National Biological Assessment and Criteria Workshop

Advancing State and Tribal Programs

Coeur d'Alene, Idaho
31 March – 4 April, 2003

WET 101

Linking Measures of Ecological Integrity with Ecosystem Processes in Mitigation Wetlands

Presented by
Siobhan Fennessy
Kenyon College

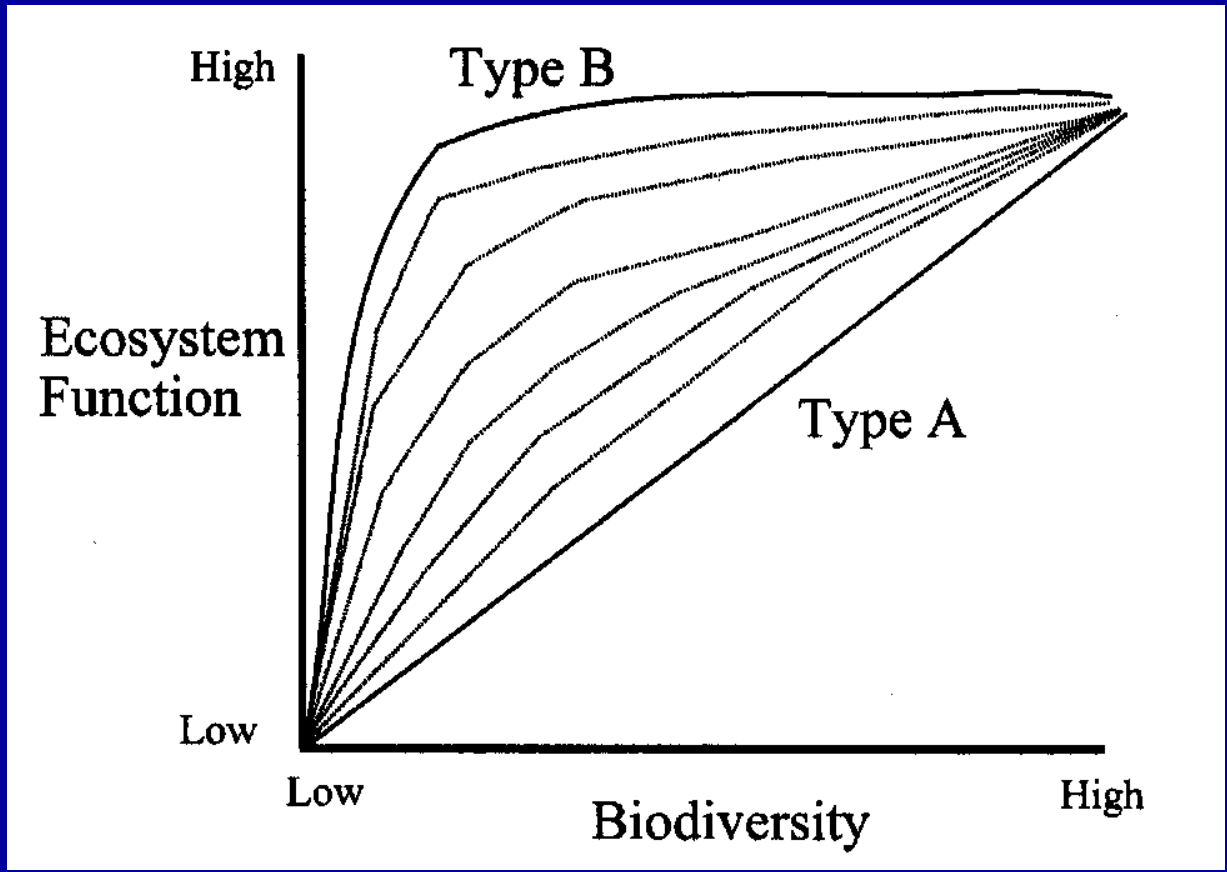
Study Design:

- 10 natural and 10 restored (mitigation) wetlands
- biological assessments made based on vegetation community composition
- Ground water and surface water levels monitored
- ecosystem processes measured including biomass production, decomposition rates, and nutrient cycling rates.

Created wetland during drydown

Natural wetland during drydown

Theoretical models of ecosystem development



Where along the continuum do mitigation wetlands fall?

Least impacted

Most disturbed

Range of Natural Wetland Condition

Natural

Mitigation - restoration

Mitigation - creation

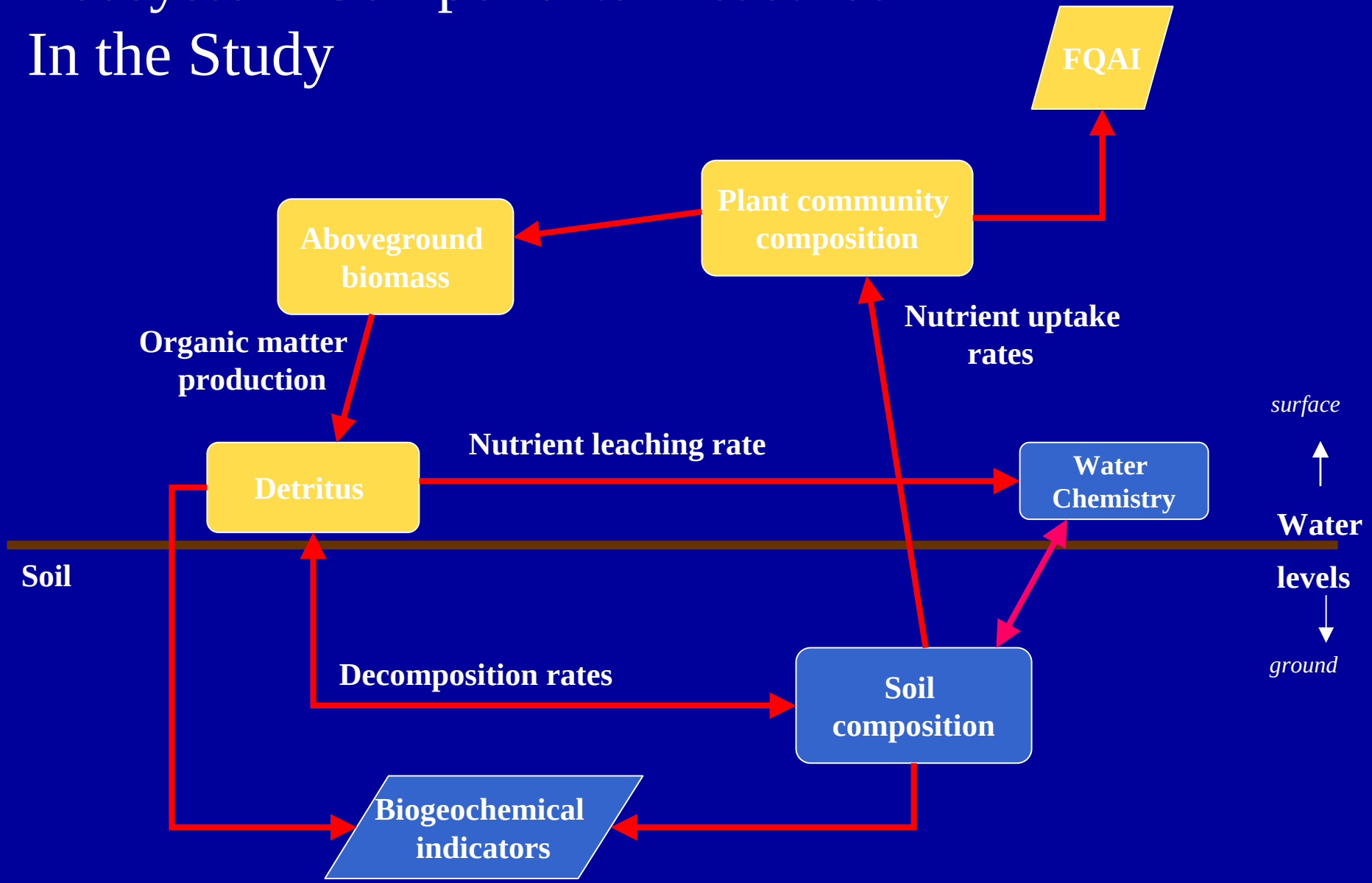
Site Selection

- Natural wetlands chosen over a range of condition
- Mitigation wetlands chosen over a range of ages (0-10 years)

