

# Using Ecological Site Descriptions to Manage Sagebrush Ecosystems

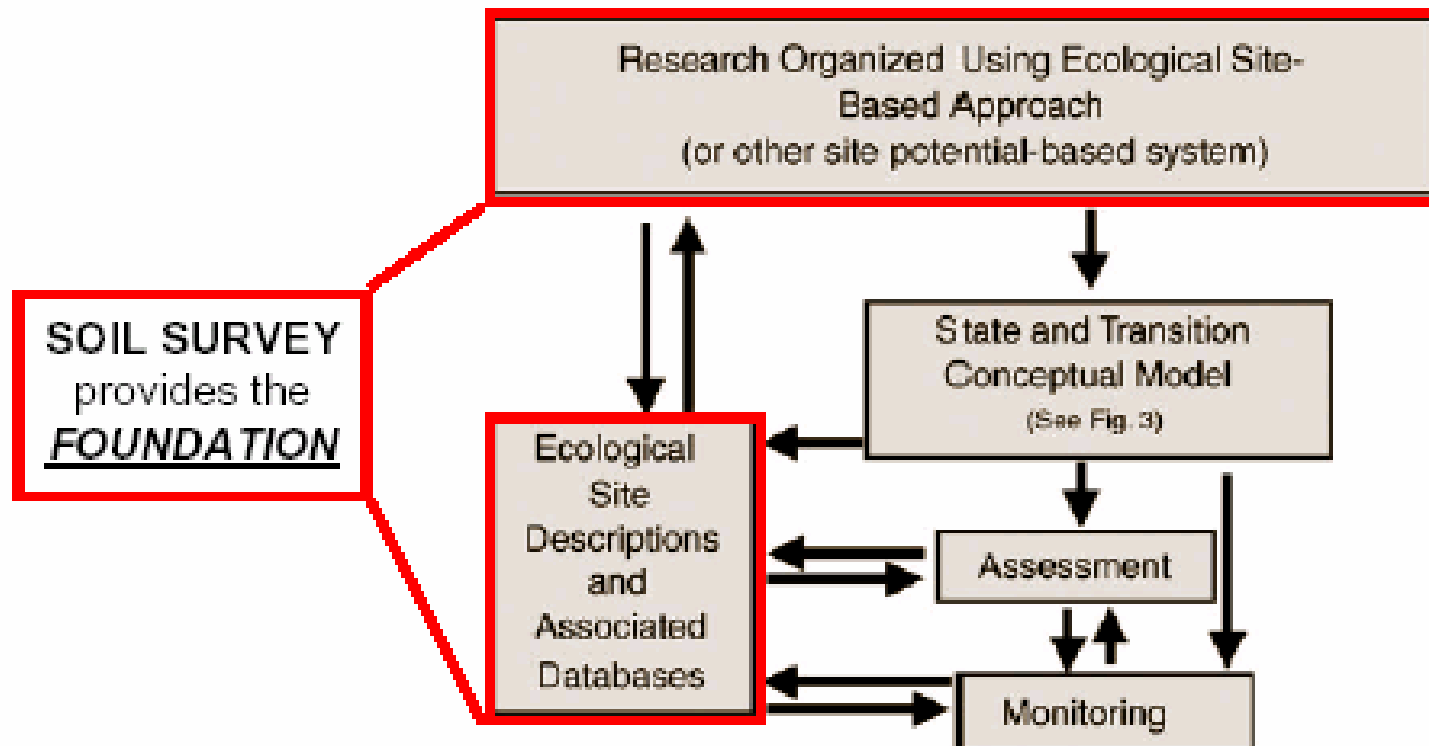
## History, Overview and Applications of ESDs for Management

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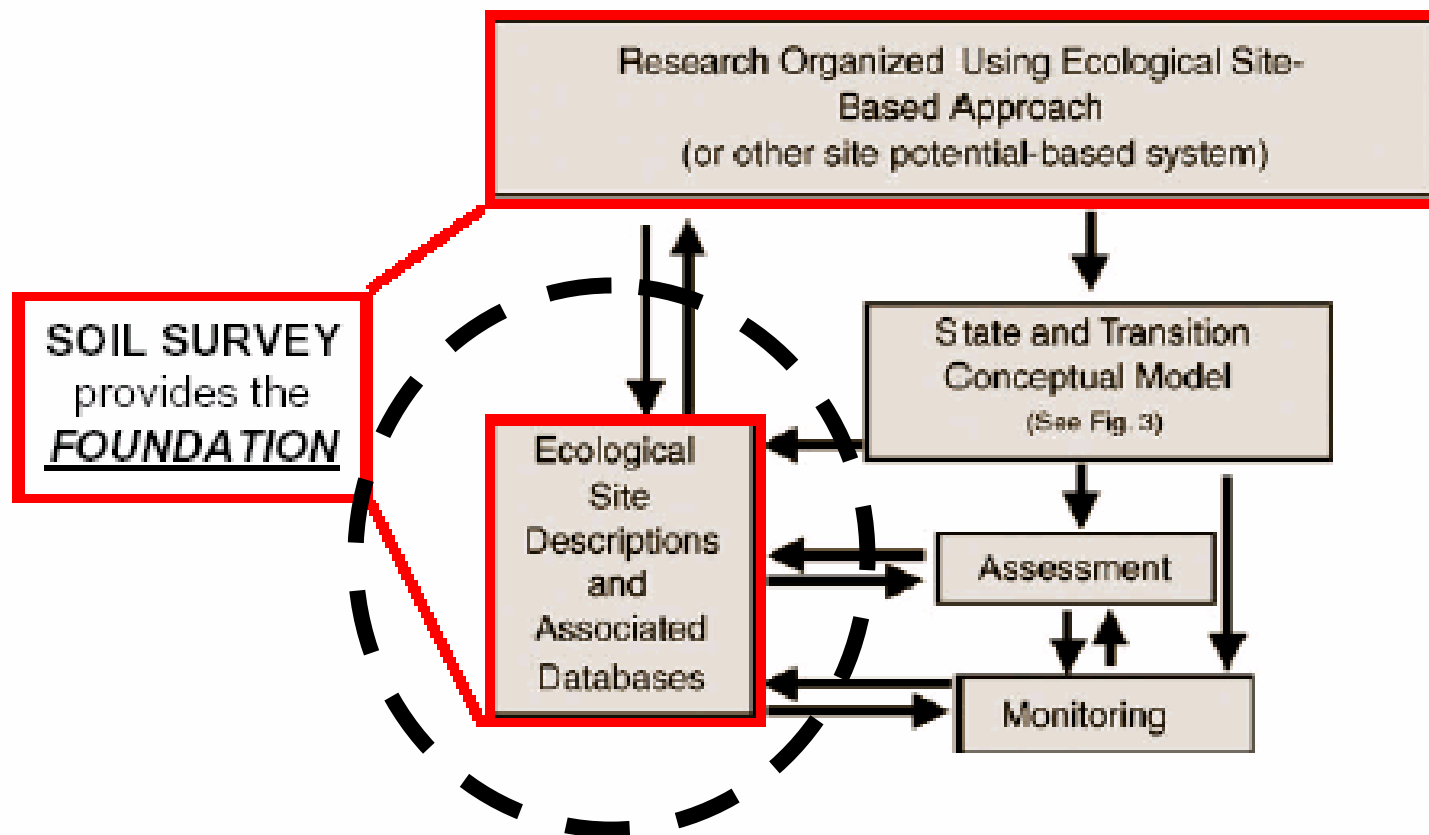
Photo by A. Wilson, Oregon Fish and Wildlife web site

# Ecological Sites and the Integrated Management Framework



Herrick, J. E., B. T. Bestelmeyer, S. Archer, A. J. Tugel, and J. R. Brown. 2008. An integrated framework for science-based arid land management. *Journal of Arid Environments* 65: 319-336.

