NEON ecological forecasting workshop
May, Boulder

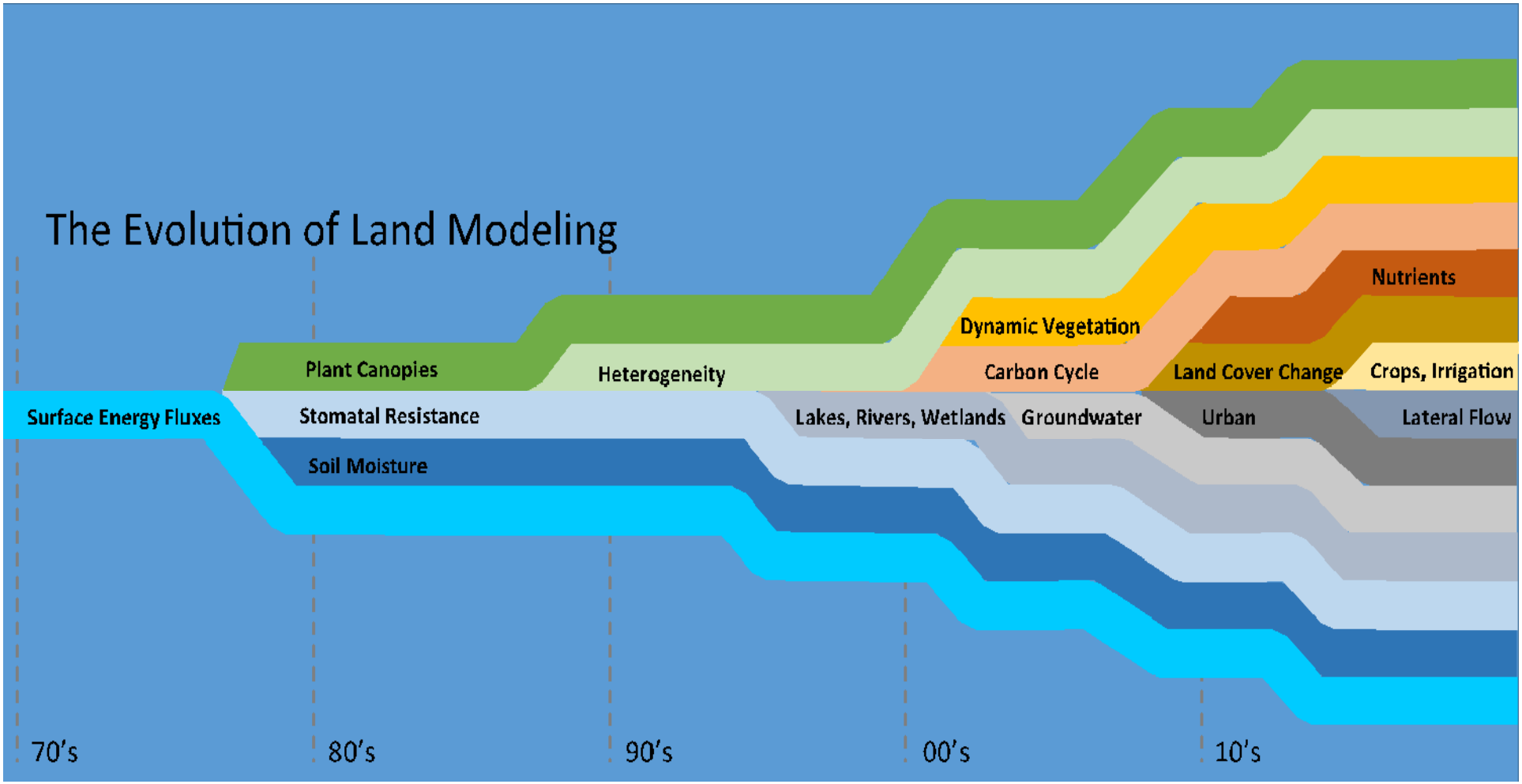
https://ecoforecast.org/efi-rcn-2020-conference/

