

Advances in Land Surface Representation: SiB4

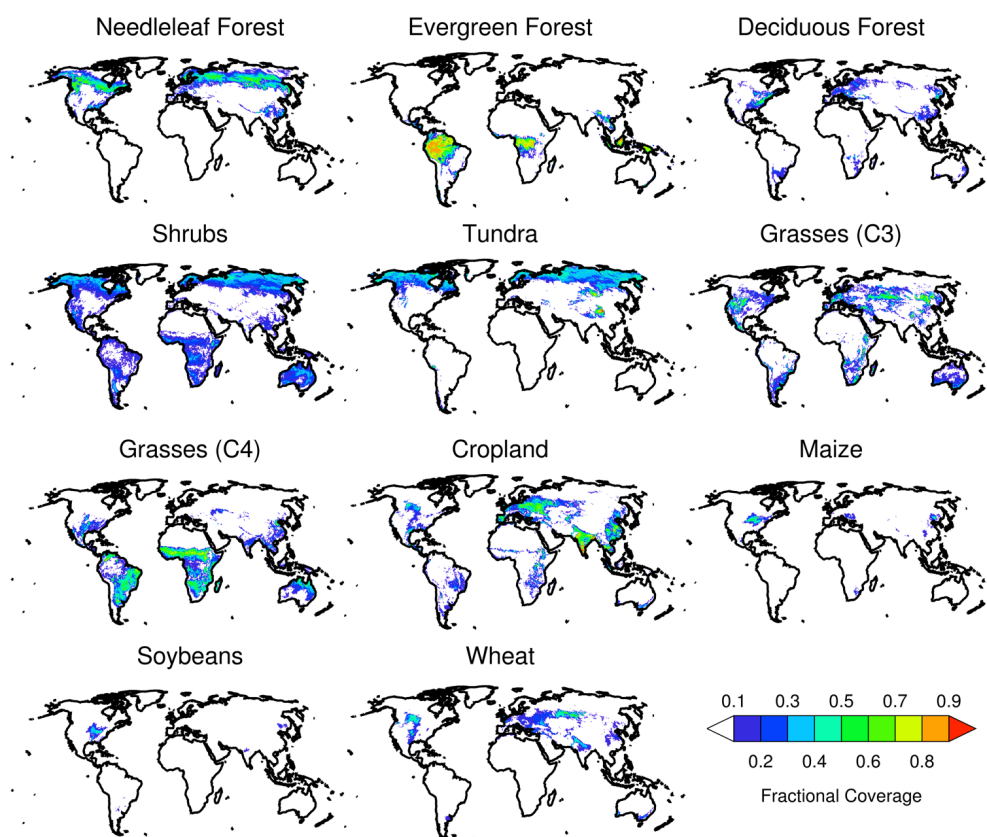


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CMMAP Team Meeting, 10-12 Jan 2012