Natural Wetland

Restored Wetland

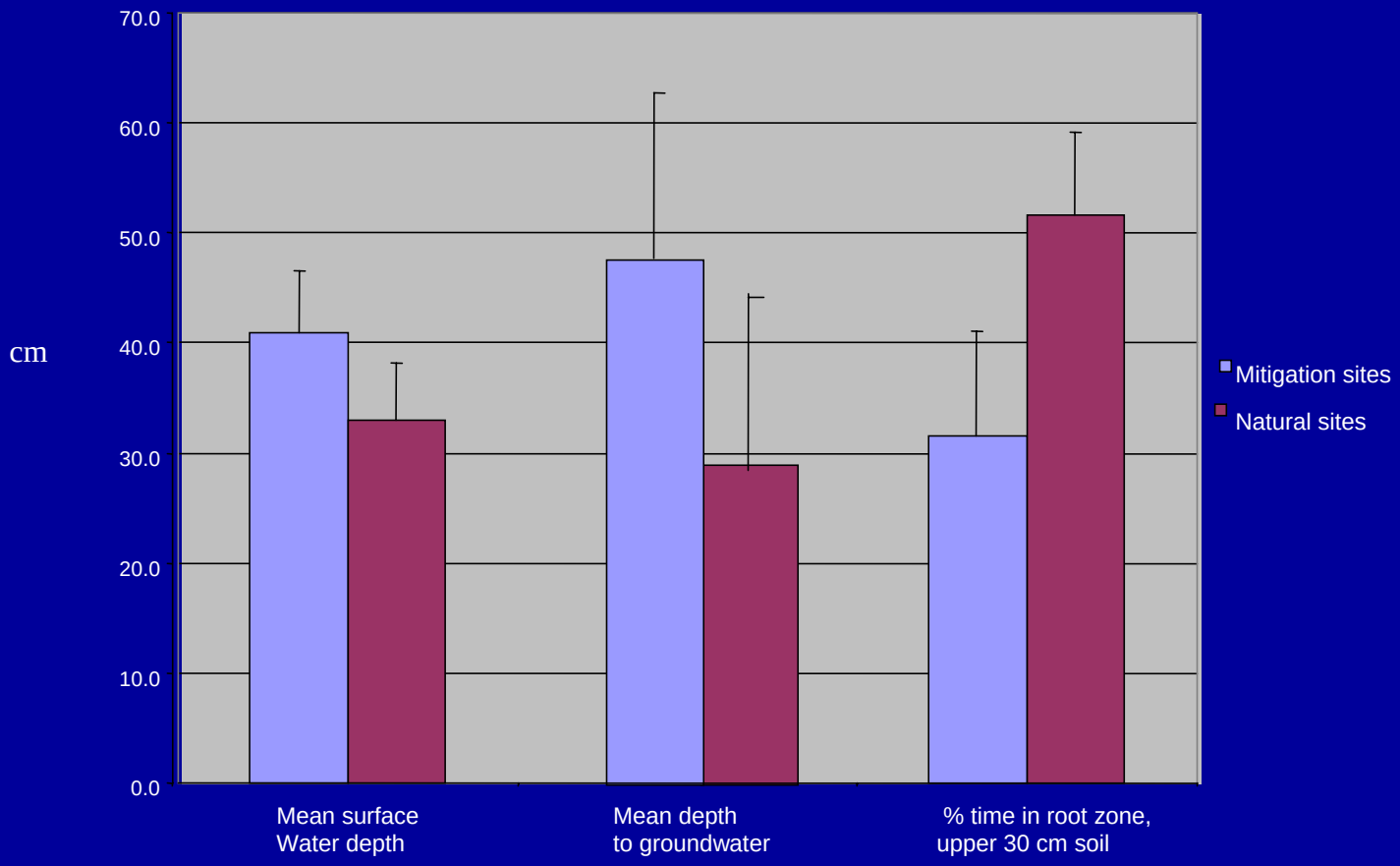
Ecosystem Components Measured In the Study



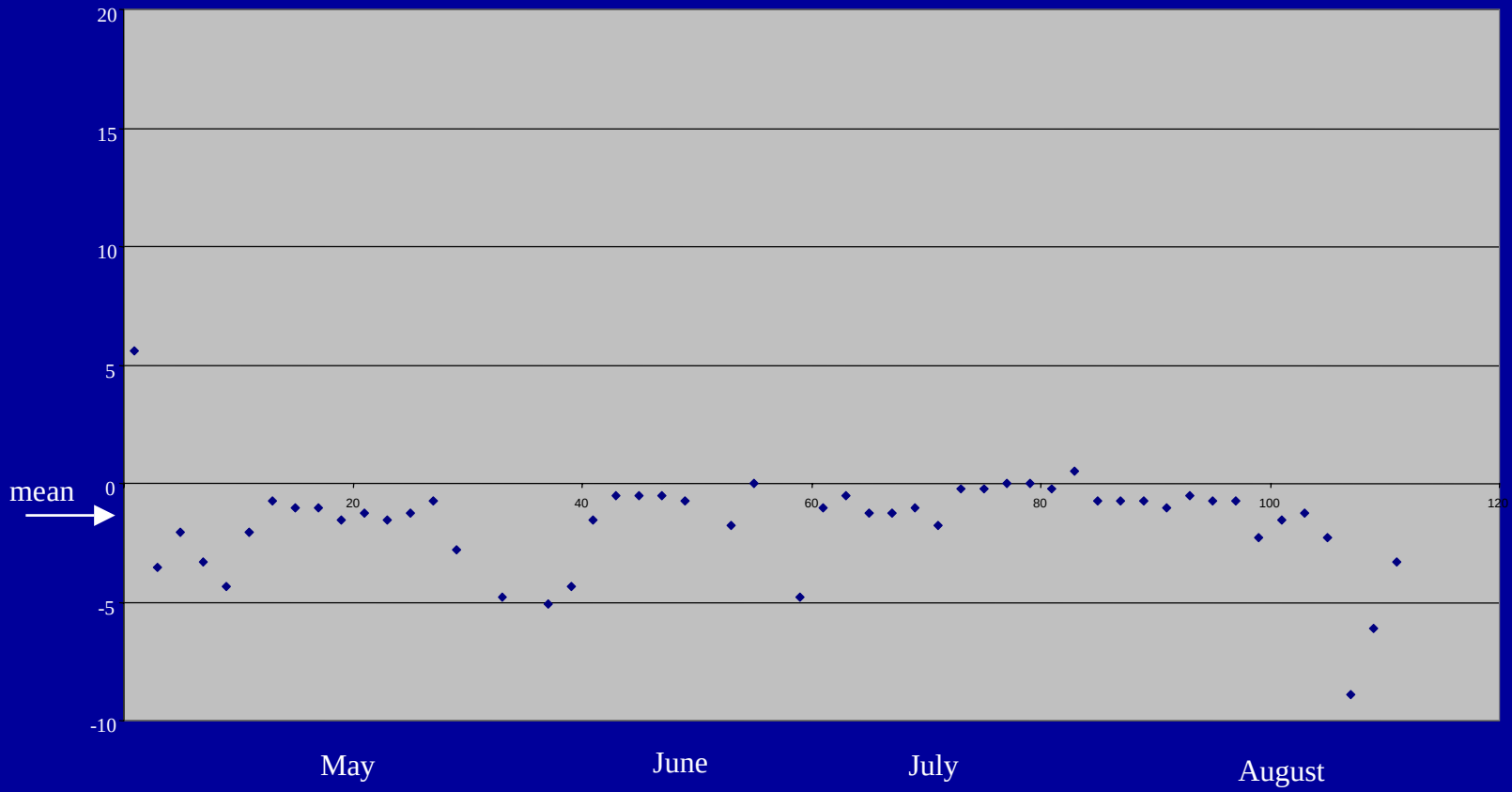
Core Elements of Wetland Structure and Function were Evaluated

- Hydrology
  - Water levels
  - Water chemistry
- Soil characteristics
- Vegetation community characteristics
- Biogeochemistry
- Plant-based biological indicators

