Land Cover Change and Biodiversity Impact

Bolivian Ecosystems Management using a GIS Modeling Environment for Land Cover Change and Habitat Assessment

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Land Cover Change in the Bolivian Lowlands

- Land Cover Change Analysis
- Model Future Land Cover Scenarios
- Assess Impacts of Predicted Change on Endemic Species
Land Change Modeler™
for ArcGIS

- Land Cover Change Analysis
  - Change Analysis
  - Map Changes
  - Spatial Trend Analysis

- Land Cover Change Prediction
  - Transition Potentials
  - Hard Prediction
  - Soft Prediction

- Implications Analysis
  - Habitat Suitability
  - Habitat Assessment
  - Change in Habitat Structure
  - Biodiversity Analysis
  - Gap Analysis

- Land Use Planning
  - Corridor Planning
  - Set Incentives
  - Set Constraints
  - Infrastructure Planning
# Bolivia’s Land Change Dynamic

Forest to disturbed class: 1992, 2001, 2004

<table>
<thead>
<tr>
<th>Land Cover Change (km²)</th>
<th>1992</th>
<th>2004</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>484875</td>
<td>461087</td>
<td>-23788 (5%)</td>
</tr>
<tr>
<td>Lowland Shrub</td>
<td>75822</td>
<td>73097</td>
<td>-2725 (4%)</td>
</tr>
<tr>
<td>Tropical Savannah</td>
<td>59877</td>
<td>58138</td>
<td>-1739 (3%)</td>
</tr>
<tr>
<td>Disturbed</td>
<td>27804</td>
<td>56773</td>
<td>+28969 (+104%)</td>
</tr>
</tbody>
</table>
Change Analysis
Deforestation over three periods
Change Prediction

Transition Potentials: empirically derived potential for change

Environment Variables

- cost distance from roads
- cost distance from the border of Brazil
- cost distance from the border of Argentina
- cost distance from Santa Cruz
- distance from major roads
- empirical likelihood from 1992 disturbance
- empirical likelihood from 1992 land cover
- empirical likelihood from the FAO soils map
- empirical likelihood from FAO ecological regions
- elevation
- slopes
- Landscan population data
- map of latitude
- map of longitude
- MODIS land surface temperature annual range
- MODIS land surface maximum temperature of the warmest month
- MODIS land surface minimum temperature of the coldest month
- MODIS mean annual land surface temperature
- TRMM mean annual precipitation
- TRMM precipitation seasonality
- TRMM maximum precipitation of the wettest month
- TRMM maximum precipitation of driest month
- MODIS Vegetation Continuous Fields - % herbaceous cover
- MODIS Vegetation Continuous Fields - % tree cover
- mean annual NDVI
- seasonality (standard deviation) of NDVI
- 26–38 monthly average NDVI for 1999
Change Prediction

Hard Prediction: single realization
Change Prediction

Soft Prediction: vulnerability to change
1. Predict to 2004 from 2001 and validate against actual 2004: skills score = .61 (hits = 62%, misses = 2%)

2. Model accuracy 90% based on training of neural network

3. Histogram of actual transition areas 2001-2004 to soft output
Deforestation Impact on Biodiversity

Combining land cover projections with endemic species

- Predict land cover (forest loss) to 2015
- Assess the impact of forest loss on endemic species
Deforestation Impact on Biodiversity
Change Prediction: Soft Prediction 2015
Endemic Species

73 for the Bolivian Lowlands

Data Source: NatureServe
Endemic Species
Alpha Diversity for Bolivian Lowlands
Deforestation Impact on Endemic Species

Risk of Endemic Loss (alpha diversity * soft prediction)