Linking Nutrient Impacts on Microbial Community Structure and Function with Biogeochemistry in the Everglades

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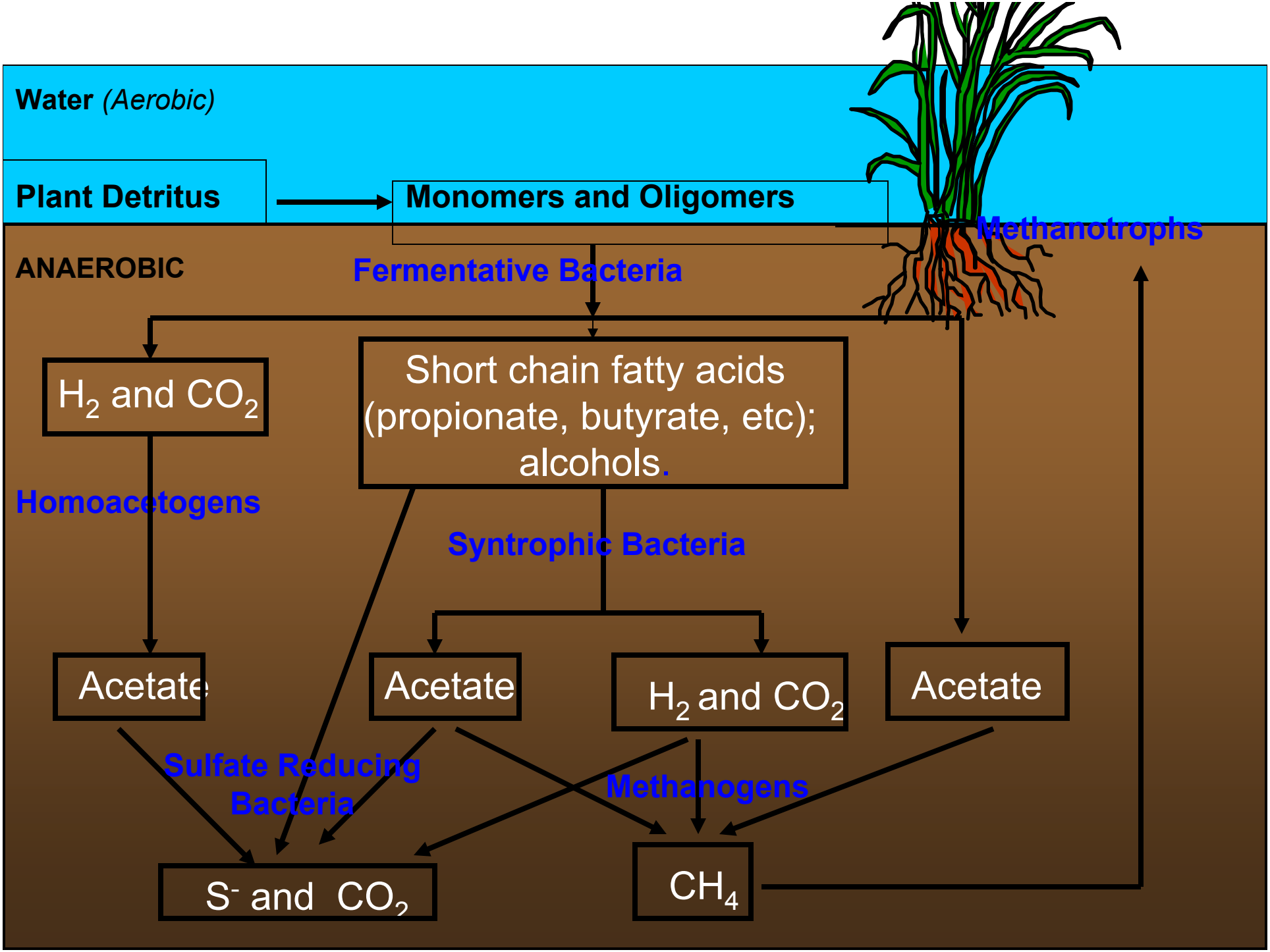
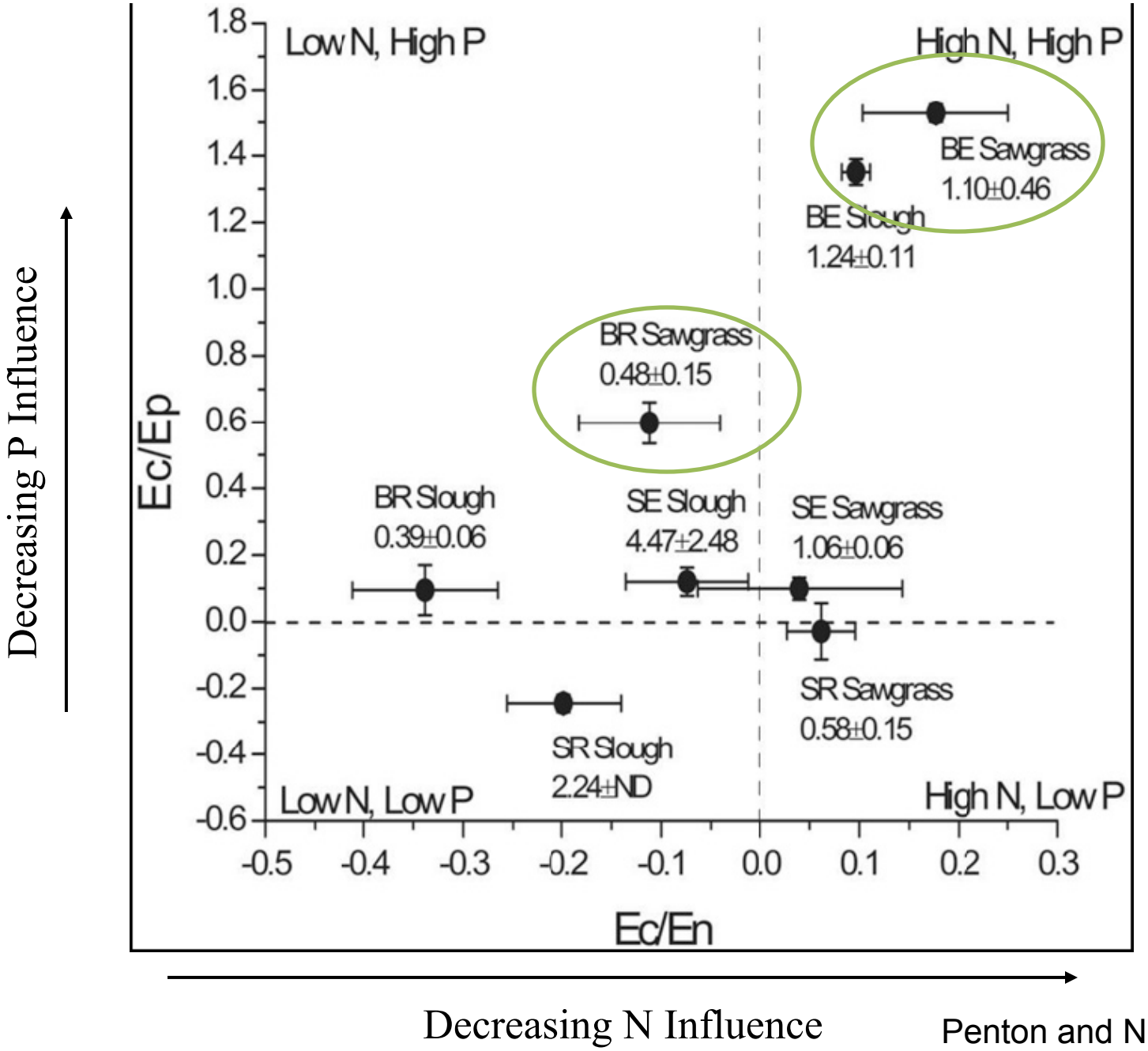
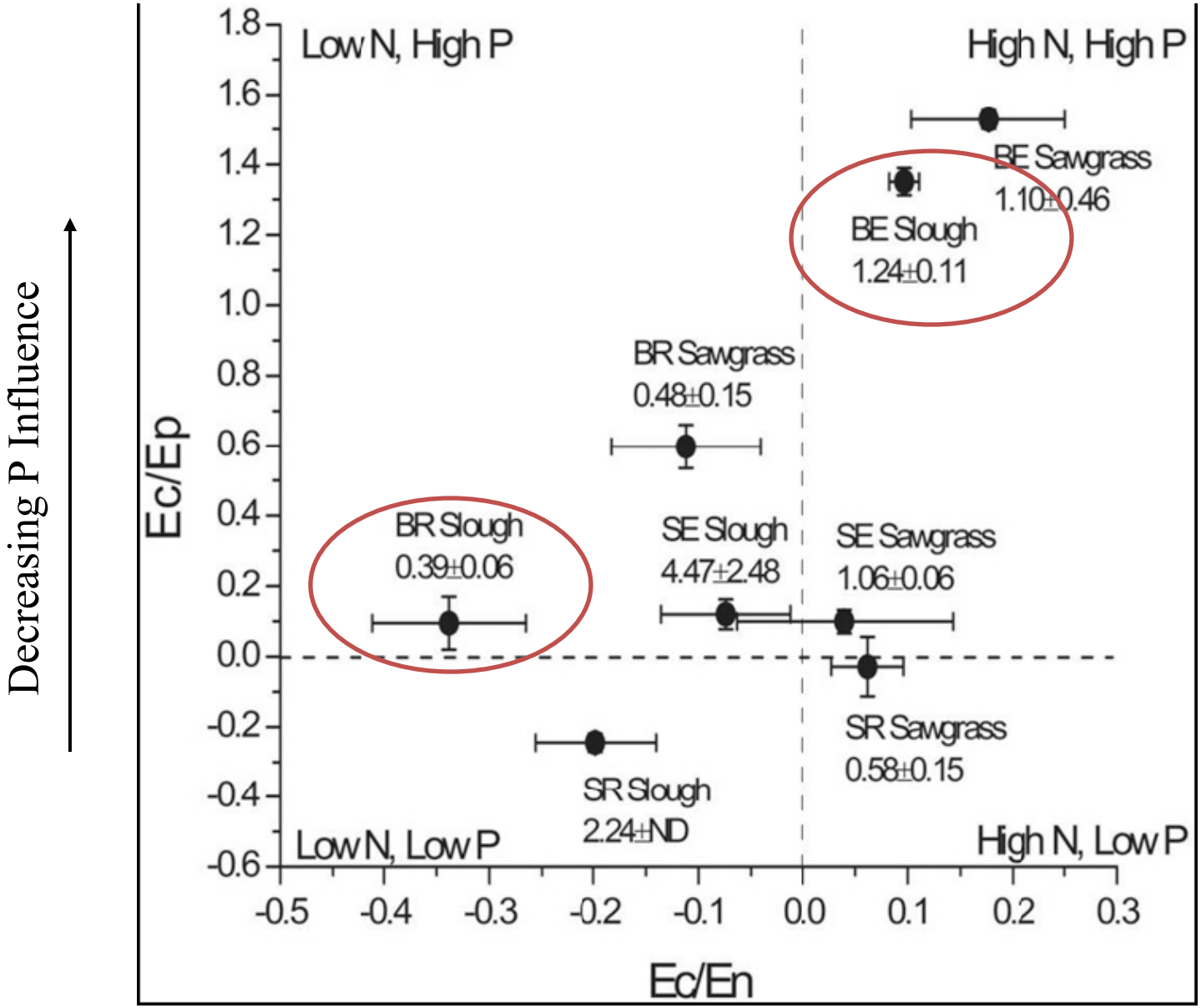

