Landscape Planning and Habitat Metrics

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Part 1. Landscape Planning Tools and Methods
Landscape Goals

Assessments
  - abiotic
  - biotic
  - cultural

Strategies & Scenarios

Adaptive Implementation & Monitoring

Reasoning together

Metrics, Inventory, Evaluation

Priorities, Portfolios, Tradeoffs
Integrated Ecological Framework (IEF)

Step 1: Build & Strengthen Collaborative Partnerships and Vision
Step 2: Integrate Ecosystem Plans
Step 3: Create Regional Ecosystem Framework
Step 4: Assess Planned Infrastructure Effects
Step 5: Establish & Prioritize Ecological Actions
Step 6: Develop Crediting/Restoration Strategy
Step 7: Develop Agreements
Step 8: Implement Agreements
Step 9: Monitoring and Adaptive Management

Available at TCAPP website:
http://www.transportationforcommunities.com/shrpc01/resource_agency
Landscape Assessments or Regional Ecosystem Frameworks

• Resource quality and distribution
• Threats
• Costs
• Opportunities
• Constraints

All leading to a potential framework with conservation targets and spatial priorities.
Conservation strategies and scenarios

- hotspot analysis
- conservation portfolio design
- investment prioritization
- tradeoff analysis

Site scores for protecting underrepresented wildlife habitat types, accounting for land cost and projected housing development in the Sierra Nevada region. (Davis et al. Ecology and Society 2006)
Tools for evaluating and mapping conservation priorities

<table>
<thead>
<tr>
<th>Tool</th>
<th>Purpose</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NatureServe Vista</td>
<td>Conservation planning</td>
<td><a href="http://www.natureserve.org/prodServices/vista/overview.jsp">http://www.natureserve.org/prodServices/vista/overview.jsp</a></td>
</tr>
<tr>
<td>Zonation</td>
<td>Multi-species habitat quality and connectivity</td>
<td><a href="http://www.helsinki.fi/bioscience/consplan/software/Zonation/index.html">http://www.helsinki.fi/bioscience/consplan/software/Zonation/index.html</a></td>
</tr>
<tr>
<td>Marxan</td>
<td>Reserve network design</td>
<td><a href="http://www.uq.edu.au/marxan/">http://www.uq.edu.au/marxan/</a></td>
</tr>
<tr>
<td>Envision</td>
<td>Scenario evaluation</td>
<td><a href="http://envision.bioe.orst.edu/">http://envision.bioe.orst.edu/</a></td>
</tr>
<tr>
<td>Circuitscape</td>
<td>Habitat connectivity</td>
<td><a href="http://www.circuitscape.org">http://www.circuitscape.org</a></td>
</tr>
</tbody>
</table>

http://www.bayarealands.org/ for a good example of regional conservation planning using Marxan
Landscape process modeling

- Tools for modeling landscape processes
- Agent-based models (e.g., HEXSIM)
- Population models (e.g., RAMAS, PATCH)
- Ecosystem models (e.g., STELLA)
- Landscape models (e.g., LANDIS, PATH)

http://www.naturecanada.ca/media/images/ord%27s-kangaroo-rat3.jpg
Modeling ecosystem services

- watershed processes: water quality & quantity
- carbon
- resource production
- pollination services
- cultural values
## Tools for modeling and mapping ecosystem services

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>InVEST</td>
<td>Ecosystem service mapping, tradeoff analysis</td>
<td><a href="http://www.naturalcapitalproject.org">www.naturalcapitalproject.org</a></td>
</tr>
<tr>
<td>N-SPECT</td>
<td>Non-point source pollution and erosion modeling</td>
<td><a href="http://www.csc.noaa.gov/digitalcoast/tools/nspect">http://www.csc.noaa.gov/digitalcoast/tools/nspect</a></td>
</tr>
<tr>
<td>SPARROW</td>
<td>Non-point source pollution modeling</td>
<td><a href="http://water.usgs.gov/nawqa/sparrow/">http://water.usgs.gov/nawqa/sparrow/</a></td>
</tr>
<tr>
<td>SolVES</td>
<td>Assess and map public values for ecosystems</td>
<td><a href="http://solves.cr.usgs.gov/">http://solves.cr.usgs.gov/</a></td>
</tr>
</tbody>
</table>
Part 2. Habitat Metrics
Habitat Metrics as a Possible Solution

