SOIL ORGANIC MATTER CYCLING IN EVERGLADES PEATLANDS

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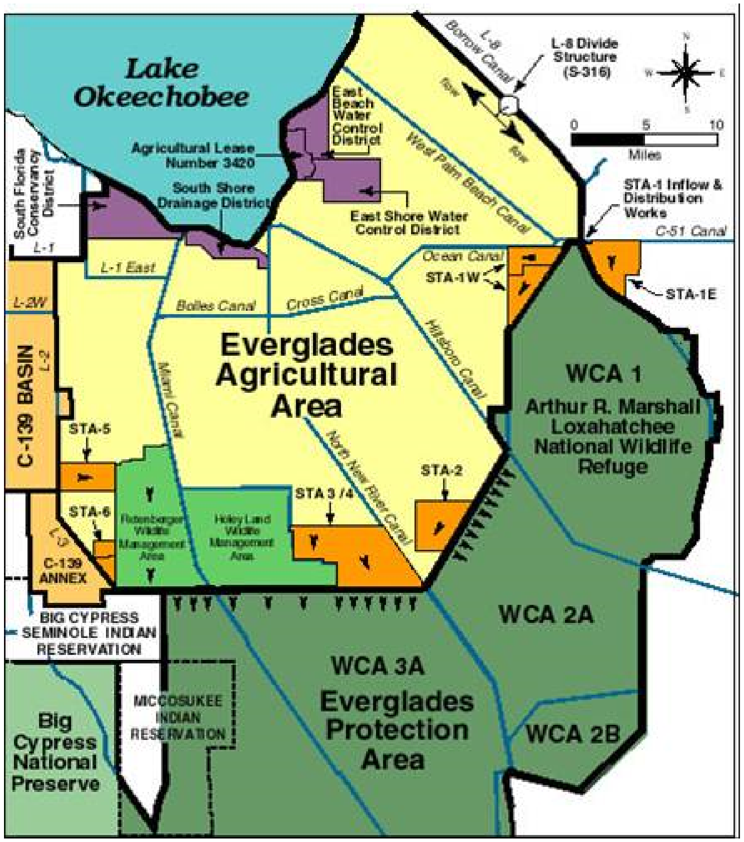
Contrasting the EAA and Everglades Wetlands

- Everglades Agricultural Area
  - Drained conditions
  - Aerobic decomposition
    - CO_2 endproduct
  - Soil and nutrient loss

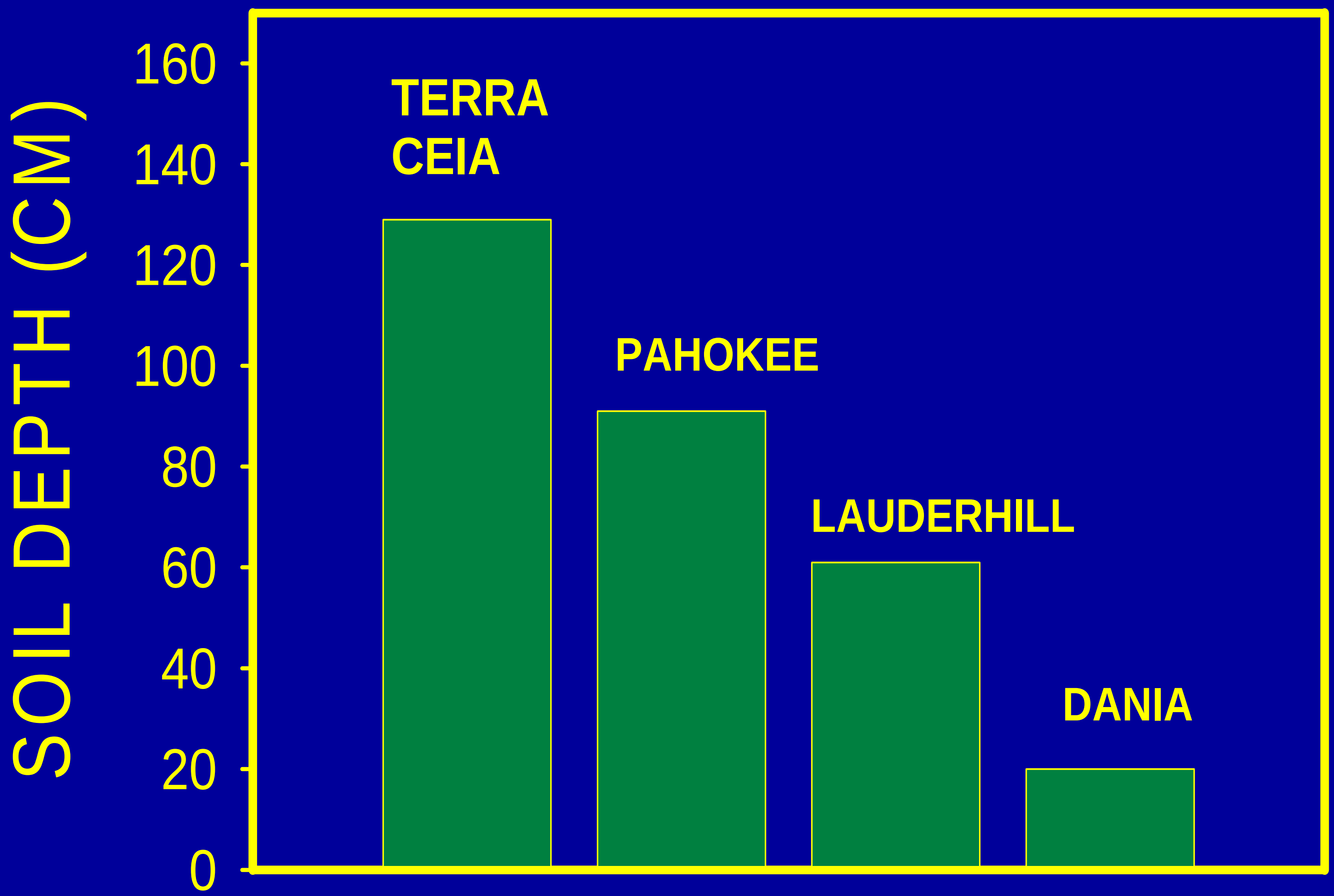
- Everglades wetlands
  - Flooded conditions
  - Anaerobic decomposition
    - CO_2, CH_4, N_2O endproduct
  - Nutrient inputs
  - Soil accretion



