An Ecosystem Diversity Planning Process for Forest Management

Jonathan Haufler

Ecosystem Management Research Institute

Seeley Lake, MT

Forest Management Objectives

- **Ecological**
  - **Biodiversity**
- **Economic**
  - **Forest Products**
  - **Other Resources**
- **Social**
  - **Aesthetic**
  - **Other Uses and Values**

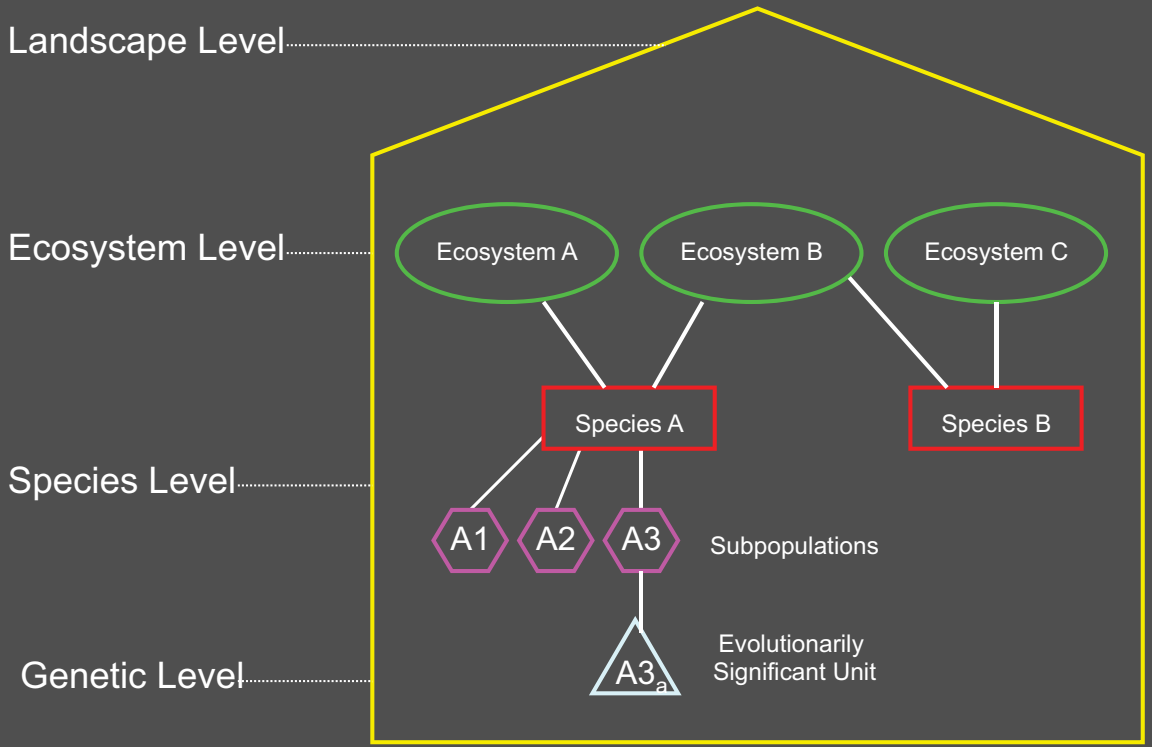
Forest Management Planning

- **Needs an approach that can integrate the different objectives in an effective, efficient, and comprehensive manner**
- **An ecosystem-based approach is the best option**

Biodiversity

- **Biodiversity is the landscape, ecosystems, species, and genetics that are native to an area**
- **Humans have interacted with biodiversity- but major recent human alterations of landscapes are considered impacts to biodiversity**

Hierarchical Organization



Premise

- **Biodiversity depends upon the array of native ecosystems that have comprised the landscape**
- **Strategy: maintain an appropriate level of representation of all of the native ecosystems of the area**

Goals

- **Provide for appropriate ecosystem amounts and distributions across landscape (landscape level)**
- **Provide appropriate composition, structure, and processes for each identified ecosystem (ecosystem level)**
- **Provide for resource utilization consistent with these first two goals**

Species Management

- Species will continue to require management, however, a focus on ecosystem diversity will address the biggest concern- providing for the habitat needs of all species.

Identifying Native Ecosystem Diversity

- **Establishes baseline**
  - **Cumulative effects**
- **Identifies ecosystems, their characteristics, and processes**
  - **Reference for setting representation objectives**

