State and Transition Modeling
Current status of the STM Framework

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Major STM Workshops

Upland STM Concepts

August 2006

Riparian ESD & STM Concepts

August 2007

Riparian Workshop

- NRCS State Range Conservationists
- University and Agency Scientist's
  - Fluvial Geomorpholgy
  - Riparian Vegetation
  - Wetland Soils

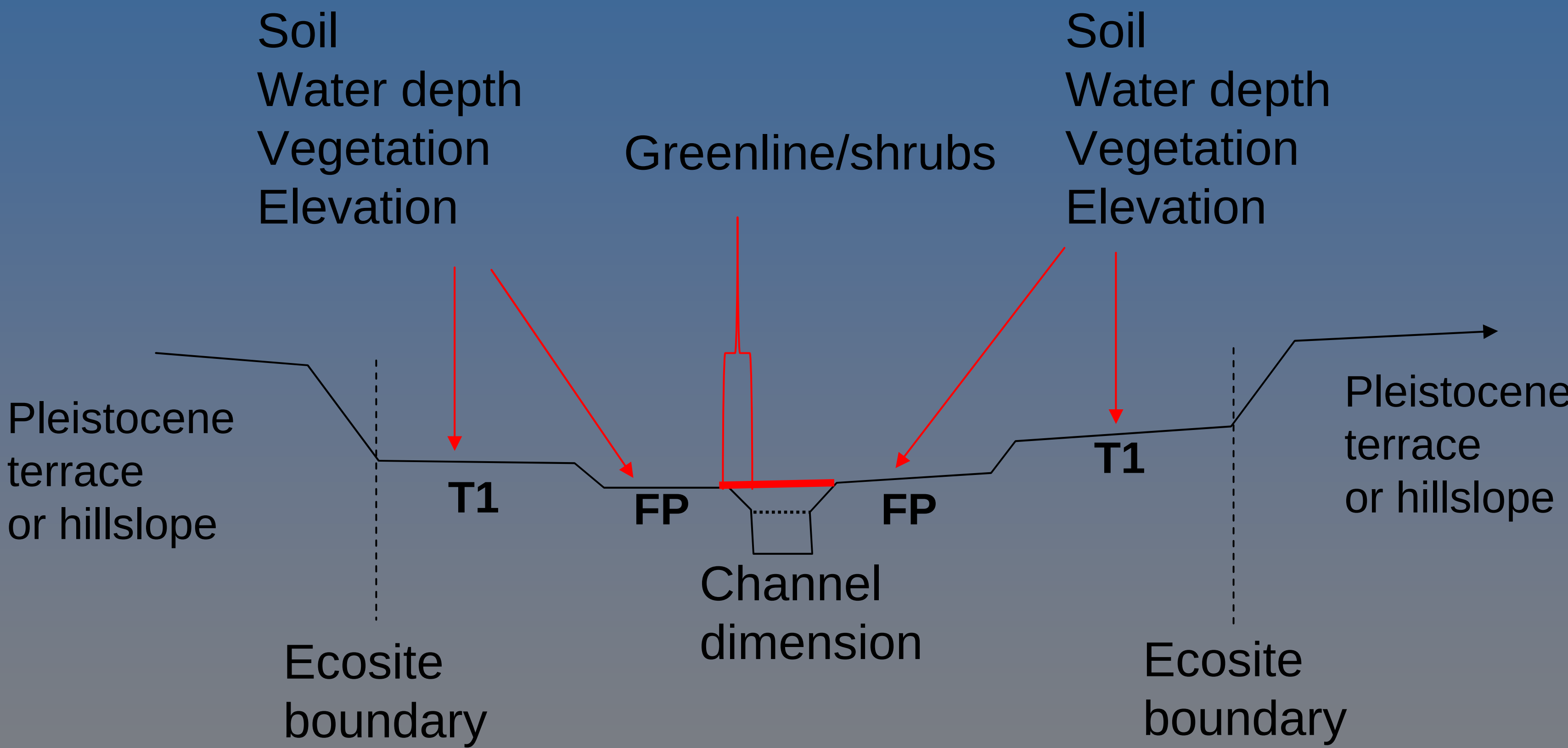
ARS Jornada Experimental Range web page

Riparian Concepts

- Stream channels: pattern, dimension & profiles
- ESD's and Riparian Complex concepts
- Similarities and perplexing difficulties
- Riparian vegetation and stream channel pattern, dimension and profile
- Stream channels and water tables
- Water table and vegetation