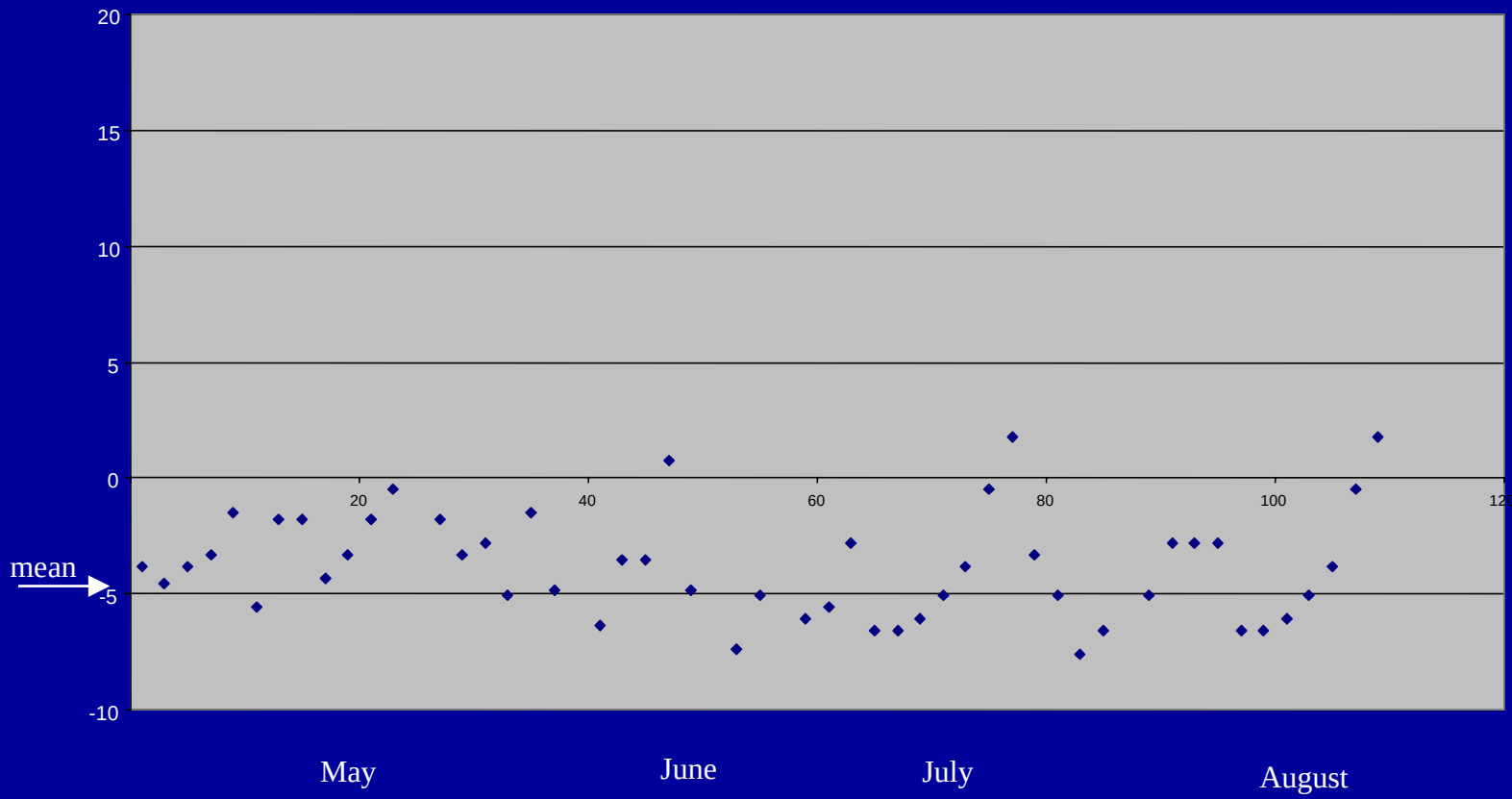
Hydrological characteristics of natural and created wetlands



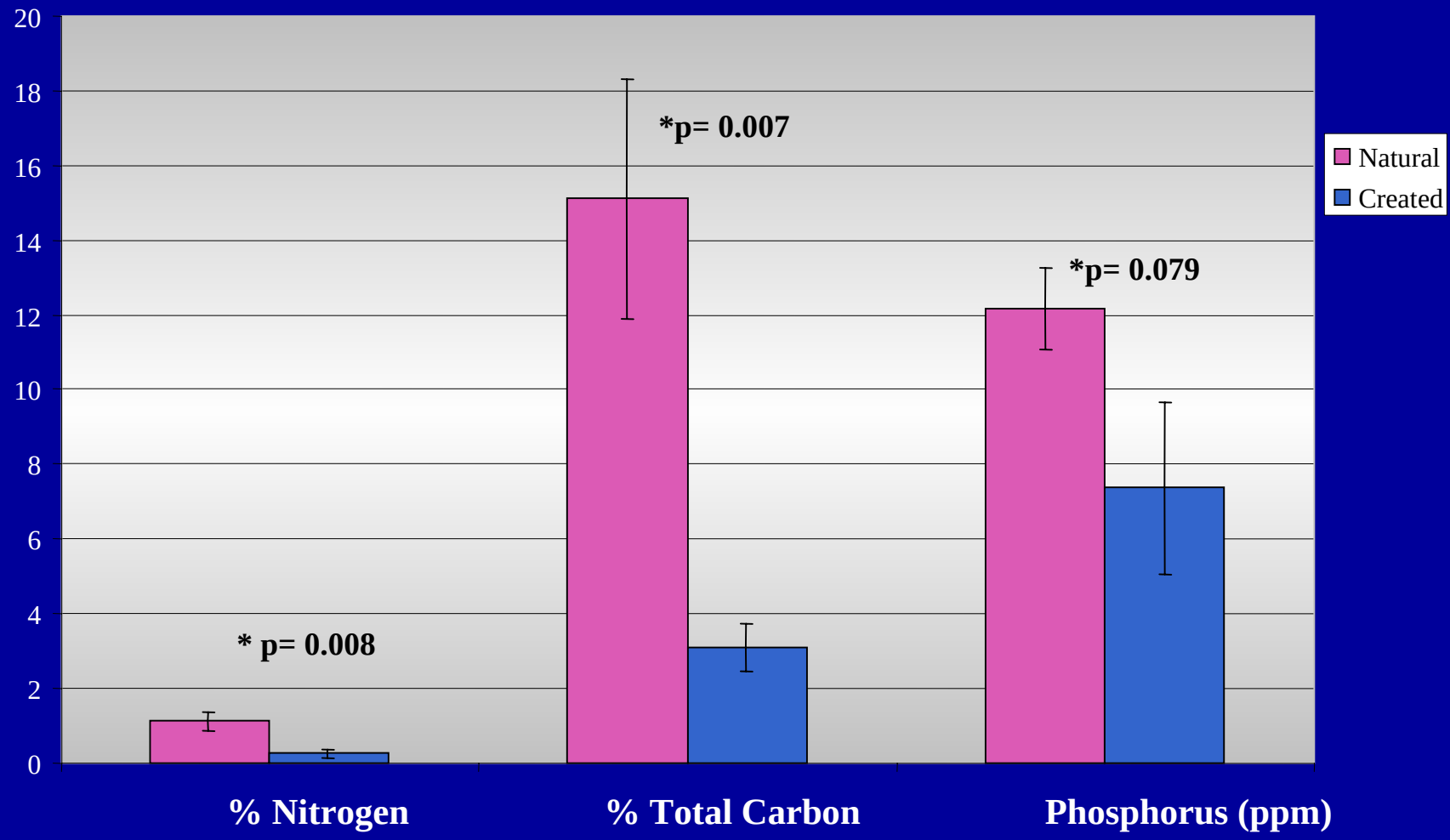
Created system: daily change in ground water levels (evapotranspiration)



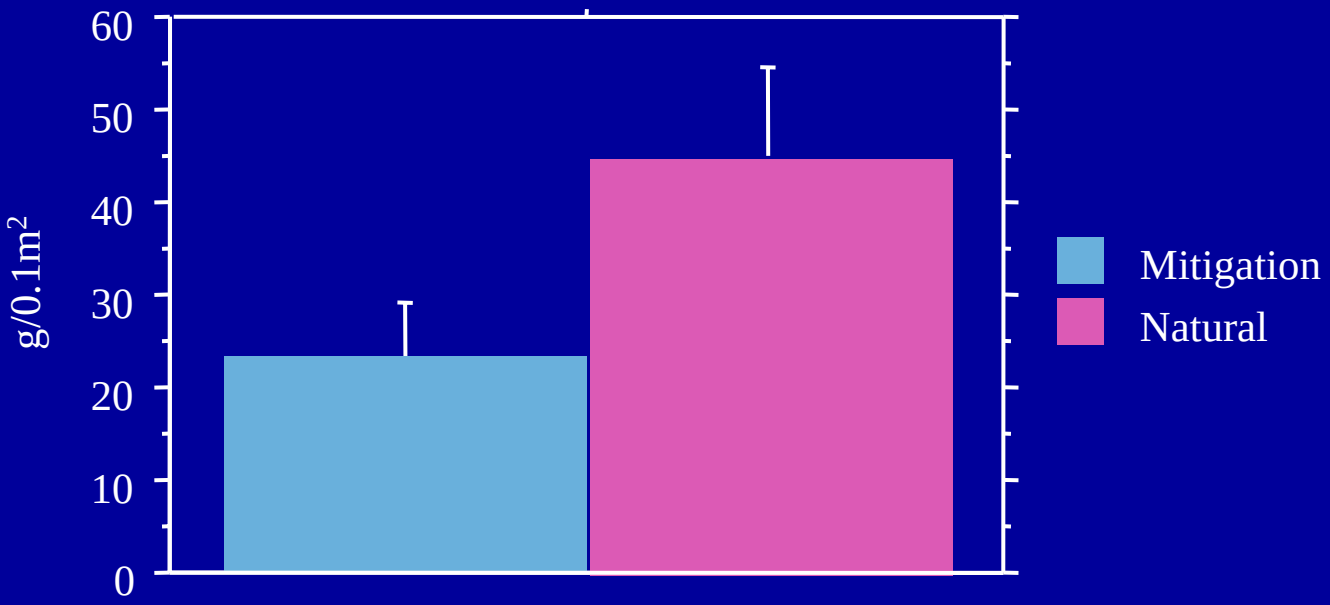
Natural system: daily change in ground water levels (evapotranspiration)