- Habitats may provide a reasonable surrogate for biodiversity services;
- Habitats are fairly easily understood by the public and decision-makers;
- Habitats, with some effort, can be finite and yet comprehensive; and
- If properly defined, habitats can have suitable measureable attributes.
<table>
<thead>
<tr>
<th>Question</th>
<th>Assessment approach</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What habitats exist?</td>
<td>Ecological systems and National Vegetation Classification</td>
<td>• FGDC standard&lt;br&gt;• Used by states, feds and NGOs&lt;br&gt;• Systematic hierarchy of types</td>
</tr>
<tr>
<td>2. Which ones are targets for action?</td>
<td>Depends on goals</td>
<td>• Mitigation sites&lt;br&gt;• Conservation lands&lt;br&gt;• Restoration zones, etc.</td>
</tr>
<tr>
<td>3. How are they faring?</td>
<td>• Ecological Integrity Assessment (EIA)&lt;br&gt;• Landscape Condition</td>
<td>• Multiple spatial scales&lt;br&gt;• Multiple scales of effort&lt;br&gt;• Consistent between levels</td>
</tr>
<tr>
<td>4. What actions are needed to achieve goals?</td>
<td>EIA stressors that can be managed on the ground</td>
<td>• Defined consistent measures&lt;br&gt;• Conservation actions tied to measures&lt;br&gt;• Resources tied to success</td>
</tr>
<tr>
<td>5. Are these actions effective?</td>
<td>EIA monitoring framework</td>
<td>• Scale effort to mgmt need&lt;br&gt;• Designed with goals in mind</td>
</tr>
</tbody>
</table>
United States

7 formation classes

77 divisions

191 macrogroups

826 ecological systems

Terrestrial ecological systems and land cover of the coterminous US, map produced by NatureServe

Groupings of plants that co-occur in landscapes sharing similar combinations of ecological processes, substrates, and/or environmental gradients
Aquatic Habitats

EPA’s Oregon Hydrologic Landscapes
How are habitats faring? What are Indicators of Ecological Integrity?

The ability of an ecosystem to support and maintain a community of organisms that has **species composition, diversity, and functional organization** comparable to natural habitats within a region.

Ecological Integrity measures are needed for:

1. Land management
2. Restoration and mitigation
3. Conservation metrics
### Ecological Integrity Rank Factors, Big Sagebrush Steppe example