Soils of the Everglades Agricultural Area

- Originated under sawgrass prairie
- Organic (>80% organic matter by weight)
- Naturally P limited
- Oxidation of the organic soil resulted in historical loss of 3 cm/yr and current loss of 1 cm/year
  - related to water table depth
  - calcification of surface soil, elevated pH
  - enhances nutrient retention in forms unavailable to crops
  - water management increasingly critical
  - may limit land-use options in the future

CLASSIFICATION OF MUCK SOILS RELATIVE TO THICKNESS OF ORGANIC LAYERS OVER BEDROCK



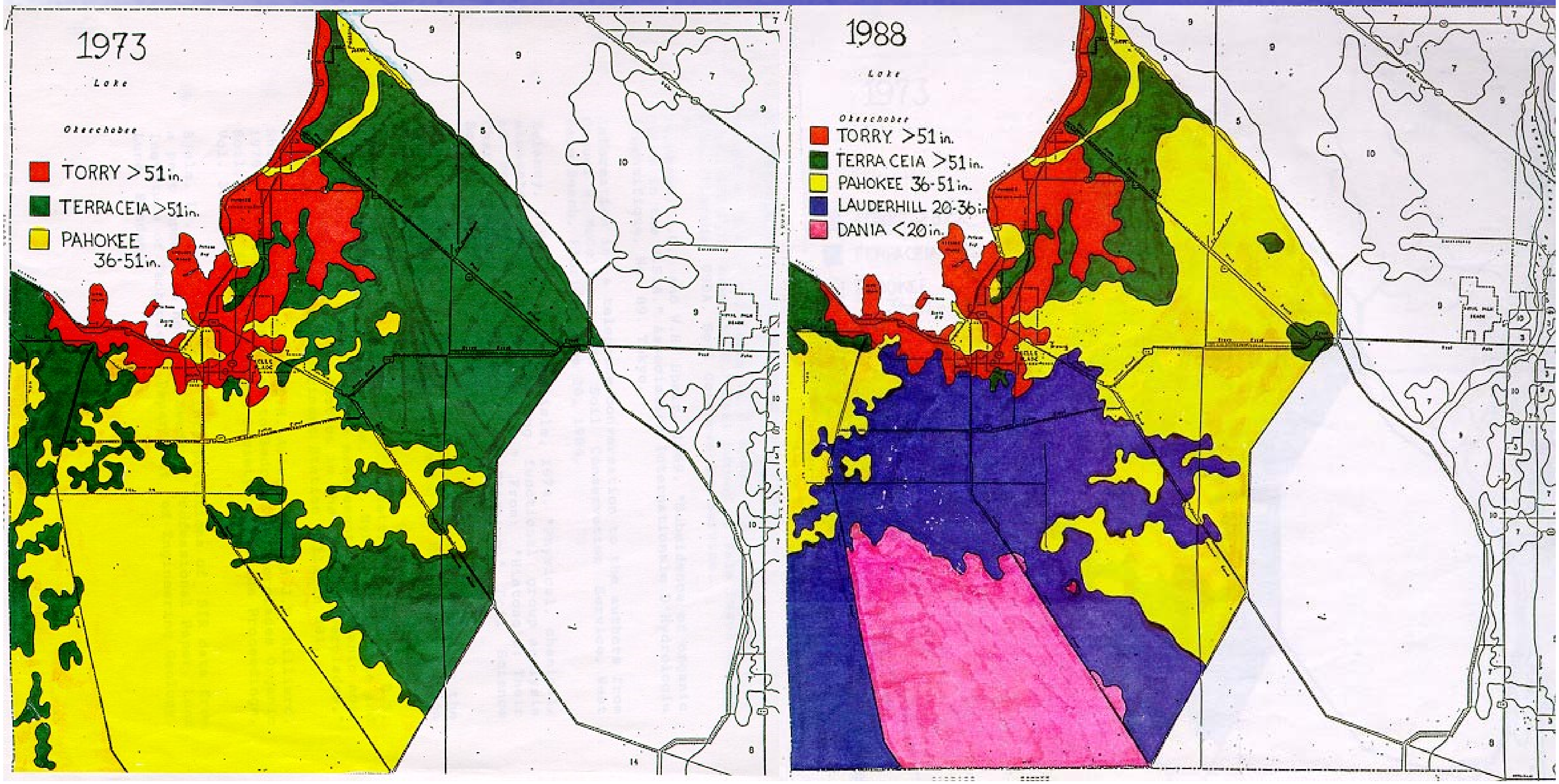
TORRY

