Clean Collections: The Front Lines of Pest and Pathogen Mitigation

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United States Department of Agriculture
Agricultural Research Service

Clean Collections: The Front Lines of Pest and Pathogen Mitigation

MaryLou Polek, Ph.D.
Research Leader/Plant Pathologist
USDA ARS National Clonal Germplasm Repository for Citrus & Dates

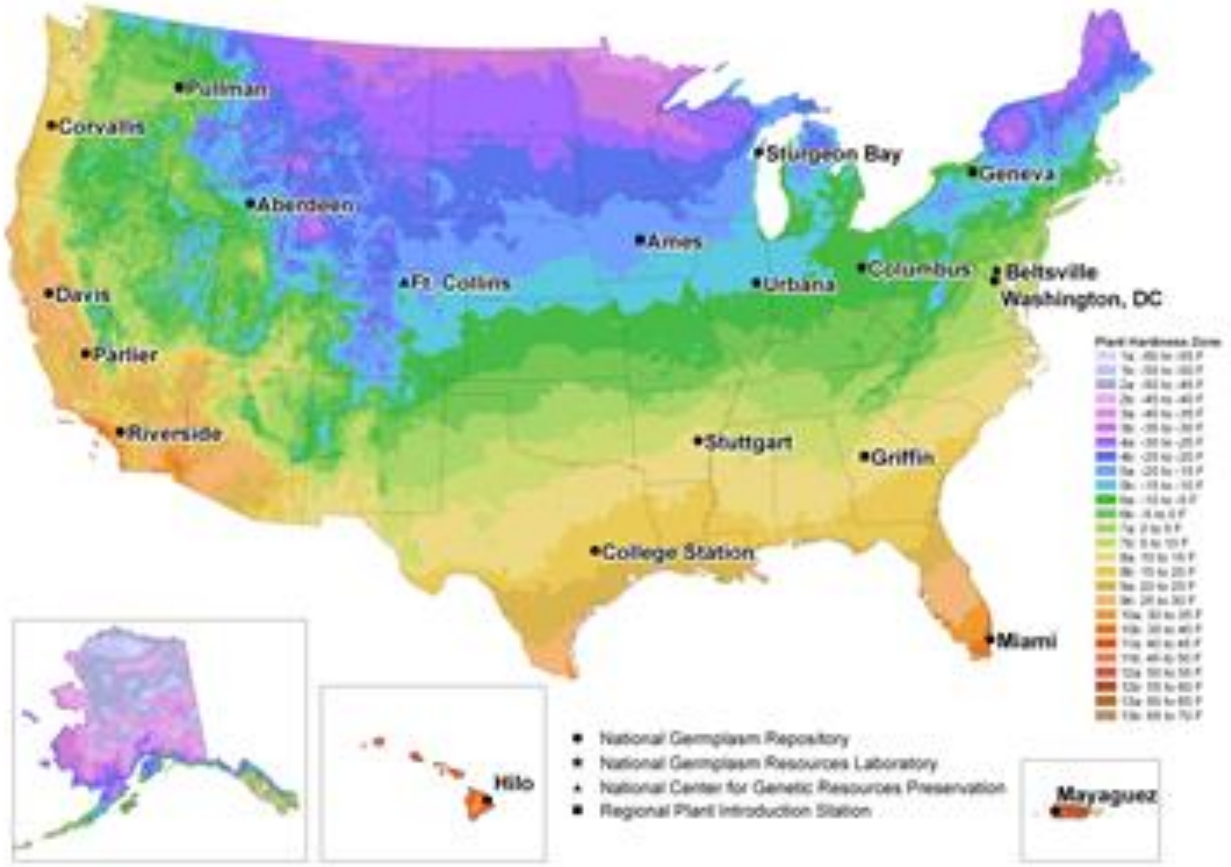
Shot Hole Borers + Fungi plague gardens in SoCal

Palm weevils spreading in SoCal along Mex border

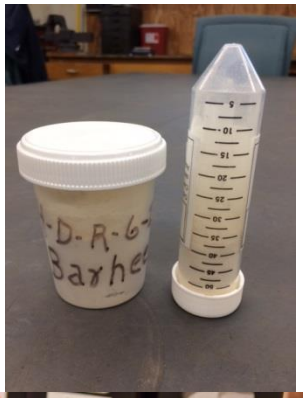
Asian citrus psyllid & Huanglongbing (aka Citrus Greening Disease)

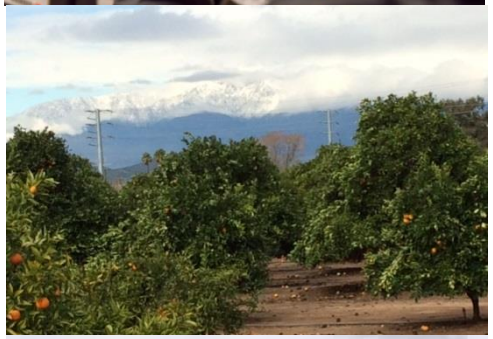
Phytophthora ramorum: Sudden Oak Death (SOD)

USDA National Plant Germplasm System (NPGS)



Mission: to acquire, maintain, preserve, evaluate, and distribute germplasm to conserve genetic diversity





What is "*Germplasm*"?

- It is the living genetic resources of a species or related group of organisms such as date palms, citrus, apples, or bananas.
- Plants, seeds or tissue maintained for the purpose of animal and plant breeding, preservation, conservation, taxonomic studies, and other research uses.
- These resources may take the form of seed collections stored in seed banks, trees growing in nurseries, animal breeding lines maintained in animal breeding programs or gene banks.
- Germplasm collections can range from collections of wild species to elite, domesticated breeding lines that have undergone extensive human selection.

Collection Maintenance


Field plantings


Protective Structures


Cryopreservation for back up

How much do you enjoy citrus?

