Design features behind success of the Ecosystem Management Decision Support system

Keith M Reynolds
USDA Forest Service
Pacific Northwest Research Station

Outline

- Quick overview of EMDS at version 4.3
- Applications to date
- Current design features
- The next generations of EMDS
- Decision support for adaptive management under climate change

EMDS 4.3

- First production release in 1997
  - Version 4.3 released in 2014
- A general application framework for designing and implementing knowledge-based decision support for environmental analysis and planning at any geographic scale or scales.
- Integrates GIS as well as knowledge-based reasoning and decision modeling technologies to provide decision support for a substantial portion of the adaptive management process of ecosystem management.

Implementation of 4.3

- Implemented as an ArcGIS 10.2 ArcMap extension.
- EMDS integrates
  - a logic engine to perform landscape evaluations, and
  - a decision modeling engine for developing strategic management priorities.
- The design strategy
  - The logic engine assesses the state of the landscape.
  - Given the state, the decision engine develops priorities.

Applications to date

- Some major examples
  - Ecological site classification, UK Forestry Commission
  - Timber suitability, Tongass NF
  - Aquatic/Riparian Effectiveness Monitoring Program , USFS Region 6
  - Spotted owl dispersal habitat, WA DNR
  - North Coast Watershed Assessment, State of CA
  - Soil impacts associated with logging and wildfire, Okanogan-Wenatchee NF
  - Integrated resource restoration and protection, USFS Region 1
  - Roads analysis for wildlife habitat, Tahoe NF
  - Wildland fuels, USFS WO and Regions, BLM, BIA, FWS, NPS
  - Managing critical loads associated with atmospheric S deposition in the southern Appalachians, US EPA
  - Integrated landscape restoration, Okanogan-Wenatchee NF
- Many applications from around the world
  - http://en.wikipedia.org/wiki/EMDS

Current design features

1. Generality – a design framework
    1. Support for large, complex, abstract problems
    2. Many topics, any scale or scales
2. Transparency – more than just a pretty map
    1. Rational, repeatable, and fully documentable
    2. Transparent – intuitive explanation of model results
3. Simplicity – a V-8 moment
    1. Decomposition into two simpler components
4. Reasoning with incomplete information
    1. Derive priorities for missing information
5. Supports multiple interdependent spatial scales

The next generations of EMDS

- Transition from desktop to enterprise edition
  - Web services to reach broad audiences
  - Components exposed as web services
- Workflows
  - EMDS 5 built with Windows Workflow Foundation (open source)
  - Incorporation of open source workflow engine into EMDS framework
    - Modify the pre-defined processing flow of the framework
    - Extensibility – easily add new engines (e.g., BN or Prolog engine)
    - Extensibility – add complex pre- and post-processing workflows
- Implementing management actions in models and data
- Provenance tracking
  - Comprehensive documentation of all steps in a complex analysis
  - Ability to roll back and branch

Decision support for adaptive management under climate change

- Logic for interpretation and synthesis
  - Vegetation change and ecosystem services
  - Biophysical, social, and economic considerations
  - Transparency in the public forum
- Prioritizing landscape units
  - Many logistical considerations
- Using actions to design strategic alternatives
  - Automated with workflows
  - Comparing expected outcomes
- Managing complexity
  - Provenance tracking for project management and accountability
- Adaptive management
  - How did we do? – Another role for logic through comparing outcomes

Thank you!

- The websites
  - http://emds.mountain-viewgroup.com/
  - http://en.wikipedia.org/wiki/Ecosystem_Management_Decision_Support
- The book
  - Reynolds, K.M., P.F. Hessburg, and P.S. Bourgeron (eds). 2014. Making Transparent Environmental Management Decisions: Applications of the Ecosystem Management Decision Support System. Berlin: Springer.