Creating Dryland Gardens

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In most of the world a garden is viewed as a treasured place of abundance, beauty and security. In the dry Plains ecoregions of Texas and its neighbors, most homes have some lawn and plantings, but many rely on irrigation using groundwater. Growing plants perform many valuable services such as increasing comfort by modifying microclimates. But can gardens perform as well using only rainfall?

Throughout the southern High Plains, communities are concerned about limited groundwater resources. The Ogallala aquifer that supplies eight states and the entire Texas Panhandle is showing declining water levels. If farmers are adapting their crop choices and extent of irrigation, non-farm households can also adapt water use to do more with less. Rain is better for plants than ground water, and with new strategies can become the main support of gardens.

The Alternative to Irrigation

Is the only alternative to irrigation the 'gravel-scape?'. Desert plants in xeriscapes are necessary in El Paso with 4" of annual rainfall, or Phoenix with 7". But the Panhandle, blessed with more than twice as much rain, can use a much wider variety of plants.

Rain of 16- 18" falls on Dalhart, Guymon OK and Hobbs NM. 19- 20" falls on average in Amarillo and Lubbock. To the east cities like Pampa, Clarendon, Borger, Plainview, Post and Childress receive 21- 24" average per year. The timing of rainfall is the main problem here as droughts can be long. But if Panhandle residents embrace drought tolerant plants and plan ahead, rainwater gardens are possible in most situations.

What Do Gardens Do?

Plantings send a signal that communicates a home is lived in and has value. Street trees indicate the quality of neighborhoods. Other functions of residential gardens include:

- space for privacy or gatherings
- source of flowers and/or food
- a visual connection between a building and its site
- shade and evaporative cooling
- wind protection
- reduction of wildfire risk (with special planning)

Images above, top to bottom: Southern California xeriscape[1], Succulent plantings near Amarillo.

[1] Photo used by permission from Wikimedia Commons by Downtowngal.

To reach its full potential, a dryland garden should also function as a low-tech system to conserve and concentrate water, and in some cases cleanse or recharge stormwater.

Steps to an Exceptional Garden

Many of these functions need a special garden to succeed in a dryland environment. Plan carefully and get knowledgeable help to follow these steps:

1. Choose among and prioritize the functions needed.
2. Sketch out what happens where.
3. Decide what functions will receive more water while reducing water use overall.
4. Choose plants: use a percentage of both local natives and drought tolerant introduced plants.
5. Outline the different stages of work.

Gardens that reinforce our sense of place and pride in our communities can be verdant yet support the future of our farms and our communities.

A step-by-step planting sequence for the future can greatly reduce garden cost. Plants for a special purpose that are suited to our alkaline soils, our winds and our rainwater resources may be worth waiting for. Some native trees may not yet be common in the nursery trade. Plant the taller shrubs and trees first and allow nature to work its magic for you. Results may last for decades and will be worth the wait.

Choose Water Use Intensity for Specific Functions

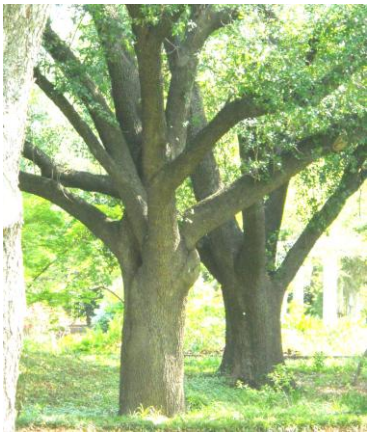
Estimate the water needs for desired function, considering alternatives. Use water intensely for only some of these functions. Sometimes a smaller area of a rich resource looks more precious by contrast with simpler surroundings.

Shade can be provided by:

- Many large, tall trees with dense branching (high water use)
- Some small trees that shade from the low afternoon sun (low-medium water use)
- Filtered shade from a few smaller, more open drought-tolerant trees (low water use)
- An overhead trellis (no water use but no evaporative cooling unless you plant a vine)

Flowers can be:

- Large beds of perennials and annuals for constant bloom and cut flowers (high water use)
- Scattered blooms throughout the year on different shrubs (medium or low water use)
- Scattered blooms in one or two seasons on a variety of succulents including cactus (no water use)



Images above, top to bottom: Dense foliage mature shade trees, Open form desert willow tree

Lawns can vary between:

- The entire site mowed, shaded lawn for heavy traffic (high water use)
- Small focused area to withstand some traffic (medium water use)
- Sunny area for light traffic in native Buffalo grass (low water use, takes care to establish)
- Low prairie grass and flowers seldom mowed (little to no water use, process takes 18 months)

Privacy can be created by:

- 6' tall evergreen hedges enclosing the entire site (high water use)
- 6' tall native deciduous hedge along the most exposed side (medium water use)
- Combining fence with native evergreens (low to medium water use)
- Locate private areas at the rear and add native deciduous shrubs for screening (low water use)

Water is precious. Use lower levels of water as much as possible.