Goal: set framework for data science competition

Initial focus
- terrestrial carbon dynamics (e.g., flux tower and inventory data)
- water quality (e.g., temperature, dissolved oxygen, chlorophyll)
- ecological populations/communities (e.g., ticks, mosquitoes, birds, community structure)

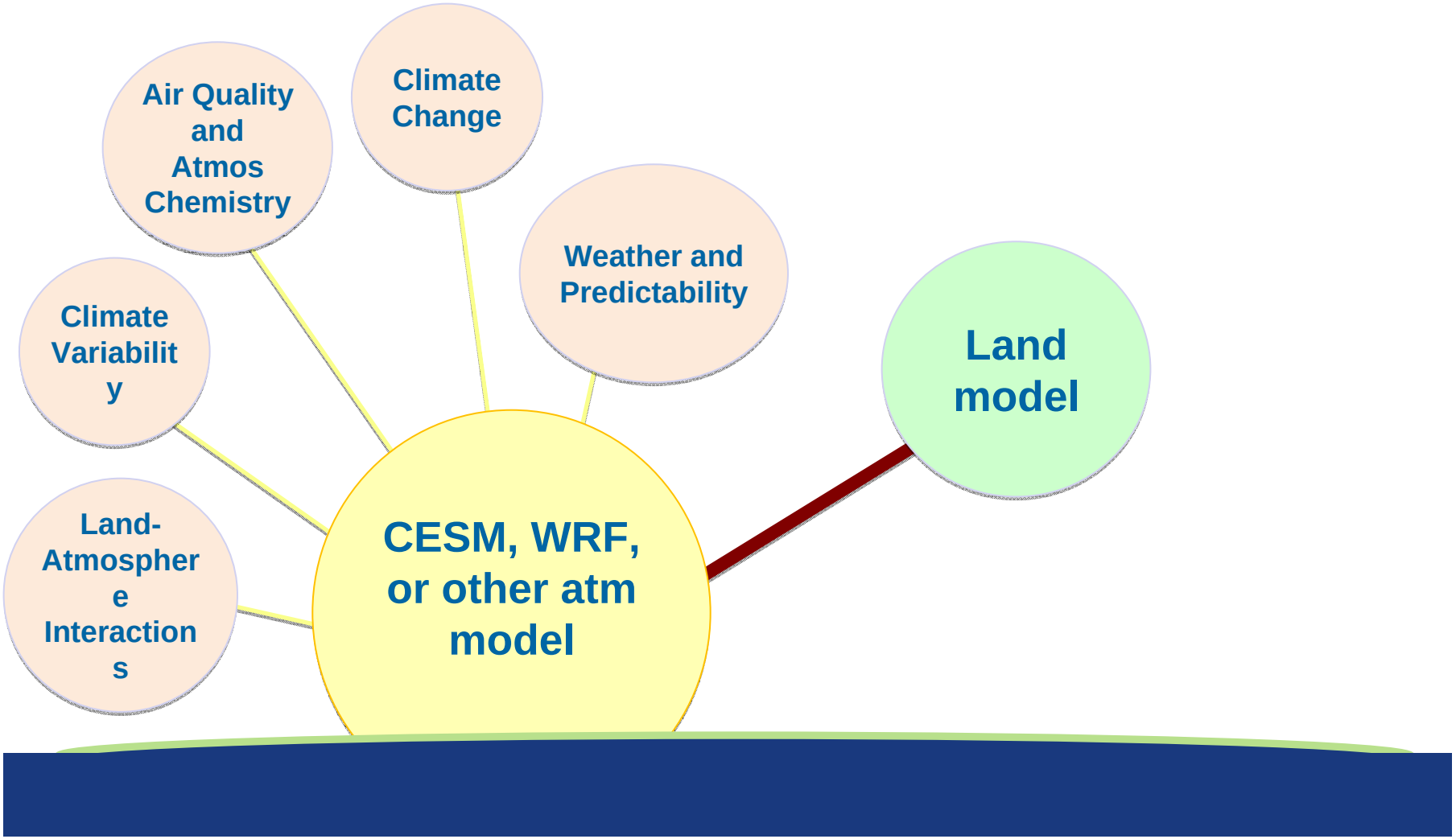
The ‘evolution’ of land models

Land as a lower boundary to the atmosphere → **Land as an integral component of the Earth System**