ARS Jornada Experimental Range web page

Proposed ESD measurements

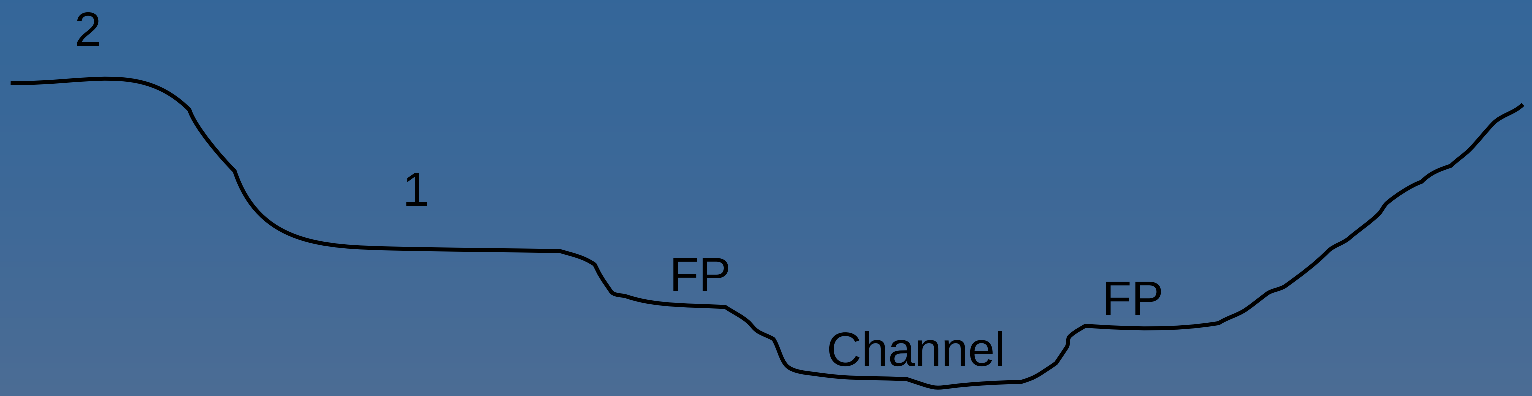


Qualitative or quantitative-derived class measurements

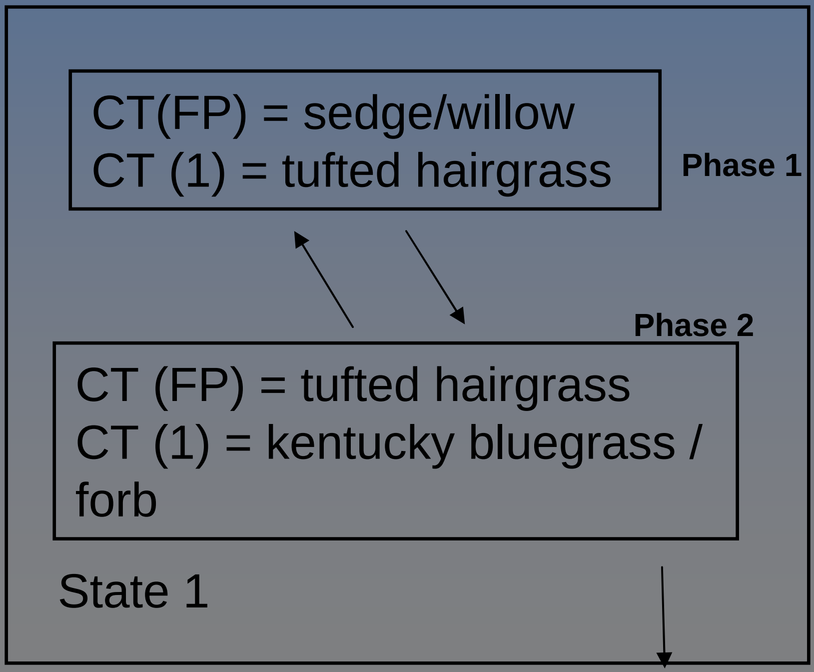
Valley type/stream substrate

Channel evolution model

Rosgen classification



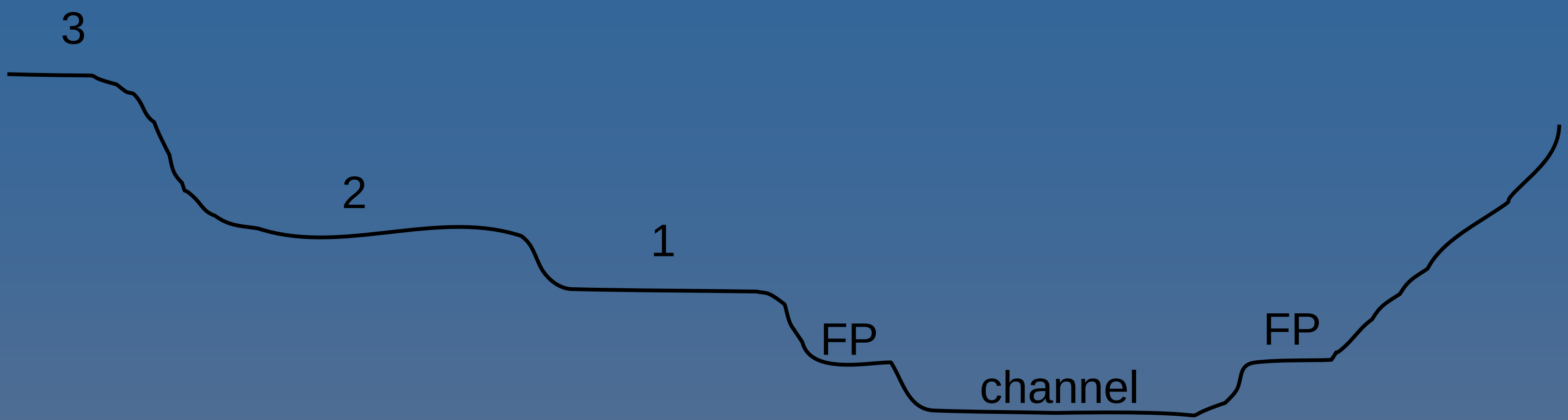
Landform associated with State 1: FP=active floodplain;
1 = tufted hairgrass meadow; 2 = pleistocene terrace



Phases potentially contain multiple CT’s.

Phase 1 to phase 2: caused by a slight incision and/or widening of the channel bed causing.

Composition (OBL’s to FACW to FAC). Phase 2 is the at-risk phase due to the lack of bank holding plants such as sedges and willows.



Landform: State 2: FP = active floodplain; 1 = kentucky bluegrass meadow; 2 = weste
wheatgrass meadow; 3 = pleistocene terrace.
Dynamics: Channel incision and stabilization new terrace;
disconnecting the meadow from channel processes (flooding and meadow recharge).

