

# State-and-Transition Model Development

Tamzen K. Stringham  
University of Nevada, Reno



# Multiple Approaches

Dig lots of holes - I will figure this out!



Hang out with the right people!



Check with the dog!



# STM Fundamentals

## Know the Subject Matter

- Briske, D.D., B.T. Bestelmeyer, T.K. Stringham and P.L. Shaver. 2008. Recommendations for development of resilience-based state-and-transition models. *Rangeland Ecology and Management* 61:359-367.
- Stringham, T.K., W.C. Krueger and P.L. Shaver. 2003. State and transition modeling: A process based approach. *J. Range Management* 56:106-113. Featured Article.
- Stringham, T. K. and J.P. Repp. 2010. Ecological Site Descriptions: Considerations for Riparian Systems. Invited Paper. *Rangelands* 32(6):43-48.

# State-and-Transition Models

(Stringham et al.2003)

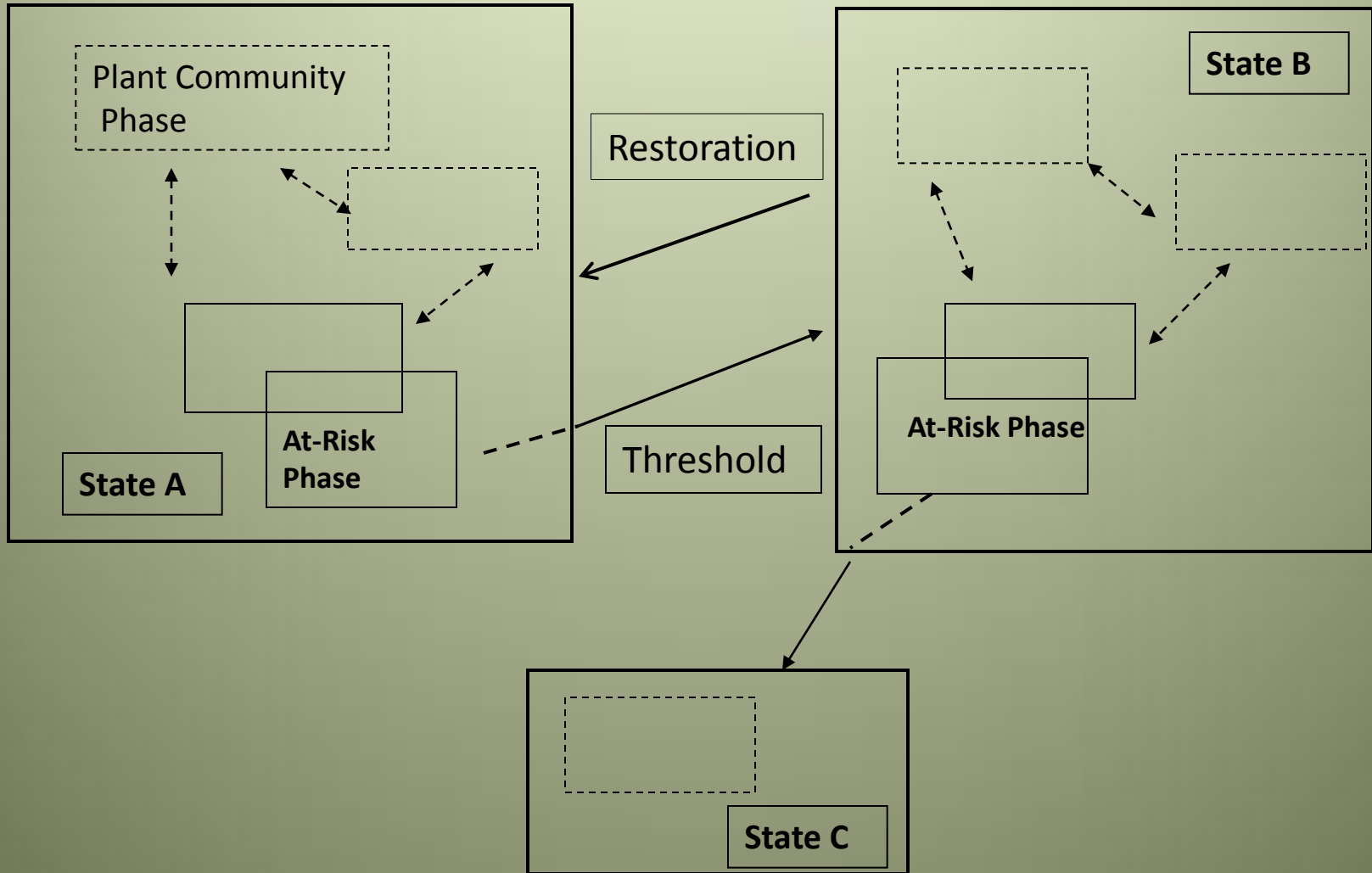
(Briske et al. 2008)