Images above, top to bottom: Irrigated lawn and boxwoods, Tall grass prairie planting in native lawn[2].

Group grasses, perennials, shrubs or trees with the same types of water need near each other. This has been discussed as 'oasis gardening' in books and articles by Art Ludwig and others. Drought tolerant plants can become weak or weedy if fertilized, so use separate beds for plants with different needs.

Let Nature Help

For dryland gardens to prosper, gardeners must learn to use micro-climates wisely, welcome and cherish moisture, and nurture roots.

Above all else, nurture deep roots. Nursery plants need temporary irrigation for the first two years to wean them from high water use and develop deep roots. A plant that can survive with watering once a month may have been raised with watering every 3 days. Give it the soil it requires, mulch it well and soak it upon planting. Don't spray plants with a hand held hose. For the first year prevent new plants from wilting. Water once a week during the growing season with a good soaking. Some plants need water during early winter or late spring, but desert plants suffer if watered during their cold, dormant season During the second growing season water once every other week. By the third year, roots should be ready for less frequent watering.

Water puddles if too much is applied to our clay soils too quickly. Irrigation is often applied in cycle and soak schedules- short application, pause for an hour, apply again. For water to soak deep it may need to be applied below the surface. Methods of releasing water under ground are discussed later.

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[2] Public domain photo from Wikimedia Commons by the Environmental Protection Agency.

Space drought-tolerant plants that will eventually receive little or no irrigation far apart so that wide root spreads can gather more water. Erosion often reveals that native junipers have deep roots reaching 10- 20' in both directions. Widely spaced dryland plants may be most attractive used as backdrops behind other plants, so the spaces of open gravel are less obvious.

Take advantage of natural windbreak effects of buildings, walls or other vegetation to reduce drying by wind as well as mechanical damage. Quick growing 'nurse' trees upwind can help slower growing target species grow quicker. Remove them before the roots interfere. Plants that tolerate part shade may thrive while they are small and more vulnerable if offered some shade from fencing or nurse shrubs planted on their south or west sides. Masonry walls and paving heat up, causing warmer microclimates if they receive sun in midday and afternoon hours. Use this to your advantage for plants that are at the northern edge of their hardiness zones. Don't use these areas for plants that are happier further north and barely tolerate our heat.

Use mulch to retain moisture in the soil. Choose mulch to suit the plant- gravel or stone for xeric plants but organic chips or compost for others. If gravel is needed under deciduous trees or shrubs with tiny leaves (like cedar elm) use larger stones instead. Unite mulch areas into larger beds and paths to simplify garden compositions. Edging and ground covers should be simple to allow the focus to remain on more upright plants or a few special elements like benches or sculptures.

How to Welcome Moisture

Choose not to see the nearly level Llano landscapes as dull and frustrating. Their unusual flatness is a subtle but pervasive composition element to be framed by taller shrubs and trees. But to use rain, add gentle slopes so gravity will collect stormwater and deliver it to your plants. Re-grading is impossible after plants are established, so consider a new garden as an opportunity for better water management.

Rain does not soak into lawns as well as into forests, native shrub areas or open fields. A large percentage of the rain that lands on lawns runs downhill, towards streets or drainage ditches. No rain soaks into buildings or pavement. Water that in the past would have slowly soaked deeper, possibly recharging aquifers, now increases surface water flows. This stormwater runoff increases peak flows after storms that cause erosion and/or flooding downstream.

Photos above, top to bottom: Newly planted bioswale for stormwater[3], Planted rain garden in Oregon[3].

Rain gardens have multiplied from Florida to California to detain and clean runoff, but have not as often been used in our more level landscapes. They are swales or small basins filled with plants that tolerate intermittent soaking and damp roots. Runoff from roofs, driveways, roads or parking lots has pollutants like oil and chemicals that can be reduce or removed by vigorous grasses, perennials and shrubs. The slowing of runoff and reduction by infiltration reduces soil erosion and benefits groundwater levels.

[3] Photos used by permission from Wikimedia Commons, from top to bottom: by Aaron Volkening, EmilyBlueGreen.