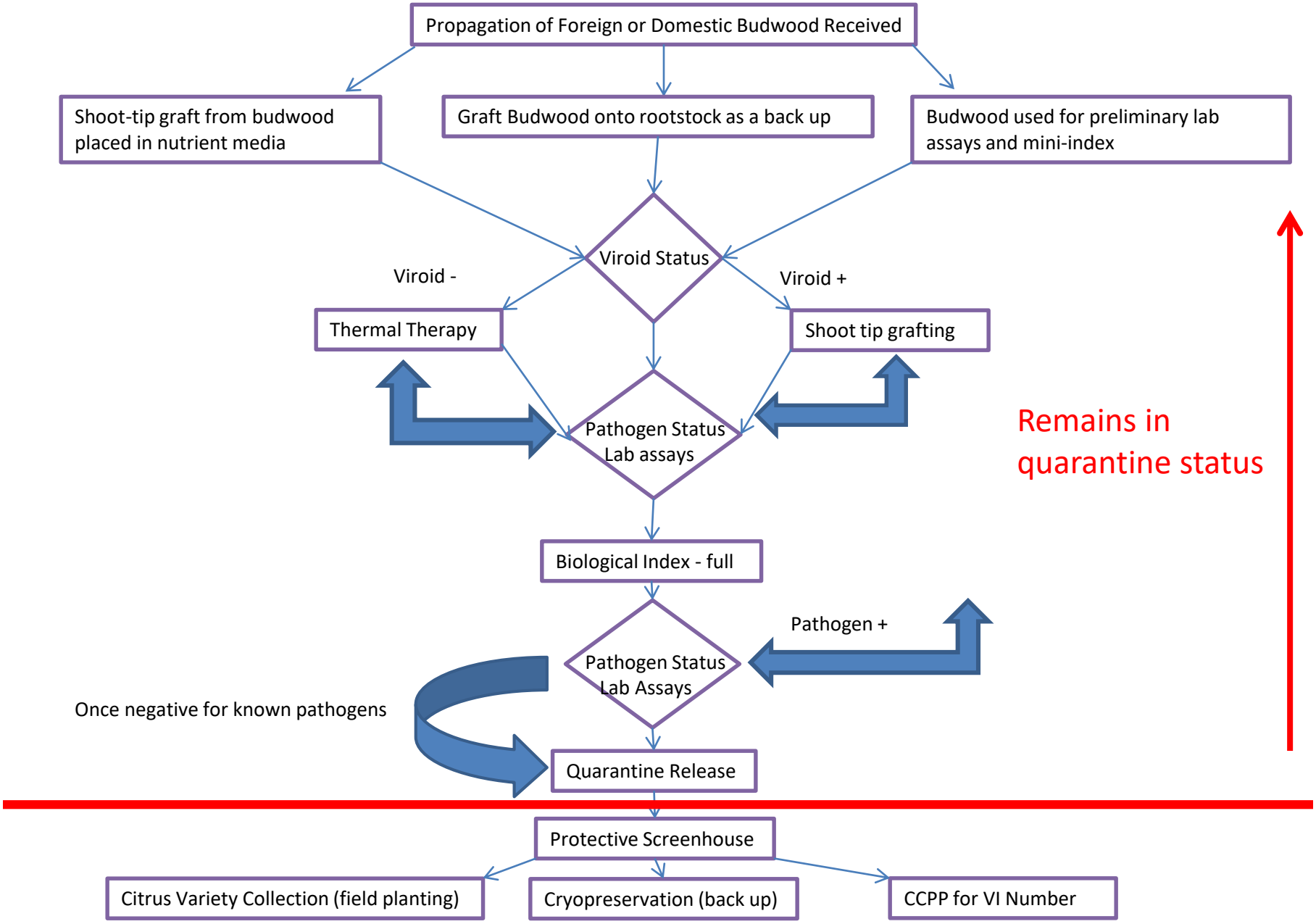
USDA-APHIS Regulations

- Acquisition of citrus requires a Plant Controlled Import Permit (PCIP)
  - Counter signed by CDFA
- Quarantined until sanitized/therapy
  - State and Federal release required
- Extensive pathogen testing, therapy required
- Propagation and movement of citrus germplasm is "prohibited" *Unless* you have proper permit
- **Obtain citrus germplasm from certified source**

Permits

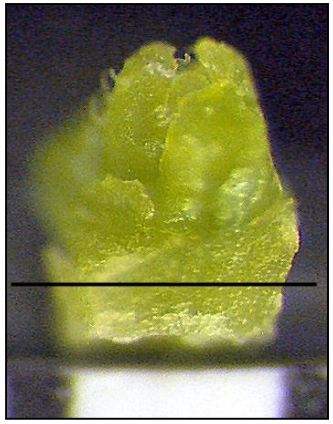
- Curatorial
  - Plant Controlled Import Permit (PCIP): one for citrus, one for date palms
  - 3 pathogen permits to maintain positive controls for testing (2 APHIS, 1 CDFA)
  - Miscellaneous moving permits
- Research Leader
  - Diagnostic
  - Seeds
  - Research

PRODUCTION OF CLEAN PLANTS FOR PUBLIC ACCESS



Citrus Therapy

- Thermotherapy: use of high temperatures to eliminate heat sensitive citrus pathogens; 40^{o} C/day; 30^{o} C/night; 3-4 months (viruses + some bacteria)



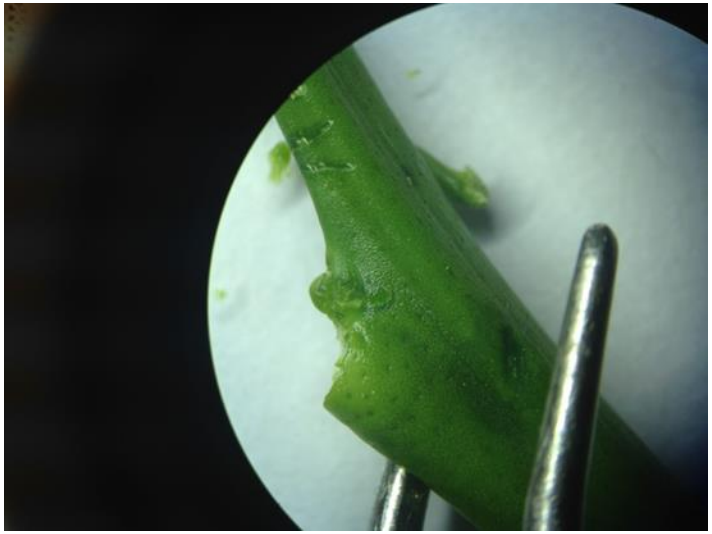
- Shoot tip grafting: excise 0.1mm of apical meristem & graft onto etiolated rootstock; for heat resistant pathogens – such as viroids & some phytoplasmas

CRYO-PRESERVATION: Definition

- Process developed to safely freeze and thaw living cells, tissues, organs, or seeds so they can be revived to the exact condition they were in when they entered the freezing process
- Type of freezing which requires extremely low temperatures, typically -80°C using solid carbon dioxide or -196 °C using liquid nitrogen
- Keep material frozen indefinitely without any "aging" related loss; maintain plant trueness-to-type
- Must remove all water from living cells
- Pre-treat with cryo-protectants




Cryopreservation is a process developed to safely freeze and thaw living objects so they can be revived to the exact condition they were in when they entered the freezing process




Huanglongbing - HLB
"Yellow Shoot Disease"

- Most severe of all citrus diseases
- "*Death sentence*" for citrus trees
- Does not discriminate between a backyard and a production grove
- Affects most plants within the citrus family (Rutaceae)
- No known therapeutics
- No "known" resistance in cvs.
- Possible resistance in relatives

The vector ……..
Diaphorina citri – Asian citrus psyllid

Disease & Vector Management

- Chemical Control: continuous, area-wide sprays
- CDFA & citrus industry apply in residential areas
- Recent stay on pesticide control strategy in CA
- Biological control: Mass-rearing of *Tamarixia radiata*

Disease & Vector Management

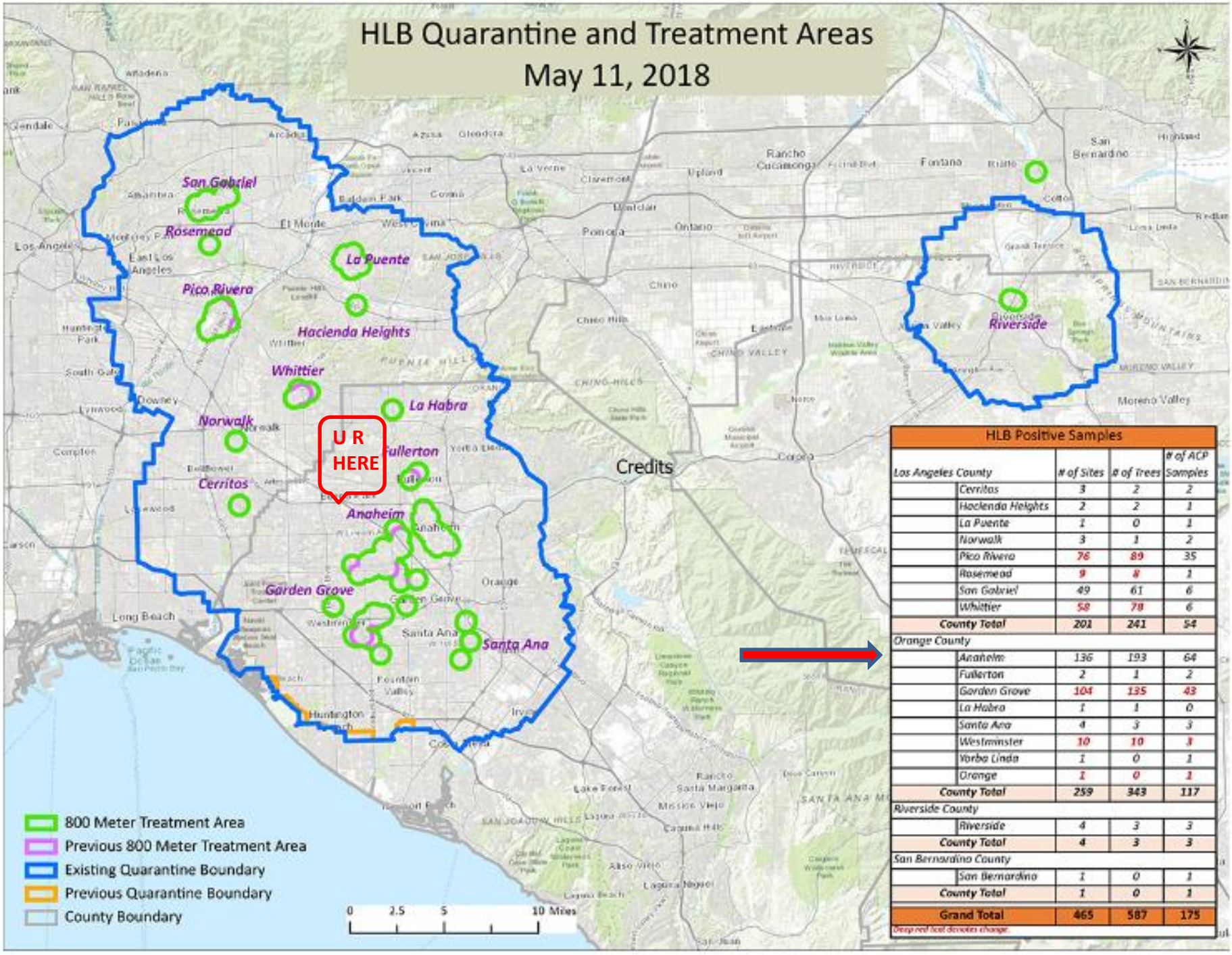
- Propagation sources trees must be under protective structures 2012
- Increase trees under screen 2013
- CUPS = Citrus Under Protective Screen

