Transplanting Madrone

Rita L. Hummel, WSU Puyallup

Soil Amendment and Mulch

Rain Gardens

Root Treatments

Effect of Compost and Bark Mulch on Trees, Shrubs, and Soils in the Landscape

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Plant Species

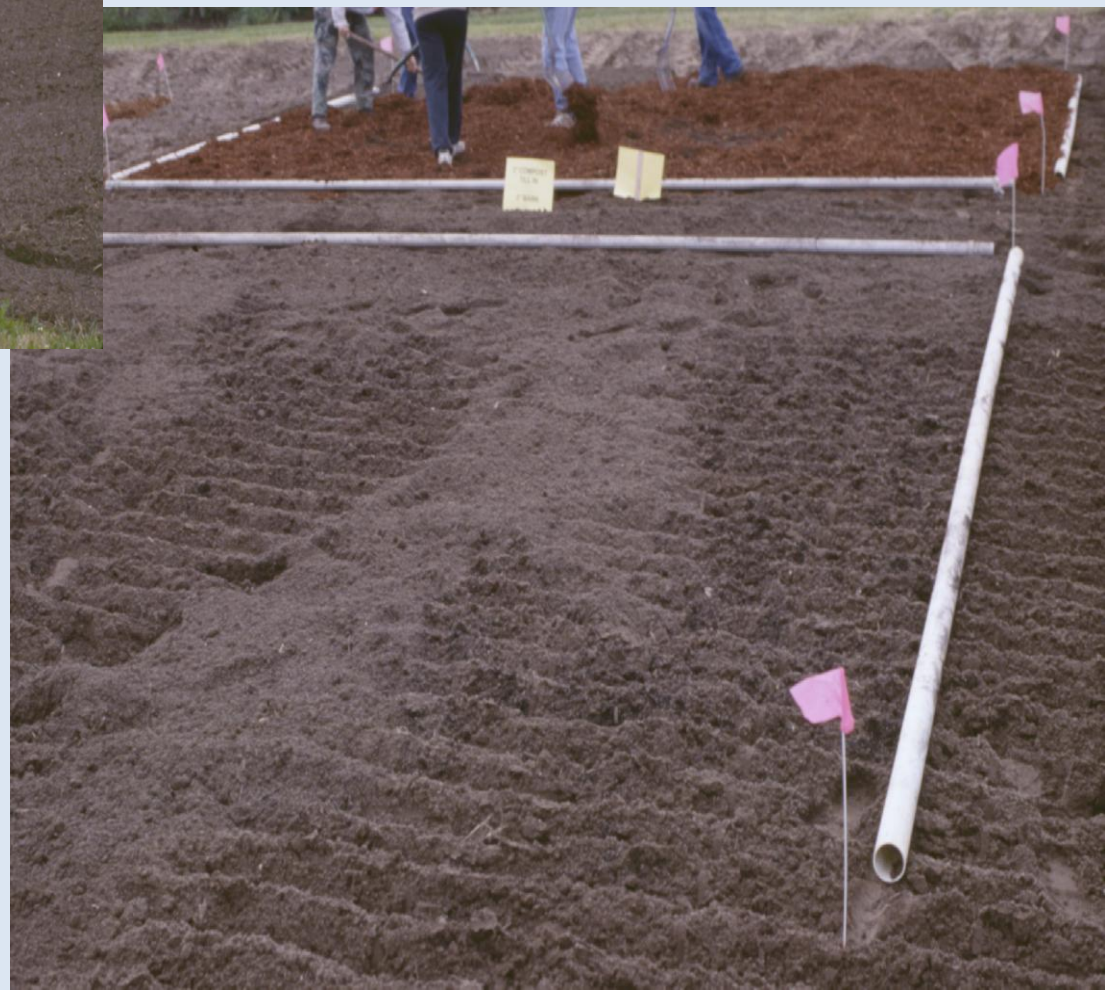
- ***Arbutus menziesii*, Pacific madrone**
  - **2 ecotypes: Sea-level and Cascade**
- ***Arbutus unedo*, Strawberry tree**
- ***Chionanthus virginicus*, Fringe tree**
- ***Cornus sericea*, Redosier dogwood**
- ***Chamaecyparis nootkatensis* 'Pendula', Alaska cedar**
- ***Rhododendron* 'Henry's Red'**

Objectives

- Assess the effects of compost and Douglas-fir bark applications on woody plant response and soil quality in the landscape
- Compare the effects of compost incorporated vs. compost applied as a mulch

Plots Established: June 2001

Soil Type: Puyallup fine sandy loam



6 treatments

4 replications

Each plot 17 ft x 20 ft (5.2 x 6.1 meters)

Treatments

No compost, no bark

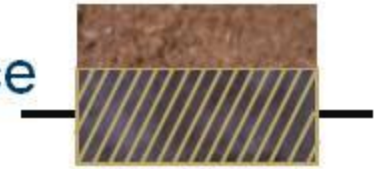
No compost, 7.6cm bark surface

7.6cm compost surface, no bark

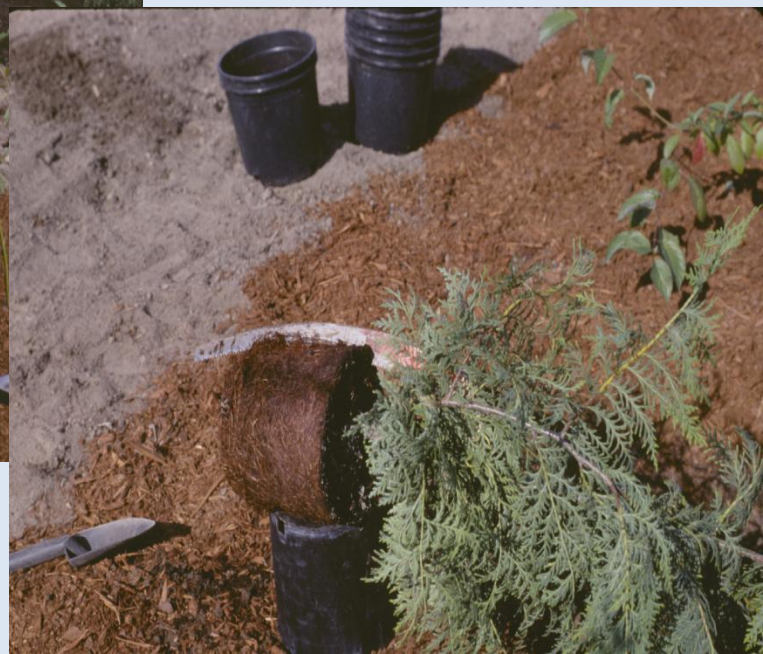
7.6cm compost surface, 7.6cm bark surface

7.6cm compost incorporated, no bark

7.6 cm compost incorporated, 7.6cm bark surface



June 18-20, 2001



Planted 264 trees and shrubs, 11 per plot.