- Accommodates: Range Succession Model  
(Quantitative Climax Model)
- Accounts for transitions, thresholds, and multiple steady states
- Process based NOT vegetation

# ECOLOGICAL **PROCESS** MODEL

## *THE BASICS*

MINIMUM SCALE FOR STATE = ECOLOGICAL SITE



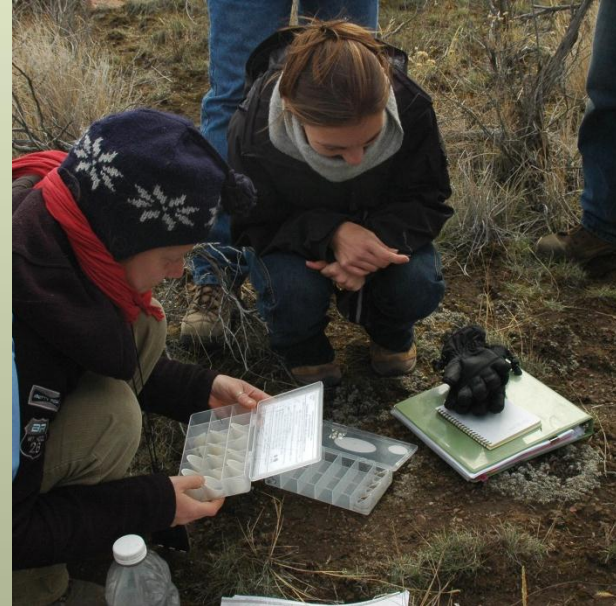
# STM Components

- What is a STATE?
- Threshold or Transition?
- Community Phase?
- Community Pathway?
- At-Risk Community Phase?
- Restoration Pathway

# What is “process-based thinking?”

- Ecological Processes ?
  - Range people think plants
  - Soil people think landscapes and soils
  - Hydrologist think flow patterns
  - Wildlife biologists think habitat
  - Administrators think \$\$\$\$\$

# Ecological Processes





# What is “process-based thinking?”

- What is driving the creation and maintenance of what I see?
- Process = amount per time (rate)
  - Infiltration rate
  - Nutrient cycling
  - Energy capture
  - Soil erosion
  - Etc.



# What is “process-based” thinking?

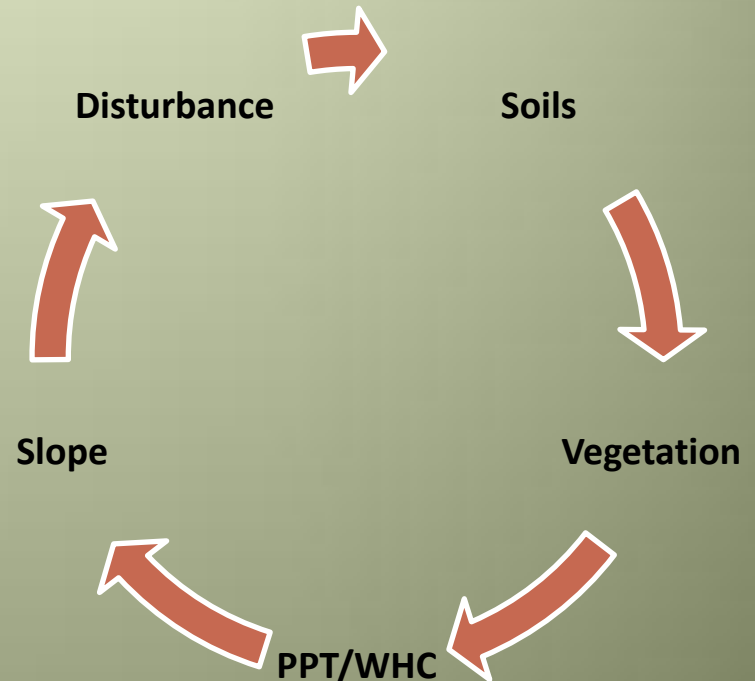
- Understanding that what we see is created by the functional capacity of ecological processes
- STMs describe ecological dynamics