Original Parent Navel Riverside, CA

Large acreage coverage, FL

Positive pressure “bubble”

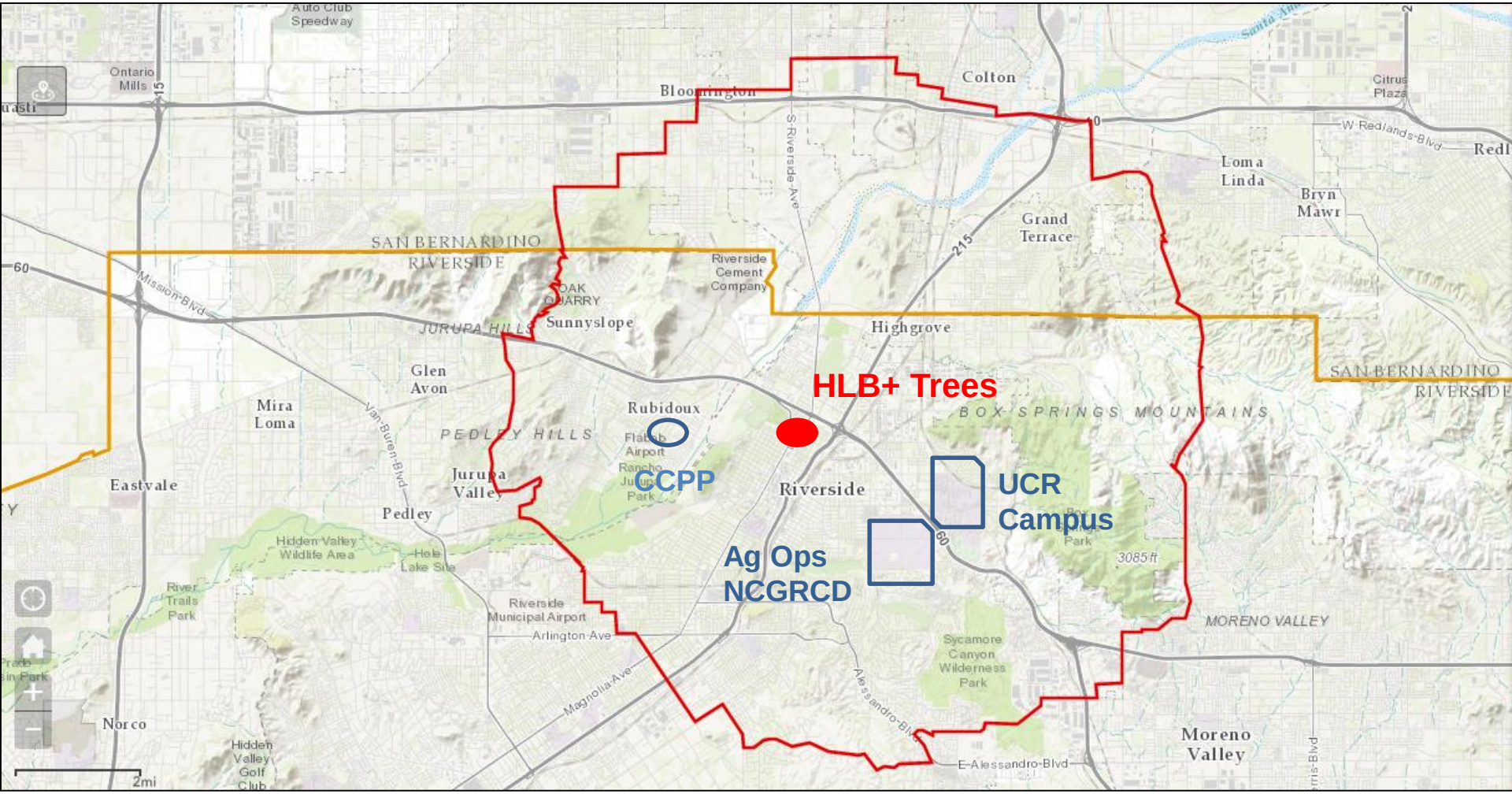
HLB Quarantine and Treatment Areas
May 11, 2018



HLB Positive Samples				
Los Angeles County		# of Sites	# of Trees	# of ACP Samples
	Cerritos	3	2	2
	Hacienda Heights	2	2	1
	La Puente	1	0	1
	Norwalk	3	1	2
	Pico Rivera	76	89	35
	Rosemead	9	8	1
	San Gabriel	49	61	6
	Whittier	58	78	6
County Total		**201**	**241**	**54**
Orange County				
	Anaheim	136	193	64
	Fullerton	2	1	2
	Garden Grove	104	135	43
	La Habra	1	1	0
	Santa Ana	4	3	3
	Westminster	10	10	3
	Yorba Linda	1	0	1
	Orange	1	0	1
County Total		**259**	**343**	**117**
Riverside County				
	Riverside	4	3	3
County Total		**4**	**3**	**3**
San Bernardino County				
	San Bernardino	1	0	1
County Total		**1**	**0**	**1**
Grand Total		**465**	**587**	**175**

Deep red text denotes change.

HLB Quarantine: Implemented in Riverside Aug 2017



NOTE: Shapes not drawn to scale

Quarantine Ramifications

- USDA APHIS implemented a “Hold Order” within 24 hours of declaration
- All germplasm held hostage
- Research came to a standstill
- Strict regulations on disposal of green waste
- Fruit must be washed prior to taking off site
- Permits are needed for everything

Developing a conservation *biological control strategy* to suppress ACP populations in the urban-grove interface

Joe Patt (USDA-ARS, Ft. Pierce, FL)
Jawwad Qureshi (UF-IRREC, Ft. Pierce, FL)
Ben Faber (UC Cooperative Extension, Ventura, CA
Randy Neidz (USDA-ARS, Ft. Pierce, FL

Cooperators:
Bob Adair, Adair Family Farms, Vero Beach, FL
Diane Kimes, CEO, Heathcote Botanical Garden, Ft. Pierce, FL
Kate Rotindo, St. Lucie County Cooperative Extension, Ft. Pierce, FL
Eric Rohrig, FDACS, Gainesville, FL
John Krist, Ventura County Farm Bureau, Ventura, CA
Leslie Leavens, Leavens Family Farms, Ventura, CA

Cow pea insectary strip planted at Adair Family Farm, Vero Beach, FL

Conservation Biological Control

- Definition: a strategy that integrates beneficial insects back into crop systems for pest control.
- It is the implementation of practices that maintain and enhance the reproduction, survival, and efficacy of natural enemies of pests.
- This strategy is based upon research that demonstrates a link between the conservation of natural habitat and reduced pest problems on farms.