Water (Aerobic)
Plant Detritus
Monomers and Oligomers
Methanotrophs
ANAEROBIC
Fermentative Bacteria
H2 and CO2
Short chain fatty acids (propionate, butyrate, etc); alcohols.
Homoacetogens
Syntrophic Bacteria
Acetate
Acetate
H2 and CO2
Acetate
Sulfate Reducing Bacteria
Methanogens
S- and CO2
CH4



Decreasing P Influence

Decreasing N Influence

Penton and Newman, 2008

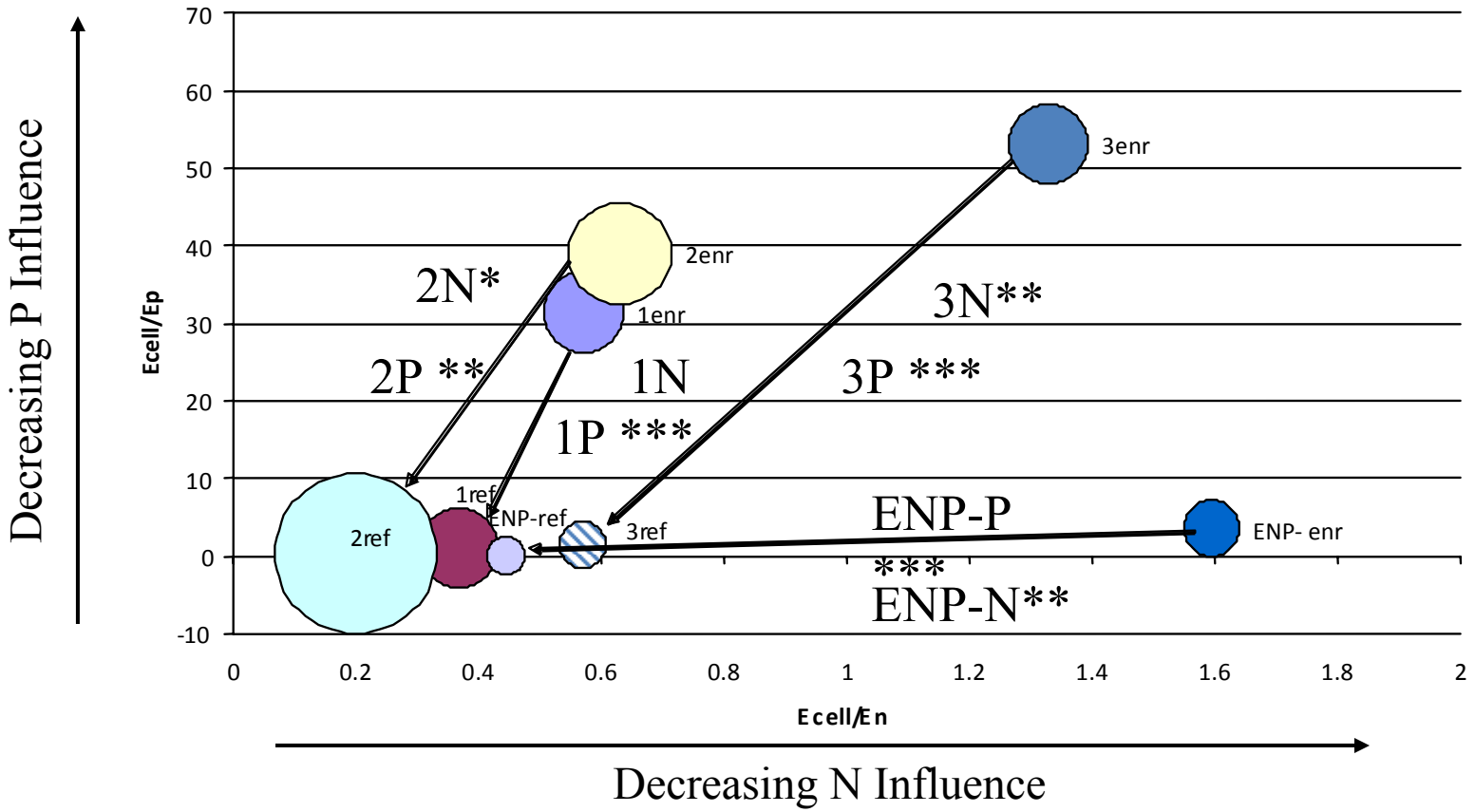


Decreasing P Influence

Decreasing N Influence

Penton and Newman, 2008

Nutrient Study – Benthic Horizon



- C mineralization less influenced by N and P at all enriched sites
- WCA-3A exhibited greatest P shift while ENP-TS exhibited greatest N shift

