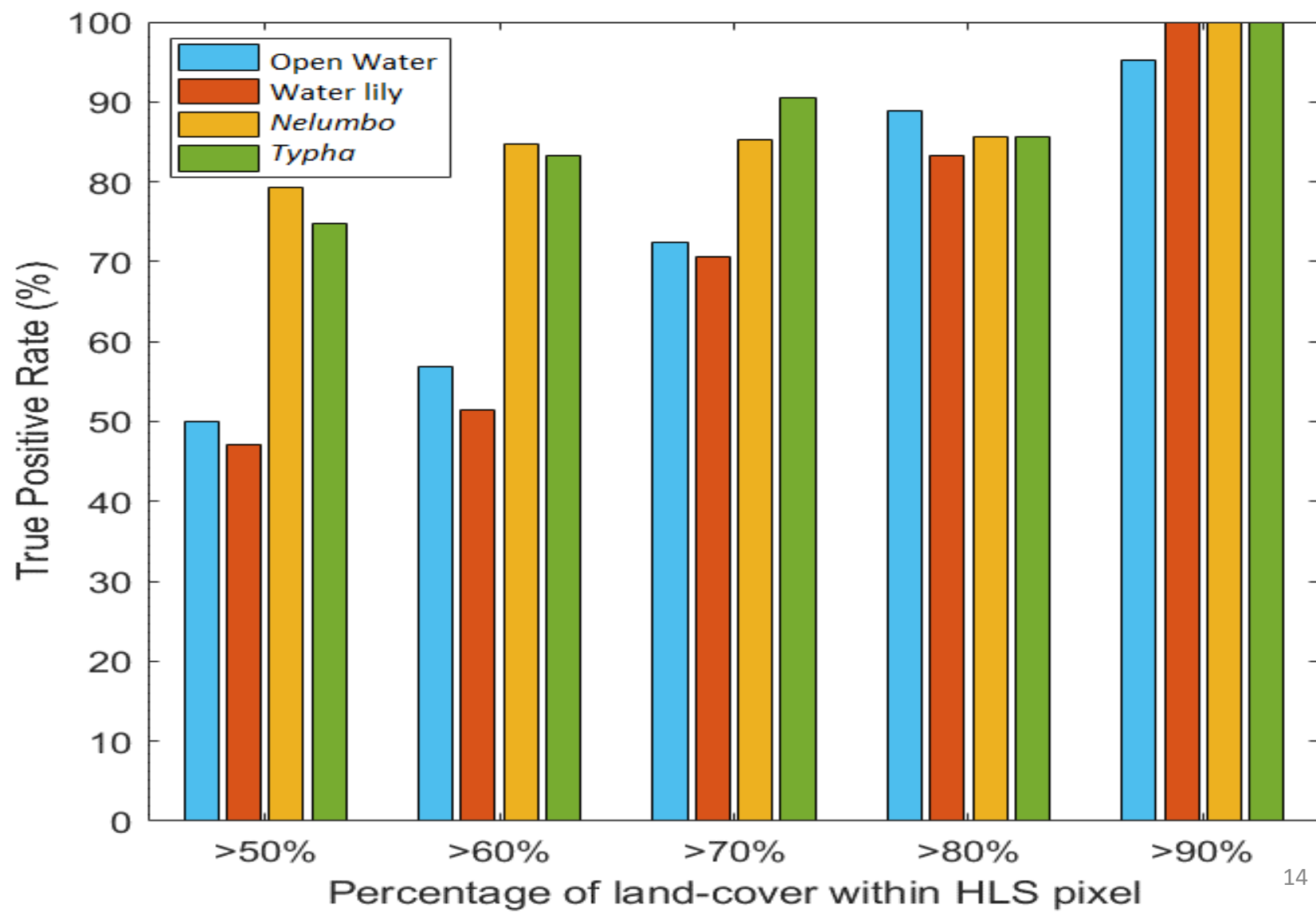
HLS

- Open water
- Water lily
- Typha*
- Nelumbo*

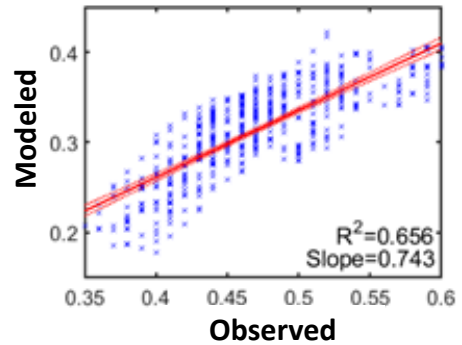
