Ecological Resilience of Peatlands and its Application in Soil Health

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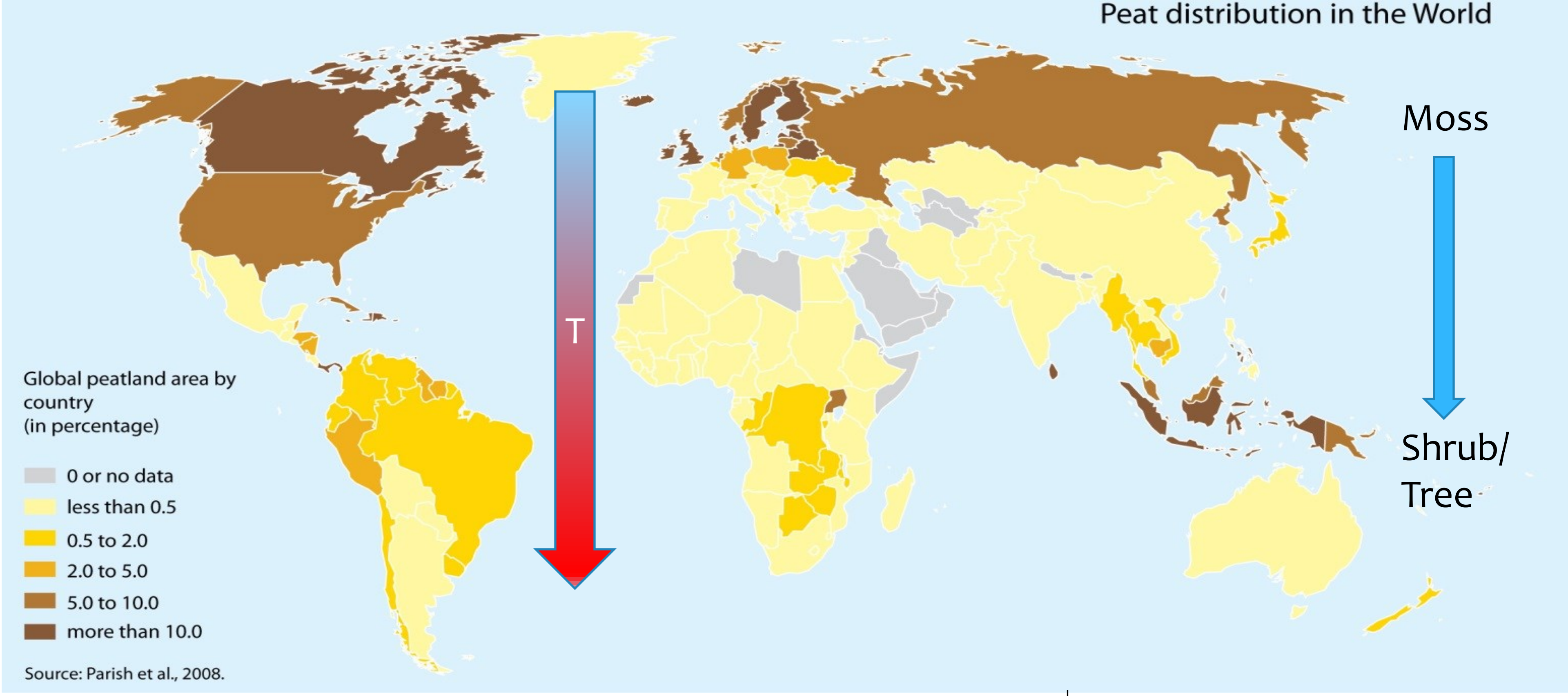
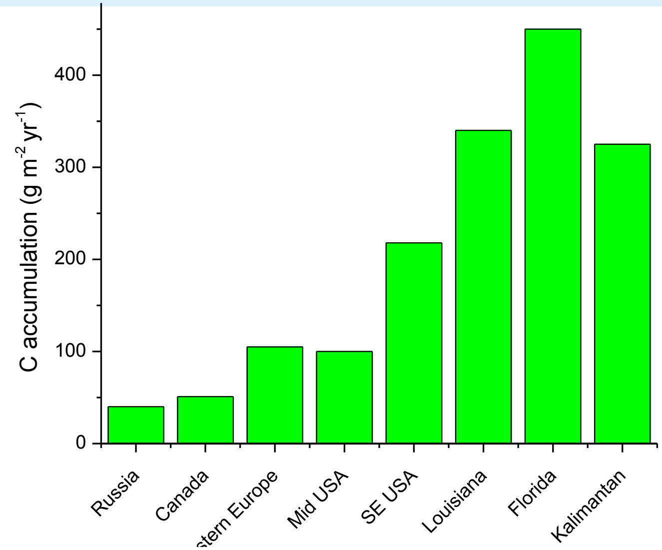