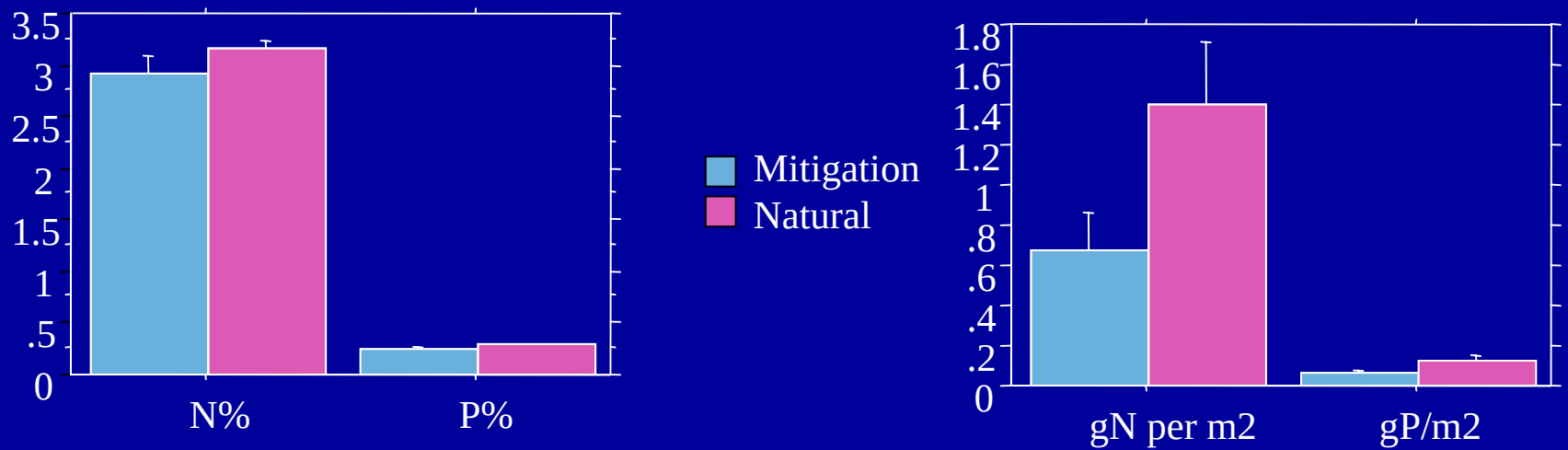
Soil nutrient levels in natural and mitigation wetlands



Mean biomass accumulation by wetland type (g/0.1m^2; n = 10)