Plants irrigated summer 2001 only.

Arbutus menziesii, Pacific madrone

- 2 ecotypes:
  - **Cascade** (seed collected on Cayuse Pass, WA at an elevation of 1417 m) – two plants per plot
  - **Sea-level** (seed collected at sea-level near Anacortes, WA) – one plant per plot

Plants were grown in 3-liter containers

Circling peripheral roots were cut and spread at transplant

All root-balls were cut an spread at transplant. As shown here for these 5-gallon container-grown pine trees.

Data Collected

- Shoot growth and quality
- Leaf color
- Weed growth
- Root depth
- Mulch depth
- Soil nitrate
- Bulk density
- Infiltration rate
- Perception of Quality Survey

Quality and Growth Data

Annually 2001-2011

- **Plant Quality Rating**
- **Shoot Growth**
  - **Plant width**
    - **widest canopy**
    - **narrowest canopy**
  - **Plant height - soil line to tallest point**
  - **Plant caliper – 6 in above soil line**

Pacific madrone

Plant Growth

no compost, no bark

compost incorp, no bark

compost surface, no bark

2005

no compost, bark surface

compost incorp, bark surf

compost surface, bark surf

Effect of Compost and Bark on Percent Survival of Cascade Madrone Trees

Treatment	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
None	100	100	100	100	100	100	100	100	100	100	100
Bark	100	100	88	88	88	88	88	88	88	88	88
Comp surf	100	100	100	100	100	100	88	88	88	88	88
Comp surf + bark	100	100	100	100	100	100	100	100	100	100	88
Comp inc	100	100	100	100	100	100	100	100	100	100	88
Comp inc + bark	100	100	100	100	100	100	100	100	100	100	75

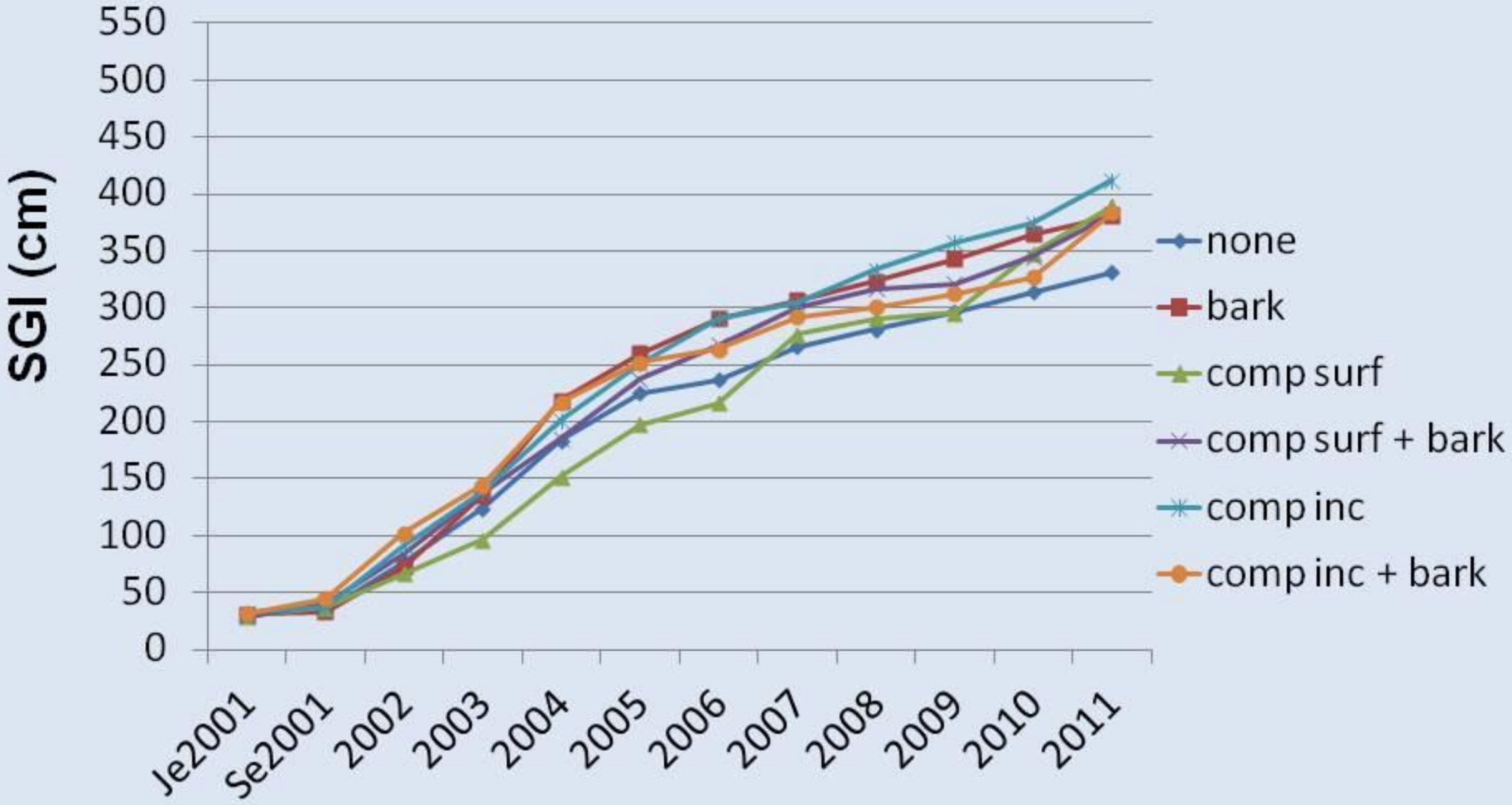
Trees were transplanted in June 2001, n = 8 trees