TERRA CEIA

PAHOKEE

LAUDERHILL

DANIA

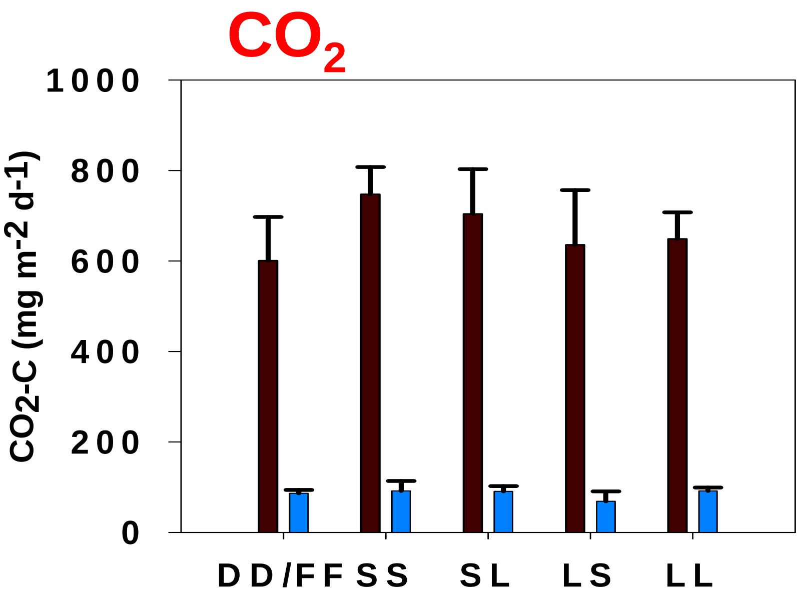


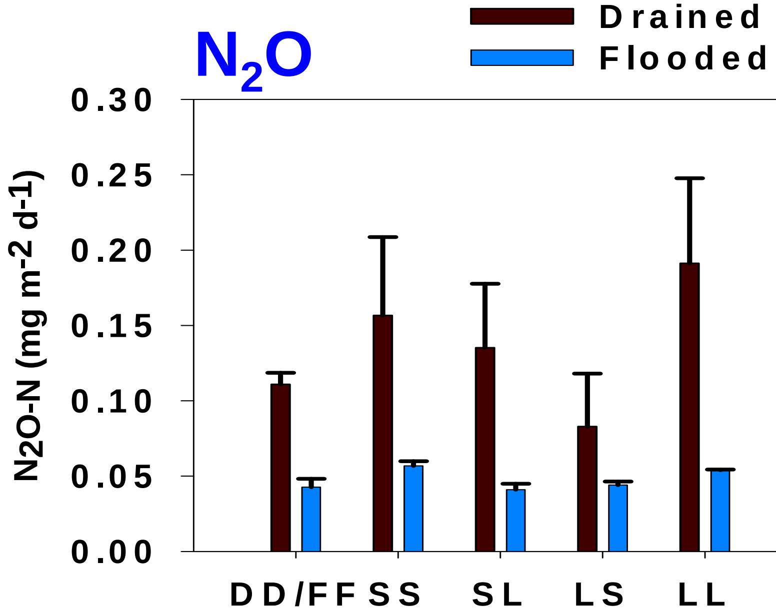
GREENHOUSE GAS EMISSIONS

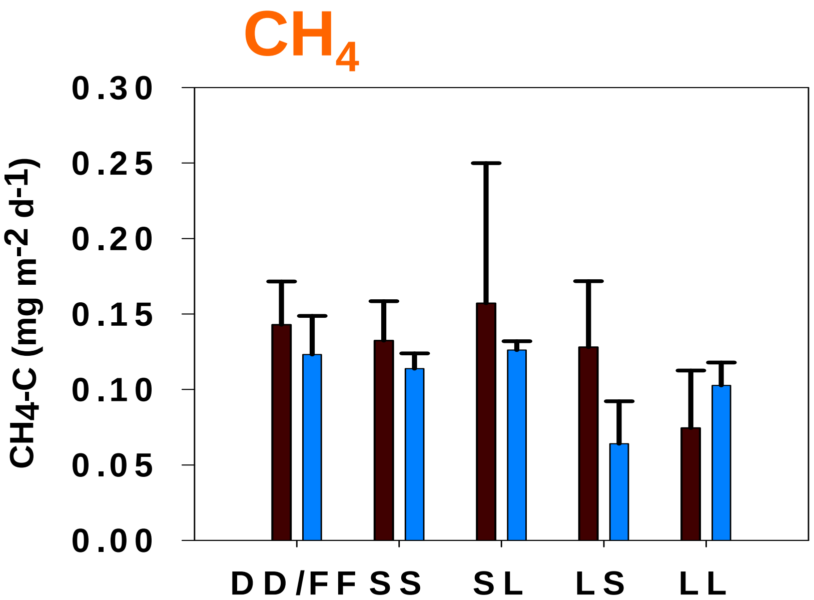
- Preflooding 2 weeks
- Treatment (24 weeks)
  - DD: Continuously drained
  - FF: Continuously flooded
  - SS: S draining + S flooding 6 cycles
  - SL: S draining + L flooding 4 cycles
  - LS: L draining + S flooding 4 cycles
  - LL: L draining + L flooding 3 cycles
- Gas flux
  - Over 1 h
  - Twice a week
  - Extra measurements flooding/draining events

Duration:
S: Short-term (2 weeks)
L: Long-term (4 weeks)

