Models:
Many types and "classes" but are they really that different?
For climate work they must be Process driven – otherwise
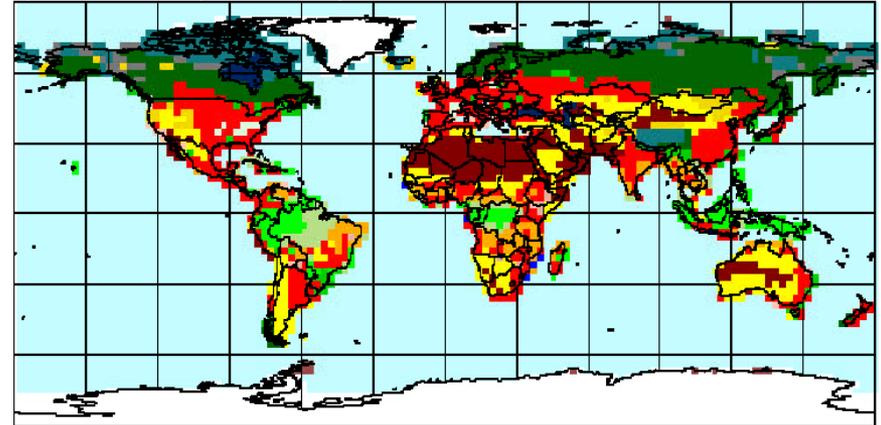
Brian's Questions

- How sensitive are LULC to the model of decision making
  - That depends on how the land cover information is passed from one model to the next. Errors in representation/ translation may be greater than the signal modeled
  - Difficult to link cause and effect if the LULC model is not process based
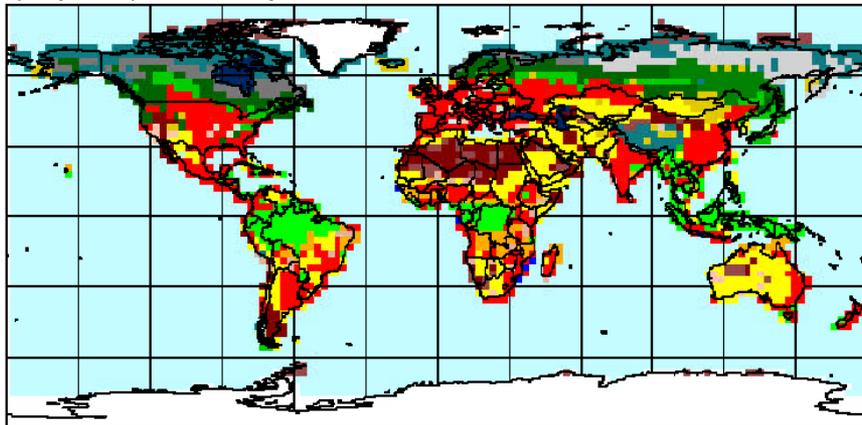
PCM Present Day Uncertainty
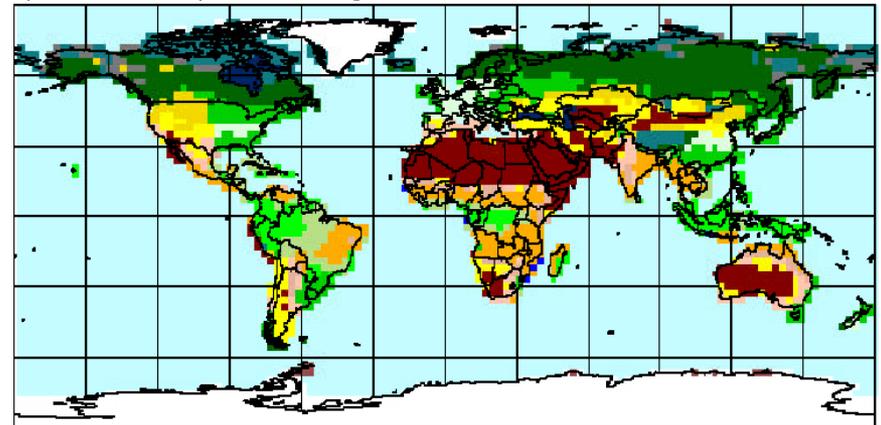
a) LSM original present day land cover: LSMlc
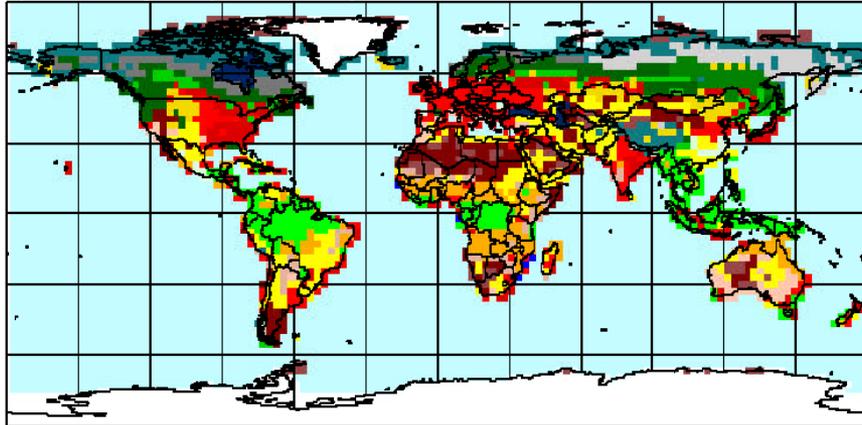
b) IMAGE 2.2 present day land cover: IMAlc