# Ecological Sites and the Integrated Management Framework



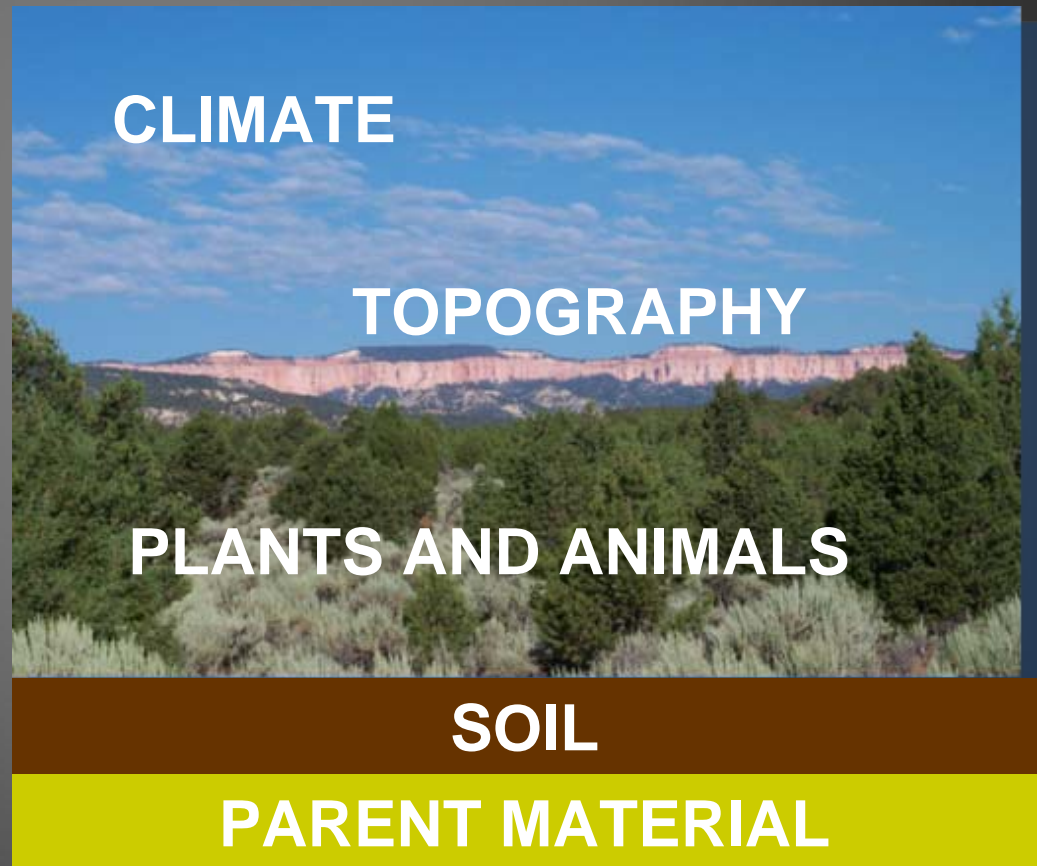
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**An ecological site is an area of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation and to respond to management.**



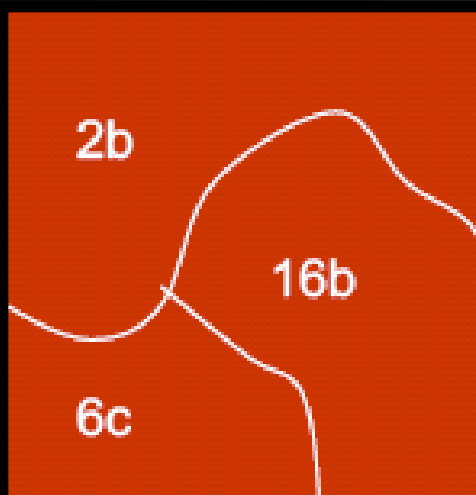
**An ecological site is an area of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation and to respond to management.**

**An ecological site is the product of all the environmental factors responsible for its development including--**

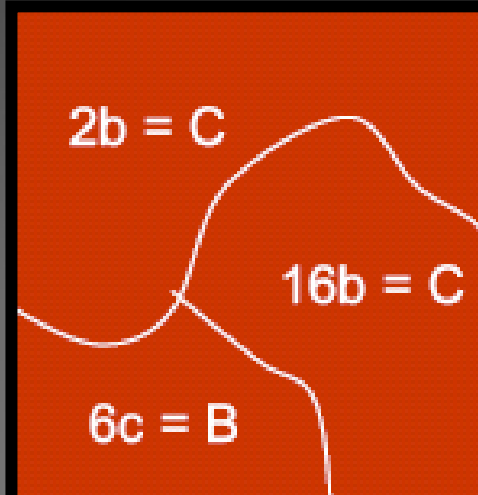


# ECOLOGICAL SITES

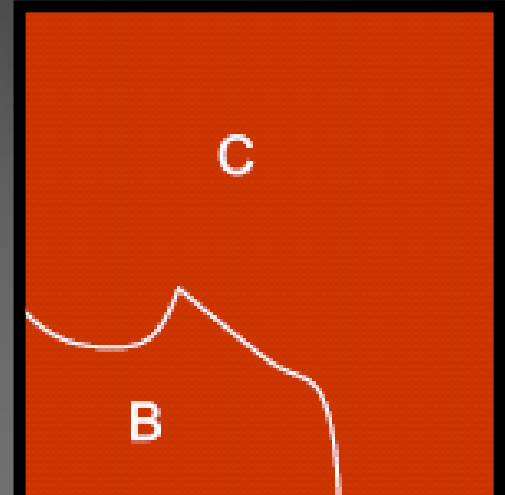
- DIFFERENTIATION BETWEEN ECOLOGICAL SITES BASED ON SIGNIFICANT DIFFERENCES IN PHYSICAL FACTORS (TOPOGRAPHY AND SOILS) THAT RESULT IN:
  - Significant **differences in the species** that are in the characteristic plant community
  - Significant **differences in the relative proportion of species** in the characteristic plant community
  - Significant **differences in the total annual production** of the characteristic plant community



Area with three soils—  
2b, 16b, and 6c  
(series,  
associations, or  
complexes)



correlated into  
two ecological  
sites--B and C--



resulting in map  
showing two  
ecological  
sites—B and C

# ECOLOGICAL SITES

- Ecological site classification represents our **best approximation of how the landscape works** as we understand it at this moment in time. Ecological site classification will always be our current approximation as to how the world is organized.

# ECOLOGICAL SITES

- The land classification represented by **ecological sites** represents a **“file”** where we can record **information** we have about the site. Accumulation of information over time will make our next approximation of how the word is organized even better.

