Ecological attributes for better management of arid ecosystem.

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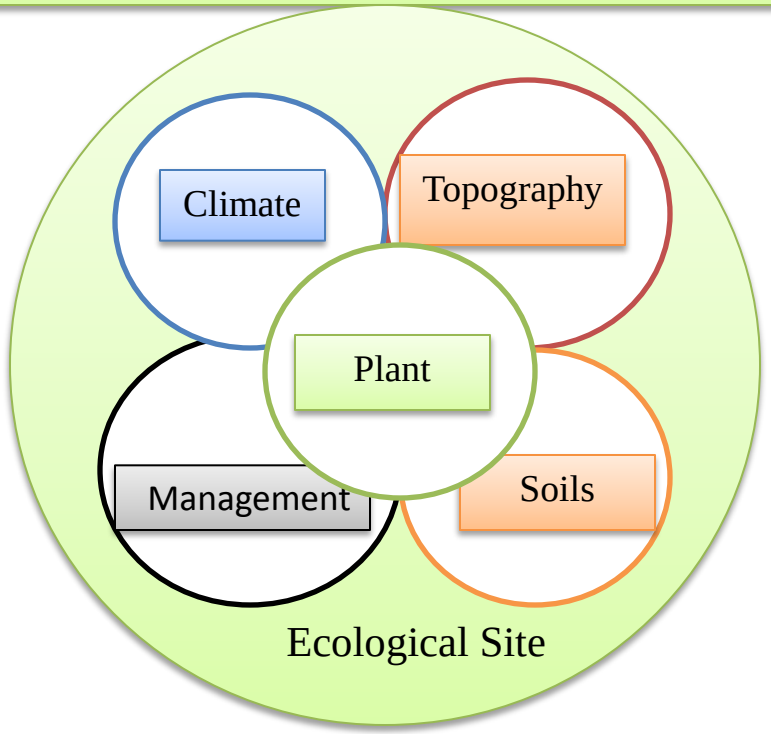
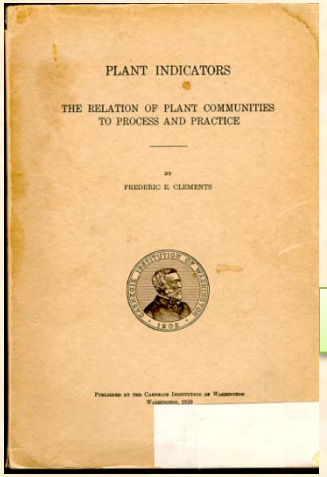


Traditional Procedure

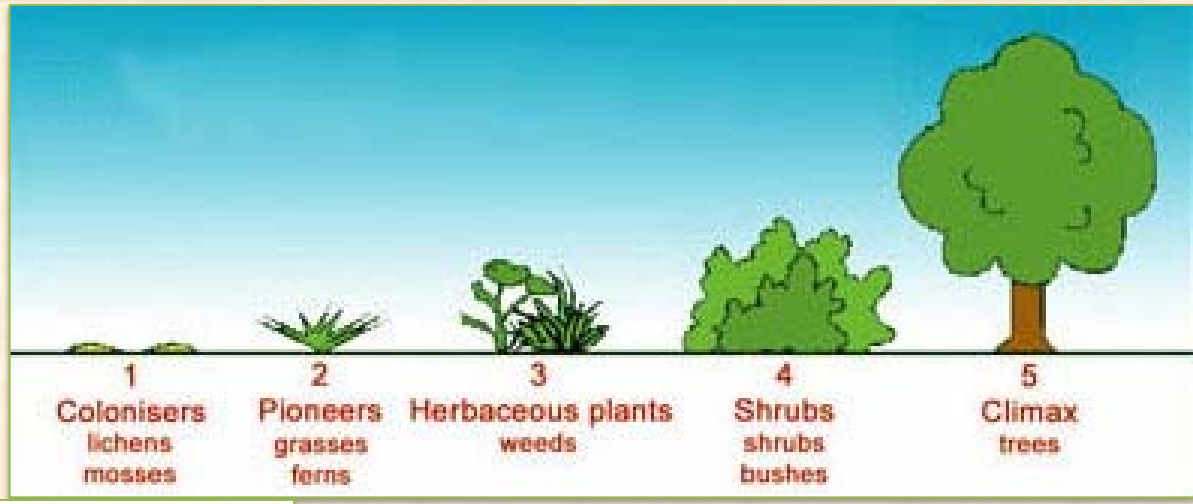
Sampson (1917) initially associated the evaluation of rangeland vegetation with ecological concepts following the development of successional theory by Clements (1916).