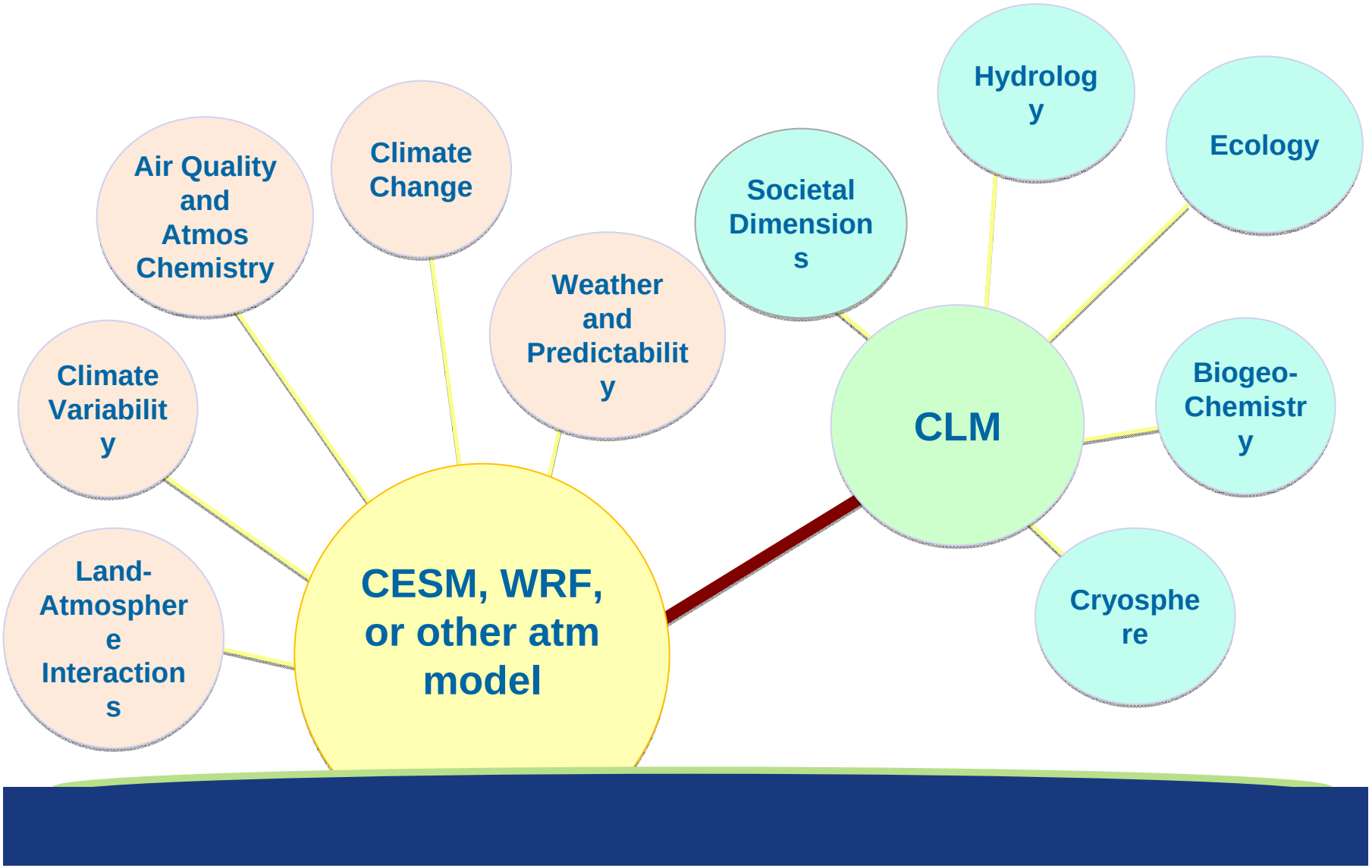


R. Fisher

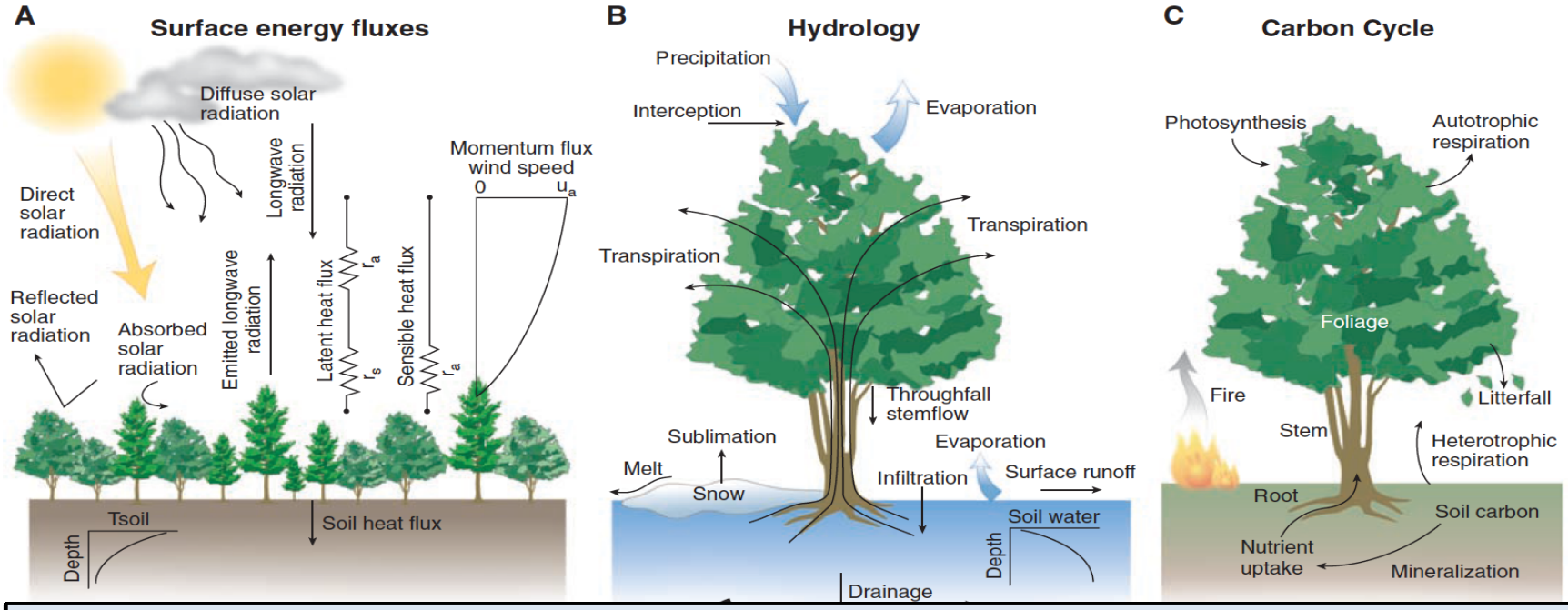
Land models for Earth