SiB4 Vegetation: PFTs

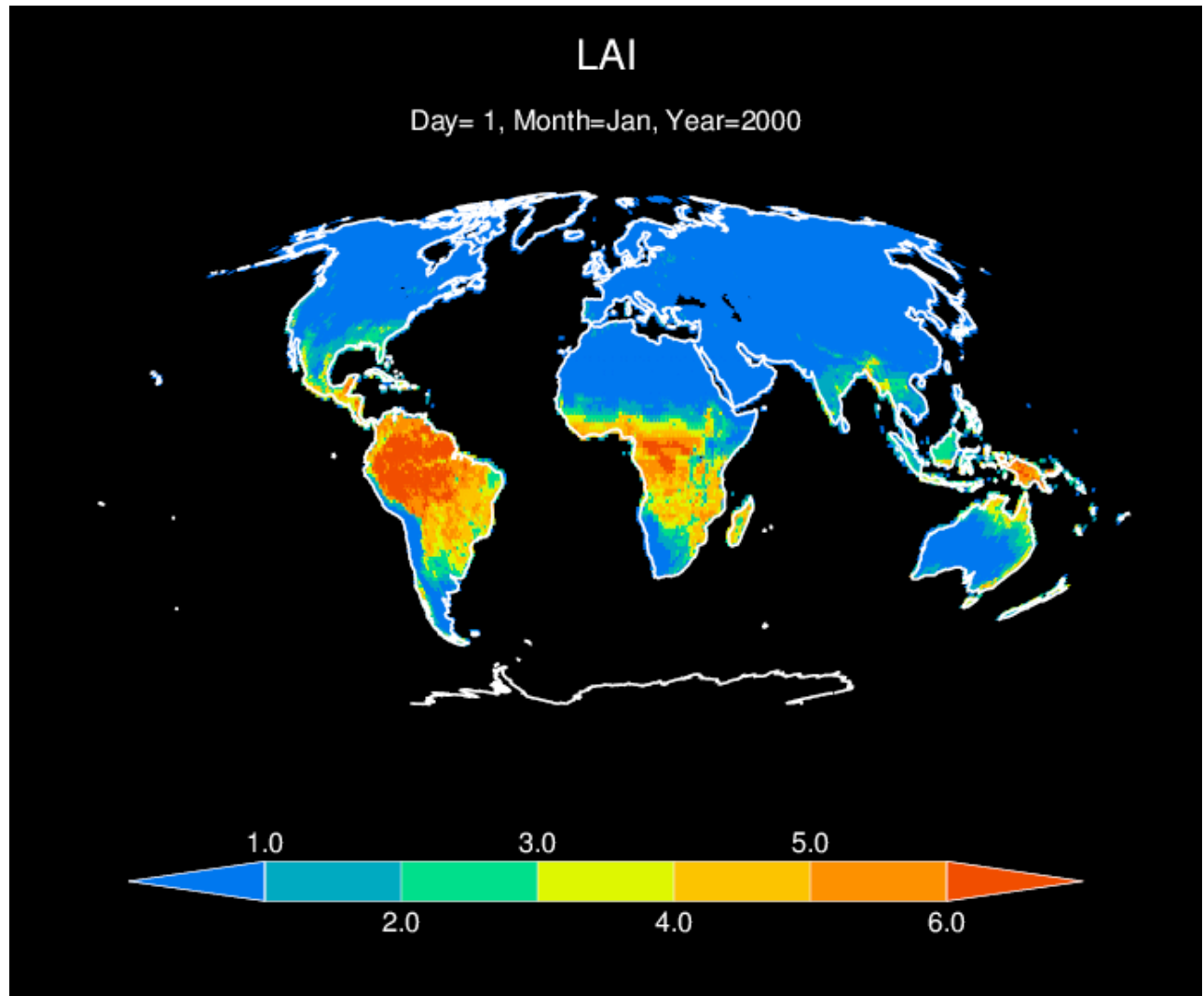


- Switched from biome classes to plant functional types (PFTs)
 - Bare Ground
 - 15 Natural
 - Forest
 - Shrub
 - Grassland
 - Generic Crop
 - 4 Crops
 - Corn
 - Soybean
 - Winter Wheat
 - Spring Wheat

