

Wyoming Drought Plan

**Prepared for
Governor Jim Geringer**

by the Wyoming Drought Task Force

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WYOMING DROUGHT PLAN

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WYOMING DROUGHT PLAN

1. BACKGROUND

The severe drought of 2000 has prompted Governor Geringer to form a drought task force and one of the charges of that task force was to develop a drought response plan. He appointed an initial committee from within the Natural Resources Sub-cabinet and the following plan is a result of that Task Force's work.

It is important to understand that drought is a natural climatic condition in Wyoming and there are actually very few actions that governmental agencies can take to alleviate the effects of drought. There are a few federal emergency relief programs that can provide direct assistance but in general the most effective actions are those taken prior to occurrence of the drought. Being prepared and having mitigation plans already in effect can lessen the consequences of drought.

Wyoming's climate is a function of its geography. The western and central portions of the state are best described as a series of high desert basins separated by mountain ranges. The eastern tier of counties can be described as high plains slowly rising to meet the Rocky Mountains. The altitude varies from slightly under 4,000 feet to almost 14,000 feet. Precipitation in the form of rain and snow varies from the desert basin areas which receive only 4 to 6 inches per year to mountain areas that receive in excess of 60 to 80 inches annually (Figure 1).

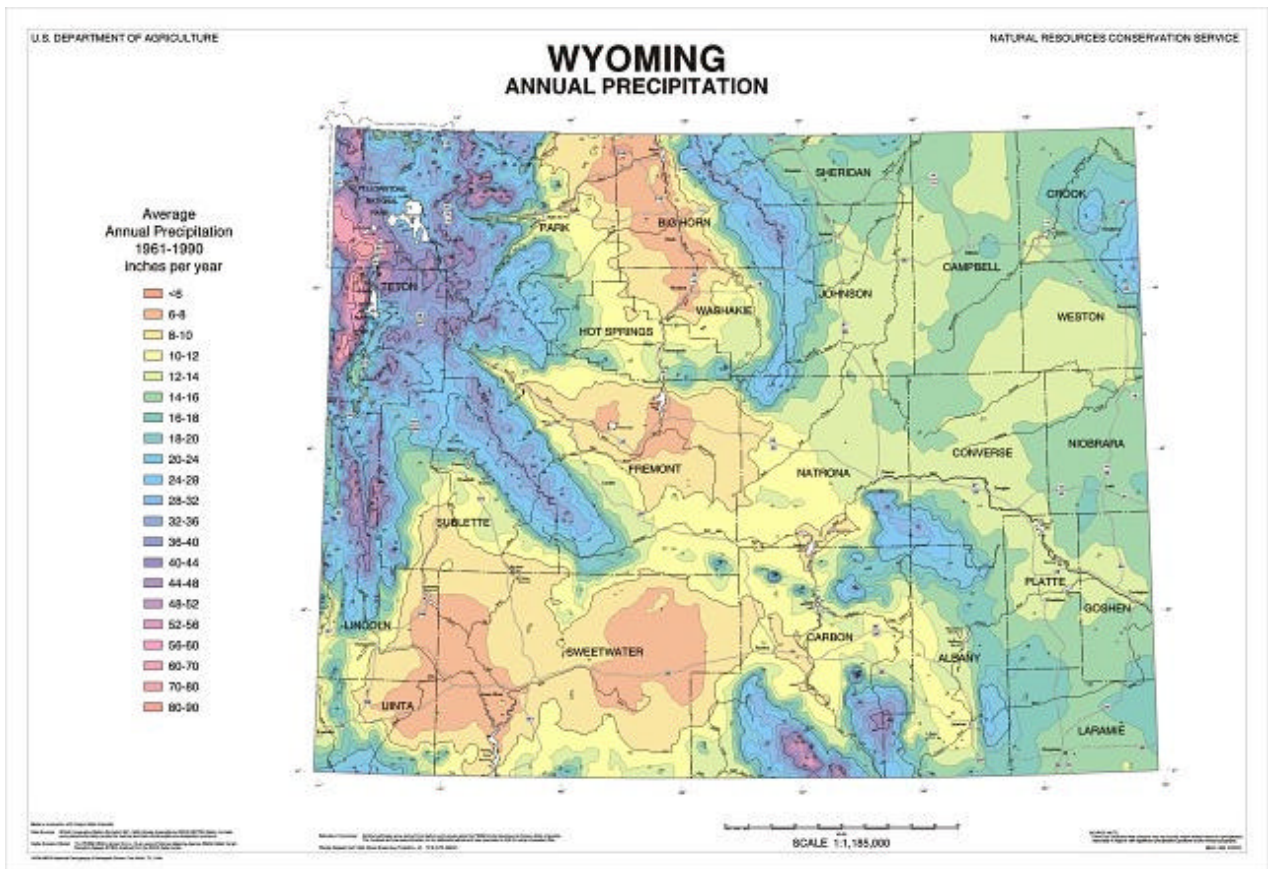


Figure 1. Annual total precipitation as determined from existing stations and elevation-terrain model (1961-90).

Rainfall in most areas of Wyoming is inadequate for the production of most crops although dryland wheat and dryland hay production is important in the eastern counties. Rangeland livestock production is totally dependent on natural precipitation and drought conditions can have a severe impact on this segment of agriculture. The larger rivers and streams in the State do have major retention structures and the ability to store water for future use does eliminate some of the risk of drought for irrigated farming. However, lack of mountain snowpack over a 2 or 3 year period can have a devastating effect on storage of water and a consequential negative affect on irrigated agriculture.

Fire hazard during drought years is a major concern both in the cost of fighting the fires and the loss of the natural resource. Major wild land fires can also have a negative effect on tourism as travelers change their vacation plans to avoid a perceived dangerous situation.

Communities are dependent on the water resource for their citizens, and long term drought situations do have significant negative impacts on cities and towns.

As an initial step in developing a Wyoming Drought Response Plan the task force examined drought plans from a number of other states. New Mexico has a very short and concise plan and with thanks to New Mexico we took the liberty of following their outline closely. We have also consulted closely with Colorado and modeled our operations after their drought plan. The National Drought Mitigation Center at the University of Nebraska at Lincoln provided a great deal of information, including a model drought response plan. Montana has a very useful drought web site that we have also used in developing our plan.

<http://enso.unl.edu/ndmc/>

<http://nris.state.mt.us/wis/supply1.html>

<http://ulysses.atmos.colostate.edu/>

<http://weather.nmsu.edu/drought/index.htm>

2. **PURPOSE OF THE WYOMING DROUGHT PLAN**

The purpose of this plan is to provide Wyoming with a framework for an integrated approach to minimize the impacts of drought on its people and resources. The plan outlines both long term and short measures that are to be used to mitigate the effects of drought. To accomplish this goal the Wyoming Drought Plan:

- 1) Identifies the local, state, federal and private sector entities that are involved with state drought management and defines their responsibilities.
- 2) Provides timely and accurate information on drought conditions to both governmental agencies and the general public so that decisions can be made before a crisis situation develops.
- 3) Defines a process to be followed in addressing drought related activities, including monitoring, impact assessment, and response.
- 4) Identifies long and short term activities that can be implemented to prevent and mitigate drought impacts.
- 5) Acts as a catalyst for creation and implementation of local drought planning and response efforts.

The Wyoming Drought Plan is intended to complement the on-going Wyoming water basin planning efforts.

Timely dissemination of drought related data plays an important role in assuring the effectiveness of the Wyoming Drought Plan. Many state and federal agencies have data related to drought, but that data is stored in various formats and may or may not be easily accessible. The drought planning team has identified a need to develop an information system that allows this data to be shared easily.

In order to make this plan as valuable and effective as possible it recognizes the following principals:

- 1) That the plan is always a document in progress. As technologies change, as new programs are developed and as agencies take on additional roles and responsibilities, the document needs to be revised.
- 2) The plan must make information available to the largest possible audience in both the private and public sectors. The Internet will be used to the greatest extent possible to disseminate information concerning climate, snowpack, water storage, stream flow, etc. and to provide timely and accurate information on programs available to mitigate or alleviate the effects of drought conditions.

Official Drought information for Wyoming is available on the Internet at:

<http://www.uwyo.edu/wrds/df/drought.html>

3. **DEFINITION OF DROUGHT**

Drought is a complex physical and social process of widespread significance and is not usually a Statewide phenomenon, with differing conditions in the State normally giving drought a regional focus.