System prediction

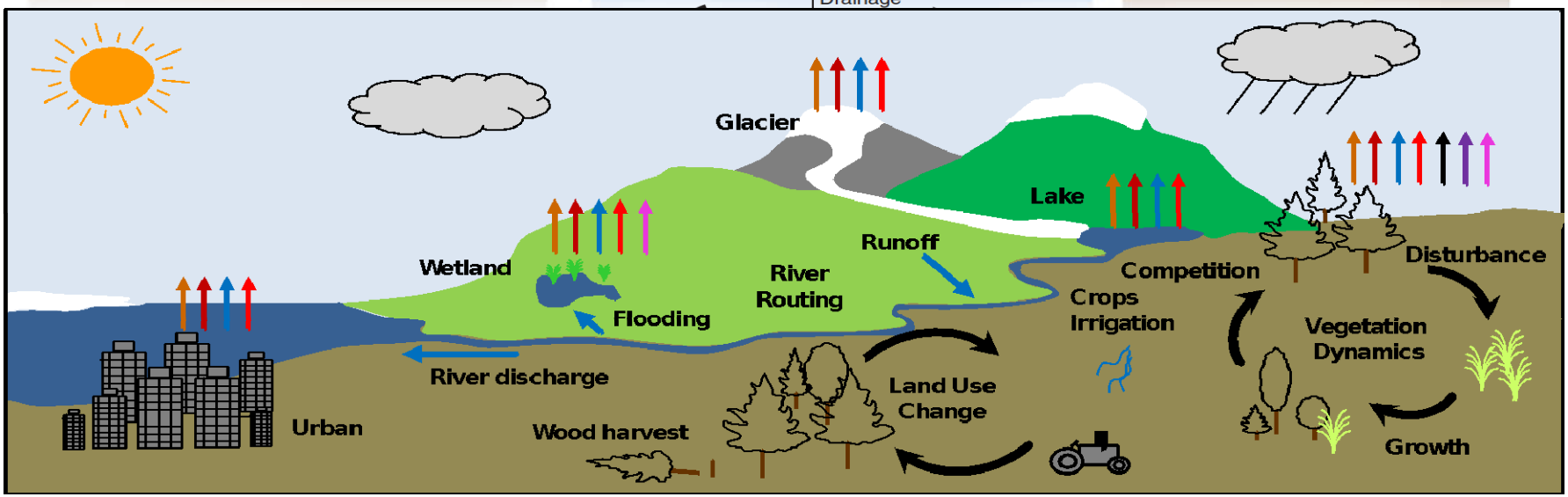


Land models for Earth System prediction