SiB4: Carbon Pools

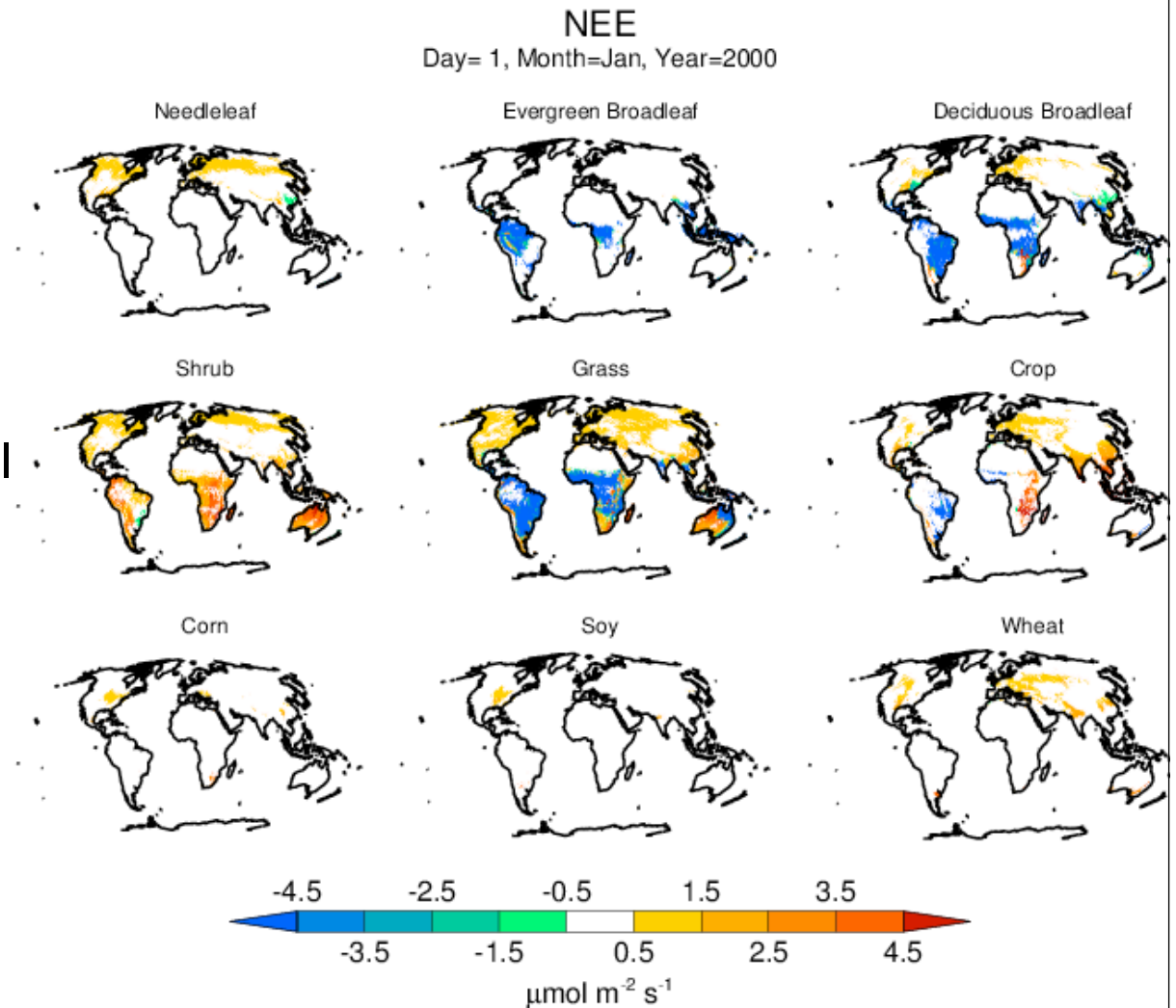
- Carbon Pools / Respiration
 - SiB3: Annual Balance (Denning et al., 1996)
 - SiB4: Carbon Biogeochemistry from Carnegie-Ames-Stanford Approach (CASA) model
 - Prognostic Biomass for 13 pools
 - Live Carbon (leaves, roots, wood)
 - Surface Litter
 - Soil Carbon
 - Calculates Respiration losses due to microbial decay (heterotrophic) and plant growth (autotrophic)
 - Schaefer et al., 2008 and 2009

SiB4: Prognostic Phenology (PGSI)



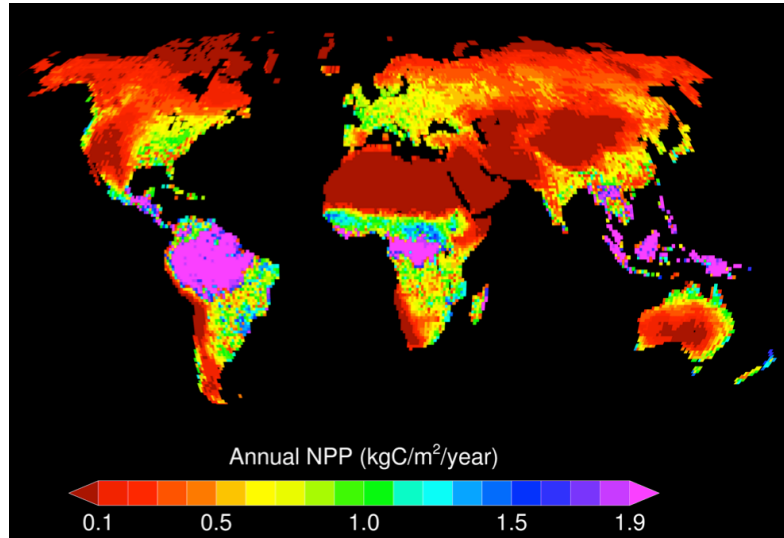
SiB4: Net Ecosystem Exchange (NEE)

- Proof-of-concept plot; respiration unrealistic
- Implementation of POOLS!
- Pools are not spun up for all PFTs
- Designed to show seasonal variability in multiple components that combine to determine grid-scale flux

