WORKSHEET 1: DROUGHT INVENTORY

Considerations	Notes
General Questions • How have previous drought years impacted your farm/ranch? • Were there any opportunities in past droughts that you took advantage of, or that you missed? • What did you manage well in past droughts?	
Weather & Climate **At your operation and off-site sources** • The historic frequency of drought • Average regional precipitation and timing (use CoAgMet or Colorado Climate Center) • The range of annual precipitation amounts • Critical growth periods for crops, rangeland forage or hay (NRCS or Extension) • Future forecasts and expectations for your region	
Water Resources • Well capacity and ability to pump • Flow rate or storage capacity (tanks or earthen structures) • Water quality • Irrigation water availability • Probability of administrative calls on water or water deficits	
Herd Resources • Number and class of livestock • Rank of value of animals, by class and individual identification	

WORKSHEET 1: DROUGHT INVENTORY (CONTINUED)

Range and Forage Resources

- Total average carrying capacity and forage demand by livestock
- Average drought reductions in carrying capacity
- Critical dates for forage production
- Forage demand by livestock
- Other feed supplies

Crops

- Input availability and costs (seed, fuel, fertilizer)
- Dates where additional water or other inputs will not increase yield or create a return on investment
- The 'salvage' point - harvesting or use the crop for something else rather than as intended

ADDITIONAL NOTES:

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

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 timeline 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)	*Reduce economic impact of drought by making our operation more flexible in drought and more able to reduce stocking rate on the base property. Several strategies can help us reach this goal, including changing the number and class of livestock, adding 'temporary' animals to the herd, proactive planning and responsiveness to the price cycle, or leasing additional land.*
Example (wheat grower)	*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.*
Example (water development)	*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.*
1.	
2.	
3.	

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 3: TRIGGER DATES & ACTIONS
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	Action
Pacific Decadal Oscillation Status La Niña/ El Niño Status Drought Outlook Winter precip relative to long-term average Current soil Moisture	Dec - April	El Niño - increased probability of above normal precipitation	By mid-April, make stocking decisions and contract yearlings. Use decision tree on ENSO / PDO Phase 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.	
Within-season management			
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, VegDri, 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 & ACTIONS
DRYLAND WHEAT EXAMPLE

The dryland wheat example is from a fictional dryland farming operation.

What to Monitor	Date	Target Condition	Action
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 & ACTIONS BLANK

Farm/Ranch: **Date:**

What to Monitor	Date	Target Condition	Action

WORKSHEET 4: LONG-TERM STRATEGIES
IDENTIFY CHALLENGES WITH PREPARATION & DEVELOP STRATEGIES

Farm/Ranch: **Date:**

Issues with Drought Preparation	**Possible Strategies**	**Farm/Ranch Goal Addressed**	**Priority** *(High, Medium, Low)*	**Potential Partners**
Use ideas you generated during the inventory.	What are potential strategies to this specific issue?	How will addressing this issue enable you to reach your operation's goals?	What's the feasibility and impact of the strategy?	Given the cost or scale, do you need additional partners?
Example (ranching) *Cattle herd size is almost at full capacity; any decline in forage likely to result in needing to sell cows.*	*Improve assessment of future carrying capacity scenarios.* *Change the herd composition to incorporate yearlings or stockers* *Consider more conservative stocking rate* *Seek alternative forage by renting/leasing pastures* *Benchmark production costs and consider operational changes based on analyses*	*Reduce economic impact of drought by increased flexibility and preparation.*	*Medium*	
Example (farming) *Profitability of dryland wheat is increasingly unreliable due to warmer temperatures and dry springs.*	*Plant perennial forages on a percentage of acres for dryland grazing.* *Increase acreage under no-till to improve soil moisture retention* *Explore specialty certifications, like organic, to capture value with reduced production.* *Consider alternative enterprises, e.g. agritourism or events.*	*Reduce economic impact of drought by diversifying crops and capturing value from crops.*	*Medium*	
Example (irrigation efficiency) *With ongoing/recent drought, irrigation supplies are not reliable and fail to provide as much water as in the past with shorter irrigation seasons.*	*Transition percent of fields to more efficient irrigation systems (flood to side rolls).* *Build additional storage* *Acquire additional water rights* *Increase civic engagement in discussion shaping basin-wide policy*	*Reduce economic impact of drought by increasing reliability in our water supply, and extend water availability later in the season.*	*High*	*NRCS or other partners for infrastructure funding; water lawyer*

***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 4: LONG-TERM STRATEGIES (Blank)
IDENTIFY CHALLENGES WITH PREPARATION & DEVELOP STRATEGIES

Farm/Ranch: **Date:**

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

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

Scenario 1: What if… a winter season drought with only 50% average precipitation occurs in 4 of 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?	

Scenario 1: What if… receiving <40% of our historical irrigation water allocation becomes normal, occuring 5 out of 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?	

Scenario 1: What if…spring/ winter conditions are dry, but an early-onset monsoon provides rain that provides favorable range conditions?	
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?	

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

WORKSHEET 5: 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.

Scenario 1: 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?	

Scenario 1: What if…	
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How do strategies developed in worksheet 4 perform?	

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

WORKSHEET 6: DROUGHT PLAN EXAMPLE

Adapted from The National Drought Mitigation Center's Drought Resources: ***https://ranchdrought.unl.edu/***

A drought plan can be as simple as a 1-2 page document that includes goals, a basic inventory, strategies, and critical dates. Use this template to bring it all together.