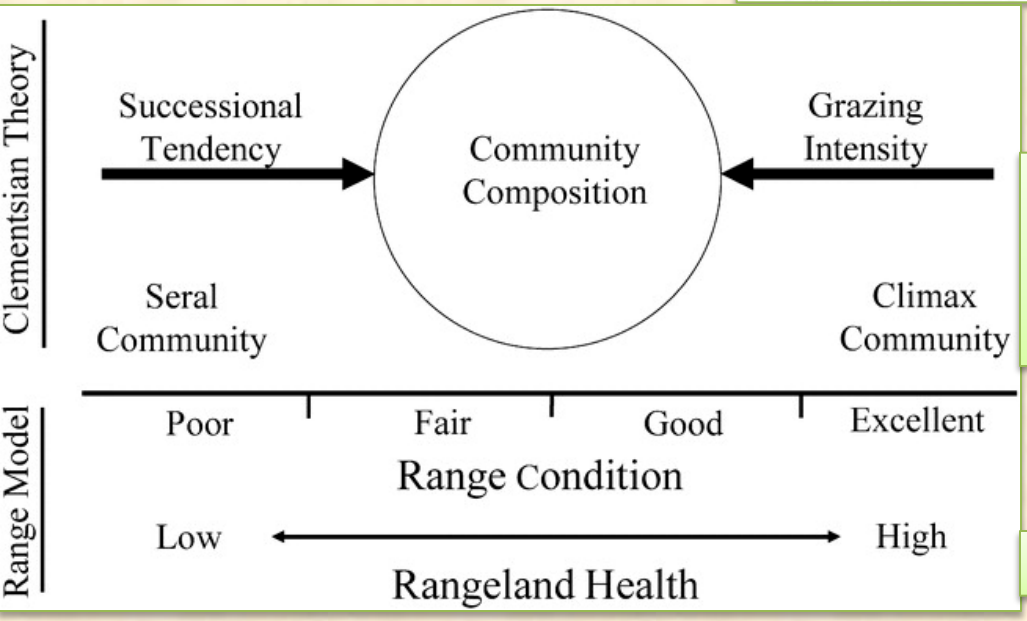

PLANT INDICATORS

THE RELATION OF PLANT COMMUNITIES TO PROCESS AND PRACTICE

FREDERIC E. CLEMENTS

Clements theoty, 1916

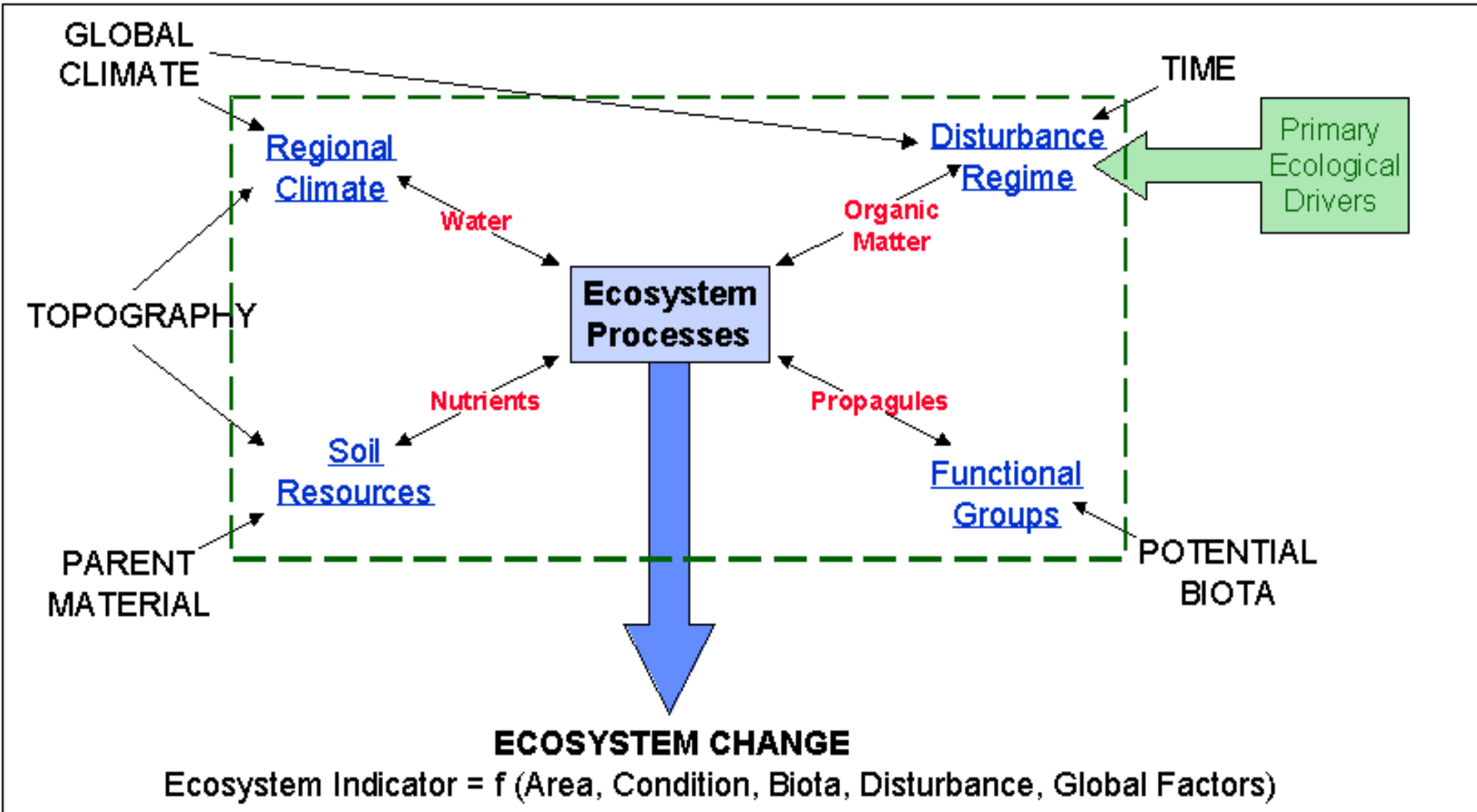




The range model describes vegetation dynamics along a single axis defined by succession and grazing intensity.

