Vegetation Modeling in the Tropics

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The Models

• **BGC-MAN:**
  – Biogeochemical model based on a few dozen differential equations giving a mechanistic description of the Energy, Water, C and N cycles within a given ecosystem
  – Inputs:
    • Daily weather data \((T_{\text{min/max}}, \text{prcp}, \text{vpd}, \text{srad})\)
    • Site data (texture, elev., slope, aspect)
    • N-Deposition data
The Models (i)

• G4M
  – Global Forest Model
    • Biophysical Growth and Yield model
    • Growth and Yield may be scaled over large areas based on physical and climatological site conditions.
    • Productivity can be estimated from global maps, Satellite products (e.g. MODIS), local data (yield tables) or regionally adapted models (e.g. BGC-MAN)
The Models (ii)

- **EPIC**
  - Environmental Policy Integrated Climate Model
    - Physiologically explicit model of agricultural productivity
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- **BGC-MAN**
  - BioGeoChemistry - MANagement Model
    - Physiologically explicit model for natural ecosystems
Examples (i)

• BGC-MAN:
  – Model Calibration & Validation:
    • TrEco data set of > 150 parcelles: virgin forest refuges, exploited forests, open and wooded savannahs, shifting cultivation, forest fallows
  – Outputs:
    • C, N & H2O stocks
    • C, N & H2O fluxes
    • ~ 600 variables
Examples (ii)

- Spatial Resilience Landscape
Examples (iii)
- Temporal Resilience Landscape
Examples (iv)
- Management tipping points I

• Forest Exploitation
Examples (v)
- Management tipping points II
- Shifting cultivation
Examples (vi)

- Management = shift in stable states
Examples (vii)
- Restoration Options

- Smart Management
t.b.c.

EPIC