# Ecological Dynamics

## Response to Disturbance

- Response to different disturbances
  - Fire
  - Grazing
  - Flooding
  - Drought
  - Insects
  - Invasive species, Etc.
  - Any combo of the above
- Resilience of Sites



# Ecological Dynamics

## Response to Disturbance

- Response to disturbances
  - Specie specific?
    - Know individual plant response
  - Dynamic soil properties
    - Vary by soil texture?
- Resilience
  - Climate
  - Soils
  - Plants



# Ecological Dynamics

## Response to Disturbance



Fire #1: injures or kills plants; may cause soil damage

Fire #2: eliminates residual plants; conversion to weed dominated

Fire #3: plant cover significantly reduced; wind erosion

# STM Development ≠ Simple

Dig lots of holes - I will figure this out!



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# STM Development ≠ Simple

- Build a team of experts on the area
- Members
  - STM developer = team lead
  - Range ecologist = senior level (more than one)
  - Soil scientist = senior level
  - GIS specialist = field worthy
  - Wildlife biologist
  - Land Managers



Range Ecologist / STM

# Experience

Range / Plant

GIS

Soils

Range / Plant





# Pitt Falls

- Assuming STM knowledge
- Lack of diversity of knowledge in team
- Inadequate literature review
- Limited field visits
- No peer review
- Unwillingness to consider new ideas
- EGOs