Farm/Ranch: **Date:**

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.
	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%; frequency of drought could double to 4 out of every 10 years.
Long- Term Goal(s) for Drought Management (max 3):	1. Pass on a viable business to the next generation and reduce economic impact of drought by preparing for future with a higher frequency of severe drought. We will do this by pursing infrastructure adaptations, making strategic business choices, and committing to improving family communication around the agricultural business.

Long-Term: Strategies (max 4):	1. Increase the reliability in our water supply, and extend water availability later in the season by developing additional water storage/supply within 3-5 years.
	  1. Identify options for additional storage or augmentation (within 1 year).
	  1. Consult a water lawyer using money from the Drought Advisors stipend.
	  2. Based on options, build infrastructure and/or develop augmentation plan.
	  1. Pursue funding options for cost-share on infrastructure (within 2 years).
	  3. Implement project (within 5 years).
	2. Develop enterprise budgets for each enterprise on the farm, evaluating profitability and effort (within 1 year).
	  1. Use enterprise analyses to prioritize efforts, make strategic business decisions and as appropriate, consider diversifying to to leverage profitability.
	3. Communicate
	  1. Implement routine family meetings. Use this time to discuss options potential changes based on above pursuits. By end of year, make decisions on future directions.

Short- Term Goal(s) for Drought Management (max 3):	1. Prioritize profitability when there is limited water. 2. Reduce uncertainty by using water supply forecasts to adaptively plan cropping schedule/ timeline (this year). 3. Reduce the emotion/ stress impact of drought.
Strategies for Managing during Drought (Short-Term) (max 4):	1. Develop prioritization schedule of high-value crops that can be grown in June and July. 2. Reduce acreage on crops that require full-season water (tomatoes, peppers) when irrigation water is expected to be limited. 3. Use best available information (Snotel) to inform above strategies. 4. Work with AgWell to develop a plan for myself on indicators of stress, and ways to manage stress in the growing season.
Critical Decision-making Dates and Target Conditions (Triggers):	**Yearly/ Recurring** • Oct: Observe soil moisture conditions going into winter. If dry, caution advised as snowpack will have less of an impact. • Jan - April: Watch SNOTEL streamflow forecasts. If supply is within 50% or more likelihood of not exceeding median flows, enact limited-water cropping plan. • May - Sept: Watch for signs of stress and pursue stress management strategies.

WORKSHEET 6: DROUGHT PLAN EXAMPLE

Adapted from The National Drought Mitigation Center's Drought Resources: ***https://ranchdrought.unl.edu/***

A drought plan can be as simple as a 1-2 page document that includes goals, a basic inventory, strategies, and critical dates. Use this template to bring it all together.

Farm/Ranch: **Date:**

Inventory:	*Average Precipitation and Variability: 13 inches; Drought occurs about 3 out of every 10 years. The majority of precipitation falls between May and September.*
	Potential future conditions in your area: Increased heat which leads to increased dryness, and possible more variation year to year (i.e., high production years followed by low production years).
Long- Term Goal(s) for Drought Management (max 3):	1. *Reduce economic impact of drought by increased flexibility and preparation.* 2. *Steward land resources well to maintain or increase ecological diversity and and production.* 3. *Pass on a viable business and healthy land to the next generation.*
Long-Term: Strategies (max 4):	1. *Benchmark production costs and use this to inform business directions, including considering a more conservative stocking rate and changing herd composition to incorporate more yearlings or stockers, and /or expanding direct marketing component of the business.* 2. *Pursue NRCS contract to improve water distribution on private acres.* 3. *Purchase drought insurance.* 4. *Develop diversified income sources to support cash-flow in drought years.*
Short- Term Goal(s) for Drought Management (max 3):	1. *Protect range health by responding early as signs of drought emerge.* 2. *Manage stress effectively through increased awareness as signs of stress emerge, and prioritizing time with family.*
Strategies for Managing during Drought (Short-Term) (max 4):	1. *Develop strategic destocking plan.* 2. *Evaluate pasture recovery monthly during the growing season and leave pastures when specified minimum residual thresholds are exceeded for three precipitation/ ecological type scenarios.* 3. *Cull if forage reserves are inadequate.* 4. *Utilize FSA disaster programs as needed.* 5. *Considering buying cattle if forage reserves are adequate.* 6. *Prioritize time with grandkids/ family when times dry.*
Critical Decision-making Dates and Target Conditions (Triggers):	1. *Starting April 1 through September: evaluate pasture recovery and biomass.* 2. *Minimum thresholds for biomass are specified relative to three precipitation scenarios: > 88.5% of average, 75-88.5% of average, <75% of average.*

WORKSHEET 6: DROUGHT PLAN TEMPLATE

Adapted from The National Drought Mitigation Center's Drought Resources: ***https://ranchdrought.unl.edu/***

A drought plan can be as simple as a 1-2 page document that includes goals, a basic inventory, strategies, and critical dates. Use this template to bring it all together.

Farm/Ranch: **Date:**

Inventory:	Average Precipitation and Variability:
	Potential future conditions in your area:
Long- Term Goal(s) for Drought Management (max 3):	
Long-Term: Strategies (max 4):	
Short- Term Goal(s) for Drought Management (max 3):	
Strategies for Managing during Drought (Short-Term) (max 4):	
Critical Decision-making Dates and Target Conditions (Triggers):	