Rocky Mountain Landscape Simulator

GIS Database

Wildlife Habitat Suitability Models

Disturbance Processes

- Anthro
- Natural

Successional Processes

- Managed
- Natural

Disturbance Scenarios

Initial Condition

T1

T2

T3

Time Step (10 yrs)

Cover

Age

Elevation

Etc.
Rocky Mountain Landscape Simulator

- Model Characteristics

- Grid-based
- Spatially Explicit
- Process-based
- Stochastic
Rocky Mountain Landscape Simulator

Model Characteristics

- Spatial scale:
  - Grain (anything)
  - Extent (10,000's - 1 million ha)
Rocky Mountain Landscape Simulator

- Model Characteristics

- Temporal scale:
  - Grain (10 yr timestep)
  -Extent (100's - 1,000's yrs)
Rocky Mountain Landscape Simulator

- GIS Database

- ArcGIS grid database
- Derived from any source, but typically from required Forest Service GIS data, supported by systems such as NRIS, INFRA, and FACTS;
- Does not require detailed stand inventory data
Rocky Mountain Landscape Simulator

- **Input Data**

- **All Modules**
  - Cover
  - Condition
  - Condition-age
  - Age
  - Elevation
  - Slope
  - Aspect
  - Streams
  - Roads

- **Optional Layers**
  - Landscape buffer
  - Riparian zones
  - Disturbance zones
  - Management zones
  - Watersheds
  - Compartments
  - Timber suitability
  - Road proximity
  - Ownership
  - Roadless areas
  - Fire polygons
  - Relative elevation
  - Treatment boundaries
Rocky Mountain Landscape Simulator

- Cover-condition
- Covcond-reclass/rescale
- Condition
- Age
- Condition-Age
- Disturbance ID
- Disturbance susceptibility
- Age since disturbance (low, high, and any mortality)

- Disturbance frequency (low and high mortality)
- Management type
- Management priorities
- Treatment type
- Shelterwood stage
- Age since management
- Age since treatment

Model
Succession transitions

- State-based transition rules
- Patch-based

Northern RM Dry-Mesic Montane Mixed Conifer Forest-Ponderosa Pine-Douglas fir

- Transition rules:
  - EARLY1.ALL (A, 11001)
  - MID1.OP (C, 32001)
  - MID1.CL (B, 22001)
  - LATE1.OP (D, 33001)
  - LATE1.CL (E, 23001)

- Times:
  - >30 yrs
  - >70 yrs
  - >120 yrs
  - >120 yrs
  - >150 yrs

- Probabilities:
  - \( p = 0.9 \)
  - \( p = 0.1 \)
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- Natural Disturbance Processes

- Wildfire
- Insects/pathogens
  - Pinyon decline
  - Pine beetle
  - Douglas-fir beetle
  - Spruce beetle
  - Spruce budworm
- Prairie dogs
Rocky Mountain Landscape Simulator

- Natural Disturbance Processes

- Climate modifier
- Initiation
- Spread
- Mortality
- Disturbance transitions

Missionary Ridge Fire, CO; June 2002; 20,093 ha; PP/WMC/CMC/AS/SF
Rocky Mountain Landscape Simulator

- Natural Disturbance Processes

- Climate modifier:
  - Palmer Drought Severity Index
  - Data range from -6 (dry) to +6 (wet); based on tree ring growth data
  - Rescaled and inverted for use in RMLANDS
Initiation and Spread:
- Climate modifier
- Susceptibility
- Spatial context (relative position, spread barriers)
- Event modifier (size constraint)
- Spotting
Simulated Spruce Budworm Spread

- **Initiation and Spread:**
  - Climate modifier
  - Susceptibility
  - Spatial context (relative position, spread barriers)
  - Event modifier (size constraint)
  - Spotting

Rocky Mountain Landscape Simulator

- Natural Disturbance Processes
Rocky Mountain Landscape Simulator

- Natural Disturbance Processes

- **Mortality:**
  - Severity level (low vs high) based on percent of overstory killed
  - Patch-based

Total Area Burned = 1,000 ha
**Rocky Mountain Landscape Simulator**

- **Natural Disturbance Processes**

- **Disturbance transitions**
  - State-based transition rules
  - Patch-based

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**Northern RM Dry-Mesic Montane Mixed Conifer Forest-Ponderosa Pine-Douglas fir**

- **Natural succession**
- **Retrogression disturbance**
- **Disturbance-mediated succession**
- **Non-state changing disturbance**

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**States:**
- **EARLY1.ALL** (A, 11001)
- **MID1.OP** (C, 32001)
- **MID1.CL** (B, 22001)
- **LATE1.OP** (D, 33001)
- **LATE1.CL** (E, 23001)
Rocky Mountain Landscape Simulator

- Vegetation Treatments

- Commercial harvest
  - Clearcut
  - Shelterwood
  - Group selection
  - Individual tree

- Restoration
- Mechanical
- Chemical
- Prescribed fire
Management Zones

Management Types

Management Regime

Max treatment area constraint

Static (suitability, road proximity, ownership, riparian, slope)

Dynamic (condition, age, disturbance history)

Static (topo, min-max unit size)

Static (width, fallow period)

Temporal constraints

Spread constraints

Adjacency constraints

Suitability constraints

Static (rotation, schedule)

Static (random, aggregated, dispersed)

Static (topo, min-max unit size)

Management Zones

Management Types

Treatments

Vegetation Treatments
Rocky Mountain Landscape Simulator

- Vegetation Treatments

- Initiation
- Spread
- Disturbance transitions