**Anthropogenic Biomes:** Observing and Modeling Carbon in an Anthropogenic Biosphere

We live in the Anthropocene
Humans have fundamentally altered ecosystem patterns & processes across most of the terrestrial biosphere.

Are conventional terrestrial biome models obsolete?

Conventional Biomes characterize the terrestrial biosphere based on global ecological patterns controlled by climate.

\[
Ecosystem \ processes = f(C) \\
C = Climate \ (precipitation \ & \ temperature)
\]

Anthropogenic Biomes characterize the terrestrial biosphere based on sustained human interactions with ecosystems

\[
Ecosystem \ processes = f(P, L) \\
P = Population \ density \\
L = Land \ use
\]

**Why Anthropogenic Biomes?**

- Nature is embedded in human systems
- Land: 22% Wild, 78% Anthropogenic
  - Wild forest: 5% Anthropogenic
  - 32% in Croplands biomes
  - 33% Forested Biomes
- NPP: 11% Wild, 89% Anthropogenic
  - Wild forest: 6% Anthropogenic
  - 60% in populated croplands (0.1 persons/ha)
- People: 80% in urban & village biomes
  - 24% in Villages, including most irrigated & rice lands
  - 60% in populated croplands (0.1 persons/ha)
- Crops: >25% of global tree cover is embedded in Croplands
  - 24% are in Villages, including most irrigated & rice lands
  - 60% in populated croplands (0.1 persons/ha)

A new Conceptual Model for Terrestrial Biomes

Drivers
- Population density
- Land use

Predictions
- Carbon emissions
- Reactive Nitrogen
- Biodiversity

Observations
- Population density
- Land use
- NPP

Anthropogenic Biomes
- Wildlands
- Forested
- Rangelands
- Croplands
- Villages

**Resources for Research & Education**
- Journal Article
- Project Web Site
- Encyclopedia of Earth

**Anthropogenic Biomes: An Empirical Approach**

- Scale: global, 5 arc minute cells (6°-85° latitude)
- Data input:
  - Population density (Ehrlich, 2005; 10,000 square km)
  - Rice value pop density (IPCC 2000; 100,000 square km)

- Procedure
  1. Identify “wild” vs. anthropogenic
     - Anthropogenic = wild with population, crops or pasture > 0
  2. Identify urban/”% urban area” (Two-step cluster analysis, 1990’s)
  3. Stratify by non-urban population density (persons/ha)
     - Dense (100), Residential (50-100), Populated (1-50), Remote (< 1)
  4. Cluster by population, land use & land cover (GISArcGIS)

**A 21st Century View of the Terrestrial Biosphere**

**Conventional Biomes (IGBP)**
- Global areas (% ice-free land)
  - Coniferous forest
  - Broadleaf forest
  - Grasslands
  - Croplands
  - Urban

**Anthropogenic Biomes**
- Village
- Croplands
- Forested
- Rangelands
- Wildlands
- Crop

**Drivers**
- Population density
- Land use

**Predictions**
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