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Views expressed do not necessarily reflect those of the Universities that employ me

Some Suggested Research Priorities

1. Determine relative sensitivity of important wetland plants to petroleum hydrocarbons
2. Determine effects of wetland plant community on soil microbial degradation of petroleum hydrocarbons
3. Develop chemical measures of hydrocarbons that are better predictors of toxicity than existing chemical measures

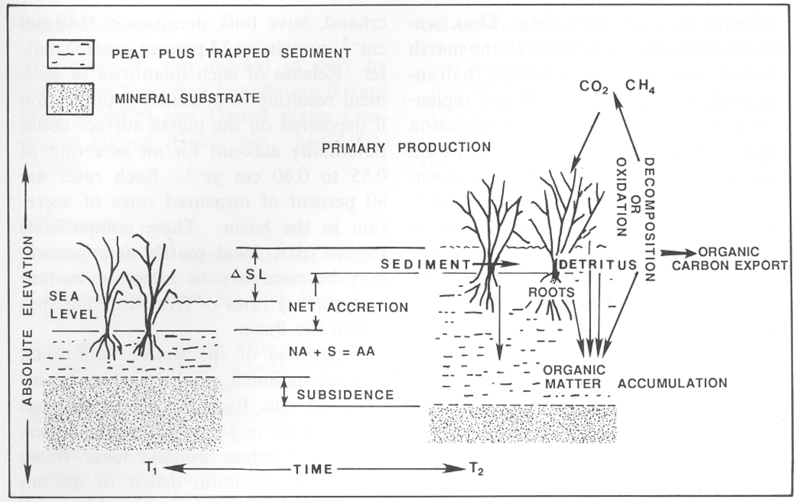
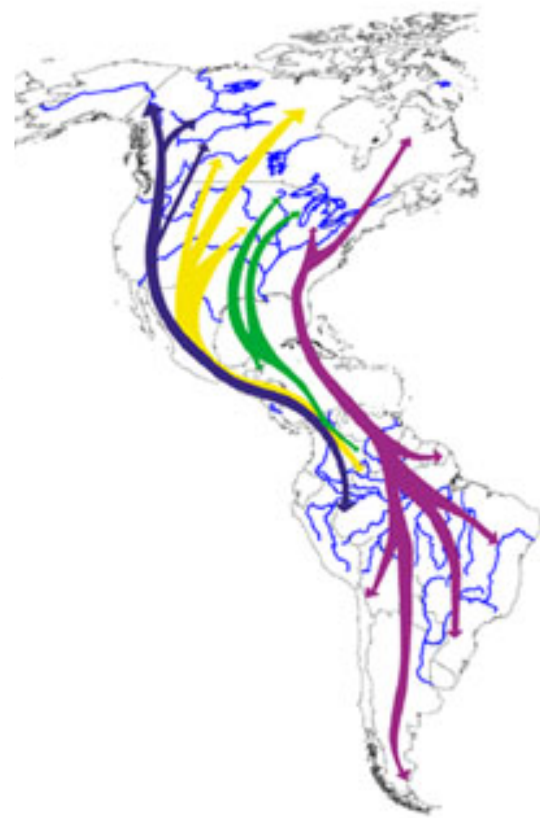
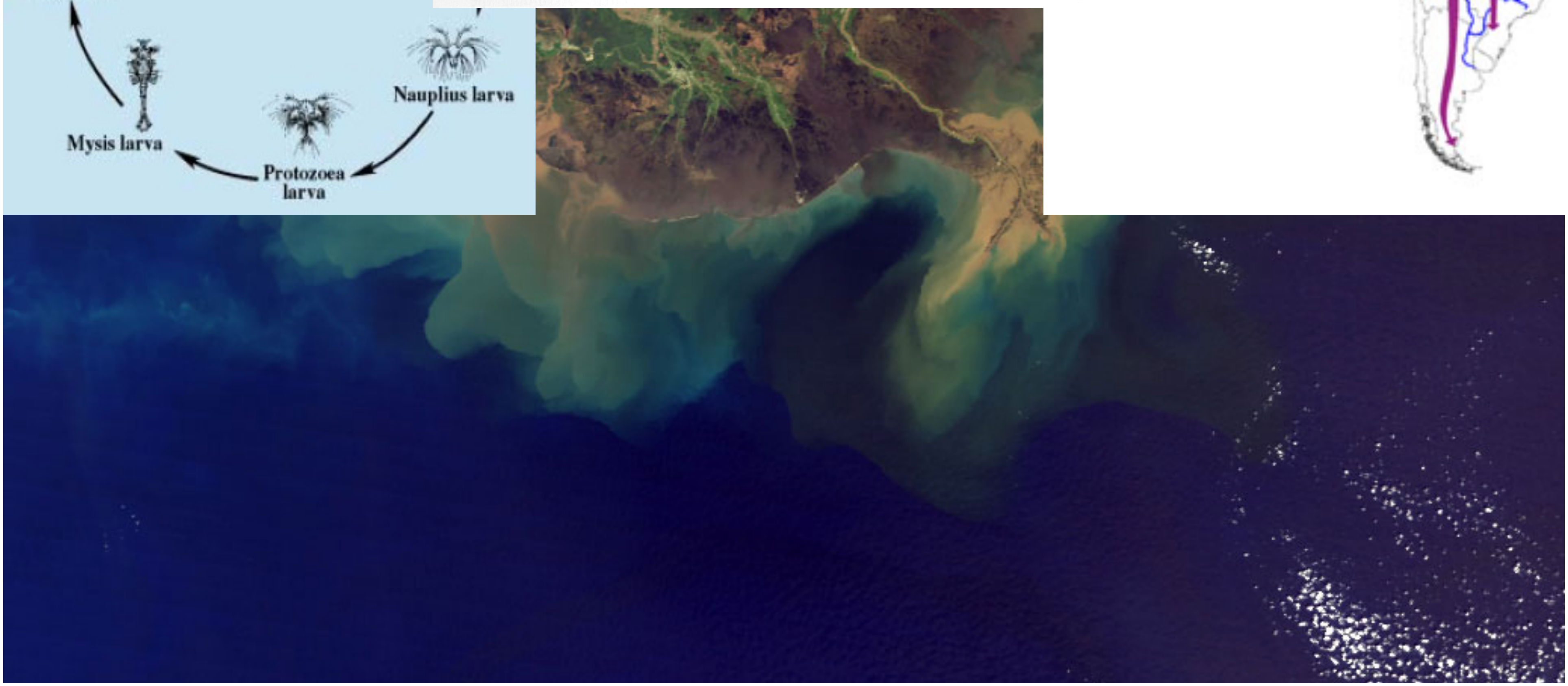


Fig. 4: *Schematic model of processes governing marsh accretion* (ΔSL = *sea level*, NA = *net accretion*, S = *subsidence*, AA = *absolute accretion*).

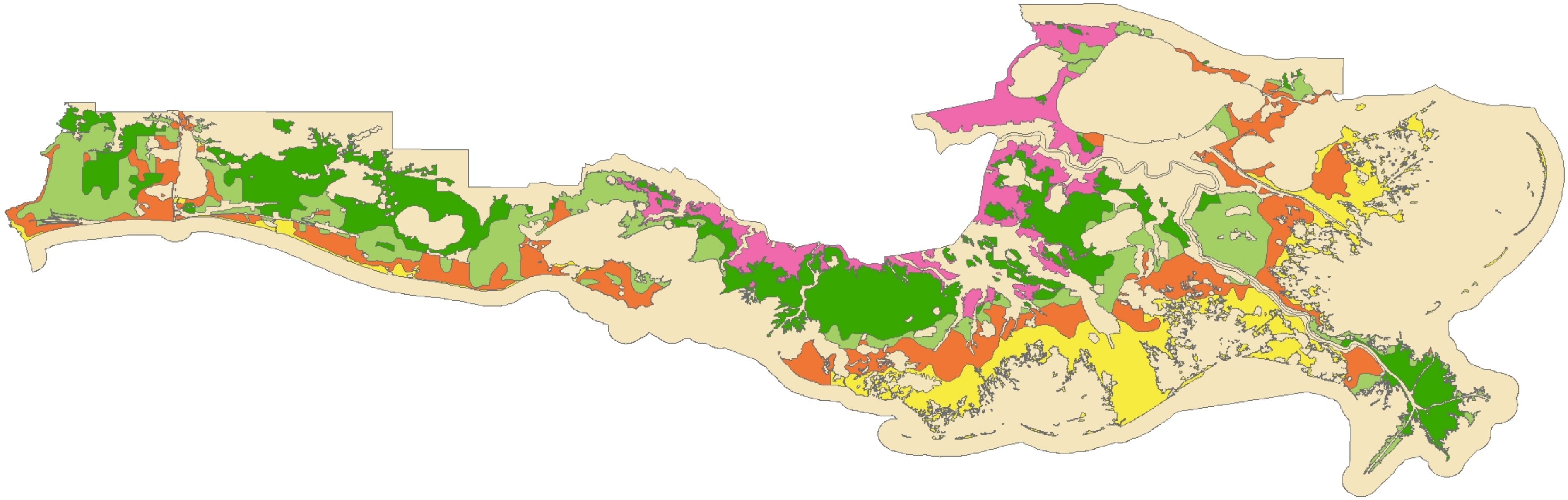





South Pass
17 May 2010

Dominant, emergent wetland plant species are fairly tolerant to crude oil on stems and leaves but tolerance varies among species. Tolerance to hydrocarbons is unrelated to tolerance to salinity and flooding. (most work by DeLaune's group; Mendelssohn's group)