c) Hybrid present day land cover: HYBlc

d) IMAGE 2.2 potential vegetation land cover: POTlc

LSM Land Cover Types

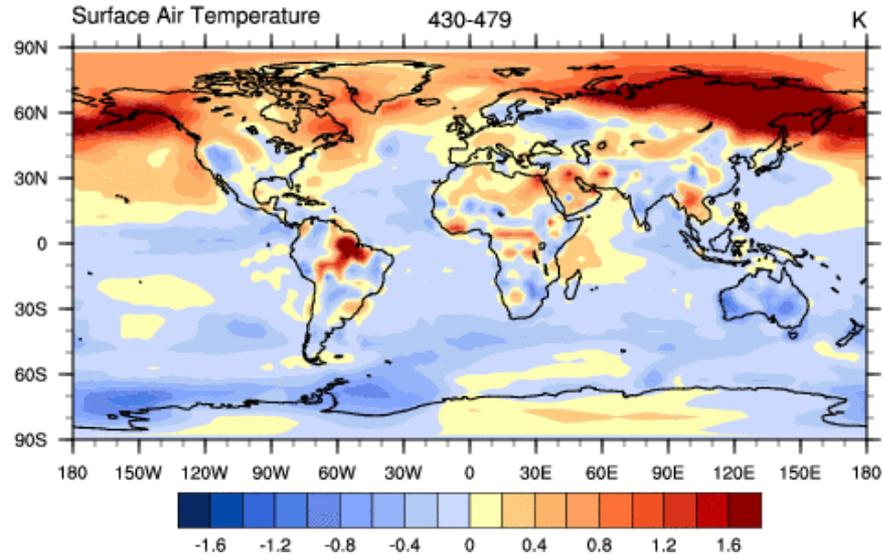|			
0 - Ocean	8 - Broadleaf decid	15 - Forest crop	22 - Semi-Desert
1 - Ice	10 - Tropical broadleaf	17 - Cool grassland/steppe	26 - Crop
2 - Desert	11 - Trop seasonal decid tree	18 - Warm grassland	27 - Forest wetland
3 - Needleleaf evergreen	12 - Savanna	19 - Tundra	28 - Non-forest wetland
4 - Needleleaf decid	13 - Evergreen forest tundra	20 - Evergreen shrub	
6 - Temp mixed forest	14 - Decid forest tundra	21 - Decid Shrub	

PCM Uncertainty v.s. Historical Land Cover

PRESENT DAY UNCERTAINTY
- Arctic — albedo
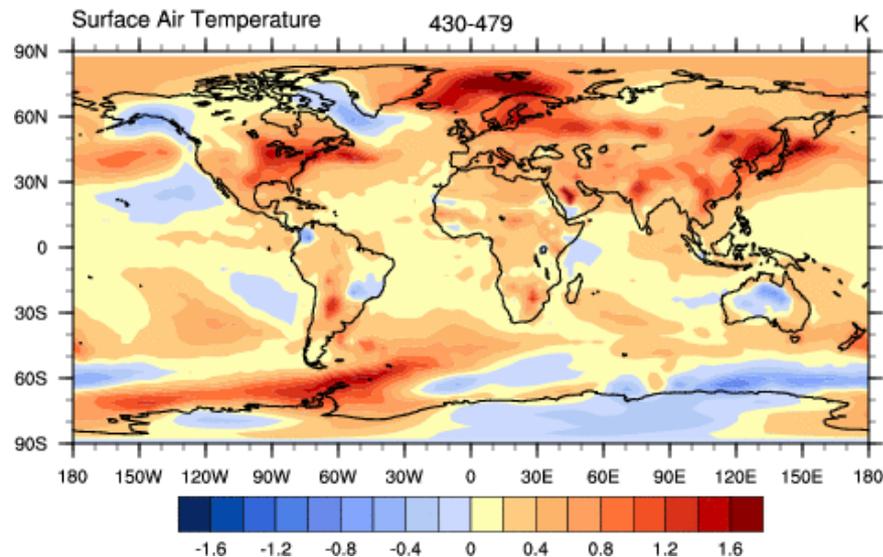- Amazon — latent heat flux
- Australia — albedo