# ECOLOGICAL SITES

- **As the ecological site classification represents our current best knowledge of how the world is organized, and is the collection of what we currently know about the site, the site description is an excellent place for a resource conservationist to learn about the lands in his or her work location.**

**DESERT**



**SEMIDESERT**



**UPLAND**



**BOTTOMLAND (RIPARIAN)**



# DESERT LOAM

**PARENT MATERIAL =**  
Alluvium derived from  
sandstone and shale

**SOIL =** Fine sandy  
loam, loamy fine sand,  
and loam

**SOIL DEPTH =** 20-60"

**SLOPE =** 1-15 percent



**PARENT  
MATERIAL =**  
Residuum and  
Alluvium derived from  
sandstone and shale

**SOIL =** Sandy Loam,  
Fine sandy loam,  
loamy fine sand, and  
loam

**SOIL DEPTH = 20-60"**

**SLOPE = 1-15 percent**

## **SEMIDESERT**

### **LOAM**



**PARENT  
MATERIAL =**  
Residuum and  
Alluvium derived from  
sandstone

**SOIL = Sandy Loam,  
Fine sandy loam,  
loamy fine sand, and  
loam**

**SOIL DEPTH = 20-60"**

**SLOPE = 1-15 percent**

## **UPLAND LOAM**



**PARENT MATERIAL =  
Residuum and Alluvium  
derived from sandstone  
and shale**

**SOIL = Sandy Loam,  
Fine sandy loam, loamy  
fine sand, and loam**

**SOIL DEPTH = >60"**

**SLOPE = 0-8 percent**

## **LOAMY BOTTOM**



**PARENT MATERIAL =  
Residuum and Alluvium  
derived from sandstone  
and shale**

**SOIL = Sandy Loam,  
Fine sandy loam, loamy  
fine sand, and loam**

**SOIL DEPTH = >60"**

**SLOPE = 0-8 percent**

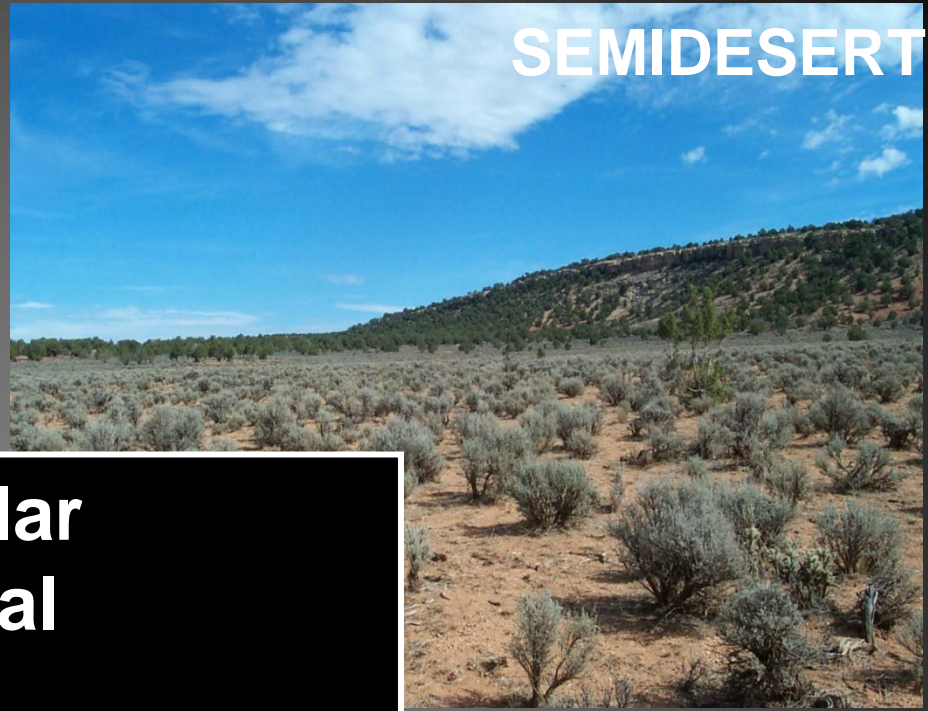
**ALSO LOAMY**



**DESERT**



**SEMIDESERT**



**Relatively similar**

**--Parent Material**

**--Soil**

**--Soil Depth**

**--Slope**

**So what's the difference?**

**UPLAND**



**BOTTOMLAND (RIPARIAN)**



# IN THIS CASE: ELEVATION, PRECIPITATION, AND PLANTS



**DESERT LOAM**

**Elevation = 4000-4800'**

**Precipitation = <8"/b>**

**Dominant Plant = Shadscale  
(indicating salt in the soil)**



**SEMIDESERT LOAM**

**Elevation = 4800-6200'**

**Precipitation = 8-12"/b>**

**Dominant Plant = Wyoming big  
sagebrush**



**UPLAND LOAM**

**Elevation = 5400-7900'**

**Precipitation = 12-16"/b>**

**Dominant Plant = Mountain big  
sagebrush**



**LOAMY BOTTOM**

**Elevation = 4000-7900'**

**Precipitation = <8->16"/b>**

**Dominant Plant = Basin big  
sagebrush**

# FOUR ECOLOGICAL SITES OF IMPORTANCE TO SAGE GROUSE



**DESERT LOAM (shadscale)**



**SEMIDESERT LOAM ( Wyoming big sagebrush)**



**UPLAND LOAM (mountain big sagebrush)**



**LOAMY BOTTOM (basin big sagebrush)**

# ECOLOGICAL SITE DESCRIPTION

- PHYSIOGRAPHIC FEATURES
- CLIMATE FEATURES
- WATER FEATURES
- SOIL FEATURES
- PLANT COMMUNITIES
- SITE INTERPRETATIONS
- SUPPORTING INFORMATION

# ECOLOGICAL SITE DESCRIPTION

## PLANT COMMUNITY INFORMATION

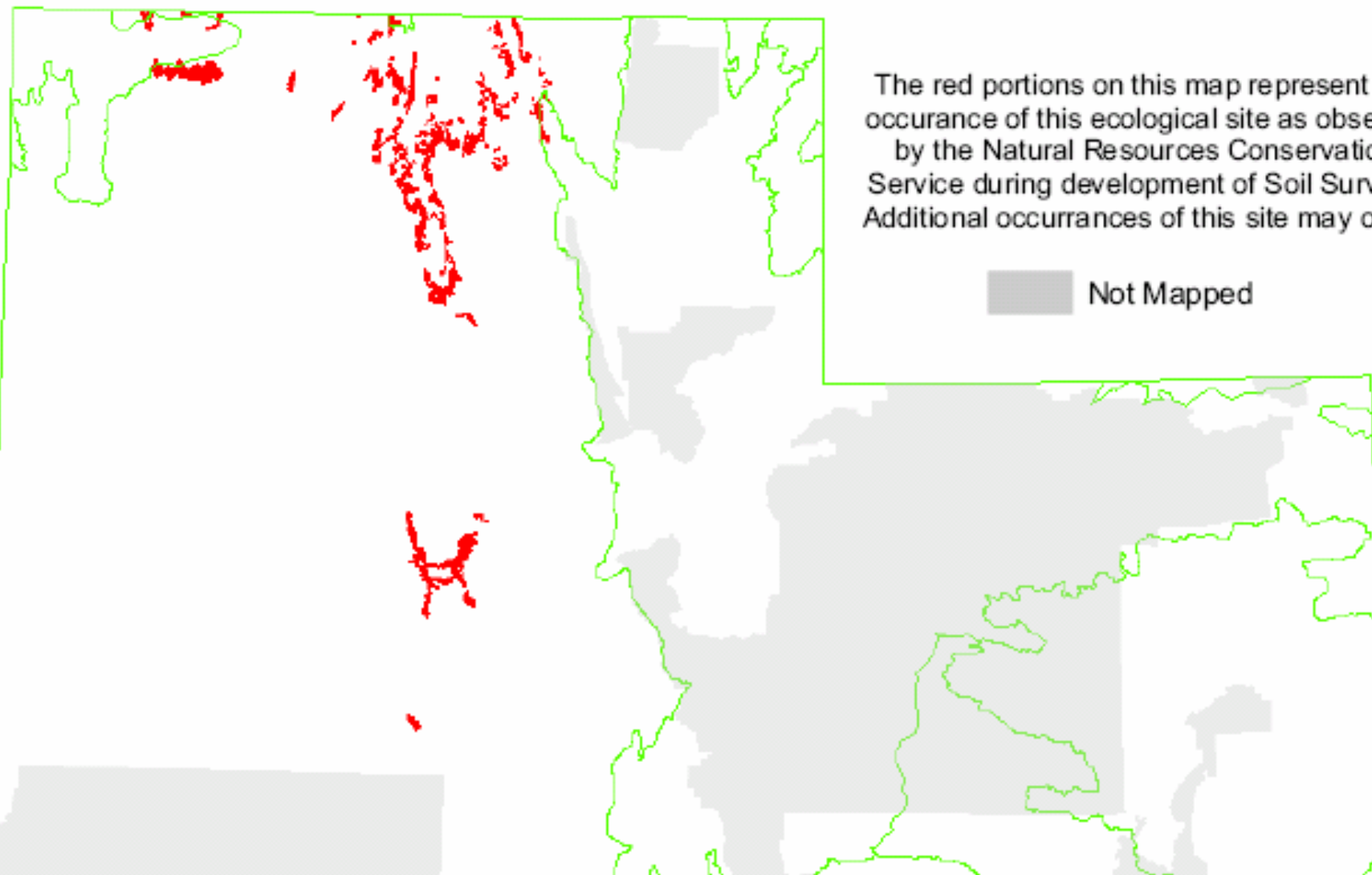
- ECOLOGICAL DYNAMICS OF SITE
- STATE AND TRANSITION DIAGRAM
- PLANT COMMUNITIES
  - COMMUNITY NARRATIVE
  - ANNUAL PRODUCTION
  - SPECIES COMPOSITION
  - GROWTH CURVES
  - COVER AND STRUCTURE
  - PHOTOS