Insectary plants are purposefully selected to enhance biological control ecosystems by providing pollen and nectar resources for naturally occurring enemies of harmful target pests.

Strip row insectary plantings in vineyards

Test array:Heathcote Botanical Garden, Fort Pierce, FL

Entire test array

Mixed species planting

Pure species planting

Information Sources

https://www.ars-grin.gov/ - Public access to the Nat'l Germplasm System

https://www.ars.usda.gov/pacific-west-area/riverside-ca/national-clonal-germplasm-repository-for-citrus/

http://www.citrusvariety.ucr.edu/ - descriptions of citrus varieties & species

https://ccpp.ucr.edu/ - order certified, disease free commercial citrus varieties

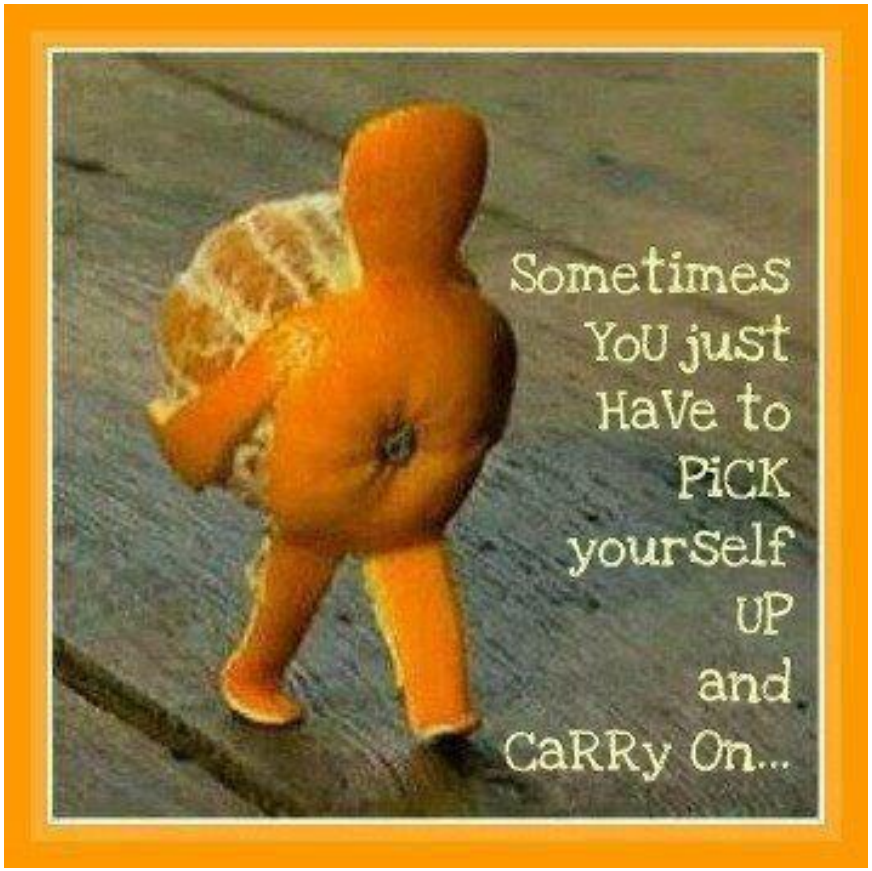
http://citrusresearch.org/citrograph/ : Citrograph Magazine 2 articles – Parts 1 and 2

Citrus Quarantine, Sanitary, and Certification Programs in the USA: Prevention of Introduction and Distribution of Citrus Diseases

- Part 1: Citrus quarantine and introduction programs: May/June 2010: pgs 26-35.
- Part 2: Certification schemes and national programs: July/Aug 2010: pgs 27-39.

Conservation Biology: Joseph M. Patt, Ph.D., Research Entomologist, USDA-Agricultural Research Service, US Horticultural Research Laboratory, 2100 South Rock Rd., Fort Pierce, FL 24945, joseph.patt@ars.usda.gov

THANK YOU!!!

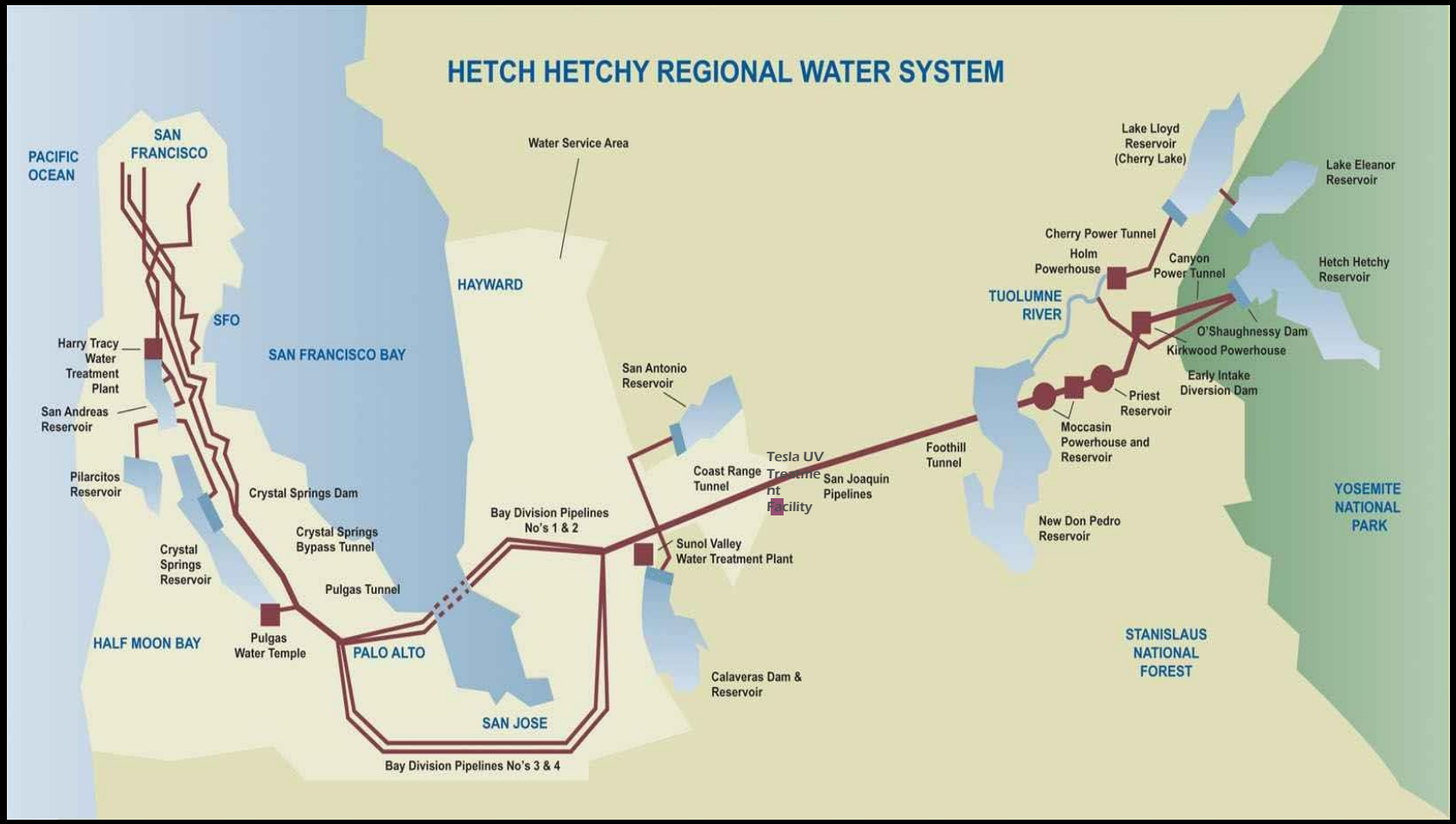


QUESTIONS ?