CT(FP) = tufted hairgrass /sedges

CT(1) = kentucky bluegrass

CT(2) = western wheatgrass

Phase 1: F-type I

CT(FP) = sedges / willow / hairgrass

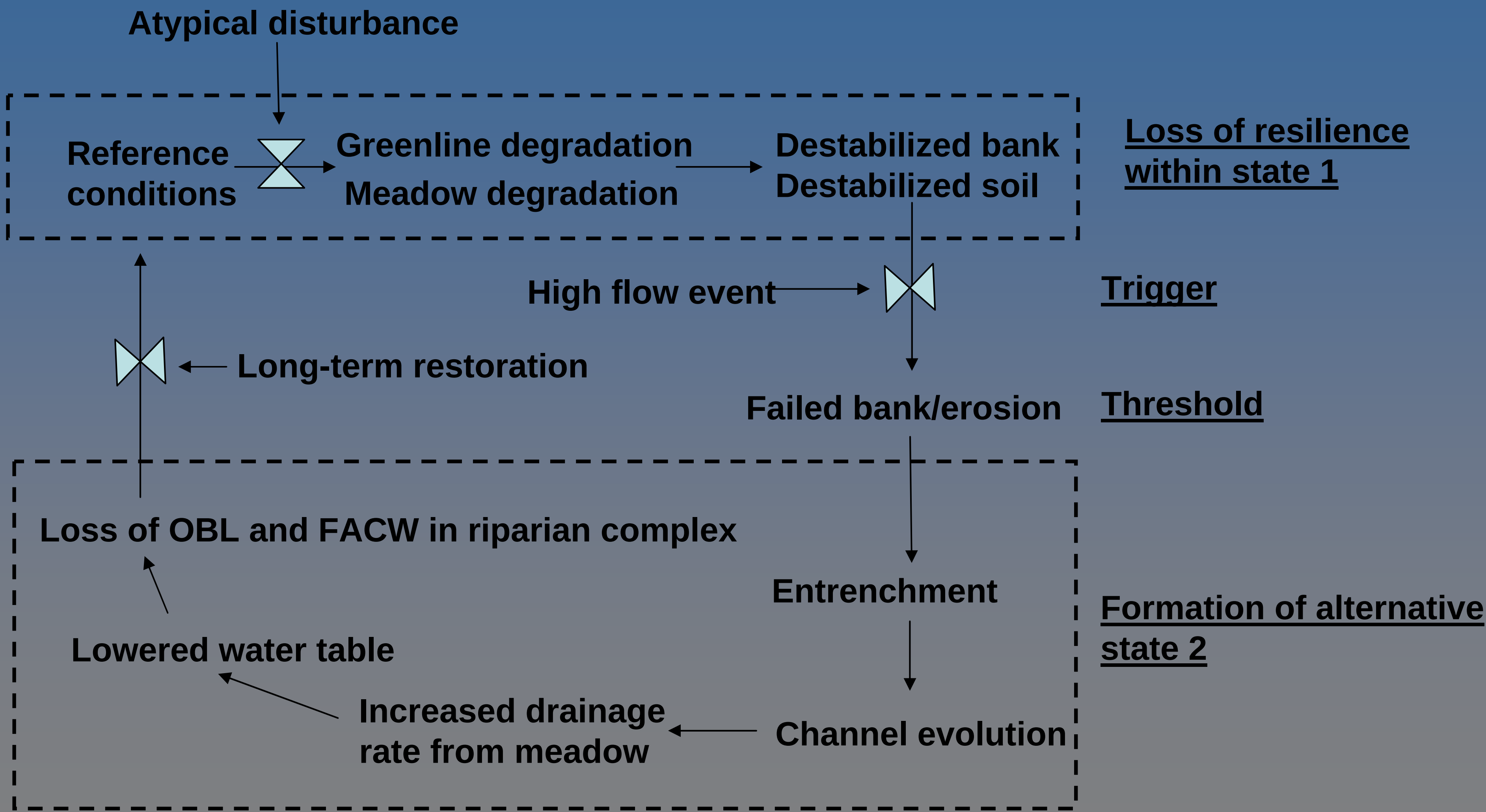
CT(1) = kentucky bluegrass

CT(2) = western wheatgrass

State 2

Channel incised
and widened from
State 1: Rosgen type C to G to F.
State 2: Phase 1
reflects a stabilizing F
With the associated
decoupled meadow (terrace1).

Draft general riparian channel-meadow model



A set of general models can be adapted to MLRA-specific STMs by including species and STM formatting

Riparian ESD & STM

Test Case Underway

STM's in *Transition*

- STM Workshop @ OSU: 2006
- Scientist's and NRCS personnel
- Problems in application
- Research needs

