Land Use Inter-Agency Working Group (LUIWG) of The U.S. Global Change Research Program (USGCRP)

Jonathan H. Smith
Co-Chair
Nancy Cavallaro
Past Co-Chair
LUIWG Members

- Jonathan Smith  USGS
- Compton Tucker  NASA
- Nancy Cavallero  USDA/NIFA
- Britta Bierwagen  EPA
- Fae Korsmo  NSF
- Fred Williams  DOT/FTA
- Garik Gutman  NASA
- Cynthia Nickerson  USDA/ERS
- Ken Brewer  USDA/USFS
- Rick Mueller  USDA/NASS
- Carolyn Olson  USDA
New USGCRP Context

- Supporting next National Assessment
- Strong emphasis on
  - adaptation,
  - mitigation,
  - decision support,
  - climate services
- Positions of Director of USGCRP and Chair of USGCRP principals will be combined
- Discussions underway for a “new vision” and “new structure”, in response to NRC reports, centered around scientific-societal issues
LUIWG Long Term Goals

- Collect, maintain and synthesize satellite and land-based observations of land-cover changes, including rates and spatial patterns of change;
- Hypothesize, measure, test and determine human-environment dynamics that give rise to these changes;
- Evaluate the biophysical consequences of future land system changes on ecosystem functions, biogeochemical cycles, and climate feedback effects; and
- Predict future global and regional environmental conditions by developing integrative land-change models coupled to models of the Earth system.
Revised/Updated Land Use and Land Cover Change Strategic Questions

1. What observations and methods are needed to quantitatively characterize historic and current land-use and land cover dynamics that influence sustainability of human societies and the environment?

2. What are the primary drivers and processes of land use and land cover change and how do they interact?

3. What will land use and land cover patterns and characteristics be 5 to 50 years into the future?

4. How do climate variability and change affect land use and land cover, and what are the potential feedbacks of changes in land use and land cover to climate?

5. In what ways do land use and land cover change interact with climate change and other stresses to produce environmental, social, economic, and human health consequences over the next 5-50 years?

6. What are the opportunities and mechanisms in land use and land cover change to achieve climate-change mitigation and facilitate adaptation of human societies?
LULCC Science Steering Group (LSG)

- Group of active LULCC researchers
- Chaired by Dan Brown (University of Michigan)
- IWG connection to the research community:
  - Outreach from and input to IWG
    - Recent scientific developments and accomplishments
    - Strategic planning input
      - Research needs and gaps
      - Input on possible future directions
      - Workshop planning
FY09 LUIWG Accomplishments

• Workshop on the plight of ecosystems in a changing climate emphasizing thresholds, land use and invasive species

• Workshop on Land Use/Land Cover Change and the Carbon Cycle
  – Workshop proceedings

• Discussions with NAS on land change modeling status report
LUIWG Plans

- NRC land change modeling study
- LULCC-Carbon Cycle book
- LULCC-Carbon cycle projects to be funded from joint solicitation
- LULCC input to the new USGCRP Strategic Plan
- Global Land Survey (GLS) 2010 Satellite Data Project
- Focus on Environmental Effects of Biomass-Based Energy on LULCC
- Improve models integrating physical, biological, economic, housing density, and demographic models for better understanding of land change and climate interactions
NRC Land Cover Change Modeling Study

Statement of work:

A NRC committee will review the present status of spatially explicit land-change modeling approaches and describe future data and research needs so that model outputs can better assist the science, policy, and decision-support communities. Future needs for higher resolution and more accurate projections will require improved coupling of land-change models to climate, ecology, and biogeochemistry models; improved data inputs; improved validation of land-change models; and improved estimates of uncertainty associated with model outputs. The study will provide guidance on the verification strategies and data, and research requirements needed to enhance the next generation of models.

In particular, the study committee will:

1. Assess the analytical capabilities and science and/or policy applications of existing modeling approaches.
2. Describe the theoretical and empirical basis and the major technical, research, and data development challenges associated with each modeling approach.
3. Describe opportunities for improved integration of land observation strategies (including ground-based survey, satellite, and remote sensing data) with land-change modeling to improve land-change model outputs to better fulfill scientific and decision making requirements.
Agency Activities
National Land Cover Database (NLCD)
Alaskan Land Cover Accuracy Assessment
<table>
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<tr>
<th>Class</th>
<th>1992</th>
<th>2001</th>
<th>Change</th>
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<tbody>
<tr>
<td>Open urban</td>
<td>44</td>
<td>56</td>
<td>12</td>
</tr>
<tr>
<td>Low density urban</td>
<td>66</td>
<td>61</td>
<td>-5</td>
</tr>
<tr>
<td>Med density urban</td>
<td>26</td>
<td>69</td>
<td>43</td>
</tr>
<tr>
<td>High density urban</td>
<td>55</td>
<td>78</td>
<td>23</td>
</tr>
<tr>
<td>Barren ground</td>
<td>32</td>
<td>53</td>
<td>21</td>
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<tr>
<td>Quarries</td>
<td>43</td>
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<tr>
<td>Transitional</td>
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<tr>
<td>Deciduous forest</td>
<td>43</td>
<td>63</td>
<td>20</td>
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<tr>
<td>Evergreen forest</td>
<td>59</td>
<td>75</td>
<td>16</td>
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<tr>
<td>Mixed forest</td>
<td>43</td>
<td>64</td>
<td>21</td>
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<tr>
<td>Shrub land</td>
<td>62</td>
<td>63</td>
<td>1</td>
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<tr>
<td>Grass land</td>
<td>51</td>
<td>61</td>
<td>10</td>
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<tr>
<td>Pasture</td>
<td>44</td>
<td>69</td>
<td>25</td>
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<tr>
<td>Cropland</td>
<td>43</td>
<td>82</td>
<td>39</td>
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<tr>
<td>Small grains</td>
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<tr>
<td>Fallow</td>
<td>43</td>
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<tr>
<td>Woody wetland</td>
<td>33</td>
<td>40</td>
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<tr>
<td>Emergent wetland</td>
<td>49</td>
<td>50</td>
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2001 to 2050
Projected LULC Change:
Washington / Baltimore / Philadelphia

Legend:
- Open Water
- Developed
- Disturbed (Cut)
- Mining/Quarry
- Deciduous Forest
- Mixed Forest
- Evergreen Forest
- Hay/Pasture
- Cultivated Crops
- Natural Grassland
- Woody Grassland
- Woody Wetland
- Herbaceous Wetland
- Model Run 2001 to 2050
- Reference Scenario - IPCC A1B
- Optimized Scenario
  - Forested Wetland restoration in Mississippi Alluvial Plain
  - Increased afforestation in Mississippi Loess Plain
  - Eliminate deforestation (other than forest harvest and replant
  - Eliminate wetland loss
  - Increase conservation tillage
  - Altered crop rotations
  - Increase forest cutting cycle period
Estimates of Major Uses of Land in the U.S., 1945 - 2007

- State level estimates of land uses
- Published in 5 year intervals
- Estimates are based on land use rather than land cover
Predicting Land Use Changes

- Regional Environment and Agriculture Programming (REAP) model
  - Integrates crop, livestock and agricultural products via supply/demand functions
  - Explicit relationship between production practices (rotation, tillage, fertilizer) and crop yields
  - Predicts land use changes and environmental impacts from agricultural and energy policies