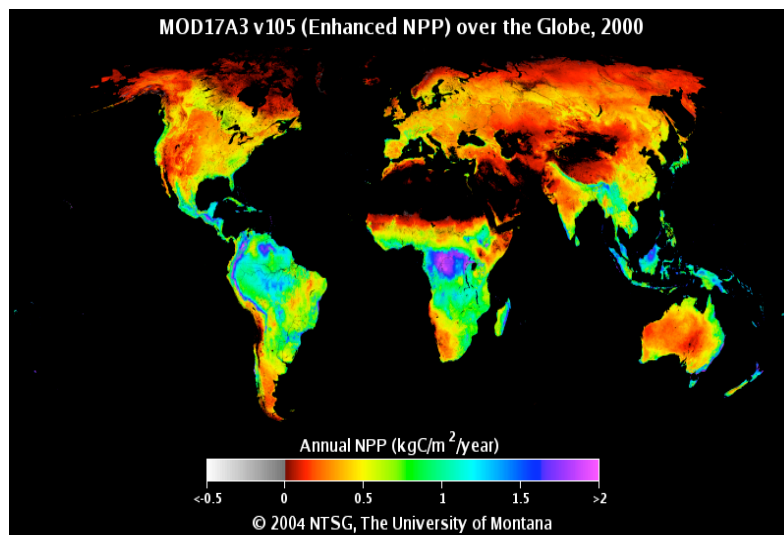
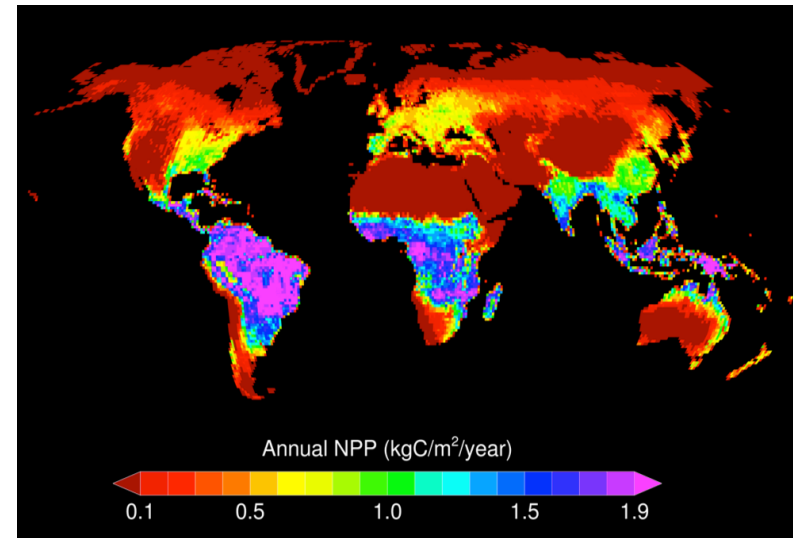


Annual Total NPP

SiB3



SiB4



- Both SiB versions have higher tropical NPP
- SiB4 higher NPP in sub-tropics (Brazil, SE Asia)

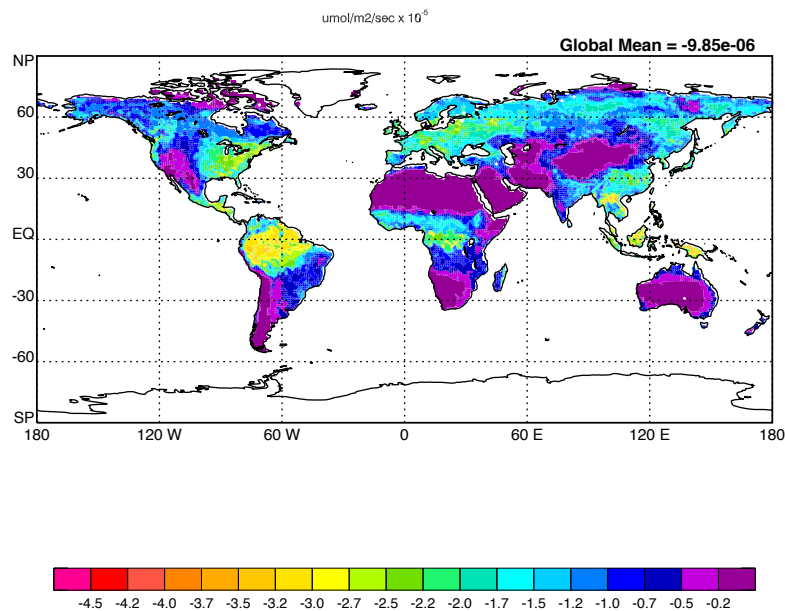
MODIS annual NPP calculated by Numerical Terradynamic Simulation Group at the University of Montana (Zhao et al., 2006). Available online at <http://www.ntsg.umt.edu/project/MOD17>

