

Table G1: Animal Unit Equivalents

Type of Livestock	Animal Unit Equivalent (aue)
1,000 lb Cow w/calf	1.0 au
1200 lb Cow w/calf	1.15 au
850 lb Replacement Heifers	.9 au
1,500 lb Bull	1.35 au
1,500 lb Horse	1.25 au
200 lb Ewe/Doe	.16 au
Geese	.07 au
Deer	.2 au
Elk	.6 au

NRCS publication
August 2006

Determining Animal Unit Equivalents	
Type of Livestock	Animal Units
Beef cow, yearlong average	1.00
Beef cow, dry	0.90
Beef cow, lactating	1.20
Bull, mature	1.25
Cal, weaned	0.50
Replacement heifers	0.85
Horse	1.25
Emu	0.20
Ram	0.25
Lamb, 1-year-old	0.15
Goat	0.20

Most commercial cows average about 1000 pounds in body weight and are considered as one Animal Unit equivalents (AU). Where cow weight averages are higher, AU may be increased accordingly, such as 1.2 AU for a 1200 pound cow, 1.3 AU for a 1300 pound cow, etc. The shown AUs are for general use in Colorado.

USDA NRCS 2005

AU's and AUE's?

- 1,000 lbs of animal weight (USDA 2000)
- 1,000 lb cow-calf pair (USDA 2002)
 - For every increase in 100 lbs, increase AUE by 0.1

Based on amount of dry weight forage an animal consumes per day.

Animal Unit (AU)

AU = a 1,000 lb (405kg) non-lactating cow or its equivalent in forage demand (animal intake).

Forage demand = 2% of body weight/day
e.g. 405 kg x 0.02 = 8.1 kg/day

Animal Unit Month (AUM)

AUM = potential forage demand of one AU in 1 month (30 days).

e.g. 8.1kg/day x 30 days = 243 kg

Is your rangeland capable of sustaining this forage intake?
For how many animals?

= Grazing capacity

The Dubious Daubenmire Frame



State and Transition Models

Westoby et al., 1989
Bestelmeyer 2003

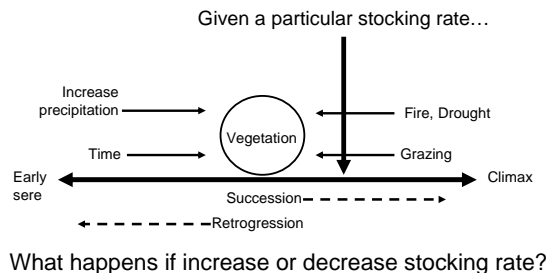
Historic concept: Dyksterhuis's model (1949)

- Succession-retrogression model =
- Range condition model =
- Quantitative climax method

Qualities:

- Clementsian theory of succession
- Climax community is end state
- Linear, continuous, reversible
- Equilibrium could be achieved between grazing and plant community succession

Dyksterhuis 1949: Westoby et al.'s interpretation



But things just didn't add up....

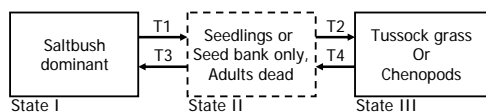
- Annual-grass dominated system of CA
- Shrub-dominated states that once were perennial-grass dominated
- Cheatgrass-dominated states in western states

State and Transition Model

- Descriptive, graphical model of vegetation dynamics
- Consists of:
 - catalogue of alternative vegetation STATES
 - catalogue of possible TRANSITIONS
- First applied to **range management** by Westoby, Walker, & Noy-Meir in 1989

State and Transition Model

Bladder saltbush on Australian Riverine Plain
From: Westoby, Walker & Noy-Meir 1989



- T1: Mass death of adult saltbush due to overgrazing, drought, or fire
- T2: Rainfall to germinate seedlings + unfavorable weather for seedling survival
- T3: Rainfall to germinate seedlings + adequate rainfall for seedling growth for 3-5 years
- T4: Same as T3, but external source of saltbush seed required

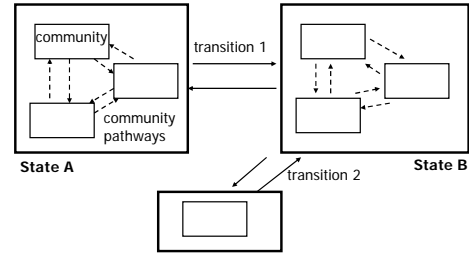
Trouble....

- Tough to apply state and transition models
- Even just five years ago, not being used (that's over a decade of time since Westoby's recommendation)

Recent pubs....

- Bestelmeyer, B. T. 2006. Threshold concepts and their use in rangeland management and restoration: The good, the bad, and the insidious. *Restoration Ecology* 14:325-329.
- Chartier, M. P., and C. M. Rostagno. 2006. Soil erosion thresholds and alternative states in northeastern patagonian rangelands. *Rangeland Ecology & Management* 59:616-624.
- Papanastasis, V. P., and D. Chouvardas. 2005. Application of the state-and-transition approach to conservation management of a grazed Mediterranean landscape in Greece. *Israel Journal of Plant Sciences* 53:191-202.
- Quetier, F., A. Thebault, and S. Lavorel. 2007. Plant traits in a state and transition framework as markers of ecosystem response to land-use change. *Ecological Monographs* 77:33-52.
- Spooner, P. G., and K. G. Allcock. 2006. Using a state-and-transition approach to manage endangered *Eucalyptus albens* (White Box) woodlands. *Environmental Management* 38:771-783.

State & Transition Model: Updated Concepts



Bestelmeyer et al. 2003 –
after Stringham et al. in 2001

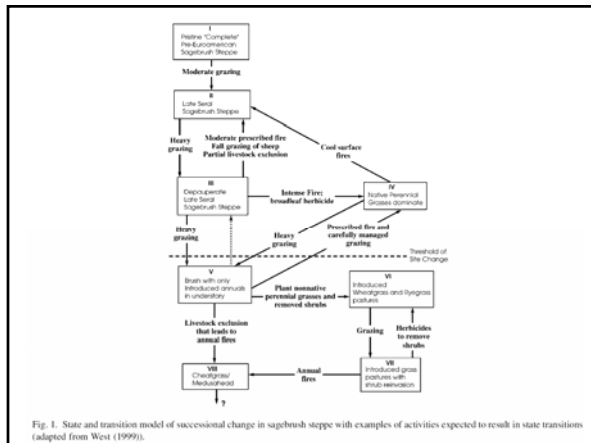


Fig. 1. State and transition model of successional change in sagebrush steppe with examples of activities expected to result in state transitions (adapted from West (1999)).

Relate State and Transition and Adaptive management

Relate State and Transition and Adaptive management

State and Transition models,
in range management,
are focused on states and transitions
that can be affected by management.

State & Transition Models:

- Address problems with Range Condition Models (Dyksterhuis 1949) with:
 - Non-linearity
 - Irreversibility
 - Multiple stable states
 - Non-additivity & differences in effects of different disturbances and stresses
 - Non-native species
- Do not replace succession-retrogression models, IF model can be represented with an S&T model

State & Transition Models

- Do S & T models represent a theory linked to a method?
- Can they replace the range condition model as a practical assessment tool?