Despite all of the problems that droughts have caused, drought has proven to be difficult to define and there is no universally accepted definition because:

1. Drought, unlike floods, is not a distinct event;

2. Drought is often the result of many complex factors acting and interacting within the environment. This interaction is such that drought often has no distinct start or end, thus complicating the problem of a drought definition.
3. The impacts of drought vary by affected sector, thus making different definitions of drought relevant to specific affected groups.

The most commonly accepted drought definitions are based on meteorological, agricultural, hydrological and socioeconomic effects.

3.A Meteorological Drought

This type of drought is often defined by a period of substantially diminished precipitation, duration and/or intensity. The commonly used definition of meteorological drought is an interval of time, generally on the order of months or years, during which the actual moisture supply at a given place consistently falls below the climatically appropriate moisture supply.

3.B Agricultural Drought

Agricultural drought occurs when there is inadequate soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought usually occurs after meteorological drought but before hydrological drought and can also affect livestock and other agricultural operations.

3.C Hydrological Drought

Hydrological drought refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow, snowpack, and as lake, reservoir and groundwater levels. There is usually a time lag between lack of rain or snow and less measurable water in streams, lakes and reservoirs, making hydrological measurements not the earliest indicators of drought.

3.D Socioeconomic Drought

Socioeconomic drought occurs when physical water shortages start to affect the health, well-being, and quality of life of the people, or when the drought starts to affect the supply and demand of an economic product.

4. DROUGHT VULNERABILITY

Potential drought impacts on the State of Wyoming are many and varied and can affect a wide range of economic, environmental and social activities. The relative vulnerability or risk exposure usually depend on the types of water demands, how these demands are met, and corresponding water supplies available to meet these demands.

Those human and natural resource activities depending solely on rainfall and soil moisture, such as dryland farming, ranching, and some environmental water uses are most at risk from drought. These activities can suffer discernible effects even with droughts of short duration.

Also at high risk are those water uses depending on in stream flows, which include direct flow irrigation, recreational water uses, aquatic, wetland and riparian environmental communities.

Less exposed to the risks of drought in Wyoming are many urban and agricultural water users who rely on surface water reservoir supplies or on groundwater resources that are not dependent on high rates of aquifer recharge or adversely affected by concentrated levels of high pumping.

The level of risk, which includes vulnerability and hazard, has been considered in the design of the structure of the Wyoming Drought Plan and is integrated into the planning, mitigation, and response activities of the Plan.

5. STRUCTURE AND FUNCTION OF DROUGHT PLANNING IN WYOMING

The following section presents the structure and function of the in-state organizations dealing with drought-related issues at the state and local level in Wyoming.

5.A *Wyoming Drought Task Force (DTF)*

The Wyoming Drought Task Force is the steering group that oversees the implementation of drought-related activities in Wyoming. The Task Force consists of senior managers of the various state, tribal and federal agencies, as well as representatives of the counties and municipalities and representatives of the agricultural and tourism industries (attachment # 1) for the complete membership of the task force. The co-chairs of this task force are the Director of the Wyoming Department of Agriculture and the State Forester.

This task force acts as a liaison between the various Sub-Groups involved with drought planning and the Office of the Governor and also assumes the lead role in intergovernmental drought response coordination and media information releases.

The Wyoming Drought Task Force will meet at least twice a year irrespective of drought conditions, and will meet as often as necessary in drought years.

5.B *Climatic Monitoring Sub-Group (CMWG)*

The Climatic Monitoring Sub-Group is the core of the Wyoming Drought Plan and is responsible for the monitoring of all available climatological data, soil moisture readings, reservoir storage levels and other pertinent information necessary to analyze the current status level of drought conditions in the State of Wyoming. This group of water resource, agricultural and climate professionals assesses the information, makes evaluations as to the current and future status of drought in the State, advises other Sub-Groups and task force members as to the current status level of drought in the State and, as necessary, employs needed "triggers" to implement further actions by other Sub-Groups. The Climatic Monitoring Sub-Group consists of technical experts from the University of Wyoming, National Weather Service, USDA - Natural Resources Conservation Service, USDA Agricultural Statistics Service, Bureau of Reclamation, State Engineer and U.S. Geological Survey.

The Climatic Monitoring Sub-Group also coordinates the dissemination of vital information such as the Wyoming Water Supply Forecast, the Wyoming Basin Outlook Report, Wyoming Reservoir Storage Report, Weekly Crop-Weather Report, and drought forecast information on the National Weather Service and U.S. Geological Survey Internet Websites.

The Chairman of this Sub-Group will be the State Climatologist. The Climatic Monitoring Sub-Group will meet a least 4 times a year irrespective of drought conditions, and should meet or confer at least monthly during drought conditions.

5.C Agricultural and Natural Resource Sub-Group

This Sub-Group is an assessment, mitigation and response group which collects input data from an existing network of local county Food and Agricultural Committees and other sources to identify drought impacts and track their occurrence and intensity relative to agricultural and natural resources. In addition to defining methods to mitigate drought this group will disseminate information on management practices that can be implemented prior to a drought that will mitigate the effects of drought. The findings and recommendations of the Sub-Group are assimilated into the overall drought assessment and help assure efficient response and mitigation capabilities and documentation for any emergency declaration. Individual agency programs are not subject to approval by this Sub-Group, which serves only to augment existing capabilities.

The membership of this group includes representatives from the Wyoming Department of Agriculture, The Wyoming Game and Fish Department, the Office of the Wyoming State Engineer, Wyoming State Lands and Investments, Wyoming Cooperative Extension Service, Tribal Representatives, USDA- Natural Resources Conservation Service, USDA-Farm Services Agency, USDA-Forest Service, Bureau of Land Management, Bureau of Reclamation, Wyoming Association of Conservation Districts, Wyoming Stock Growers, Wyoming Wool Growers, Wyoming Farm Bureau, Wyoming Farmers Union and other agricultural organizations.

There are a number of federal programs that are designed to help agricultural producers during droughts (attachment #2). The Agricultural and Natural Resource Sub-Group is responsible for disseminating information on these drought programs and for making recommendations on how these programs can be made more effective.

County disaster declarations for drought are critical in order to be eligible for USDA assistance. The Wyoming Department of Agriculture has developed a process to facilitate this designation (attachment #3). The Department of Interior requires a county drought declaration from the Governor in order to be eligible for Interior assistance.

The Chairman of this Sub-Group will be the Director of the Wyoming Department of Agriculture or his/her designated representative. The Sub-Group should meet at a minimum of once a year and as often as necessary in drought years.

5.D Drinking Water, Health and Energy Implementation Sub-Group

This Sub-Group makes assessments and develops mitigation strategies for drought related impacts on drinking water systems, energy delivery systems, and public health conditions. These assessments are based upon the most recent data available from a network of system managers and from a prepared list of vulnerable public utility systems.

Specialists in this Sub-Group include representatives from the Wyoming Department of Agriculture, Wyoming State Engineer, Wyoming Department of Environmental Quality, Wyoming Water Development Commission, Wyoming Emergency Management Agency, Wyoming National Guard, Tribal Representatives, Wyoming

Association of Municipalities, Wyoming Association of County Commissioners, Wyoming Rural Water Users Association, and the U.S. Bureau of Reclamation.

The Chairman of this Sub-Group will be appointed annually by the co-chairs of the Wyoming Drought Task Force. The Sub-Group should meet at a minimum of once a year and as often as necessary in drought years.

5.E *Wildfire Protection Sub-Group*

The role of this Sub-Group is to make assessments, identify major vulnerable areas of concern, and develop mitigation and response alternatives for drought impacts on wildfire occurrence.

Participants in this Sub-Group include representatives from the Wyoming Emergency Management Agency, Wyoming Division of Forestry, USDA-Forest Service, USDA-Natural Resources Conservation Service, Tribal Representatives, Wyoming County Commissioners Association and the U.S. Bureau of Land Management.

The Wyoming State Forester, in conjunction with the federal land management agencies has identified a process to help guide the implementation of fire restrictions under drought conditions (attachment #4). Wyoming law gives the authority and responsibility to declare fire restrictions and bans to the county commissioners. In addition, each land management agency has the authority to set fire restrictions and bans on lands managed by the agency.

The Chairman of this Sub-Group will be the State Forester or his or her designated representative and should meet at a minimum of once a year and as often as necessary in drought years.

