Method for Determining Long-term Drought Status (March 2015)

The Monitoring Technical Committee uses percentile values for precipitation and streamflow to determine drought status in each of Arizona's watersheds. Arizona's long-term drought status map, updated quarterly, incorporates 24-, 36- and 48-month precipitation *and* streamflow percentiles from multiple gages in each of Arizona's major watersheds. To arrive at these values, precipitation and/or streamflow totals for each period (24, 36, 48 months) are compared to a 40-year historical record. Therefore, only gages with a 40-year record of data are used.

The precipitation and streamflow percentiles are evaluated against the trigger levels shown in the table below to determine drought status for each watershed.

Trigger Levels (based on precipitation & streamflow percentiles)	Drought Status	Possible Impacts
>30	Normal Conditions	
21-30	Abnormally Dry	• Measurable reduction in precipitation • Stress to seasonal grasses • Stock pond storage somewhat reduced
11-20	Moderate Drought	• Noticeable reduction in precipitation • Some vegetation stress; depending on season, could result in major stress • Stock pond storage reduced • Reduced streamflows • Lower than average reservoir levels
6-10	Severe Drought	• Long-term reduction in precipitation • Low snowpack • Reduction in reservoir levels • Vegetation stress affecting trees and shrubs • Habitat and pasture degradation • Stock pond and tinaja storage reduced • Reduced stream- and spring-flows
2-5	Extreme Drought	• Multi-year precipitation deficits (including snowpack) • Noticeable reduction in reservoir levels • Measurable reduction in groundwater levels • Near-record low streamflows

		• Considerable stress on trees and rangeland degradation • Diminished wildlife populations
1-2	Exceptional Drought	• Significant multi-year precipitation deficits (including snowpack) • Significant reduction in reservoir levels • Drastic reduction in groundwater levels • Record low streamflows • Major stress on trees, rangeland degradation, diminished wildlife habitat and population mortality

For any given precipitation or streamflow total, and any given time period, a percentile value measures how "rare" that precipitation value is as compared with historical values. If precipitation for the period of February - April, for example, is in the 16th percentile based on 30 years of record, then this means that only 16% of all precipitation totals for the period February – April over the last 30 years were lower than the current total (a moderate drought status).

Once the percentile values are determined, drought status is evaluated differently depending on whether the drought status is improving or worsening:

- To avoid premature changes in drought status, and to recognize that drought takes time to develop and to improve in Arizona, precipitation and streamflow percentiles must show improving conditions for at least four consecutive months before a watershed is changed to a less severe drought status.
- Precipitation and streamflow percentiles must show worsening conditions for two consecutive months before moving to a more severe drought status.

After the drought status maps are created, other data are evaluated to verify the calculated drought status. The Committee considers indicators such as vegetation health, reservoir levels, snowpack conditions, and other drought impact data from observers around the state. Based on these other indicators, the Committee may choose to adjust the status of one or more watersheds.

This method of determining long-term drought status was adapted from the Georgia Drought Management Plan (2003). The method has been adapted to account for Arizona's varied topography and to take into account the considerable contribution of snow to Arizona's hydrology.

Examples of impacts from recent Arizona droughts (taken, in part, from the U.S. Drought Impact Reporter and AZ DroughtWatch):
Exceptional Drought, in the years 2002-2004, included impacts such as:

- water emergencies in some towns
- reduction of water allocations by Salt River Project
- desiccation of stock ponds, tinajas and springs throughout Arizona
- desiccation of small lakes in northern Arizona

- water hauling to keep large mammal populations in northern Arizona from massive mortality
- extensive conifer mortality
- extensive mortality of Sonoran Desert species, such as palo verde
- extensive reduction in Sonoran pronghorn populations
- large wildland fires
- reduction in tourism at state parks and national recreation areas
- reduction in quail populations

Extreme Drought, in the years 2006-2008, included impacts such as:

- depletion of grass and shrubs for pronghorn in southern Arizona, resulting in the need for water hauling to maintain populations
- wildlife, such as deer, mountain lions, bears, javelina, wandering into urban areas, in search of food
- restrictions on the use of fire or fire-causing activities in National Forests
- USDA declarations of natural disaster areas for agriculture
- loss of lake volume in small-to-medium-sized lakes in central Arizona, to the point where boat ramps are no longer in the water
- lack of snowfall, resulting in loss of winter tourism and recreation, in northern Arizona
- cottonwood mortality along rivers in northeastern Arizona

Severe Drought, in the years 2009-2010, included impacts such as:

- pumping of groundwater to supplement meager spring-flow in a southern Arizona regional park
- use of reclaimed water to irrigate baseball stadium grass, due to a lack of monsoon rain in southern Arizona
- loss of tree foliage in a southern Arizona riparian area, due to failure of monsoon rainfall
- lack of new annual grass growth in northwestern Arizona rangelands, impacting cattle operations and resulting in emergency cattle sales
- reduced planting in southeastern Arizona

Moderate Drought, in 2010, included impacts such as:

- unusually low range productivity, and significant loss of rangeland vegetation due to dry conditions and blowing of sandy soil in northeastern Arizona
- lack of plant health, diminished livestock condition, and reduced surface water availability in northwestern Arizona