From the Ground Up: Constructing a nursery and new native plant collection with the best management practices that exclude Phytophthora

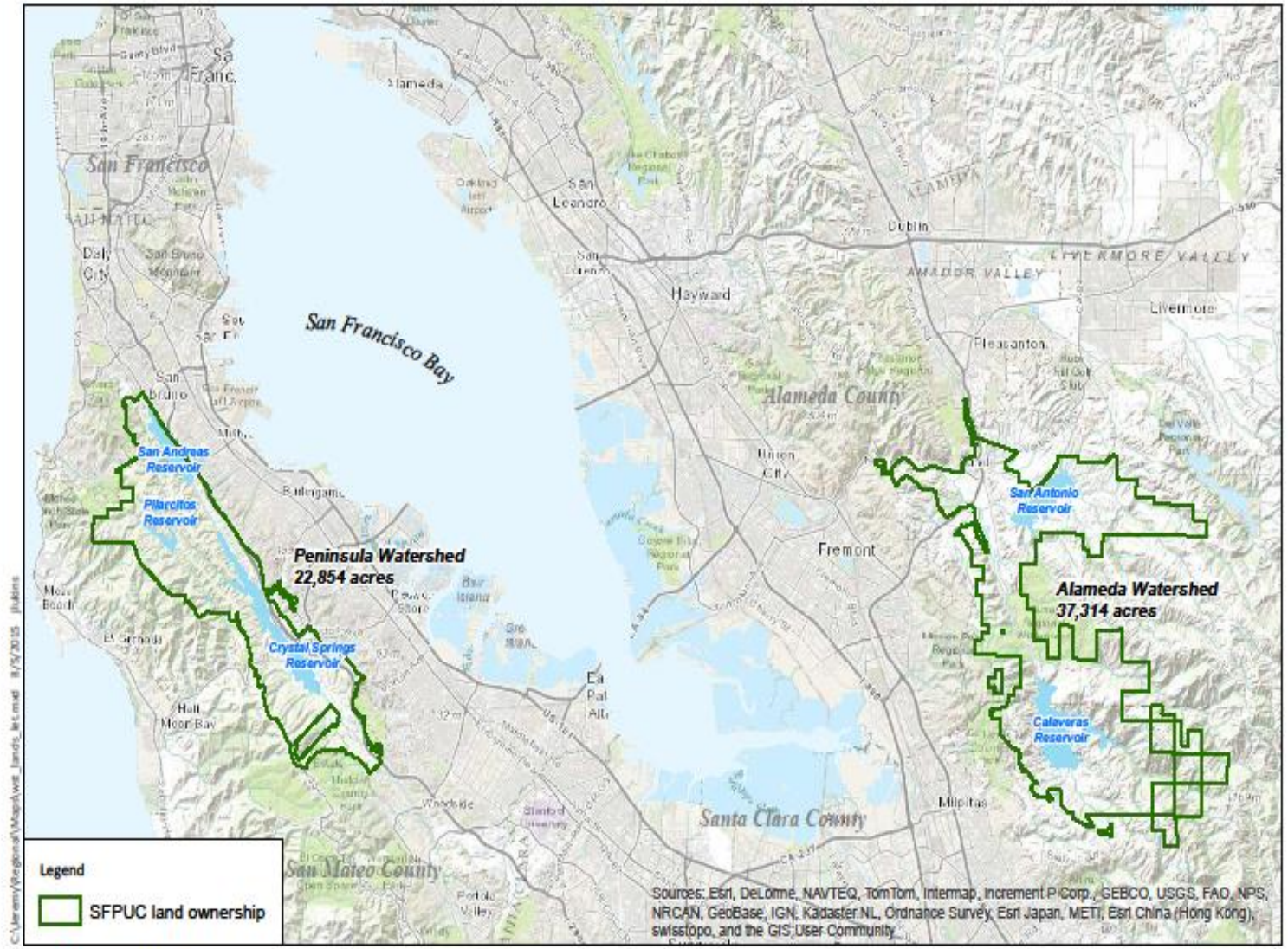
Mia Ingolia
City and County of San Francisco
San Francisco Public Utilities Commission,
Water Enterprise
Natural Resources and Lands Management Division

Hetch Hetchy Regional Water System



Delivering drinking water every day to 2.6 million residents and businesses in Southern Alameda, Northern Santa Clara, San Mateo and San Francisco counties.

Stewards of SFPUC Watershed Lands



Regional Water System

Services of the San Francisco Public Utilities Commission
Natural Resources Division Author: JGL Date: 8-5-15