Challenges of Ecosystem Diversity

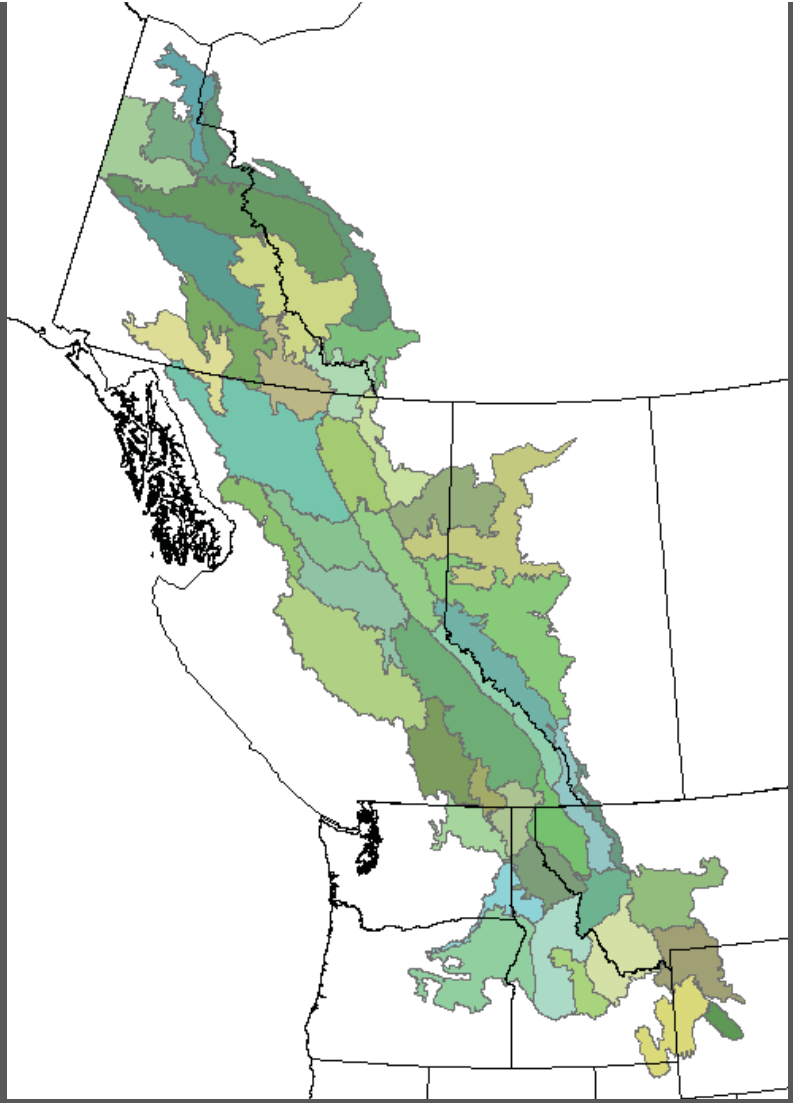
- Ecosystems are not as easily recognized as species
- Scale issues are critical
- Appropriate attention to detail must be balanced with practical limits to application