Experience is critical  
Plant / soil relationships  
Disturbance response



≠

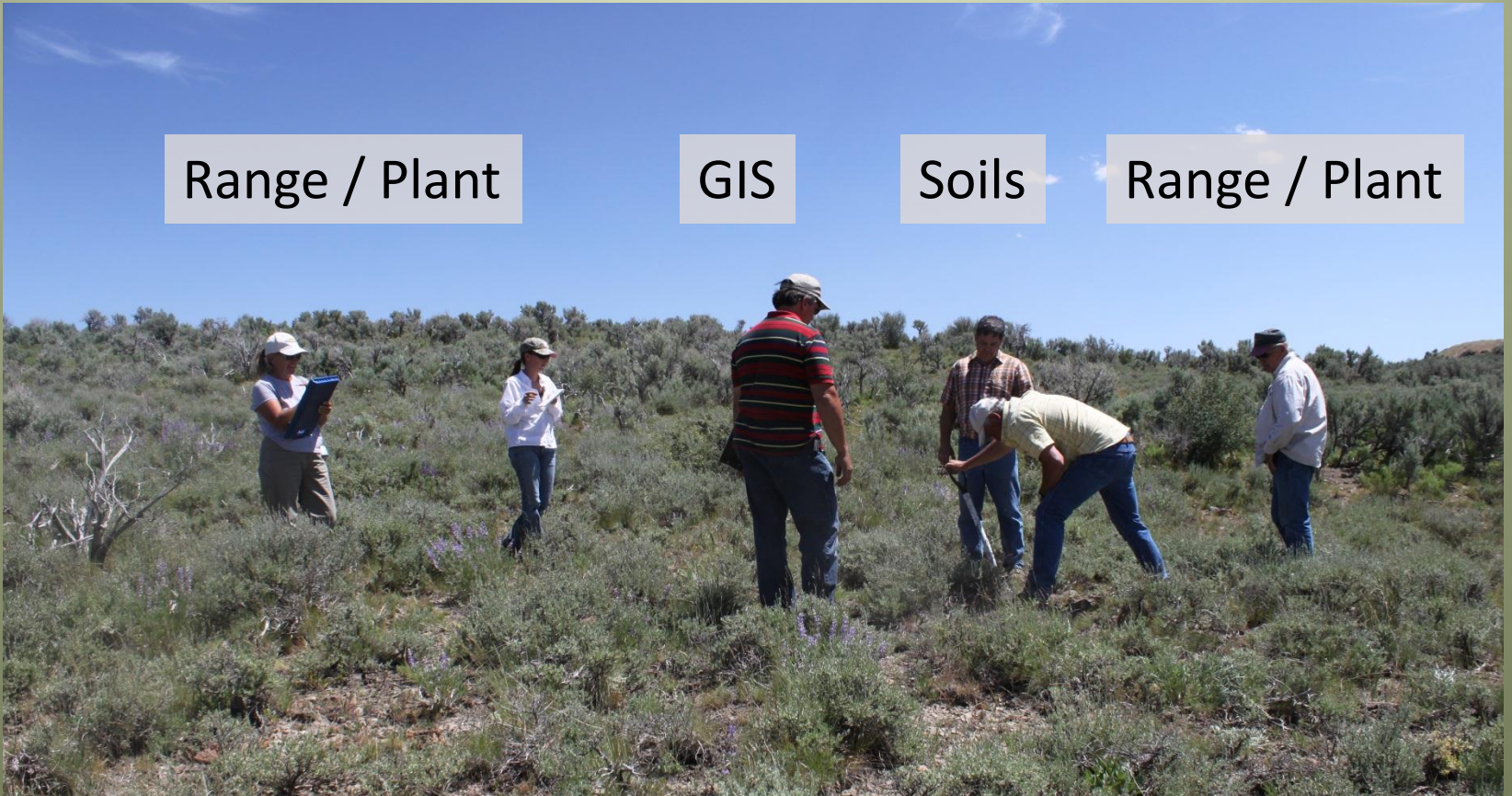
STM Knowledge

Range / Plant

GIS

Soils

Range / Plant



# STM Development Process Disturbance Response Groups

- Assemble the core TEAM
- Invite others to participate in office / field events
- Teach the STM concepts to the core TEAM
  - Multiple times; office & field

# STM Development Process

## Disturbance Response Groups

- MLRA or LRU scale
  - Build understanding of the climate, soils, plants
    - Soil scientist teach geology, soils, etc
    - GIS specialist create data layers of soil map units; fire events; roads; public / private land; etc.