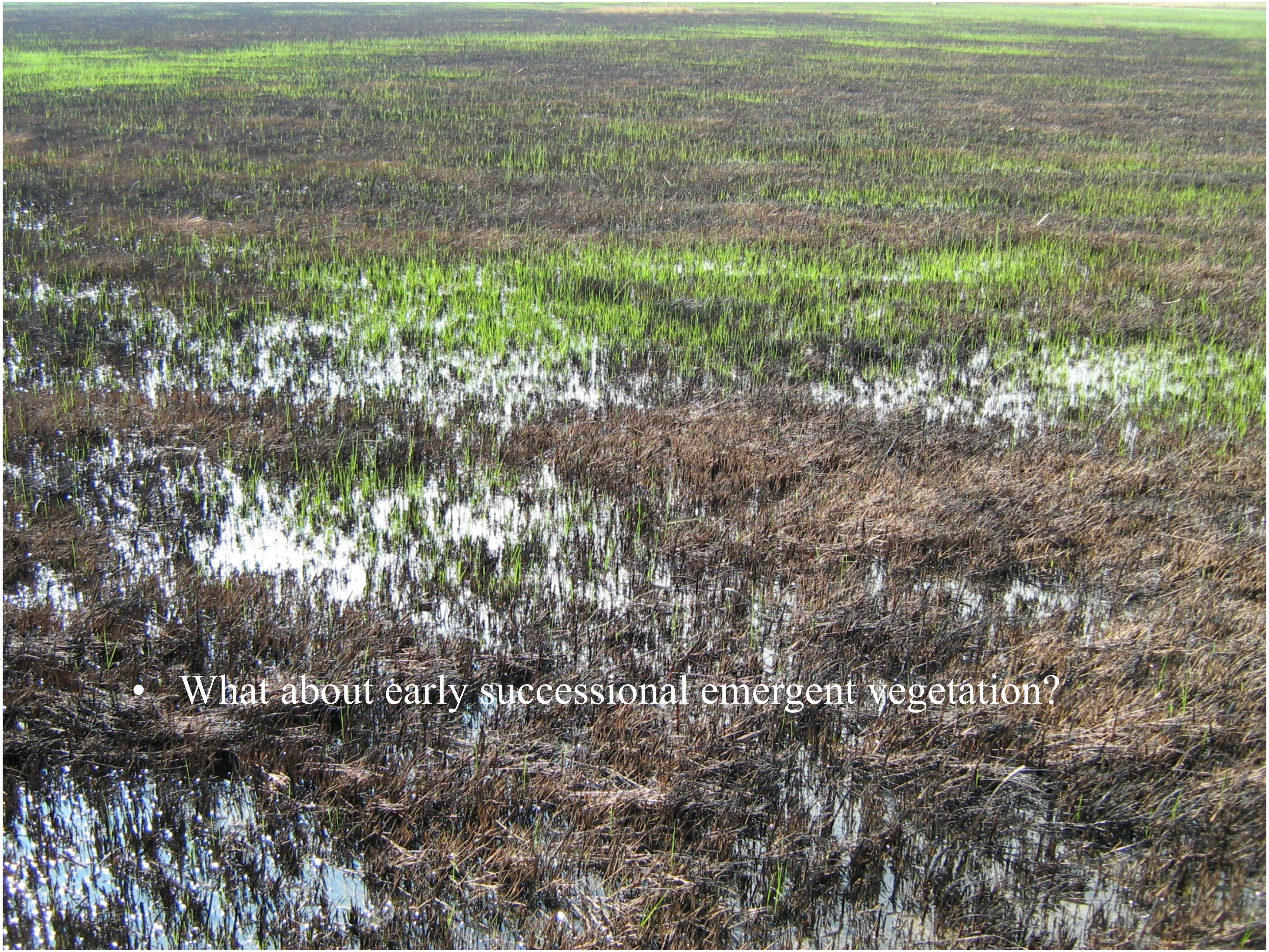
Pezeshki, S.R., M.W. Hester, Q. Lin, and J.A. Nyman. 2000. The effects of oil spill and clean-up on dominant US Gulf Coast marsh macrophytes: a review. Environmental Pollution 108:129-139.



- Dominant plants fairly tolerant to crude oils on stems and leaves:
  - saline marsh: *Spartina alterniflora* (intermediate tolerant)
  - brackish and intermediate marsh: *Spartina patens* (sensitive)
  - fresh marsh: *Sagittaria lancifolia* (most tolerant), *Panicum hemitomon* (intermediate tolerance), Phragmites australis (most sensitive)
  - Lin, Mendelssohn, & Shaffer


Pass A Loutre
19 July 2010


• What about early successional emergent vegetation?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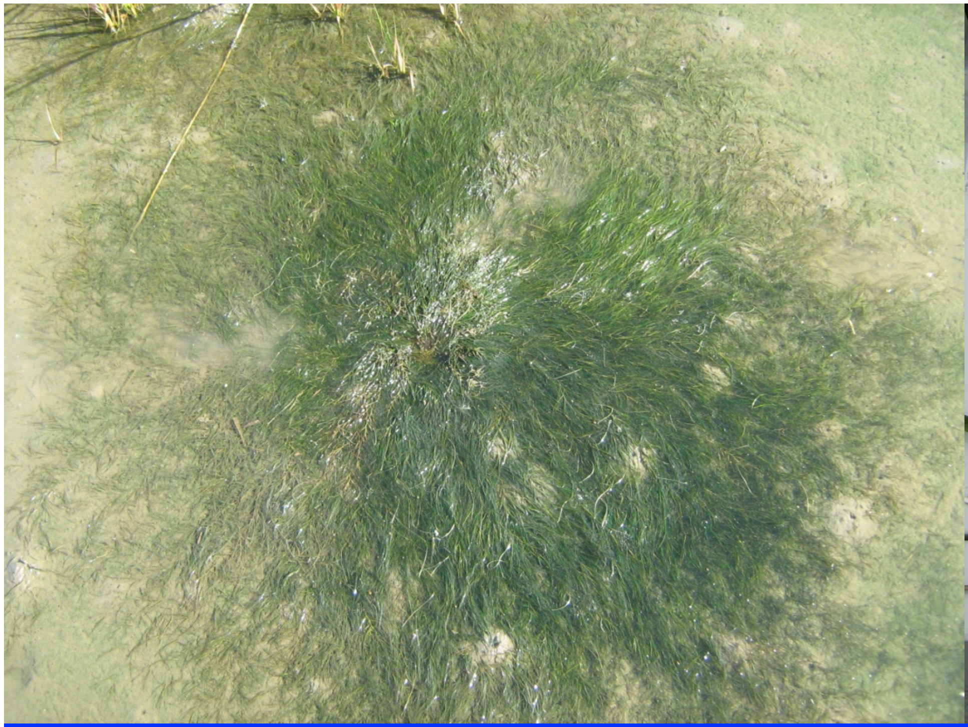


- What about submersed aquatic vegetation?

