

# Greywater in the landscape

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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

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- 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:

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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

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- 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

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- 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.

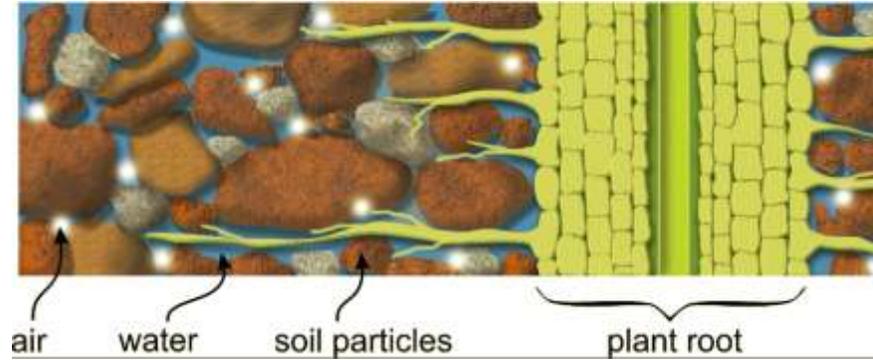


# Crown and root rot are caused by water molds aka oomycetes

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- 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

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- *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

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- 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

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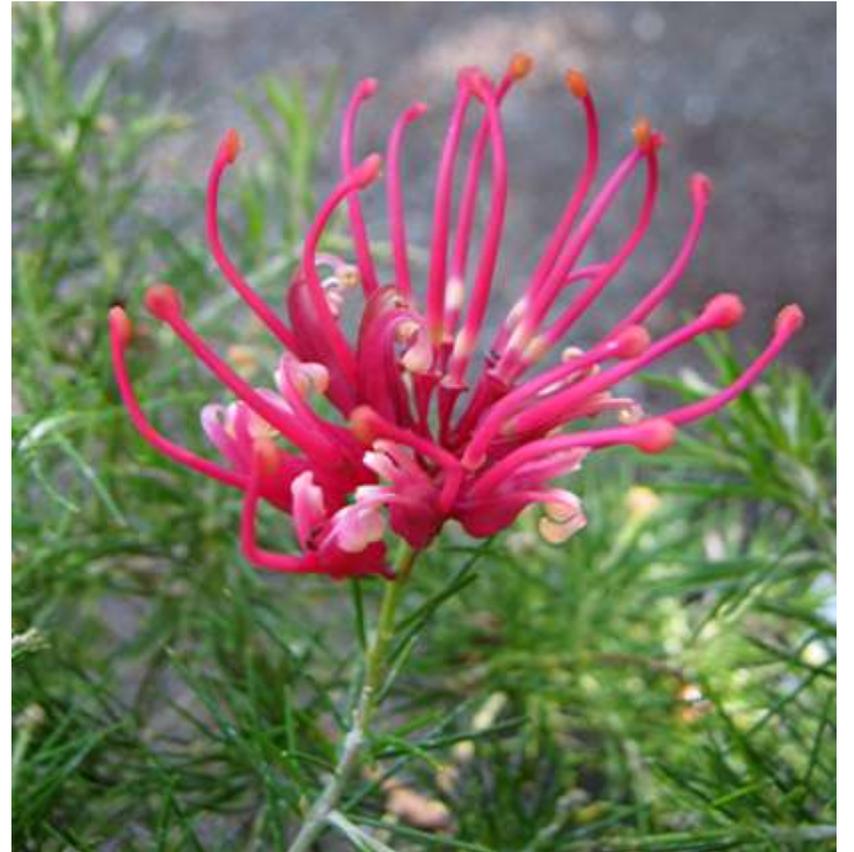
Increasingly important in low-water California landscapes due to climate similarities.

*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

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- 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

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- 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.