Desert dwellers have often used micro-catchment (planting in waffle shaped areas) to direct runoff to plants spaced apart. Pitting is the use of enlarged planting 'saucers' to place individual plants in gentle dips lower than surrounding ground levels to receive extra runoff. Contour 'bunding' is the use of low stone or clay berms following the contour, with small 'ties' running slightly uphill. Trees or shrubs are planted just above the berm which retains some of the natural downslope runoff. If planting beds are mulched, berms or pits of a few inches height will not be noticeable but may still increase water directed to plants. This can be particularly helpful when plants are young.

A related technique used at the Lubbock Arboretum in a Master Gardener display area effectively slowed runoff from pavement that was eroding gravel paths. New garden beds formed a curving gently sloped swale, and repeated half-moon berms were shaped like soil erosion control checkdams with larger gravel (to resist motion from water forces) placed along the swale midpoint. This can be called a berm and basin installation.

Image above: Erosion control checkdams[4].

The most serious hindrance to rain gardens in our region is the common heavy clay soil of the Llano areas. These soils are called 'well-drained' under normal limited rainfall. But when water is concentrated by adding more from nearby impervious surfaces, clays often retain puddles which do not percolate. Rain gardens in heavy clay soils must be sized conservatively or have added infiltration features.

Some users cut road curbs to allow storm runoff from public streets into their property. This can be a source of significant amounts of water that might need to have pollutants removed. But stormwater handling must be accurately sized for the site soils to prevent nuisance standing water and/or mosquito breeding. In Amarillo reducing stormwater runoff amounts can result in reductions to your water bill and/or installation cost rebates if plans are approved by the city.

Infiltration Structures

Irrigating by dripping or spraying water on the soil surface provides little water deep within clay soils. A swale or basin infiltrates only as much water as its square area can transmit slowly through our clay soil.

One traditional supplement used in desert areas with sandy soil that drains too quickly is to dig holes for 'olla' unglazed ceramic jars and place the top at ground level. A stone is placed over the top and removed to periodically fill the jar. Simple ollas can be made by joining two unglazed planting pots if the bottom one has no hole and the top has a hole. Olla application rate is slow so this is more useful for small plants. Ollas also become eventually clogged from minerals in the irrigation water. Some gardeners use gallon milk jugs with pinholes instead.

To provide water to tree roots a soil augur can create a hole several inches in diameter 3 or 4' deep. After gravel is added to form a bottom layer, a perforated pvc pipe can be installed with the top cut off at ground level. Several are used around each tree and covered with a stone or tile in between use. Irrigation

[4] Image by Tennessee Water Resources Research Center

companies have made more sophisticated tree watering devices that use a copper mesh to discourage clogging by tree roots.

A french drain is a simple delivery method that can provide deeper water supply to linear planting beds for trees or shrubs. Adding a french drain at the low point of a swale increases the infiltration surface and provides temporary storage. Construction is simple as filter fabric is laid in a square cross-section trench dug with a level bottom. The trench is filled with gravel (or broken bricks and sand) and topped by the fabric. Gravel is placed on top to protect the fabric from wear.

A drywell is larger but has a similar function. Often a round hole is dug several feet deep and the edges lined with stacked brick or urbanite to retain the soil. Filter fabric is laid on the bottom and sides and the central space is filled with gravel and/or stones. The fill in the center must be firmly stacked or compacted and well covered with filter fabric to prevent settling or silt filling the voids.

Harvesting Rainwater

When rain falls intermittently but in intense storms, modest garden swales and basins can be inadequate to detain it and much ends up in surface waters.

Rainwater can also be harvested from roofs and stored in large tanks or cisterns for later reuse. The Texas manual provides many details. With a simple pipe device to divert the small 'first flush' amount that rinses dirt off the roof, rainwater can be saved for later irrigation during short or long droughts.

If filtration and disinfection systems are used, rainwater also makes excellent potable water for drinking, cooking and bathing.

Through either simple or more sophisticated systems, rainwater harvesting directly reduces withdrawals from limited groundwater resources as well as allowing users more direct control over the quality of their water.

Using Gray and Alternative Water

If stormwater cannot be harvested and stored, it can also be supplemented during drought periods by adding greywater or other alternative water sources to subsurface infiltration. Greywater is legal to use in Texas, Oklahoma and New Mexico. Check your state for their specific requirements. Generally greywater is water drained from clothes washers, bathtubs or showers and bathroom sinks. Usually it must be applied only below ground.