N

0 1 2 3 4 Miles

SFPUC Watershed Lands
San Francisco Bay Area







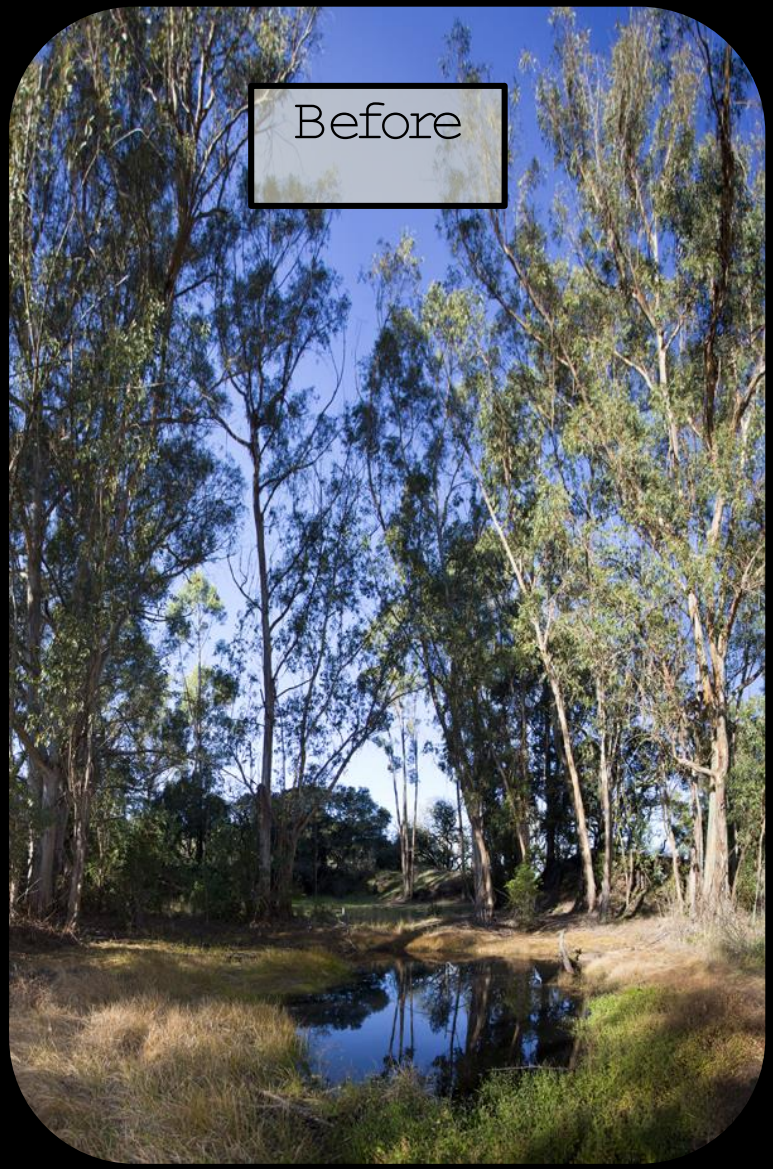






Large Infrastructure Projects

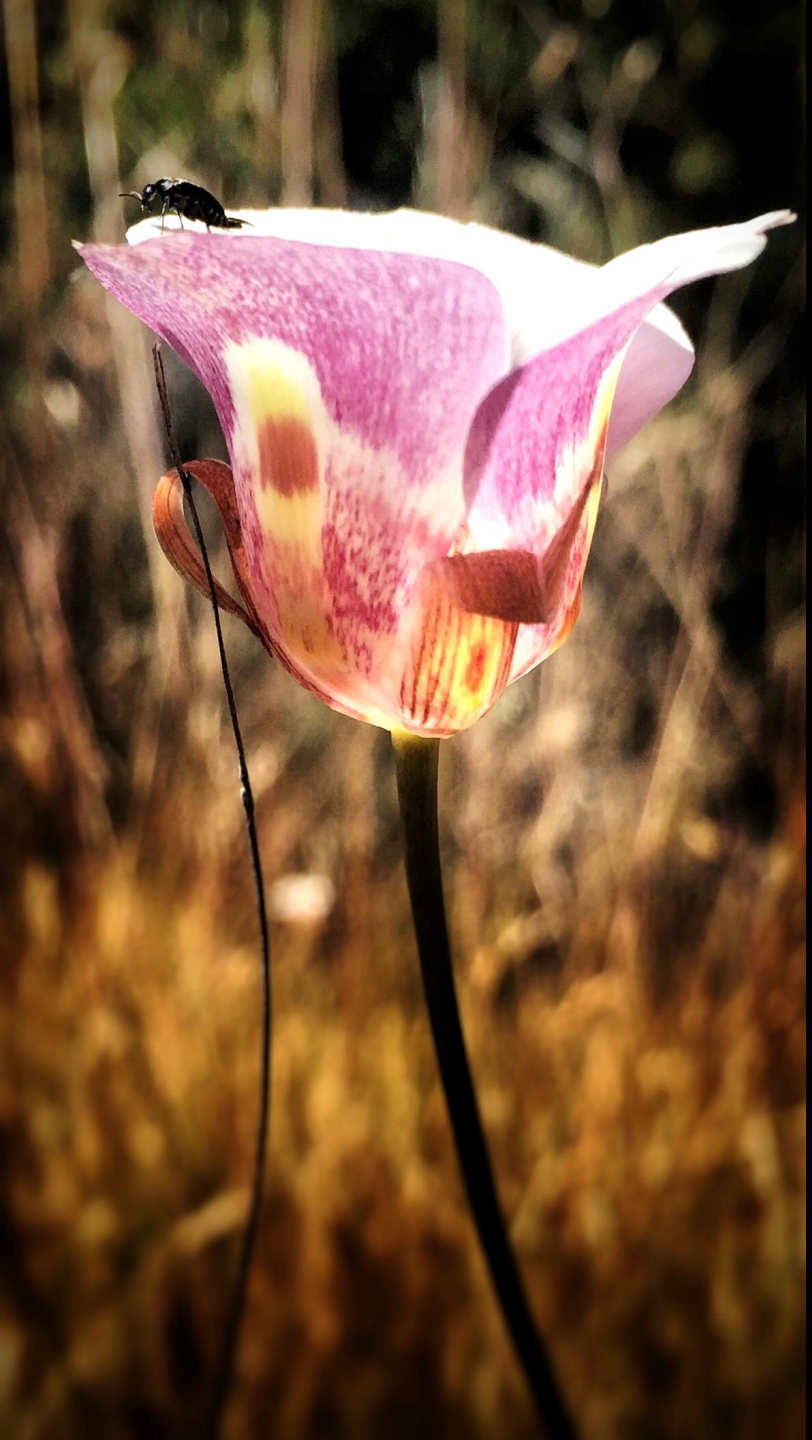

Calaveras Dam
Replacement Project


Before


After

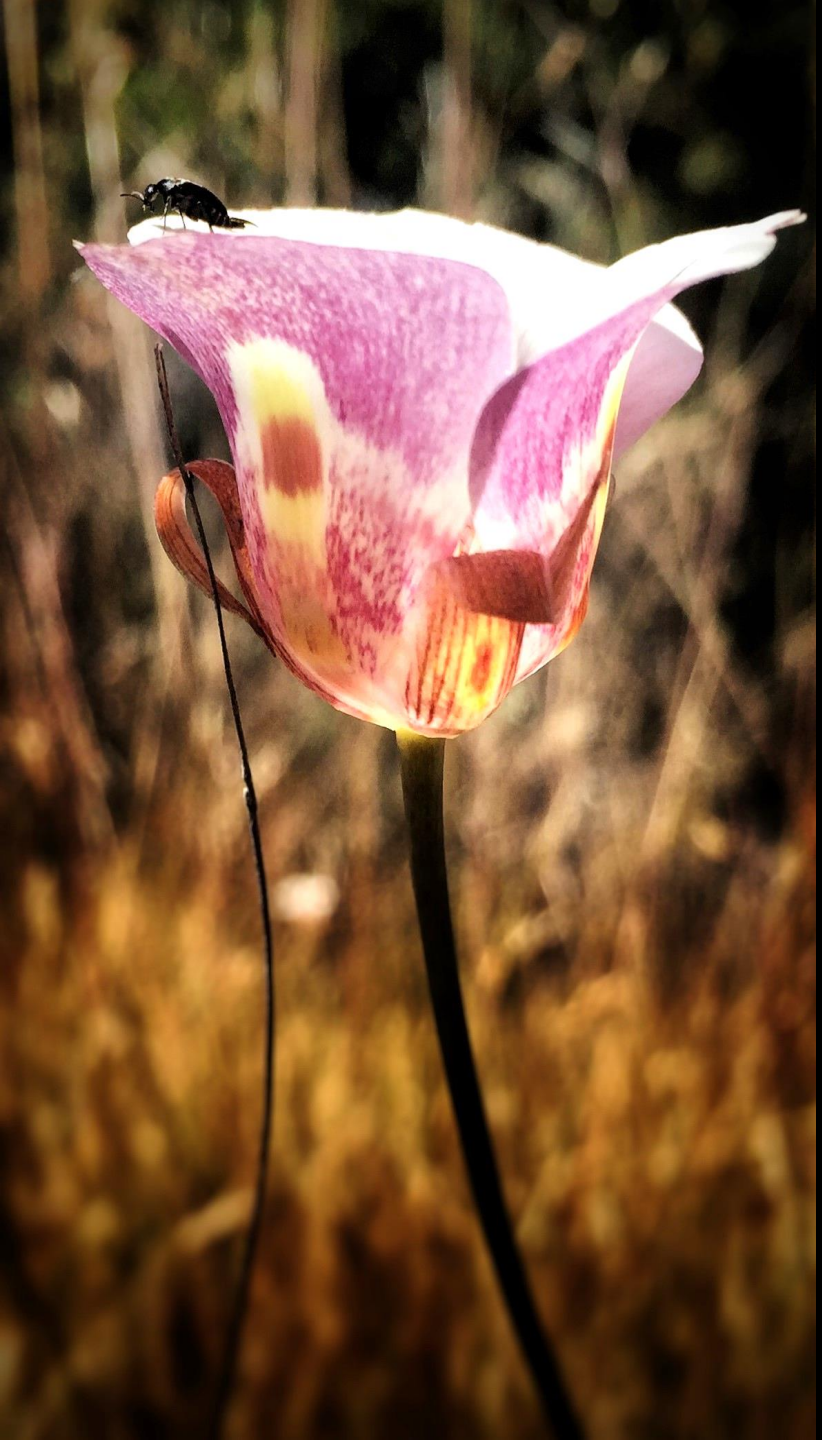

San Antonio Creek

SOD in tanoaks on the Peninsula



What is Phytophthora?