The Community Land Model





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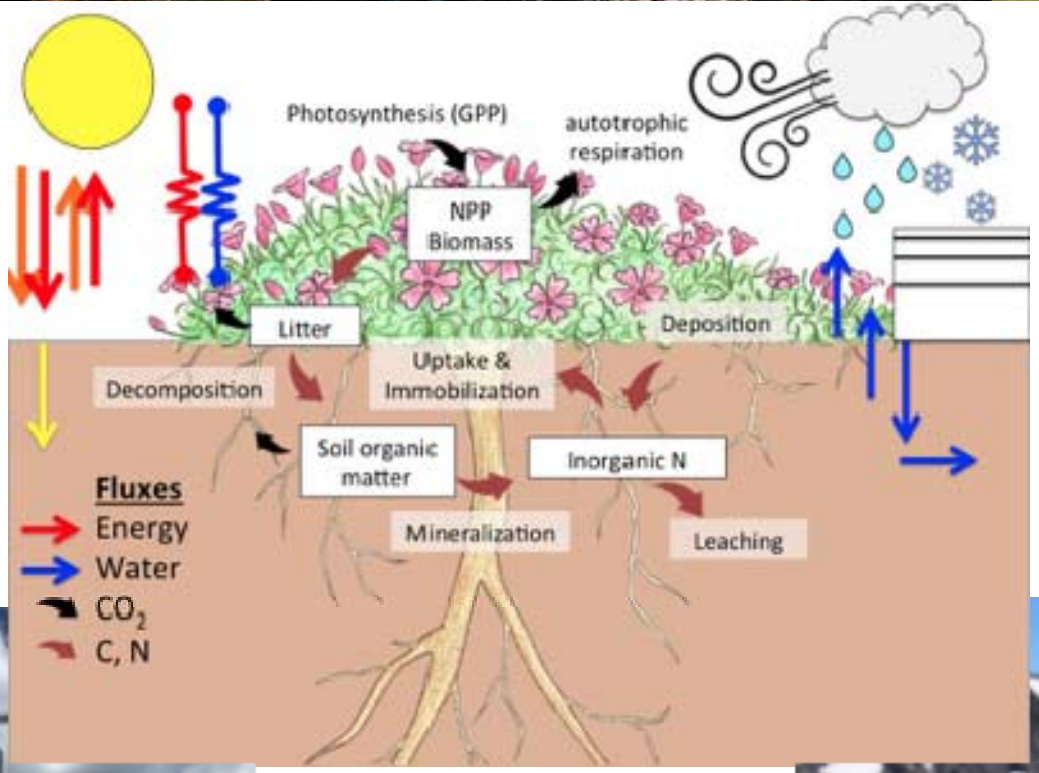