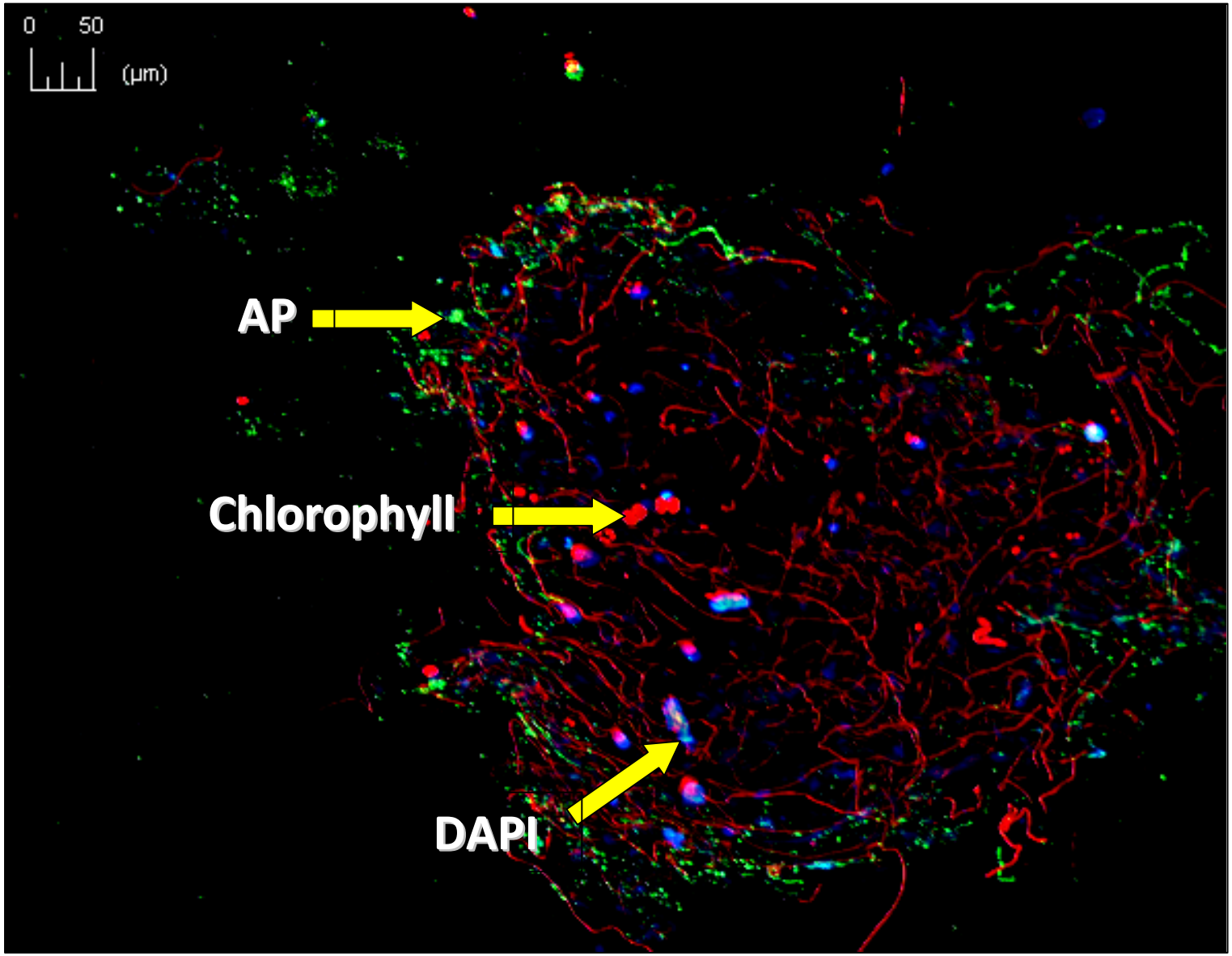
Penton and Newman, 2007

Periphyton mats

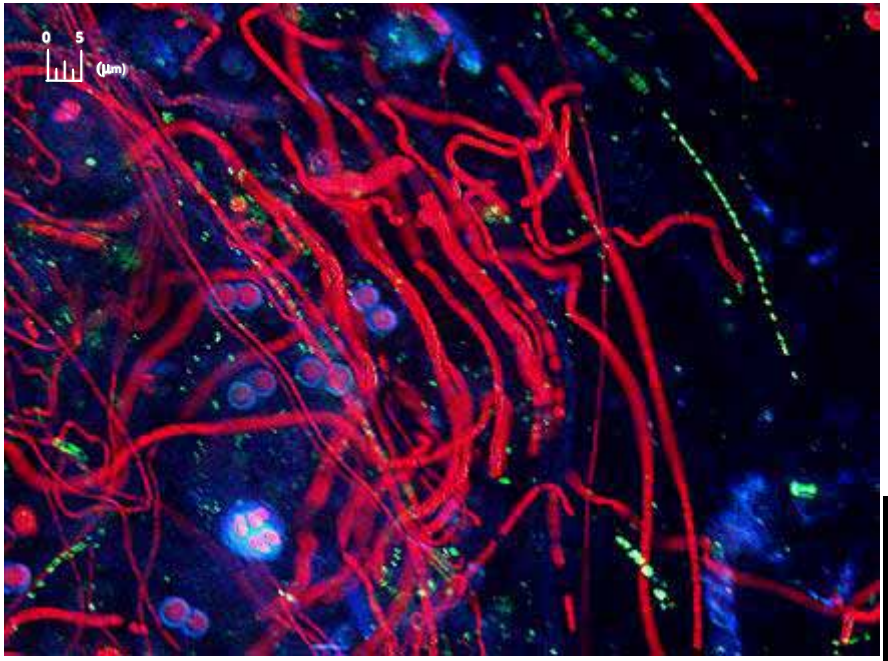
Photo credit: P. Inglett

- Periphyton refers to the assemblages of prokaryotic and eukaryotic algae.

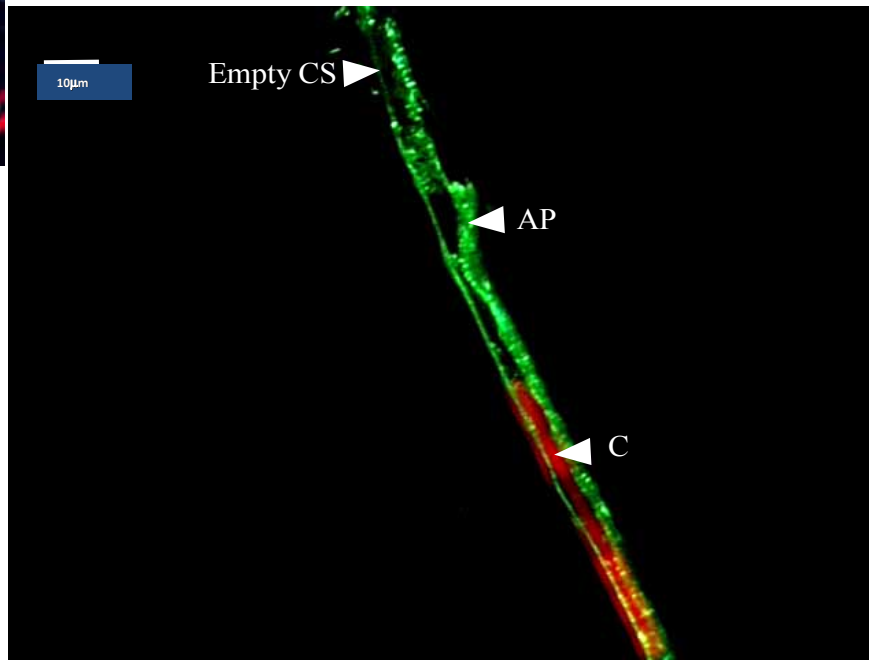
- Develop at interfaces of water-solid substrates and water-air.