Briske et al. 2005

The Ecosystem Framework for Understanding Change



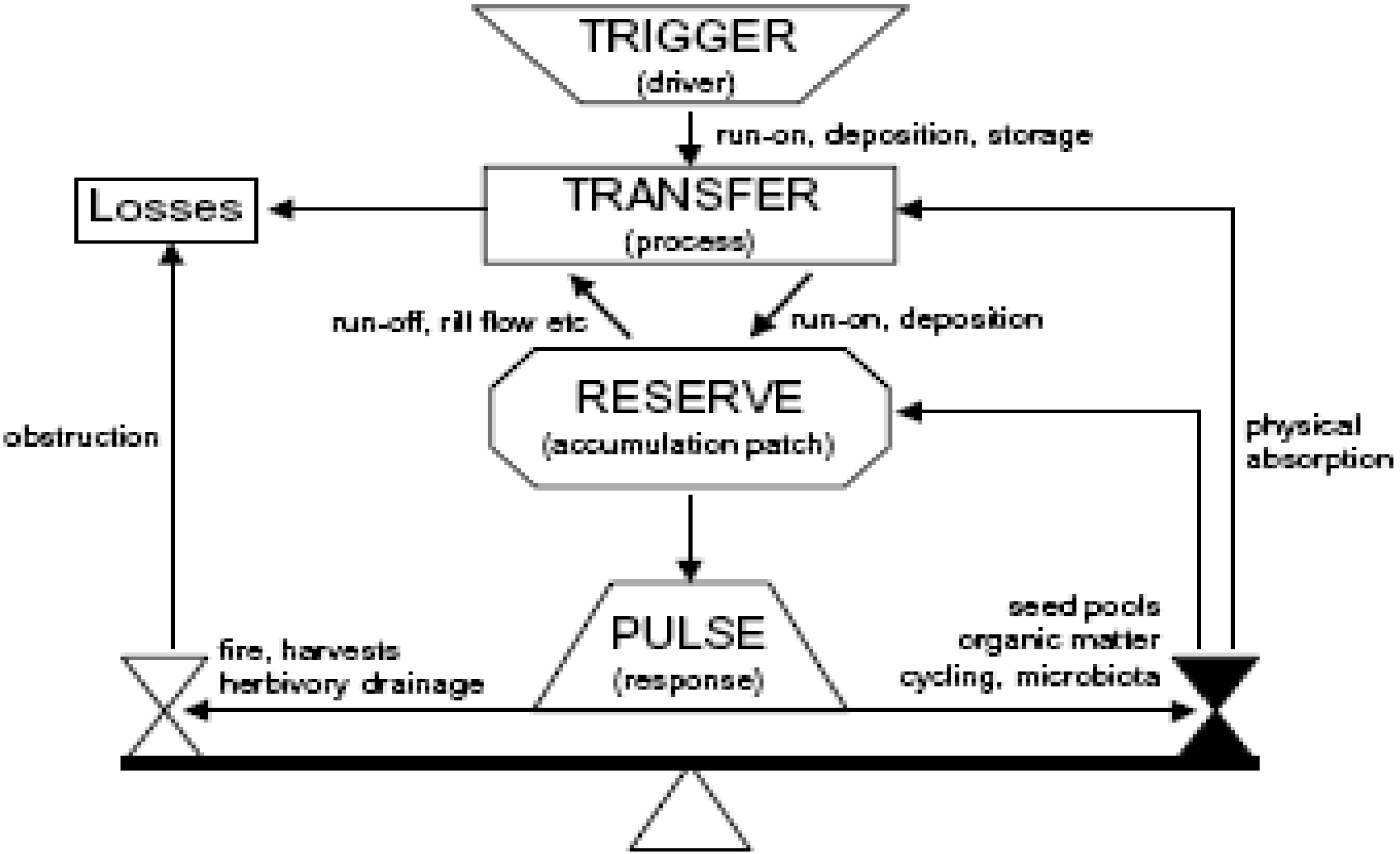
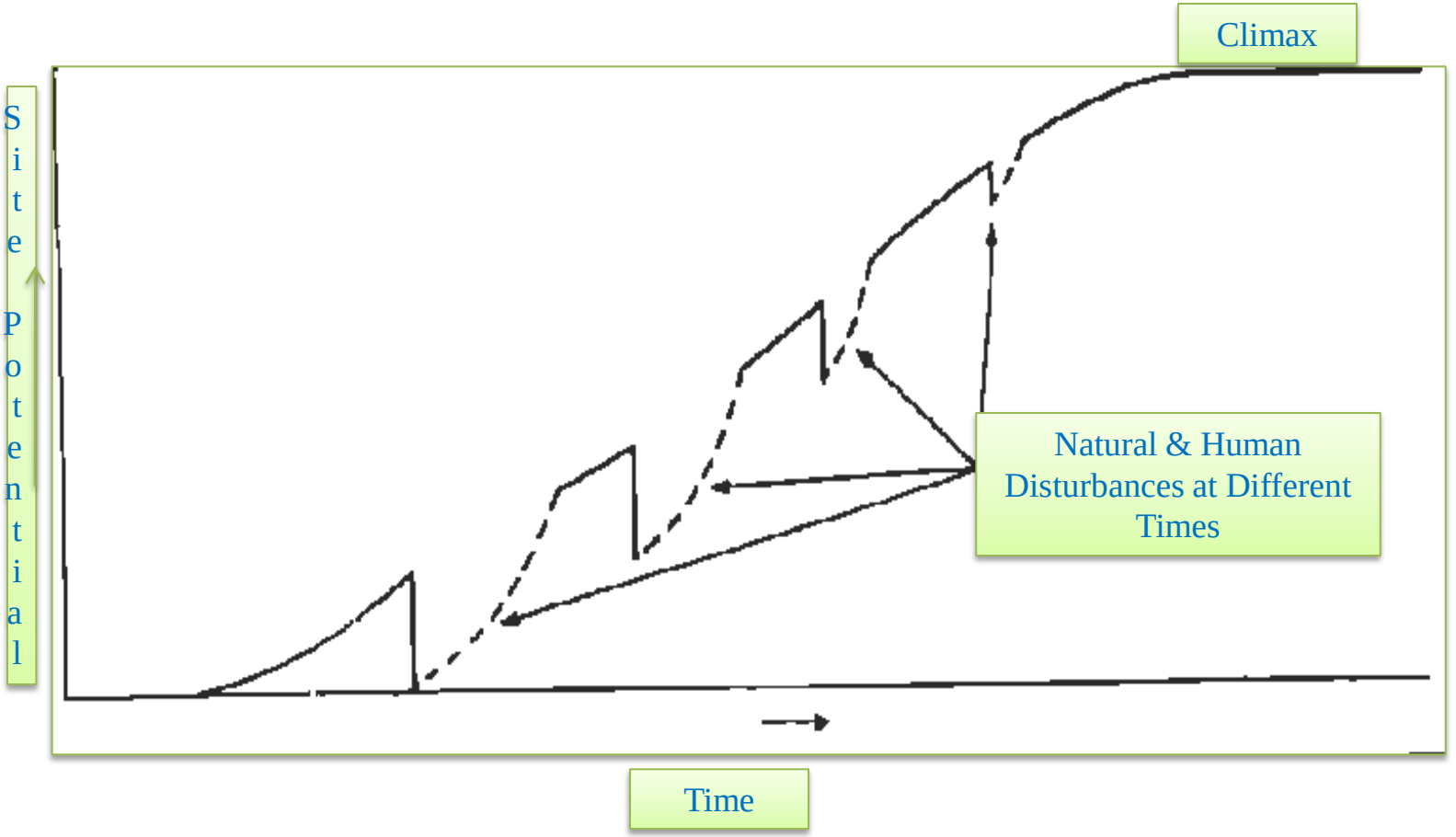