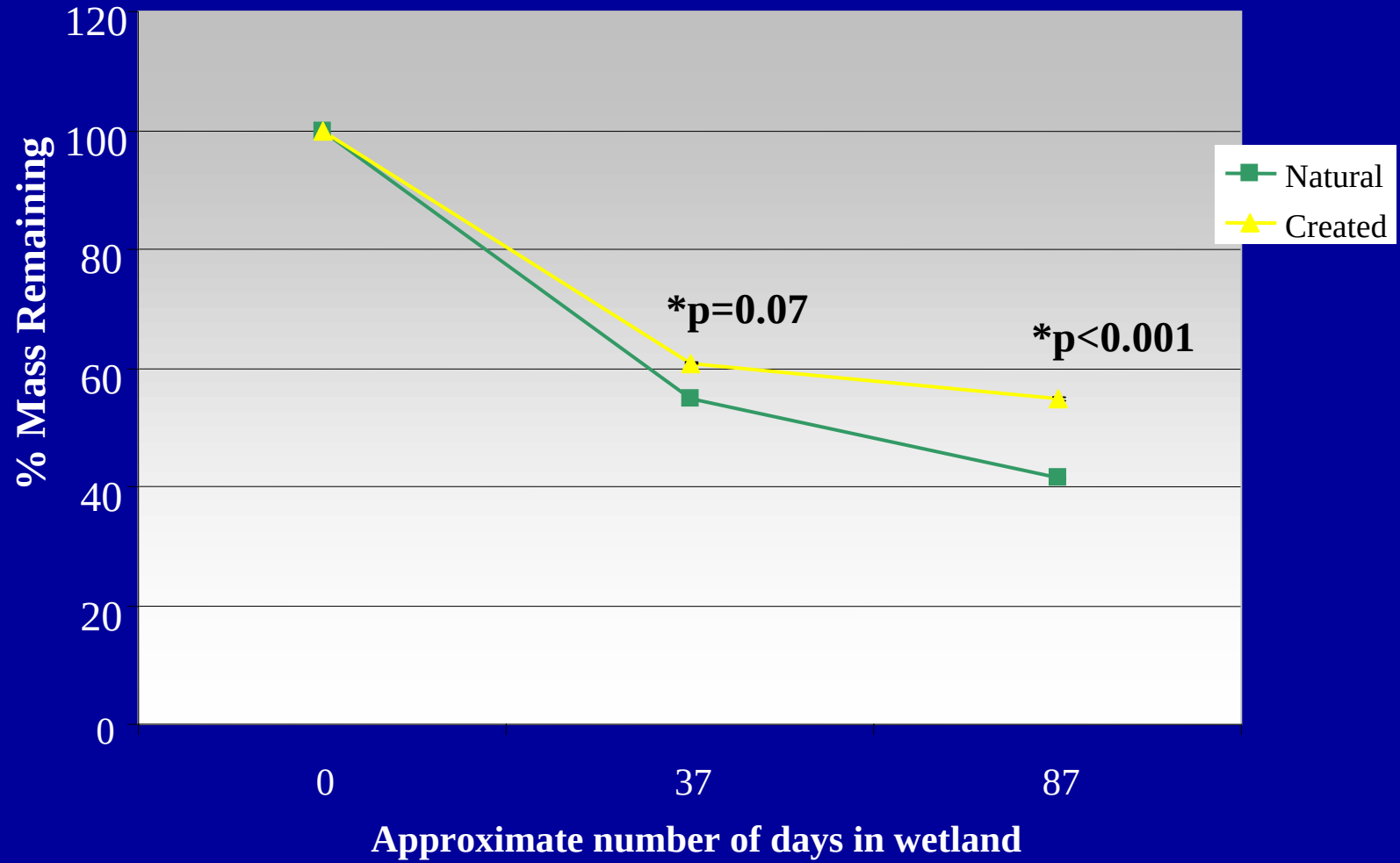


Aboveground plant tissue nutrient accumulation differs by wetland type

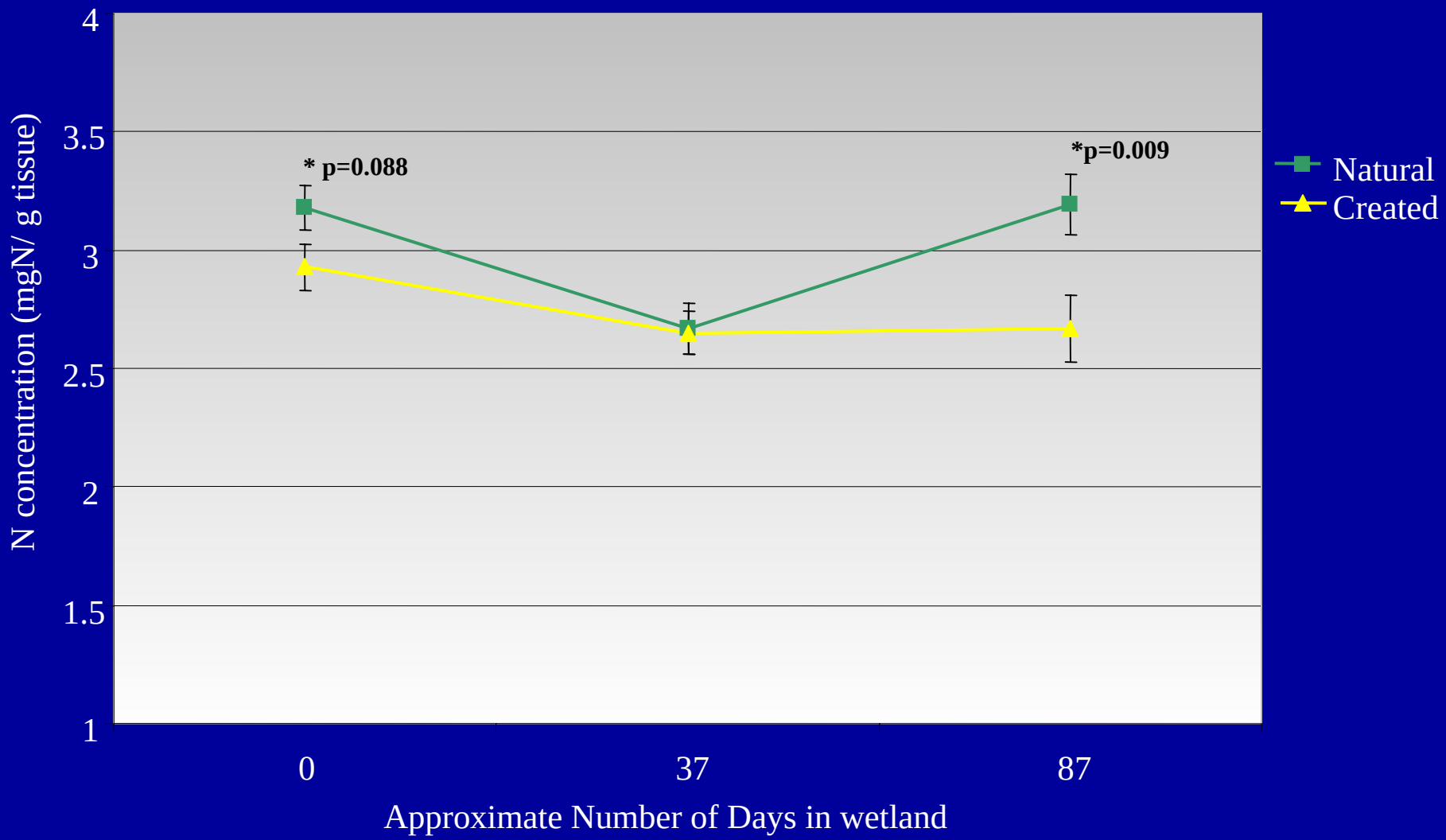


Litterbags incubating in wetland

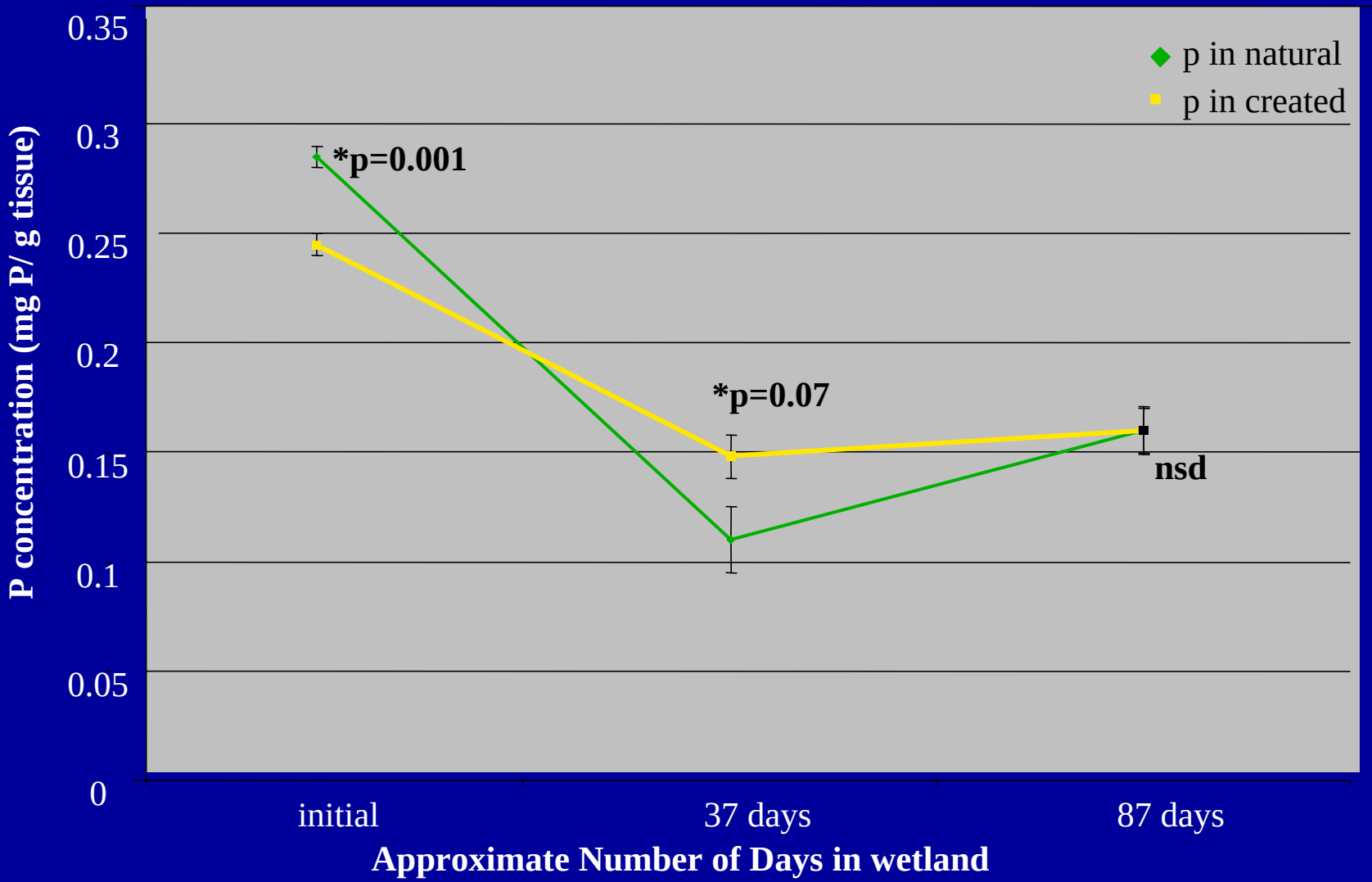
Wetland function: Plant decomposition



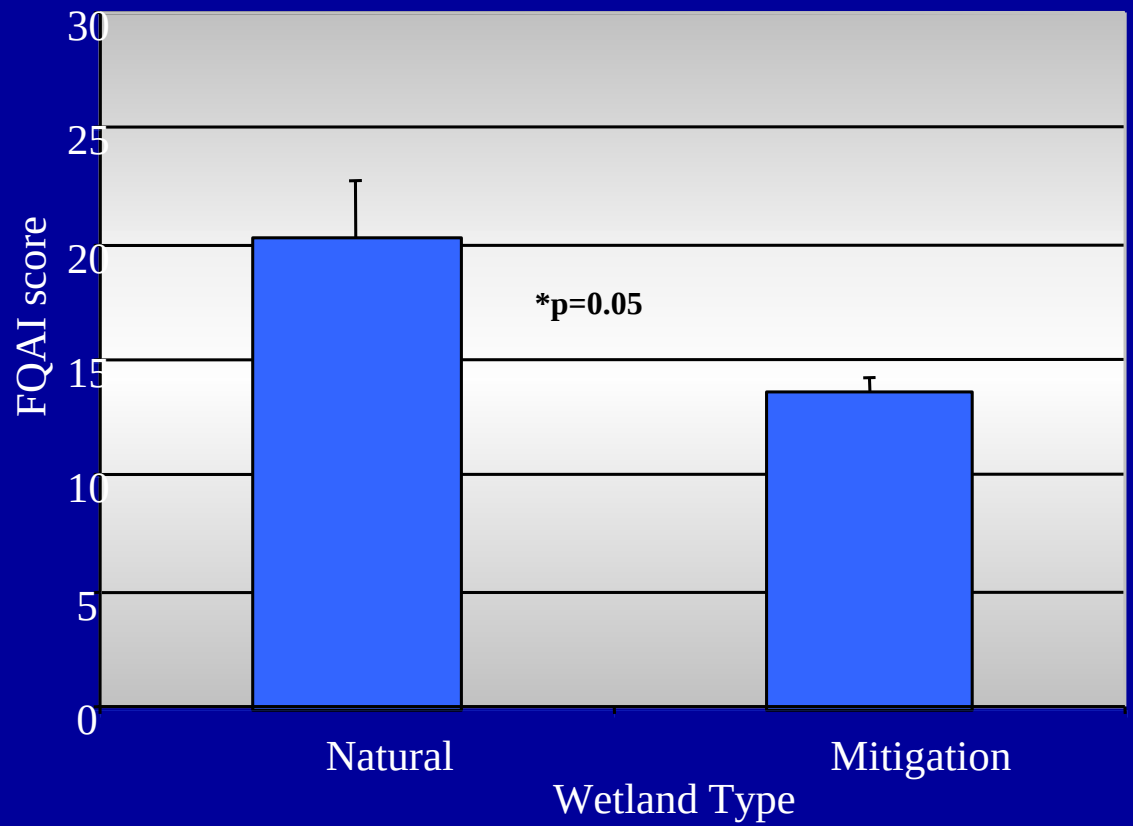
Nutrient flux in decomposing litter: Nitrogen



