Towards Sustainable Gardening: Rainwater Harvesting and Greywater Use

March 22, 2014

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Alternate Water Sources for our Gardens-

- Rain
- Greywater
- Why bother?
The California Water Story

Water Conservation -

Important for all Californians

All the time
“But I’m on a well ...!"

- Groundwater + Surface water -
  - a connected system that feeds creeks
Sierra foothill groundwater

- stored in cracks - unpredictable, localized, and not well studied

- generally only a few hundred feet deep.

[Image: Water stored underground in cracks and pores]
So, we all need to conserve water

Gardens = A big piece of the pie

On most of West Slope, water used per day per person =

60% Outdoor

= 144 gallons

240 gallons

Source: EID Feb 2014
Goal: Sustainable Gardens that can handle drought

1. Lower our water demand:
   – Plant selection
   – Garden layout
   – Irrigation methods, timing
   – Mulch
Goal: Sustainable Gardens that can handle drought

1. Lower our water demand:
   - Plant selection
   - Garden layout
   - Irrigation methods, timing
   - Mulch

2. Alternative water supply:
   - Rain
   - Greywater
Legal to collect/use

New California Plumbing Code

- Rainwater tanks now regulated in California
- Permit not required if
  - Storage < 5,000 gallons
  - Tank directly on grade
  - Height: diameter or width < 2:1
  - Non-spray irrigation
    » Surface, subsurface, drip
Rain

Water quality:
Good soft water- plants love it
Prevent contamination-
from roof itself
from critters
Rain

Challenges to address:

• Timing of rain (winter) vs need (summer)
• Avoiding contaminants
• Mosquitos/critters- exclude
• Drowning hazard to children
• Algae- keep in shade
Rain

Just how many inches of rain do we get a year?

<table>
<thead>
<tr>
<th>Annual Rainfall</th>
<th>Average</th>
<th>Lowest</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Dorado Hills</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Placerville</td>
<td>39</td>
<td>15</td>
</tr>
<tr>
<td>Camino</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>
Rain

How much rain can I collect then?

\[
\text{square footage of building (ft}^2) \times \frac{\text{inches of rain}}{12} \times 7.48 \times .9 = \text{Gallons of rain that can be collected each year}
\]

For a 10 x 12 ft shed:

\[
120 \text{ ft}^2 \times \frac{39}{12} \times 7.48 \times .9 = 2,625 \text{ gallons}
\]
Behind the Averages

It may make more sense to focus on lows...
Rain

What size shed would be needed for lowest rainfall years?

\[
\text{Gallons of rain that can be collected each year} = \text{square footage of building} \times \frac{\text{inches of rain}}{12} \times 7.48 \times .9
\]

For a 25 x 12 ft shed:

\[
300 \text{ ft}^2 \times \frac{15}{12} \times 7.48 \times .9 = 2,525 \text{ gallons}
\]
Rain System parts

- Screening of roof:
  - big debris
A homemade first flush diverter
Rain System parts

• First flush diverter is nice
Rain System parts

• Overflow –
  – Size it big enough
Rain System parts

- Mosquito/critter/child protection
Rain System parts

• Way to get water out-spigot is nice
Rain System parts

Way to clean barrel - every two to three years
Rain System parts

• “Do not drink” signage

CAUTION:
NONPOTABLE WATER,
DO NOT DRINK
Rain

Some rainwater systems
Surge tanks
Rain Large tanks
Rain   Multiple barrels connected
Rain
Mosquitos

- Carry diseases -
  - West Nile Virus

larvae

pupae

emerging adult
Mosquitos

- Carry diseases - West Nile Virus

Don’t confuse with very young tadpoles!
A Different Approach -
Store rainwater in the soil

- Rain gardens
- Earthwork diversions and basins
Rain Gardens

- “Sunken” into ground
- Low water use plants
- Seasonally inundated
- Onsite stormwater
Rain Gardens

- Must plan for overflow
- Water should not stand > 24 hours
- Do not site in naturally wet area
Rain EID Rain Garden
Rain Elk Grove Rain Garden
Rain  Advantages of Rain Gardens

- Inexpensive
- Accumulate resources like leaves along with the water
- Reduce runoff
Rain Expanding: Earthworks

- Typical garden-
  - Sunken paths
  - Raised mounds
Rain

What if instead, we raise the paths?
Rain Raised paths, “sunken” gardens
Rain

Trying it out in Diamond Springs
Rain Earthworks

• Build berms/basins, trenches, canals
• Divert rain water to plants
• Slow water for better infiltration
Tools Needed

Rain

• Careful observation
• Creativity
• Shovel
Rain Orchard berms
Rain  Water diversion “canals”
Rain

What about oil from driveways?