5.F *Tourism and Economic Implementation Sub-Group*

This Sub-Group monitors the effects of drought on the various economic indicators derived from data representing all sectors of the State economy, including tourism. Projections are made regarding future impacts, and recommendations for mitigation and recovery strategies are provided to other working Sub-Groups.

Representation on the Sub-Group includes participants from the Wyoming Business Council, Wyoming State Parks Division, US Forest Service, Bureau of Land Management and the National Park Service.

The Chairman of this Sub-Group will be the CEO of the Wyoming Business Council or his/her designated representative. This Sub-Group should meet at a minimum of once a year and as often as necessary in drought years.

5.G *Communication Sub-Group*

This Sub-Group is responsible for providing a wide range of information related to drought for both internal and external audiences. This would include communication to the general public about the severity of drought at any point in time, information on proactive steps to prepare for upcoming drought, how to mitigate effects of drought and potential sources of assistance.

Membership on this Sub-Group could include participants from all the members of the Drought Task Force, but would at a minimum include communication specialists from the Governor's office, The Travel and Tourism section of the Business Council and the U.W. Cooperative Extension Service and the University of Wyoming.

In periods of drought, the effectiveness of the Wyoming Drought Plan hinges on the timely dissemination of clear and precise information to the public.

To accomplish this objective, the following communications guidelines have been established:

- a. Initial release of any drought status or response information will originate from the Office of the Governor, with technical oversight being provided by members of the Wyoming Drought Task Force.
- b. Drought status and response information, developed by the Task Force and Monitoring and Assessment Groups, will not be posted to any Website until the information has initially been released by the Office of the Governor.
- c. Drought press releases from the Office of the Governor will use the existing client list to target media outlets, congressional delegations and State of Wyoming Cabinet and Department heads.
- d. Other agencies within the State of Wyoming are encouraged to redirect information obtained from the Office of the Governor to their respective client bases; however no information will be released to these clients until after the initial release by the Governor. These agency client lists should emphasize clients not already receiving information from the Office of the Governor and/or those needing drought related services available from the originating agency.
- e. The Wyoming Drought Task Force will be responsible for the dissemination of existing Drought Public Service Announcements for the use of radio and television media in drought affected counties.

The Chairman of this Sub-Group will be appointed annually by the co-chairs of the Wyoming Drought Task Force and should meet at a minimum of once a year and as often as necessary in drought years.

6. DROUGHT MONITORING

Drought monitoring and the ability to predict the current and future stages of drought development are instrumental to the Wyoming Drought Plan. Various moisture indicators and climatic indices have been developed by water resource and climatological professionals for use in drought planning and these indices have been integrated into the Wyoming plan as key elements examined and tracked by the Monitoring Sub-Group:

http://www.wrds.uwyo.edu/wrds/wsc/wy_drought_2001/wy_drought.html

Some of these indices have a high degree of reliability and are well developed in Wyoming. Other indices are poorly developed or not available at all. Over time there is a real need to improve the reliability of these indices and to develop a professional staff within the state that can devote resources on a full time basis to

monitoring drought status across the state. The Water Resources Data System at the University of Wyoming hired a State Climatologist who will serve as the Executive Secretary on this Drought Task Force. As such, meeting minutes and other related information will be sent to the Executive Secretary for inclusion on the official state's drought website (jcurtis@uwyo.edu).

It is important to understand that none of the indices, in and of themselves, provide definitive answers about drought conditions. They are but tools, that when combined into an overall climate history of the state, will allow the Climatic Monitoring Sub-Group to estimate the severity of a drought and give an early warning to allow state, local and federal agencies, as well as individuals, to prepare appropriate responses.

6.A *Temperature and Precipitation Records*

The National Weather Service has collected and maintained both temperature and precipitation records all across the state for over 100 years. These records are a very accurate and reliable source of data. They provide a very accurate measure of conditions at any point in time and are also one of the key inputs to calculate other drought indices such as the Palmer Drought index. Significant below normal precipitation departures, especially during times of winter snow pack and summer thunderstorm activity, indicate that a drought is occurring. These records are available on the Internet at:

http://www.wrds.uwyo.edu/wrds/wsc/wy_drought_2001/wy_drought.html

6.B *Mid and Long Term Weather Forecasts*

The National Weather Service develops a number of mid term and long term weather forecasts. Predicting weather is an inexact science, but these forecasts improve in accuracy every year. The longer the forecast period the more inexact the forecast, but they are still one of the only tools available that can be used to predict what will occur in the future.

These forecasts are available on the Internet at:

<http://www.cpc.ncep.noaa.gov/products/predictions/90day/>

6.C *Snow Survey and Stream Flow Prediction*

The Natural Resource Conservation Service and the U.S. Geological Service provide Snow Survey data and stream flow predictions for all of the water basins in Wyoming. In addition the Bureau of Reclamation provides reservoir storage data for all of the major storage facilities on the State. These tools do provide a very good estimate of water availability for those irrigators who use either direct flow or storage water.

This information is now available at:

www.wrds.uwyo.edu

www.wrds.uwyo.edu/nrcs

www.gp.usbr.gov

<http://water.usgs.gov>

6.D *Ground Water Records*

Both the State Engineer and the USGS maintain records on ground water supplies across the state. These records are excellent in some portions of Wyoming and are very poor in other areas. It is important to recognize that shallow aquifers can be strongly influenced by drought conditions, but as a general rule ground water reacts slowly at both ends of a drought cycle. During the initial phases of a drought ground water may not be effected at all, but if a drought is severe enough to deplete ground water, it will also take a long time after the drought is over for the ground water to recover.

Ground Water Records may be found on the Internet at:

<http://www.usgs.gov/>

6.E. *Palmer Drought Severity Index (PDSI)*

The Palmer Drought Severity Index (PDSI) is a "meteorological drought" index that responds to weather conditions that have been abnormally dry or abnormally wet. The PDSI is calculated based on precipitation, temperature and Available Water Content (AWC) of the soil. The Palmer Index varies from +6.0 to -6.0 with a classification scale indicating relative meteorological and hydrological development cycles. Table 1 reflects the range and extent of the PDSI classification system. At this time the Palmer Index is available for the 10 climate divisions (Figure A) in Wyoming, but there are concerns about the number of data points used to calculate the index as well as the accuracy of the data used.

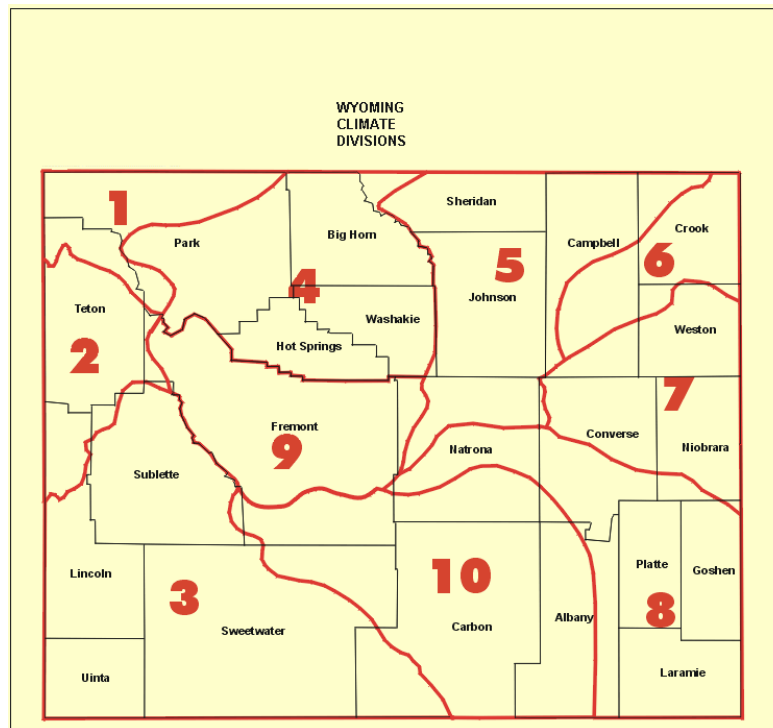


Figure A. Wyoming Climate Divisions.