Effect of Compost and Bark on Percent Survival of Sea-level Madrone Trees

Treatment	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
None	100	100	100	100	100	100	100	100	100	100	100
Bark	100	100	100	100	100	100	100	100	100	100	100
Comp surf	100	100	100	75	75	75	75	75	75	75	75
Comp surf + bark	100	100	100	100	100	100	100	100	100	100	100
Comp inc	100	100	100	100	100	100	100	100	100	100	100
Comp inc + bark	100	100	100	100	100	100	100	100	100	100	100

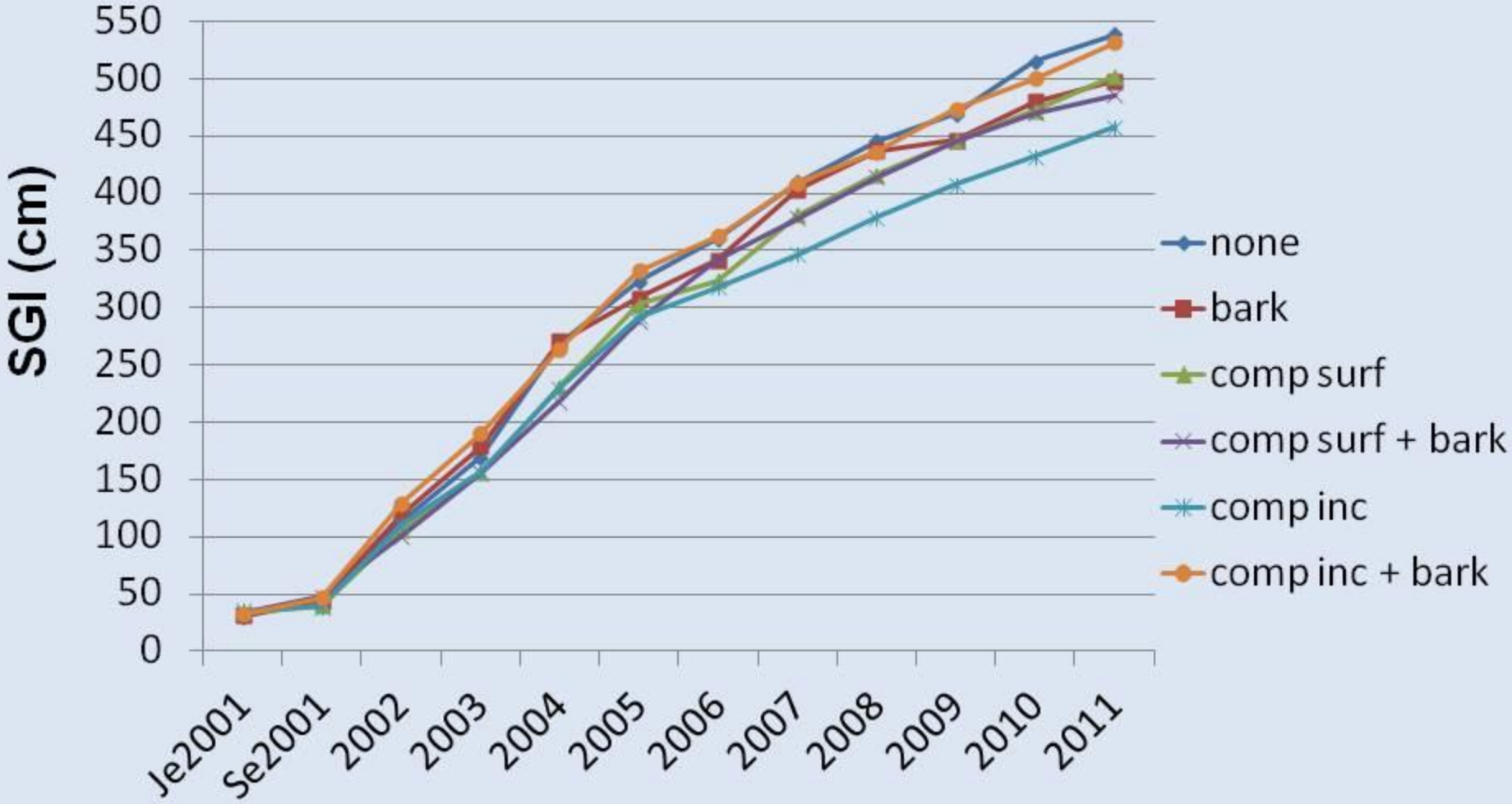
Trees were transplanted in June 2001, n = 4 trees