HISTORICAL CHANGE
Climate difference from land cover classification is as large as the climate difference from land cover change

- Primarily shift due to agriculture

Present Day (IMAGE) Land Surface minus control

Natural Vegetation minus Present Day (IMAGE)

- Are IAMs missing important processes
  - Yes
  - Details about land use and land type
  - Inconsistency between base scenarios for IAMs vs other models
  - Simplified land cover representation lead to interpolation/ interpretation errors

Brian's Questions

- How to connect regional land use scenarios and data to global scenarios?
    - Splicing of dataset
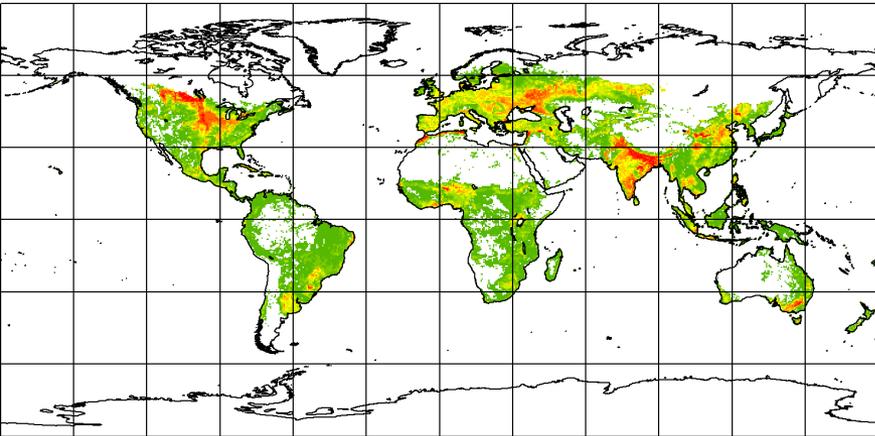   - Boundary conditions
    - Integration of data

Brian's Questions

- How sensitive are climate and biogeochem to LULC
  - Models are potentially very sensitive to some variables but much less so to others. We need to test the variables that are most critical
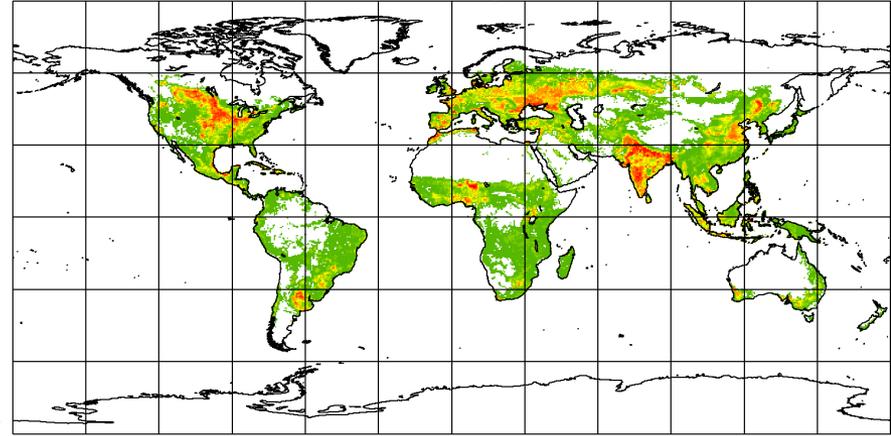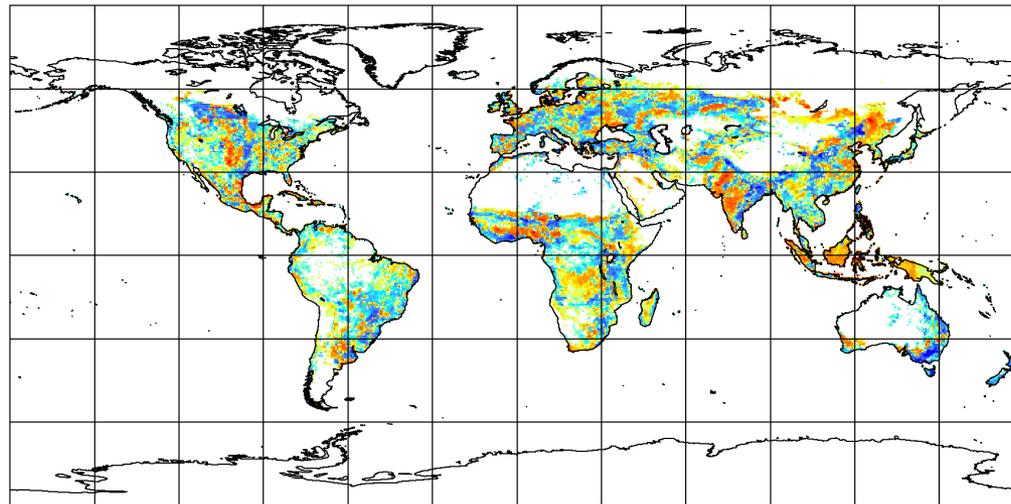
Year 2000 Crop comparison