The initial estimates are not considered as accurate as later updates. At this time the Palmer index is of limited use in Wyoming and needs to be used with caution. The Task Force does recommend that the initial task of a State Climatologist would be review and correct the Palmer Index to improve its usefulness in Wyoming. It is available at this time on the Internet at:

4.00 or more	Extremely wet
3.00 to 3.99	Very wet
2.00 to 2.99	Moderately wet
1.00 to 1.99	Slightly wet
.50 to .99	Incipient wet spell
.49 to -.49	Near normal
-.50 to -.99	Incipient dry spell
-1.00 to 1.99	Mild drought
-2.00 to -2.99	Moderate drought
-3.00 to 3.99	Severe drought
-4.00 or lower	Extreme drought

6.F Surface Water Supply Index (SWSI)

This index is now available for Wyoming. The National Resource Conservation Service calculates this index. Overtime, it is expected to be refined.

The Surface Water Supply Index (SWSI) was developed to complement the Palmer Index. The objective of the SWSI is to incorporate both hydrological and climatological features into a single index, and is intended to be an indicator of surface water conditions where mountain snowpack is a major component.

Four inputs are required for the SWSI: snowpack, stream flow, precipitation, and reservoir storage. Because it is dependent on the season, the SWSI is computed with only snowpack, precipitation and reservoir in the winter months, with stream flow replacing snowpack in the equation during the summer months. Like the Palmer Index, the SWSI is centered on zero and ranges from +4.2 to - 4.2, as shown in Table 2.

Table 2: Surface Water Supply Index (SWSI)

+3.0 to +4.0	Extremely wet
+2.0 to +3.0	Moderately wet
+1.0 to +2.0	Slightly wet
-1.0 to +1.0	Near average
-2.0 to -1.0	Slightly dry
-3.0 to -2.0	Moderately dry
-3.0 to -4.0	Extremely dry

6.G *Standardized Precipitation Index (SPI)*

At this time the Standard Precipitation Index is available for the 10 climate regions in Wyoming, but there are concerns about the number of data points used to calculate the index as well as the accuracy of the data used.

At this time the SPI is of limited use in Wyoming and needs to be used with caution. The Task Force does recommend that one of the first tasks of a State Climatologist would be review and correct the SPI to improve its usefulness in Wyoming .

It is available at this time on the Internet at:

<http://enso.unl.edu/ndmc/>

The Standardized Precipitation Index (SPI) is designed to quantify the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources. The SPI is calculated by taking the difference of the precipitation from the mean for a particular time scale, and then dividing by the standard deviation. A drought event is defined as any time the SPI is continuously negative and reaches intensities where the SPI is -1.0 or lower. The drought event ends when the SPI becomes positive.

Each drought event therefore has a duration defined by its beginning and end, and intensity for each month that the event continues, as shown by the example in Table 3.

SPI Values	Drought Category	Time in Category
0 to -.99	Mild Drought	34.1%
-1.0 to -1.49	Moderate Drought	9.2%
-1.5 to -1.99	Severe Drought	4.4%
-2.00 or less	Extreme Drought	2.3%

Table 3 also shows the percent of time that the SPI is in each of the drought categories based on an analysis of

available station data. Because the SPI is standardized, these percentages are usually expected from a "normal distribution" of the SPI. The 2.3% of SPI values within the *Extreme Drought* category is a percentage that is typically expected for an *extreme* event. In contrast, the Palmer Index reaches its *extreme* category more than 10% of the time across section of the Great Plains. This standardization allows the SPI to determine the rarity of a current drought as well as the probability of the precipitation necessary to end the current drought.

6.H *Soil Moisture*

The USDA Agricultural Service publishes a weekly soil moisture estimate report and the Climate Prediction Center provides a one and three month forecast of soil moisture in each county. This is not a quantitative measure but still provides a useful approximation of soil moisture conditions across the state. Additional, Torrington, Wyoming agriculture site provides quantitative hourly soil moisture from 2 to 40 inch depths. These reports can be found on the Internet at:

<http://www.nass.usda.gov/wy/internet/cropwthr.htm>

http://www.cpc.ncep.noaa.gov/soilmst/img/cas_w_mon.lead1.gif

<http://www.wcc.nrcs.usda.gov/scan/site.pl?sitenum=2018&state=wy>

6.I *Triggering Mechanisms*

Drought means different things to different segments of our society. The farmer and recreation interests depend on reservoir levels while ranchers rely on spring rains to increase grassland yields. Forest land depends on ample winter snowpack and a minimum of summer thunderstorm activity in order to hold down fires. While other states use a variety of indexes including the Palmer index, the Standard Precipitation Index (SPI) and the Surface Water Supply Index (SWSI) in combination to indicate where in the drought cycle a geographical region of their state is in at a particular point in time, Wyoming has adopted a less complicated approach.

In figure 2, the onset of a drought is initially determined by the historical level of the major reservoirs in state as of 1 October of each year. Basically, as the reservoir levels fall below the 80 percent level a drought alert is warranted. The next milestone for determining drought is to look at the 1 March or 1 April SWE and the April-September precipitation and stream flow forecasts. If a drought has persisted more than one year, additional snowpack and precipitation is required and therefore the forecast for excessive precipitation by percent needs to be factored in. If after the winter precipitation verifies as below normal in terms of the 1 March or 1 April historical snowpack levels (SWE), then the appropriate actions to implement water restrictions and/or issue declarations or emergencies should be considered. Another important criterion for plains ranchers is the amount of April precipitation that falls. If the short term April forecast is for precipitation to be below 80 percent of normal, a serious drought should be considered a strong possibility; especially if the existing soil moisture is more than 59 mm below normal in the top 2 meters. If the drought is more than one year long, additional forecasted precipitation (above 100 percent) is required to recharge soil moisture. Indices such as the 6-month SWSI, SPI, PDSI, and 12-month precipitation percentiles should be referred to for this determination. Agencies should have taken appropriate action to prepare for the drought by 1 April.

If the drought is marginal, then the summer precipitation forecast should be considered by the 1 May milestone date for action. Using the derived reservoir drought index, average weekly stream flow can be used to monitor evolving droughts. If the summer forecast is for hotter than average temperatures, additional precipitation needs to be factored in. Also, the threat of forest fires are not determined by the amount of forecasted precipitation since thunderstorms cause more than 70 percent of these types of fires. An important consideration is whether there was sufficient snowpack and if the summer temperature forecast is expected much hotter temperatures than average.