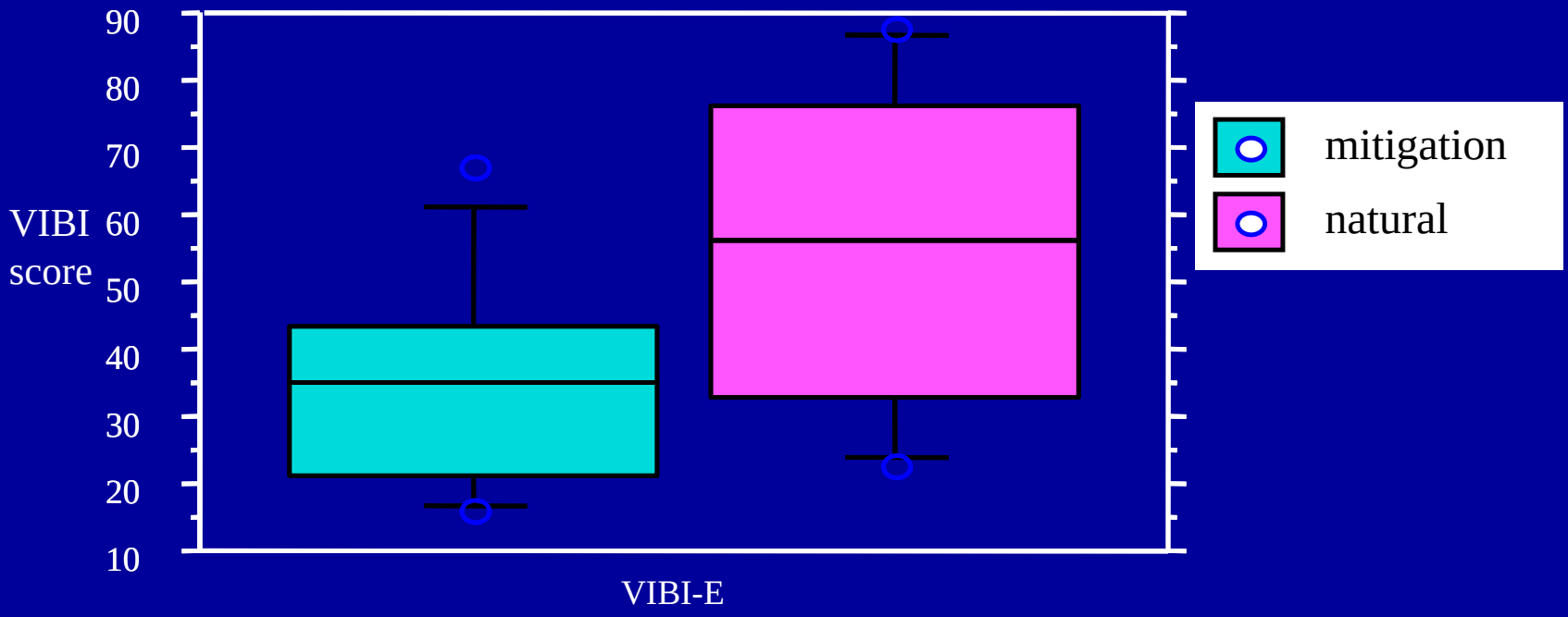
Nutrient flux in decomposing litter: Phosphorus



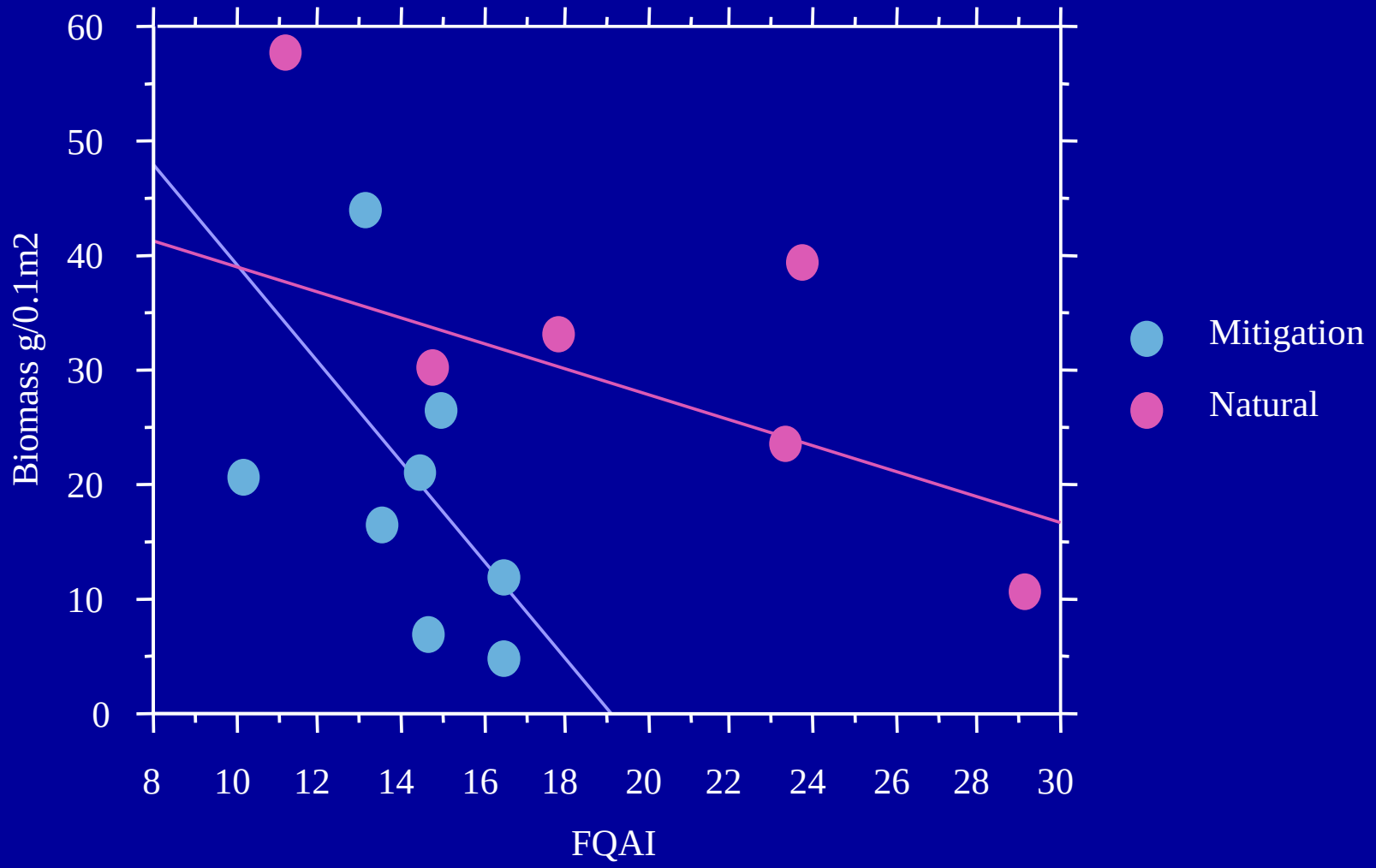
Using biological indicators to assess mitigation success: the FQAI