Effect of Compost and Bark on Shoot Growth Index of Cascade Madrone Trees



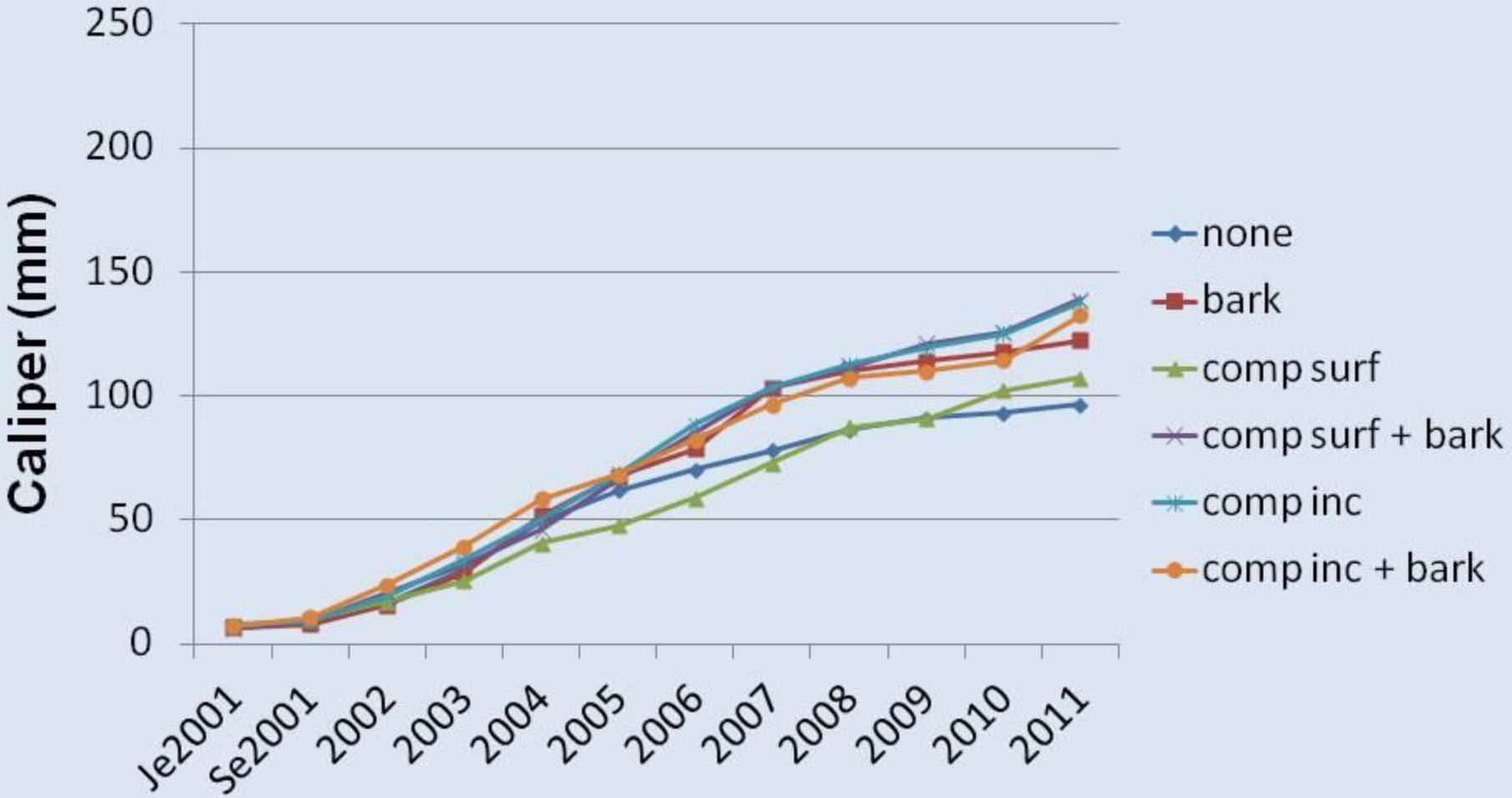
Shoot Growth Index (SGI) = [({wide width + narrow width}/2)+ height]/2