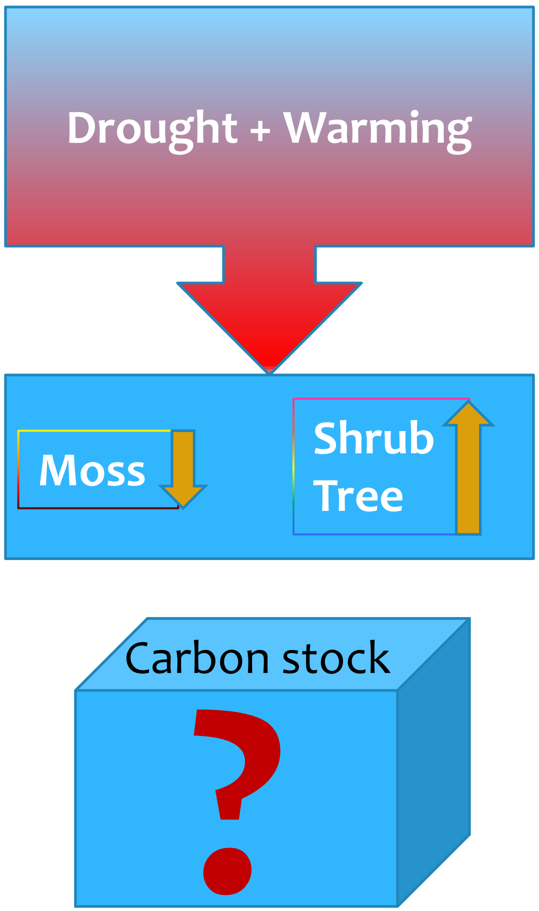
Scientific Questions

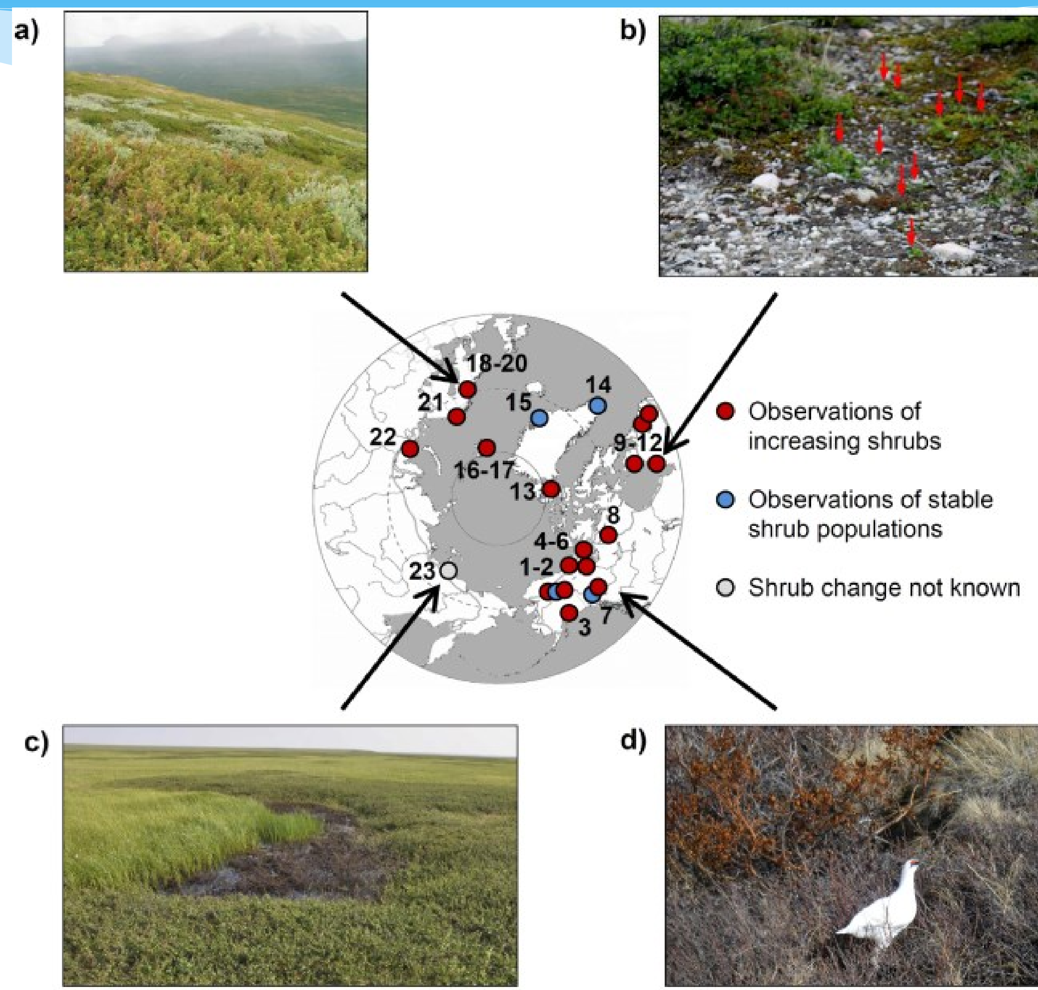
- Fate of boreal peatlands?
- Why do non-boreal peatlands exist?
- Carbon sink or source under climate change?



