

Inventory Worksheet| Worksheet 1

Consideration	Notes
<p>General Questions</p> <ul style="list-style-type: none"> <li>● How have previous drought years impacted your farm/ranch.</li> <li>● Were there any opportunities in past droughts that you took advantage of, or that you missed?</li> <li>● What did you manage well in past droughts?</li> </ul>	
<p>Weather and climate at your operation and off site sources</p> <ul style="list-style-type: none"> <li>● The historic frequency of drought</li> <li>● Average regional precipitation and timing (use <a href="#">CoAgMet</a> or <a href="#">Colorado Climate Center</a>)</li> <li>● The range of annual precipitation amounts</li> <li>● Critical growth periods for crops, rangeland forage or hay (NRCS or Extension)</li> <li>● Future forecasts and expectations for your region</li> </ul>	
<p>Water resources</p> <ul style="list-style-type: none"> <li>● Well capacity and ability to pump</li> <li>● Flow rate or storage capacity (tanks or earthen structures)</li> <li>● Water quality</li> <li>● Irrigation water availability</li> <li>● Probability of administrative calls on water or water deficits</li> </ul>	
<p>Financial resources</p> <p>Consider how drought impacts:</p> <ul style="list-style-type: none"> <li>● your business plan</li> <li>● the cost of production for each of your enterprises,</li> <li>● the riskiness of potential enterprises.</li> <li>● Marketing alternatives</li> </ul>	
<p>Human and personnel resources</p> <ul style="list-style-type: none"> <li>● Family member’s interests and abilities</li> <li>● Resources for coping with stress in drought</li> </ul>	
<p>Soil characteristics</p> <ul style="list-style-type: none"> <li>● Water holding capacity</li> <li>● Infiltration rate</li> </ul>	

<ul style="list-style-type: none"> <li>● Fertility</li> <li>● Soil moisture at critical periods</li> </ul>	
<p>Herd Resources</p> <ul style="list-style-type: none"> <li>● Number and class of livestock</li> <li>● Rank of value of animals, by class and individual identification</li> </ul>	
<p>Range and Forage Resources</p> <ul style="list-style-type: none"> <li>● Total average carrying capacity and forage demand by livestock</li> <li>● Average drought reductions in carrying capacity</li> <li>● Critical dates for forage production</li> <li>● Forage demand by livestock</li> <li>● Other feed supplies</li> </ul>	
<p>Crops</p> <ul style="list-style-type: none"> <li>● Input availability and costs (seed, fuel, fertilizer)</li> <li>● Dates where additional water or other inputs will not increase yield or create a return on investment</li> <li>● The ‘salvage’ point - harvesting or use the crop for something else rather than as intended</li> </ul>	

Worksheet adapted from: Managing Drought Risk on the Ranch: A Planning Guide for Great Plains Ranchers. The National Drought Mitigation Center, University of Nebraska at Lincoln, South Dakota State University and Texas A&M Kingsville, 2014. Full handbook at: <https://drought.unl.edu/ranchplan/Overview.aspx>

## Worksheet 2: Goals for Drought Preparation and Response | Example

Think back to the first step of this planning process and the assessment of your operation. Consider what you have and where you've been. Where are you trying to go with your operation to lessen the impact of drought? How do goals to lessen the impact of drought help you achieve your overall management goals for the operation? Goals should be specific, attainable, and ideally include a time-line for accomplishment. We've included three examples to demonstrate what a goal might look like for a ranching and crop growing operation.

Goal	Goal description
Example (ranching)	<i>Reduce economic impact of drought by making our operation more flexible in drought and more able to reduce stocking rate on the base property. This goal can be reached many ways including changing the number and class of livestock, adding 'temporary' animals to the herd, or leasing additional land.</i>
Example (wheat grower)	<i>Reduce the economic impact of drought by diversifying crops and increasing acreage using conservation tillage practices, thus increasing the ability to retain soil moisture, improve soil health, and capture more economic and environmental value from existing operations.</i>
Example (water development)	<i>Reduce economic impact of drought by increasing reliability in our water supply, and extend water availability later in the season by developing additional water storage/supply by 2027.</i>
1.	
2.	
3.	
4.	
5.	
6.	

Worksheet adapted from: Guide to Co-Developing Drought Preparation Plans for Livestock Grazing on Southwest National Forests by Hawkes et al., 2018. Full handbook at: <https://cals.arizona.edu/droughtandgrazing/>

## Worksheet 2: Goals for Drought Preparation and Response - Blank

Think back to the first step of this planning process and the assessment of your operation. Consider what you have and where you've been. Where are you trying to go with your operation to lessen the impact of drought? How do goals to lessen the impact of drought help you achieve your overall management goals for the operation? Goals should be specific, attainable, and ideally include a time-line for accomplishment. We've included three examples to demonstrate what a goal might look like for a ranching and crop growing operation.