HYDE 3.0

Ramankutty 2000

% Grid Cell

- 0
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Difference

% Difference

- -100 - -50
- -50 - -25
- -25 - -10
- -10 - -5
- -5 - -2.5
- -2.5 - -0.5
- -0.5 - 0.5
- 0.5 - 2.5
- 2.5 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 100

Year 2000 Grazing comparison

HYDE 3.0

% Grid Cell

- 0
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
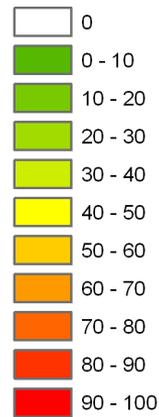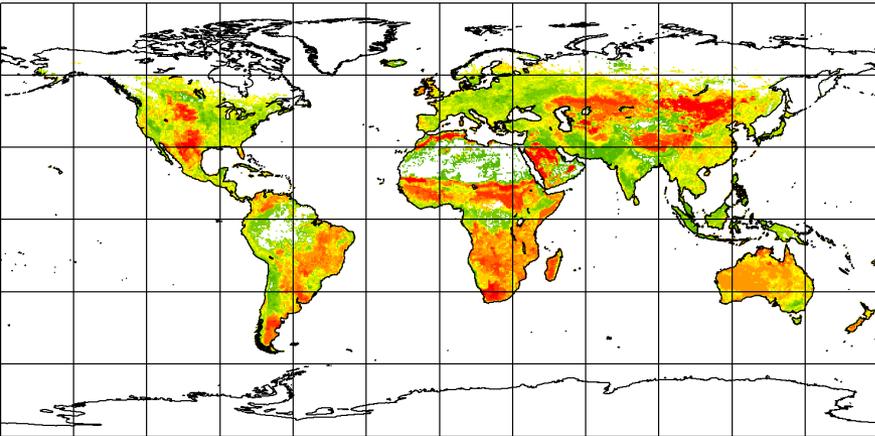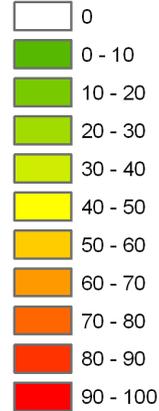
Ramankutty 2000

Difference

% Difference

- -100 - -50
- -50 - -25
- -25 - -10
- -10 - -5
- -5 - -2.5
- -2.5 - -0.5
- -0.5 - 0.5
- 0.5 - 2.5
- 2.5 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 100
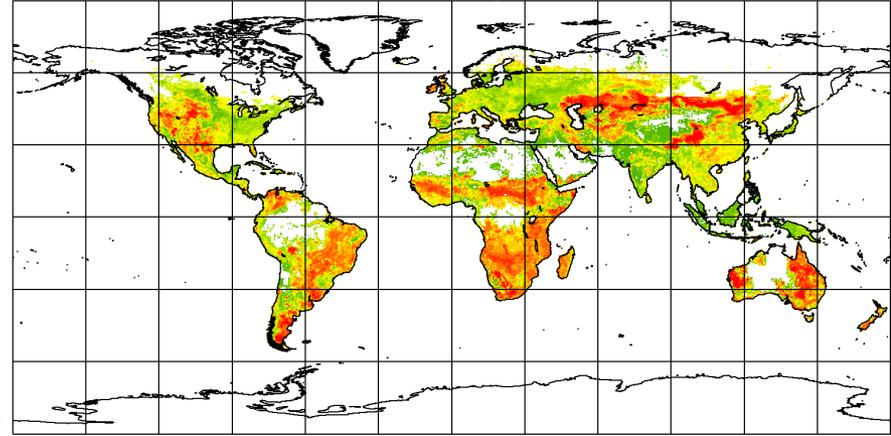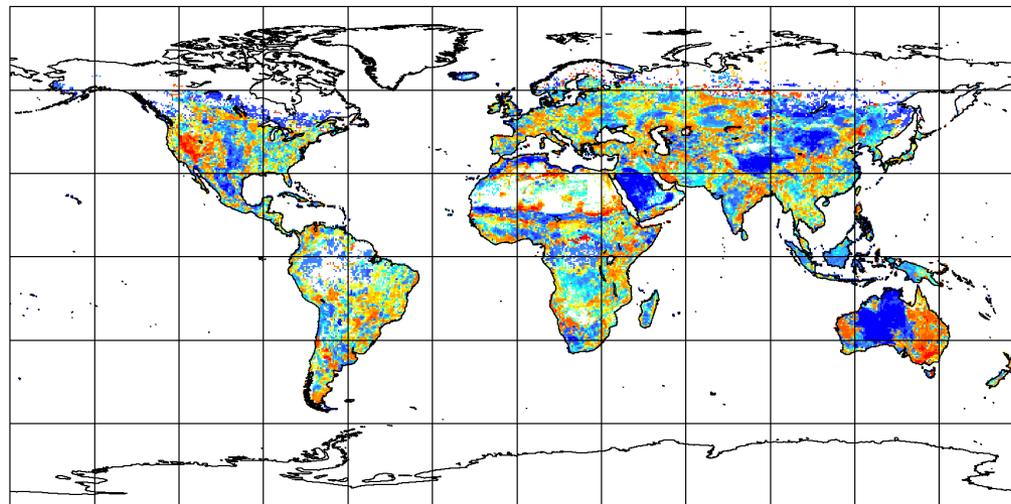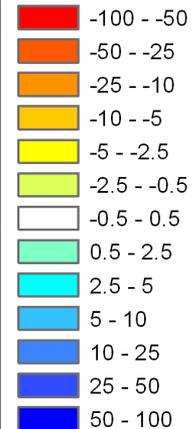
Urban land cover