# Upland Gravelly Loam (Wyoming big sagebrush)

<ftp://ftp-fc.sc.egov.usda.gov/UT/Range/D28AY/28AY307UT.pdf>

- The interpretive plant community for this site is the historic climax community (HCPC).
- Dominant vegetative aspect is Wyoming big sagebrush and Bluebunch wheatgrass with other grasses and forbs in the interspaces.
- The air-dry composition weight is 50% perennial grasses, 15% forbs and 35% shrubs.
- Plants begin growth around April 20 and end growth around September 15.

# Upland Gravelly Loam (Wyoming Big Sagebrush) R28AY307UT



# Plant Composition Table-- Grasses

Common Name	National Symbol	Total Annual Production		
		Group	Lbs. / Acre	% by Weight of Total Composition
Grasses and Grass Likes		0		40 - 60 %
Bluebunch wheatgrass	PSSP6	0	162 - 330	25 - 30
Slender wheatgrass	ELTR7	0	33 - 110	5 - 10
Western wheatgrass	PASM	0	3 - 110	5 - 10
Group 1		1		5 - 10 %
Muttongrass	POFE	1	20 - 55	3 - 5
Bottlebrush squirreltail	ELEL5	1	7 - 33	1 - 3
Nevada bluegrass	PONE3	1	20 - 55	3 - 5
Sandberg bluegrass	POSA12	1	20 - 55	3 - 5
NeedleandThread	HECO26	1	7 - 55	1 - 5
Indian ricegrass	ACHY	1	7 - 55	1 - 5
Other Perennial Native Grasses	PPGG	1	33 - 110	5 - 10
Other Annual Native Grasses	AAGG	1	20 - 55	3 - 5

# Plant Composition Table--Forbs

Common Name	National Symbol	Total Annual Production		
		Group	Lbs. / Acre	% by Weight of Total Composition
Forbs		0		7 - 20 %
Louisiana sagewort (White sagebrush)	ARLUC8	0	20 - 55	3 - 5
Tapertip hawksbeard	CRAC2	0	20 - 55	3 - 5
Group 2		2		1 - 10 %
Shaggy Fleabane	ERPU2	2	7 - 33	1 - 3
Longleaf Phlox	PHLO2	2	7 - 33	1 - 3
Torrey's milkvetch	ASCA9	2	7 - 33	1 - 3
Lobeleaf groundsel	PAMU11	2	7 - 33	1 - 3
Desert parsley (Gray's biscuitroot)	LOGR	2	7 - 33	1 - 3
Low beardtong	PEHU	2	7 - 33	1 - 3
Carpet Phlox	PHHOC	2	7 - 33	1 - 3
Sego Lilly	CANU3	2	7 - 33	1 - 3
Owl clover	ORLU2	2	7 - 33	1 - 3
Other Perennial Native Forbs	PPFF	2	33 - 110	5 - 10
Other Annual Native Forbs	A AFF	2	33 - 110	5 - 10

# Plant Production and Composition Tables

**Production**      **“LOW” = UNFAVORABLE AND “HIGH” = FAVORABLE GROWING CONDITIONS**

	Low	High
Favorable Year	1100	1200
Normal Year	650	1100
Unfavorable Year	300	500

**Composition**

	Low	High
Gasses and Grasslikes	40	60
Forbs	7	20
Shrubs	33	45
Trees	0	0

# Plant Cover Tables

Cover Type	Percent Canopy Cover	Height Range	Percent Basal Area Cover
Grasses & Grass-like (perennial)	20-30	18 in. – 26 in.	10
Forbs (perennial)	7-12	1 in. – 12 in.	3
Shrubs	15-25	10 in. – 40 in.	5
Trees	0-1	0	0
Cryptogams	1-3	0.25 in.	1
Litter	10-20		
Coarse Fragments	10-15		
Bare Ground	15-25		