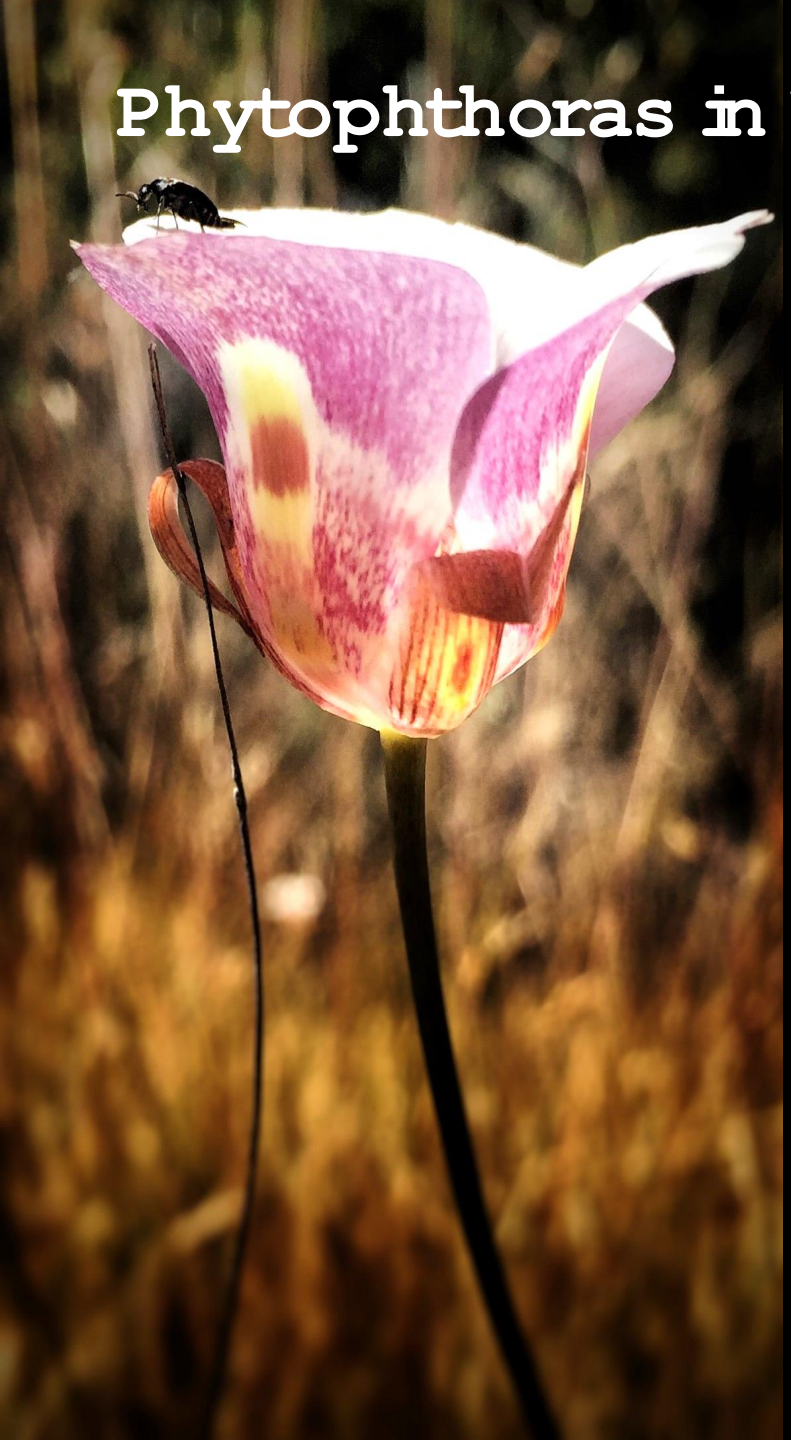
- Name Phytophthora means "plant destroyer"
- Genus of plant-damaging Oomycetes (water molds)
- Resemble fungi but actually belong to a different major eukaryotic group called the stramenopiles
- Commonly called "water molds", they produce swimming spores, called zoospores, and thrive under wet environmental conditions
- P. infestans caused potato late blight and led to the Irish potato famine of the 1840s



Pathogen Risk Minimization Measures

- Contract specifications required pest and pathogen free work product and sterilization for equipment ***exceeding industry standards***
- Equipment steam, pressure, and/or chemically disinfected
- Brand new pumps, boats, etc.
- Nurseries and contractors inspected
- Seed mixes screened
- Root wads and logs heat treated

Land Management Response



Phytophthoras in Native Habitats Work Group

Nursery Management Resources

- Guidelines to Minimize *Phytophthora* Pathogens in Restoration Nurseries
- Buying healthy plants: What to look for at a nursery Understanding results from the CDFA lab a handout for nurseries

Guidelines for Restoration Activities

- Restoration guidance
- Guidance for contaminated or sensitive sites
- Holding nursery guidance
- Guidance to reduce the risk of *Phytophthora* and other plant pathogen introductions to mitigation sites

Sunol Long-Term Improvements Project

Alameda Creek Watershed Center

LEED Gold Building

- Passive Solar Design
- Roof top Solar Panels
- BMS (building management system) willbe used to closely monitor and regulate HVAC and Electrical loads for efficiency
- Low flow plumbing fixtures
- Highly efficient LED lighting
- Raw water willbe used throughout building other than sink faucets and drinking fountains to minimize potable water use
- Earth berm on the north side of the building willhelp insulate building from solar heat gain which will minimize HVAC needed
- Permeable materials willbe used on pathways and certain parking areas to help reduce the amount of stormwater runoff
- Rain Water Harvesting (may be an alternate bid item)
- Interpretive signs

PLANTING PALETTE

Trees

AC	Aesculus californica
AM	Acer macrophyllum
CO	Cercis occidentalis
CSS	Cornus sessilis var. sessilis
HA	Heteromeles arbutifolia
PR	Platanus racemosa
PS	Pinus sabiniana
PVD	Prunus virginiana demissa
QA	Quercus agrifolia
QB	Quercus berberidifolia
QD	Quercus douglasii
QL	Quercus lobata
QW	Quercus wizlenzii
SLA	Salix lasiolepsis
SNC	Sambucus nigra ssp. caerulea

Entry Road Groundcovers

E1	Arctostaphylos cruzensis
E2	Arctostaphylos 'John Dourley'
E3	Arctostaphylos Hookeri Franciscana
E4	Arctostaphylos 'Pacific Mist'
E5	Baccharis pilularis 'Pigeon Point'
E6	Ceanothus thyrsiflorus griseus 'Yankee Point'
E7	Agrostis pallens/ Carex praegracilis/ Bouteloua gracilis

Native Meadow

M1	Achillea millefolium
M2	Sisyrinchium bellum
M3	Argrostris pallens
M4	Artemisia douglasiana
M5	Epilobium canum subsp. Canum
M6	Solidago elongata
M7	Ranunculus californicus var. californicus
M8	Leymus triticoides
M9	Koeleria macrantha
R3	Rhamnus californica
R9	Juncus effusus subsp. pacificus

Valley Needlegrass

G1	Nassella pulchra
G2	Lupinus formosus var. formosus
G3	Penstemon heterophyllus var. purdyi
G4	Eriogonum fasciculatum polifolium
G5	Sidalcea malviflora subsp. Laciniata
G6	Lupinus albifrons
G7	Eriophyllum confertiflorum var. confertiflorum
G8	Chlorogalum pomeridianum var. divaricatum

Riparian

R1	Carex nudata
R2	Rosa californica
R3	Rhamnus californica
R4	Stachys rigidia var. quercetorum
R5	Mimulus cardinalis
R6	Mimulus guttatus
R7	Lonicera hispidula
R8	Symphoricarpos albus var. laevigatus
R9	Juncus effusus subsp. pacificus
CCS	Cornus sericea subsp. sericea

Diablan Sage Scrub

SS1	Artemisia californica
SS2	Salvia mellifera
SS3	Eriodictyon californicum
SS4	Mimulus aurantiacus
SS5	Eriogonum fasciculatum var. polifolium
SS6	Salvia apiana
G3	Penstemon heterophyllum var. purdyi
G6	Lupinus albifrons var. albifrons
G7	Eriophyllum confertiflorum var. confertiflorum

Chaparral

C1	Erysimum capitatum var. capitatum
C2	Melica torreyana
C3	Monardella villosa ssp. villosa
C4	Penstemon centranthifolius
C5	Silene laciniata subsp. Californica
C6	Adenostoma fasciculatum var. fasciculatum
C7	Arctostaphylos glauca
C8	Cercocarpus betuloides var. betuloides
C9	Rhamnus californica ssp. tomentella
C10	Lonicera subspicata
C11	Prunus illicifolia
C12	Rhamnus illicifolia
C13	Solanum umbelliferum
G3	Penstemon heterophyllus var. purdyi
G7	Eriophyllum confertiflorum var. confertiflorum
SS4	Mimulus aurantiacus