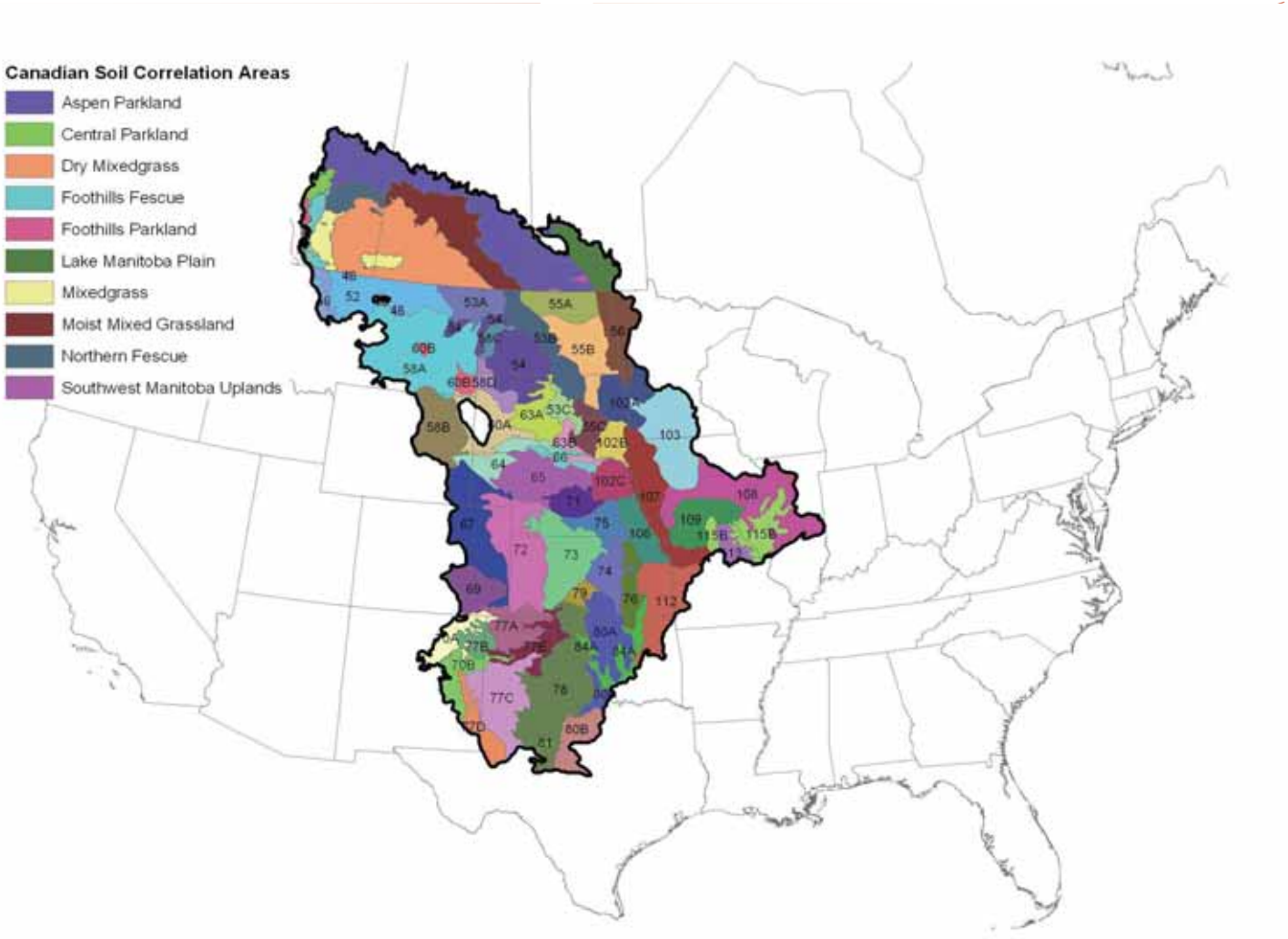
Ecosystem Diversity Process Steps

- **Step 1. Delineate planning landscape**
- **Step 2. Characterize ecosystem diversity**
- **Step 3. Quantify reference conditions**
- **Step 4. Quantify existing conditions**
- **Step 5. Set management goals**
- **Step 6. Check representation goals**

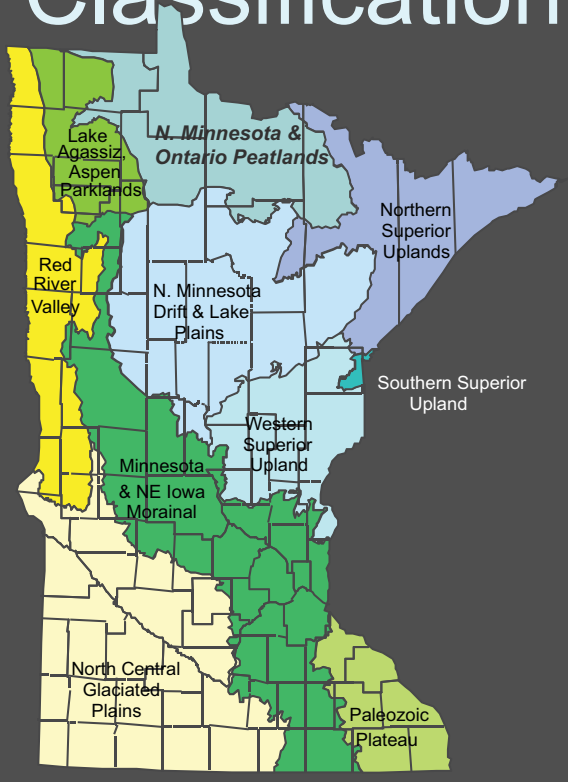
1. Delineate Landscape

- **Landscape should be large**
- **But not too large**
- **Use geo-climatic boundaries where possible to reduce variability in ecosystem diversity**




Canadian Soil Correlation Areas
Aspen Parkland
Central Parkland
Dry Mixedgrass
Foothills Fescue
Foothills Parkland
Lake Manitoba Plain
Mixedgrass
Moist Mixed Grassland
Northern Fescue
Southwest Manitoba Uplands

Ecological Classification System



2. Characterize ecosystem diversity

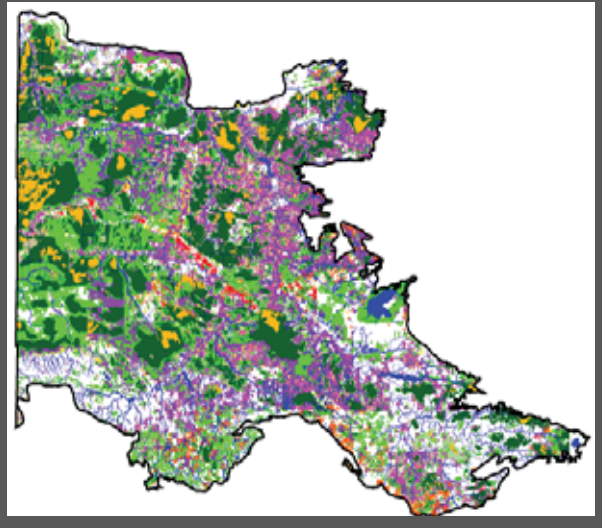
- **Ecosystem diversity has 2 primary drivers:**
  - **Ecological sites- abiotic features**
  - **Disturbance regimes**
- **The combination of ecological sites and responses to disturbance produced the native ecosystem diversity within each landscape**

Ecological Site Classification

- **Many possible classifications**
- **Scale considerations- the right number of units**
- **Examples in terrestrial systems:**
  - **Manitoba Ecosite Descriptions**
  - **Habitat types for North Central Minnesota**

Mapping Ecological Sites

- Data layers used to map habitat type classes:
  - landform
  - soil associations
  - slope
  - typography
  - surficial geology
  - vegetation