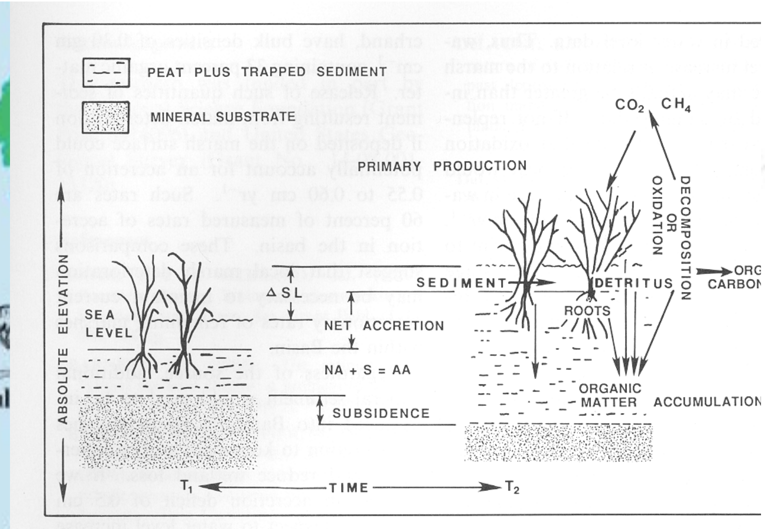
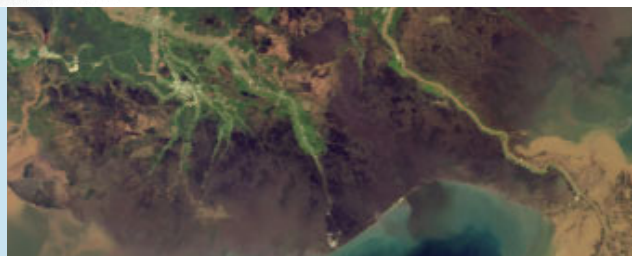
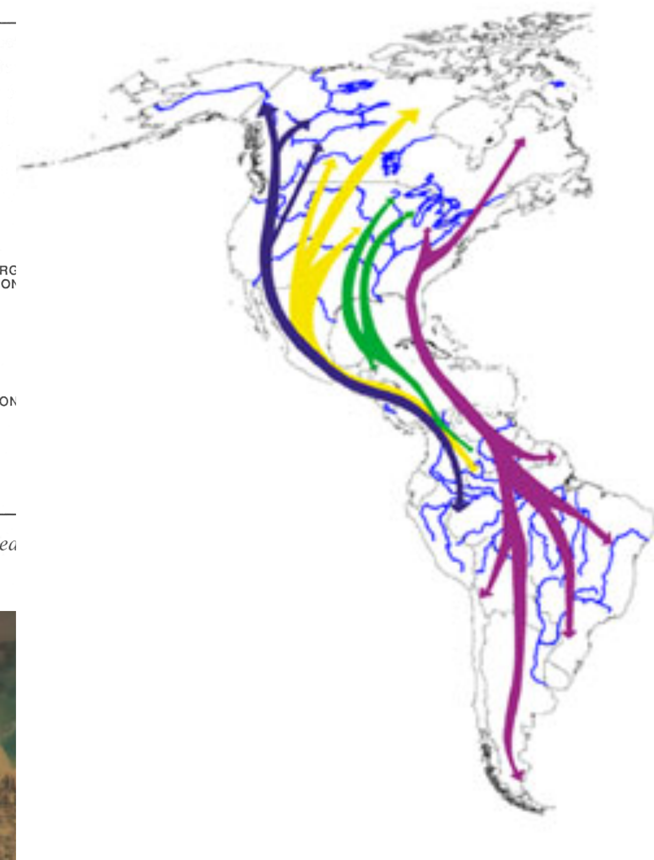


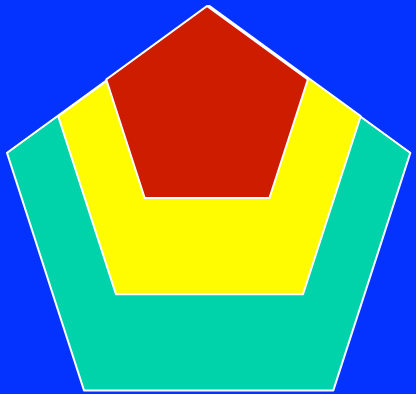
Fig. 4: *Schematic model of processes governing marsh accretion (ΔSL = sea*
NA = net accretion, S = subsidence, AA = absolute accretion).





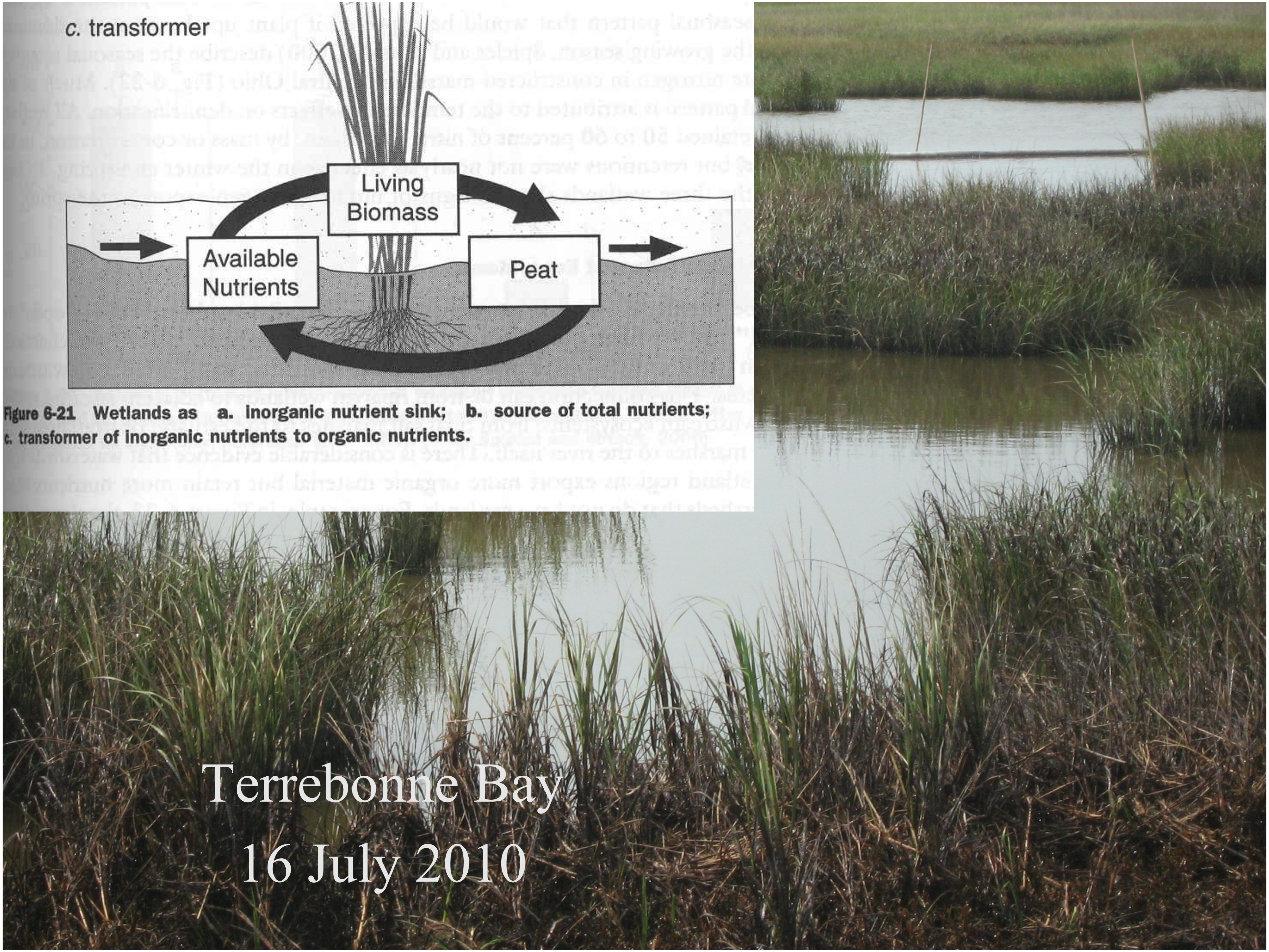
1. Determine relative sensitivity of important wetland plants to petroleum hydrocarbons
   - submersed aquatic vegetation (SAV)
   - emergent species that are early successional