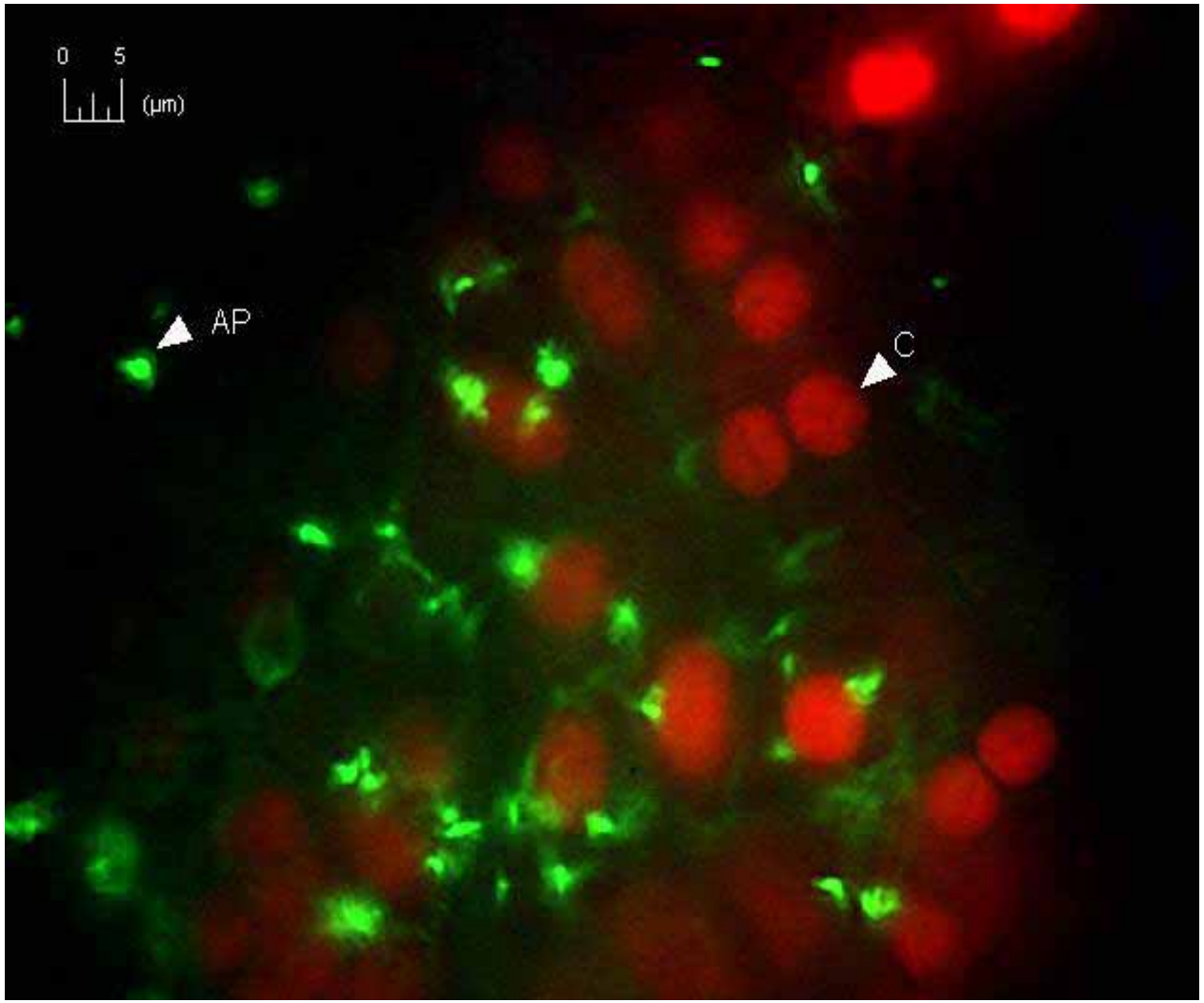
AP activity appears to be associated with cells that surround the cluster of chlorophyll containing filamentous cells