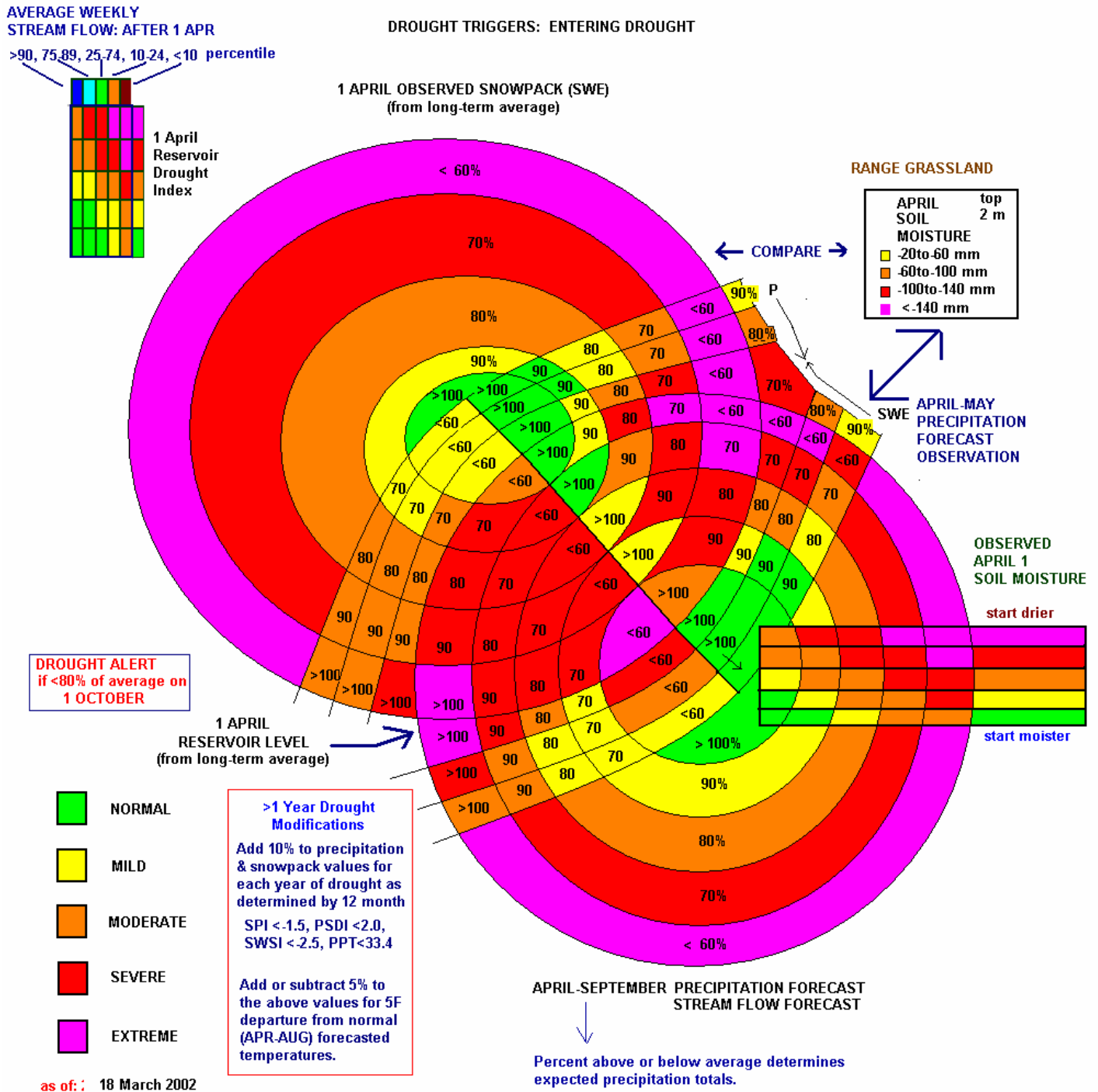


Figure 2. Wyoming Drought Triggers (ONSET). If the 1 April reservoir level is 70% and the SWE is 70% and 6-month forecasted precipitation and/or stream flow forecast is 70%, the reservoir drought index is considered severe (red). If the 1 April soil moisture is observed to be -80mm, it is therefore considered moderately dry and if the April precipitation forecast is for 90 percent of normal, then the range or basin drought forecast is for moderate drought. If a severe reservoir drought index is compared with the weekly average basin stream flow in the 75-89 percentile range, the drought is then considered moderate (orange). For every year a drought persists, the percent of snowpack and precipitation is increased 10 percent in the rings of the circles.

All these factors rely heavily on the accuracy of the weather forecast. In figure 3, the cessation of drought follows the same logic flow. Figure 4 is a time line of suggest actions based on the results that are yielded from Figures 2 and 3.

The end of a drought will usually occur after summer when water demands are minimal. By 1 April, if a drought meets the criteria for ending, all appropriate restrictions are lifted and the emergency is declared over.

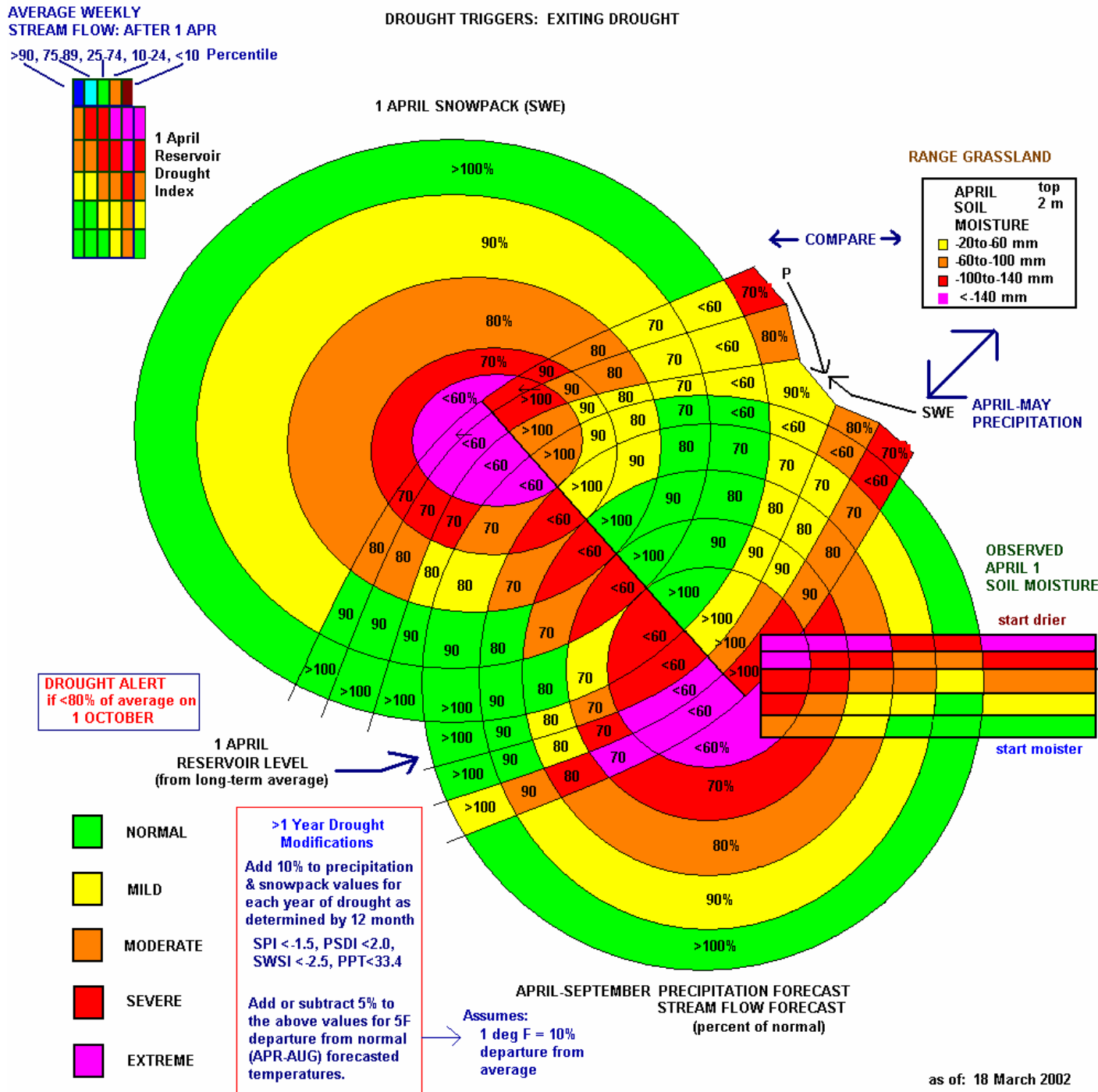


Figure 3. Wyoming Drought Triggers (CESSATION)

It is important to understand that this technique is not used in isolation but instead is combined with the judgments and

experience of the Sub-Group's members to evaluate the severity of a drought.