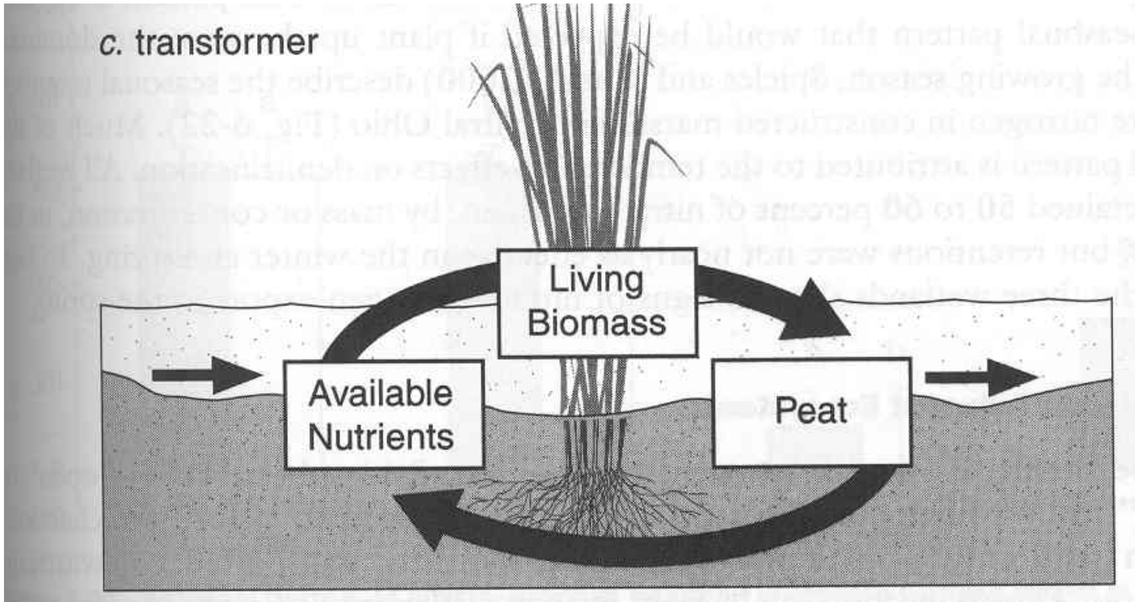
- Soil hydrocarbon concentration creates 3 zones:
  - 100% mortality,
  - mature plants recover but no reproduction, may not be evident for a growing season
  - mature plants recover and reproduction possible



Pezeshki, S.R., M.W. Hester, Q. Lin, and J.A. Nyman. 2000. The effects of oil spill and clean-up on dominant US Gulf Coast marsh macrophytes: a review. Environmental Pollution 108:129-139.


Terrebonne Bay
16 July 2010


c. transformer
Living
Biomass
Available
Nutrients
Peat
Figure 6-21 Wetlands as a. inorganic nutrient sink; b. source of total nutrients; c. transformer of inorganic nutrients to organic nutrients.
Terrebonne Bay
16 July 2010



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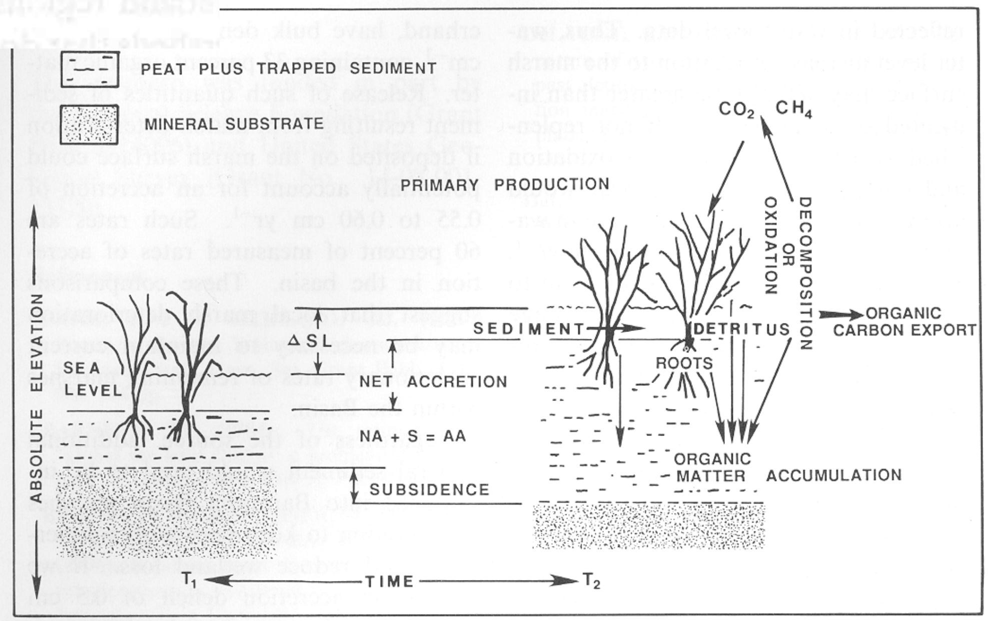

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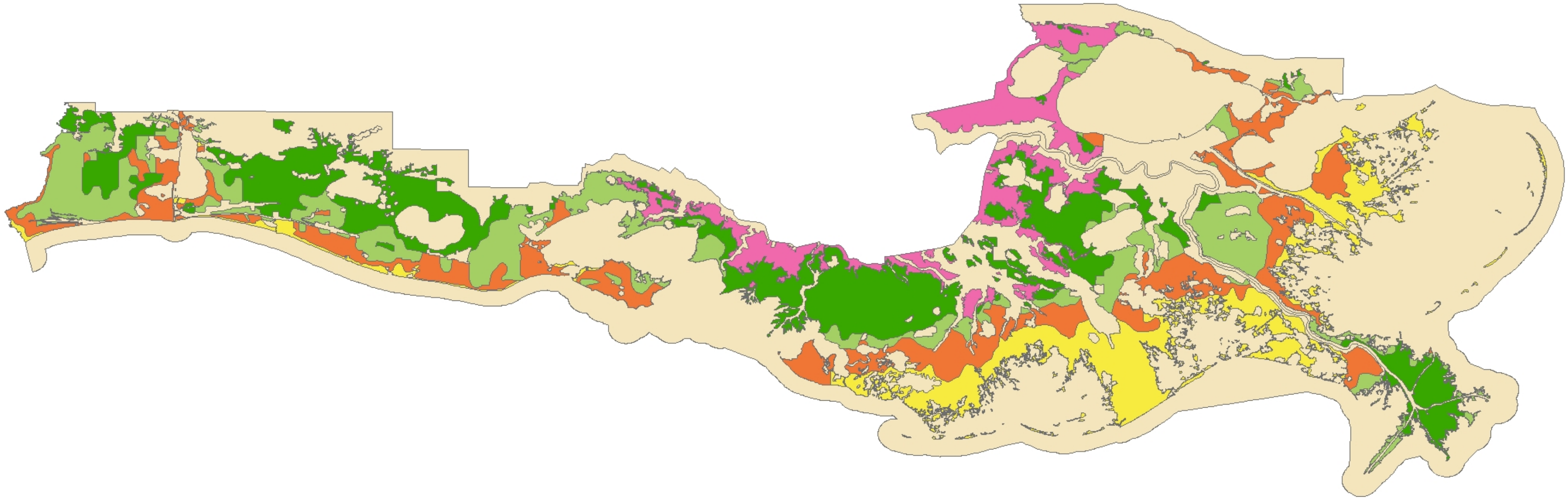
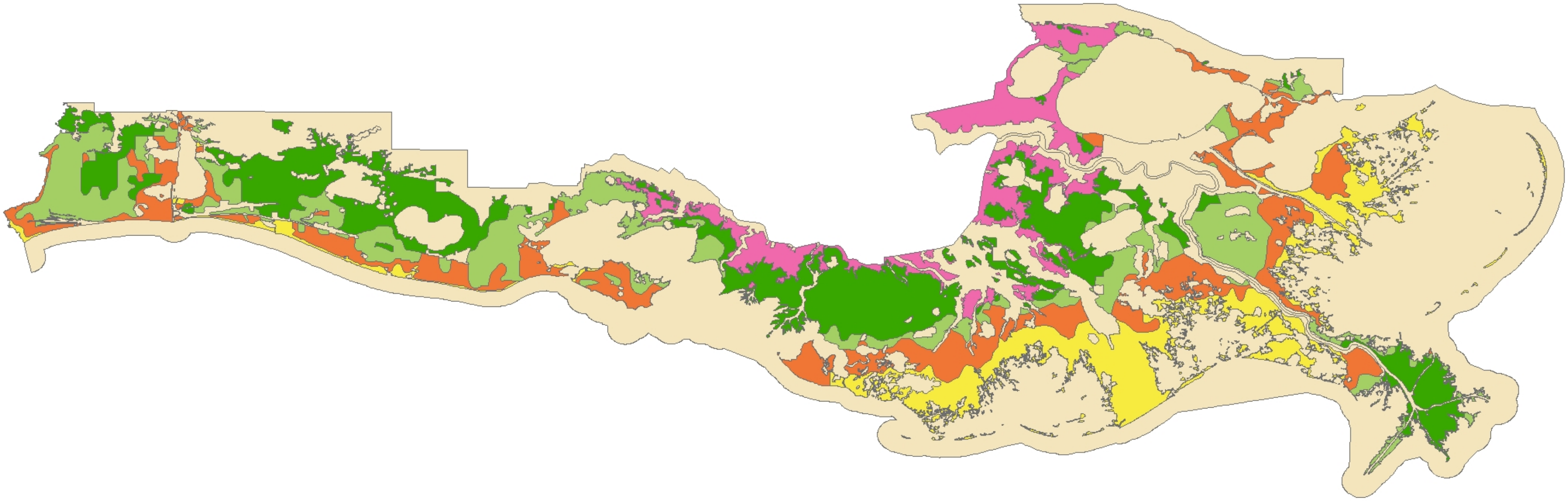


- crude oil accelerates microbial activity in fresh (P. hemitomon and S. lancifolia) and saline marsh soils (S. alterniflora and J. romerianus)
- recovery was faster where activity was faster
- oil disappeared faster where activity was faster
- Nyman, J.A. 1999. Microbial Ecology 37:152-162
- Nyman, J.A and T.E. McGinnis. 1999. Louisiana Applied and Educational Oil Spill Research and Development Program, OSRADP Technical Report Series 99-007.



