Module 2: Building Resilience Part I >> Water Resources and Infrastructure

Fact Sheet 1: Stretching Water Resources in the Dry Season

With the potential impact of greater temperature extremes and periods of extended drought, an important aspect of building the resilience of your water resources and infrastructure is to look for ways to stretch your water resources during the dry season. In this fact sheet, we look at some of the tools and strategies that can help you reach this goal.

Topics Covered: ◆ Monitoring ◆ Water Budgeting ◆ Rainwater Harvesting ◆ Dry Farming ◆ Cultivar/Species Selection. Topics related to irrigation are covered in the factsheet **Selecting the Right Irrigation Strategy for your Farm**, and not in this factsheet.

How to Use This Fact Sheet

This fact sheet includes tools and strategies that are generally applicable across a range of climates and production systems in the U.S. However, every farm or ranch exists within its own environmental context, and not all tools and resources will suit your particular operation. Therefore, use this fact sheet as a starting point for your own process of exploration and discovery, focusing on what would work best in your circumstances. Before making any changes to your production system, do your research, talk to your Extension advisor or other experts, and get input from your own farm team and other farmers in your area. Then see how well those changes align with your own goals, priorities, and resources. If you decide you want to move forward with any changes, test out your ideas in a small section of your farm/ranch before scaling up to a larger area.

Monitoring

Building and managing climate resilience for your water resources and infrastructure relies on accurate information about field conditions and the effect of any changes you are making in your system over time. Developing that information requires a regular program of monitoring. Here we highlight several monitoring tools to help you with this task.

Monitoring Soil Moisture

Monitoring soil moisture is an essential strategy for stretching water resources. Soil moisture data can help prevent over-irrigation and runoff (which can result in soil erosion and water pollution) and help you assess whether the amount of water in the soil is sufficient for good crop growth. This information is vital for irrigation scheduling and managing dry farming systems. There are several methods you can use to monitor soil moisture, as described in the following resources:

- ☑ Methods and Techniques for Soil Moisture Monitoring (University of Wyoming). Covers both direct and indirect methods and techniques for soil moisture measurement, sensor technology, and installation procedures as a strategy for efficient irrigation management.
- ☑ Soil Moisture Sensors for Irrigation Scheduling (University of Minnesota Extension). Provides an overview of different types of soil moisture sensors as well as information about how to install and use each type.
- ☑ Methods to Monitor Soil Moisture (University of Wisconsin Extension)
- ☑ Principles and Operational Characteristics of Watermark Granular Matrix Sensor to Measure Soil Water Status and Its Practical Applications for Irrigation Management in Various Soil Textures (University of Nebraska Lincoln). Describes the Watermark Granular Matrix Sensor for soil moisture measurement. Covers installation, data interpretation, and practical applications in different soil textures.

To learn more about how to use your soil moisture data, see the factsheet on **Selecting the Right Irrigation Strategy for your Farm**.

Monitoring Water Availability

Knowing how much water you have available during the growing season is critical for making sound water management decisions. This applies to all sources: groundwater, surface water, and stored water. For example, in Module 1 of this course, you evaluated the susceptibility of your crops to water deficits at various stages of their growth cycle. During periods of limited water supply, this information can be useful in deciding when (or if) to stop irrigation. Regular monitoring of your available water allows you to anticipate when adjustments might be necessary. If you have rainwater stored on your farm, monitoring the water levels in those tanks or ponds can assist you in forecasting your water availability for the season and determining when that water might be needed. See the following resources for information on tools and methods for monitoring water availability:

- ☑ Measuring Well Water Levels (Oregon State University Extension Service). Provides information about several methods that you can use to measure the level of the water in your well.
- ☑ See the Rainwater Harvesting section of this factsheet for more information about how to measure pond and tank capacity.

The factsheet on **Selecting the Right Irrigation Strategy for your Farm** provides additional resources on how to use water availability data for irrigation scheduling and management.

Monitoring Weather and Drought

Keep an eye on current weather information, as well as weather and climate projections for your area. This will help you prepare for extreme weather events (drought, excess rain, heat domes) and anticipate potential long-term impacts in your area. More information and resources are available at:

- ☑ Be Prepared: Drought Monitoring and Planning for your Small Farm (Oregon State University Extension). Provides more information about available weather monitoring tools and what to do with the data you gather from those tools.
- ☑ USDA's The Climate Toolbox. Referenced in Module 1. A collection of web-based tools for assessing climate change impacts. Links at the top of the page organize the tool sets in four categories: agriculture, climate, fire, and water. We recommend starting with these four tools: *Climate Mapper*, *Future Cold Hardiness Zones*, *Historical Water Watcher*, and *Future Climate Dashboard*. This site is optimized for the Google Chrome browser, and the data is currently limited to just the contiguous 48 states.