<table>
<thead>
<tr>
<th>RANK</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Ecological Attribute: Edge Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Edge Length</strong></td>
<td>75 – 100% of edge is bordered by natural communities</td>
<td>50 – 75% of edge is bordered by natural communities</td>
<td>25 – 49% of edge is bordered by natural communities</td>
<td>&lt; 25% of edge is bordered by natural communities</td>
</tr>
<tr>
<td><strong>Edge Width</strong></td>
<td>Average width of edge is at least 100 m.</td>
<td>Average width of edge is at least 75-100 m.</td>
<td>Average width of edge is at least 25-75 m.</td>
<td>Average width of edge is at least &lt;25 m.</td>
</tr>
<tr>
<td><strong>Edge Condition</strong></td>
<td>&gt;95% cover native vegetation, &lt;5% cover of non-native plants, intact soils</td>
<td>75–95% cover of native vegetation, 5–25% cover of non-native plants, intact or moderately disrupted soils</td>
<td>25–50% cover of non-native plants, moderate or extensive soil disruption</td>
<td>&gt;50% cover of non-native plants, barren ground, highly compacted or otherwise disrupted soils</td>
</tr>
<tr>
<td><strong>Key Ecological Attribute: Vegetation Condition</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Relative Cover Native Plants</strong></td>
<td>Cover of native plants relative 95-100%.</td>
<td>Cover of native plants relative 80-95%.</td>
<td>Cover of native plants relative 80-50%.</td>
<td>Cover of native plants &lt; relative 50%.</td>
</tr>
<tr>
<td><strong>Relative Native Bunchgrass Cover</strong></td>
<td>Perennial bunchgrasses &gt; 80% relative cover or less if near site potential.</td>
<td>Perennial bunchgrasses 50-80% relative cover or reduced from site potential.</td>
<td>Perennial bunchgrasses 30-50% relative cover or reduced from site potential.</td>
<td>Perennial bunchgrass &lt;30% relative cover and much reduced from site potential.</td>
</tr>
<tr>
<td><strong>Absolute Cover Invasive Species</strong></td>
<td>None present.</td>
<td>Invasive species present, but sporadic (&lt;3% cover).</td>
<td>Invasive species prevalent (3–10% absolute cover).</td>
<td>Invasive species abundant (&gt;10% absolute cover).</td>
</tr>
<tr>
<td><strong>Relative Cover Native Increasers</strong></td>
<td>Absent or incidental</td>
<td>&lt;10% cover</td>
<td>10-20% cover</td>
<td>&gt;20% cover</td>
</tr>
<tr>
<td><strong>Key Ecological Attribute: Landscape Structure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Connectivity</strong></td>
<td>Intact: Embedded in 90-100% natural habitat; connectivity is expected to be high.</td>
<td>Variegated: Embedded in 60-90% natural or semi-habitat; habitat connectivity is generally high, but lower for species sensitive to habitat modification;</td>
<td>Fragmented: Embedded in 20-60% natural or semi-natural habitat; connectivity is generally low, but varies with mobility of species and arrangement on landscape.</td>
<td>Relictual: Embedded in &lt; 20% natural or semi-natural habitat; connectivity is essentially absent</td>
</tr>
</tbody>
</table>
Excellent integrity - A rank

- Highest quality sites
- Unfragmented landscape
- Landscape area larger than minimum dynamic area
- Exemplary size (e.g., area-dependent species)
- Biotic/abiotic components well within natural range of variability
- Invasives largely absent
- Natural processes in place
Poor integrity - D rank

- Severely altered characteristics
- Highly fragmented
- Landscape well below minimum dynamic area
- Size is small, e.g. unable to sustain area-dependent species.
- Biotic/abiotic components severely altered from natural range of variability
- Invasives abundant
Habitat Condition measures of Ecological Integrity – Columbia Basin of OR & WA
Setting Ecological Integrity Goals

Ecosystem Conservation Goal

Increasing ecological integrity

Increasing human disturbance

Rank A

Rank B

Rank C

Rank D
Which habitats are targets for action?

- Wetlands
- Priority ecosystems and habitats for regulated species
- Longleaf pine forests; fire stressed ecosystems
- Threatened and Endangered species critical habitat
Barriers To Implementation of Nationwide Habitat Metrics

1. Scale Issues:
   a) National or regional scale datasets are needed for indicators and analysis of success, but may not work for markets
   b) Locally collected data for restoration and mitigation are not rolled up to inform larger scales.

2. Cost and Implementation Issues:
   a) No agency is responsible for classifying and mapping and analyzing habitats, although many want to be given funds to do this.
   b) Public agencies collect data independently in response to their own needs, but could do more (inexpensively).
Overcoming Cost and Implementation Issues

• Take advantage of existing ongoing data collection: Forest Service’s FIA and NRC’s NRI
• Build off of regional efforts (eg. Western Governor’s CHAT, Landscape CCs)
• Incorporate or build on national mapping efforts (ReGAP, NLCD) and develop a strategy to compile and integrate local fine scale data.
• Merge or integrate national funding for comprehensive mapping and integrity analysis.
• Make this a single entity’s job?
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Institute for Natural Resources – Portland
Oregon Biodiversity Information Center

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