- hypothesize
  - 1. hydrocarbon biodegradation is slowest in S. patens marshes because soil microbial activity is slowest there
  - 2. microbial activity in S. patens marshes is most sensitive to hydrocarbons because microbial activity is slowest there
- Nyman, J.A. and R.D. DeLaune. 1991. Limnology and Oceanography 36:1406-1414

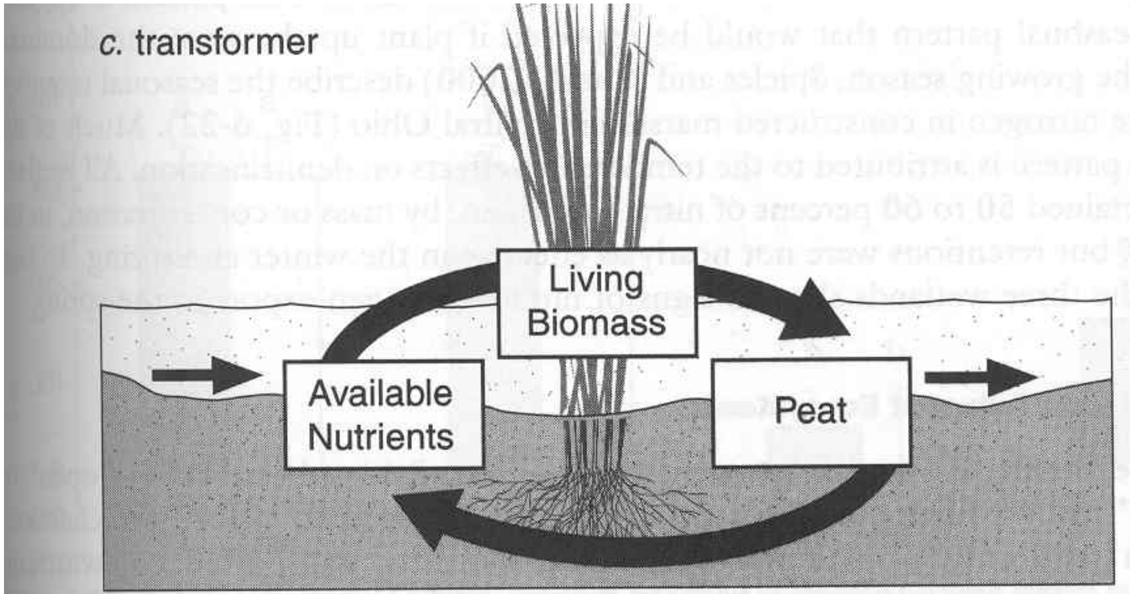
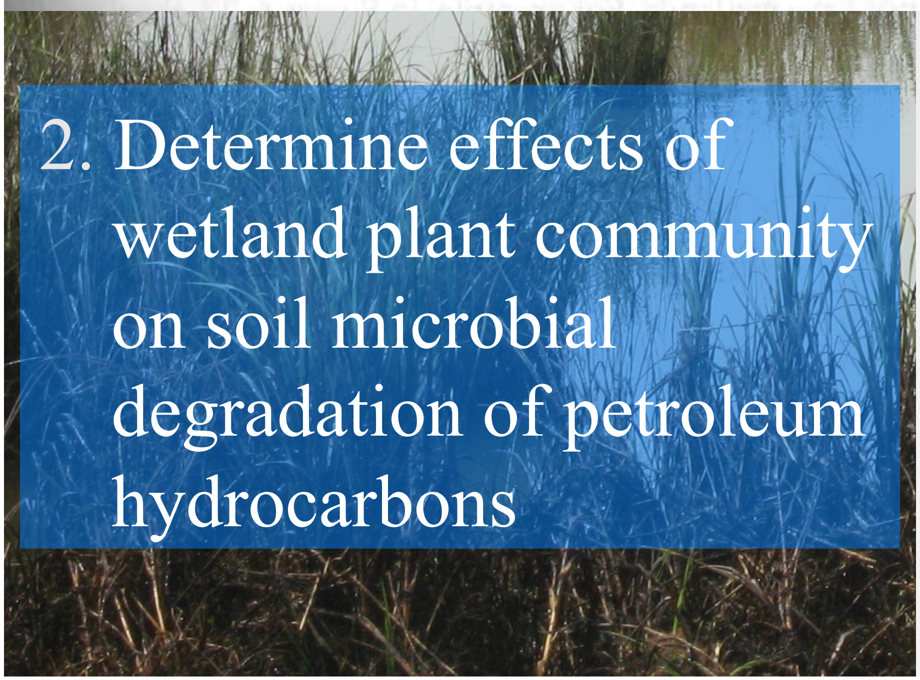
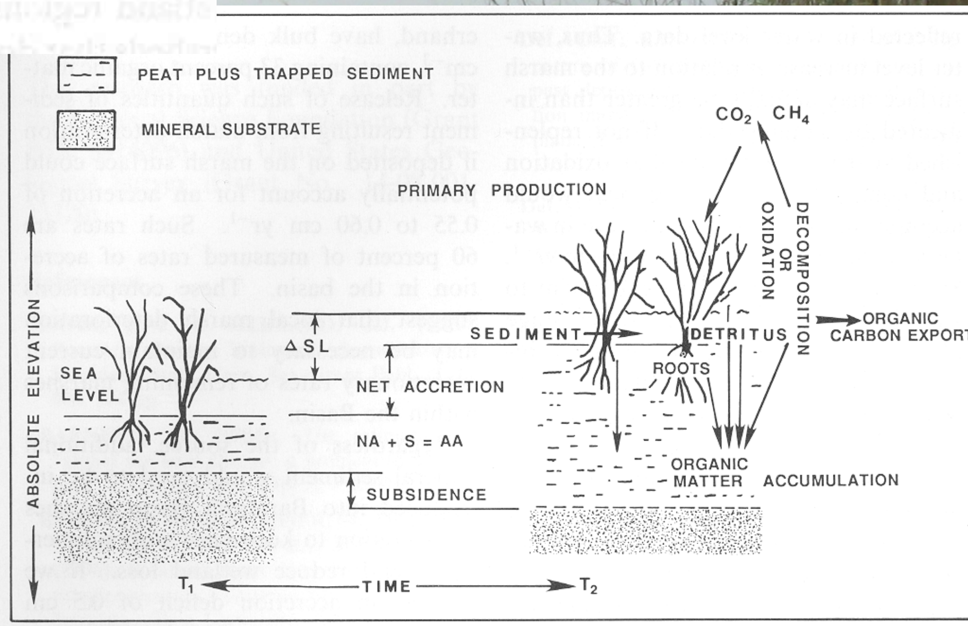


Figure 6-21 Wetlands as **a.** inorganic nutrient sink; **b.** source of total nutrients; **c.** transformer of inorganic nutrients to organic nutrients.