Figure 5: Trigger–transfer–reserve–pulse sequences in rangeland rehabilitation.

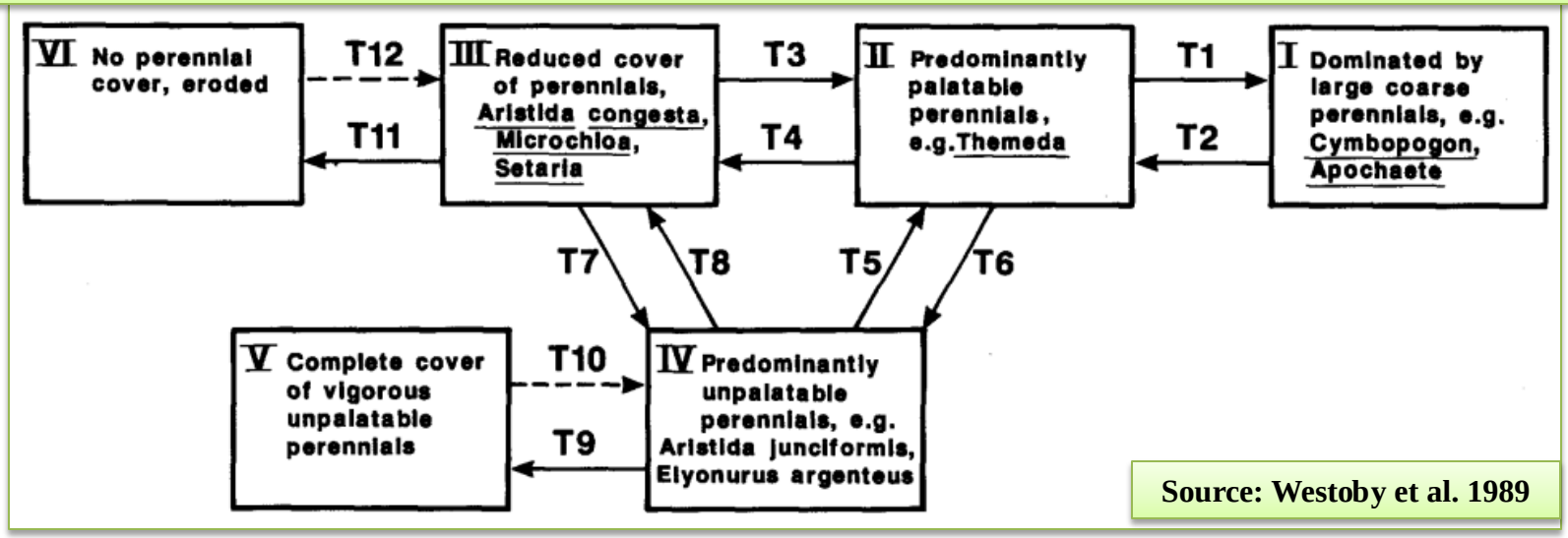
Source: after Ludwig and Tongway (1997).