Bakker et al., 1997

Climate change-induced plant succession





Myers-Smith et al., 2011

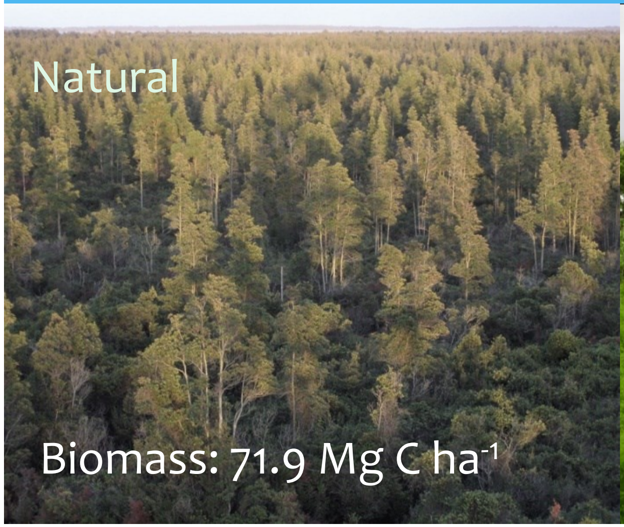
What controls C decomposition?

* Generally, low C quality decreases C decomposition
* Not only anoxia, other factors, substrate or buildup chemical resistance must exist to reduce decomposition under drought

Pocosin Bog Study sites in coastal NC

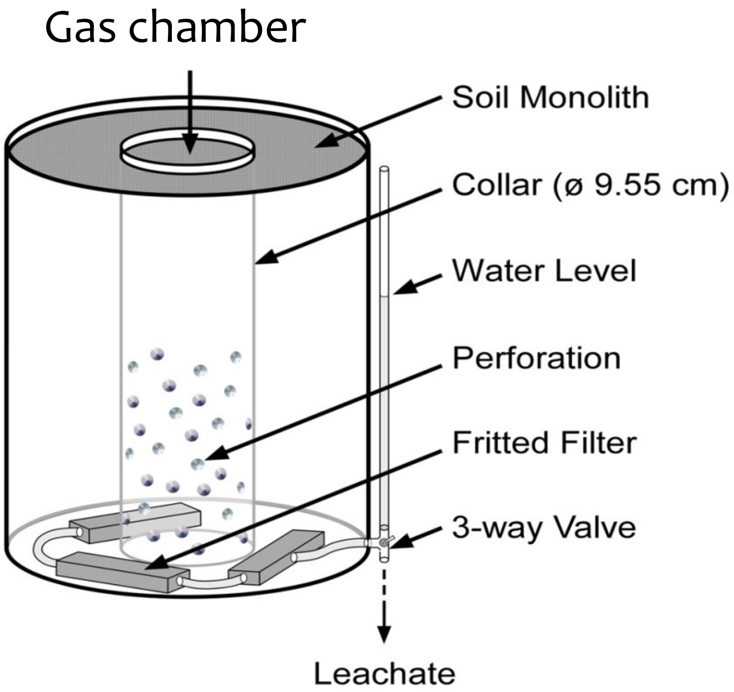
Natural site | Restored site | Drained site