# STM Development Process

- Range sites
  - Describe Reference Condition = State 1
  - Describes landscape, climate, soils, plants, production
  - Describes response to disturbance
- Team analyzes each site & determines how it responds to disturbance
- Group sites

# STM Development Process

## Disturbance Response Groups

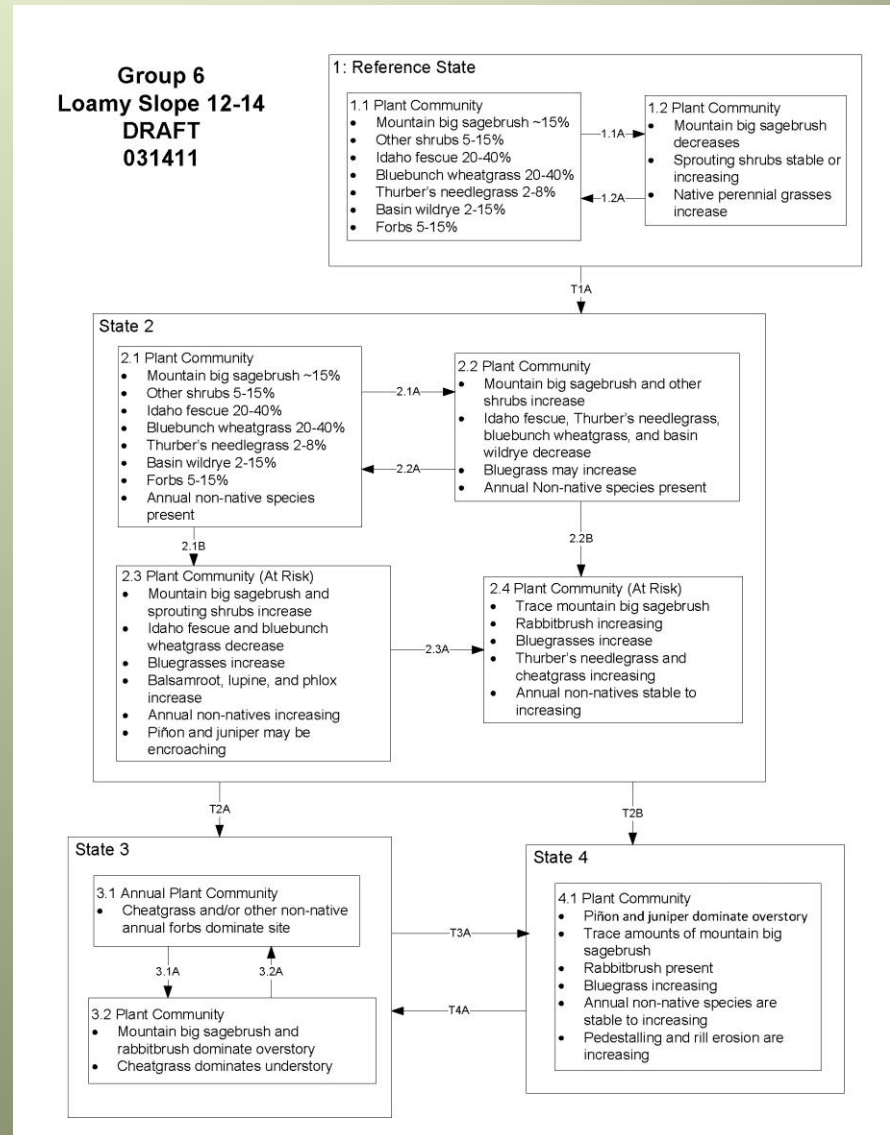
- Grouping process leads to building blocks for STM
  - Discussion involves
    - Soils and soil differences within groups
      - resilience
    - Plant species response to numerous disturbances
    - Response to repeated disturbance
- Modal site
  - greatest amount of acres mapped or
  - typical disturbance response of the group