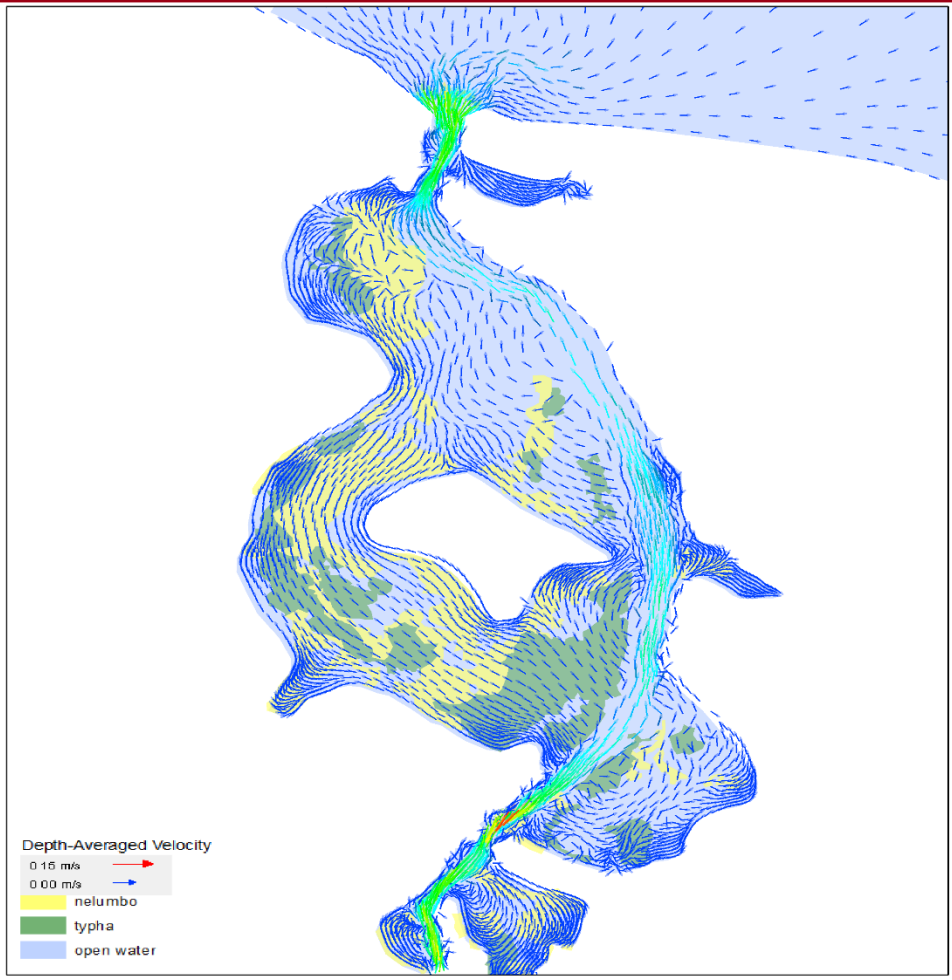
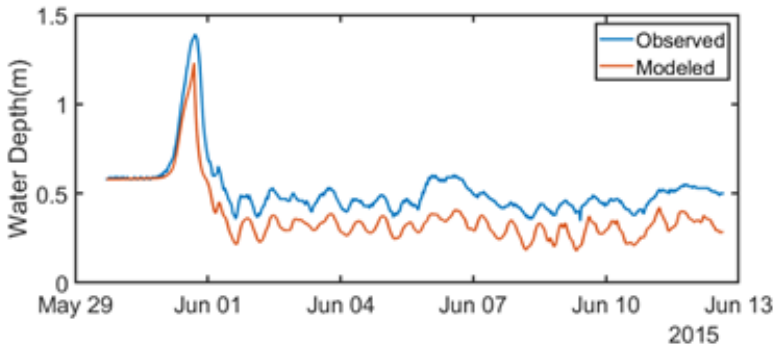
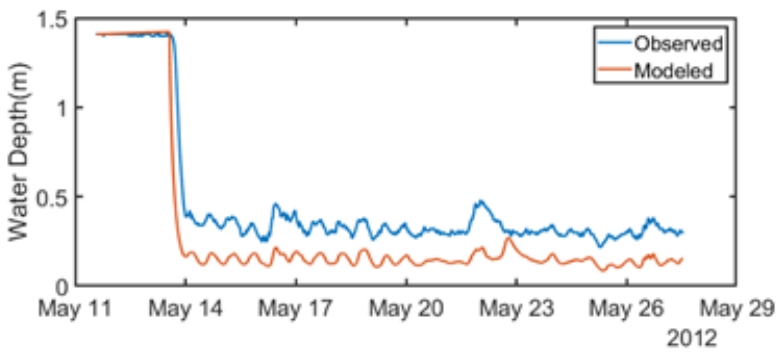