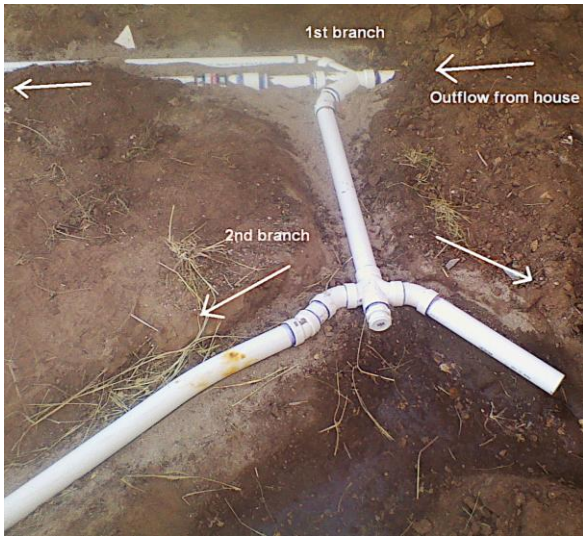


Image above: Branched drain greywater piping with joints level at each branching point.

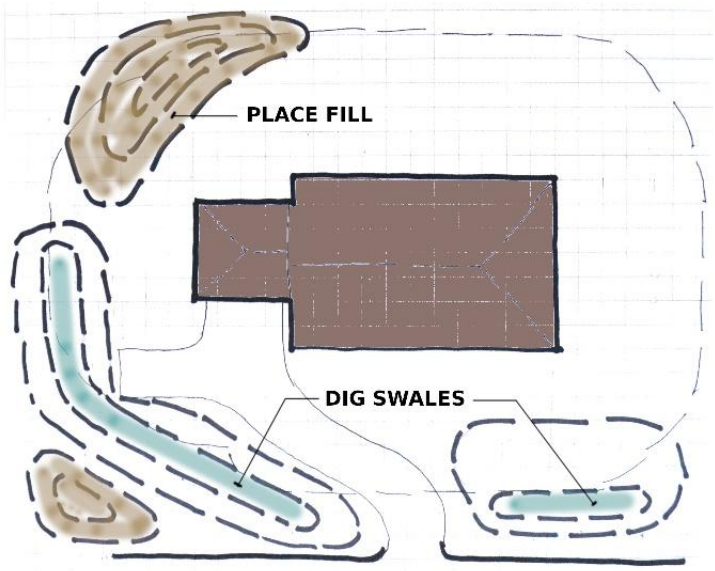
If greywater is stored for 24 hours before dispensing, bacteria can increase, so the simplest way to use it is to run it directly to some sort of sump, and then directly into a subsurface irrigation system. The sump can be cleaned in case of grease or fiber buildup.

Books by Art Ludwig or Brad Lancaster show simple diagrams of how to run a branched pipe system that delivers it directly to plants. Greywater without filtration can clog smaller irrigation applicators, but if added into a french drain infiltration trench it should be delivered to a level spreader pipe with level drain holes a small distance above the bottom.

Water from kitchen sinks contains too much nutrient load (grease and broths containing food elements) or possibly bleach. Water from toilets or that used to wash diapers should also never be used.

New construction can have plumbing that runs the correct types of drain lines into irrigation, though some states require that systems have a valved alternative route into normal septic or sewer lines. Clothes washers are the simplest way to access greywater in a pre-existing building, because the washer drain is usually a hose placed loosely in a larger drain (an effective air gap system that is important to prevent cross-contamination into the potable water system which is unlikely but very problematic if it happens). If users limit bleach or strong cleaners to separate rinse cycles drained into the conventional waste lines, and use plant friendly detergents, then most of the 40+ gallons a week that 3- 4 people use to wash clothes can be re-used to supplement irrigation.

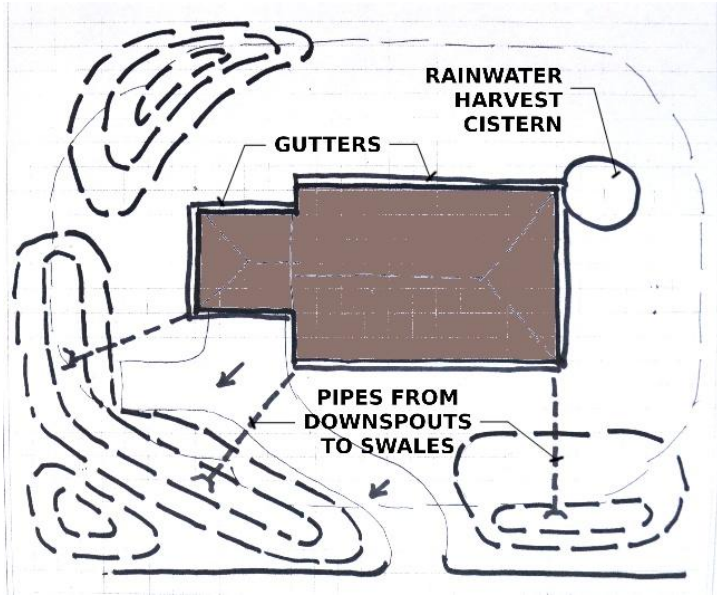
One easy to access alternative water source is the condensate drain from air conditioners or heat pumps, which is clean enough for many uses.