# STM Development Process

- NO range site
  - Soil survey / ESD team
    - Include a team member who specializes in STM development
  - Beyond Soil Survey / Site Development
    - STM Team will need to visit multiple locations of the same site to understand the potential states, transitions, community phases etc.

# Draft STM Development – Tier 1

- STM expert develops the draft STM before field visits
- Team reviews

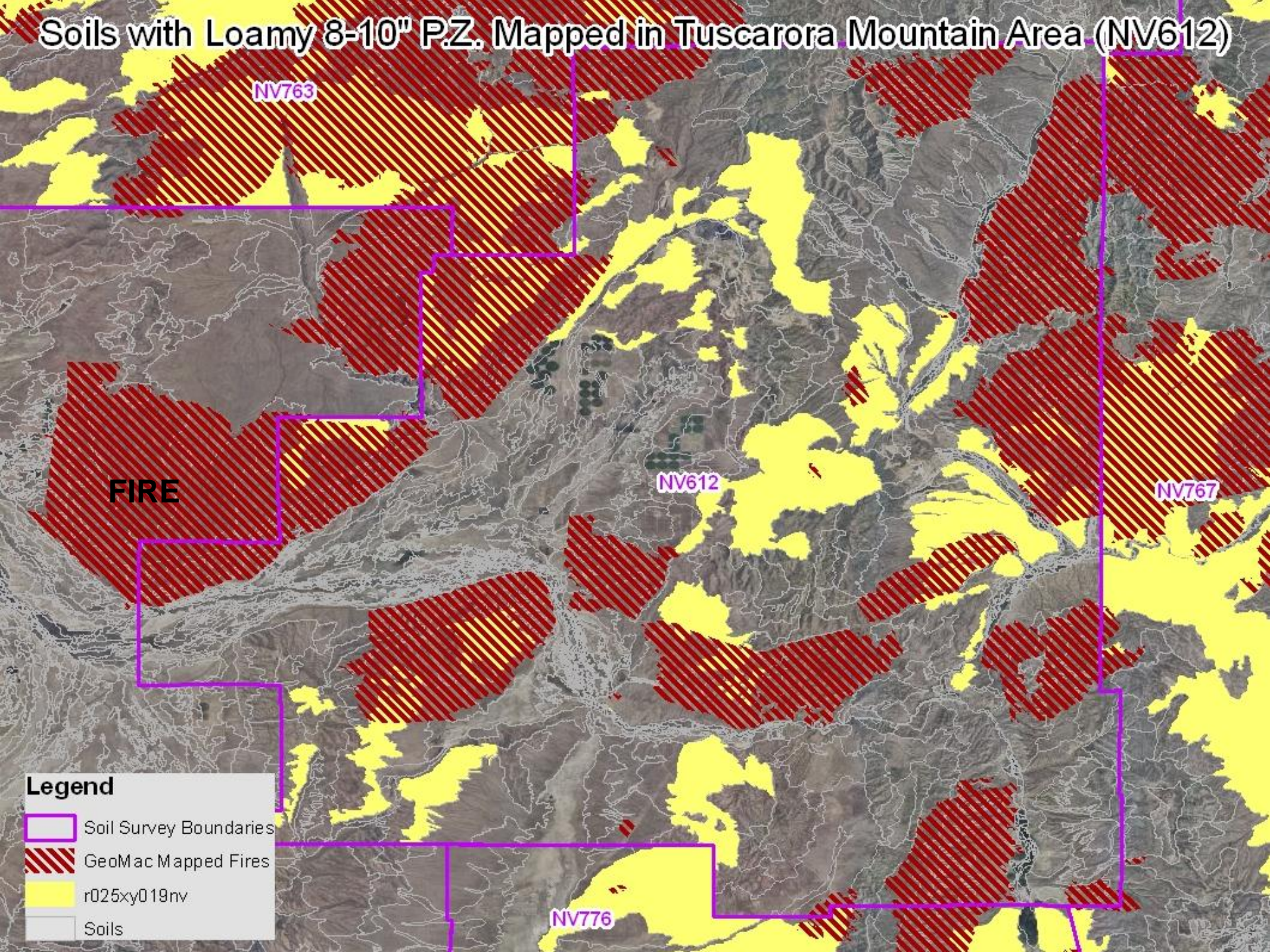




# Draft STM Development – Tier 2

- Field Tours
  - Core TEAM participation required
- GIS layers
  - Locate sites; fire history; roads etc.
  - Modal focus
    - Multiple locations visited
      - Validate states, community phases, thresholds
  - All other sites in group
    - At least one location – multiple preferred

# Soils with Loamy 8-10" P.Z. Mapped in Tuscarora Mountain Area (NV612)



NV763

NV612

NV767

FIRE

NV776

**Legend**

- Soil Survey Boundaries
- GeoMac Mapped Fires
- r025xy019nv
- Soils

Shadscale



Big Sagebrush



Site Confirmation



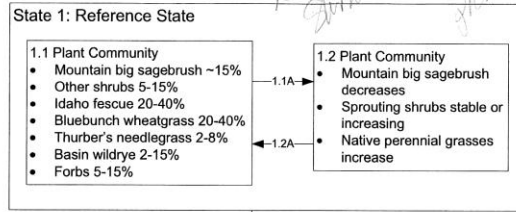
# Draft STM Development – Tier 2

- Site verified
- Plant list
- Range Health Assessment
- Photos
- DISCUSSION
- DISCUSSION
- DISCUSSION

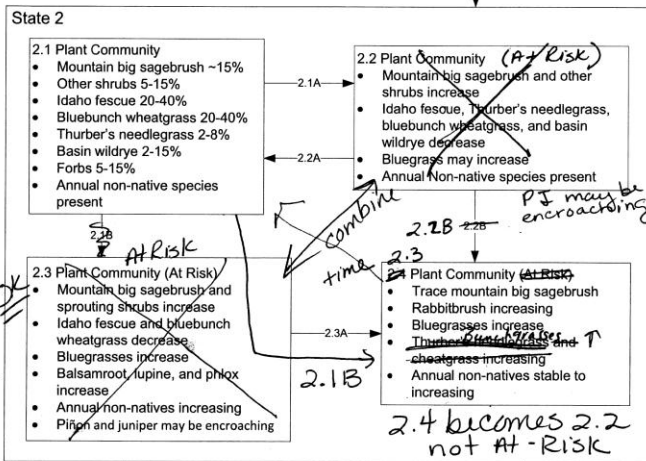


# Tier 2 – Field Validation

## Group 6 Loamy Slope 12-14 DRAFT



*Add shrub-dominated phase*

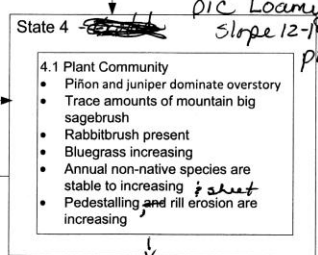
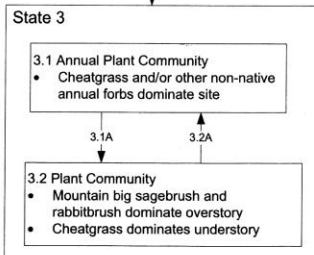