Long-term treatments in field

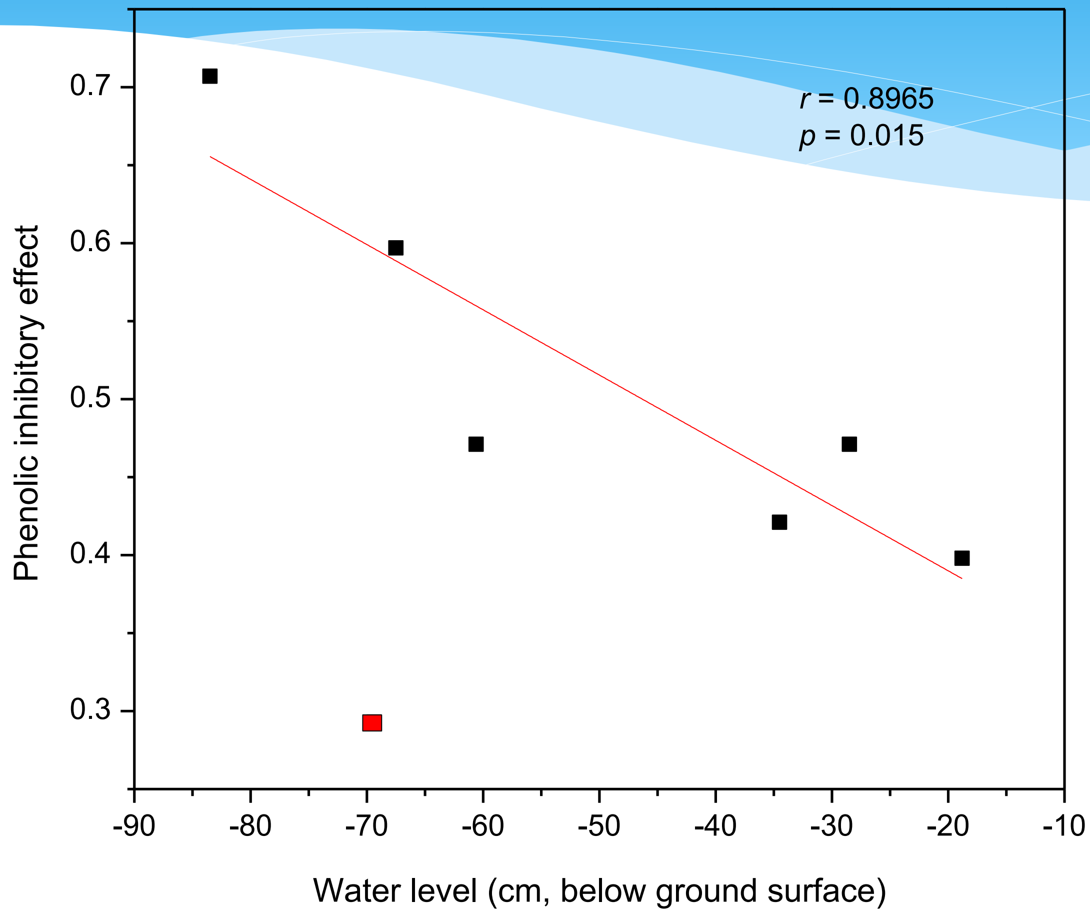


Sites	Water level (cm)		Dominant species
	Winter	Summer	
Natural	0-60	> 100	Mature trees: Pond pine (Pinus serotina Michx.), loblolly bay (Gordonia lasianthus (L.) Ellis), fetterbush lyonia (Lyonia lucida (Lam.) K. Koch), and swamp bay (Persea palustris (raf.) Sarg.).
Drained	>50	>120	Western brakenfern (Pteridium aquilinum (L.) Kahn) and winged sumac (Rhus copallinum L.)
Restored	20-30	>60	Shrub: inkberry (Ilex glabra(L.)A. Gray), large gallberry (Ilex coriacea(Pursh) Chapm.), fetterbush lyonia (Lyonia lucida (Lam.) K. Koch) and laurel greenbrier (Smilax laurifolia L.).