New thinking in ecology

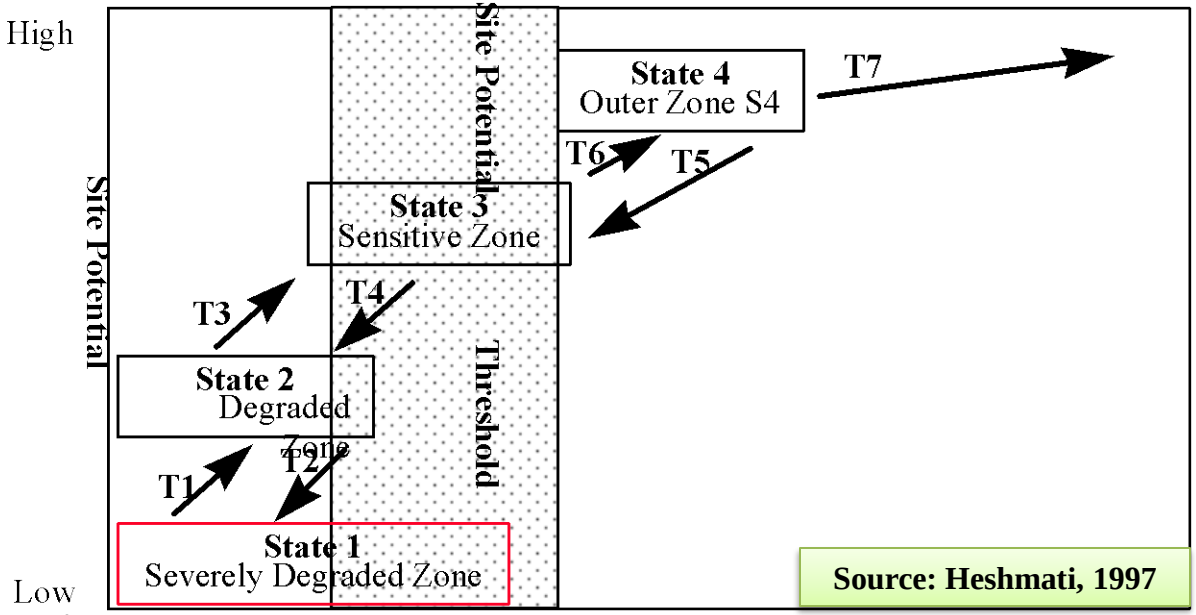
It is proposed that sudden, unpredictable and perhaps irreversible change is frequently seen when major disturbances occur.



State-and-transition models best describes the observed changes of plant dynamics.

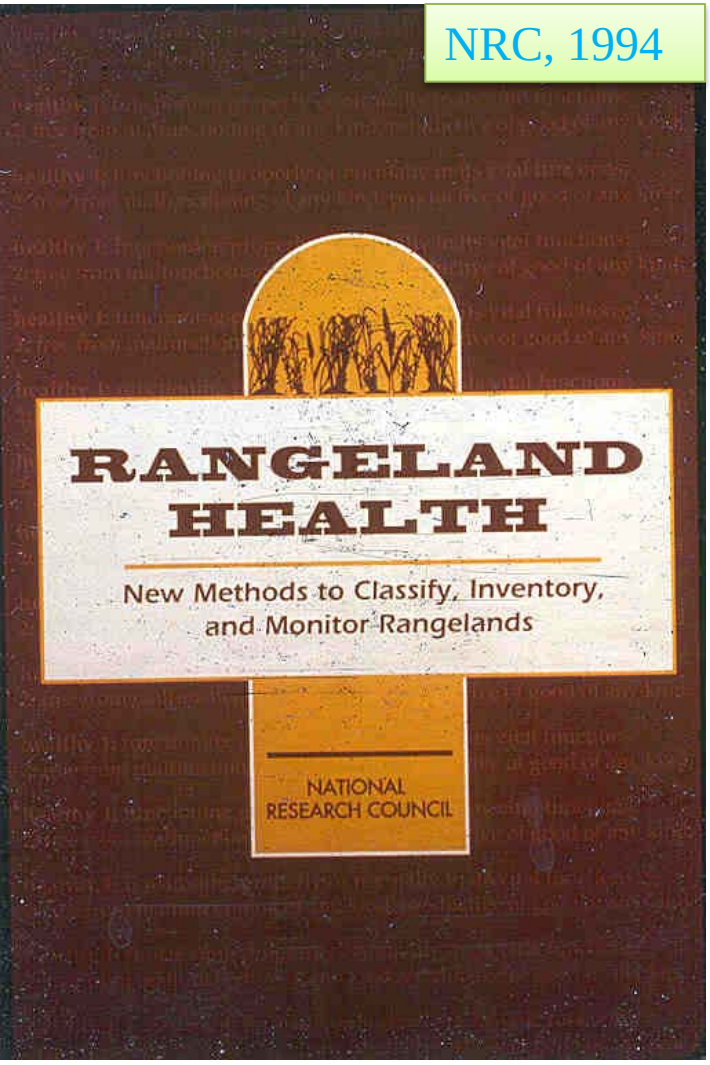


Conceptual field model for South Australian chenopod shrublands under paddock grazing systems



The NRC (1994) and SRM Task Group (1995) both endorsed the development of alternative procedures to evaluate rangeland health, and several federal land management agencies have developed and evaluated rangeland health procedures during the last decade (Pyke et al. 2002).