Filaments showing AP activity did not appear to have any chlorophyll

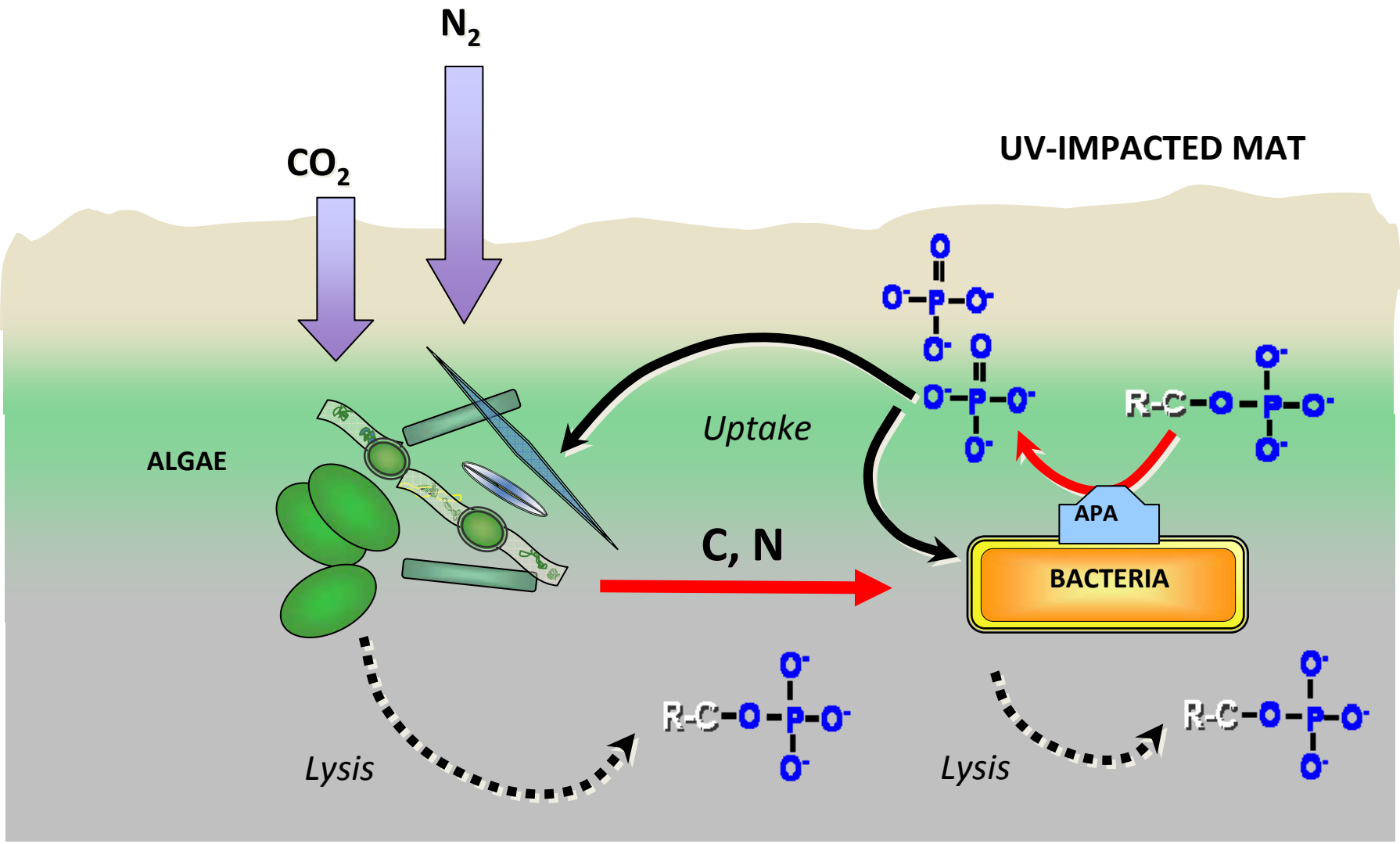


Empty sheath of cyanobacteria (CS) with AP activity. C: chlorophyll

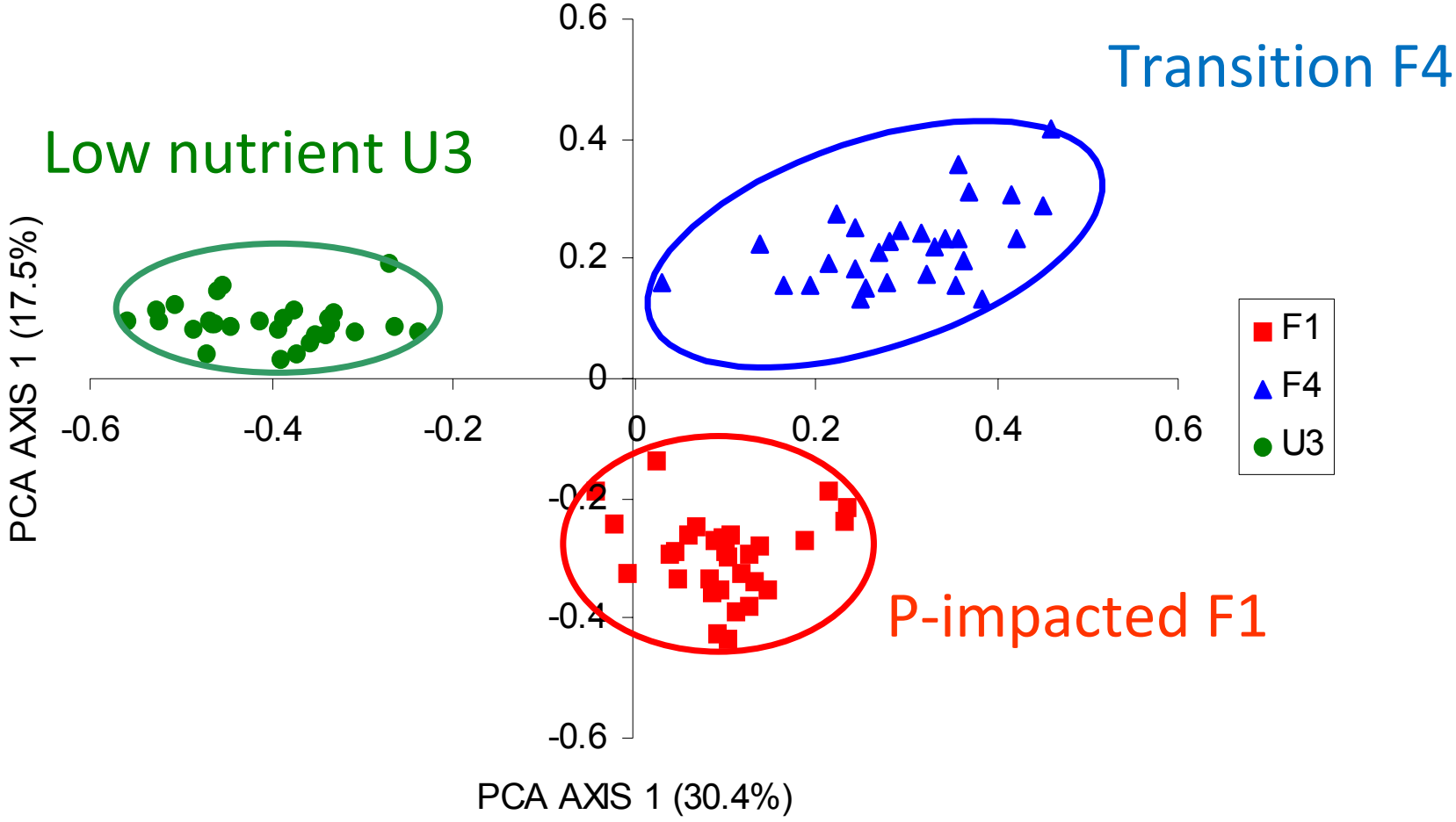


Chlorophyll containing cells (C) appear to be closely associated with sites of AP activity.