Effect of Compost and Bark on Shoot Growth Index of Sea-level Madrone Trees

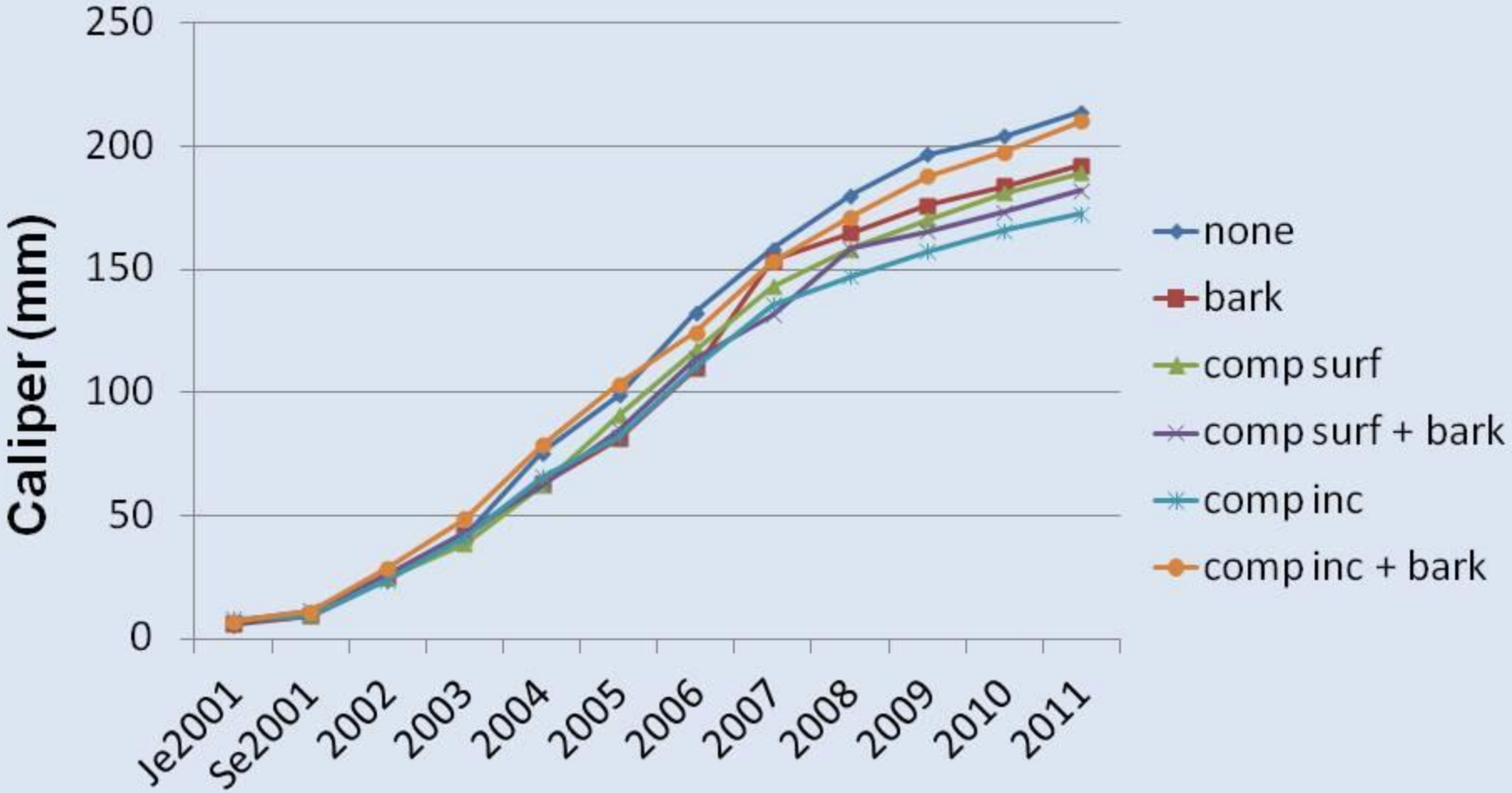


Shoot Growth Index (SGI) = [({wide width + narrow width}/2)+ height]/2

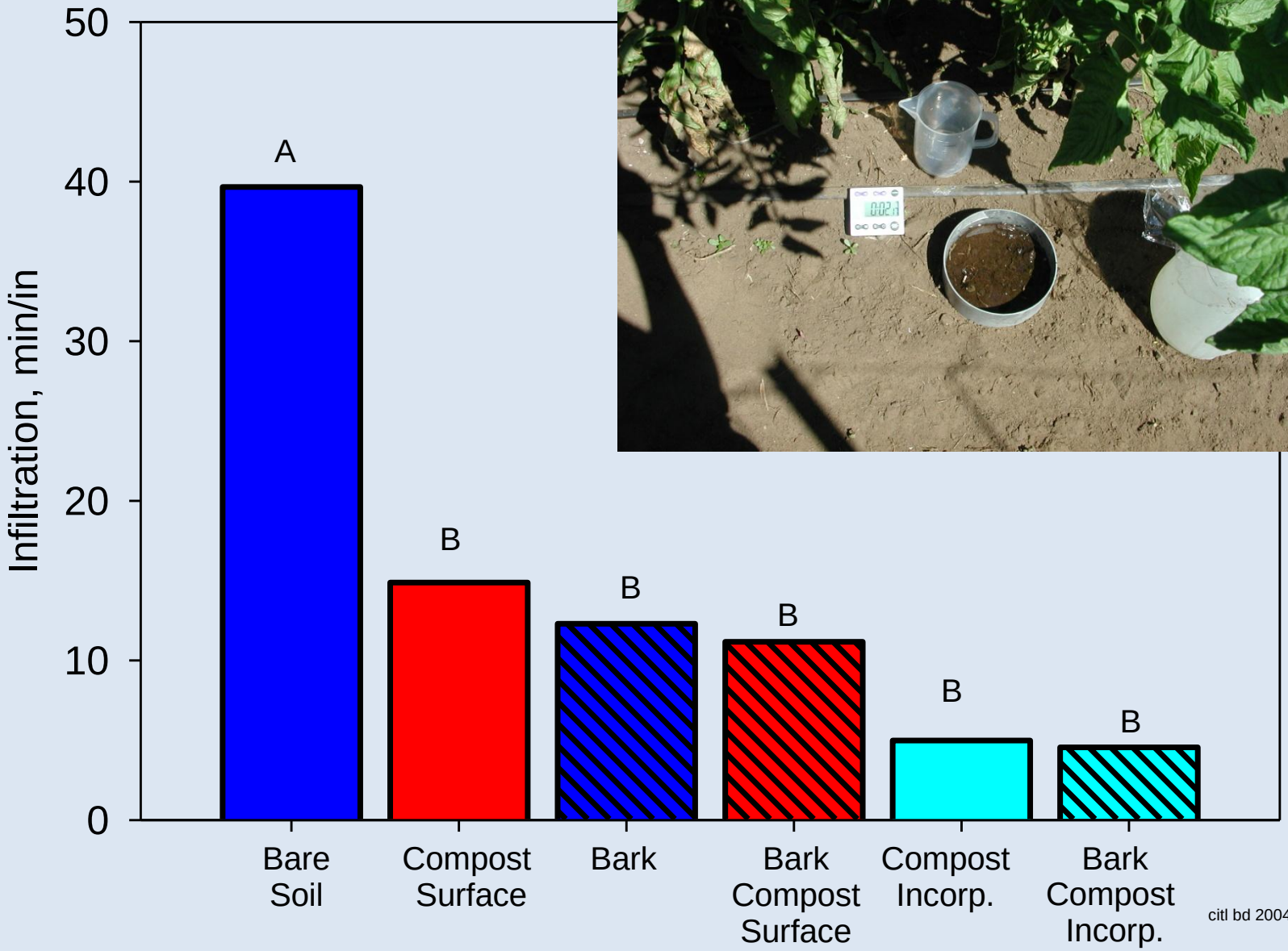
Effect of Compost and Bark on Caliper Growth of Cascade Madrone Trees



Effect of Compost and Bark on Caliper Growth of Sea-level Madrone Trees



Compost in the Landscape
Infiltration Rate into Soil, 2005



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Rain Gardens

Utilize the biological, physical, and chemical properties of plants, soil media and microorganisms to infiltrate water and filter pollutants.

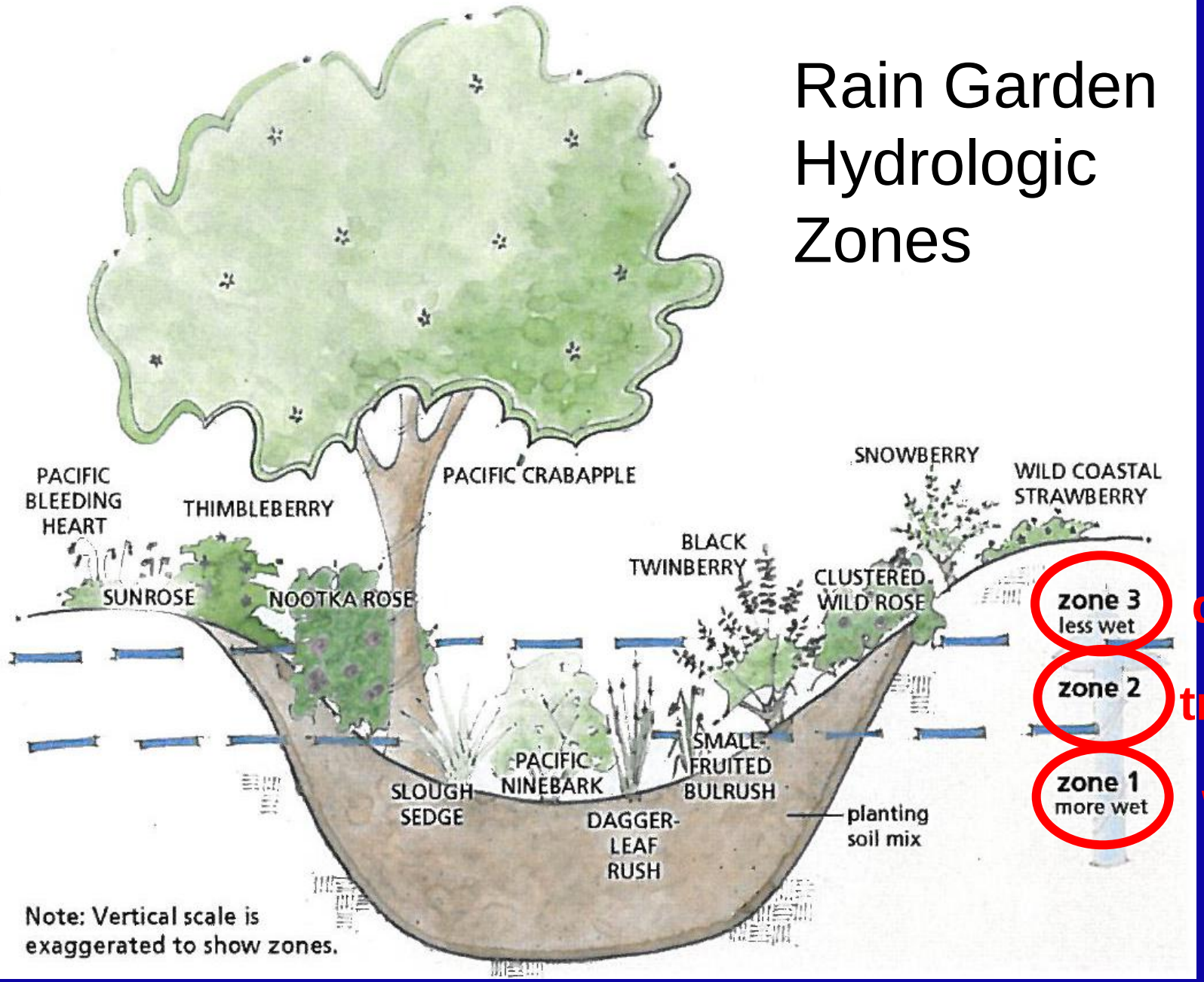
Reduce the impact of stormwater in built areas.