Field and Lab Experiments

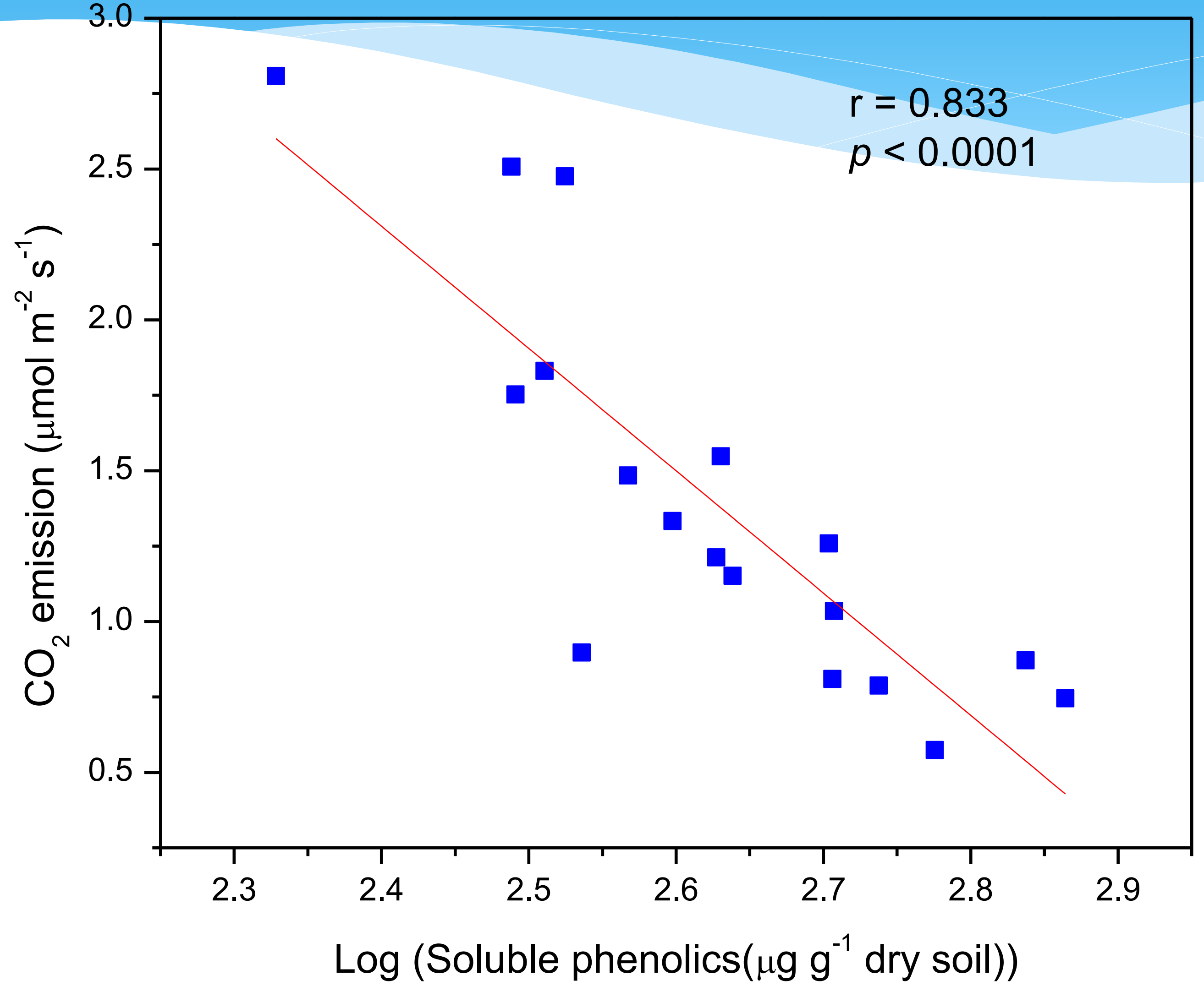


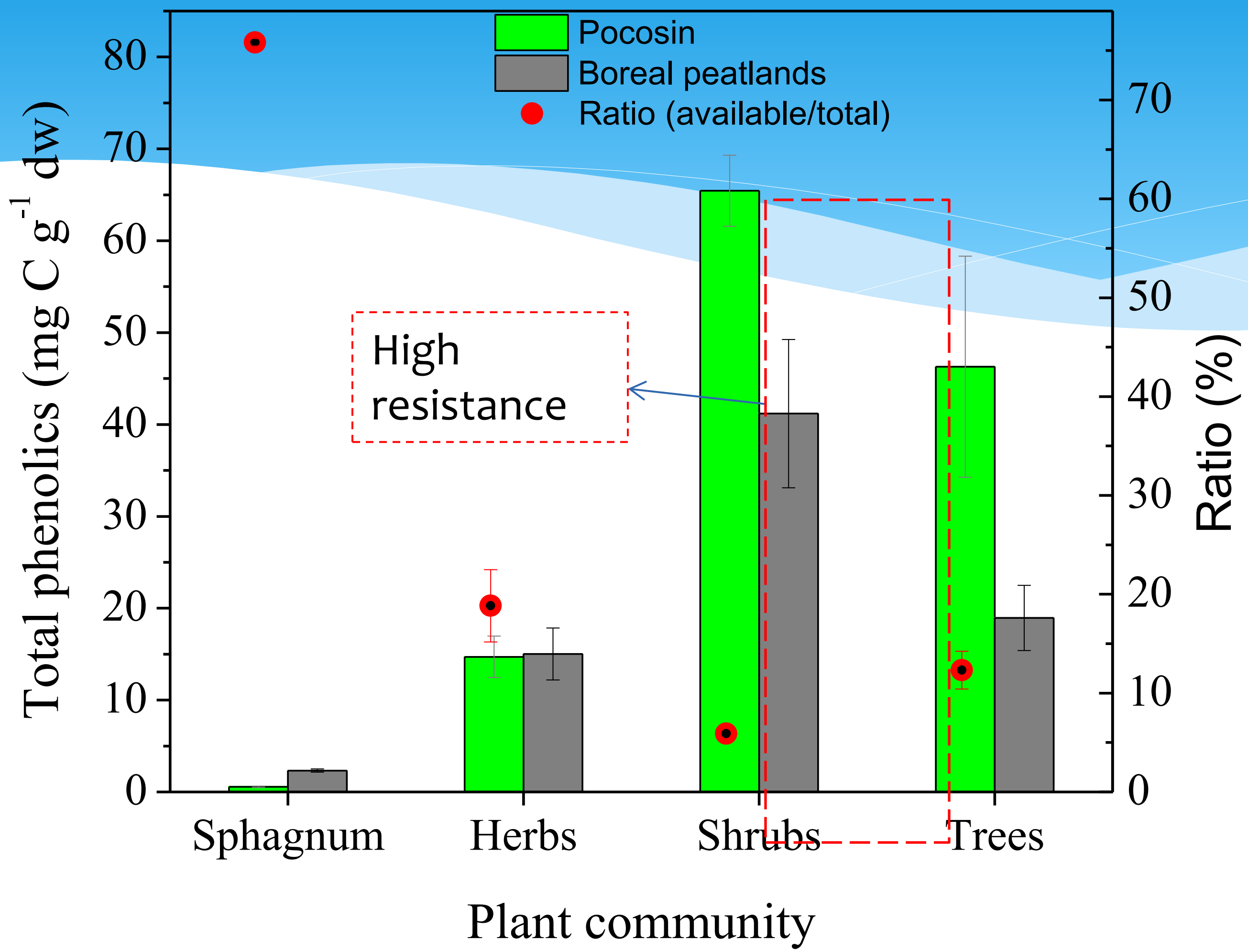
Lower water level, higher phenolic inhibitory effect



* Phenolic inhibitory effect is defined as a negative value of Pearson's r between soil respiration and soluble phenolics in the surface soil.