# Upland Gravelly Loam (Wyoming big sagebrush) STATE AND TRANSITION MODEL

## Historic Climax Plant Community State

Perennial Grasses  
Wyoming Big Sagebrush

Perennial Grasses

Wyoming Big Sagebrush  
co-dominant with  
Perennial Grasses

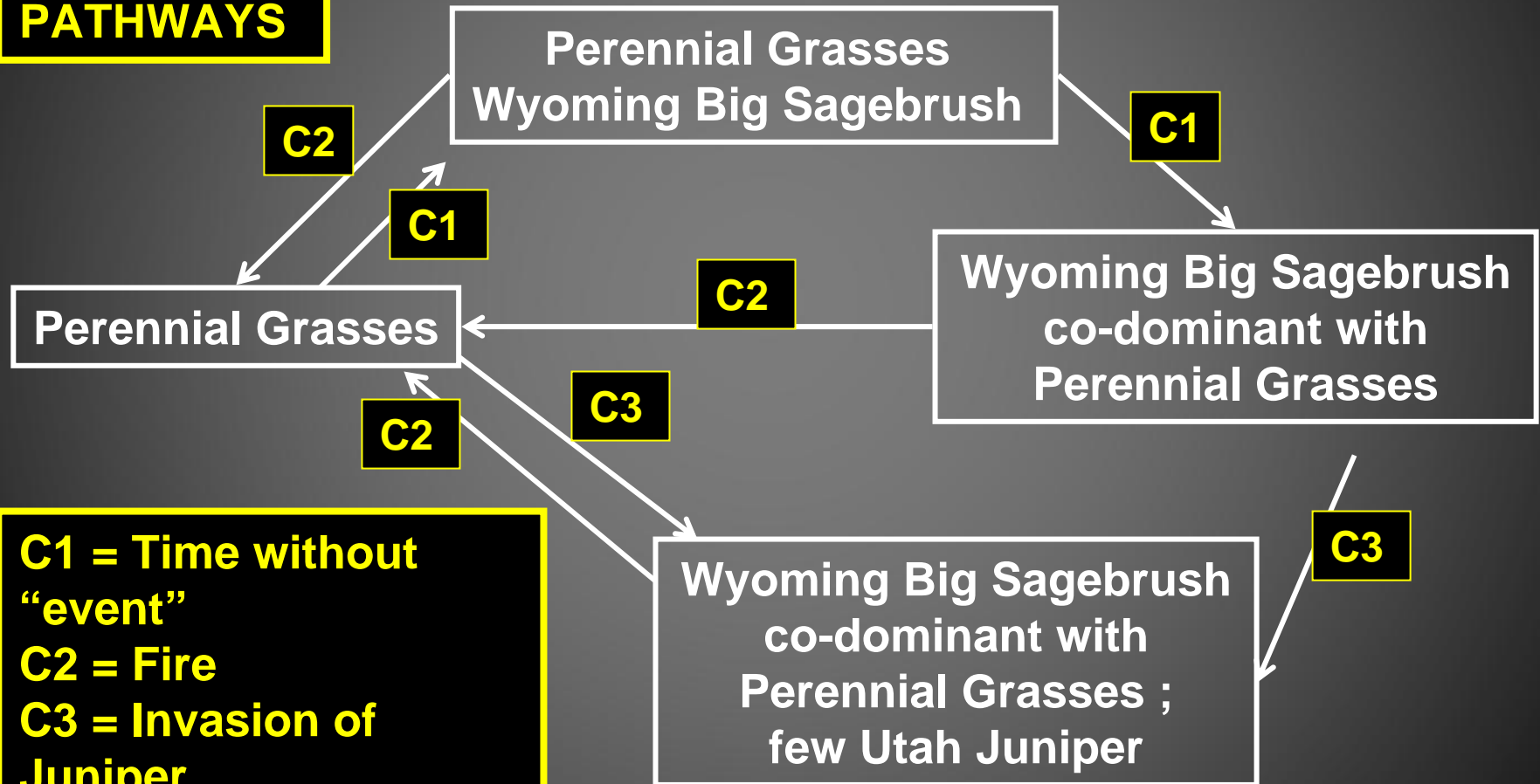
Wyoming Big Sagebrush  
co-dominant with  
Perennial Grasses ;  
Few Utah Juniper