@ Niwot Ridge

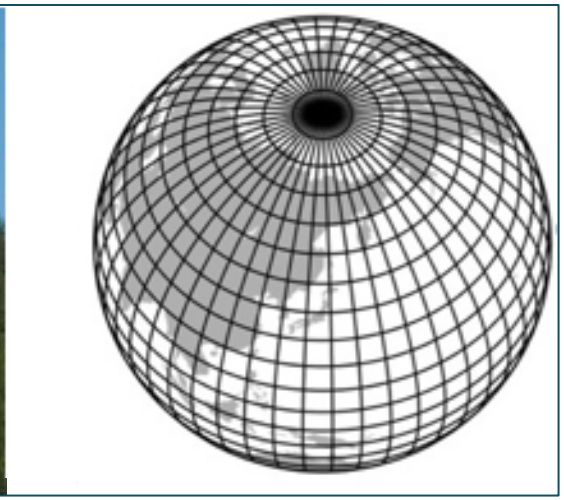
The Community Land Model

Atmospheric Inputs

forcing

Land inputs

surface data & parameters



Model output & validation data

CLM @ Niwot Ridge

Sample work flow:

Inputs:

T-Van

Plant traits

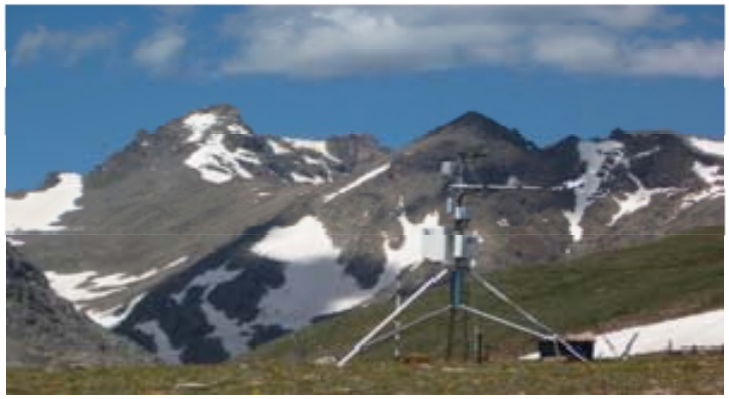
Soil depth

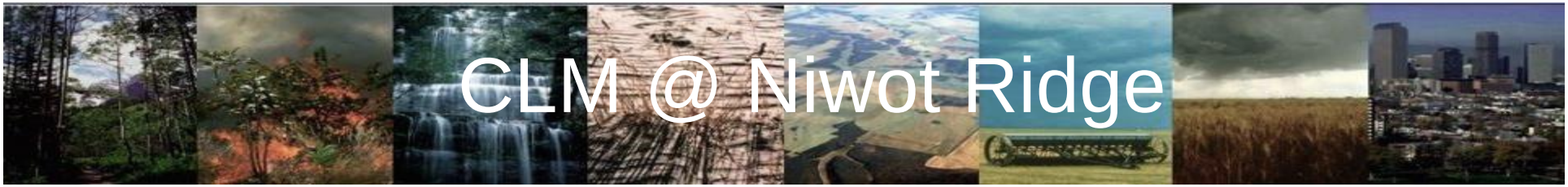
Validation:

Snow depth

Productivity

Soil moisture & temp.





Extensions

Forecasting:

Manipulations

- Future projections
- Hindcast historic conditions

Questions:

- Exposure to extremes

Changes in community composition

Resources

Brainstorms for datasets

Sample publications from CLM @ NWT

- Wieder et al 2017
- Burns et al. 2018
- Swenson et al. 2019

See Google Drive version of these slides for these links

CLM Info

Github

- Overview: Lawrence et al. 2019 (includes technical note)

Tutorial materials

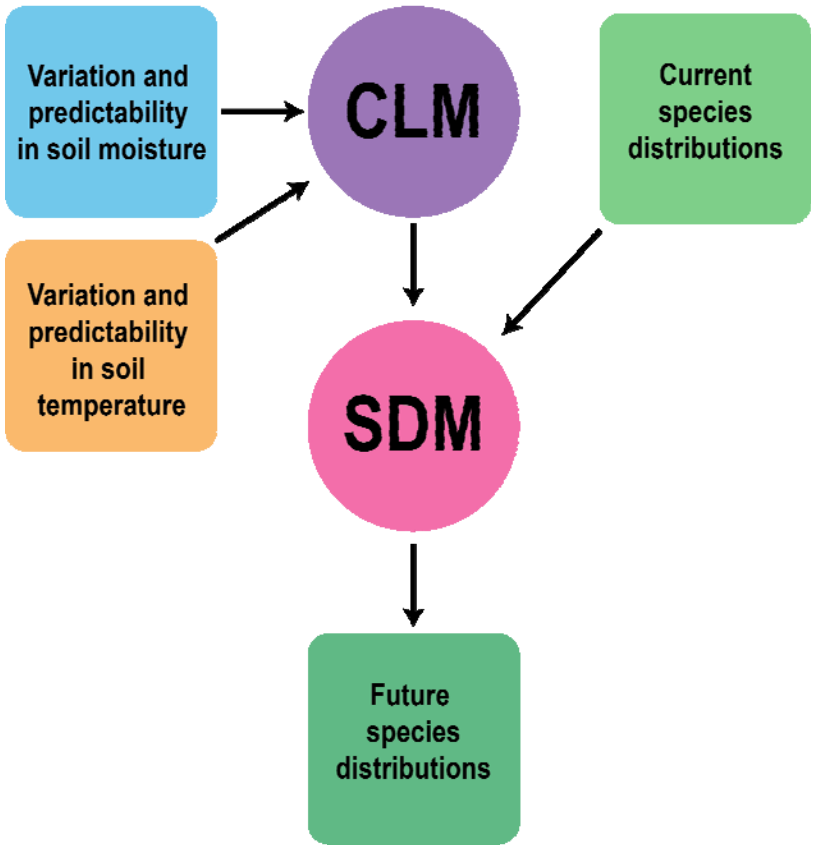
Niwot data archive

- CLM4.5 results
- [messy & dated] Code for analyses

Environmental variation and species distributions

Hypothesis: alpine species have life histories that are adapted to the amount of variation in soil moisture and how predictable it is

Possibly improve forecasting potential of Community Land Model as an input of the Species Distribution Models