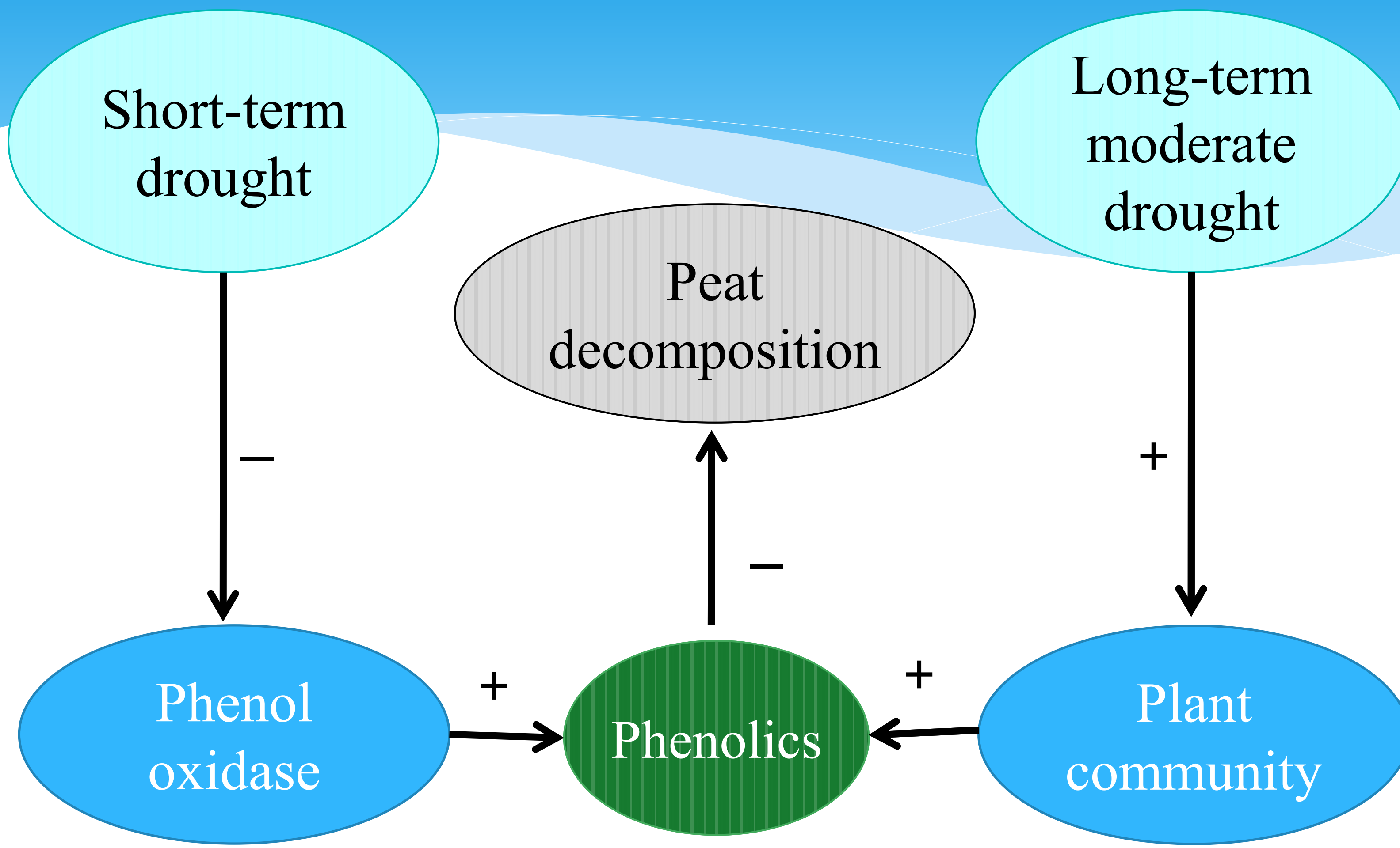
Phenolics inhibit SR





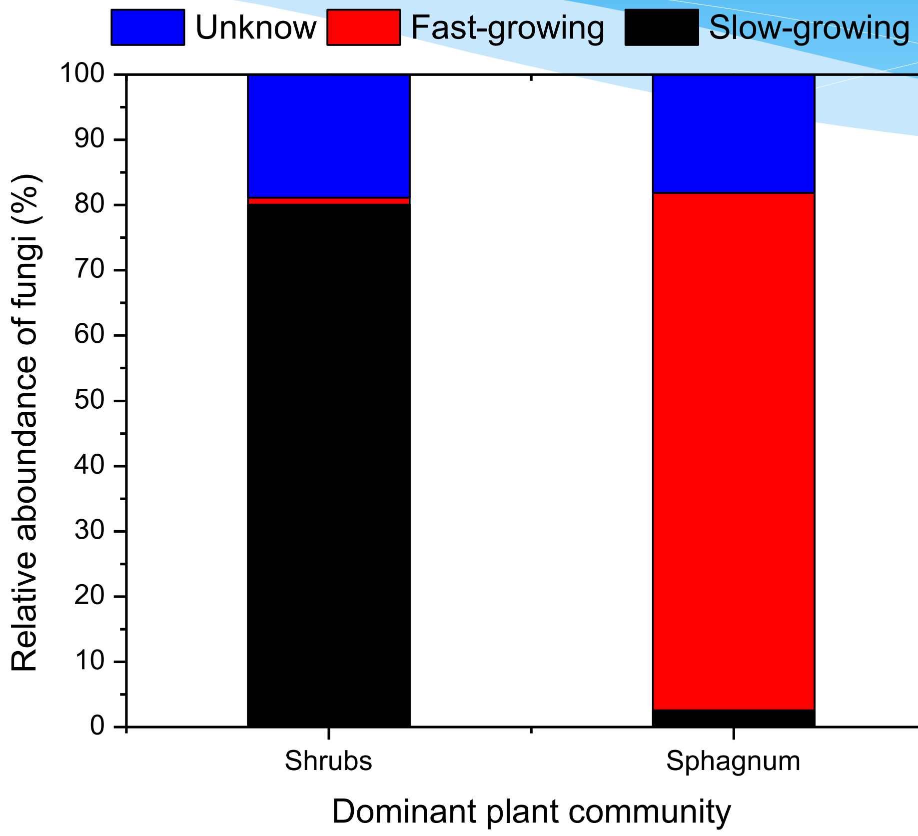
* Highest available and total phenolics found in shrub leaves

Summary 1