National or state-operated weather stations can provide ballpark information about the weather in your area. This is a great place to start, and in most situations provides sufficient detail for making management decisions. However, if you have a unique microclimate and want more accurate site-specific data, you will need to set up your own weather station. The resources below can help you with this:

- ☑ AgriMet Weather Stations: agricultural weather stations located in the Pacific Northwest. Region-specific weather data can be downloaded from each station.
- ☑ Personal Weather Station for Specialty Crop Management (Iowa State University Extension). Provides information about how to select a weather station for your farm as well as reviews of several personal weather station models.
- ☑ Your Farm Weather Station: Installation and Maintenance Guidelines (USDA NIFA Southeast Climate Extension). Provides detailed information about siting and maintaining your weather station.

Water Budgeting

Developing a water budget can help you project how much water you will need on your farm in a growing season. In the Water Resources section of Module 1 of this course, you began a list of your crops and livestock and their associated water needs. You can use that information to begin developing your water budget. Other tools on this topic are listed below:

- ☑ Irrigation Scheduler Mobile (Washington State University). Although this is an irrigation scheduling tool, you can also use it to develop a water budget for your crop irrigation needs based on historical evapotranspiration data in your area using the nearest weather station.
- ☑ Western Oregon Irrigation Guides from Oregon State University Extension Service provide step-by-step worksheets for calculating crop water needs for many commonly produced crops in Western Oregon.
- ☑ OpenET. OpenET is an online platform that uses satellite data to estimate evapotranspiration (ET), the process by which water evaporates (E) from the land and transpires (T) from plants. This ET data represents the "consumptive use" of water, making it a crucial component of water budgeting. OpenET's data allows farmers to track their annual water usage, informing irrigation and crop management. By incorporating OpenET data along with rainfall and irrigation data into a water budget, users can achieve more sustainable and efficient water management practices.

☑ University Extension services and other local resource providers often have local information and tools for developing water budgets.

Rainwater Harvesting

Installing rainwater catchment systems allows you to harvest and store rainwater during the rainy season that you can use during the dry season. Rainwater harvesting systems may not be appropriate or feasible for every farm, so it is important to assess whether rainwater harvesting makes sense for your farm context before investing in rainwater catchment infrastructure. Rainwater can be harvested in tanks or ponds. The regulations governing each type vary by state and locality, so your pre-planning and assessment should also include contacting local regulators to learn about your options and how to be in compliance. Suggested contacts include your state department of water resources, local water district, and county land use planning department. Your local extension service may also have information about properly designed and approved rainwater catchment systems for your area. For more information see the following resources:

☑ Water Harvesting Assessment Toolbox (University of Arizona). Provides tools for assessing whether rainwater harvesting is a good fit for your farm.

☑ Permits for Rainwater Harvesting FAQ (Oregon State University Extension). Information about the regulations around rainwater harvesting permits in Oregon.

Your goals for your rainwater catchment system as well as certain features of your farm will dictate the design of your system. Below are several resources for designing and installing rainwater catchment tanks on your farm:

☑ Rainwater Harvesting for Small Nurseries and Home Gardens (Louisiana State University Extension Service). Provides detailed information about the fundamentals of rainwater harvesting. As you're considering your system design, this is a good place to start.

☑ Rainwater Harvesting: Guidance for Homeowners (NC State Extension). Offers practical guidance for homeowners covering essential components of a rainwater harvesting system, including cisterns, gutter systems, overflow pipes, and outlet pipes. The guide explains how to construct a simple rainwater harvesting system and its multiple benefits. Additionally, it provides insights into cistern selection, location considerations, and maintenance, along with information on local plumbing codes.

☑ American Rainwater Catchment Systems Association This website has a wealth of information about rainwater catchment system design as well as a directory of system designers, suppliers, and installers.

☑ Rainwater Harvesting: System Planning (Texas A&M AgriLife Extension). A guide to designing relatively small-scale rainwater catchment systems that hold less than 100,000 gallons of water. Note that this resource must be purchased.

☑ Rainwater Harvesting for Livestock Production Systems (University of Kentucky)

☑ The Basics of Irrigation Reservoirs for Agriculture (Clemson University Extension Service). Discusses important design and management considerations for rainwater storage ponds.

☑ Pond Measurements: Area, Volume and Residence Time (PennState Extension)

- ☑ Pond Assessment and Inspection (PennState Extension)
- ☑ Farm Ponds: Strategies for Multiple Functions (Cornell University Extension). Provides information about additional uses and considerations for on-farm ponds.
- ☑ Resources for DIY Pond Management (Natural Waterscapes). Includes resources on pond weed management, fixing leaks, and managing algae among other topics. Mention of a product or company does not constitute an endorsement of the product by Oregon State University.

The cost of installing a rainwater catchment system can be a major barrier for implementing this strategy. If you are interested in harvesting rainwater, reach out to resource providers in your area to see if they have funding available to support your work. Resource providers like the Natural Resources Conservation Service (NRCS) and your county's Soil and Water Conservation District may have cost-share programs for the installation of rainwater harvesting systems and/or may be able to help with system design.