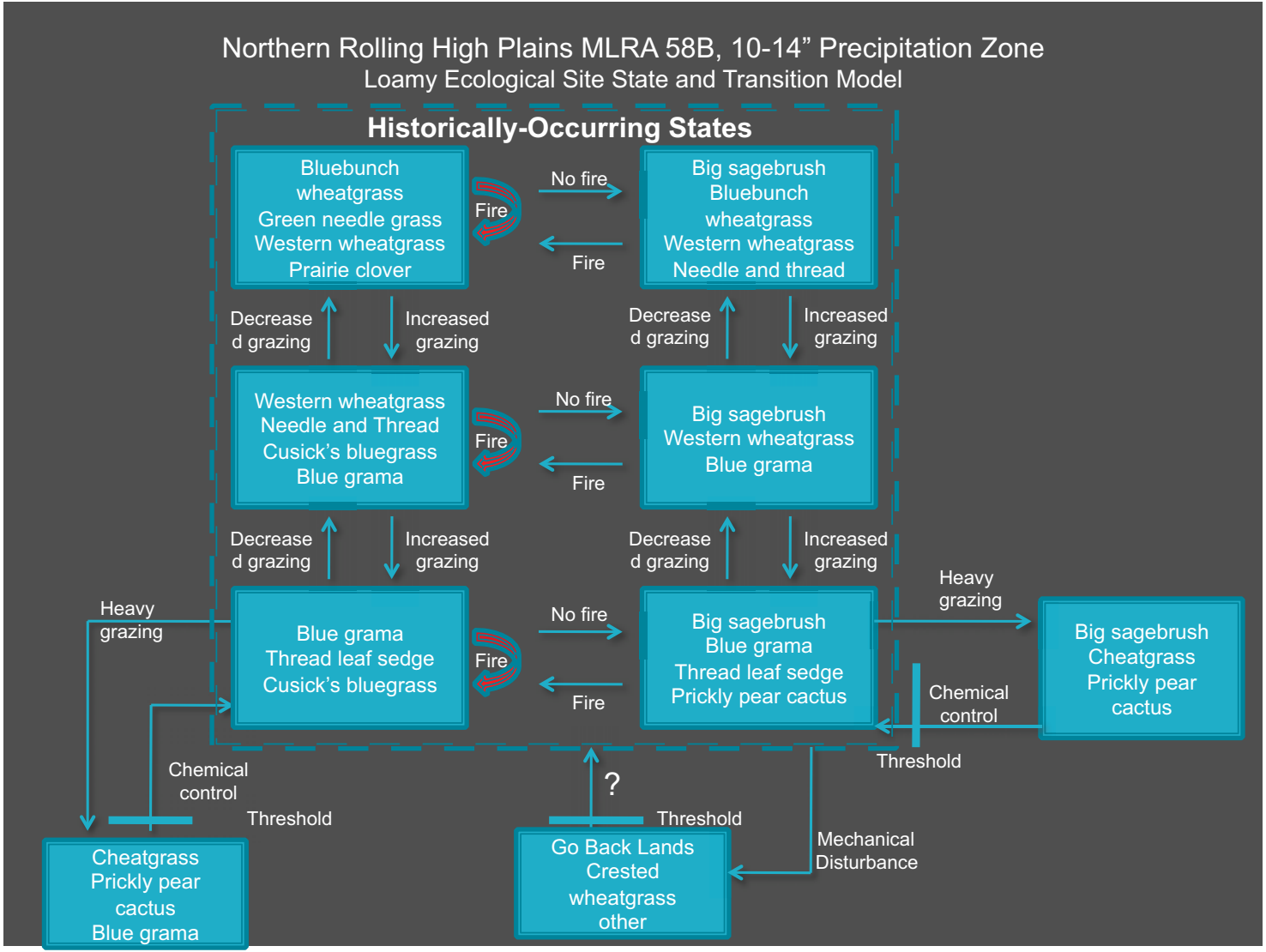


Forest Ecosystem Disturbances

- Diseases/insects
- Shade Tolerance
- Windthrow
- Fire

Describing Disturbance Responses

- **Understanding natural disturbance responses to define reference conditions**
- **Anthropogenic disturbances can be added to understand current and future conditions**
- **Provides a basis for predicting future conditions including possible effects of climate change**


Northern Rolling High Plains MLRA 58B, 10-14” Precipitation Zone
Loamy Ecological Site State and Transition Model
Historically-Occurring States
Bluebunch wheatgrass
Green needle grass
Western wheatgrass
Prairie clover
Fire
No fire
Fire
Big sagebrush
Bluebunch wheatgrass
Western wheatgrass
Needle and thread
Decreased grazing
Increased grazing
Decreased grazing
Increased grazing
Western wheatgrass
Needle and Thread
Cusick’s bluegrass
Blue grama
Fire
No fire
Fire
Big sagebrush
Western wheatgrass
Blue grama
Decreased grazing
Increased grazing
Decreased grazing
Increased grazing
Heavy grazing
Blue grama
Thread leaf sedge
Cusick’s bluegrass
Fire
No fire
Fire
Big sagebrush
Blue grama
Thread leaf sedge
Prickly pear cactus
Heavy grazing
Big sagebrush
Cheatgrass
Prickly pear cactus
Chemical control
Threshold
Chemical control
Threshold
?
Threshold
Mechanical Disturbance
Cheatgrass
Prickly pear cactus
Blue grama
Go Back Lands
Crested wheatgrass
other

Ecosystem Diversity Matrix (EDM)