Cooperative relationship within a periphyton mat from a low P region

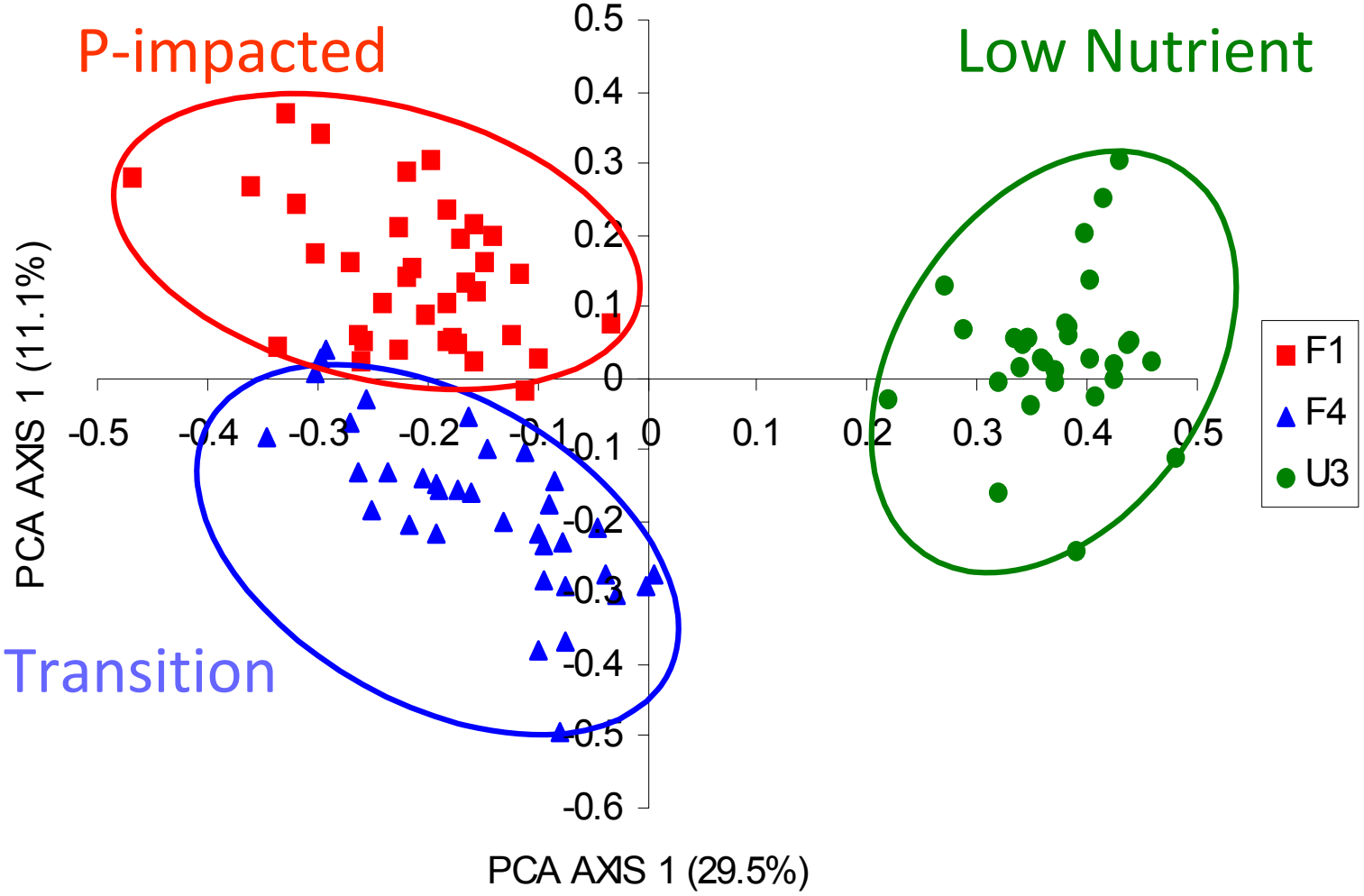


Distribution of sulfate reducing bacteria

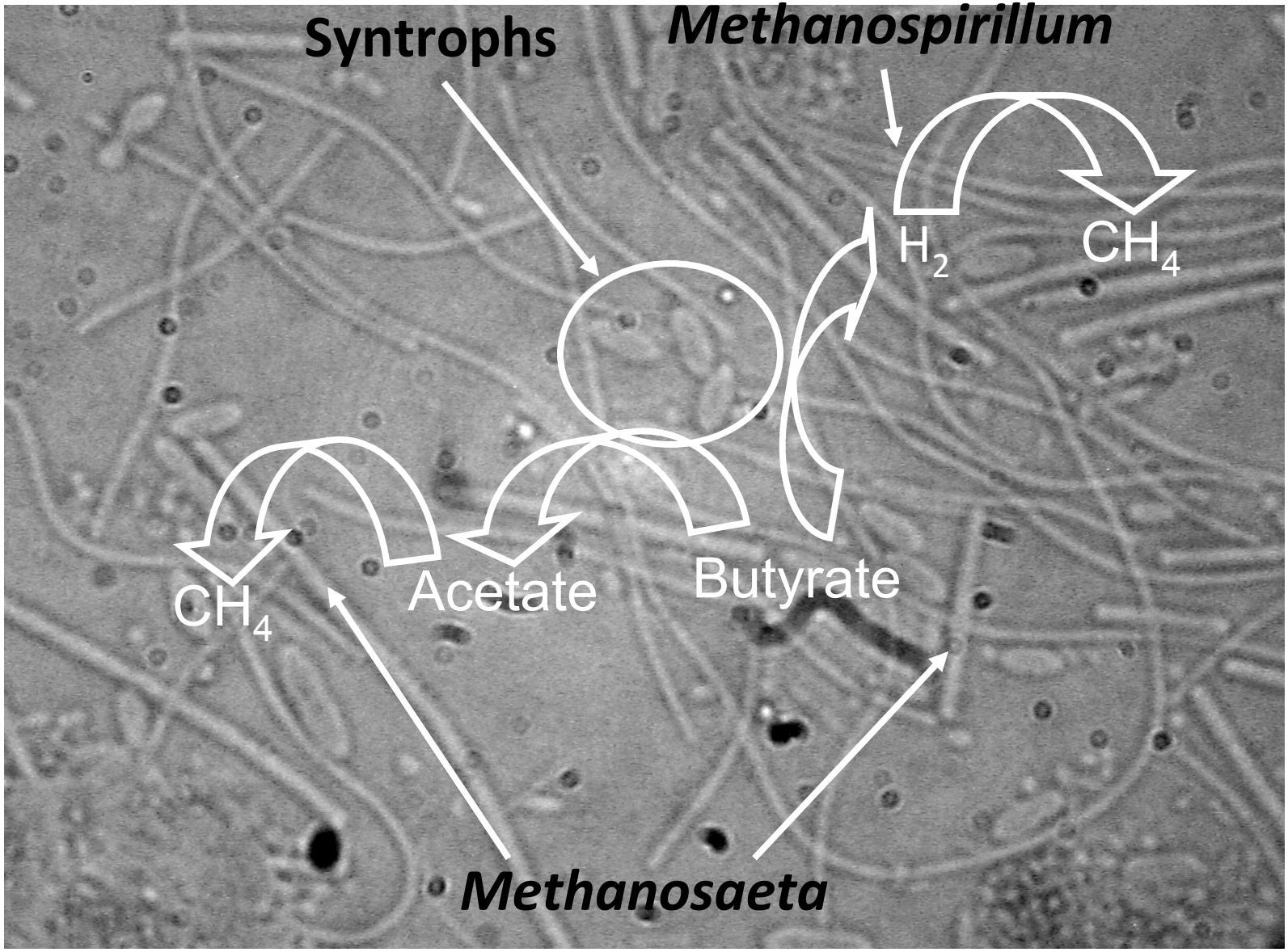


Resolution of SRP assemblages from P-impacted, transition, and low P sites taken over one year.