# Upland Gravelly Loam (Wyoming big sagebrush)

## STATE AND TRANSITION MODEL

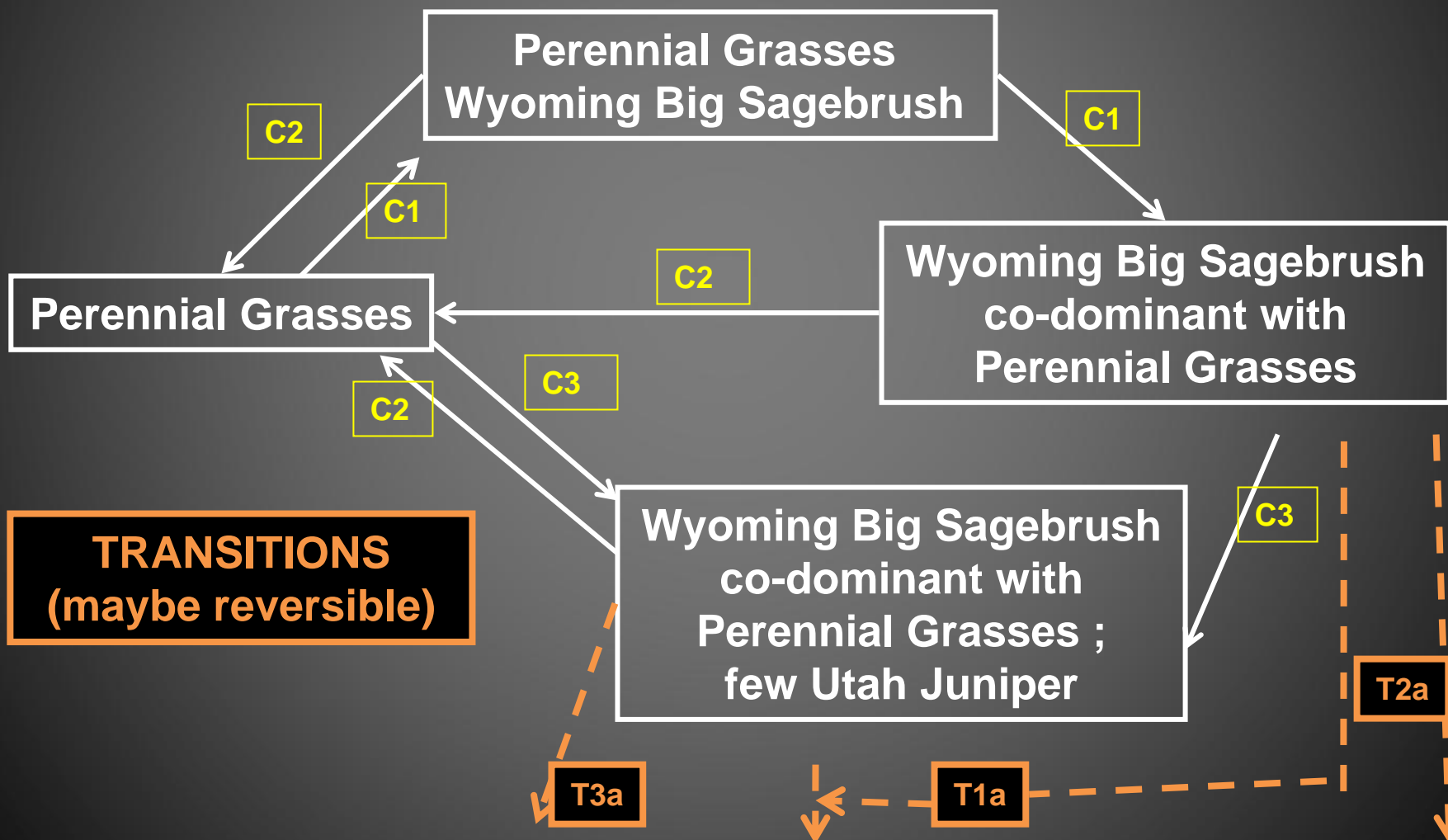
Historic Climax Plant Community State

**COMMUNITY  
PATHWAYS**



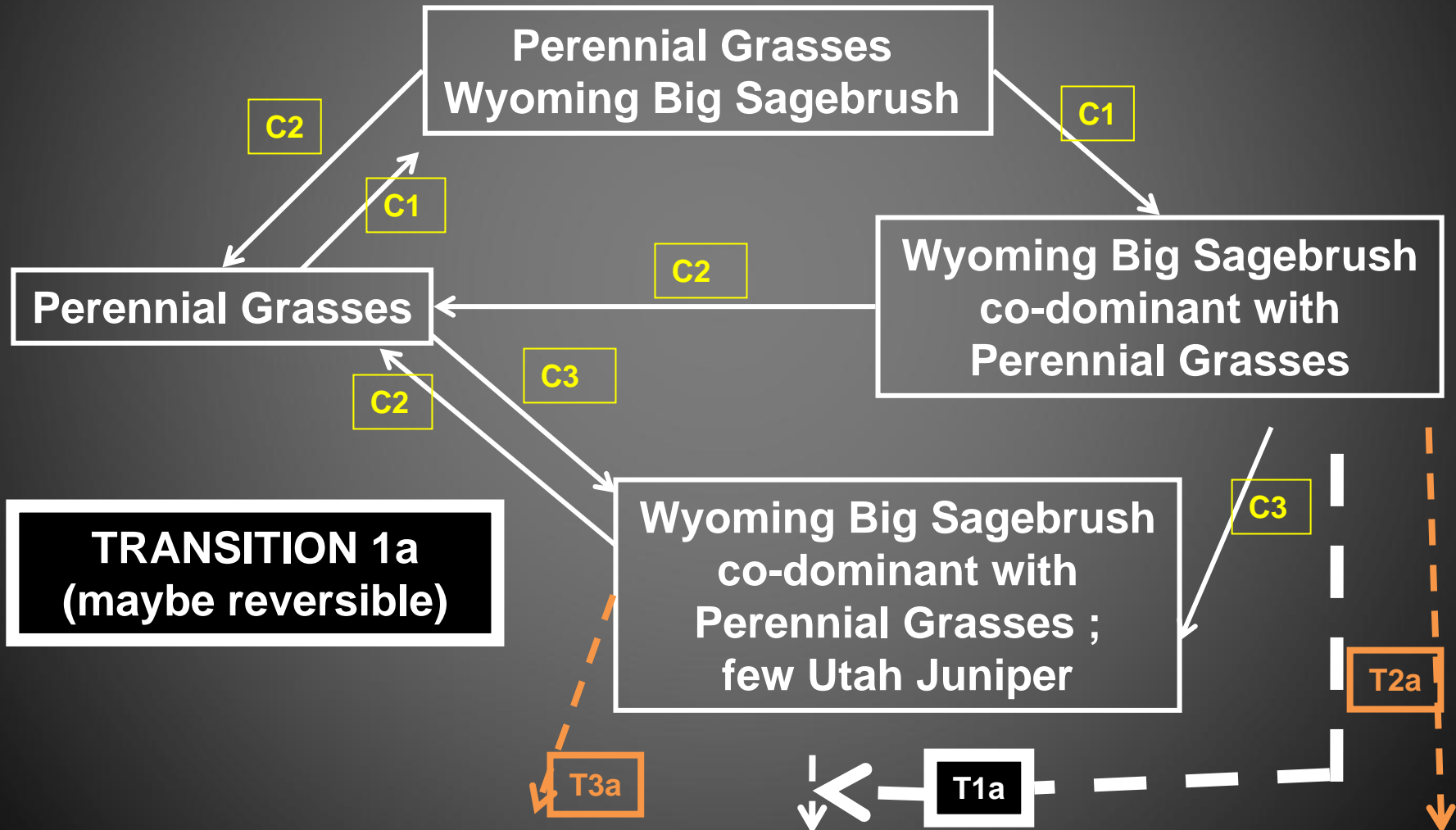
# Upland Gravelly Loam (Wyoming big sagebrush) STATE AND TRANSITION MODEL

## Historic Climax Plant Community State



# Upland Gravelly Loam (Wyoming big sagebrush) STATE AND TRANSITION MODEL

## Historic Climax Plant Community State

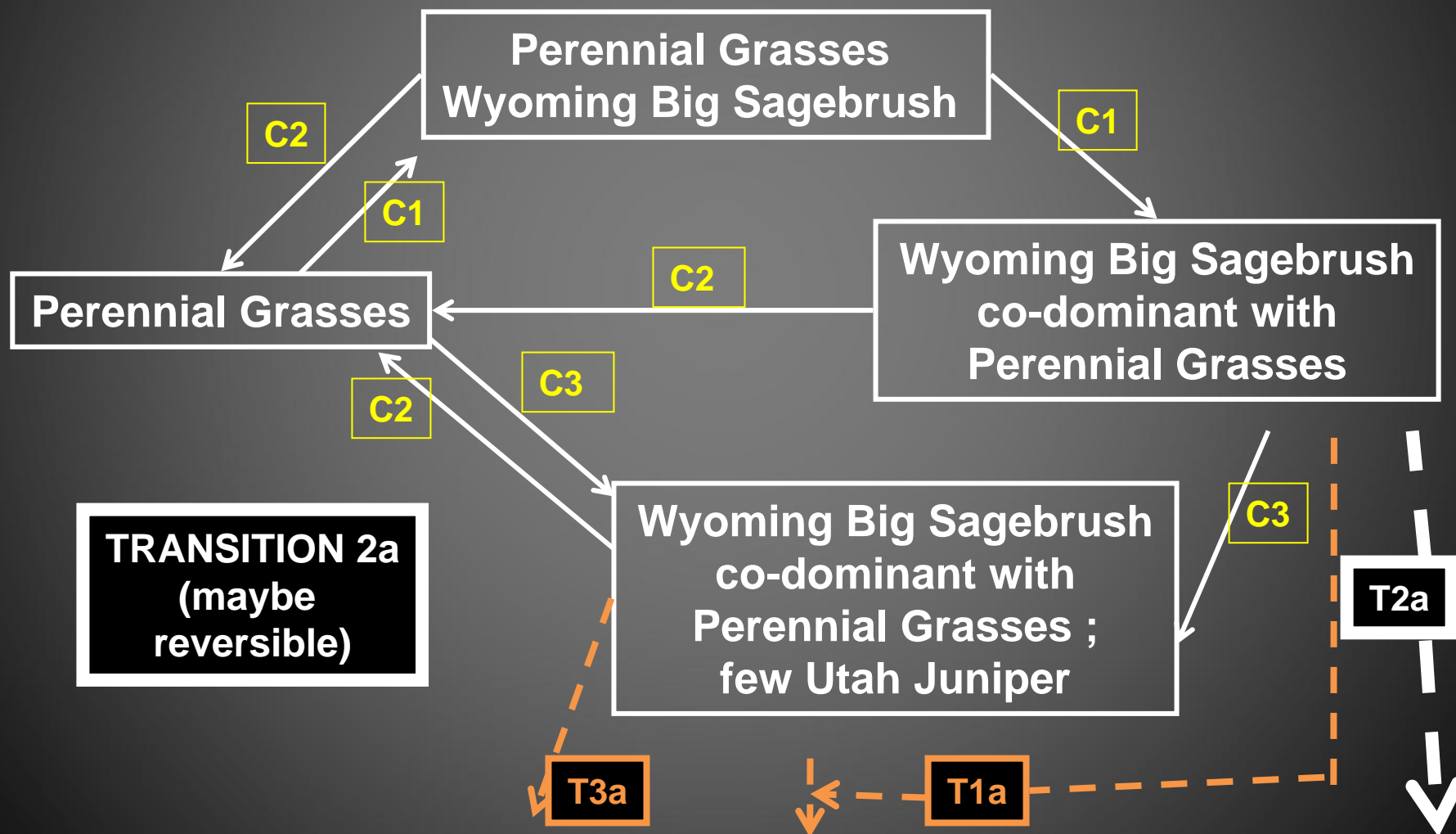


# TRANSITIONS

**T1a = Disturbances: (1)Overgrazing; (2) Extreme lengthening of the fire interval frequency; or (3)prolonged drought. This takes place when the sagebrush canopy gets so heavy that it destroys the perennial grass and forb under story and the fire frequency is increased from 50- to 60 years to 70 – 90 years.**