Positives

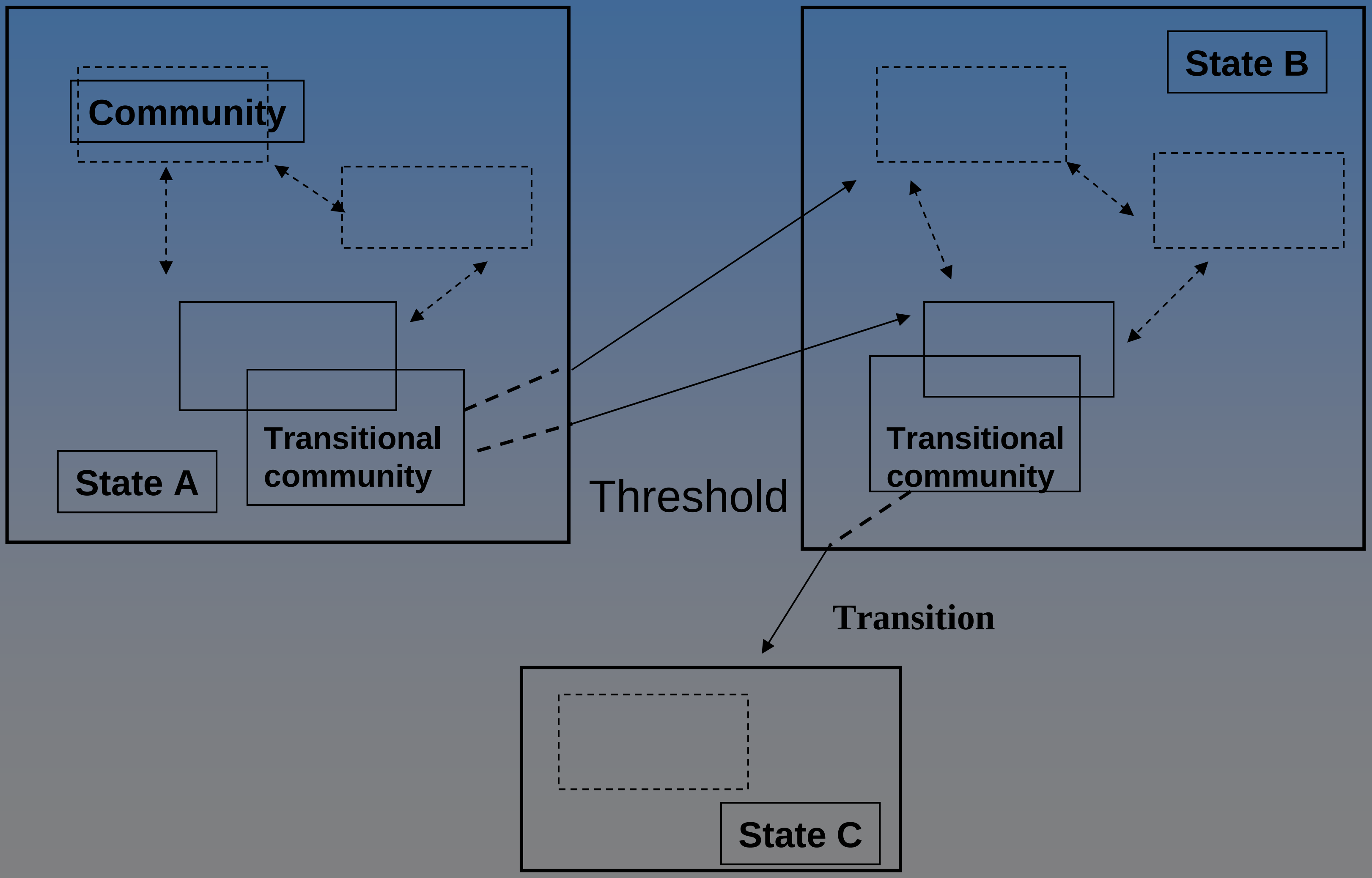
- State-and-Transition (Stringham et al. 2003)
  - Accommodates: Range Succession Model (Quantitative Climax Model)
  - Accounts for transitions, thresholds, and multiple steady states
  - Process based

Positives

- State-and-Transition
  - Allows for more detail in triggers and pathways of vegetation change
  - Spatial scale: Ecological Site
  - Temporal framework: Current climate
  - Used in ESD’s

Generalized STM Format

Stringham et al. 2003



STATE

A recognizable, resistant and resilient complex of two ecosystem components, the soil base and the vegetation structure

Vegetation Structure

- above ground communities of plant species assemblages
- competitively capture and utilize the available resources

Soil Base

- developed through time from specific parent material, climate, landscape position and interaction with biota
- determines the site's capability

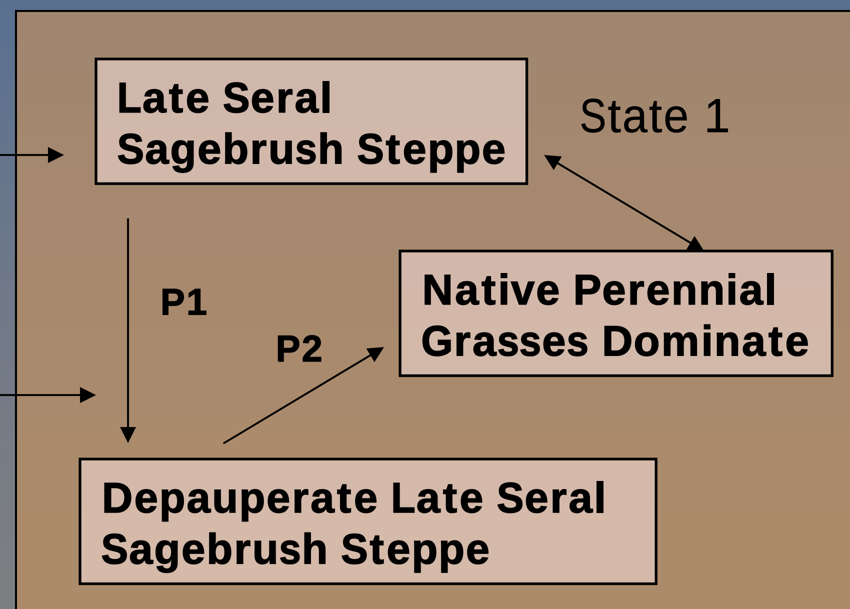
❖ interaction between **soil** and **vegetation** determines the functional status of the site and inherent resistance to change