Where we are: Carbonyl Sulfide

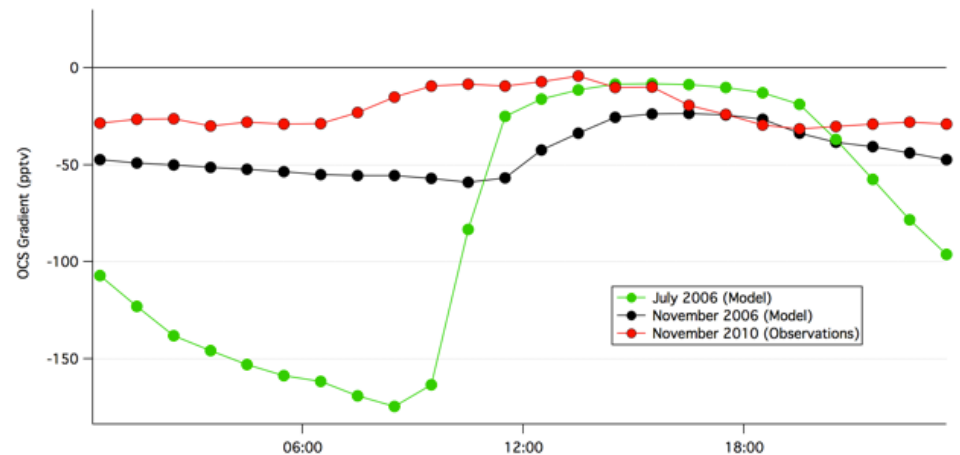
- OCS: uptake by photosynthesis and soil, no major natural terrestrial sources
- Use OCS to constrain photosynthesis parameterizations

Dec 19, 2011

COS FLUX BETWEEN CAS-REF LEVEL



Harvard Forest



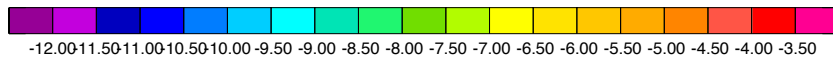
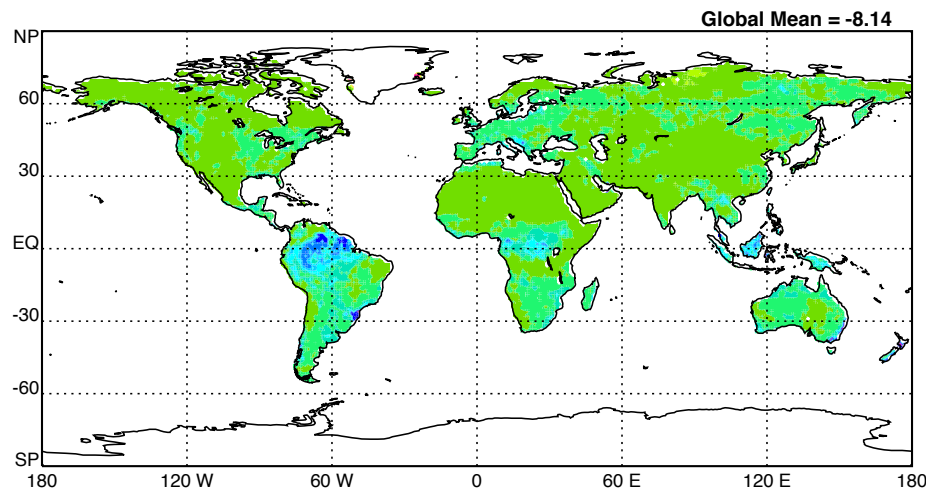
What we've done: Carbon Isotopes

- Carbon is fractionated across the photosynthetic pathway
- Del, or depletion of ^{13}C , is recorded in carbon pools
- Fossil fuel signature is changing atmospheric del ^{13}C