Goal	Goal description

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### Worksheet 3: Trigger Dates | Livestock Example

This worksheet provides a framework for thinking about trigger dates on an ongoing basis throughout the year. The livestock example is adapted from the Central Plains Experimental Range and the [Collaborative Adaptive Rangeland Management experiment](#) run by USDA-ARS. The Central Plains Experimental Range contracts yearlings each year. The ranch manages ten 320 acre pastures, with two pastures rested per year for reserve forage in drought. Because they run contracted yearlings, they have flexibility on stocking rate but these decisions must be made in April.

**Drought Management Goal:** Reduce economic impact of drought by having full grazing seasons and not having to remove cattle early due to drought. Pastures should not be grazed beyond the drought thresholds in order to avoid lasting damage to vegetation and other objectives (e.g., tall structure bird habitat).

What to Monitor	Date	Target Condition	Adaptive Action
<a href="#">Pacific Decadal Oscillation</a> Status <a href="#">La Niña/ El Niño</a> Status Drought Outlook Winter precip relative to long-term average Current soil Moisture	Dec - April	El Niño - increase probability of above normal precipitation	By mid-April, make stocking decisions and contract yearlings. Use <a href="#">decision tree on ENSO / PDO Phase</a> and residual biomass to set stocking rate low, moderate or high relative to long-term average.
Residual Biomass (data summary; measured in Oct.)	After growing season	Specific targets based on bird habitat goals, ecological sites, and conditions - ranging from 300 in least productive sites in drought to 550.	
<b><i>Within-season management</i></b>			
Cumulative precipitation and soil moisture. Soil moisture and rainfall is monitored continuously.	Weekly starting May 15	Minimum thresholds for biomass are specified relative to three precipitation scenarios: > 88.5% of average, , 75-88.5% of average, <75% of average.	Leave pastures when specified minimum residual thresholds are exceeded for three precipitation/ ecological type scenarios. If the eight pastures planned for grazing have been used, consider using the pastures planned for rest. Consider available biomass, recent rainfall and soil moisture, and other range management objectives. After all ten pastures have either been used or intentionally skipped (due to a decision related to other objectives), consider regrazing previously grazed pastures (see below).
Near-real time monitoring products for forage conditions, and GrassCast, <a href="#">VegDri</a> , NDVI and standing biomass from up to 1 week ago.	Weekly starting May 15		Calculate whether cattle may need to leave CPER sooner than Oct 1 (decision to initiate discussions with cattle owners/stakeholders); Change rotation based on spatial variation in forage conditions; Implement rotation criteria as planned.
Biomass values for regrazing	Only after all 10 pastures have been used	Biomass values must exceed the drought threshold enough to allow for additional regrazing	If conditions are not met, cattle need to be removed from the station if biomass values do not exceed the drought threshold in all 10 pastures. At least two weeks' warning should be given to producers if this is about to happen.

### Worksheet 3: Trigger Dates | Crops Example

This worksheet provides a framework for thinking about trigger dates on an ongoing basis throughout the year.

<b>What to Monitor</b>	<b>Date</b>	<b>Target Condition</b>	<b>Adaptive Action</b>
Fall moisture for winter wheat planting	September	Soil moisture sufficient to plant	If moisture is insufficient, do not plant, or consider applying irrigation after planting (if applicable). Apply pre-plant fertilizer if possible when good soil moisture conditions exist or are forecasted short term.
Soil Fertility	March	Understanding of nutrients existing in soil prior to spring fertilization	Use soil samples to determine soil existing nutrient credits. Apply fertilizers at rates based on expected crop yields minus credits. Be sure to account for other existing sources such as manure, organic matter, and previous legume crops, if applicable.
Winter precipitation amount	April	Wet soils and positive short term weather forecast.	If soil conditions are dry, carefully survey stand to determine appropriate inputs relative to potential yield. If stand is poor, consider crop insurance if eligible (e.g., winter kill).
Short-term weather forecast	April	Positive short-term forecast	See above. If residual soil moisture is low, and 10 day forecast does not look promising for precipitation, do not apply fertilizer.

### Worksheet 3: Trigger Dates | Blank

This worksheet provides a framework for thinking about trigger dates on an ongoing basis throughout the year.