Restore or maintain the natural hydrologic function.

Rain Gardens

Shallow depressions in the landscape filled with soil media and plants.

Rain Garden Hydrologic Zones



Graphic by AHBL Engineering. From Hinman, Curtis. 2005. LID Technical Manual for Puget Sound. Puget Sound Action Team Publication No. PSAT 05-03. Olympia, WA. http://www.psp.wa.gov/downloads/LID/LID_manual2005.pdf

Rain Garden Hydro-Zones

Pacific madrone in Rain Gardens?!?

WSU Puyallup LID Research Area

Rain Gardens

Hydraulic Cells

Mesocosms

Picture taken
October 11, 2012

WSU Puyallup LID Research Rain Gardens

There Are 16 Individual Rain Garden Cells

Each Cell Has Approximately 256 ft^2 of Surface Area

The Bioretention Soil Mix is a 60% Sand:40% Compost Blend

The Soil Mix Depth is 18 inches

Funding for the construction of this infrastructure was obtained through a Department of Ecology Grant .

Rain Garden Cells

Overall Dimension is 16 by 16 ft
Bottom Dimension is 10 by 10 ft

Bioretention soil mix is a 60% sand: 40% compost blend added to rain garden cells to a depth of 18 inches.

Plants in the WSU Puyallup LID Research Rain Gardens

Rain garden experiments include 4 treatments:

1) trees and shrubs planting
2) mixed landscape planting with trees, shrubs, ornamental grasses, sedges and rushes;
3) a managed grassland planting of four grass species
4) unplanted control

Each treatment is replicated four times.

Plants were irrigated the first growing season.

Some plant species are planted in more than one rain garden hydrologic zone.

Plants Under Evaluation* in the WSU Puyallup LID Research Rain Gardens

Scientific Name	Common Name	
	TREES	
Acer truncatum x A. platanoides 'Warrenred'	Pacific Sunset® maple	**Transition Zone
Amelanchier x *grandiflora* 'Autumn Brilliance'	Serviceberry	Dry and Wet Zones
Arbutus menziesii	Pacific madrone	Dry Zone
Arbutus 'Marina'	Strawberry tree	Dry Zone
Betula nigra 'Summer Cascade'	Summer Cascade birch	Transition and Wet Zones
Magnolia virginiana 'Henry Hicks'	Sweetbay magnolia	Dry and Wet Zones
Nyssa sylvatica	Tupelo	Transition Zone
Taxodium distichum	Bald cypress	Wet Zone
Taxodium distichum 'Cascade Falls'	Cascade Falls Bald cypress	Transition Zone

***This is a list of plants being tested for their potential adaptability to rain garden hydro zones, NOT a list of recommended plants.**

Planting the rain gardens – cut and spread all tree and shrub root-balls at transplant