HYDE 3.0
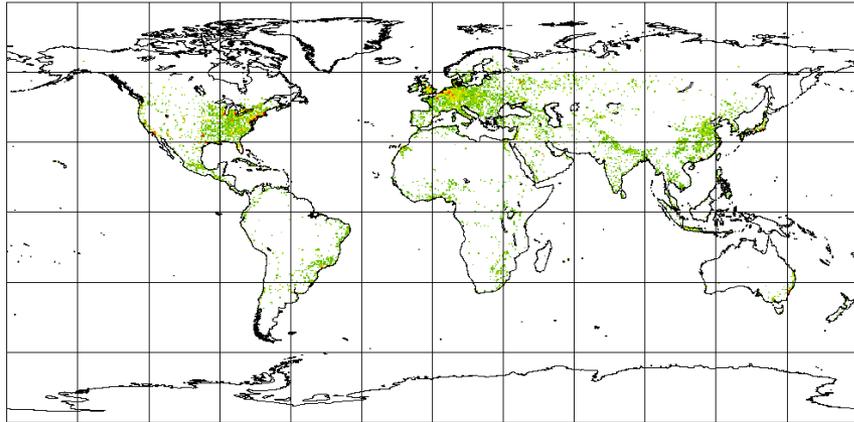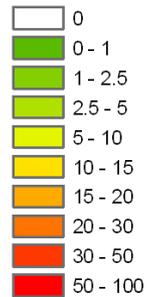
Jackson and Feddema 2004

% Grid Cell
- 0
- 0 - 1
- 1 - 2.5
- 2.5 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 30
- 30 - 50
- 50 - 100