*pic CP2.3 Loamy slope 12-14 pic 63*

*2/2 goes to State 4 or State 3 will fire*

*combine 2.2 & 2.3 label as 2.3 At Risk*

*pic Loamy Slope 12-14 pic 14*



*4.2 - eroded discuss potential Eroded state*

## Document

Location: GPS

Map Unit

Soils

Elevation

Landform

Range Health

Production

Fire History

Disturbance: farming, ground water

Pumping, herbivory etc.

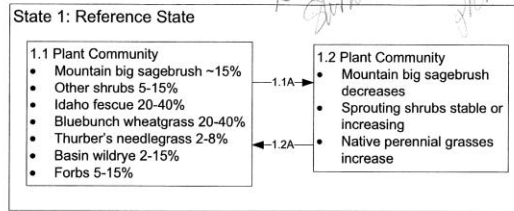


# Draft STM Development – Tier 2

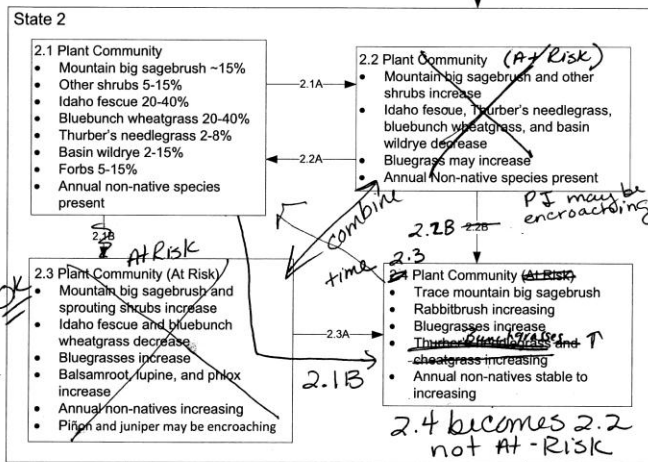
- STM Expert modifies model per DISCUSSION
- Draft ecological dynamics section
  - States
  - Community Phases
  - Community Pathways
  - Thresholds or Transitions
- Model reviewed by core TEAM

# Tier 2 – Field Validation

## Group 6 Loamy Slope 12-14 DRAFT



*Add shrub-dominated phase*



*pic CP2.3 Loamy slope 12-14 pic 63*

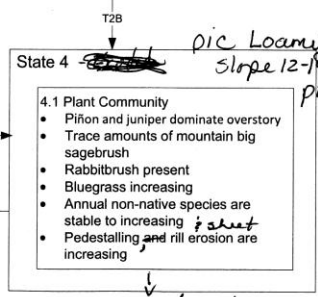
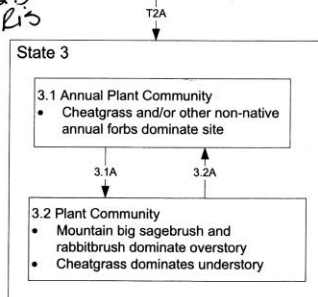
*combine time*

*2.2B becomes 2.2*

*2/2 goes to State 4 or State 3 will fire*

*2.4 becomes 2.2 not At-Risk*

*combine 2.2 & 2.3 label as 2.3 At Risk*



*pic Loamy Slope 12-14 pic 14*

*4.2 - eroded discuss potential Eroded state*

## Document

Location: GPS

Map Unit

Soils

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Landform

Range Health

Production

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Disturbance: farming, ground water

Pumping, herbivory etc.



# Review

- Larger group
- Field
- Office
- Workshop





# Conclusions

- STMs not simple
- Expert Team required
- STM concepts must be taught / reviewed
- Robust STMs require multiple site visits
- Develop draft STM in office
- Use to guide field discussions
- Revise
- Peer Review - Revise
- STMs ALWAYS DRAFT