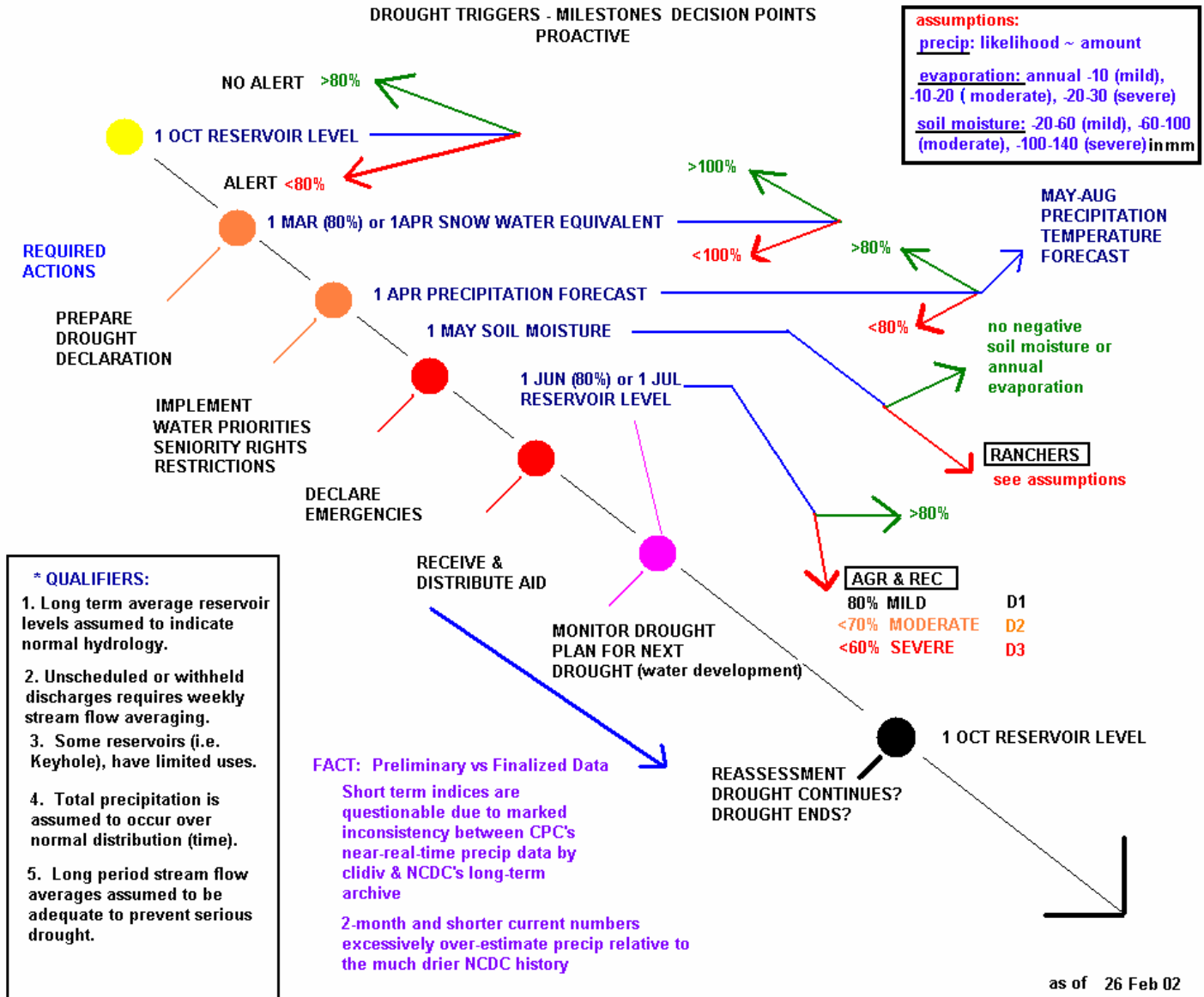


Figure 4. Time line of milestone decision points as drought develops.

7. DROUGHT ASSESSMENT AND RESPONSE

The role of drought assessment and response in Wyoming is designed to be proactive and to assist existing state, federal and local agencies to carry out their designated missions for assisting drought affected customer groups.

To carry out this role, the Sub-Groups as described earlier in Section 5 serves as a consortium to assess and address the impacts of drought on their respective target groups. The five Sub-Groups are:

- a. Agriculture
- b. Drinking Water, Health and Energy

- c. Wildfire Protection
- d. Tourism and Economic Impact
- e. Communication

7.A *Assessment*

These five Sub-Groups will develop proactive action items that can mitigate the effects of drought on their target group. These actions include items that are to be taken before a drought event to reduce effects of a future drought as well as actions that are to be taken during various stages of on-going drought.

The actions that are proposed to be carried out by the respective and local, state and federal agencies emphasize the targeting of agency resources to affected parties and encourage agencies to develop strong partnerships between other agencies, their customers and the general population of Wyoming. These efforts may challenge the management of many agencies to look beyond their current service or regulatory role and identify new partnerships and opportunities that will be of the greatest benefit to the State of Wyoming in minimizing the effects of drought.

These agency representatives form the nucleus of the Sub-Groups and during the time of actual drought situations serve as the main conduit for the flow of information between their respective agencies and the Sub-Group.

In addition to the principal membership, each sub-group is encouraged to open lines of communications with affected customer groups throughout the state to increase the flow of available data from the drought affected areas to the membership of the sub-group.

7.B *Response*

The response to the particular drought mitigation needs of a target sub-group are determined and initiated by agency representatives in each sub-group. These response actions have usually already been planned well in advance of the drought situation, or in the case of unforeseen situations, will be the result of intense analysis of available problem data by the sub-group membership. Any additional assistance needs which cannot be met by existing in-state resources are passed on to the Drought Task Force for further action.

Signature page

Governor Jim Geringer _____ date _____

Ron Micheli, Co-chair _____ date _____

Tom Ostermann, Co-chair _____ date _____

8. ATTACHMENTS

- Attachment #1 Task Force Membership
- Attachment #2 Process for Designation of Drought Counties by USDA (on internet site)
- Attachment #3 Fire subcommittee Action Plan
- Attachment #4 Agriculture and Natural Resources Action Plan
- Attachment #5 Drinking Water, Health and Energy Action Plan
- Attachment #6 Wyoming Fire Restrictions (to be added later)
- Attachment #7 Tourism and Economic Impact Action Plan (to be added later)
- Attachment #8 Communication Action Plan (to be added later)

Attachment # 1

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Attachment # 2

Process to Request Disaster Designation for Your County

Two separate ways to start disaster process

Farm Service Agency (FSA) Assistance

The county FSA committee provides the State FSA Committee with a request and the necessary documentation of the disaster. The state FSA Committee evaluates the request. If they approve, they forward the request and documentation to USDA. USDA determines approval or disapproval.

County Declaration of Disaster

The County Commissioners will, if the situation warrants, and in accordance with Wyoming Emergency Management Agency guidelines, declares an agri-business disaster area. The county's Emergency Management Coordinator and Emergency handbook can provide correct wording.

The local FSA Executive Director provides damage assessment. This assessment helps clear the way for verification required later by USDA.

The local Disaster Assistance Committee and the Food and Agriculture Committee coordinate and assist the commissioners in the declaration process.

The County Commissioners send the County Disaster Declaration, FSA forms, and other damage assessment information to the Governor, with information copies to the Wyoming Department of Agriculture (WDA) and Wyoming Emergency Management Agency Directors.

WDA will coordinate with the Wyoming Emergency management Agency and the Governors office.

If sufficient justification exists, the Governor requests the U.S. Secretary of Agriculture approve the disaster designation for the county. Copies of the Governor's request are forwarded to Wyoming's congressional delegation and state agencies for their information.

USDA will request verification of the disaster from the state and local FSA. USDA determines approval of disapproval.

Attachment #3

Fire Subcommittee Action Plan:

The Drought Task Force’s Fire Subcommittee will meet annually to review drought processes and needed revisions. This meeting may be in conjunction with other fire related meetings already scheduled.

In addition to the normal, ongoing interagency pre-suppression planning, training, and coordination; suppression; and detection activities, the following steps will be taken upon “drought” determination combined with “Very High” or greater fire danger rating:

- 1. Advisory notices will be issued and forwarded to agency field offices, county Fire Wardens, and County Commissioners.**
- 2. Interagency Fire Prevention messages will be issued and coordinated through appropriate officials.**
- 3. Wyoming State Forestry Division (WSFD) will remind County Fire Wardens and Commissioners of their authority and responsibility for burning restrictions within their counties and encourage them to coordinate any restrictions with federal and state land management agencies within their counties.**
- 4. Local and state land management agency offices will be reminded by their state level Fire Management Officer (FMO) or equivalent to coordinate burning restrictions with each other and local officials.**
- 5. Fire restrictions will be distributed via agency communication networks and by WSFD to the WDTF communications, Tourism and Economic Development Committees.**
- 6. Federal and state FMO’s will coordinate federal and state pre-positioning of fire suppression resources, utilizing “severity” funding and other available resources.**
- 7. The Wyoming Military department will be advised by WSFD of drought conditions. Black Hawk Helicopters and fire crews may be pre-positioned as needed and available.**
- 8. WSFD will coordinate with Wyoming Emergency Management Agency (WEMA) and Wyoming Department of Agriculture (WDOA) concerning potential wildfire/drought disaster declarations (similar to 2000)**

Attachment #4

Agriculture and Natural Resource Drought Subcommittee Meeting Minutes

April 25, 2001

By

Grant Stumbough, Co-chair

The meeting was called to order by co-chair Grant Stumbough at 10:00am.

Those in attendance:

Ron Micheli, Wyoming Department of Agriculture, co-chair
Phil Rosenlund, University of Wyoming Cooperative Extension
John Barnes, State Engineers Office
Bob Mountain, U.S. Forest Service
Don Christianson, WDA
Carl Jensen, Farm Service Agency
Kay Hawker, FSA
Martin, Hoffland, FSA
Lois Van Mark, Farmer
Terry Jones, Farmer
Marty Griffith, Bureau of Land Management
Tom Enright, BLM

Those not in attendance: Gary Butler, Wyoming Game & Fish Department

The purpose of the meeting was to initiate a drought management plan for agriculture and natural resources. Our goal is to be proactive and practice “risk” management rather than “crisis” management. This committee is a subcommittee of the Governor’s Drought Management Task Force.