Difference

% Difference
- -100 - -50
- -50 - -25
- -25 - -10
- -10 - -5
- -5 - -2.5
- -2.5 - -0.5
- -0.5 - 0.5
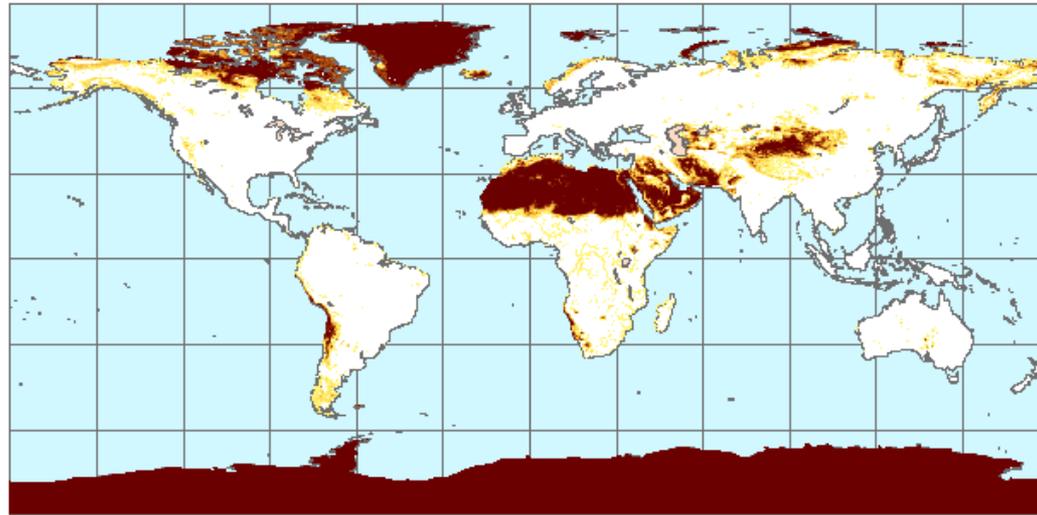- 0.5 - 2.5
- 2.5 - 5
- 5 - 10
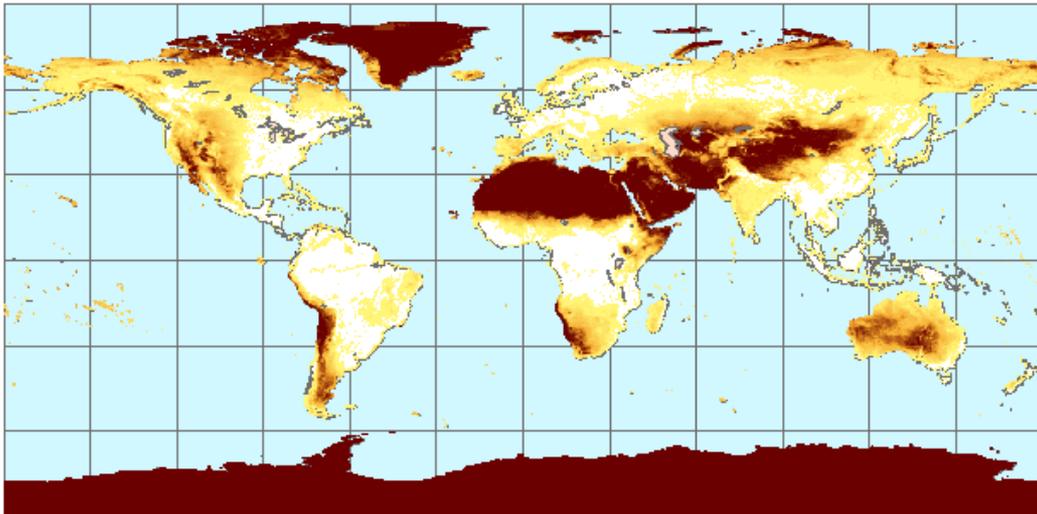- 10 - 25
- 25 - 50
- 50 - 100
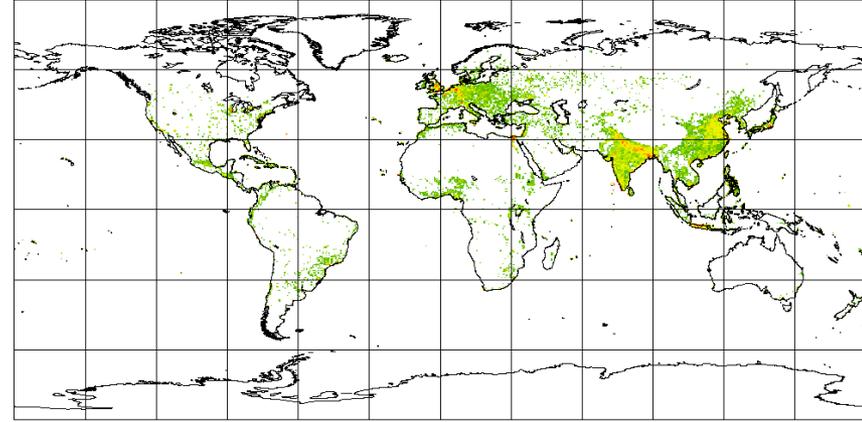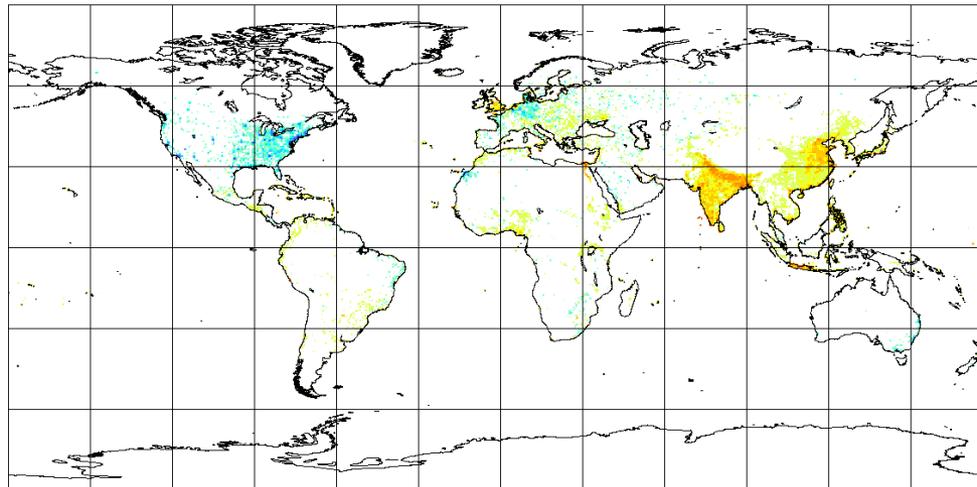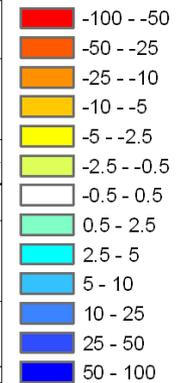
Comparison of Discover and MODIS Bare Ground Fraction