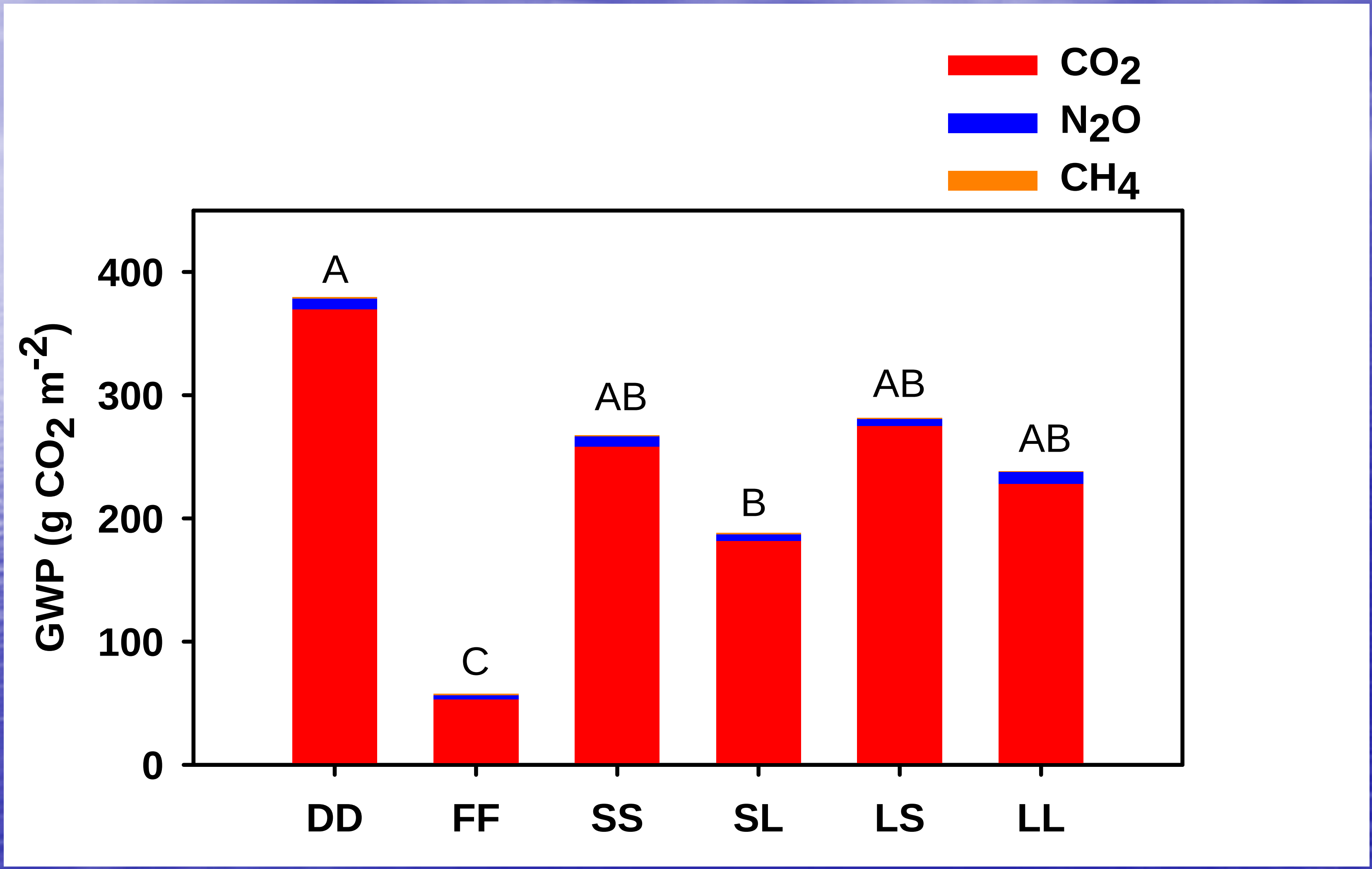
Average Daily Gas Fluxes





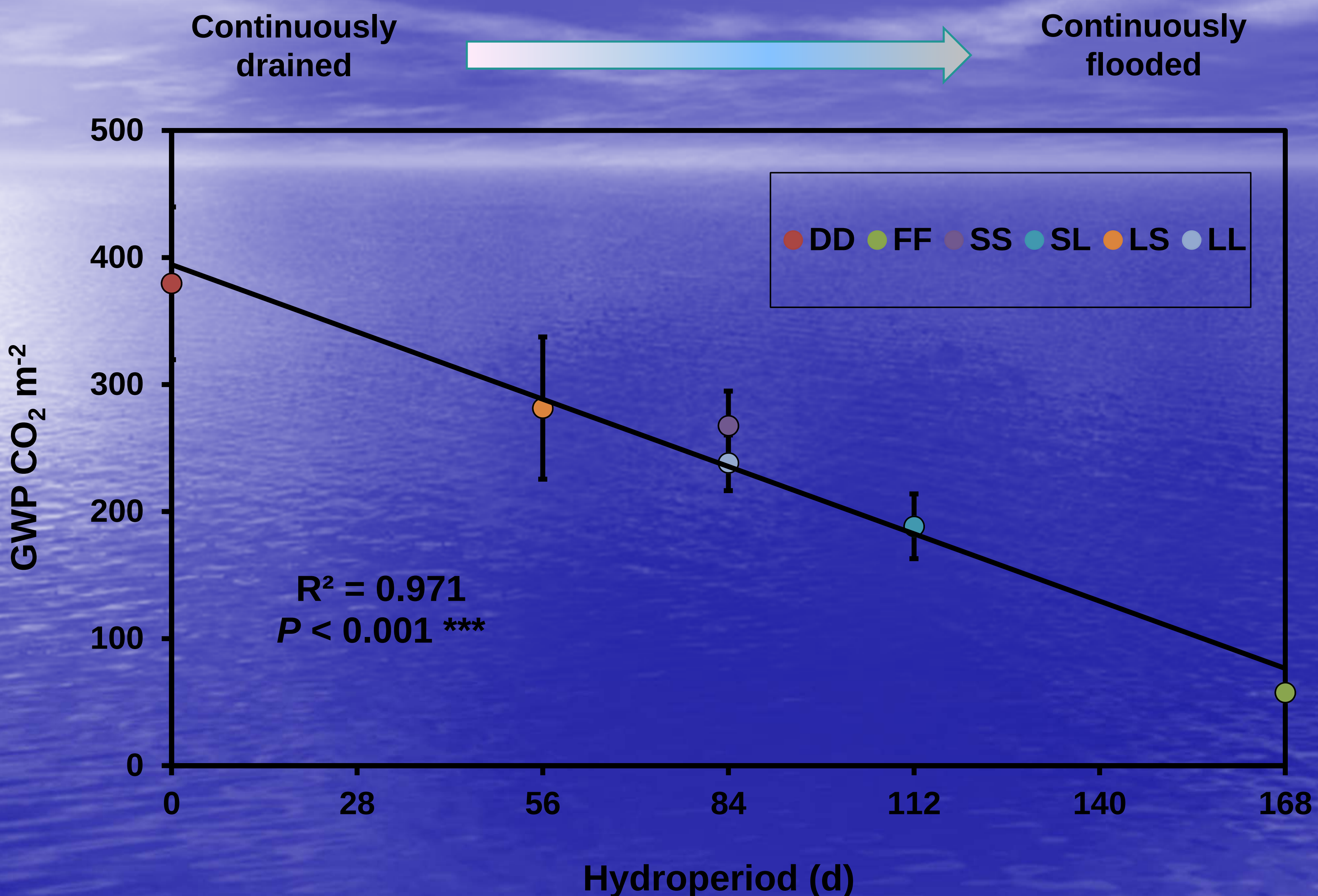


Global Warming Potential



CO_2 : 92-98% N_2O : 2-6% CH_4 : < 2%

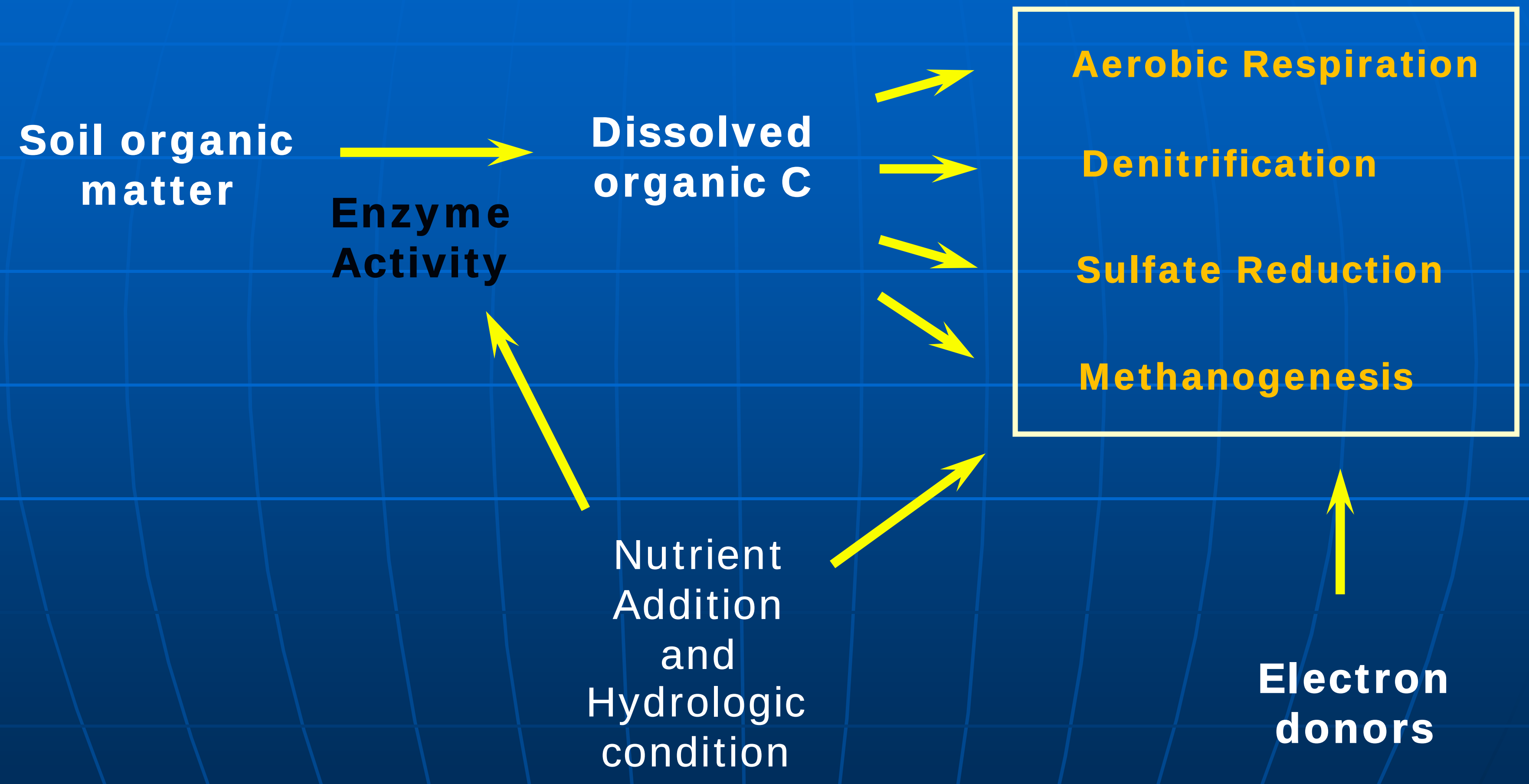
Global Warming Potential



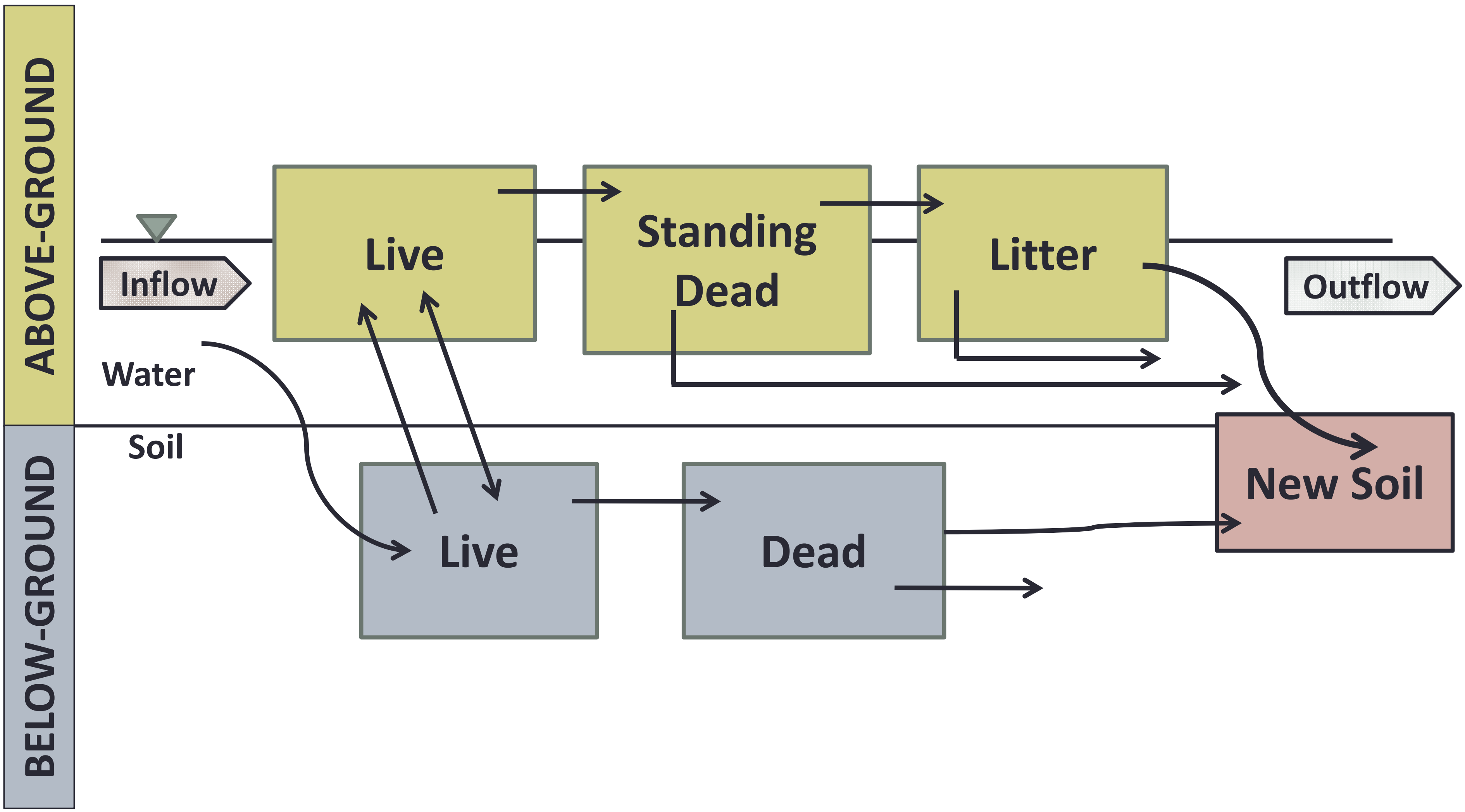
Managing Soil Organic Matter in the EAA