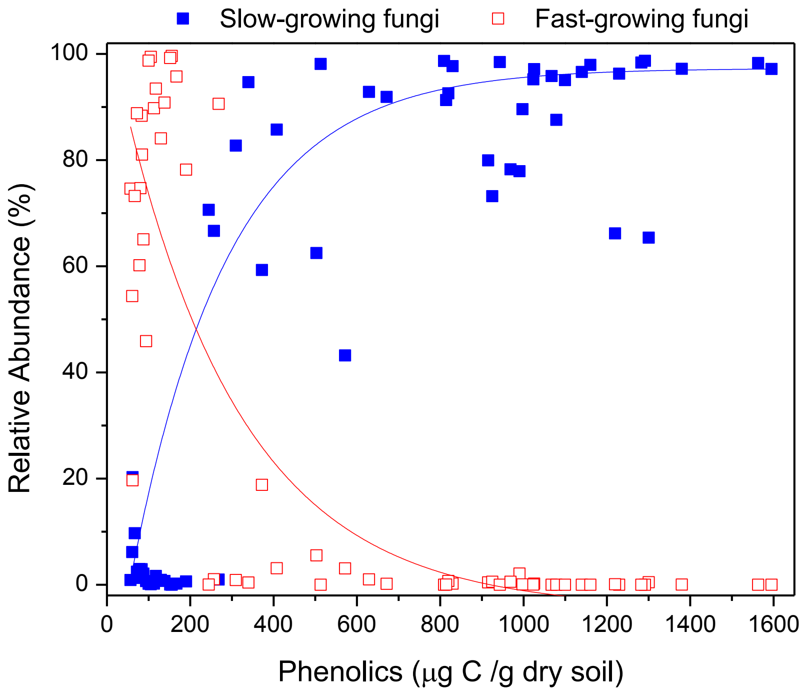
Wang, H., C. J. Richardson and M. Ho, 2015. Dual controls on carbon loss during drought inpeatlands. Nature Climate Change, 5: 584–587.