Various Federal and State agencies provided an update of their drought relief programs as follows:

FSA DROUGHT RELIEF PROGRAMS:

Handouts on each FSA program discussed are attached

Livestock Assistance Program (LAP)

The LAP will provide direct payments to eligible livestock producers who suffered grazing losses due to natural disasters during the current calendar year. To be approved, a county must have suffered 40 percent or greater loss of available grazing for at least 3 consecutive months as a result of drought, hot weather, or other disasters. The county must have been declared a disaster county by the Secretary of Agriculture or the **President. Sign-ups were extended to May 4, 2001.**

Concerns:

- 1) Producers will not receive payment from last year’s grazing losses until late May or later.
- 2) Requests are expected to exceed relief dollars available. Thus, FSA will only be able to pay a percentage of a full payment to each eligible livestock owner
- 3) This is a temporary program which requires that all claims nationwide must be submitted and approved before any payments are made. Conversely, a standing or entitlement program allows a 100-percent payments on an on-going basis.

4) Livestock owners can only utilize the program. Landowners who lease pasture are not eligible for the program, even though they suffered losses directly due to drought.

Emergency Conservation Program (ECP)

The ECP shares with the agricultural producers the cost of rehabilitating eligible farmlands damaged by natural disaster. During severe drought, ECP also provides emergency water assistance both for livestock and for existing irrigation systems for orchards and vineyards. County disaster designation by the U.S. Secretary of Agriculture is not needed to receive benefits. Applications for ECP moneys are requested by the county FSA committee. Because this is a standing entitlement program, payments are made as soon as they are approved, until moneys for that county are depleted

Concerns: Only Uinta and Crook counties are eligible.

200X Crop Disaster Program CDP

The CDP is available to farmers who suffered crop losses in 200x due to natural disasters. Farmers can be compensated if their losses exceed 35% of historic yields.

Pasture Recovery Program

Purpose is to provide assistance to owners and operators of pasture land on which livestock is normally grazed that was damaged or destroyed by natural disaster during calendar year 200x.

Concerns:

1) Hay land and rangelands are NOT eligible. This program requires reseeding of pasture lands to receive payment.

2) PRP is available only in counties approved for ECP.

Other Programs: Low interest FSA loans are available to eligible producers in counties designated a disaster area by the U.S. Secretary of Agriculture. Several other drought relief programs exist that are not available or do not apply to Wyoming.

ACTION ITEMS:

WDA will work with FSA in drafting a letter to be signed by the Governor and sent to the Secretary of Agriculture and copied to various agriculture groups, agencies, and associations. The letter will emphasize the following:

- 1) The need for a drought relief program that will benefit Wyoming RANGELAND producers
- 2) Stress the importance of timely drought relief Payments. Currently, producers are waiting a year to receive payments resulting in late bank payments and financial disaster for most producers

suffering from last year's drought.

3) Stress the importance of block payments to individual states to allow for timely drought relief payments and avoidance of bureaucratic red tape. This would also provide the states with increased flexibility to help those producers that truly need assistance.

4) Encourage FSA drought relief programs to become standing or entitlement programs to increase program efficiencies, to ensure timely payments, and to stabilize drought assistance nationwide. The existing Federal Fire Fighting Fund can be used as an example of a successful standing, block-grant federal program.

It was also suggested that key agriculture leaders in Wyoming (agriculture organizations, agency directors, state legislators, etc) contact our Congressional Delegation and the Senate and House Ag Committee Chairman regarding the need for improved drought assistance programs for rangeland producers.

NATURAL RESOURCES CONSERVATION SERVICE DROUGHT RELIEF PROGRAMS:

NRCS currently administers the Emergency Watershed Protection Program to assist sponsors and individuals in implementing emergency recovery measures to relieve imminent hazards to life and property created by drought or other natural disasters.

Concern: This program is currently not funded. Hopefully, this program will be funded in the near future.

NRCS can also provide technical assistance for developing irrigation water management plans upon request by producers.

WYOMING GAME AND FISH HABITAT IMPROVEMENT PROGRAMS:

The Wyoming Game and Fish Commission's Water Development, Riparian and Upland Habitat Improvement Grants provide \$300,000 matching funds annually to landowners, private and public land managers, conservation groups, other government agencies and nonprofit organizations for the promotion and development of Wyoming's riparian/wetland/upland habitat and wildlife resources. The program also has opened access to private lands for hunting, fishing and wildlife viewing.

Initiated in 1996, this is a matching grant program to assist local entities with their projects to improve or maintain Wyoming's riparian/wetland/upland wildlife resources. Grants up to a maximum of \$10,000 each for riparian and upland improvements or \$7,500 for water development are available for each approved project. Sponsors are required to provide at least 50% of project costs through cash, other conservation funds, or in-kind contributions. Limited access for hunting, fishing or wildlife viewing is also required.

Landowners, land managers, government agencies, civic and conservation groups, other non-profit organizations and other agencies may apply for projects. Separate chapters or units of statewide organizations are considered as separate applicants. Two or more entities may join in a single project.

WATER DEVELOPMENTS ON FEDERAL LANDS:

The committee discussed the need for increased water developments for wildlife and livestock on public lands during dry years. Permanent water developments require more NEPA documentation than temporary developments. USFS and BLM have the ability under guidance from the regional Forest Supervisor and State BLM director to use categorical exclusions to authorize the grazing of vacant allotments and development of temporary water sources during drought. Very little paperwork is involved

Concerns:

- 1) When categorical exclusions do not apply, cultural clearances on federal lands can take up to 3 months or longer due to large archeological workloads.
- 2) Roadless and wilderness areas may require more NEPA documentation in developing new water sources.

ACTION ITEMS:

- 1) The Wyoming Department of Agriculture will meet with Wendy Bredehoft, director, State Historical Preservation Office (SHPO), to discuss increased flexibility in obtaining Cultural Clearances during dry years or drought.
- 2) Forest Service and BLM will explore utilizing existing field staff that are properly trained to conduct archeological reviews. (Currently Montana is allowing BLM field staff to conduct these reviews).
- 3) It was recommended that water development guidelines or “procedures” be developed by the Forest Service and BLM to streamline the NEPA and permitting process during dry or drought years. This could eliminate inconsistencies and increase efficiencies between forests and field offices in developing water.

ROAD MAINTENANCE FOR WATER HAULING PURPOSES:

The committee discussed the need for federal agencies to allow road maintenance for hauling water to livestock in dry or drought years. The committee strongly encouraged BLM and Forest Service to increase road maintenance efforts for hauling water (especially for sheep producers). Livestock producers need to notify BLM and FS officers of the roads that need to be maintained for hauling water.

WATER POND MAINTENANCE:

The committee discussed pond maintenance on BLM lands. It is often difficult to obtain the necessary authorization to maintain wildlife and livestock watering ponds. These ponds can be invaluable in sustaining wildlife and livestock during dry or drought years and is a perfect example of a proactive drought management strategy that reduces risk. Maintenance of existing ponds should require little authorization as compared to new pond development. Cooperative agreements between BLM and

Permittees should continuously be reviewed and updated to streamline pond maintenance efforts.

AFTER THE FACT BILLING

After the Fact Billing was discussed as a way to help offset producer costs during drought. BLM requires that an allotment management plan (AMP) be developed before After the Fact Billing is allowed. In addition, BLM will refund permittees for the unused portion of their permit when early removal of livestock is necessary due to lack of forage or water during drought conditions. BLM will also approve applications for either total or partial non-use of annual grazing authorizations in consideration of forage production due to drought. Costs therefore are in accordance with the amount of use authorized. BLM can also prepare billing schedules for permittees to assist in spreading grazing costs over time to ease financial burdens. BLM normally applies the refund to the next year's bill, but in drought years BLM officials can allow the refund following the grazing season.

Forest Service will allow split billing which enables permittees to pay half now and pay half later for grazing costs. Currently, the Forest Service does not grant grazing refunds but will credit the permittee for the next grazing season. However, this policy could be modified to allow refunds if requested by the permittees.

WAIVER OF SURCHARGES:

BLM stated that very few permittees pay surcharges for subleases and waving these charges would provide little assistance in times of drought.