Dry Farming and Dryland Farming

Dry farming is the practice of growing crops without irrigation during the dry season by relying on soil moisture retained from the wet season in areas that receive 20 inches or more of rainfall annually. Dry farming has been practiced around the world for millennia. Its use waned with the adoption of modernized irrigation practices, but many farmers are beginning to practice it again because of its many potential benefits, which include drought risk mitigation, improved weed control, and new marketing potential. (Dryland farming occurs in areas with fewer than 20 inches per year, where there are more constraints on which crops can be used. In the Pacific Northwest, dry farming occurs west of the Cascade mountains, while dryland farming occurs on the east side.) Recent initiatives in the Pacific Northwest have produced a number of excellent resources on the topic of dry farming:

- ☑ Dry Farming Techniques in the Maritime Pacific Northwest (USDA Climate Hubs)
- ☑ Intro to Dry Farming Organic Vegetables (Oregon State University Extension)
- ☑ Dry Farming Accelerator Program (Oregon State University). Provides in-depth information about many of the practices and principles shared in the above publication through a combination of videos and written materials.
- ☑ Dry Farming Resources (Oregon State University, Small Farms Program). Clearinghouse for research and information on dry farming. Covers topics such as which crop varieties are best suited to dry farming, what effect tillage has in dry farming scenarios, what plant spacing is appropriate for dry farming.
- ☑ Dry Farming Collaborative. Helps you connect with farmers and researchers who are studying and implementing dry farming practices. Learn about dry farming research, events, and other educational resources about dry farming.
- ☑ Dry Farming Resources – Dry Farming Institute. The Dry Farming Institute, a nonprofit based in Corvallis, OR, provides a collection of online resources as well as a Dry Farming Seed Directory for sourcing seed of dry farm crop varieties.

☑ Advances in Dryland Farming in the Inland Pacific Northwest (Washington State University Extension). Packed with tools, resources, and the most current research, this book supports farmers as they make decisions relating to productivity, resilience, and their bottom lines.

Cultivar/Species Selection

Another key strategy for stretching water resources during the dry season is to carefully select crop cultivars that are well suited to your specific growing conditions. Varieties perform well when dry farmed tend to be drought tolerant varieties; if you are not dry farming but are farming during a drought or in dry conditions, consider planting these varieties on your farm.

☑ Dry Farming Resources (Oregon State University, Small Farms Program). Contains research reports from various dry farmed vegetable variety trials.
☑ Dry Farming Seed Directory. Includes information about where to purchase seeds for crop varieties that do well in dry farmed conditions.

Animal Species/Breed Selection

Much like crop selection, selecting the right animal species and breeds for the water conditions on your farm is an important tool in your climate resilience toolbelt. When going about this process, it is a good idea to select animal species and breeds that are well suited to or originate from places with conditions similar to the ones that your farm will experience due to climate change. The livestock section of this module discusses breed and species selection in climate change in greater detail. Below are several resources to get you started on this topic:

☑ Livestock Breed Comparison Charts (The Livestock Conservancy). These charts provide information about place of origin of many different livestock breeds in addition to other breed characteristics.
☑ Breeds of Livestock (Oklahoma State). Detailed descriptions of a number of cattle, sheep, goat, horse, swine, poultry, and other livestock breeds.

Where to Find Local Assistance

Whatever your goals are for managing your water resources, we encourage you to connect with other people who can provide expertise and advice, and support you in your efforts to build greater climate resilience. Below, we include an initial list of potential contacts to get you started. In addition to offering technical guidance and information, some state and federal agencies may also have funds available for farmers and ranchers in the form of grants, cost-share programs, or loans that can help cover some of the costs of implementing the climate resilience and water management practices highlighted in this course.

Extension Service. You can find your local county Extension Service by searching your county name followed by 'Extension Service'.

USDA Natural Resources Conservation Service. To find your local office, see NRCS—Find Your Local Service Center.

Resource Conservation Districts. Conservation districts are local units of government established under state law to carry out natural resource management programs at the local level. Districts work with millions of cooperating landowners and operators to help them manage and protect land and water resources on private and public lands in the United States. Search this website to see what is available in your area: List of Resource Conservation District's nationwide by region.

Other types of conservation districts and rural development organizations. In addition to Resource Conservation Districts, your state may also have other organizations with similar goals and are ready to support you in your climate resilience work. Search this website for more information on your state (scroll down for clickable map): Land Conservation Assistance Network / Soil and Water Conservation Districts.

State and local nonprofits who work with farmers and ranchers. Ask your Extension advisor or other farmers in your area for suggestions.
Farmer-to-farmer networks. Ask your Extension advisor or other farmers in your area if they can recommend any groups that work in your region.

In addition, check with your:
Local water regulatory agency (in Oregon this would be Oregon Water Resources Department).
Local irrigation district or ditch organization.

September 2025