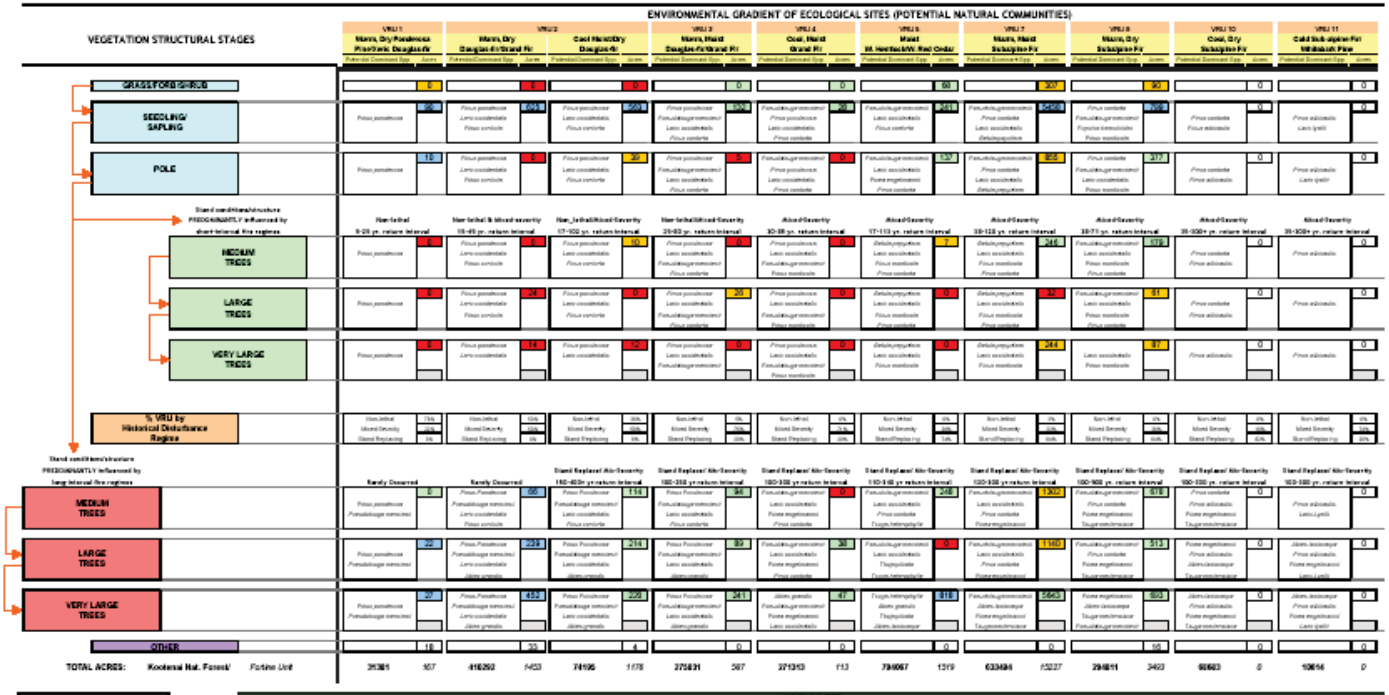
- **Conservation planning tool that classifies ecosystems according to ecological site and response to natural disturbances.**
- **Allows for display of cumulative changes to ecosystem diversity**

Ecosystem Diversity Matrix (simplified)

	Habitat Type Class			
VEGETATION GROWTH STAGE	Dry Fir	Rich, Moist Fir	Wet Fir/ Cedar	Wet Spruce
Seedling/Sapling				
Shade Intolerant: Small Tree				
Shade Intolerant: Medium Tree	Ecosystem			
Shade Intolerant: Large Tree				
Shade Tolerant: Small Tree				
Shade Tolerant: Medium Tree				
Shade Tolerant: Large Tree				
Shade Tolerant: Old Growth				

ECOSYSTEM DIVERSITY MATRIX - FLATHEAD VALLEY ECOREGION

Upland Forested Systems of the Fortine Unit, Fortine District, Kootenai National Forest



References:

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2) Hoffer, J.R. et al. 1999. Using a coarse-filter approach with species assessment for ecosystem management. Wildl. Soc. Bull. 28(3):568-580.
3) Hoffer, J.R. et al. 1998. An ecological framework for planning for forest health. J. Sustainable Forestry. 28(3):307-316.

Vegetation Response Unit (VRU)/Habitat Type Classes derived from:
1) Vegetation response unit characterization and target landscape prescription. 1998. Kootenai National Forest, U.S. Dept. of Agric., U.S. Forest Service, Northern Region.
2) Pfister et al. 1977. Forest habitat types of Montana. USDA For. Serv., Intermtn. For. Range Exp. Sta. GTR INT-34.

Fire Regimes described/ derived from:
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3) S. Barrett. 2002. Fire regimes database for U.S. For. Serv. Reg. 1.