Bioswales
Rain Soil Intake of Water

```
<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Basic Intake Rates for Bare Soils*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>0.6</td>
</tr>
<tr>
<td>Loamy Sand</td>
<td>0.5</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>0.4</td>
</tr>
<tr>
<td>Loam</td>
<td>0.35</td>
</tr>
<tr>
<td>Clay Loam</td>
<td>0.2</td>
</tr>
<tr>
<td>Silty Clay</td>
<td>0.15</td>
</tr>
<tr>
<td>Clay</td>
<td>0.1</td>
</tr>
</tbody>
</table>

* Units are inches per hour
```

Source: EID website
Rain Water in Soils

Water Holding Capacity by Soil Type

- Available Water
- Available Water Under Stress
- Field Capacity
- Unavailable Water

Percent Water by Volume

MAD or YTD
PWP
Unavailable Soil Water

Source: EID website
Rain Earthworks increase infiltration

Act as porous sponges-
water is pulled into soil quickly

Helping them act as sponges:
* Mulches
* Vegetation-
  roots make microchannels
facilitates other soil life that improves infiltration
Rain

Soil infiltration

Compacted and Unproductive

- Shallow, stunted rooting occurs
- Poor air & water movement

Open, Fertile and Receptive

- Increased yields and soil productivity
- Enhanced soil structure holds water & nutrients
- Roots, water & air move freely & distribute uniformly

Water ponds on the surface
Challenge: Our hot, dry summers

http://www.backyardnature.net/sierras/wx-place.gif
Enter: Greywater

Continued supply in dry hot season:

- Landscape, 60%
- Toilet, 11%
- Clothes Washer, 9%
- Faucet, 6%
- Other, 2%
- Shower, 7%
- Leaks, 5%
Greywater

What it is (and isn’t)

Legality of using it

What’s in it

Where to use it

How to use it
Definitions

Potable Water- safe to drink

Nonpotable water-

- Greywater- wastewater from clothes washers, showers/baths, bathroom faucets

- Blackwater- wastewater from toilets, kitchen sinks, dishwashers, anything contaminated like diapers
Greywater: A long history of use—and also a history of being illegal to use.

Regulations vary state to state, and even year to year.

Became more widely legal in 2009 in California.


Be careful what you read online or hear locally!
History of Use

Greywater

In Calif: used in 1970’s, early 1990’s, since 2009

Also used- Australia
Arizona,
New Mexico
Texas
Greywater

Intro to current CA law:

Intent is to facilitate: “greater reuse of laundry, shower, lavatory and similar sources of discharge for irrigation and/or indoor use.”
Greywater can have pathogens-
- E. coli,
- salmonella,
- giardia,
- etc.

Prevent all direct human contact
Chemicals in Greywater

• Good:
  Phosphorus

• Bad:
  Chlorine bleach
  Boron
  Sodium/salts- 
    * toxic
    * interferes with ability to take up water
Soaps:
- want biocompatible, not just biodegradable
  - No bleach
  - No boron
  - No sodium, salts
  - Or: Use less soap

Some safe laundry detergents:
*ECOS, Trader Joe’s, Vasca, Dr. Bonner’s...*
Look for “safe for greywater” label
Prevent Salt Built Up in Soil

1. Divert greywater to sewer during rainy season
2. Let the rain leach salts out
3. Enhance leaching of salts by diverting extra rain (e.g., earthworks)
4. Use low sodium soaps only
Greywater

Don’t use:

- lawns
- root crops
- where edible plant parts touch ground

To be safe, UCCE recommends only ornamentals.
Where to Use

Greywater

But not on acid loving plants:

Azaleas
Camelia
Gardenia
Rhododendron
Begonia
Hydrangea
Fern

Philodendron
Xylosma
Bleeding Heart
Foxglove
Impatiens
Primrose
Violet
How to Use Greywater

Best use:

trees and shrubs

Best way to deliver:

under at least 2” of mulch
Why under mulch?