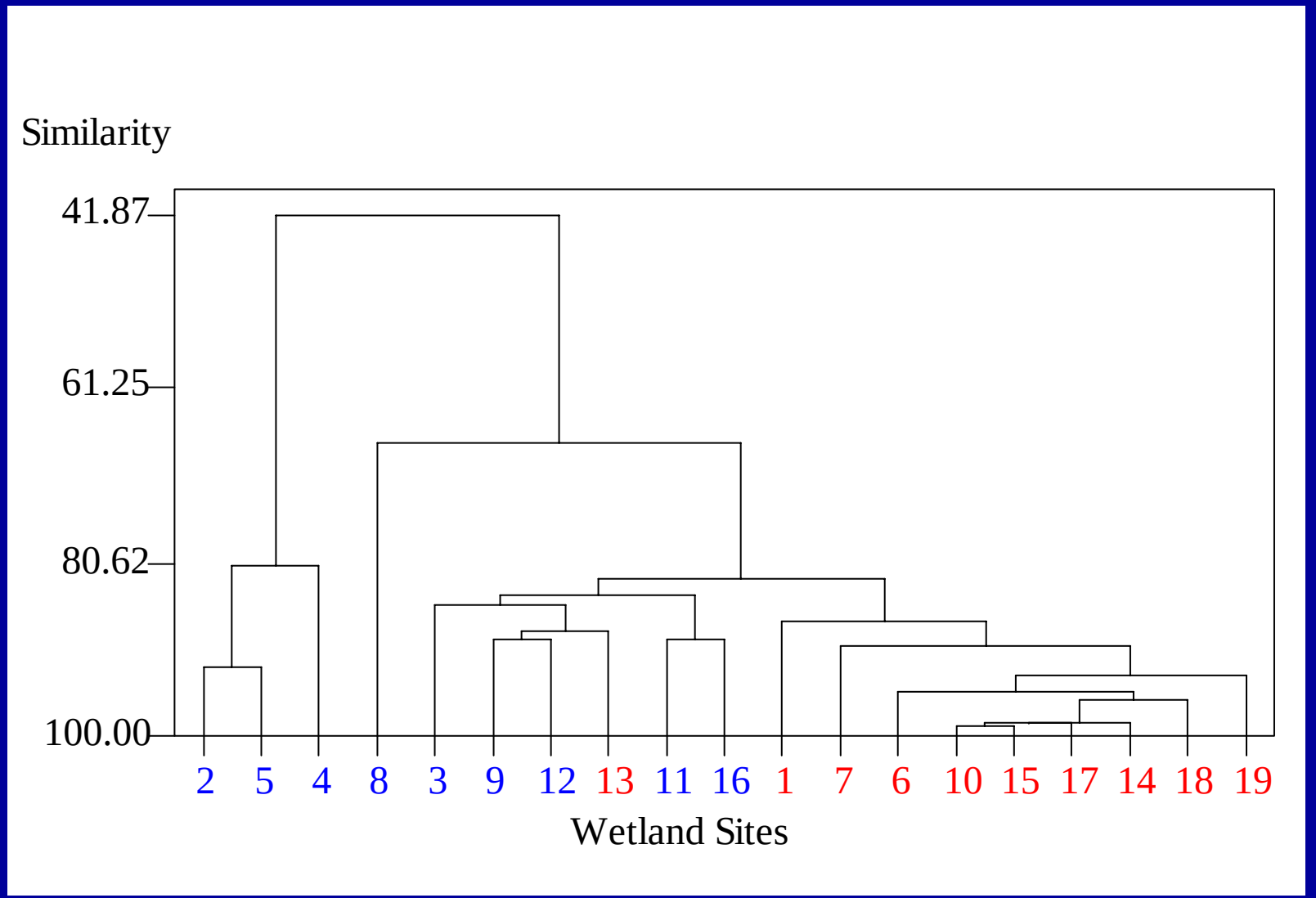
Using biological indicators to assess mitigation success: the VIBI



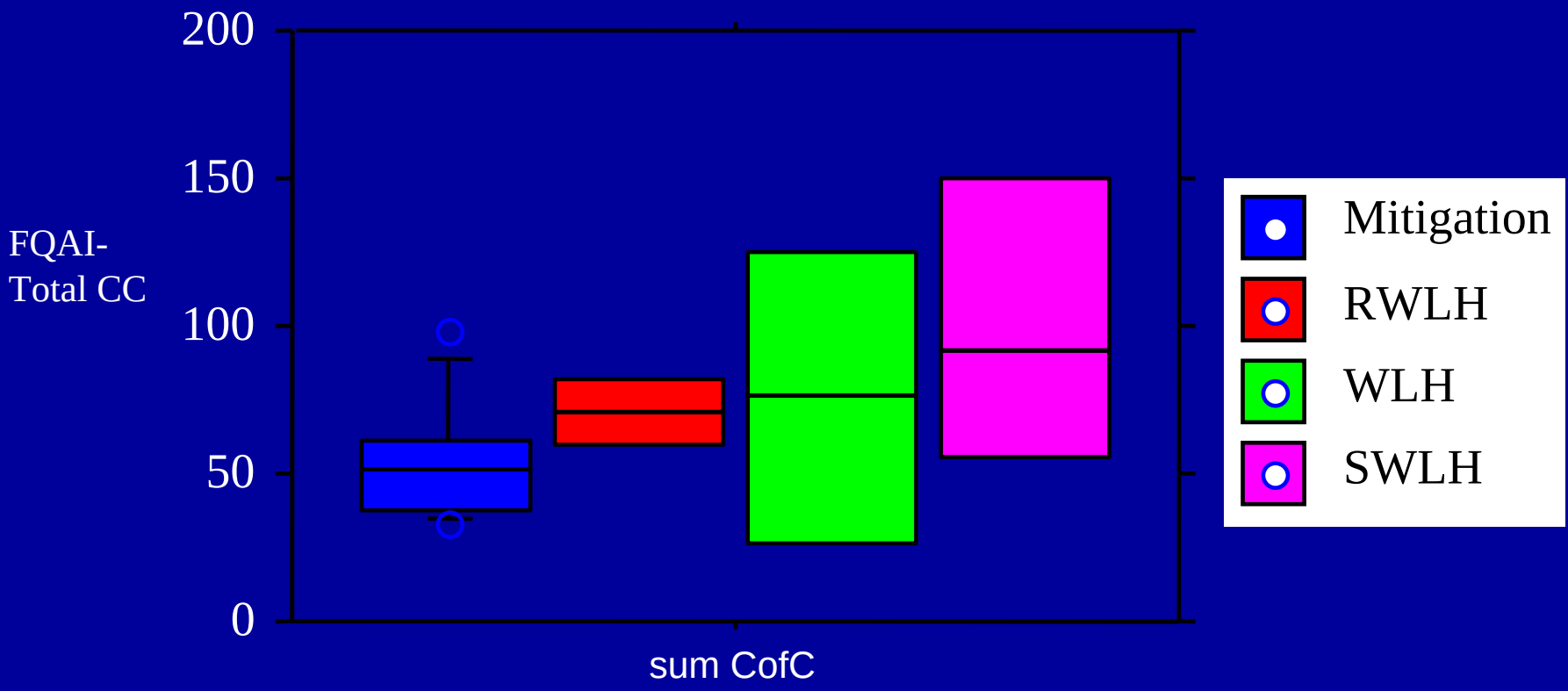
Relationship between FQAI scores and biomass production



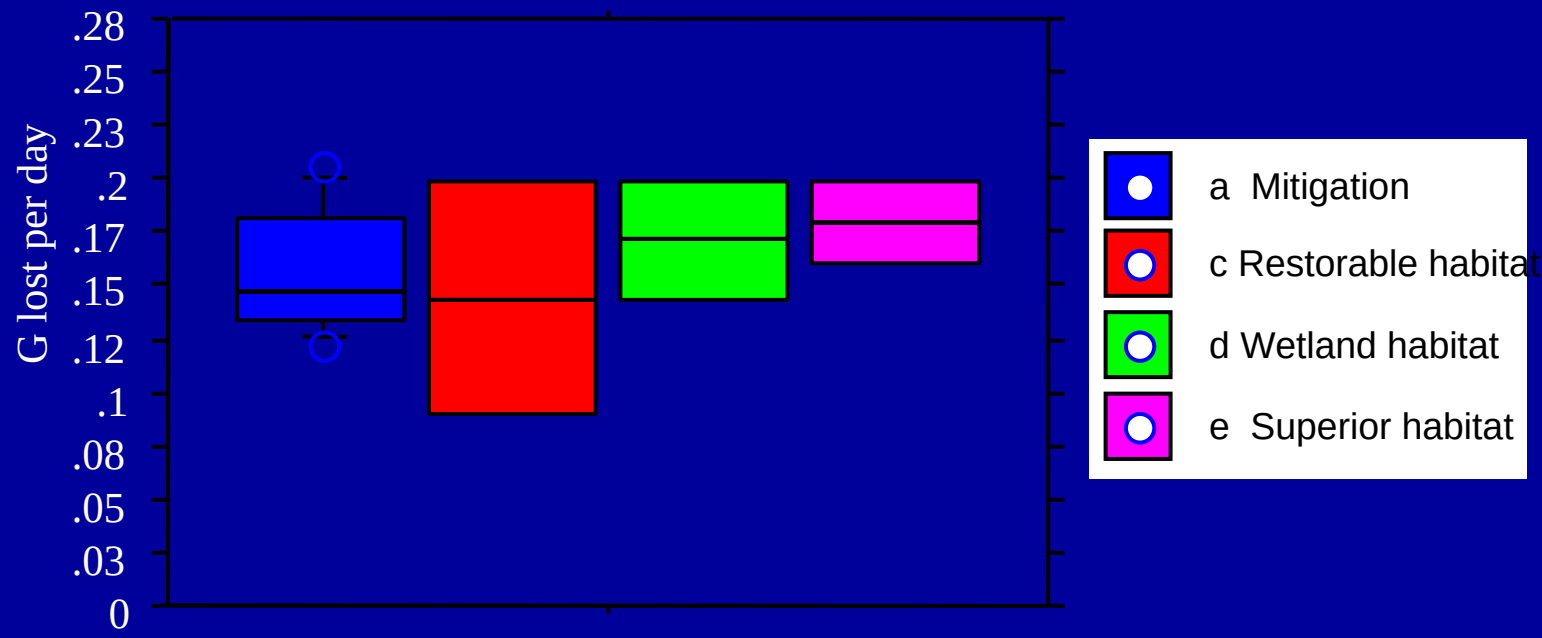
A Comparison of the *Similarity* between Natural and Created Wetlands