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Stand Replace/ Mix-Severity 100-300 yr return interval		Stand Replace/ Mix-Severity 110-340 yr return interval		Stand Replace/ Mix-Severity 120-300 yr return interval	
Pseudotsuga mensiesii	0	*Pseudotsuga mensiesii*	248	*Pseudotsuga mensiesii*	1302
Larix occidentalis		*Larix occidentalis*		*Larix occidentalis*	
Picea engelmannii		*Pinus contorta*		*Pinus contorta*	
Pinus contorta		*Tsuga heterophylla*		*Picea engelmannii*	
Pseudotsuga mensiesii	38	*Pseudotsuga mensiesii*	0	*Pseudotsuga mensiesii*	1140
Larix occidentalis		*Larix occidentalis*		*Larix occidentalis*	
Picea engelmannii		*Thuja plicata*		*Pinus contorta*	
Pinus contorta		*Tsuga heterophylla*		*Picea engelmannii*	
Abies grandis	47	*Tsuga heterophylla*	818	*Pseudotsuga mensiesii*	5643
Pseudotsuga mensiesii		*Abies grandis*		*Abies lasiocarpa*	
Picea engelmannii		*Thuja plicata*		*Picea engelmannii*	
Larix occidentalis		*Abies lasiocarpa*		*Tsuga mertensiana*	

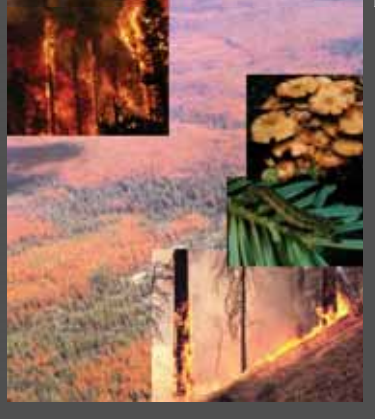
3. Reference Conditions

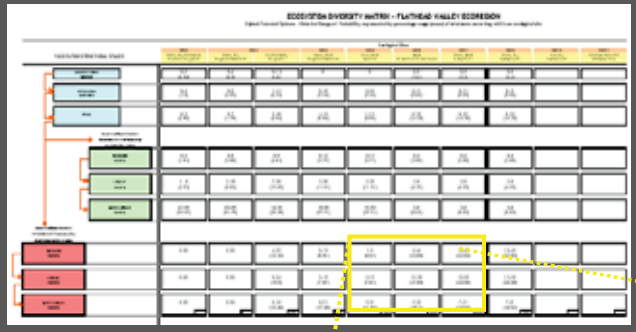
- **Quantify the variation in amounts of each ecosystem within an ecological site for the landscape over a defined past timeframe**

SIMPPLLE Model

- Developed by the USFS
- Spatially explicit landscape-scale model
- Simulates vegetation change caused by disturbance
- Uses include simulations of historical & future conditions

SIMulating Patterns and Processes at Landscape scaLEs





Historical Range of Variability

1-8 (6.51)	2-44 (20.55)	10-45 (22.83)
2-19 (7.87)	12-26 (21.69)	12-26 (24.09)
9-31 (17.45) 14%	5-23 (19.2) 31%	7-21 (14.52) 28%

4. Quantify Existing Conditions

- **Landscape-**
  - **Mapping of existing ecosystems**
- **Ecosystem-**
  - **Determining current composition and structure**

Compare Reference to Existing Conditions

- **Landscape level-**
  - **Changes in amounts of ecosystems**
- **Ecosystem level**
  - **Changes in compositions, structures, process**
  - **Occurrence of exotic species**

- ≤ 10% Historical
- > 10% but ≤ 30 % Historical
- > 30% but ≤ 100 % Historical
- > 100 % Historical

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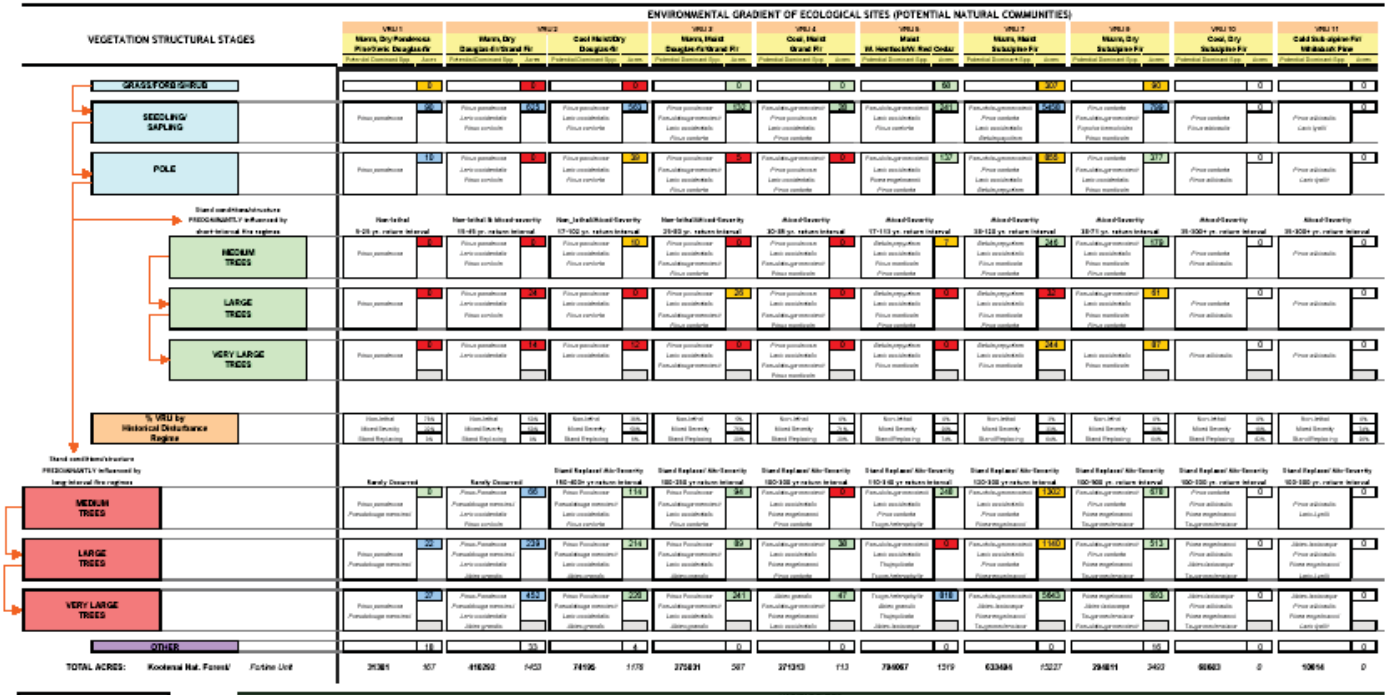