NRC, 1994



SRM. 1995

J. Range Manage.
48:271-282 May 1995

NEW CONCEPTS FOR ASSESSMENT OF RANGELAND CONDITION

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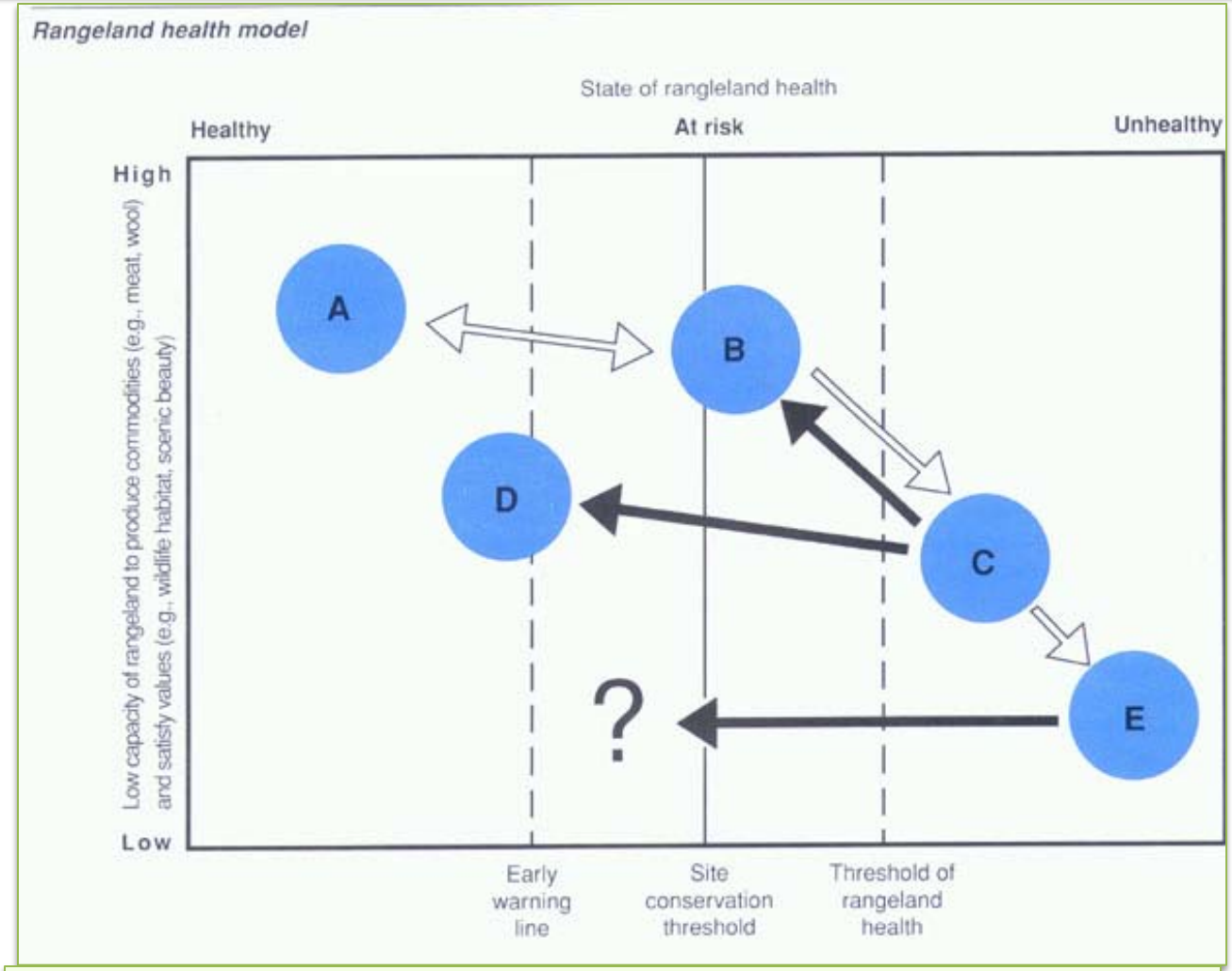
Abstract

Range condition score or classification does not tell us, in a general sense, much of what managers and the public want to know about rangelands. Range condition is not a reliable indicator, across all rangelands, of biodiversity, erosion potential, nutrient cycling, value for wildlife species, or productivity. Succession, the basis for the current concept of range condition is not an adequate yardstick for evaluation of rangelands. The Society for Range Management (SRM) established the Task Group on Unity in Concepts and Terminology which has developed new concepts for evaluation of the status of rangelands. These concepts are based on the premise that the most important and basic physical resource on each ecological site is the soil. If sufficient soil is lost from an ecological site, the potential of the site is changed. The Task Group made three recommendations, which were adopted by the SRM: 1) evaluations of rangelands should be made from the basis of the same land unit classification, ecological site; 2) plant communities likely to occur on a site should be evaluated for protection of that site against accelerated erosion (Site Conservation Rating, [SCR]); and 3) selection of a Desired Plant Community (DPC) for an ecological site should be made considering both SCR and management objectives for that site.

Visual examples of some of these concepts will appear in an article to be published in *Rangelands* Vol. 17(3):85–92, June 1995.

Key Words: Range Condition, Desired Plant Community, Site Conservation Threshold, Sustainability, Ecological Site, Soil Erosion