2 YEAR GRAZING DEFERMENT AFTER WILDFIRE OR BURNING

Forest Service and BLM explained that a 2 year grazing deferment after a wildfire or prescribed burn was a standing policy. However, the length of grazing deferments can be flexible and evaluated on a case by case basis to assist permittees in need of range during dry years or drought. For example, if an allotment was burned in the spring, it could be possible for that allotment to be grazed the following grazing season if forage has sufficiently recovered for livestock grazing.

DIFFERENCES IN IMPLEMENTATION OF POLICIES AMONG BLM OFFICES

There was agreement that efforts need to be made to minimize differences

COUNTY DROUGHT AND FIRE MANAGEMENT COMMITTEES:

Doug Thompson, Chairman of the Wyoming State Grazing Board, requested in writing that the Wyoming Drought Management Task Force discuss ways to organize local or county drought management committees. This would allow local people to develop local drought management plans and would also provide a structure to encourage communications between the state task force and local committees. This idea was well received by our sub-committee.

After much discussion, it was decided that the County Commissioners would have the most expertise and ability to effectively develop these committees. Extension agents, County Emergency Coordinators, rural fire control officers, local Conservation Districts, BLM, Forest Service, Irrigation Districts, NRCS, lending institutions, Congressional Delegates, state agency officials, and others would serve on the local

committees. Every county is unique and every county would probably require a different make up of committee members to effectively address local drought and fire concerns.

[The Fire Response Team met on April 27 and also agreed that forming County Drought and Fire Management Committees was an excellent idea and should be pursued. Joe Evans, Executive Director of the Wyoming County Commissioners Associations currently chairs that committee.]

ACTION ITEM (From the Fire Response Team meeting):

1) Joe Evans will discuss with county commissioners at their meeting in two weeks setting up a video conference with members of the Wyoming Drought Management Task Force and all County Commissioners in early June to discuss forming County Drought and Fire Management Committees.

INFORMATION AND EDUCATION:

Many agricultural producers do not know what is available, who to contact, or how to minimize risk during dry years or drought. Ag producers need more information on programs available, who to contact for assistance, management practices that will minimize risk, funding, and general guidelines to follow during drought or dry years.

ACTION ITEM:

1) Phil Rosenlund will work with the communications subcommittee in developing an effective drought management brochure. Brochures will be sent to Ag organizations, agencies, and local governments for distribution. In addition, Extension Service has developed a drought website which will be hot linked into various other websites to assist in getting drought information out to the general public.

OTHER:

1) Forest Service and BLM agreed to notify the Wyoming Department of Agriculture with a 15 day notice, whenever possible, before any livestock are removed or AUM's reduced. The state, at the request of the permittee, will develop a technical team of specialists to review the BLM proposal and make recommendations to them.

2) Last April, the "Friends of the Bow" requested information regarding USFS Drought Management Guidelines for the Rocky Mountain Region. They requested this information under the Freedom of Information Act. Apparently, the Friends of the Bow were concerned that they were not given an opportunity to provide public comment on the USFS Drought Management Guidelines before implementation.

The meeting adjourned at 3:00pm.

Attachment #5

Subcommittee on Drinking Water, Public Health, and Energy Implementation

Subject: The outcome of First Meeting, Agriculture Department Conference Room

Meeting Date: May 2, 2001

Attendees: See Attached

The subcommittee primarily focused on identification of potential adverse impacts from a long-term drought that would affect storage capacity and diversion of greatly diminished direct flows. These are drought conditions that occur over a period of time whereby physical surface water shortages and storage begins to affect public health, quality of life, the economy, or can result in emergency response conditions. However, short term localized drought conditions could have some impact on public health services. The subcommittee also identified mitigative measures and developed Action Items for subsequent meetings.

Analysis of Public Health Impacts

- **Responding to Fire Fighting Camps, including sewage, water, and food services. Demand on State services to support these camps.**
- **Preparations to deal with accedences of wastewater treatment discharge permit limits.**
- **Responding to limitation on contact recreational sports.**
- **Responding to disease outbreaks from poorer water quality or reduced water quantity. Greater stress on animals or organisms that are impacted by the quality or availability of water may increase incidences of disease in humans.**
- **Dealing with mental stress, primarily in rural populations.**
- **Responding to that portion of the population most at risk.**

Remedies for Public Health Impacts

- **In response to immediate fire danger, identify communities in line with smoke. Provide education on health effects, identify at risk population, provide local guidance and state support services. Evacuation plans, if necessary usually handled by federal agencies.**
- **For disease outbreak prevention, develop educational material and develop a strategy to deliver this material to the affected stakeholders.**
- **Following major fire, potential threats to surface water supplies from runoff may exist.**
- **Respond to emergency requests for alternative discharge limits for wastewater treatment facilities.**
- **Provide counseling for mental stress to individuals with substantial and direct losses.**

Public Health Action Items

- 1. Develop a strategy for local educational packages (Karl Musgrave).**
- 2. Develop strategy for mental health counseling (Karl Musgrave).**
- 3. Do we have a mechanism to coordinate with Tribal Governments on Indian Lands?**
- 4. We should add Game & Fish Division to the Subcommittee.**

Analysis of Public Water Supply Impacts

- **During drought conditions, rather than strictly following the doctrine of appropriation for**

water rights, flexibility should be recognized so that all water users share the burden. We should advocate the concept of community solutions, rather than strike legal and regulatory measures. Realize need for some minimum level of in-stream flow to maintain in-stream aquatic life and habitat.

Develop an inventory of those Public Water Systems that will be severely impacted by shortages.

- **Are there unique consumers of water supplies in State Government?**

Remedies for Public Water Supply Impacts

- **Public Water Systems which rely on surface water should have water conservation plans. These plans should include both long-term measures that encourage conservation and reactive measures for severe drought conditions. Development of water conservation plans should be rewarded by the state.**
- **Under severe drought conditions, public water systems may have to be augmented for long periods of time by the addition of new sources or hauling water. These conditions need to be identified 90 to 120 days in advance to allow adequate planning and implementation (see attached Corp. Of Engineers info). We need to develop an emergency response plan for these situations.**

Public Water Supply Action Items

Emergency response planning:

1. **Develop an inventory of PWSs in the Western and Northwestern part of state that could be in a position to need augmented supplies during the next year or two. (Brian Mark)**
2. **Look into Corp. of Engineer's process and response time to emergencies. (John Scorine)**
3. **Evaluate potential for a WWDC emergency response mechanism. (Barry Lawrence).**

Water conservation planning:

4. **Develop a strategy that encourages the development of water conservation plans for all PWSs in the state. (Wes Bressler)**
5. **Add Corp. of Engineers and Bureau of Reclamation to subcommittee**

Analysis of Private Water Supply Impacts

- **Most private PWSs are on shallow groundwater sources. The primary impact will be loss of shallow groundwater supplies.**
- **Many times the groundwater sources are under the influence of surface water, which may impact the quality of the groundwater during drought conditions.**
- **Indirect economic impacts from loss of these small systems if their water supply system goes dry.**

Remedies for Private Water Supplies

- **Is there a public section responsibility to provide remedies?**
- **Impacts to these systems seem like a smaller priority.**
- **Provide education, awareness, and counseling as a remedy.**

Analysis of Energy Supply Impacts

- **Severe drought conditions may result in reduced production of energy.**

1. The effect would be on out-of-state customers first and most. Instate customers may realize higher costs, reduced employment, and lower revenues. Reduced head on reservoirs may affect efficiency of hydro power production.
2. In severe conditions, may have some instate effects, such as curtailing supply to large consumers.
3. The cost of energy would be the greatest resulting impact from water shortage.

Remedies for Energy Supply Impacts

- Include power generators in the dialogue and planning.
- Promote conservation as a remedy, but not as the solution.

Energy Supply Action Items

1. Engage other power suppliers in the dialogue. (Bob Tarantola).
2. Develop a mechanism for feedback from the power supplies to the task force. (Bob Tarantola).

Attendees

Drought Management Subcommittee

5/2/01

<u>Name</u>	<u>Affiliation</u>
Gary Beach	DEQ/WQD
Karl Musgrave	DOW/PNSD
Wes Bressler	City of Laramie
Brian Mark	DEQ/WQD
Bob Tarantola	Pacific Power
Neal Bloomenrader	WDA
Laurie Leis	WDA/CHS
John Scorsine	WYNG/WMD
Barry Lawrence	WWOC
Ed Wallace	WEMA
John Barnes	WSEO
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*** Need to add Bureau of Reclamation to subcommittee**

*** Add Corp. of Engineers to subcommittee in the future**