Seasonal characteristic
NDVI profile

Classification of vegetation patch from HLS NDVI

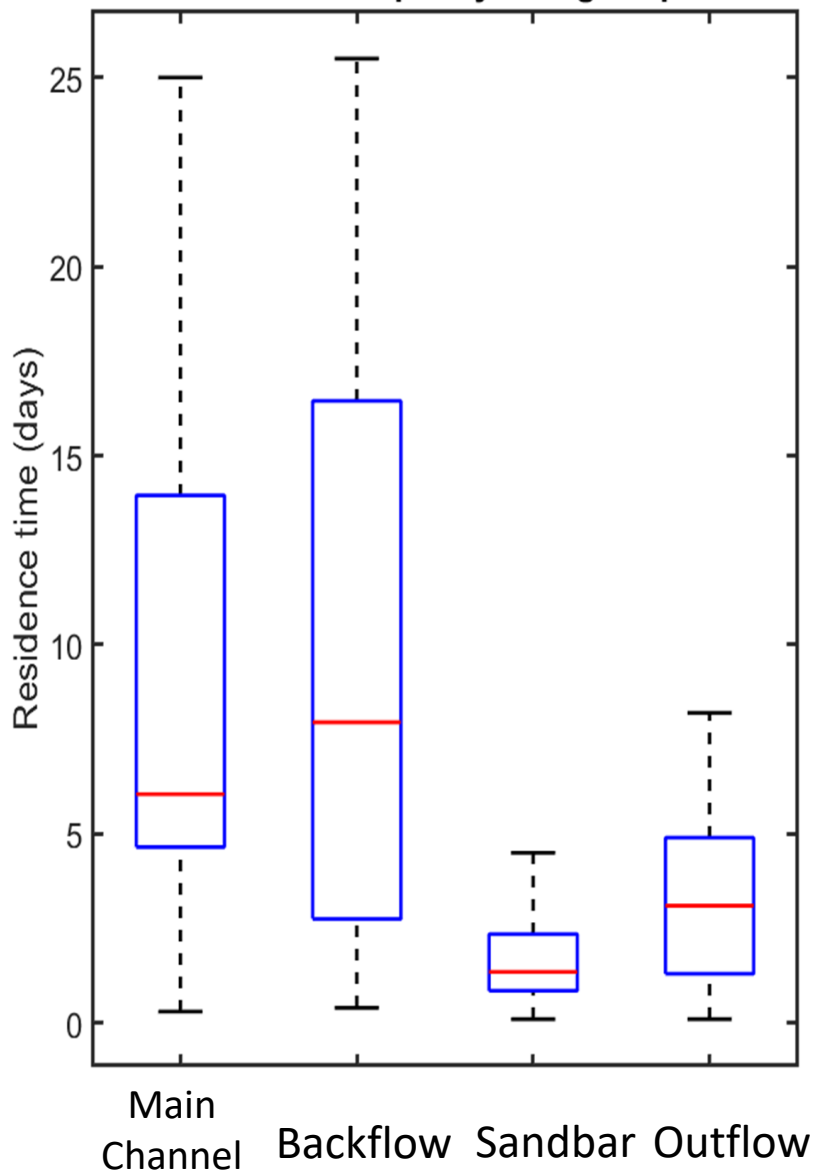


DG-SWEM

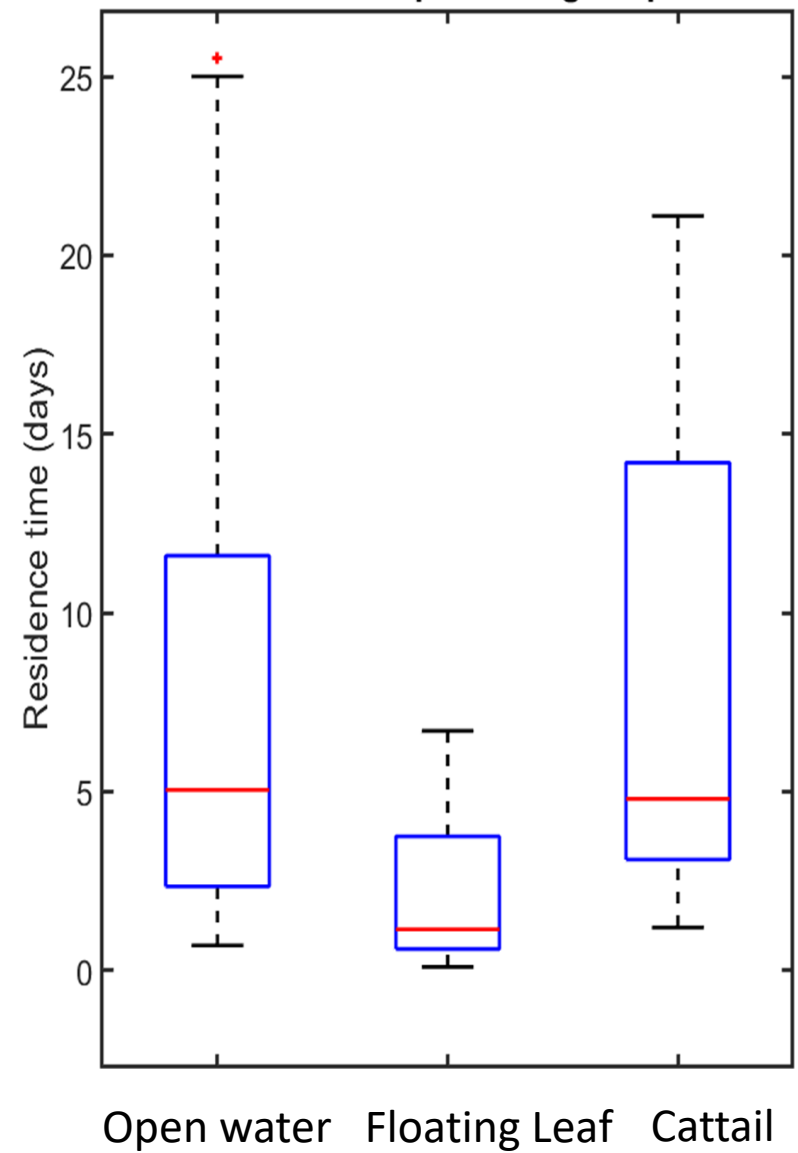


High Resolution hydrodynamic simulations for patch-level aggregate metrics

Residence time per hydrologic location



Residence time per vegetation patch type



Thank you

T · H · E
OHIO
STATE
UNIVERSITY

Funding and support

