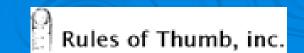
# Design features behind success of the Ecosystem Management Decision Support system

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#### 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









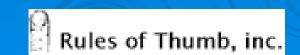


#### **EMDS 4.3**

- 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.









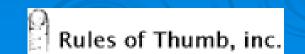


### Implementation of 4.3

- 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
  - 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
  - Decomposition into two simpler components
- 4. Reasoning with incomplete information
  - 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.