<b>What to Monitor</b>	<b>Date</b>	<b>Target Condition</b>	<b>Adaptive Action</b>

Worksheet 4: Identify Challenges with Preparation and Develop Strategies | Long-Term | Example

Farm/ Ranch: \_\_\_\_\_ Date: \_\_\_\_\_

<b>Issues with Drought Preparation</b> <i>Use ideas you generated during the inventory</i>	<b>Possible Strategies</b> <i>What are potential strategies to this specific issue?</i>	<b>Farm/Ranch Goal Addressed</b> <i>How will addressing this issue enable you to reach your operation's goals?</i>	<b>Priority (High, Low, Medium)</b> <i>What's the feasibility and impact of the strategy?</i>	<b>Potential Partners</b> <i>Given the cost or scale, do you need additional partners?</i>
<b>Example (ranching)</b> <i>Cattle herd size is almost at full capacity; any decline in forage likely to result in needing to sell cows</i>	<ul style="list-style-type: none"> <li>• <i>Change the herd composition to incorporate yearlings or stockers; therefore, more flexible</i></li> <li>• <i>Consider more conservative stocking rate</i></li> <li>• <i>Seek alternative forage by renting/leasing pastures</i></li> </ul>	<i>Reduce economic impact of drought by increased flexibility and preparation.</i>	<i>Medium</i>	<i>Family/ business partners</i>
<b>Example (farming)</b> <i>Profitability of dryland wheat is increasingly unreliable due to warmer temperatures and dry springs.</i>	<ul style="list-style-type: none"> <li>• <i>Plant perennial forages on a percentage of acres for dryland grazing.</i></li> <li>• <i>Increase acreage under no-till to improve soil moisture retention</i></li> <li>• <i>Explore specialty certifications, like organic, to capture value with reduced production.</i></li> </ul>	<i>Reduce economic impact of drought by diversifying crops and capturing value from crops.</i>	<i>Medium</i>	<i>Family/ business partners</i>
<b>Example (irrigation efficiency)</b> <i>With ongoing/recent drought, irrigation supplies are not reliable and fail to provide as much water as in the past with shorter irrigation seasons..</i>	<ul style="list-style-type: none"> <li>• <i>Transition percent of fields to more efficient irrigation systems (flood to side rolls).</i></li> <li>• <i>Build additional storage</i></li> <li>• <i>Acquire additional water rights</i></li> <li>• <i>Increase civic engagement in discussion shaping basin-wide policy</i></li> </ul>	<i>Reduce economic impact of drought by increasing reliability in our water supply, and extend water availability later in the season.</i>	<i>High</i>	<i>NRCS; water lawyer; seek other potential partners for infrastructure funding</i>

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Worksheet 4: Identify Challenges with Preparation and Develop Strategies | Long-Term | Blank

Farm/ Ranch: \_\_\_\_\_ Date: \_\_\_\_\_

<b>Issues with Drought Preparation</b> <i>Use ideas you generated during the inventory</i>	<b>Possible Strategies</b> <i>What are potential strategies to this specific issue?</i>	<b>Farm/Ranch Goal Addressed</b> <i>How will addressing this issue enable you to reach your operation's goals?</i>	<b>Priority (High, Low, Medium)</b> <i>What's the feasibility and impact of the strategy?</i>	<b>Potential Partners</b> <i>Given the cost or scale, do you need additional partners?</i>

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Worksheet 5: Response Strategies to Deal with Current Conditions and Scenarios | Short-Term | Example

Worksheet adapted from: An Easy to Use System for Developing a Drought Management Contingency Plan. 2017. University of Arizona Cooperative Extension AZ1725.

<b>If</b>				<b>Then</b>
<b>Scenario Category</b>	<b>What are you watching (indicators)?</b>	<b>Scenarios</b>	<b>Likelihood of Scenario as of (date)...</b>	<b>Management Strategies</b>
<b>Best Case</b>	<ul style="list-style-type: none"> <li>- SNOTEL streamflow forecast: 70% chance streamflow will exceed median flows.</li> <li>- Forage: fast growth in spring.</li> <li>- Conditions on the ground: Soils saturated going into winter; pastures in good condition going into winter. Cool, wet conditions in spring</li> </ul>	Forage: 800 lbs/acre Water supply: full allocation	By late May, given favorable conditions. If conditions are warm in dry in spring, this scenario becomes unlikely.	Retain steers and extra heifers; defer extra pastures; water hauling likely not needed.
<b>Average Case</b>	<ul style="list-style-type: none"> <li>- SNOTEL streamflow forecast: 50% chance streamflow will exceed median flows.</li> <li>- Forage: moderate growth in spring.</li> <li>- Conditions on the ground: average going into winter; Average spring conditions</li> </ul>	Forage: 500 lbs/acre Water supply: partial irrigation after 1st cutting	Late May	Normal culling and prepare to cull older cows. Planned rotation, and no deferral of pastures. May have reduced hay yield depending on monsoon and temperatures.
<b>Worst Case</b>	<ul style="list-style-type: none"> <li>- SNOTEL streamflow forecast: 30% chance streamflow will exceed median flows.</li> <li>- Forage: slow spring growth.</li> <li>- Conditions on the ground: dry going into winter; Dry, hot spring</li> </ul>	Forage: 200 lbs/acre Water supply: no water after 1st cutting	Late May	Water hauling and supplemental forage needed. Supplemental forage or culling to base herd likely will be needed. Hay yield likely decreased.