Greywater

Soil is alive!

One teaspoon =
One billion living microbes!

Mulch: air, organic material = good home for the rich soil biology to break down hair, lint, etc.

Mulch = mini-treatment plant for greywater
**Mulch basin**

**Figure 5.3: Standard Mulch Basin for New Planting**

- Root crown
- Dirt from basin forms walls
- Root extent
- Drip line
  - Basin width = several times diameter of plant

*Slide from Laura Allen, www.greywateraction.org*

*Image from "Create an Oasis with Greywater" by Art Ludwig*
About mulch

• Add to top of ground- don’t mix in
• Keep several inches away from trunks of trees
• For greywater mulch basins, large wood chips are best- also small wood chips, bark, even gravel
Greywater outlet, irrigates drip line of tree. Mulch basin will be filled to top when complete.

Image from Create an Oasis with Greywater
Greywater Basics Outdoors

Do's
- Use mulch
- Use a 3-way valve
- Use plant friendly products
- Use a "proven" design

Don'ts
- Store greywater
- Use a filter that needs cleaning
- Use if you're near a creek or river
- Use if water doesn't drain on the site

Slide from Laura Allen, www.greywateraction.org
Greywater  County Bldg Permits

Not needed: Laundry-to-landscape

Yes: All other greywater systems
A small and simple start...

Mistakes:

Hoses too small for outlet

Connection was too low and machine siphoned water out

Have to protect machine from weather
Laundry to landscape - permit exempt system
(Materials only: $100-$250 Full installation: $700-$2000)

Slide from Laura Allen, www.greywateraction.org
- 3-way diverter valve
- "auto" vent (prevents a siphon from draining machine as it tries to fill)
- 1" pipe
Discharge under 2" into mulch

½ inch lines irrigate off main 1" line

Bury and stake tubing

Slide from Laura Allen, www.greywateraction.org
Code compliant- GW discharged under mulch shield

Not code compliant
Greywater

- Landscape: 60%
- Shower: 7%
- Leaks: 5%
- Toilet: 11%
- Clothes Washer: 9%
- Faucet: 6%
- Other: 2%
Shower and Sink Systems

Image from "Create an Oasis with Greywater" by Art Ludwig
Installing a 3-way valve (requires a permit)

1. 

2. 

3. Greywater enters

Greywater

Sewer

Slide from Laura Allen, www.greywateraction.org
Remote 3 way diverter valve

Diverts greywater to sewer

Comes in different sizes
Branched Drain System
$150-300 materials only, $1,000-3,000 complete installation

- Flows by gravity
- No moving parts
- No external filters
- Flow is divided using flow splitters

Final outlets receive a few gallons each use - system is sized to match plant needs.
Future tree

Flow splitter divides flow in half

Greywater in
Branched drain - one shower subsurface, gravity, no storage

Newly planted trees and shrubs - 2 weeks after greywater install and planting
Can be simplified—move the shower outdoors....

Or

Simplest of all...
Common errors

- storage tank
- pump zealously
- filters that need changing

"I'm going to pump my greywater to the top of my property and store it in two 500 gallon tanks, then gravity flow it down the hill to irrigate through a soaker hose."

"I put a 80 gallon tank in my laundry room that collects the laundry water. Then I pump it outside into a sprinkler to water the lawn. At first the sprinkler clogged, so I added a sock filter to the inflow of the tank."
Greywater is a Resource

- Saves water
- Saves energy
- Saves water/energy/chemicals at treatment plant
- Encourages healthy product use
- Connects people to their yards
- Protects rivers
- Redefines our relationship to water
- Creates green jobs
We are in a drought.

Water is a limited resource even in good years.
We’re not the only ones that need water
Treat Water Resources with Care

Don’t forget:

plant selection, garden design, and irrigation methods

* Rainwater and greywater can save water and lead to more sustainable gardens

* Be creative and thoughtful-


Find what works in your unique yard
Thank you

Laura Allen, Greywater Action
Art Ludwig, Create an Oasis with greywater, 2009
Brad Lancaster, Rainwater Harvesting for Drylands and Beyond, 2009
UCCE greywater fact sheet, https://ucanr.edu/mg/users/Documents/5758Dealing%5Fwith%5FDrought50709.pdf