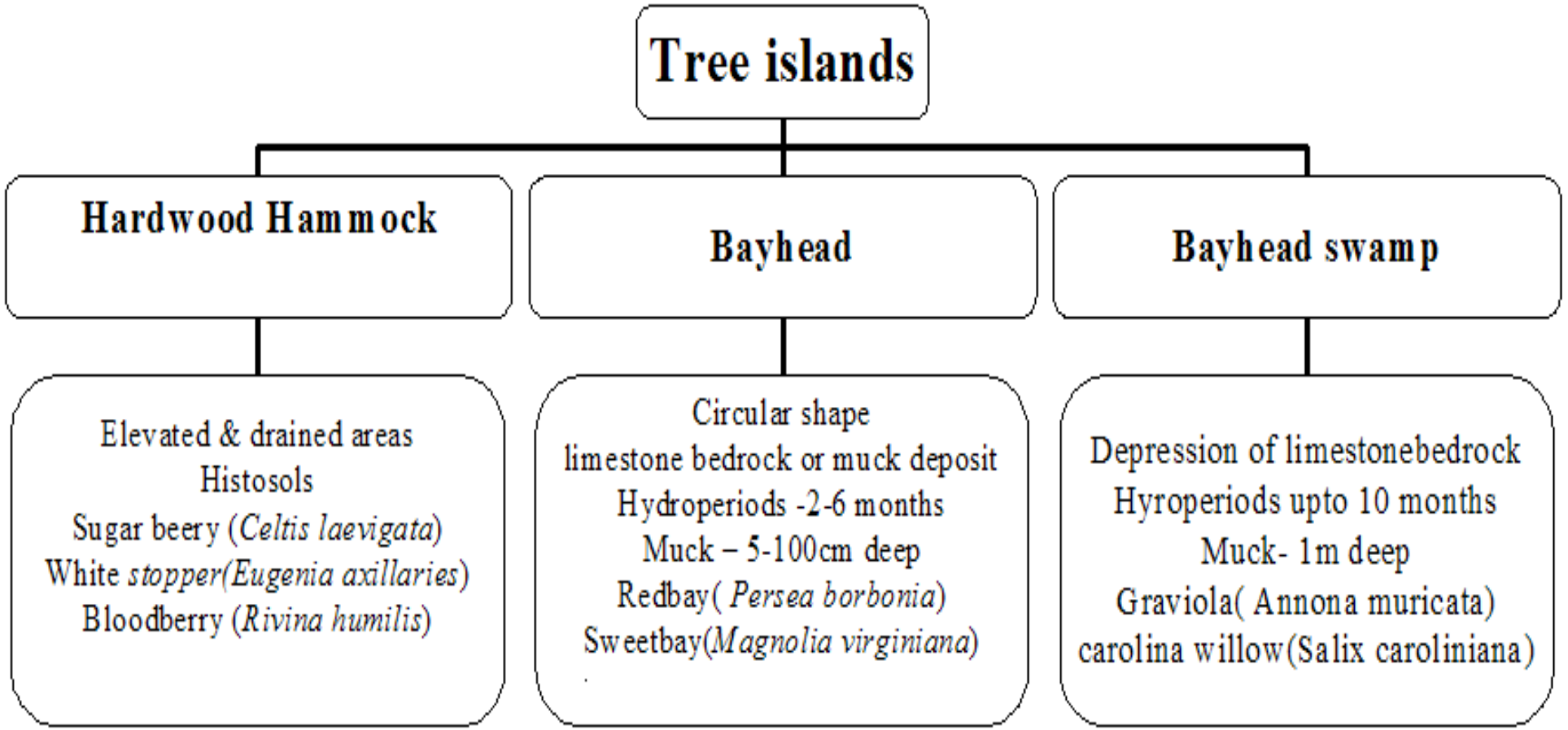
Distribution of methanogens



Resolution of methanogenic assemblages from P-impacted, transition, and low P-sites taken over one year.


Syntrophs
Methanospirillum
H2
CH4
CH4
Acetate
Butyrate
Methanosaeta

Tree Islands


Tree islands
Hardwood Hammock
Bayhead
Bayhead swamp
Elevated & drained areas
Histosols
Sugar beery (Celtis laevigata)
White stopper(Eugenia axillaries)
Bloodberry (Rivina humilis)
Circular shape
limestone bedrock or muck deposit
Hydroperiods -2-6 months
Muck – 5-100cm deep
Redbay(Persea borbonia)
Sweetbay(Magnolia virginiana)
Depression of limestonebedrock
Hyroperiods upto 10 months
Muck- 1m deep
Graviola(Annona muricata)
carolina willow(Salix caroliniana)

- Hammocks more diverse and rich
- High relative ratio of 342-361 bp- hammocks
- Short lengths- 314-327- Alpha and cynaobacteria
- Intermediate lengths- beta, gamma and delta proteobacteria, flexibacter-bacteriodes-cytophaga
- Longest domains- low and high G + C gram positive bacteria
- Gamma proteobacteria grow on nutrient rich and alpha proteobacteria on nutrient poor media

Conclusions from Tree Island Studies

Hammocks are more microbial diverse and rich than bayhead and swamps

Carbon and phosphorous determine the structure of microbial community in tree island ecosystems under the influence of moisture

Summary

- Microbial communities in various compartments differ as a function of nutrient enrichment:
  - Nutrient enrichment changes community structure and activities
- Activities important to restoration are likely impacted by nutrient enrichment