

Greywater in the landscape

Don Shor

Member, Tree Davis Board of Directors





Properly installed and managed,
greywater can:

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- augment our irrigation of established shrubs and trees,
 - help to establish young trees,
 - safely be used near many landscape species.
 - Care should be taken in the planting design and system installation for how close the wet zone is to some types of plants.

Key issues

- Cannot be stored
- Water output is intermittent and variable
- Output doesn't correlate with plant water usage
- Some landscape species are intolerant of frequent irrigation





Solutions:

Apply carefully to woody species

- Site outflow away from plant crown
- Ensure that water drains away from woody plants
- Be aware of vulnerable species
- Useful to establish young trees
- Use to augment irrigation of larger shrubs and trees



Safety first

- Use of grey water in the landscape needs to be safe for humans, and safe for the plants.
- Food safety: primary risks are *E. coli* and salmonella.
- Do not use greywater with low-lying vegetables and fruits such as strawberries; leafy greens, and root vegetables.



Fruit and nut trees

- The outflow from a washing machine may provide enough water for a young fruit tree that's getting established in its first or second summer.
- Daily watering is not optimal even for newly planted trees. Fruit trees are generally watered deeply and infrequently, with amount and frequency largely determined by soil type.
- Denser soils retain moisture which can lead to crown and root rot.
- For an established tree, laundry irrigation not likely to provide all of what the tree needs but can certainly be used to augment the irrigation system or hose watering.

Plant issues

- Safe use around plants specifically means avoiding creating conditions that can lead to root or crown rot.
- Crown rot is one of the most common summer problems in our landscape when we “overwater.”

Joseph OBrien, USDA Forest Service, Bugwood.org





“Overwatering” is a misleading term

- Applying a very large amount of water all at once is not harmful to a plant so long as it percolates into the soil or drains away from the crown.
- Watering so often that the area at the interface of the bark and the soil stays constantly wet is an invitation to crown rot infection.



Crown and root rot are caused by water molds aka oomycetes

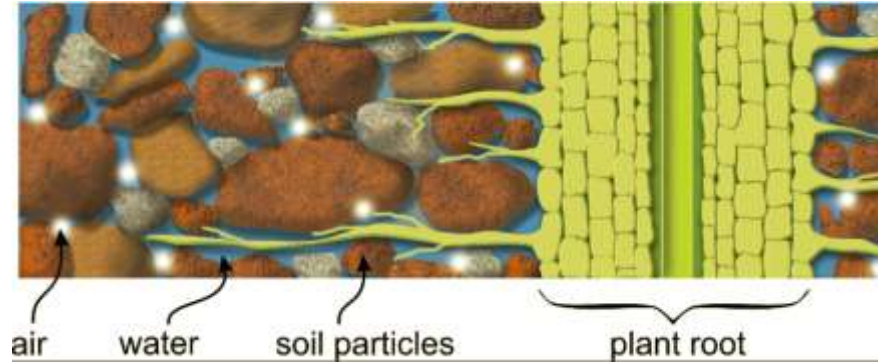
- No longer considered fungi, now classed with algae.
- The key organisms in landscapes and ag are *Phytophthora* species
- Highly invasive and have caused widespread crop injury worldwide:

Late blight of potato (*P. infestans*)

Sudden oak death (*P. ramorum*)

- Crown and root rot: *Phytophthora cinnamomi*.

Motile spores and moisture enhance the spread



- Zoospores can swim
 - In a film of water on a leaf
 - On the surface of a root
 - In free water in the soil.
- Likeliest infection is at high temperatures with high soil moisture.
- Dense soils retain moisture and increase susceptibility (poor drainage)
- Irrigation frequency in summer is the commonest factor.



Why is crown rot such a problem in our landscapes?

- Plants that evolved in regions where there is summer rainfall are likelier to have resistance to crown rot.
- Those that evolved in dry-summer regions are not likely to be resistant.
 - These are some of our key species in xeric landscapes!



Resistance vs susceptibility

- Example:

Leaves of *Arbutus unedo* (strawberry tree), native to Ireland and other parts of Europe, contain substances that suppress phytophthora (and other pathogens)

Arbutus menziesii, our native madrone, is so vulnerable that it is rarely grown successfully outside of its native range.

Best- management practices for crown and root rot:

- Manage irrigation frequency: allow surface drying between waterings
- Planting: avoid prolonged moisture status around the crown (don't bury the root flare)
- Grading: woody plants should be installed an inch or so above grade so that water will percolate away from the crown.
- Buried emitterized tubing is often set to water daily, which can increase crown rot. Allow surface drying between waterings.
- Greywater systems that supply water daily can be problematic for susceptible species.
- → The outflow should be away from the crowns of woody plants.



Very susceptible species

- Plants from dry-summer areas can be vulnerable and these are some of our preferred plants for low-water or xeric landscapes. Especially vulnerable are many of the popular California native shrubs and trees.
 - *Fremontodendron* (flannel bush) are so susceptible that even very careful native plant experts kill them off regularly.
 - *Ceanothus* (wild lilac), some of our most popular natives, are quite susceptible. “Garden-tolerant” varieties have been identified. Examples: ‘Yankee Point’, ‘Concha’.