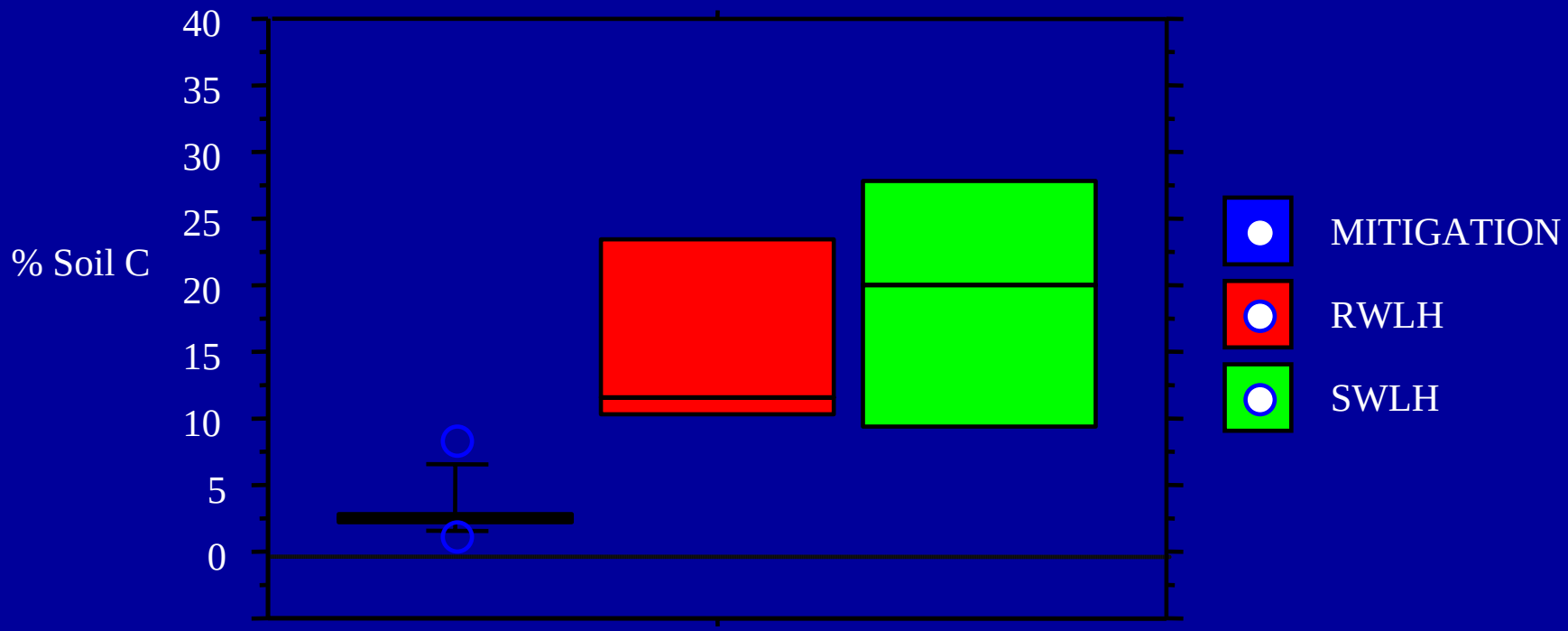
Variation in FQAI-CC values by Aquatic Life Use category



Variation in decomposition rates by Aquatic Life Use category

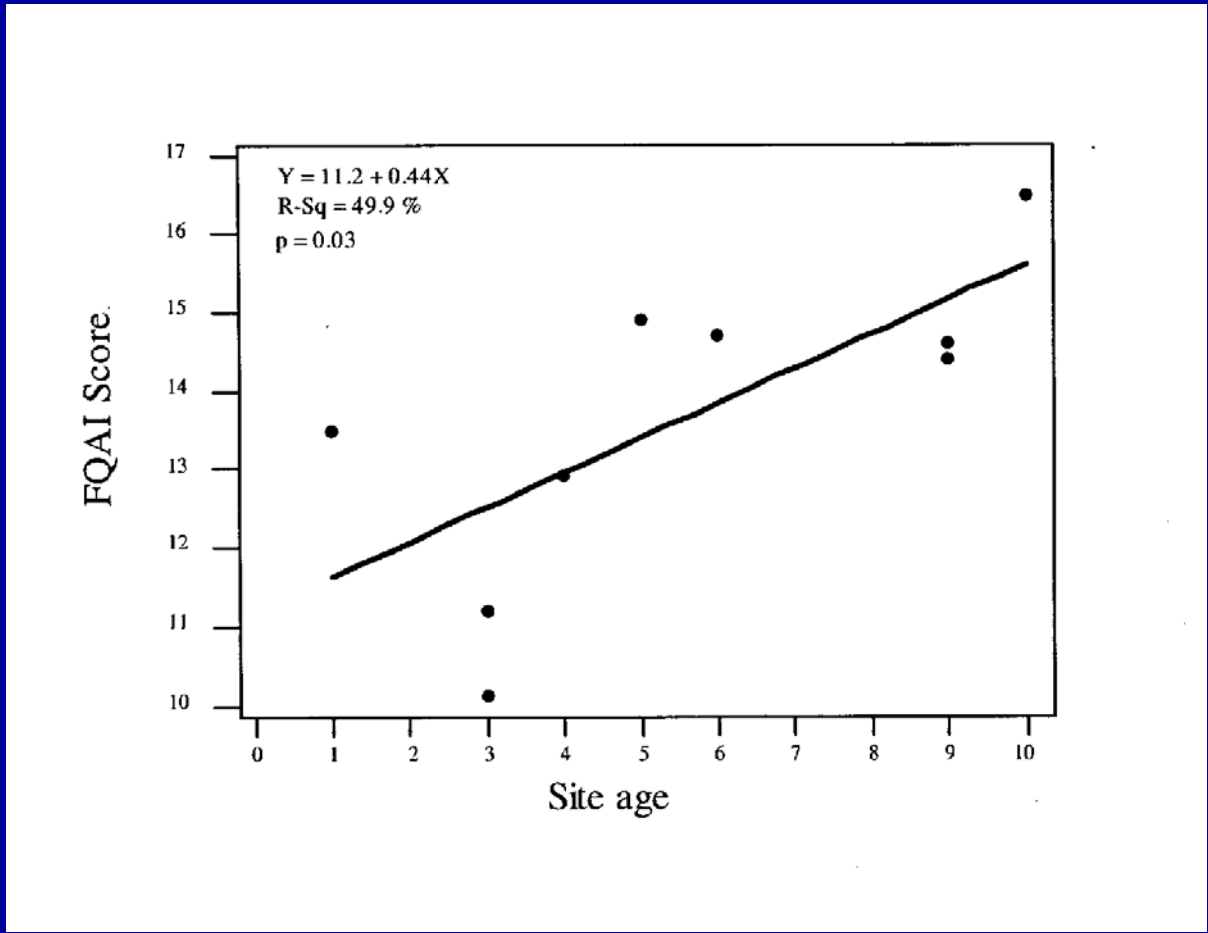


Soil carbon content by Aquatic Life Use category



Note: insufficient data for "Wetland Habitat" category

Age of restoration project versus FQAI score



Conclusions

- Essentially all measures of biological integrity were lower at mitigation sites
- Plant species diversity higher in natural wetlands
- Biomass production and nutrient retention higher in natural sites
- Decomposition rates higher in natural wetlands
- Nutrient limitation in mitigation wetlands appears to be slowing success