Deschampsia cespitosa

Geum rossii

Forecasting changing dominance of tundra grass and forb

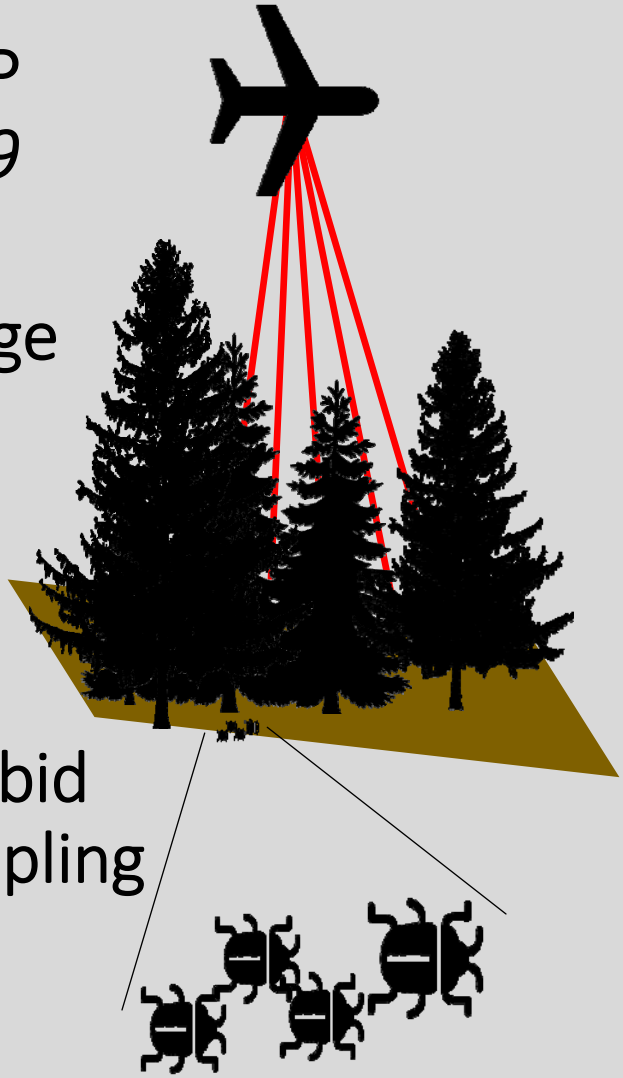
- general question: how and where do grasses expand with environmental change (climate, nutrients)?
- pikas: cache both species for winter forage; pikas on the ridge really need the forb for calories through the winter (cool research in the 1990s) so if the forb loses out, the pikas might also.

- main plants competing over a good portion of Niwot Ridge
- grass is beginning to gain ground in some areas
- much known about biology (could construct various models)
- CLM could be used to project key abiotic conditions

Data (lots)
- Plant species composition data for Saddle grid, 1989 – ongoing
- ~100 plots, moisture gradient
- x,y coord (10 cm) for ~10 y, every 3-5 y before that
- soil properties (1 time)
- annual snow cover/melt & total biomass
- experiments

NEON AOP
2017-2019

Niwot Ridge
subalpine



NEON carabid
beetle sampling
2015-2019

Predictor variables

Canopy gaps
Canopy cover
Hydrology (DEM)
Slope
Aspect

Litterfall/woody debris
Precipitation
Rel humidity
Solar radiation

… other environmental variables from Niwot LTER, NEON, Ameriflux

Surface temp
soil moisture
Soil temp
Microtopography

Response: carabid abundance/occurrence with global warming

NEON: mosquito time series

- See Google Drive for a full description of this project idea

Our project ideas

- Niwot: Community land model (CLM) projections
- Niwot: Species distribution models of tundra plants
- Niwot: Changing dominance of tundra grass and forb
- NEON-Niwot: Species distribution models of forest species
- NEON: Mosquito time series
- NEON: Ticks. Can we forecast tick abundance with phenocam (and other) data? Tick borne pathogens.
- Niwot: Decoupling of temperature and growing season length in ANPP
- Predicting host states using microbial traits