Worksheet 5: Response Strategies to Deal with Current Conditions and Scenarios | Short-Tem | Blank

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<b>If</b>				<b>Then</b>
<b>Scenario Category</b>	<b>What are you watching (indicators)?</b>	<b>Scenarios</b>	<b>Likelihood of Scenario as of (date)...</b>	<b>Management Strategies</b>
<b>Best Case</b>				
<b>Average Case</b>				
<b>Worst Case</b>				

## Worksheet 6: Scenarios | Examples

Use the following worksheet to come up with drought scenarios (or potential realistic situations) and how you would respond if they were to occur.

<b>Scenario 1:</b> What if... we experience a winter season drought with only 50% average precipitation for 3 consecutive years	
What will we do?	
What flexibility do we have?	
How could we increase preparedness for this possible scenario?	
How do strategies developed in Worksheet 4 perform?	
<b>Scenario 2:</b> What if... receiving 20% of our historical irrigation water allocation becomes normal, occurring 5 out of every 10 years	
What will we do?	
What flexibility do we have?	
How could we increase preparedness for this possible scenario?	
How do strategies developed in Worksheet 4 perform?	
<b>Scenario 3:</b> What if... the trend for the irrigation season to end earlier becomes normal, occurring 5 out of every 10 years. Or what if temperatures continue to increase during the summer, requiring more irrigation water to offset the increase in $E_t$ ?	
What will we do?	
What flexibility do we have?	
How could we increase preparedness for this possible scenario?	
How do strategies developed in Worksheet 4 perform?	

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## Worksheet 6: Scenarios | Blank

Use the following worksheet to come up with drought scenarios (or potential realistic situations) and how you would respond if they were to occur.

<b>Scenario 1:</b> What if...	
What will we do?	
What flexibility do we have?	
How could we increase preparedness for this possible scenario?	
How do strategies developed in Worksheet 4 perform?	
<b>Scenario 2:</b> What if...	
What will we do?	
What flexibility do we have?	
How could we increase preparedness for this possible scenario?	
How do strategies developed in Worksheet 4 perform?	
<b>Scenario 3:</b>	
What will we do?	
What flexibility do we have?	
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How do strategies developed in Worksheet 4 perform?	

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Worksheet 7: Prioritize Strategies | Long-Term | Example

Prioritize the top 5 actions you will take based on the above brainstorm in Worksheet 4.

Farm/ Ranch: \_\_\_\_\_ Date: \_\_\_\_\_

Strategies (draw from Worksheet 4)	Timeline	Goal Addressed	Priority	Accomplished	
				Year	What
1. <i>Example (ranching): Examine costs/ benefits and infrastructure needs of allocating a percentage of our average carrying capacity to stockers. If advisable based on this analysis, incrementally increase the percentage of forage allocated to stockers and decrease size of cow-calf herd.</i>	5-10 years	Reduce economic impact of drought by increased flexibility and preparation.	High	2022  2023	Assessment of forage status and long-term carrying capacity; did not restock to full capacity following the 2020 drought.  Evaluated cost-benefit trade-offs and infrastructure needs. Purchased stockers.
2. <i>Example (farming): Examine costs/ benefits of various scenarios of planting perennial forages on a percentage of acres for dryland grazing. If warranted, incrementally increase acreage in perennials to 30% by 2028.</i>	1-3 years	Reduce economic impact of drought by diversifying crops and capturing value from crops.	High	2022	Cost/benefits analysis & inventory of fields.  Favorable monsoon gave the opportunity for planting perennial forage in 10% of acres.
3. <i>Example (irrigation efficiency): Transition percent of fields to more efficient irrigation systems (flood to side rolls). Explore contracts with NRCS partners and get estimates on timeline and cost-share options.</i>	2-5 years	Reduce economic impact of drought by increasing reliability in our water supply, and extend water availability later in the season.	High	2022  2023	Initial discussion and site visit with NRCS to assess options. 3 year delay in engineering. Signed contract.  Work on other aspects of drought plan
4.					