STATE

The soil and vegetative components combined produce a sustained equilibrium that is expressed by a specific plant community in its various seral stages

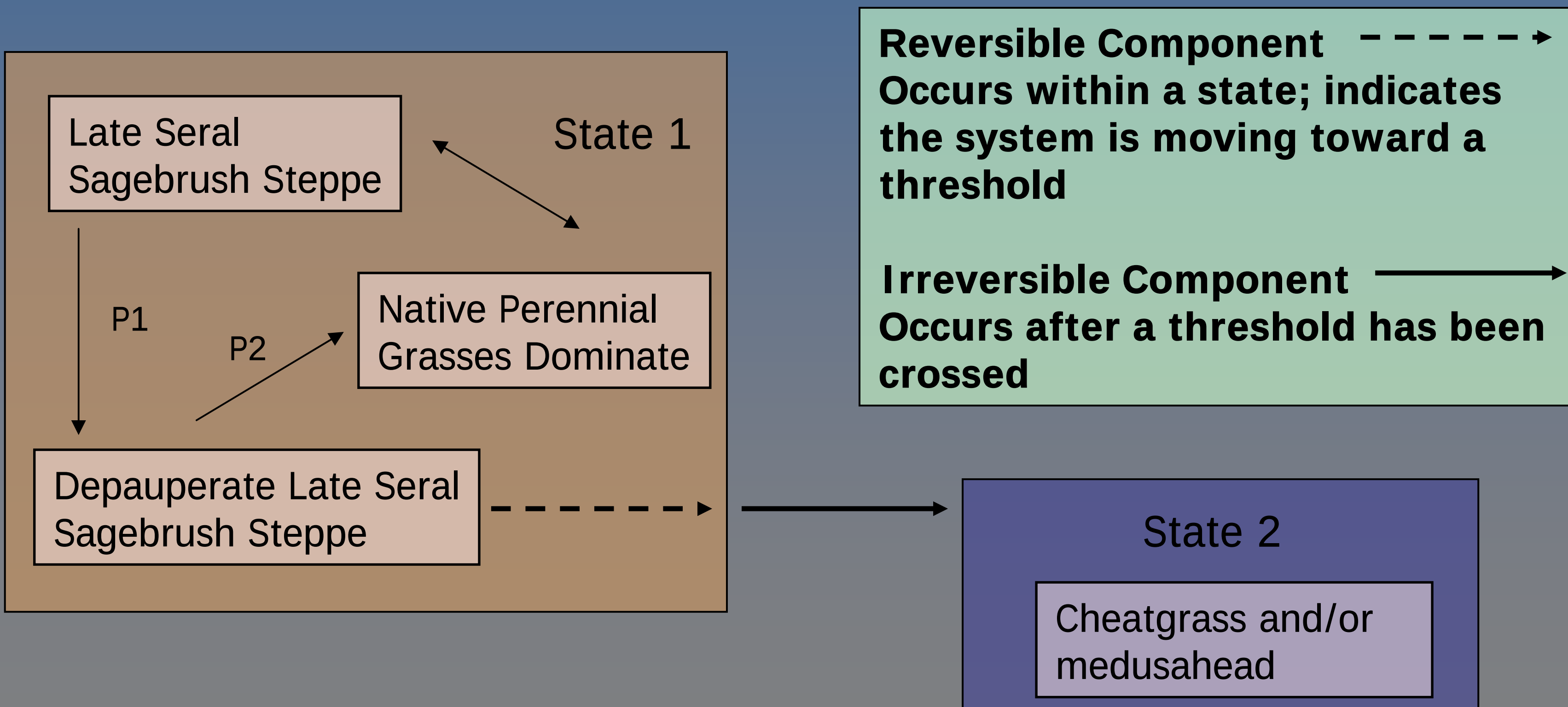
Plant Community Phases = Seral Stages

Plant Community Pathways = dynamics



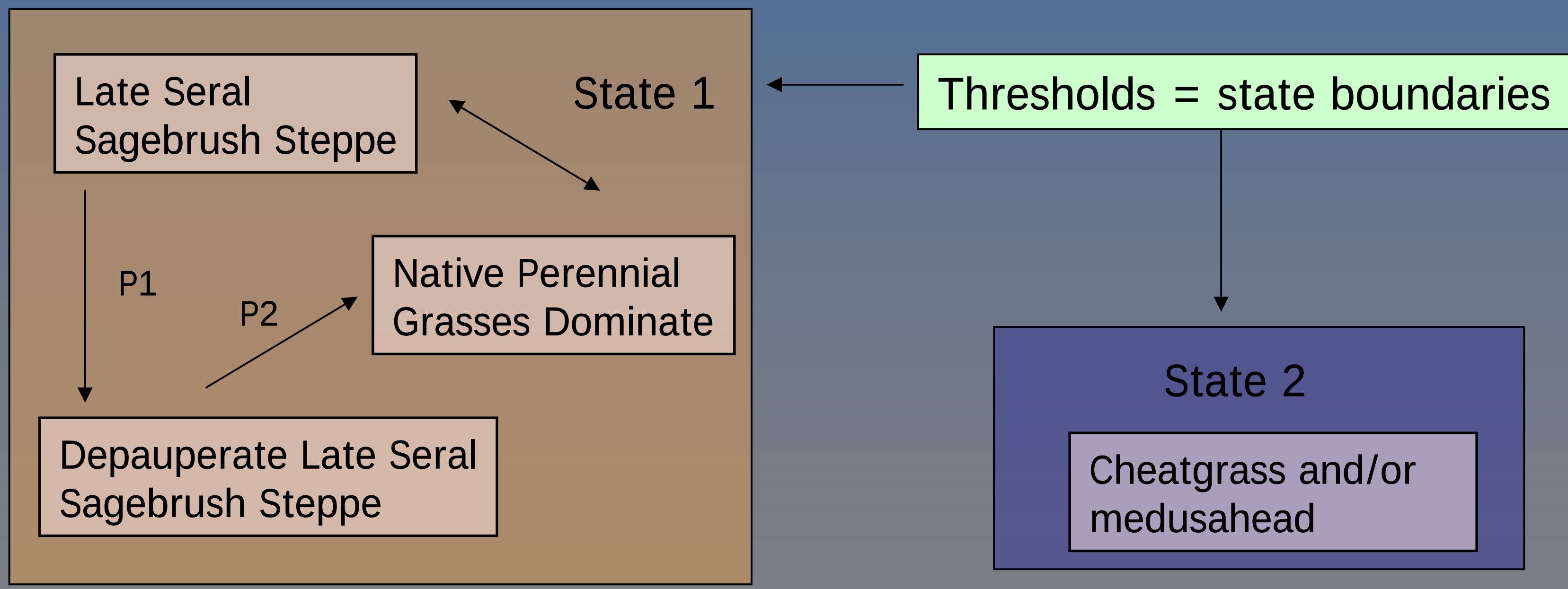
Transitions

A trajectory of system change away from the current stable state that is triggered by natural events, management actions, or both



Threshold

Point in space and time between any and all states such that one or more of the primary ecological processes has been irreversibly changed precluding return to the prior state



Ecological Processes

- Hydrology: capture, storage and on-site use of precipitation
- Energy Capture: conversion of sunlight to plant matter
- Nutrient Cycling: the cycling of nutrients through the physical and biotic components of the environment

Interpreting Indicators of Rangeland Health
Technical Ref. 1734-6 2000

- Ecological processes functioning within a normal range will support a suite of specific plant communities

- Maintenance of a functional site or repair of a damaged site requires management focused on:

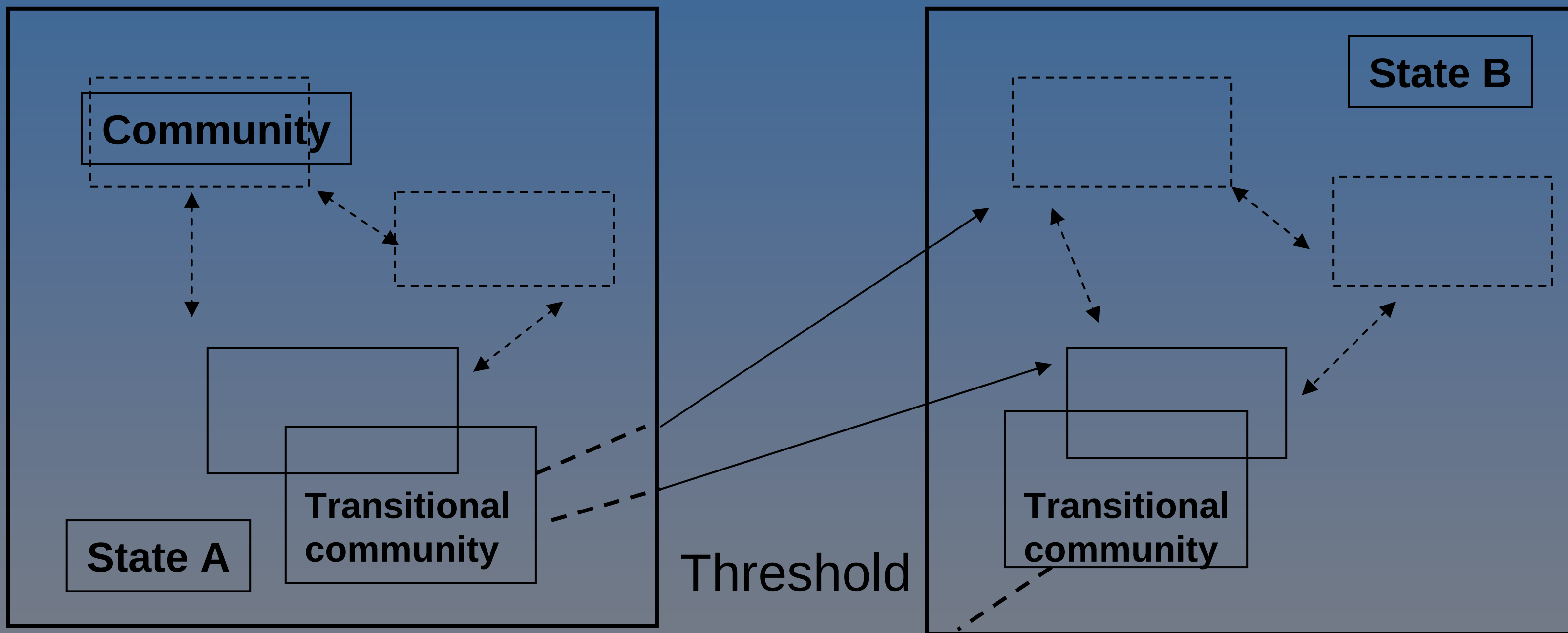
❖ soil stability
❖ nutrient cycling
❖ capture, storage and safe release of moisture

- Vegetation should be used as a ***tool*** for repair or maintenance

- Vegetation *or soil* change may be an indicator of a change in the functional capacity of the ecological processes

Generalized STM Format

Stringham et al. 2003



Issues:

- Definitions of concepts

- Application of concepts

Issues

- State-and-Transition
  - Research: Focus on identification of thresholds
  - Management: Threshold focused
  - Process based: difficulty with quantification

Issues

- State-and-Transition
  - Ecological structure ignored
  - Ecological resilience lacks detail
  - Triggers and feedback mechanisms: lack inclusion within current model

Response

- Improved definitions of model concepts
- Increase attention on:

  RESILIENCE MANAGEMENT vs.
  threshold management

- Increased emphasis on *at-risk plant community phases* *(transitional phase)*

Response

- Range Health Indicators for identification of at-risk plant community phases
- Include descriptions of triggers and feedbacks within model discussion
- Restoration Pathways: Describe activities necessary to restore the structure and function of a prior state

Outcomes

- New Manuscript:
  - Recommendations for Development of Resilience-based State-and-Transition Models. *In Review*. J. of Rangeland Ecology and Management.

    Briske D., Bestelmeyer B. and T. Stringham

  - SRM Symposium

Symposium

- Resilience concepts
- Up-dated model concepts
- STM Examples:
  - Oregon High Desert
  - Great Basin
  - Chihuahuan Desert
  - Northern Great Plains
  - New Mexico

    Deep Sand Savannah

Morning

Afternoon

Symposium

- Panel Discussions: morning & afternoon
    - Research needs
    - Management application
    - ?????