Some other very susceptible species

- *Arctostaphylos* (manzanitas) apparently susceptible to root rot symptoms: chronic micronutrient deficiencies and sporadic dieback.

Some “nativars” are considered resistant (“garden tolerant”).
Example: ‘Howard McMinn’.

Very vulnerable: *Arctostaphylos uva-ursi* (bearberry), the ground cover species. Coastal origin, not adapted to interior soils and climate.

- *Rhamnus* species
 - native *Rhamnus californica* (coffeeberry)
 - Mediterranean *Rhamnus alternus* (Italian buckthorn)
A tolerant cultivar of *R. alternus* has been introduced (‘John Edwards’).

Oaks are a special concern.

- *Phytophthora cinnamomi* has been decimating native and planted stands of cork oak (*Quercus suber*) and other species in Europe.
- Our native species are also vulnerable.

→ **Mature native and Mediterranean oaks in the landscape should never have irrigation increased around their trunks.**

It has been observed that young oaks can be irrigated properly without issues.

(Note: this is not sudden oak death (SOD); that is *Phytophthora ramorum* which is confined to our coastal fog belt of Northern California.)



California natives that are resistant?

- Riparian species: willows, cottonwoods, and other streamside species are tolerant of constant and intermittent moisture and tend to resist crown and root rots.
- Not commonly recommended for our landscapes –
 - aggressive roots (adaptation for acquiring water) can be problematic in small yards.
 - most have pest issues





Southwestern natives more resistant?

- Plants native to Arizona, New Mexico, and Texas are adapted to seasonal monsoon rainfall in summer, likelier to have resistance.
- Difference especially notable in *Salvia* (sages):
 - many species, and hybrids from a complex of species around the Four Corners states as well as northern Mexico, are quite adaptable in gardens as well as xeric landscapes
 - our native California salvias can be vulnerable.



Mediterranean plants are often susceptible

- Includes many popular garden shrubs:

Lavender, rosemary, rockrose

Lavender as a crop for oil and flowers is planted on raised beds with furrows to remove excess water.

Australian species variable

Increasingly important in low-water California landscapes due to climate similarities.

P. cinnamomi has decimated many native Australian plants since arriving there nearly a century ago.

Extensive observations of susceptible and resistant species.

Example: *Grevillea* (many species and varieties in the nursery trade there and here) are very susceptible, but *G. lanigera* and *G. rosmarinifolia* are resistant.

Plants from South Africa, increasingly important in our landscapes, can also be vulnerable. More info needed.





Some common trees

Susceptible:

- Cypress
- Dogwood
- Juniper
- Maple
- Oak
- Privet
- Redbud
- Yew

Resistant

- Ash
- Coast redwood
- Crapemyrtle
- Elm
- Ginkgo
- Magnolia
- Olive

- Plane tree & sycamore
- Sumac
- Tulip tree

Variable:

- Acacia
- Eucalyptus



Bottom line for ornamental woody plants

→ Plants which are considered drought tolerant should be considered vulnerable to crown rot.

- landscapers should research the exceptions.
- These plants can be harmed by the frequent irrigation provided by daily shower greywater systems.
- Follow BMP's and avoid problems!



Fruit tree types differ in water needs

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- High water: Apples, pears, and quince require more water here than other types and are likely to benefit from a nearby area of moisture.
 - Intermediate water: stone fruits and nut trees (home gardens), citrus
 - Low to very low water: pomegranate, fig, persimmon, jujube.





Fruit types differ in crown rot susceptibility

- Citrus can be susceptible but rootstocks vary. Those currently used (trifoliate and C35) have reasonably good resistance.
- Older citrus may be on more sensitive rootstocks such as rough lemon
- Avocadoes are highly susceptible to crown rot and have been the focus of considerable research on managing it.



Stone fruits are variable

- Some common rootstocks have partial resistance, including the well-known 'semi-dwarf' rootstock Citation.
- Lovell, a popular and generally adaptable, widely-used rootstock, unfortunately is susceptible to crown rot.
- Almond and walnut rootstocks are also variable.

Other fruit types



- Pears and apples are not considered susceptible to *P. cinnamomi* (though other species may be an issue in other regions)
- The following fruit tree types are generally resistant:
 - Persimmons, figs, and pomegranates.
 - Passion fruit and loquats.





Some other landscape plants

- Grasses, reeds, and sedges can tolerate daily watering and quite a range of water qualities.
- Bamboo is especially adaptable and can tolerate even daily watering
 - Many from regions with monsoon rainfall cycles and intermittent drought.
 - 500+ species and varieties available in the nursery trade in the US: many are non-invasive.
 - Aggressive roots of many grasses, including bamboo, can plug outflow areas as well as drip system emitters. Barriers can be installed to control the spread of the rhizomes.
- To avoid problems with bamboo, plant the right types: *Bambusa* species are clumpers, *Phyllostachys* are runners.