Discover - CLM 3.0

MODIS

Percent Bare

- None
- 0-5
- 5-10
- 10-15
- 15-20
- 20-25
- 25-30
- 30-35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
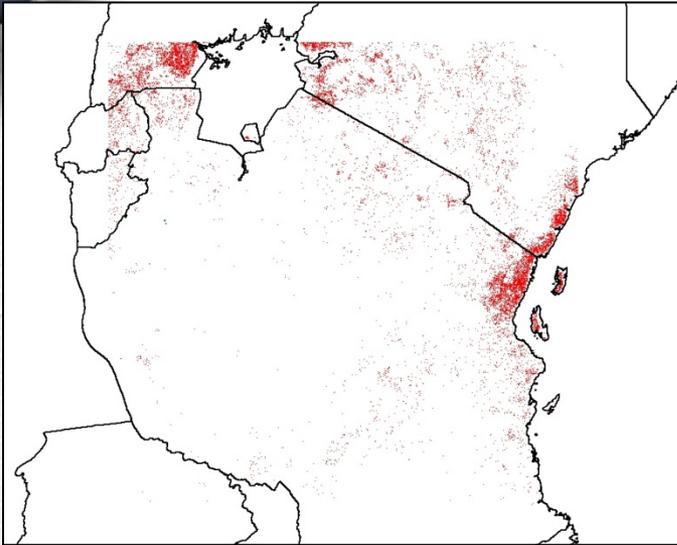- 65-70
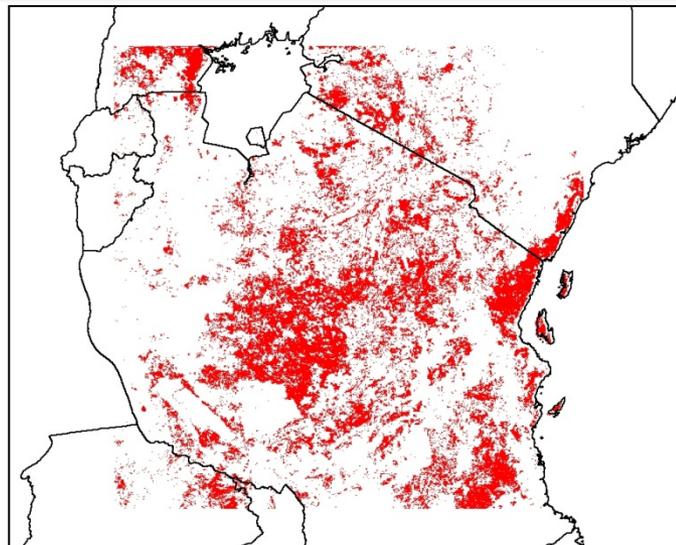- 70-75
- 75-80
- 80-85
- 85-90
- 90-95
- 95-100
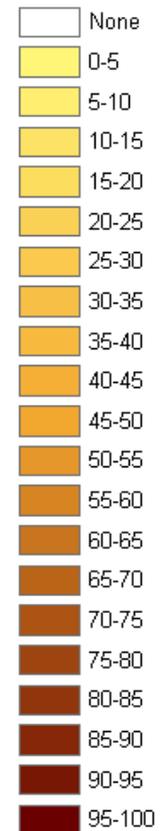
Source: Peter Lawrence, CIRES, University of Colorado