2. Determine effects of wetland plant community on soil microbial degradation of petroleum hydrocarbons



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Different measures of hydrocarbons measure different things

- Total Petroleum Hydrocarbons-Fluorometry
- Total Petroleum Hydrocarbons-Gas Chromatography/Flame Ionization Detector
- Total Petroleum Hydrocarbon-Gas Chromatography/Mass Spectrometry
- Total Aromatic Hydrocarbons
- Target Aromatic Hydrocarbons
- Total Polycyclic Aromatic Hydrocarbons


South Pass
19 July 2010

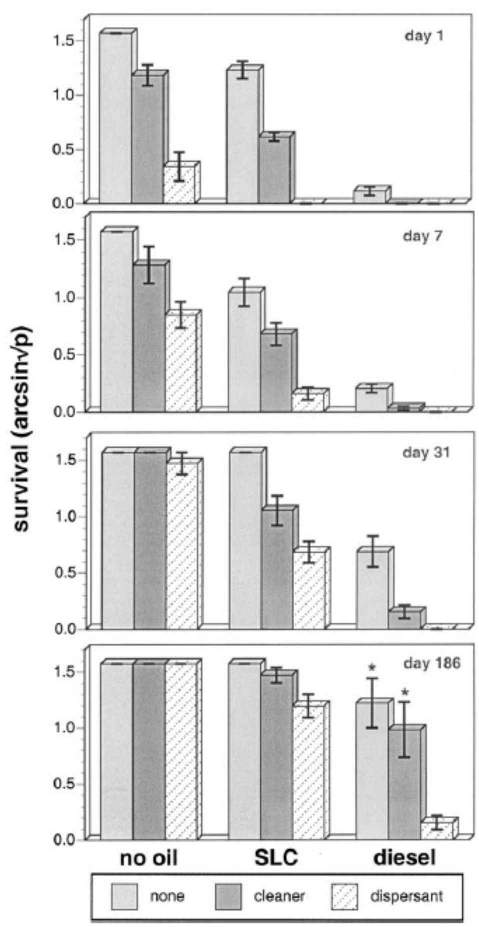


Fig. 1. Survival (least square mean±S.E.) showing oil and chemical additive treatment effects for exposures with the medaka. The bioassays for medaka used only the water from the microcosms. Samples sizes are $n=8$ (with exception of for $n=7$ for two means, indicated by *). Results are shown separately for each of the four different time points (day 1, 7, 31, and 186) on which bioassays were started. A 1.57 value for arcsine$\sqrt{p}$ corresponds to 100% survival.

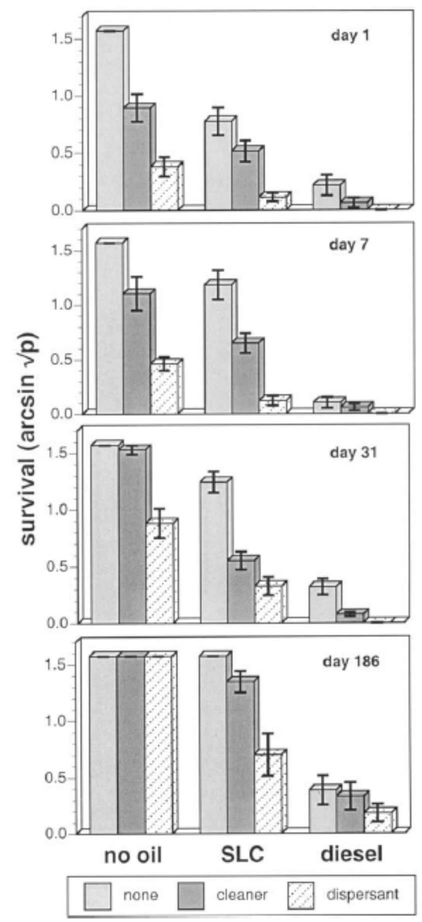


Fig. 2. Survival (least square mean±S.E., $n=8$) showing oil and chemical additive treatment effects for exposures with the daphnia. Exposures for daphnids used only the microcosm water. Results are shown separately for each of the four different time points (day 1, 7, 31, and 186) on which bioassays were started. A 1.57 value for arcsine $\sqrt{p}$ corresponds to 100% survival.

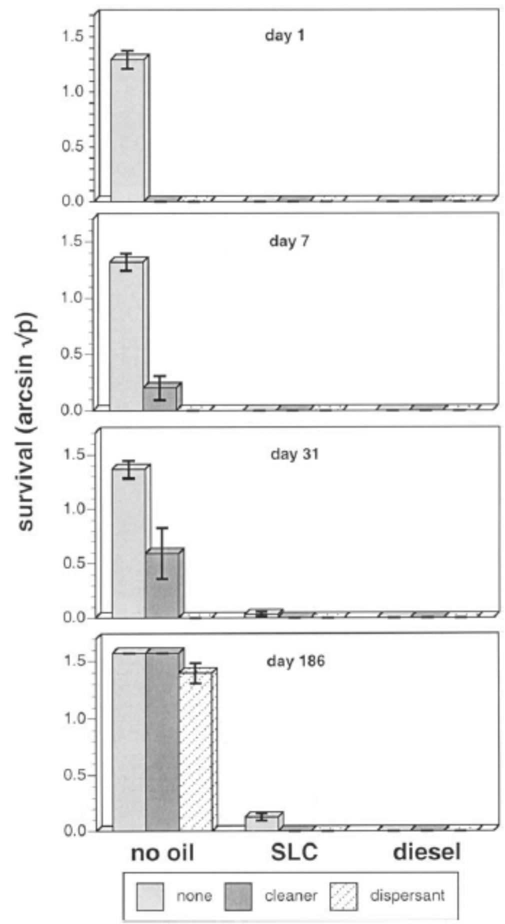


Fig. 3. Survival (least square mean±S.E., $n=8$) showing oil and chemical additive treatment effects for exposures with the chironomids. Tests with chironomids were performed with the microcosm soil slurry (water+oil). Results are shown separately for each of the four different time points (day 1, 7, 31, and 186) on which bioassays were started. A 1.57 value for arcsine$\sqrt{p}$ corresponds to 100% survival.

Bhattacharyya, S., P.L. Klerks, and J.A. Nyman. 2003. Toxicity to freshwater organisms from oils and oil spill chemical treatments in laboratory microcosms. Environmental Pollution 122:205-215.

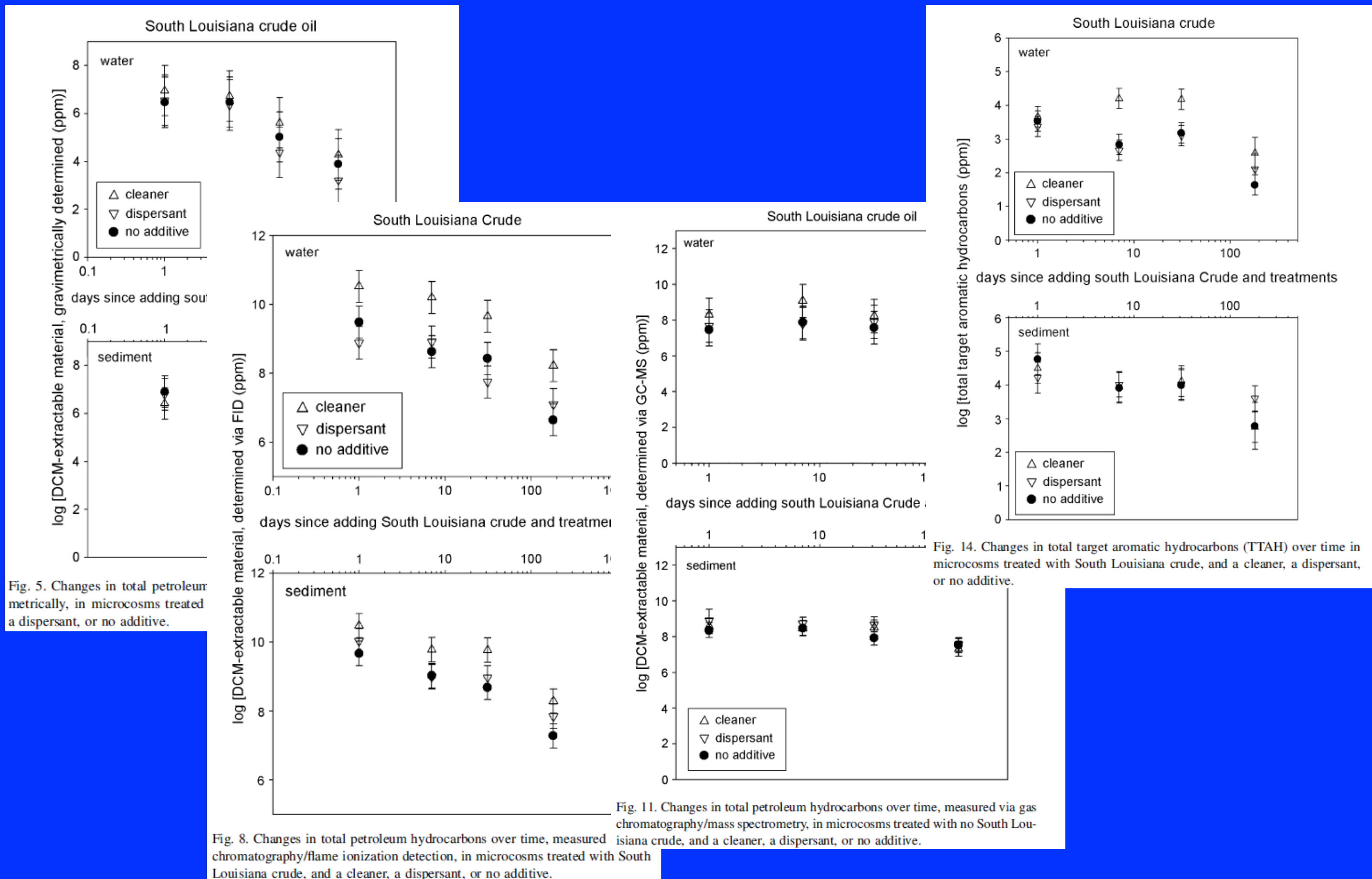


Fig. 5. Changes in total petroleum ... metrically, in microcosms treated ... a dispersant, or no additive.