- Soil loss through oxidation
- Maintenance of high water tables retard decomposition
- Nutrient dynamics/fertilization
  - pH increases
- Seasonal flooding
  - New cropping systems/crops
- Organic matter addition
  - Compost/manure/mill mud
  - Green cane harvesting

Soil Organic Matter Decomposition in Everglades Wetlands

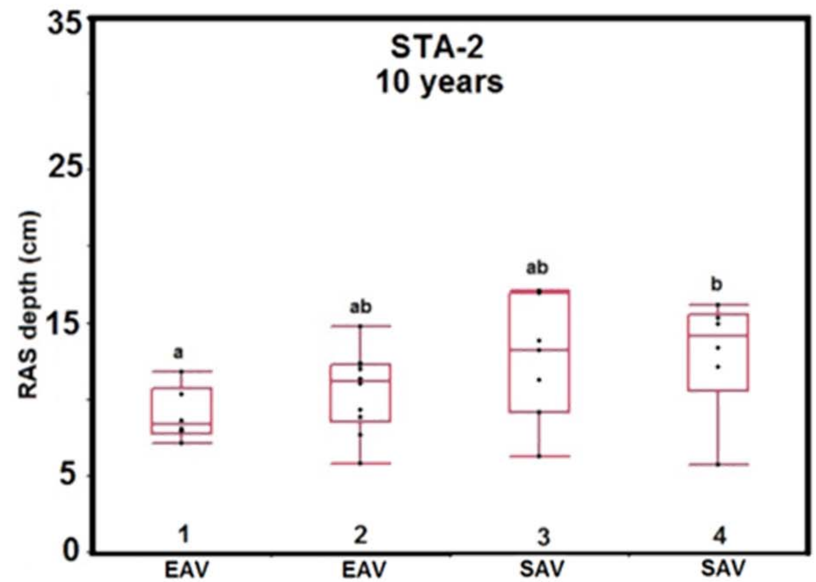


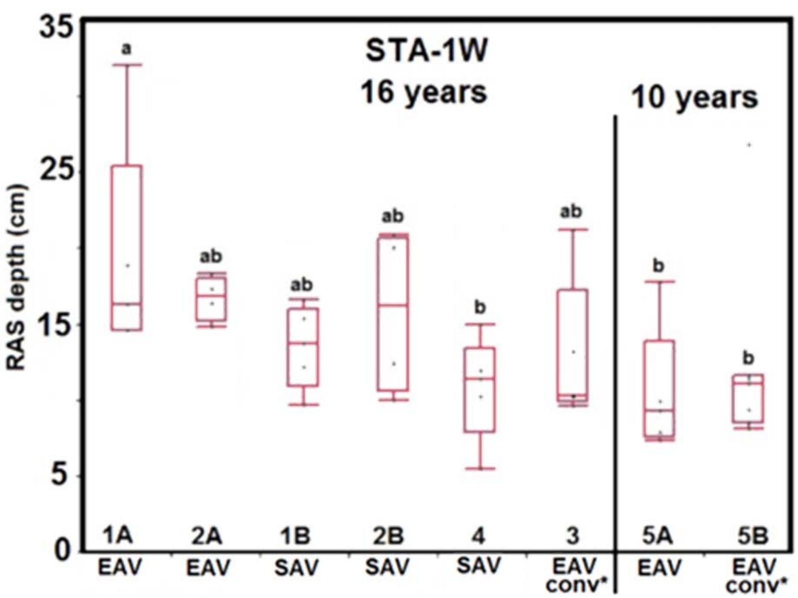
SOIL ACCRETION PATHWAY

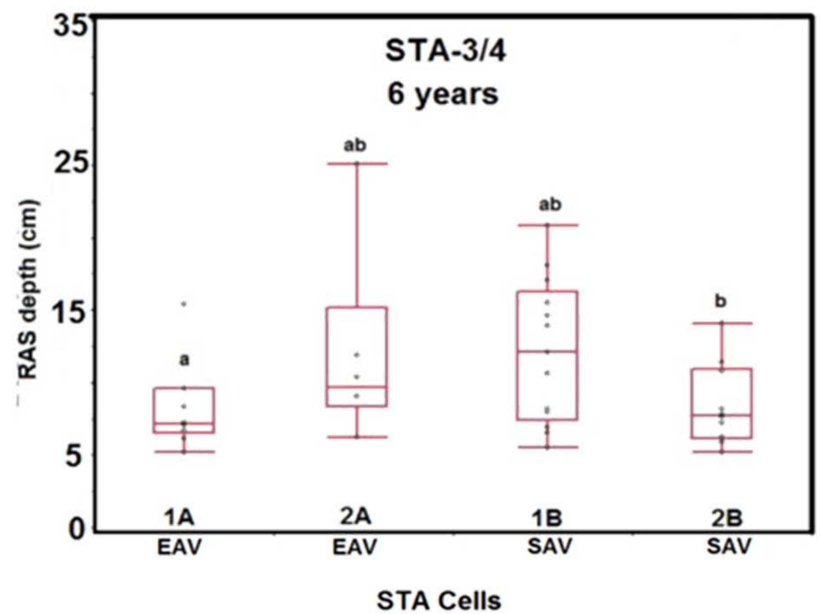


RECENTLY ACCRETED SOIL DEPTH DETERMINATION

- Mean RAS depths in STA cells with variable vegetation
- Avg. RAS depth for STA-1W, STA-2 and STA-3/4 was 15 ± 5, 11 ± 3 and 10 ± 4 cm