Comparison of Agriculture land classes from 3 satellite products
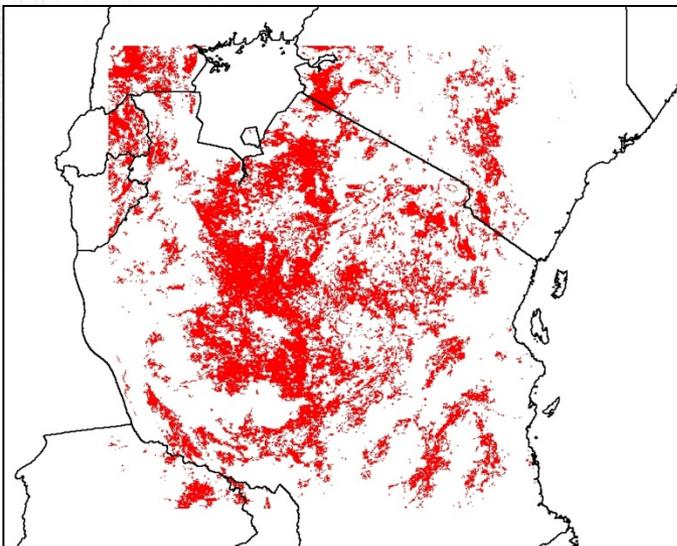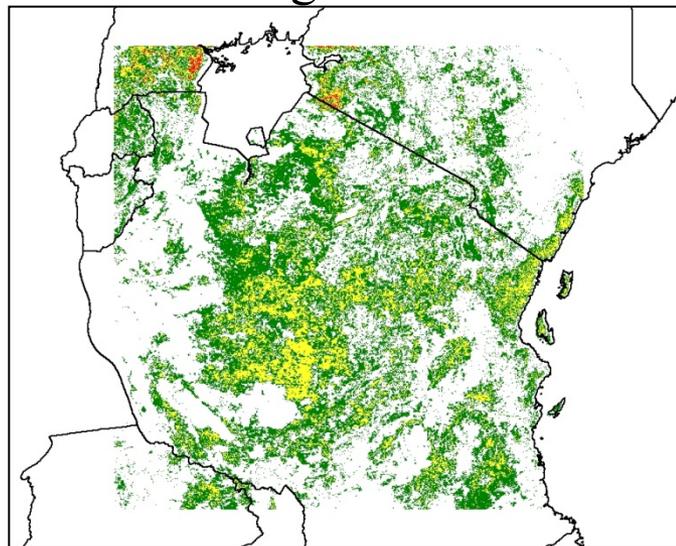## 10 degree tile over East Africa

MODIS

IGBP

GLC2000

Agreement

- No Ag
- 1 product
- 2 products
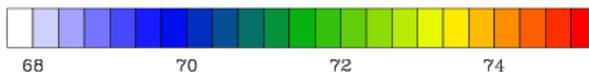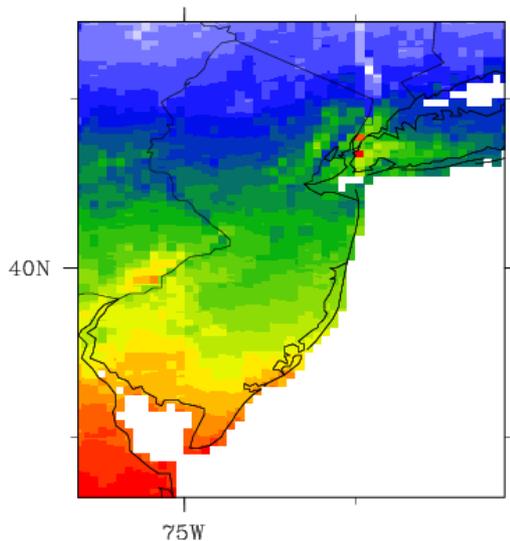- All products

Brian's Questions

- Can validation be improved
  - This process has hardly started!
  - IAM MIP of 20th century
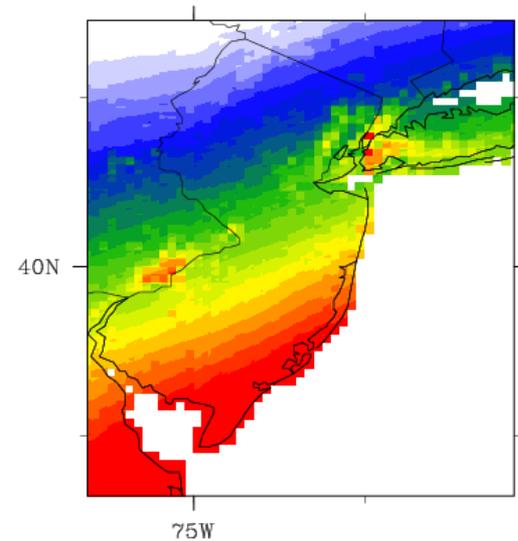 - Validation of source data between models

High Resolution Modeling – North East US

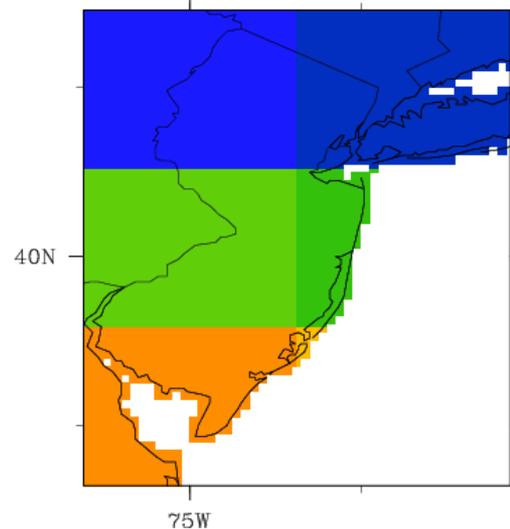**From: Peter Lawrence**