Land use and land cover data

• Importance
  – climate modeling, urban planning, landscape change assessment, hydrological models, \textit{and unknown future issues}
  – Demand that data can be re-purposed for a variety of end uses

• Often produced and disseminated as categorical data
  – variation in nomenclature and class definitions pose significant hurdles to effective and synergistic use of Land Use & Land Cover information resources

• Standards Initiatives
  – National Vegetation Classification Standard (Vegetation Subcommittee, 1997), the Nordic Landscape Monitoring Project (Groom, 2005), the CORINE Land Cover (CEC, 1995 and 1999; Bossard et al., 2000), the standard classification for land cover of South Africa (Thompson, 1996), GLC2000 (Bartholomé and Belward, 2005), UNEP/FAO Land Cover Classification System (LCCS) (Di Gregorio and Jansen, 2000)
Despite standards, information semantics is a growing problem

- Cognitive science suggest that humans need categories in order to process experiences, form memories, for analysis, or to summarize and communicate knowledge (Lakoff, 1987; Rosch, 1978)

- The use of categorical data in computer based land analysis poses a significant problem because it usually leads to a binary treatment of the information in subsequent analysis, harmonization.
A traditional land cover taxonomy

- Typically follows divisions into class-subclass relations
  - CORINE
  - GlobCover
  - MODIS/IGBP
- Even the same agency (ex. USGS) system change from one time to the other
  - National Land Cover Data (NLCD) used slightly different classes in 1992 and 2001
Different classification systems create problems!
A fundamental issue...

“...The gradation of properties in the world means that our smallish number of categories will never map perfectly onto all objects: The distinction between member and nonmembers will always be difficult to draw or will even be arbitrary in some cases [...] if the world consists of shadings and gradations and a rich mixture of different kinds of properties, then a limited number of concepts would almost have to be fuzzy.” (Murphy, 2004).
Same issues around global definitions of “forest”

after Lund (2006) and Comber et al. (2006)
Current situation

- Increased recognition that variation in nomenclature and class definitions pose significant hurdles to effective and synergistic use of Land Use & Land Cover information resources

- Example initiatives:
  - FAO LCCS
  - EU EBONE
  - USGS Ontology for the National Map
  - INTEROP
FAO/LCCS - Land Cover Meta Language (LCML)

U.S. NLCD 1992 Low Intensity Residential

<table>
<thead>
<tr>
<th>Domain</th>
<th>Scale</th>
<th>Range</th>
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<tbody>
<tr>
<td>waterCov.owl</td>
<td>Ratio</td>
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</tr>
<tr>
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<td>{Ice, Water}</td>
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<td>Ratio</td>
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<tr>
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<td>Nominal</td>
<td>{Residential, Commercial, Mining}</td>
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<tr>
<td>surfaceType.owl</td>
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<tr>
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<tr>
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<td>{(Semi)Natural, Cultivated/Planted}</td>
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</tr>
<tr>
<td>crop.owl</td>
<td>Nominal</td>
<td>{RowCrops, SmallGrains, Fallow, Hay, Grass}</td>
</tr>
<tr>
<td>waterPersistence.owl</td>
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<td>{Permanent, Periodically, Waterlogged}</td>
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Attributes values allow for evaluation of category semantics

- In Ahlqvist (2004) I suggested two metrics of semantic relations
  - Distance
  - Overlap

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### U.S. NLCD 2001 Developed, Low Intensity

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Attributes values allow for evaluation of category semantics

- Two metrics of semantic relations
  - Distance
  - Overlap

- Bivariate color scheme
  - Show different combinations of these two metrics
Land Use and Land Cover Semantics
Ola Ahlqvist

Land Use and Land Cover Semantics

Ola Ahlqvist

As I see it, these are some needs:

- Identifying a coherent set of tools, guidelines or standards to help researchers, data producers and practitioners.
- Review foundational aspects of semantics in data modeling to be aware of in order to providing clear and consistent semantic metadata.
- Provide a resource on current best practices for handling semantics in work on Land Use and Land Cover.
- Present a forward-looking collection of ongoing research and development across the entire spectrum of LULC semantics.
Calling for contributions

Springer / CRC Press Book

I. Principles and foundations
II. Use cases and best practice
III. Ongoing development and future prospects
What should be in this book? - TOC

- **Principles and foundations**
  - LULC as information on human-environment systems
  - Data sources
  - Categories and information
  - Formal modeling of semantics
  - Semantics as metadata
  - Semantic support for Spatial Data Infrastructures
  - …

What would make you read/contribute to the book?

- **Use cases and best practice**
  - INTEROP/SOCoP
  - GeoVoCamps
  - Ontology for the National Map
  - EAGLE – EU monitoring
  - UN/FAO – LCCS
  - …

- **Ongoing development and future prospects**
  - Earthcube
  - iPlant derivatives
  - …
Next steps

Tentative timeline/due dates

● Extended abstracts – March 1, 2014
● Full chapter manuscripts – June 1, 2014

Sessions at meetings

● Association of Am. Geographers, April 2014
● AGILE, June 2014

● …

Other ideas?