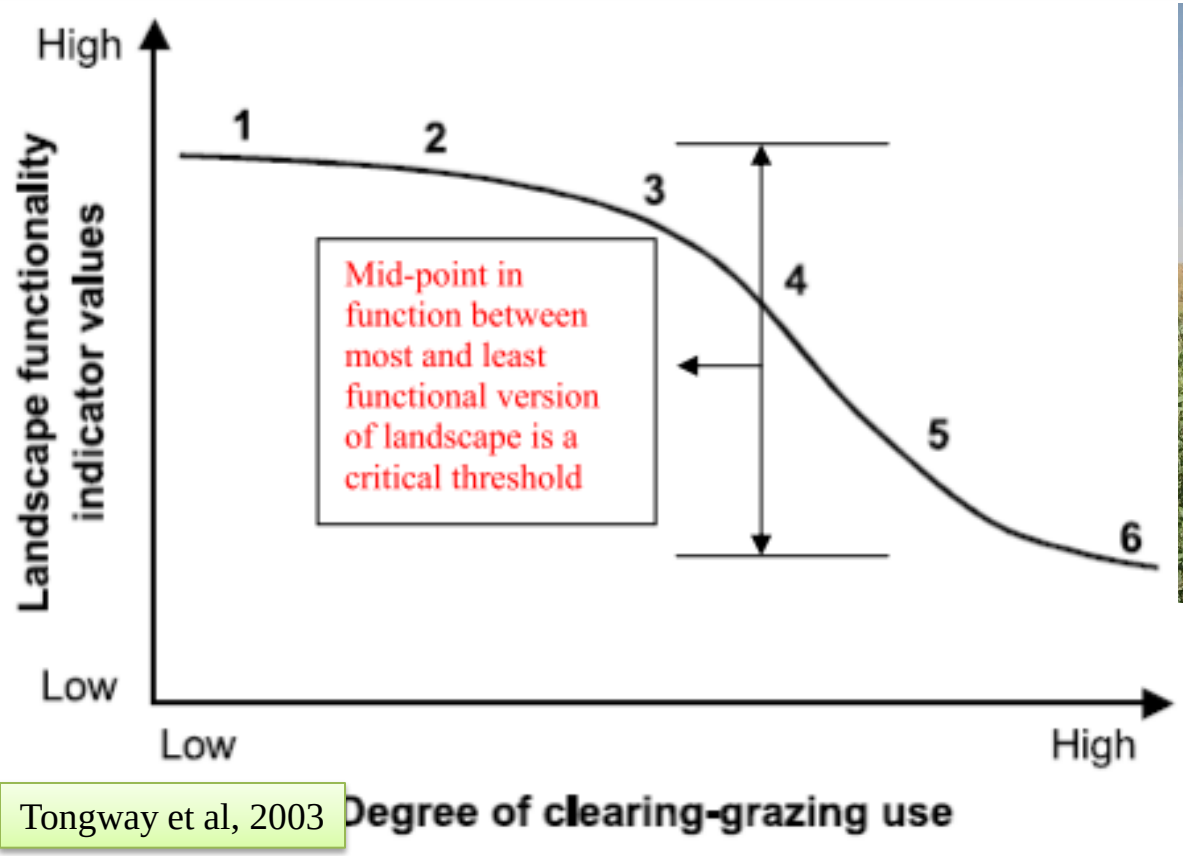
Rangeland managers need a workable framework. The state and transition approach may offer an appropriate framework as an aid for decision making and can be used to highlight 'management windows' where opportunities can be seized and hazards avoided.



Source: National Research Council Committee on Rangeland Classification, 1994. The site conservation threshold is from the Society for Range Management, 1995.

Threshold concept:

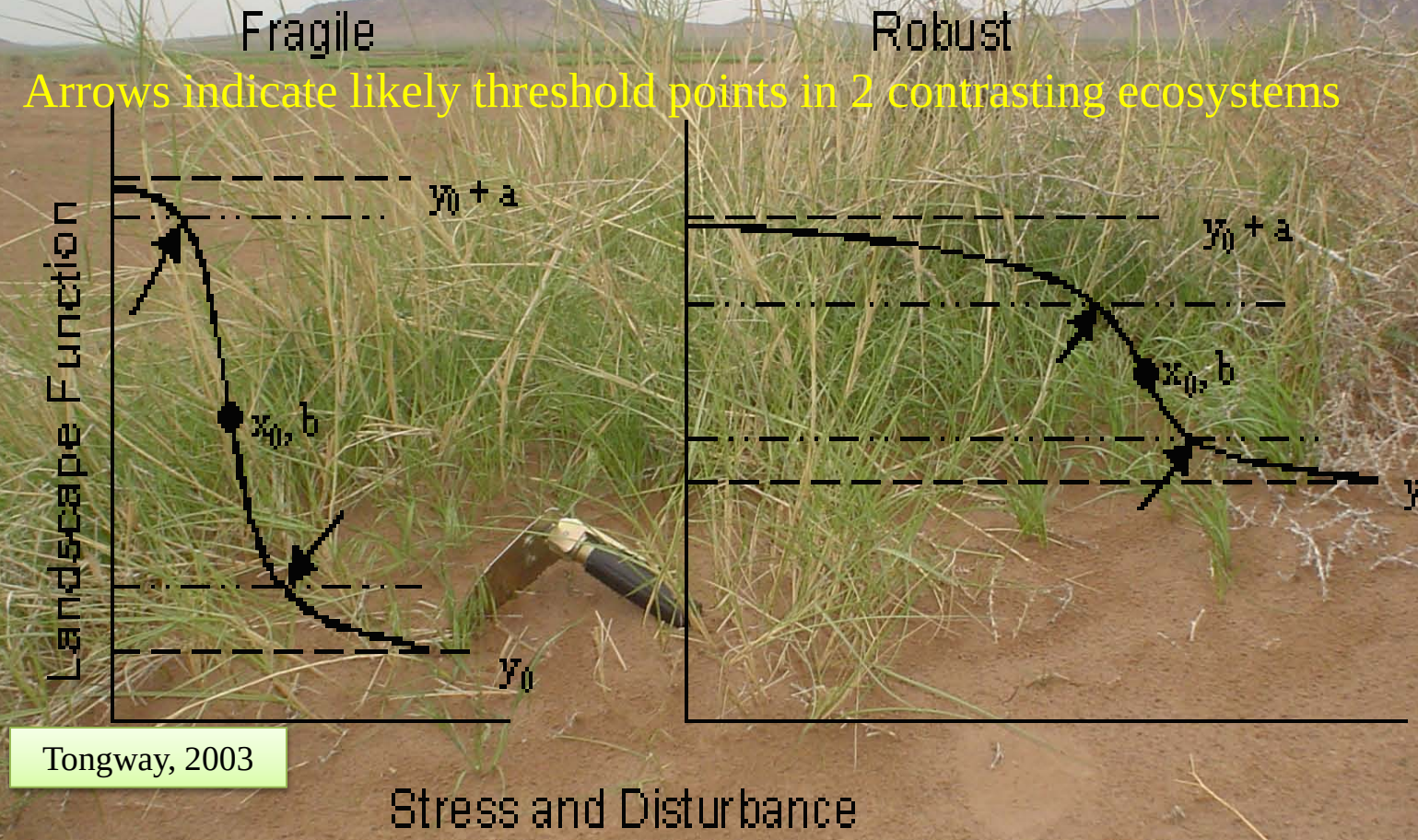
The threshold concept (Fridel, 1991) describes unidirectional changes in ecosystem structure and ecosystem functional processes and demarcates the points of incipient change.