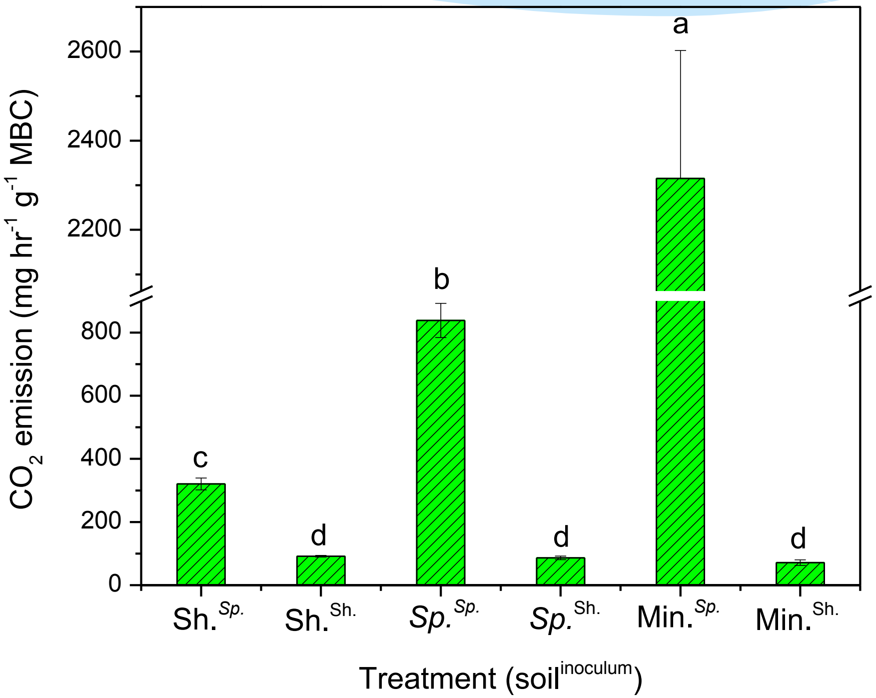
Phase 2



Wang et al., under review

Slow-growing microbes with low carbon turnover rate in shrub peatlands





Wang et al., under review

Summary 2

* Peatlands can adapt to climate change by **gradually shifting microbial & plant communities to maintain essential carbon sequestration functions and processes.**

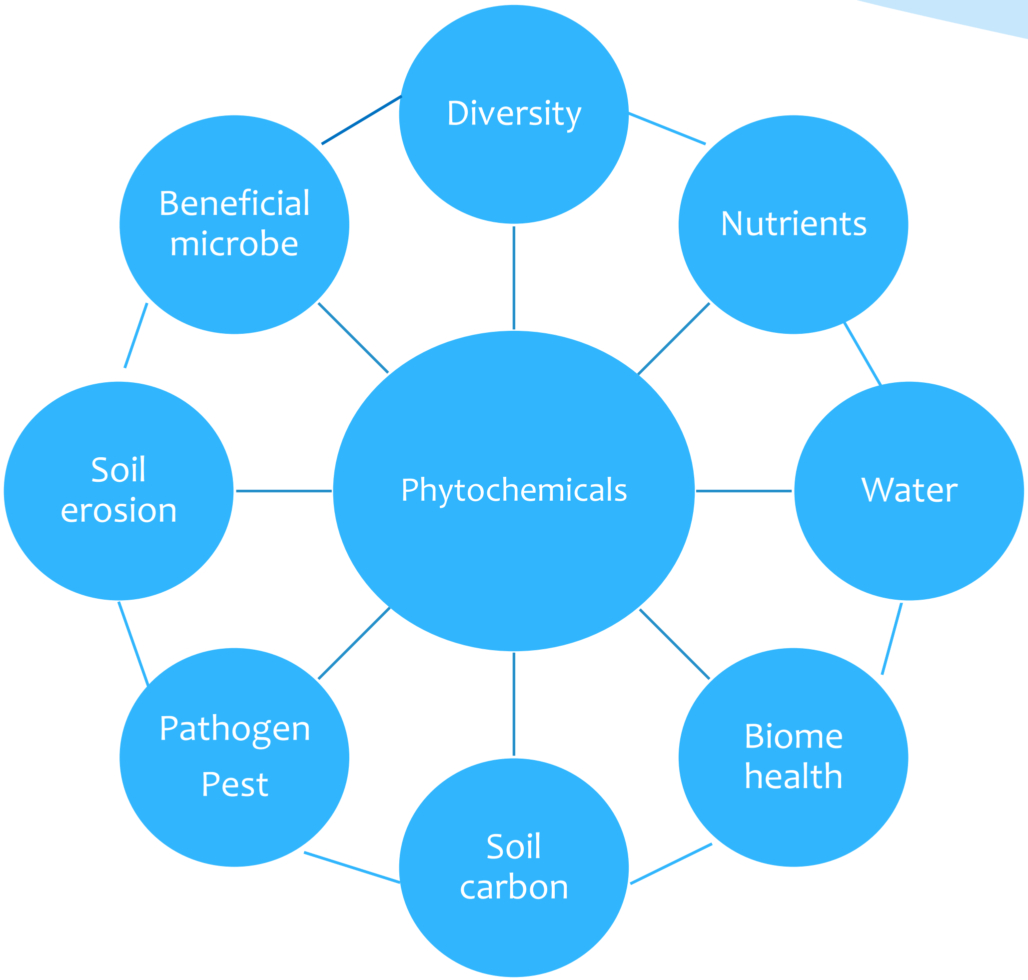
* **Phenolics linked plant-microbe symbioses**

Application in Soil Health

- **Can we enhance phenolic or phytochemical linkage in farmlands?**

- **Right crops, right fertilizer, right inoculants, right-plant-induced chemicals ?**

Phytochemical Linkage to Health of Soil, Plant, Animal and Human



- How human activities and climate change have changed the linkage in natural ecosystem and farmlands wetlands?

- How can we fix and enhance this linkage to improve ecosystem sustainability and resilience?

An example—Organic Farming

Phenolic acids	19%
Flavenones	69%
Stilbenes	28%
Flavones	26%
Flavonols	50%
Anthocyanins	51%
Cadmium	-48%

* Barański et al. 2014. Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses. British J. Nutrition. 112:794-811.

Questions?

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