October 2010 – just after planting

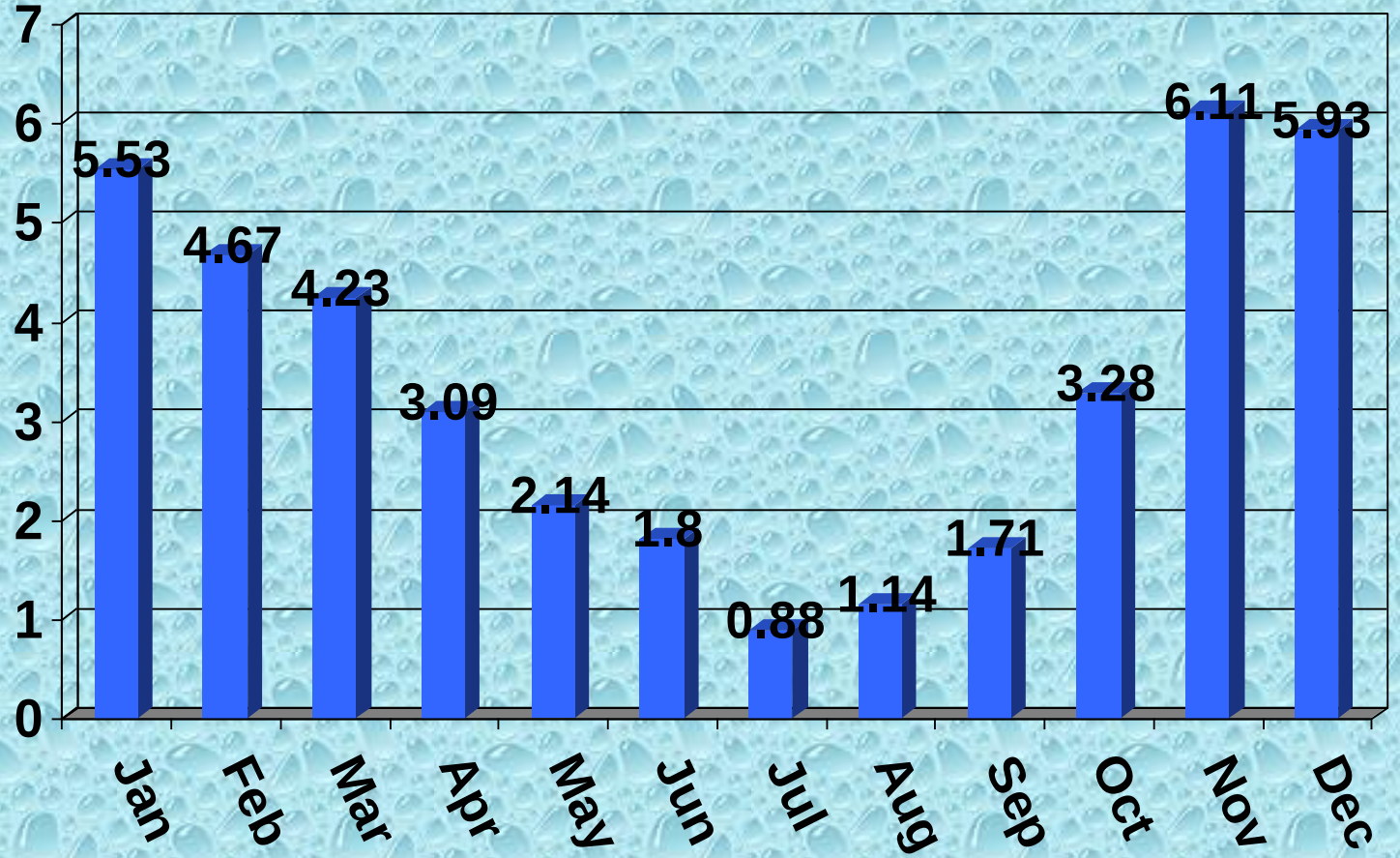
April 2011

Research rain gardens at WSU Puyallup, July 2011

The **trees and shrubs treatment** is shown in the foreground with the **managed meadow treatment** just behind it. The **mixed landscape treatment** is seen in the left background with the **unplanted control** in front of it.

DROUGHT STRESS

Average Monthly Precipitation (inches) for Puyallup, Washington



In 2006, July precipitation was 0.10 inch, August was 0.01 inch. In 2012, there was no rain from July 20 to Oct 12.

Arbutus menziesii
Pacific madrone

October 11, 2012

Arbutus menziesii
Pacific madrone

8 planted in the dry zones
Phytophthora spp. killed 2 in the same garden
6 survive and thrive
75% Survival in the Dry Zone

September 11, 2014

September 2015

Survival in the dry zone is 75%

Transplanting Pacific Madrone

Proper root treatment at transplant can prevent structural defects from causing tree failure later on.

12 years after planting in the landscape from a 1-gallon container

CUT AND SPREAD BEFORE WE'RE DEAD!

After nearly 10 years in the landscape, girdling roots caused this 21-foot-tall tree to blow over in a wind storm.

Transplanting Pacific Madrone

Proper root treatment at transplant can prevent structural defects from causing tree failure later on.

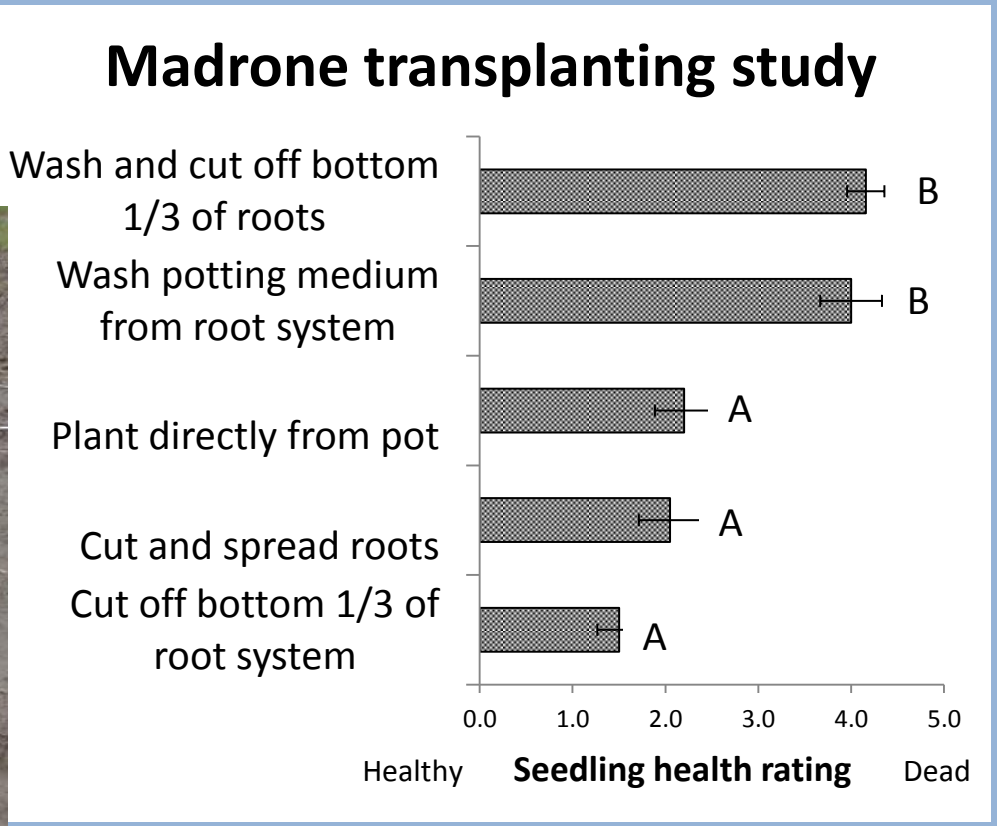
Pacific madrone is considered difficult to transplant.

What is “proper” root treatment at transplant for Pacific madrone?

Transplanting Pacific madrone

Marianne Elliott and Gary Chastagner

This species is reported to be difficult to transplant.