Tongway et al, 2003

Structural thresholds are defined by changes in species and growth form composition and spatial vegetation distribution, whereas functional thresholds signify changes in various ecosystem processes.

Centeral Desert of Iran, 2004



Tongway, 2003

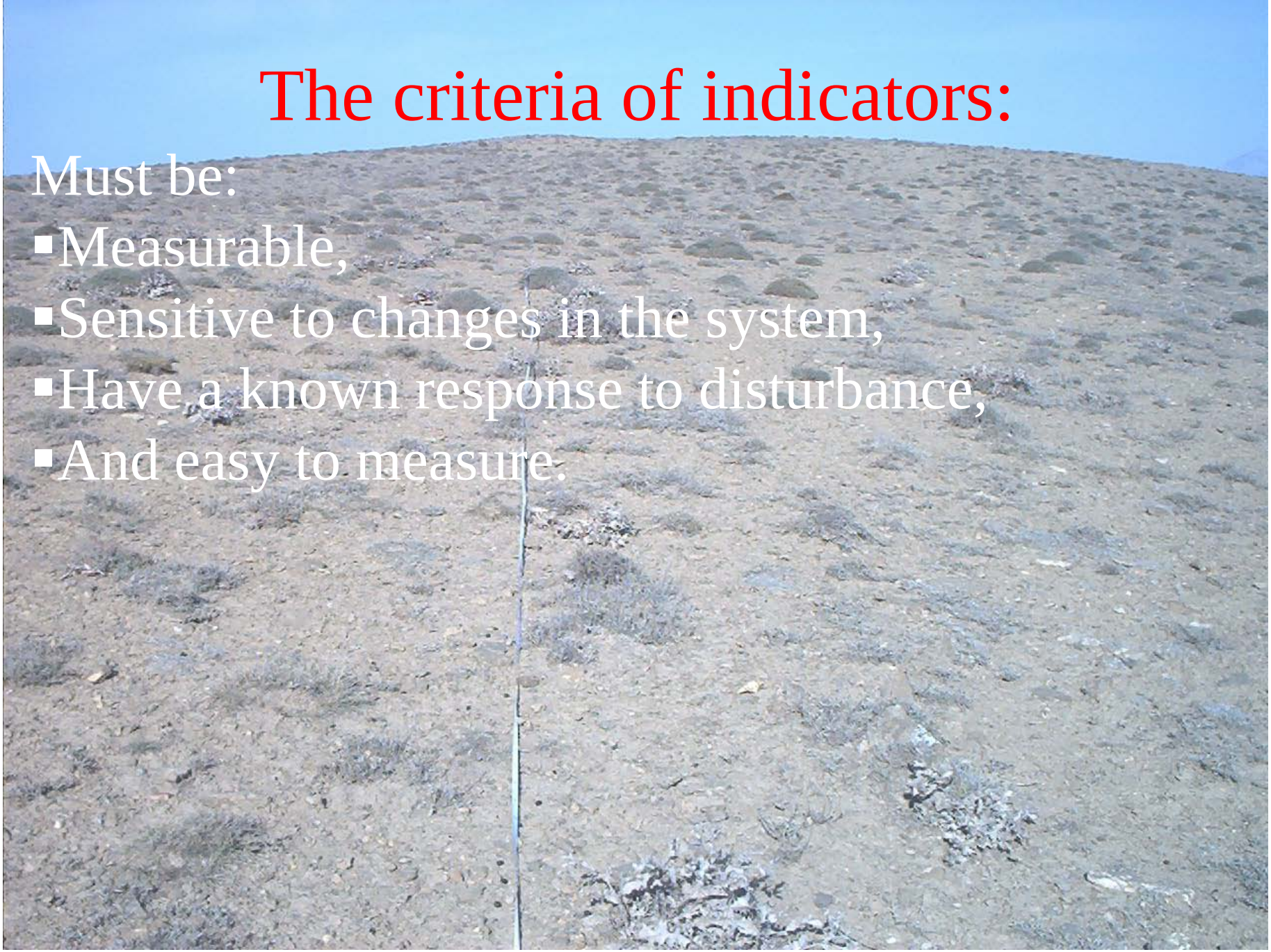
Indicators:

- Ecological thresholds can be categorized into two general groups (structural components and functional processes); their distinction has important **ecological** and **managerial implications.**
- There is need for an early warning phase between "healthy" and "at risk" states and the need to identify thresholds between "at risk" and "unhealthy" states.
- It would be valuable to have a set of indicators to:
- (i) give an early warning of such change
- (ii) facilitate the recovery of the system.

The criteria of indicators:

Must be:

- Measurable,
- Sensitive to changes in the system,
- Have a known response to disturbance,
- And easy to measure.



Important measurable attributes:

- In order to understand better vegetation dynamics, the measurement of vegetation composition, density and distribution are important.
- The soil attributes such as soil texture, depth, structure, fertility, pH and salinity could be considered as surrogates for plant patterns.
- Also, attributes of the soil-surface condition (soil cover, soil texture, cryptogam cover) may be combined in various ways to provide useful indicators of landscape function such as stability, infiltration by water or nutrient cycling.

Management Applications:

- A combined assessment of soil and vegetation characteristics provide a comprehensive understanding of disturbance affects,
- Provide a firm basis for sustainable utilization of the plant community.
- In addition, precision is low when small data sets are used to estimate plant dynamics as a function of ecological site.

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