Fig. 8. Changes in total petroleum hydrocarbons over time, measured ... chromatography/flame ionization detection, in microcosms treated with South Louisiana crude, and a cleaner, a dispersant, or no additive.

Fig. 11. Changes in total petroleum hydrocarbons over time, measured via gas chromatography/mass spectrometry, in microcosms treated with no South Louisiana crude, and a cleaner, a dispersant, or no additive.

Fig. 14. Changes in total target aromatic hydrocarbons (TTAH) over time in microcosms treated with South Louisiana crude, and a cleaner, a dispersant, or no additive.

Nyman, J.A., P.L. Klerks, and S. Bhattacharyya. 2007. Effects of chemical additives on hydrocarbon disappearance and biodegradation in freshwater marsh microcosms. Environmental Pollution 149:227-238.

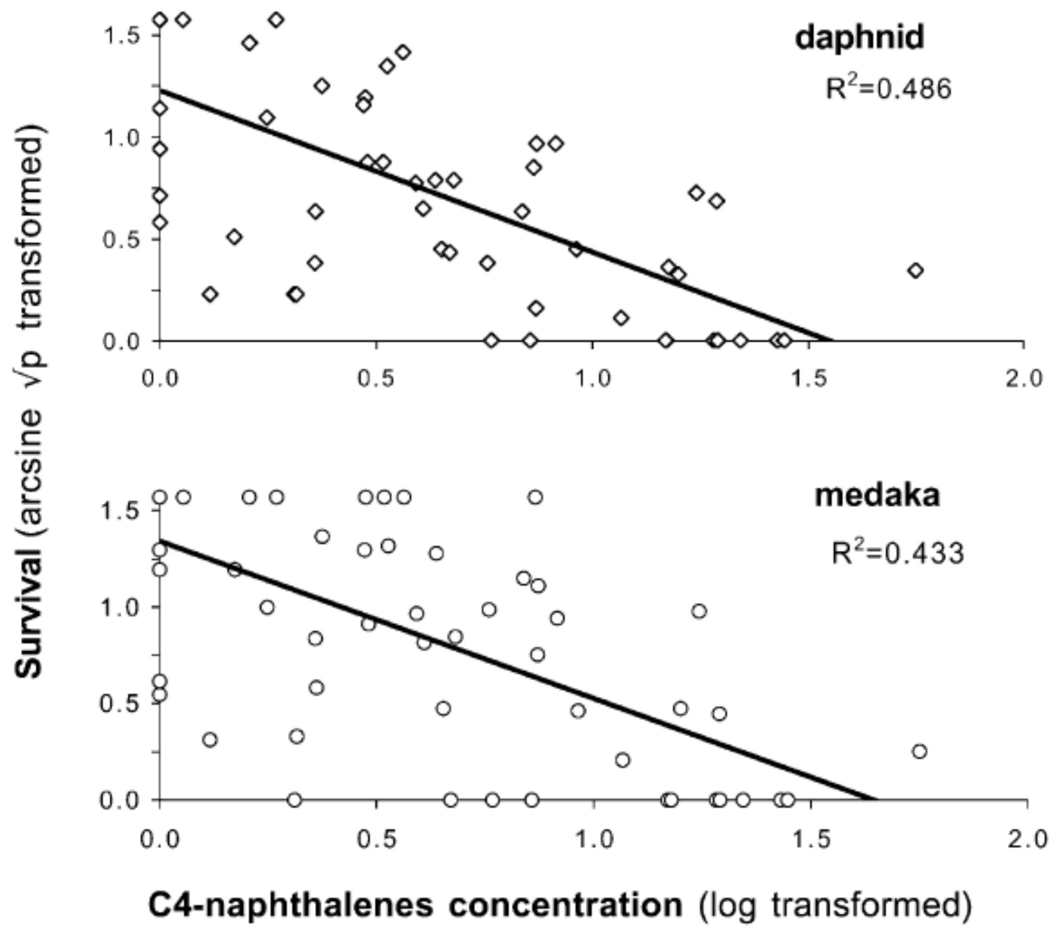
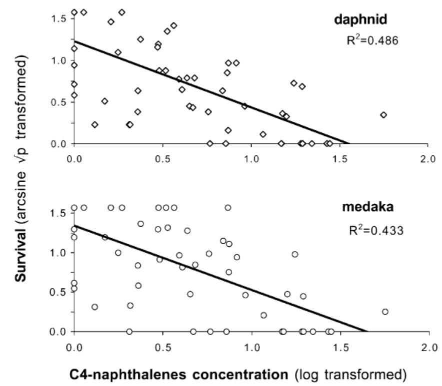


Fig. 2. Relationship between survival (of *Daphnia pulex* and the medaka *Oryzias latipes*) and the concentration of C4-naphthalenes in microcosm water. Survival was arcsine $\sqrt{p}$ transformed (100% survival corresponds to a transformed value of 1.57) while the concentration of C4-naphthalenes was log-transformed. Sample size was 57 for each species.

Klerks, P.L., J.A. Nyman, and S. Bhattacharyya. 2004. Relationship between hydrocarbon measurements and toxicity to a chirinomid, fish larvae, and daphnid for oils and oil spill chemical treatments in laboratory freshwater marsh microcosms. Environmental Pollution 129:345-353.



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Mao, D., R. Lookman, H. Van de Wegh, R. Weltans, G. Vanermen, N, de Brucker, and L. Diels. 2009. Estimation of ecotoxicity of petroleum hydrocarbon mixtures in soil based on HPLC-GCXGC analysis. Chemosphere 77:1508-1513.

Wong, D.C., E.Y. Chai, K.K. Chu, and P.B. Dorn. 1999. Prediction of ecotoxicity of hydrocarbon-contaminated soils using physiochemical parameters. Environmental Toxicology and Chemistry 18:2611-2621.

3. Develop chemical measures of hydrocarbons that are better predictors of toxicity than existing chemical measures

Redfish Bay

17 May 2010

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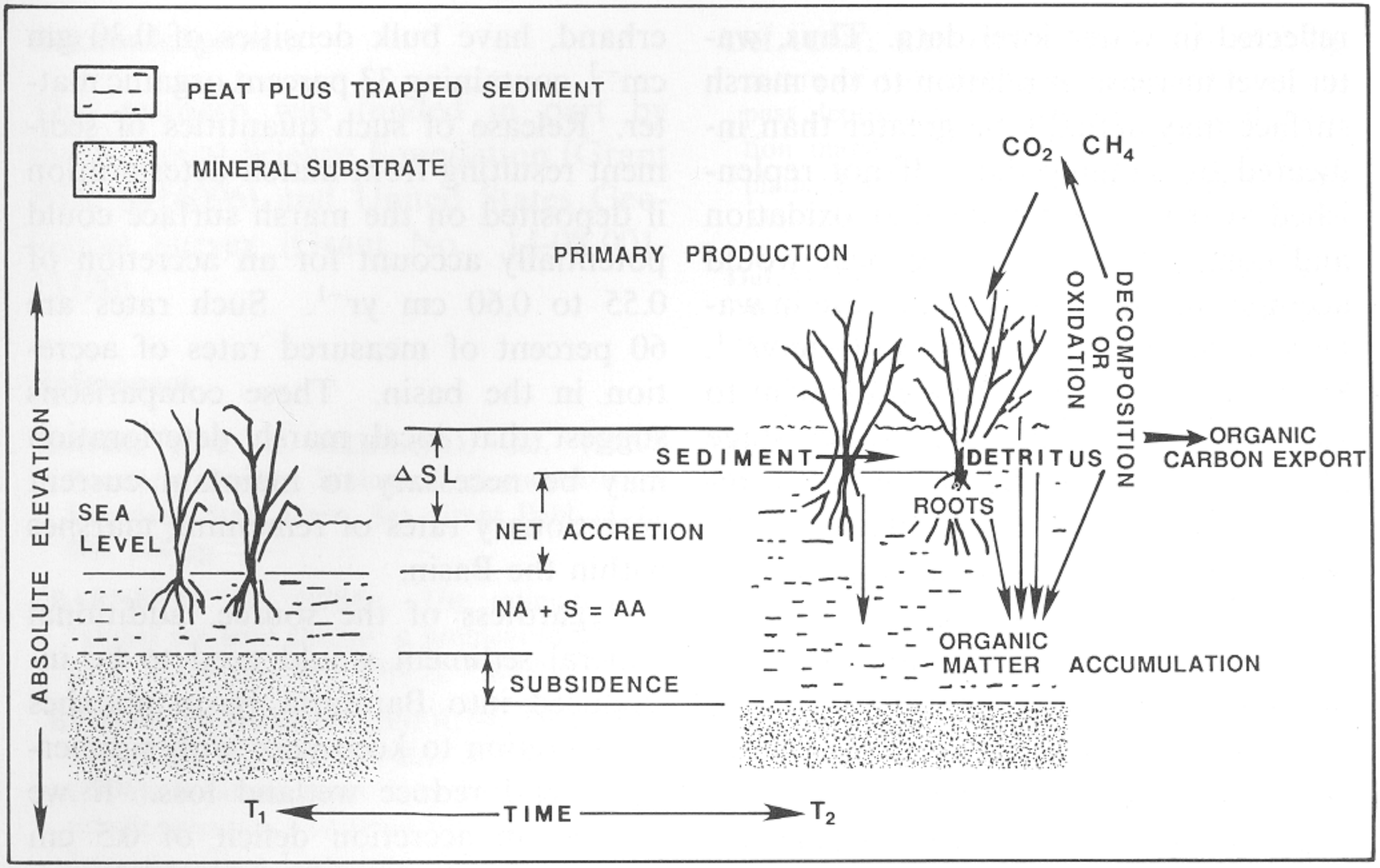