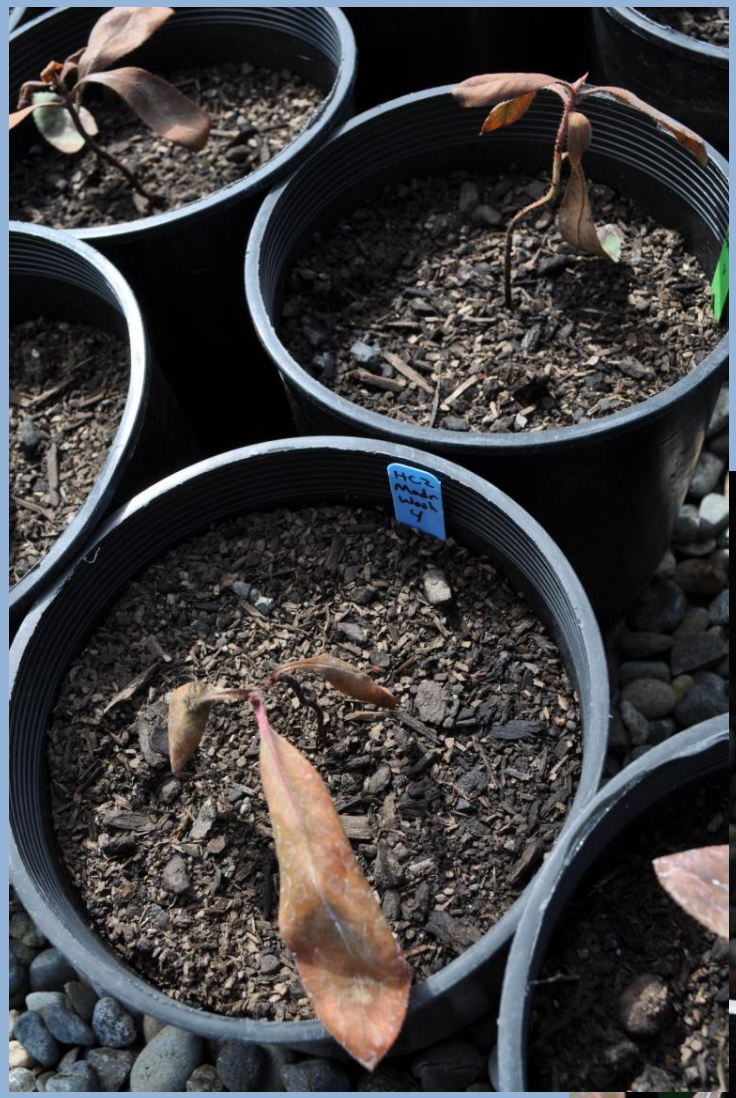
Slide courtesy of Marianne Elliott

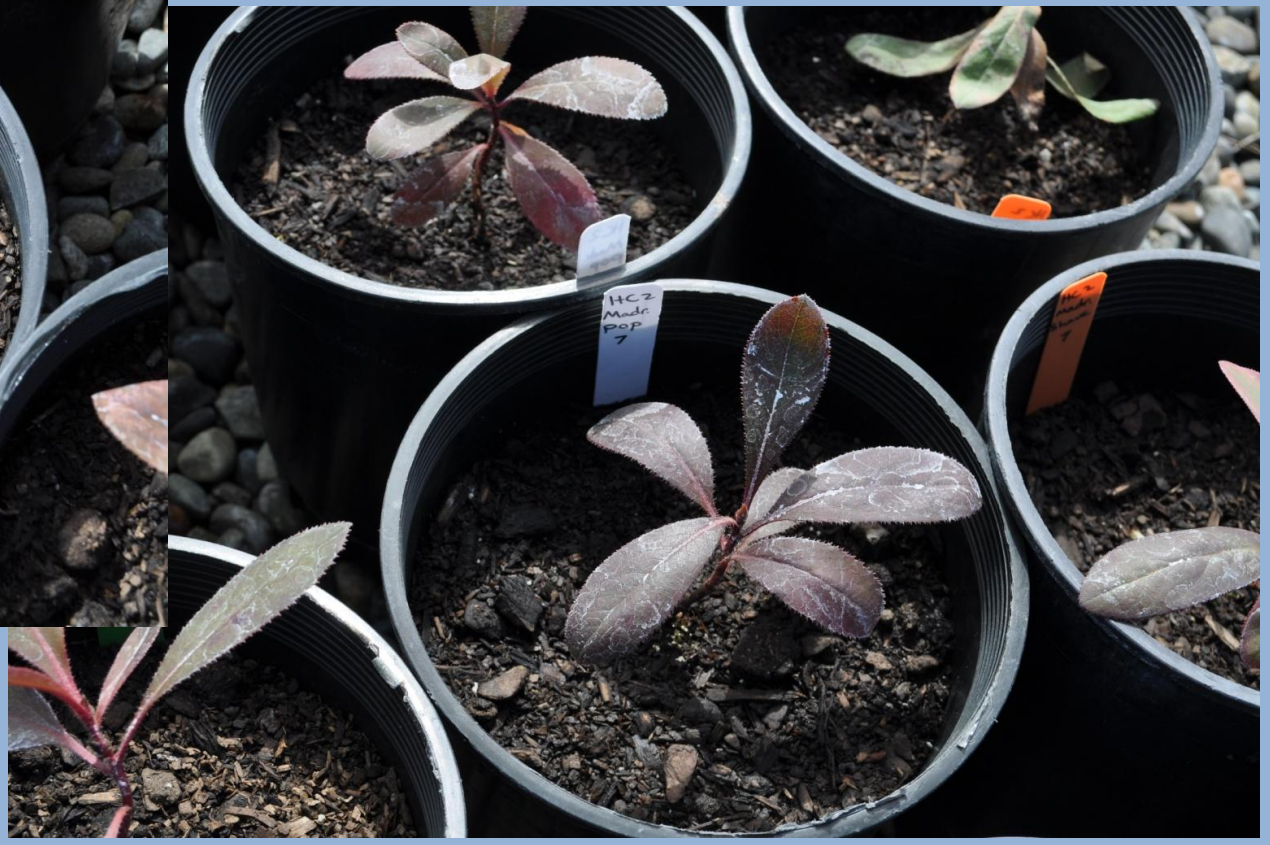
Pacific madrone seedlings

Root treatments at transplant in the nursery

Pacific Madrone Seedlings

Growing in the nursery





Pacific Madrone Seedlings After 1 Growing Season


THE END