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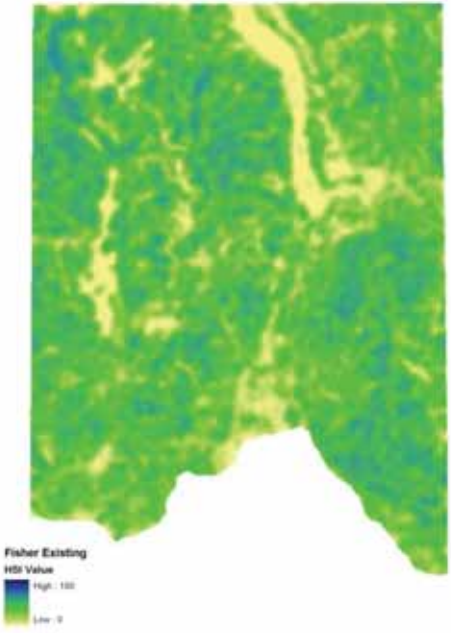
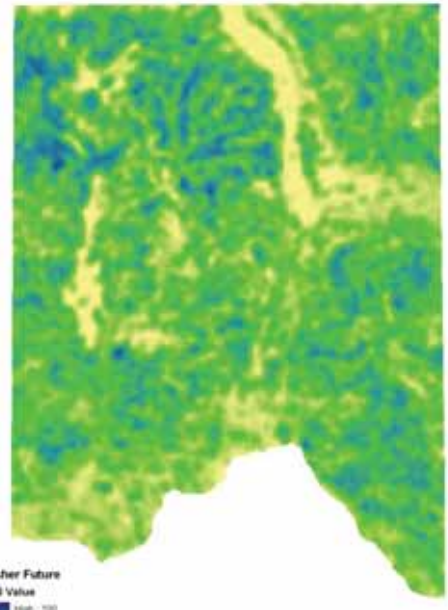
5. Management Recommendations

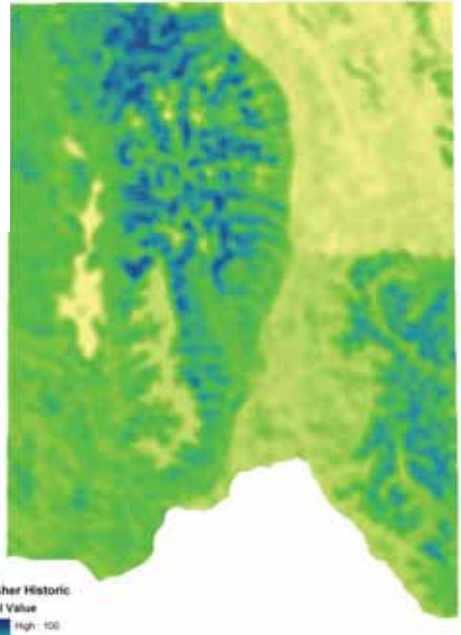
- **Landscape level**
  - **Identify desired amounts and distributions of native ecosystems**
- **Ecosystem level**
  - **Identify desired compositions and structures for representative areas**
- **Guide management prescriptions**