# Upland Gravelly Loam (Wyoming big sagebrush) STATE AND TRANSITION MODEL

## Historic Climax Plant Community State



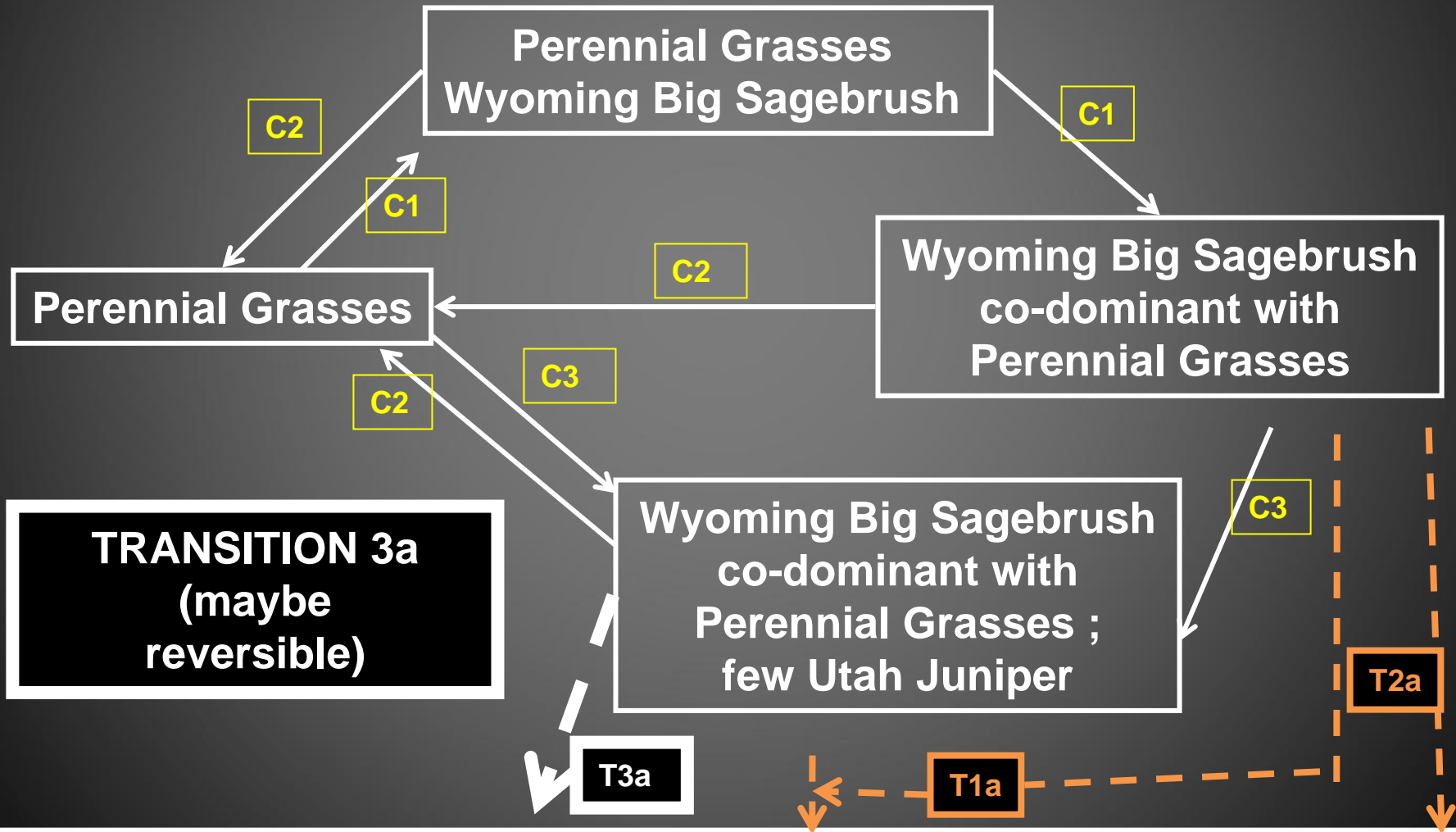
# TRANSITIONS

**T1a = Disturbances: (1) Overgrazing; (2) Extreme lengthening of the fire interval frequency; or (3) prolonged drought. This takes place when the sagebrush canopy gets so heavy that it destroys the perennial grass and forb under story and the fire frequency is increased from 50- to 60 years to 70 – 90 years.**

**T2a = Disturbances: (1) Shortening of the fire interval frequency from 50 – 60 years to 15 – 20 years and (2) the introduction of invasive annual grass species.**

# Upland Gravelly Loam (Wyoming big sagebrush) STATE AND TRANSITION MODEL

## Historic Climax Plant Community State



# TRANSITIONS

**T1a = Disturbances:** (1)Overgrazing; (2) Extreme lengthening of the fire interval frequency; or (3)prolonged drought. This takes place when the sagebrush canopy gets so heavy that it destroys the perennial grass and forb under story and the fire frequency is increased from 50- to 60 years to 70 – 90 years.

**T2a = Disturbance:** Shortening of the fire interval frequency from 50 – 60 years to 15 – 20 years and the introduction of invasive annual grass species.

**T3a = Disturbance:** Decrease of fire frequency from 50 – 60 years to 70 – 80 years.

# Upland Gravelly Loam (Wyoming big sagebrush)

## STATE AND TRANSITION MODEL

### THRESHOLDS

Historic Climax Plant Community State

T1b

**NOT REVERSIBLE!!!!**

T2b

Potential Natural Community State

Wyoming Big Sagebrush and Perennial Grasses ; co-dominant with invasive annuals and few Utah Junipers

C4

HSPC State With Invasive Annuals

C7

Perennial Grasses co-dominant with Invasive Annuals; Fire Tolerant Shrubs

C6

C6

# TRANSITIONS

**T1b = SAME AS T1A EXCEPT CHANGE HAS PROGRESSED SO FAR THAT IT IS NOT REVERSIBLE WITHOUT SIGNIFICANT INVESTMENT OF ENERGY AND MONEY (CHAINING AND SEEDING)**

**Disturbances: (1)Overgrazing; (2) Extreme lengthening of the fire interval frequency; or (3)prolonged drought. This takes place when the sagebrush canopy gets so heavy that it destroys the perennial grass and forb under story and the fire frequency is increased from 50- to 60 years to 70 – 90 years.**

# TRANSITIONS

**T2b = SAME AS T1b EXCEPT CHANGE HAS PROGRESSED SO FAR THAT IT IS NOT REVERSIBLE WITHOUT SIGNIFICANT INVESTMENT OF ENERGY AND MONEY (ANNUAL GRASS CONTROL AND SEEDING)**

**Disturbances: (1) Shortening of the fire interval frequency from 50 – 60 years to 15 – 20 years and (2) the introduction of invasive annual grass species.**

# Upland Gravelly Loam (Wyoming big sagebrush)

## STATE AND TRANSITION MODEL

**COMMUNITY  
PATHWAYS**

Historic Climax Plant Community State

T1b

**NOT REVERSIBLE!!!!**

T2b

Potential Natural Community State

Wyoming Big Sagebrush and Perennial Grasses ; co-dominant with invasive annuals and few Utah Junipers

C4

HSPC State With Invasive Annuals

C7

Perennial Grasses co-dominant with Invasive Annuals; Fire Tolerant Shrubs

C6

C6

**C4 = Overgrazing, Long Drought, No Fire**

**C6 = Management of Grazing, Appropriate Treatments**

**C7 = Overgrazing, Shortening of Fire Cycle**

# Upland Gravelly Loam (Wyoming big sagebrush) STATE AND TRANSITION MODEL

Historic Climax Plant Community State

T1b

NOT REVERSIBLE!!!!