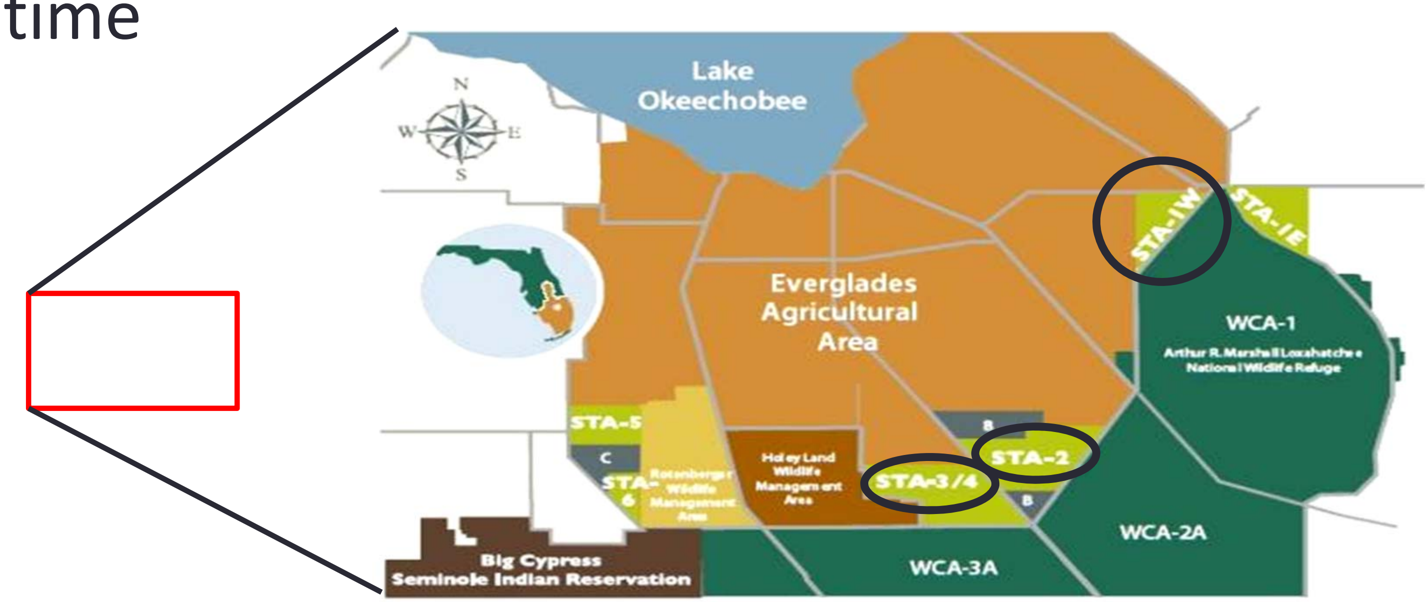




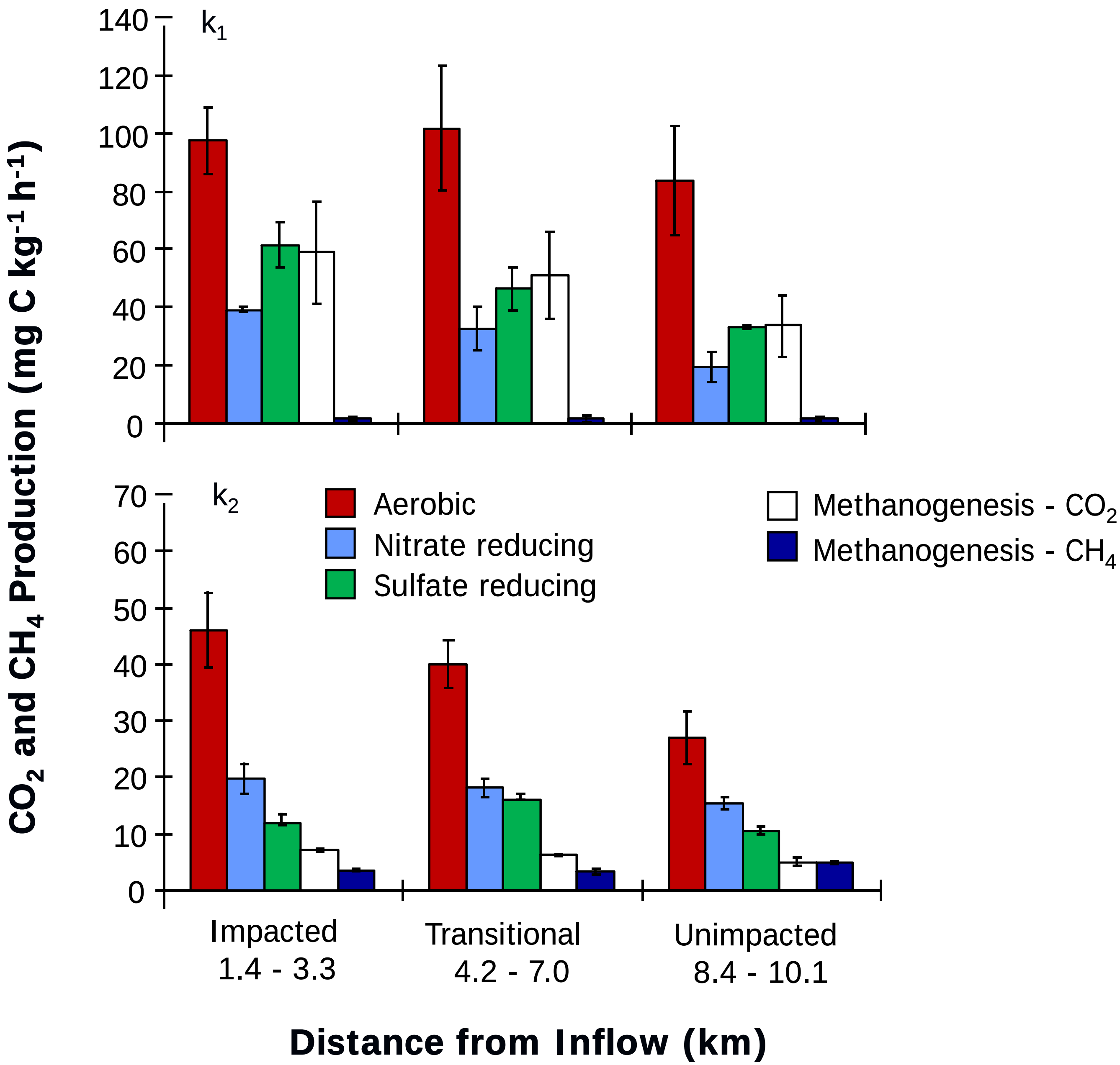


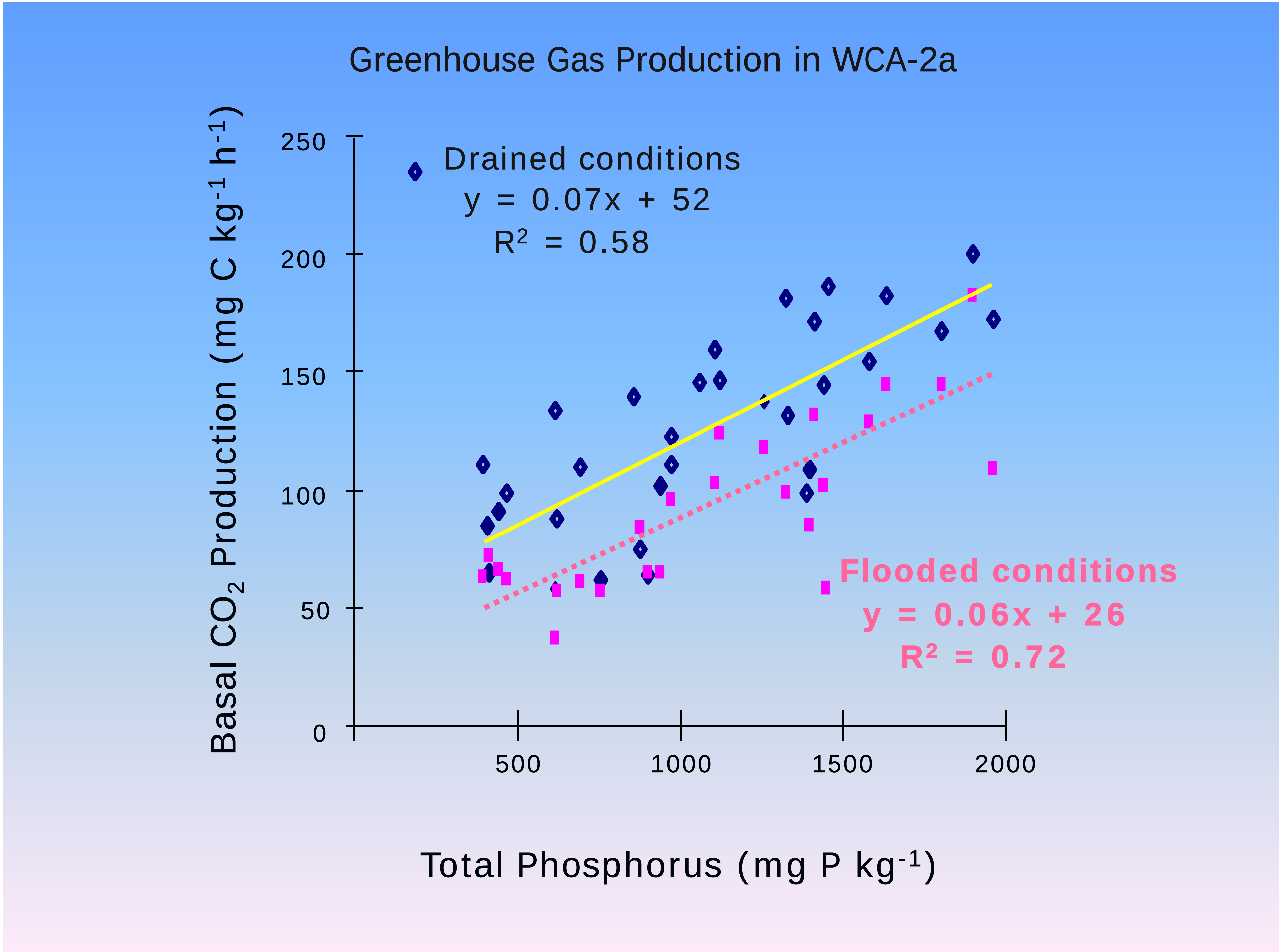
SOIL ACCRETION

- Mean RAS depth is 10 – 15 cm
- Soil accretion rate range is 1.0 – 1.7 cm yr^{-1}
- Phosphorus accretion rate for these STAs ranged from 1.3 - 3.0 g P m^{-2} yr^{-1}
- Soil and phosphorus accretion rates showed decline through time



Greenhouse Gas Production in WCA-2a





Greenhouse Gas Production in WCA-2a
Drained conditions
y = 0.07x + 52
R^2 = 0.58
Flooded conditions
y = 0.06x + 26
R^2 = 0.72
250
200
150
100
50
0
500
1000
1500
2000
Basal CO_2 Production (mg C kg^{-1} h^{-1})
Total Phosphorus (mg P kg^{-1})

Conclusions

- Soil Accretion and loss
  - EAA – soil loss of 0.5 cm/yr
  - Wetlands – soil accretion of 1-2 cm/yr
- Aerobic decomposition dominates in EAA
  - regulated by O_2
- Anaerobic decomposition dominates in wetlands
  - dependent upon electron acceptor inputs
- Pathways of organic matter decomposition change with trophic state
  - Methanogenesis at interior of wetlands
- Higher catabolic activity in P-impacted wetlands
  - Nutrient generation
  - Internal load
  - Greenhouse gas production