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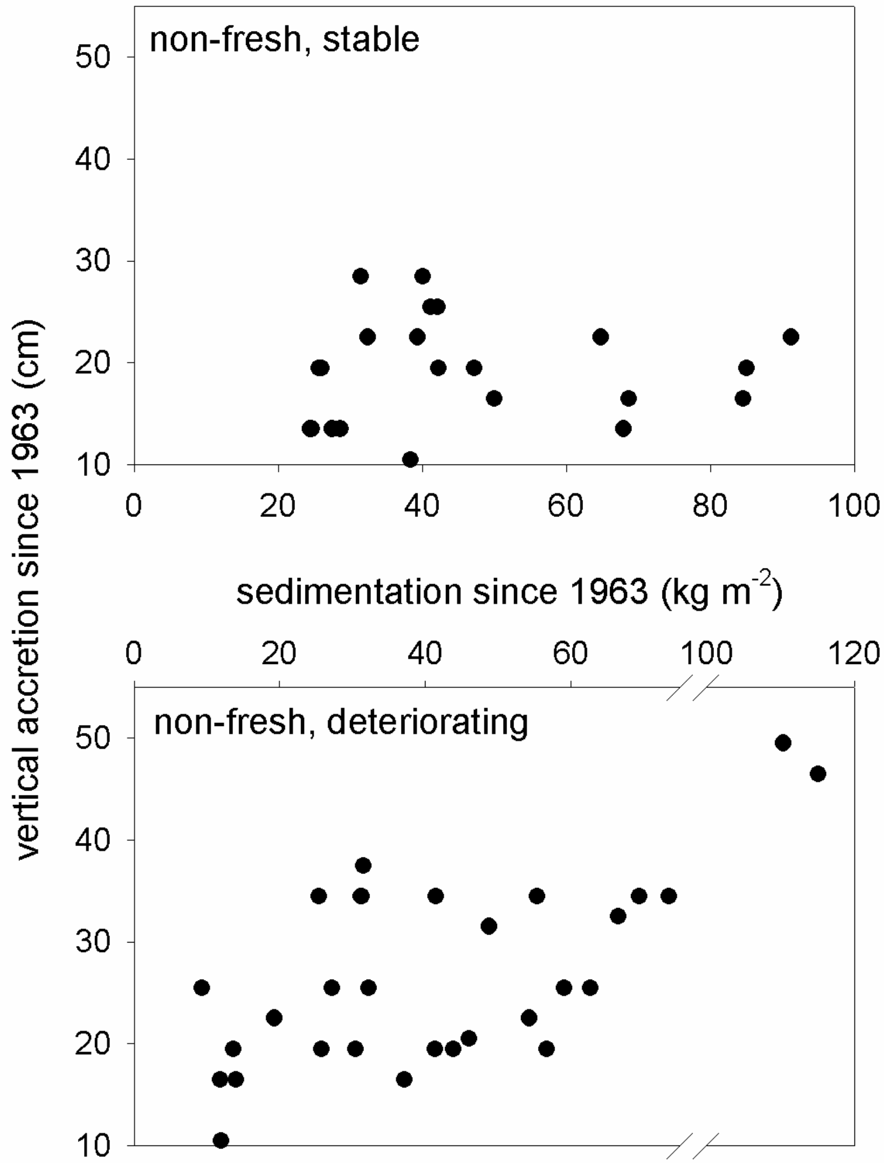
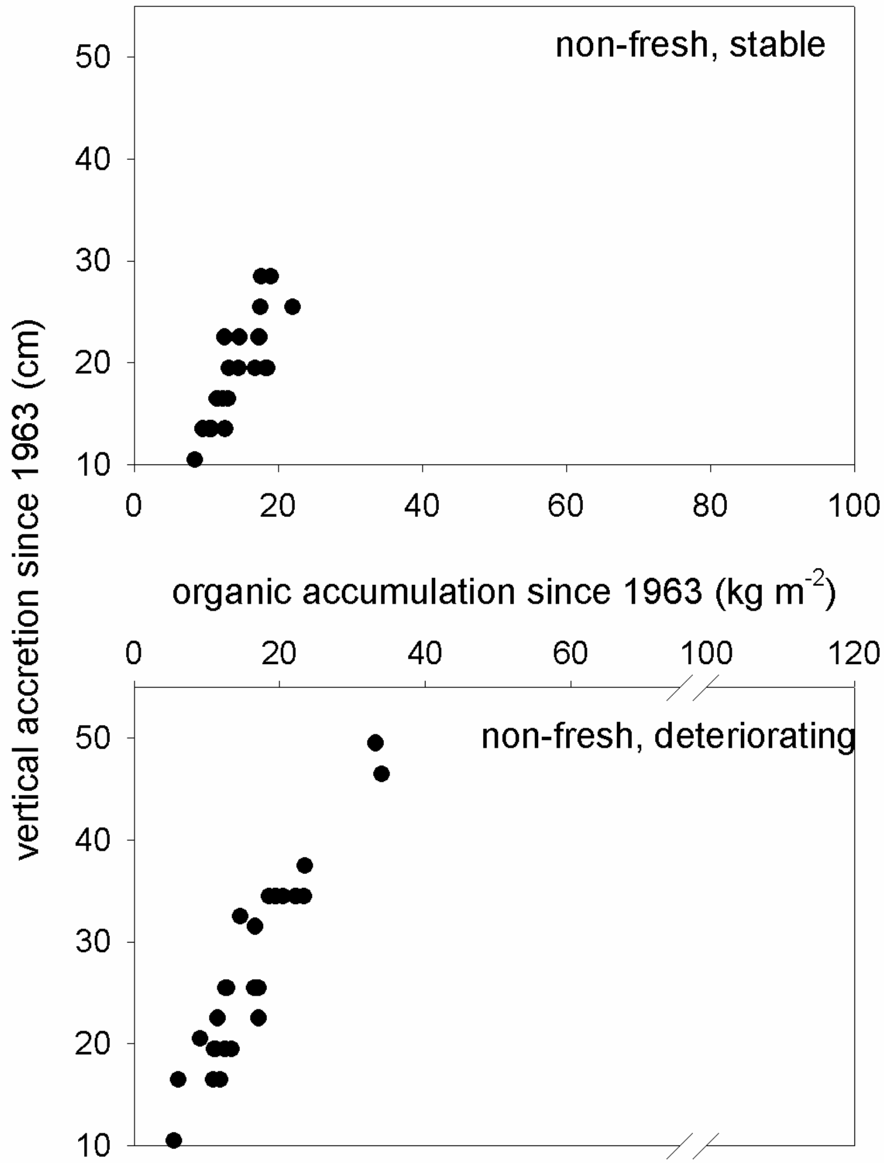
DeLaune et al. 1990. Catena 17:277-288



Nyman et al. 2006. Estuarine Coastal and Shelf Science 69:370-380.



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