



# Local Impacts of Drought: A Criteria and Indicator Based Assessment

Public and private land managers occasionally must deal with events that are outside the historic range of variation. Drought is one such variable phenomena that can impact rangeland conditions and management in many ways. In the short term, it decreases forage availability for both wildlife and livestock. Over longer periods, droughts can cause native plants to die out, soil to erode, and water supplies to dry up. Effects of drought on rangeland-dependent communities have been well documented. The two primary physical effects are on vegetation and water supplies.

- ❖ Rangeland aboveground biomass
- ❖ Annual rangeland productivity
- ❖ Number of domestic livestock on rangeland
- ❖ Wildlife numbers
- ❖ Annual removal of native hay
- ❖ Area of infestation of invasive weeds

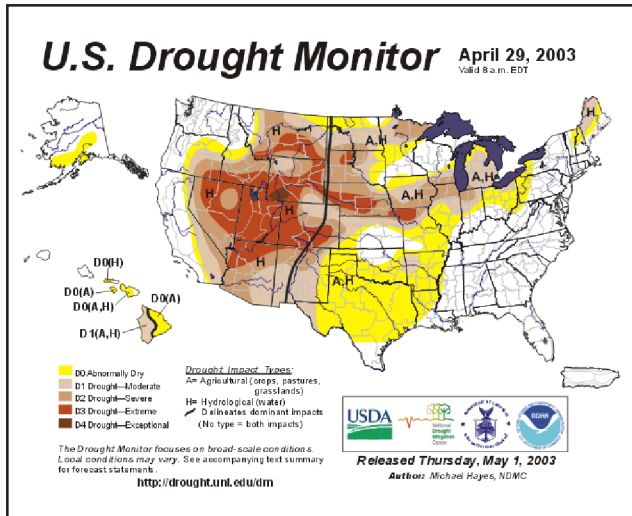
## Hydrological Drought

Hydrological drought results from declines in the soil profile, as well as surface and subsurface water. Water loss has an immediate effect on productive capacity. Extended hydrological droughts can cause long-term damage to natural ecosystems, especially those adjoining wetlands and ephemeral streams. If extended over several years, loss of vegetation cover can make soils more susceptible to wind erosion. SRR indicators that measure responses to hydrological drought include:

- ❖ Change in area of bare ground
- ❖ Changes in groundwater systems
- ❖ Change in stream no-flow periods
- ❖ Condition of riparian systems and wetlands

## Socio-economic Drought

The supplies of many goods and services, such as water, forage, and food grains, depend upon weather. Inadequate rainfall causes a decrease in the production of rangeland goods and services. Ef-



Drought indices, alone, do not provide managers with information needed to make decisions. Although Sustainable Rangeland Roundtable (SRR) indicators relating to drought are fairly broad-scale, so is drought, itself, as shown by the map above. Droughts are multiple-year events able to devastate entire regions, therefore regional/national indicators are useful in accurately tracking their effects.

## Agricultural Drought

Rangeland productive capacity is an integral part of our Nation's agriculture. In the broadest sense, however, agriculture encompasses much more than livestock. Ranchers profit from wildlife, hay, recreation, and other products, all of which are negatively affected by drought. Several SRR indicators are relevant to tracking impacts of agricultural drought:

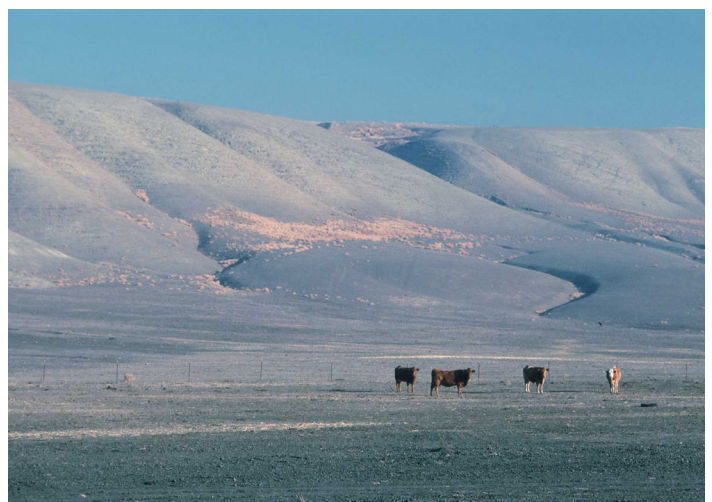


Photo Credit: USDA Natural Resources Conservation Service

fects of drought on rangeland-dependent counties and towns are widely recognized. Indicators of socio-economic drought include:

- ❖ Value of forage harvested
- ❖ Employment diversity
- ❖ Land tenure, use and ownership patterns
- ❖ Sources and amounts of community income
- ❖ Return on rangeland investments

### Use of Multiple Indicators

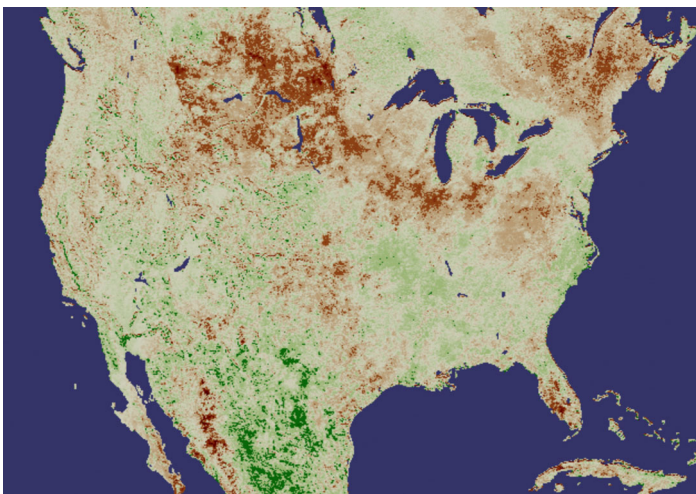
Scientists constantly learn more about drought and its impacts on ecosystems and communities. No adequate monitoring system or suite of data presently exist to provide state and local governments, landowners, agency managers, and others with critical information necessary to assess and deal with drought in rangeland areas.

Contending with drought is most effective when public land managers collaborate with private land owners and local governments. Scarce resources can be most efficiently allocated when decision-makers have a thorough understanding of all ecological and socio-economic impacts. Clearly an inclusive suite of indicators, as developed by SRR, can be very useful at the local level.

### Specific Drought Indicators

#### Primary Productivity

The most graphic depiction of the drought's effects upon rangelands is changes in primary productivity, the rate at which plant biomass accumulates during a growing season. One of the best metrics for primary productivity is a remotely-sensed value,



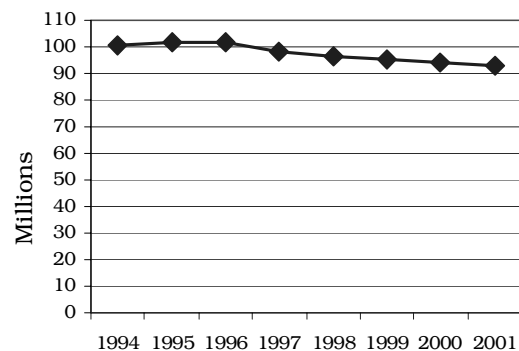
NDVI maps show distribution and extent of areas where primary productivity deviates from the norm (green indicates more vegetation than normal and brown less). Map Courtesy NASA/Goddard Space Flight Center Scientific Visualization Studio

NDVI or the Normalized Difference Vegetation Index. This measure of productivity has two distinct advantages: It has been in use for many years, and data can be aggregated from the management unit level to the entire Nation.

#### Rangeland Aboveground Biomass

Aboveground biomass includes green vegetation, dead material from preceding years, and litter. While dead material is low in nutrients and has low palatability, it can be used by grazing animals when forage is limited. No adequate data sets presently exist for monitoring total aboveground biomass, though the SRR has identified it as a useful indicator to monitor drought effects.

#### Number of Cattle on Grasslands and Shrublands



Data Source: USDA National Agricultural Statistics Service and Heinz Center "The State of the Nation's Ecosystems"

#### Number of Livestock on Rangeland

During drought years, livestock are often sold because of a lack of forage. Research has shown that near normal weaning weights can be realized when stocking rate is adjusted to the forage supply.

Statistics on livestock that spend some of the year on pastures and rangeland cannot be partitioned to the management unit level, partly because of sampling intensity and partly to safeguard landowner privacy. Nonetheless, regional trends in livestock herd sizes can be used to corroborate management actions by land managers to de-stock drought-stricken rangeland. Some day, statisticians may be able to adequately describe local trends in livestock numbers using improved monitoring protocols.

#### Employment Diversity

Employment diversity is related to economic resiliency and the ability of an economy to adapt to changes in conditions. This indicator is applicable locally, as well as regionally, because it is measured at the county level. Drought can have a major influence on local economic resiliency, which makes this indicator useful in assessing community well being over the longer term.