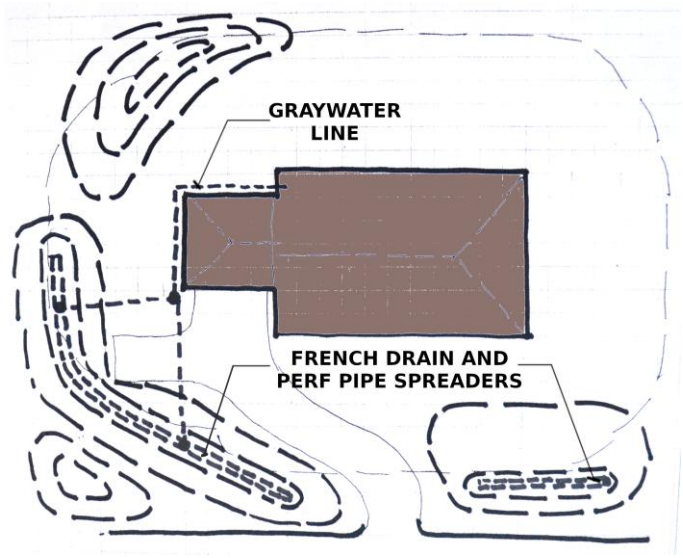
Example Plans for Runoff Reuse

The sketch site plan above right shows the simplest way to use stormwater by capturing it downhill from paved areas and/ or from the building. Fill must be located where it won't direct runoff toward the building.

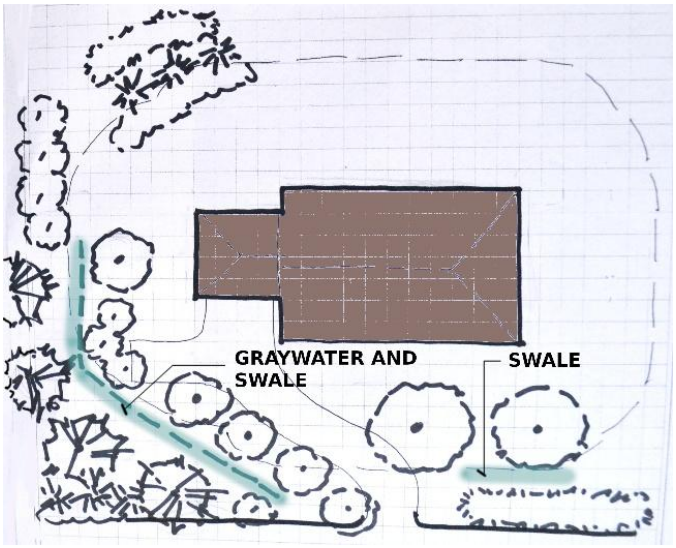
The plan at right shows how the same depressed swales can receive runoff from gutters on the building. This can reduce evaporation loss or runoff down the driveway to the street. An added cistern should be located away from the front of the house and where it can conveniently receive water from downspouts that are not convenient to the swale system.



The sketch plan at right shows where a greywater line might be directed from a clothes washer in a utility room to join french drain-type infiltration areas. A level pipe spreader would be added because the flows from household greywater are likely to be smaller contributions that never fill up the gravel voids and would only soak in right below the pipe outflow points. If the greywater line is not convenient to the swale to the right side, concentrate use of the greywater in the left side swale only.



The final sketch plan below right shows potential use of the storm runoff. Evergreen trees and shrubs at the lower left would develop into a windbreak. The dashed line around the building shows a potential setback of 30' that would define the open zone for wildfire prevention- most conifers are highly flammable and best located more than 30' from buildings. The individual trees closer to the building could be low-flame deciduous varieties for both fruit and wind reduction like nectarines, followed by several large fruiting shrubs like Chickasaw plums. A line of more drought tolerant deciduous shrubs can be planted further from the swale, and plantings on the small fill berm may need to include some very low water use succulents if they are on a sunny slope facing south.



Although dryland gardens may take thought and planning, there are many strategies to make plants thrive without using groundwater for irrigation in the Texas panhandle and neighboring counties.

More information is available on my research page online about species of low-water plants that thrive in Panhandle soils and climate and about plants that have tested low or high flame response.

All photos and drawings are by Patricia Stouter unless listed otherwise.