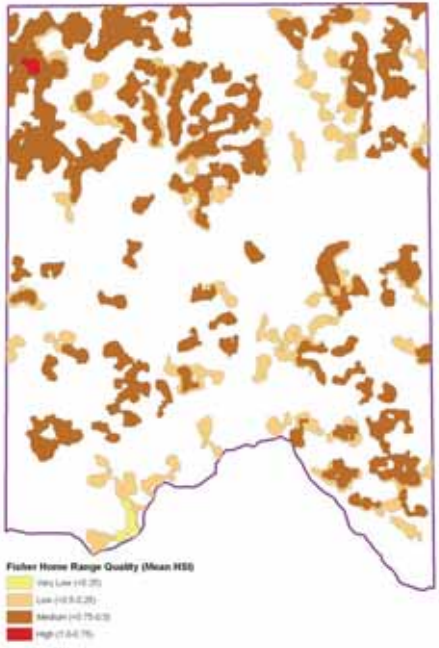
6. Check Representation Goals

- **Species can be used to check on adequacy of representation**


Fisher Existing
HSI Value
High : 100
Low : 0

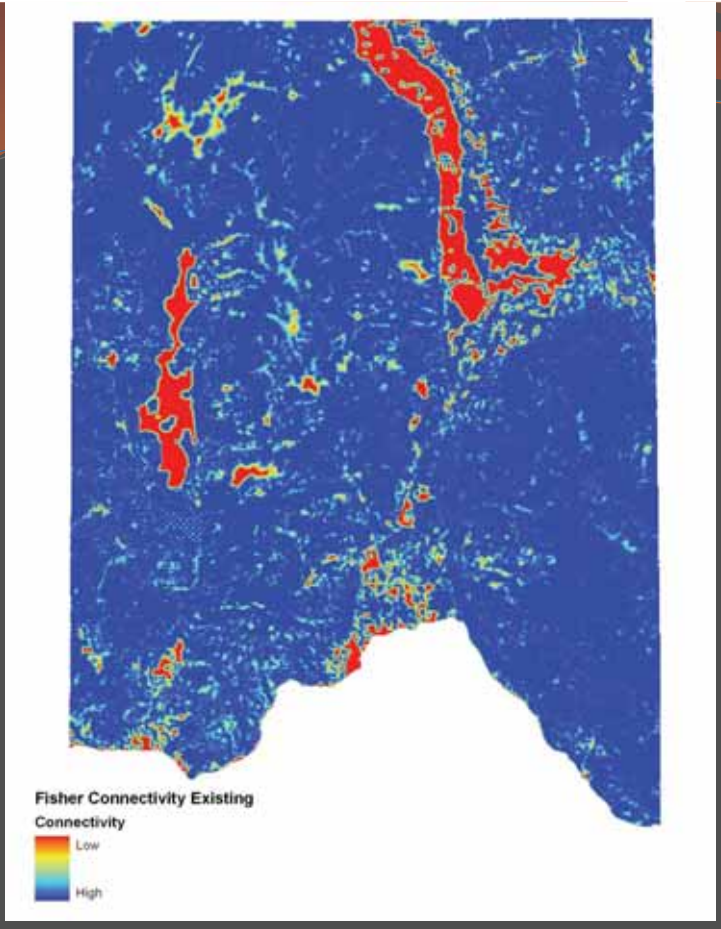

Fisher Future
HSI Value
High : 100
Low : 0

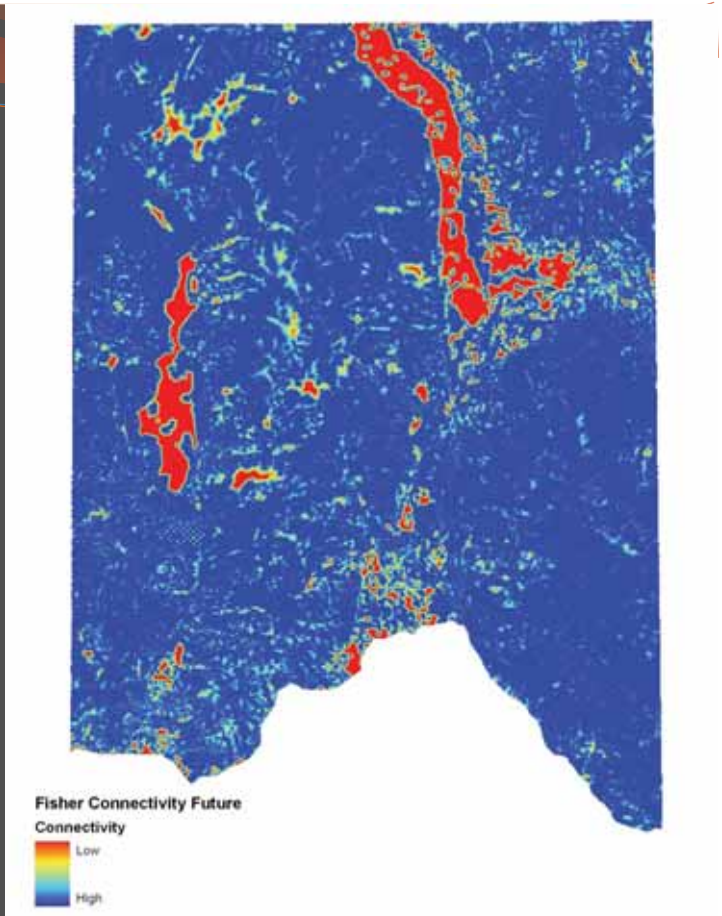

Fisher Historic
HSI Value
High : 100
Low : 0


Fisher Home Range Quality (Mean HSI)
Very Low (<0.25)
Low (>0.5-0.25)
Medium (>0.75-0.5)
High (1.0-0.75)


Fisher Home Range Quality Future
Mean Hsi
Low (>0.5-0.25)
Medium (>0.75-0.5)
High (1.0-0.75)


Fisher Home Range Quality HRV
Mean Hsi
Low (>0.5-0.25)
Medium (>0.75-0.5)
High (1.0-0.75)


Fisher Connectivity Existing
Connectivity
Low
High


Fisher Connectivity Future
Connectivity
Low
High

Summary

- **Ecosystem diversity is a cornerstone for conservation of biodiversity**
- **It can be effectively and efficiently characterized, mapped, and used to set management objectives**
- **An ecosystem-based process has been used to develop management plans for numerous areas and for all types of ecosystems**
- **It allows for the integration of ecological, social, and economic objectives**