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## Drought Plan Template - Example

*Adapted from The National Drought Mitigation Center's Sample Drought Plan examples, available at <https://drought.unl.edu/ranchplan/WriteaPlan/SampleDroughtPlans.aspx>  
See pages 11-13 of the [Drought Handbook for Colorado Ag](#)*

### **Goal(s) for Drought Management (max 3):**

#### **Tips**

- Drought related goals should be motivating, important to the producer, and focused on high priorities for an operation.
- Goals should be specific, attainable, and ideally include a time-line for accomplishment.
- Goals should be shared among relevant planning partners.
- Consider the timeline. Goals can be long (10+ years) or short term (1-5 years). A producer may have different goals to cope with an acute drought situation, versus long-term preparedness
- Consider the overall mission and vision of your operation, and set drought-related goals that help you achieve the broader mission and vision.

#### **Goal - Example (Long-term)**

1. *Reduce economic impact of drought by increasing reliability in our water supply, and extend water availability later in the season by developing additional water storage/supply by 2027.*
2. *Reduce economic impact of drought and labor by developing enterprise budgets for each enterprise on my farm, evaluating profitability, and prioritizing effort accordingly by 2024.*

#### **Short-term- Example (Short-term)**

3. *Reduce short-term drought impacts by using water supply forecasts to adaptively plan cropping schedule/ timeline (this year).*
4. *Reduce the emotion/ stress impact of drought by developing a plan for responding as signs of excess stress emerge (this year).*

#### **Inventory:**

- Average Precipitation and Variability: *Example: Average precip is 14"/year; experience drought 2 out of 10 years on average; On average years, have enough water for 2 cuttings*
- Potential future conditions in your area (if relevant): *Future precipitation (by 2050) uncertain but temp increase expected to drive higher evapotranspiration and thus reduced irrigation water and soil moistures. Flows could be reduced by 30%; rate of drought could double to 4 out of every 10 years.*

### **Strategies for Increasing Drought Preparedness and Timeline for Completion (max 4):**

If goals are “where is a producer trying to go”, strategies are the “how” to get to there.

Goal 1: *Reduce economic impact of drought by increasing reliability in our water supply, and extend water availability later in the season by developing additional water storage/supply by 2027.*



*Strategies:*

- Pursue options to build additional storage by using money from the Drought Advisors stipend to consult a water lawyer.
- Pursue NRCS contracts and additional funding options for cost-share on infrastructure.

Goal 2) *Reduce economic impact of drought and labor by developing enterprise budgets for each enterprise on my farm, evaluating profitability, and prioritizing effort accordingly by 2024.*

*Strategies:*

- Winter 2023/24 - develop enterprise budgets and evaluate profitability.
- Family meeting to discuss options potential changes.
- By end of 2024, make decisions on future directions.

### **Critical Decision-making Dates and Target Conditions:**

Critical dates identify in advance the important conditions and dates that “trigger” specific actions. Critical dates or trigger dates tie calendar dates with threshold conditions and paired actions.

*(see below as part of Goal 3)*

### **Strategies for Managing During Drought (max 4):**

Short-term strategies involve an action that is immediate or in the near future based on when precipitation, soil moisture, or other conditions identified by a producer indicates that drought conditions exist or may develop

*Goal 3: Reduce short-term drought impacts by using water supply forecasts to adaptively plan cropping schedule/ timeline (this year).*

*Strategies:*

- Oct: observe soil moisture conditions going into winter. If dry, caution advised as snowpack will have less of an impact.
- Nov- April: Watch SNOTEL streamflow forecasts. If supply is within 50% or more likelihood of not exceeding median flows, plan cropping schedule to prioritize high-value crops that can be grown in June and July. Reduce acreage on crops that require full-season water (tomatoes, peppers).

*Goal 4: Reduce the emotion/ stress impact of drought by developing a plan for responding as signs of excess stress emerge (this year).*

- Work with AgWell to develop a plan for myself on indicators of stress, and ways to manage stress in the growing season.

## Drought Plan Template

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### **Goal(s) for Drought Management (max 3):**

### **Inventory:**

- Average Precipitation and Variability:
  
- Potential future conditions in your area:

### **Strategies for Increasing Drought Preparedness and Timeline for Completion (max 4):**

### **Critical Decision-making Dates and Target Conditions:**

### **Strategies for Managing During Drought (max 4):**