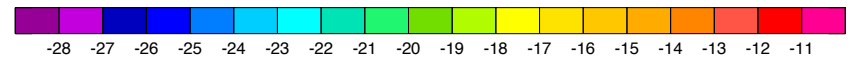
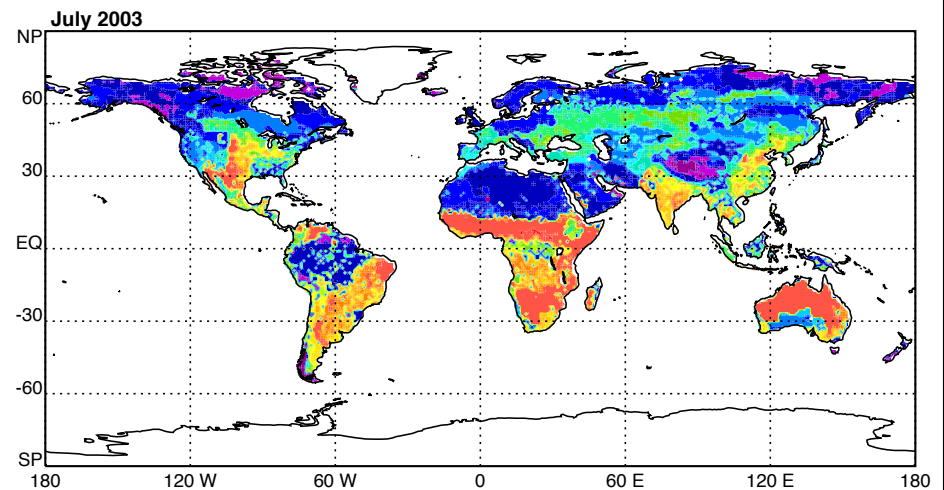
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DEL 13C OF CANOPY CO2



DEL 13C OF RESPIRATION



New Modeling Strategy

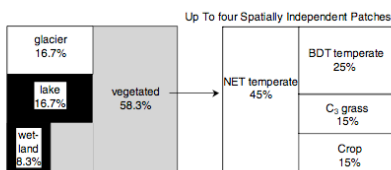
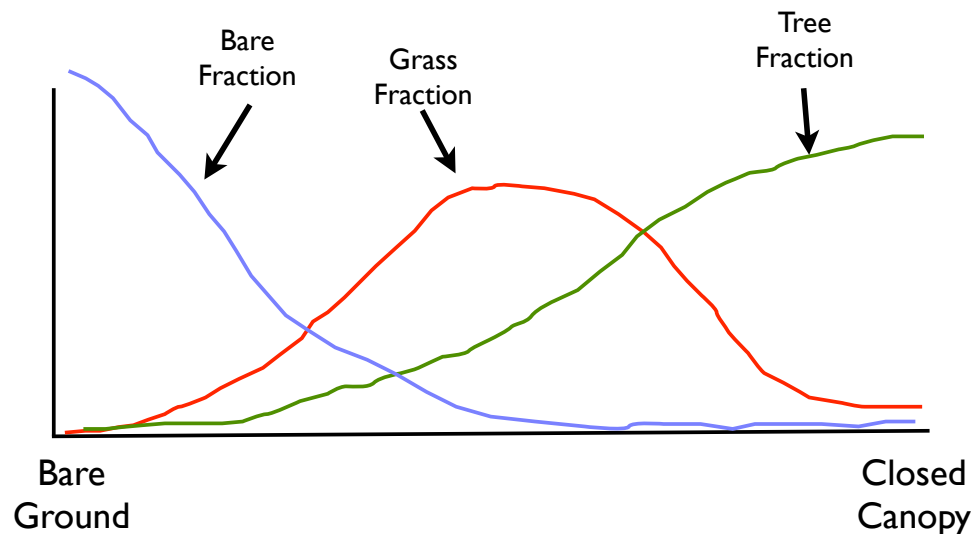
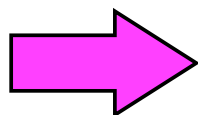


Figure 2. Subgrid patches of glacier, lake, wetland, and vegetation in the new version of the NCAR LSM. The vegetated portion of the grid cell is divided into up to four PFTs with unique composition and leaf area.

Ice	Hetero. Vegetation
Water	
Urban	
Crop	



Multiple Physiology!
(Hanan et al 2005)