T2b

Potential Natural Community State

Wyoming Big Sagebrush and Perennial Grasses ; co-dominant with invasive annuals and few Utah Junipers

C4

HSPC State With Invasive Annuals

C7

Perennial Grasses co-dominant with Invasive Annuals; Fire Tolerant Shrubs

C6

C6

T5a,b

TRANSITIONS (maybe reversible)

T4a,b



# TRANSITIONS

**T4a = Disturbance: Overgrazing and increase of fire frequency over a very prolonged period of time. (10 – 15 year fire frequency )**

**T4b = Disturbance: Continued overgrazing and increase of fire frequency over a very prolonged period of time. (8 – 12 year fire frequency )**

**Results in annual grasses and fire tolerant shrubs**

# TRANSITIONS

**T4a = Disturbance: Overgrazing and increase of fire frequency over a very prolonged period of time. (10 – 15 year fire frequency )**

**T4b = Disturbance: Continued overgrazing and increase of fire frequency over a very prolonged period of time. (8 – 12 year fire frequency )**

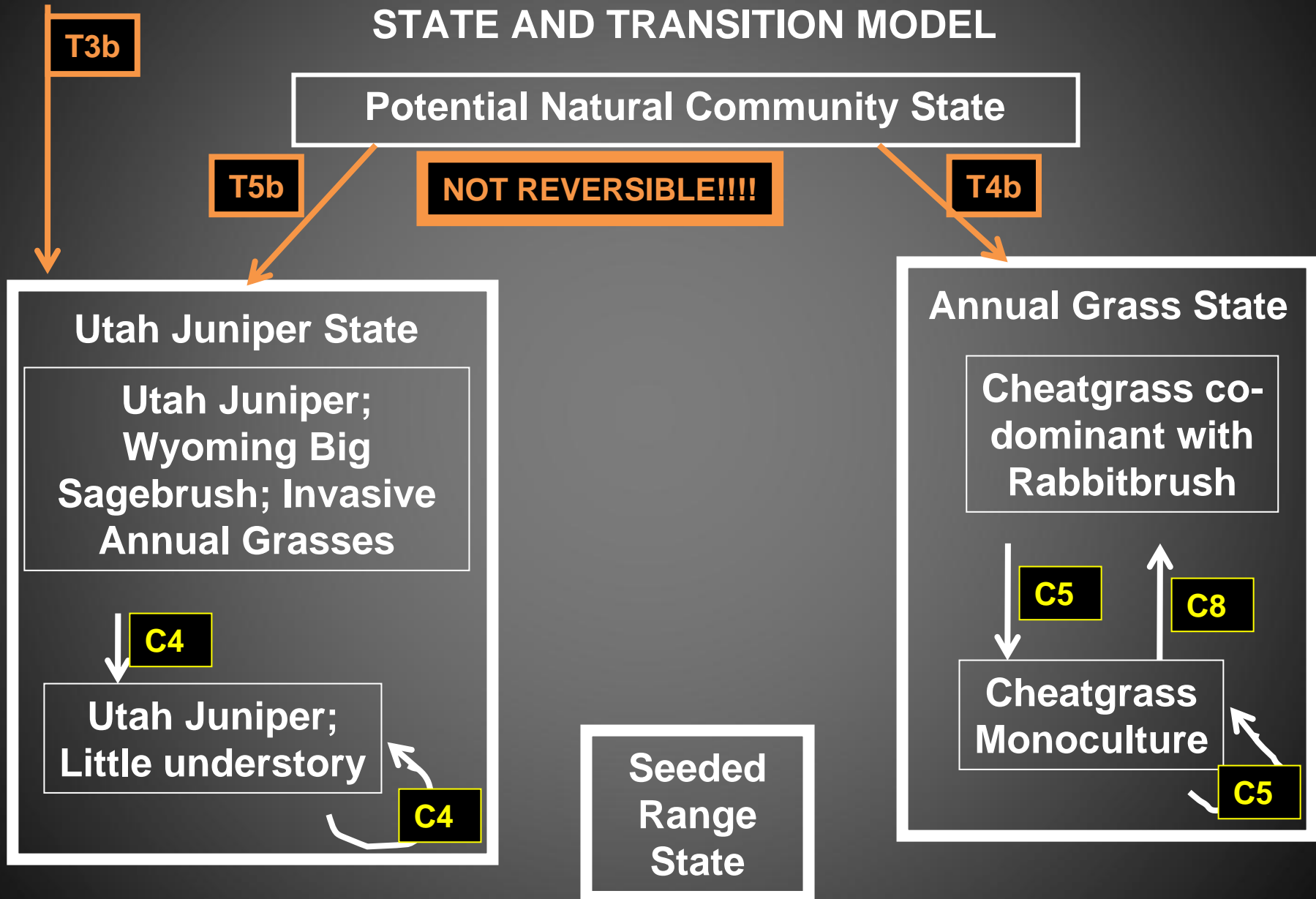
**T5a = Prolonged Drought and/or Overgrazing and/or Extreme lengthening of the fire frequency from 50- to 60 years to 70 – 90 years.**

**T5b = Prolonged Drought, Overgrazing, Extreme lengthening of the fire frequency from 50- to 60 years to 70 – 90 years followed by the introduction of Utah juniper.**

**Results in Utah Juniper**

# Upland Gravelly Loam (Wyoming big sagebrush)

## STATE AND TRANSITION MODEL



# TRANSITIONS

**C4 = Overgrazing, prolonged drought, no fire**

**Results in Utah Juniper with little or no understory**

**C5 = Increased fire frequency (10 – 15 years to 3 – 5 years) and intensity without follow up management (seeding)**

**Results in cheatgrass and/or Medusahead wildrye**

**C8 = Lengthening of fire interval (3 – 5 years to 10 – 15 years)**

**Results in cheatgrass and/or Medusahead wildrye and fire tolerant shrubs such as rabbitbrush**



# TRANSITIONS

**T2b = Shortening of fire interval, introduction of invasive annual grasses, increase in fire tolerant shrubs**

**T6 = Weed and brush management, rangeland seeding**

**T7a and b= Proper management and long term succession**

# ECOLOGICAL SITE DESCRIPTION

## SITE INTERPRETATIONS

- ANIMAL COMMUNITY (WILD AND DOMESTIC)
- HYDROLOGY
- RECREATIONAL USES
- WOOD PRODUCTS
- OTHER PRODUCTS
- OTHER INFORMATION
- SPECIES PREFERENCES
- FOREST SITE PRODUCTIVITY

# Wildlife Interpretation

This site is a part of the sagebrush steppe supporting populations Greater Sage-grouse (*Centrocercus urophasianus*), Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*), other at-risk neotropical migratory bird species, pygmy rabbit (*Brachylagus idahoensis*) on deep stone free inclusions, Utah prairie-dog (*Cynomys parvidens*), white-tailed prairie-dog (*Cynomys leucurus*), or Gunnison's prairie-dog (*Cynomys gunnisoni*). Other wildlife using this site include Black-tail Jackrabbit; Coyote; Gold Eagle; Ravens and Mule Deer. This is a short list of the more common species found. Many other species are present as well and migratory birds are present at certain times of the year.

***Information about unique wildlife use in each steady state should be added***