Oak Savannah

C2	Melica torreyana
C7	Arctostaphylos glauca
C10	Lonicera subspicata
C11	Prunus illicifolia
C12	Rhamnus illicifolia
C13	Solanum umbelliferum
G1	Nassella pulchra
G3	Penstemon heterophyllus var. purdyi
OS1	Bromus carinatus var. carinatus
SS4	Mimulus aurantiacus

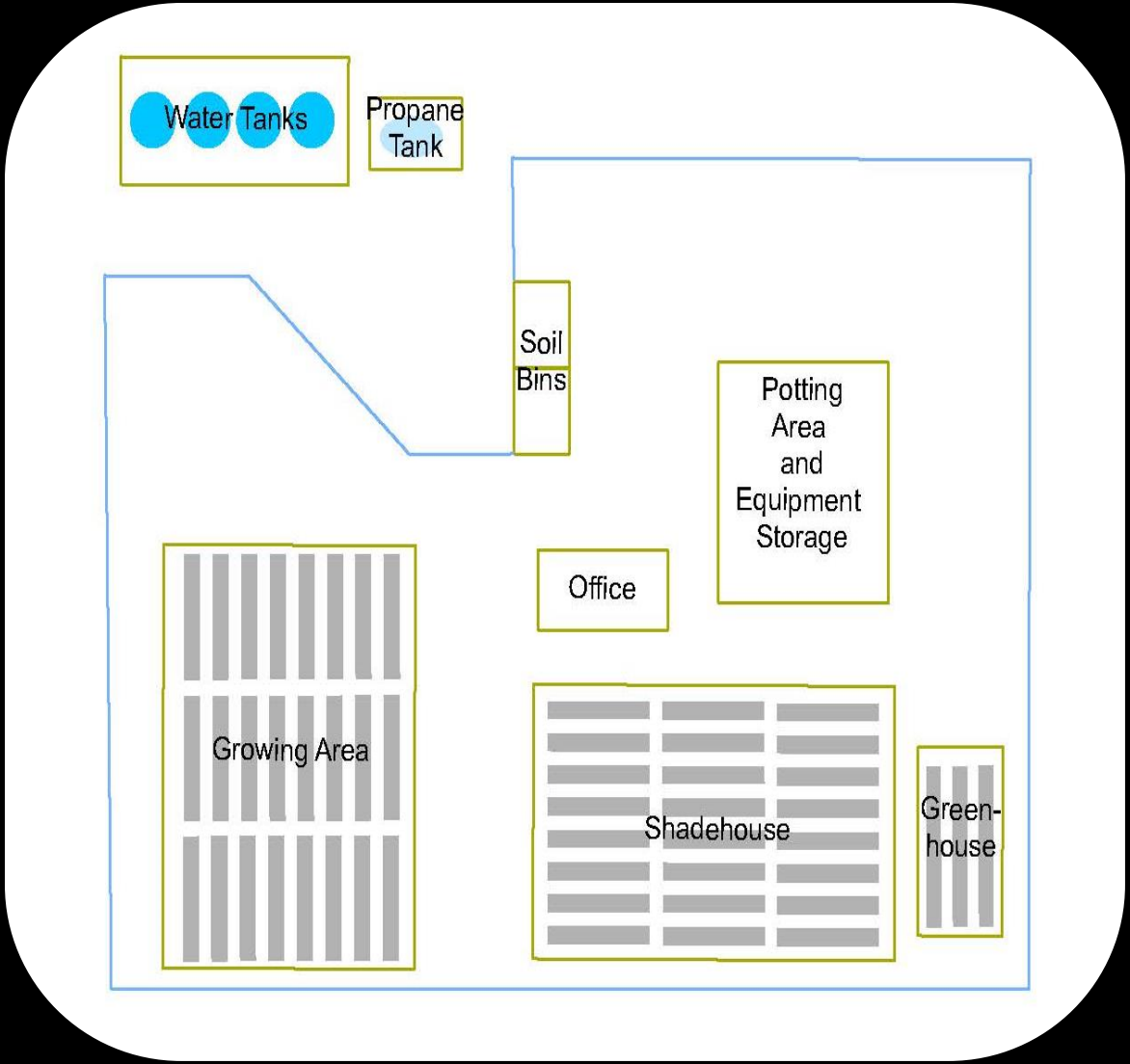
Mixed Evergreen Forest

EF1	Aquilegia formosa
EF2	Satureja douglasii
EF3	Stachys rigida var. quercetorum
EF4	Thalictrum fendleri var. polycarpum
EF5	Physocarpus capitatus
EF6	Ribes sanguineum var. glutinosum
C12	Rhamnus illicifolia
R3	Rhamnus californica
R7	Lonicera hispidula
R8	Symphoricarpos albus var. laevigatus


PENNS
VALL

Nursery Design

- Reduce opportunities for introducing contamination into plant stock.
- Maximize separation between clean and potentially contaminated areas



Propagative Materials

- Start with propagative material that is free from infection or external contamination by Phytophthora species as well as other possible pathogens.
- Only using seeds, cuttings, and on a limited basis divisions
- Some seed has been purchased, most has been collected from our watersheds
  - Propagules are only collected from healthy plants, not located within restoration sites or known infected areas
  - All propagule collection is done with clean hands, placed in disinfected or new containers, and cutting tools are sanitized frequently
  - Seed/fruit is not collected directly from the ground
  - If seed is collected off the ground, it is kept separate and later disinfected

Tools, surfaces, and the nursery environment

- Decontamination supplies (brushes and disinfectant sprayers) for sanitizing footwear are placed at all entrances to clean areas.
- Tools and equipment are assigned for exclusive use in the clean production areas
- Container stock are not placed on the ground or unsanitized surfaces at any point.
- Benches are cleaned and sanitized before placing new plants on them.

Clean Containers & Media

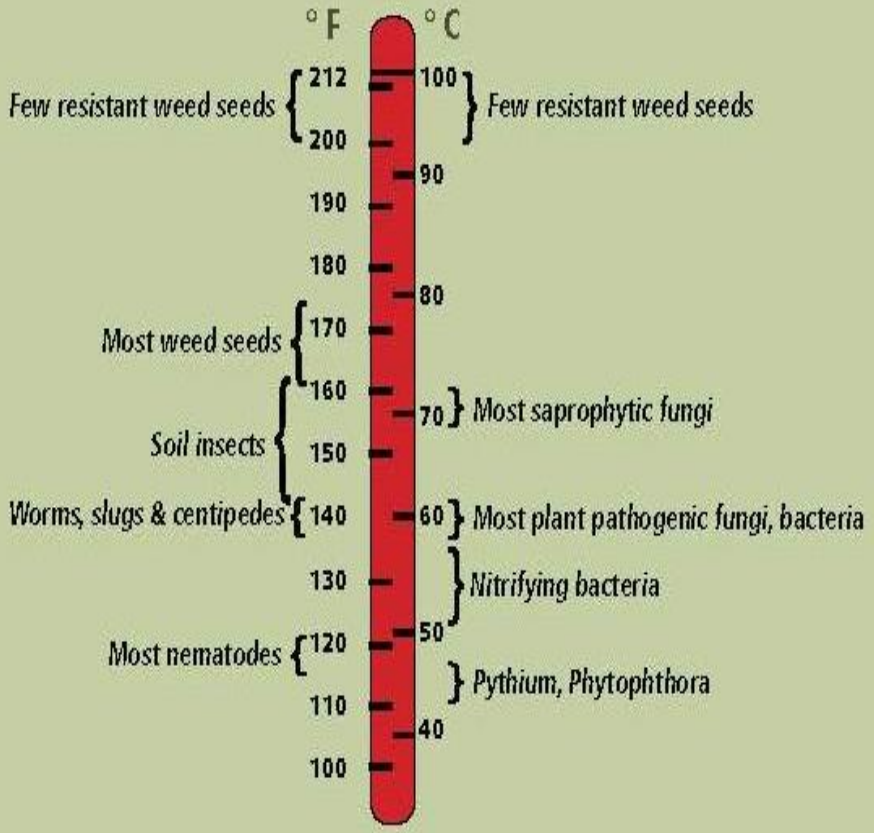
Pots

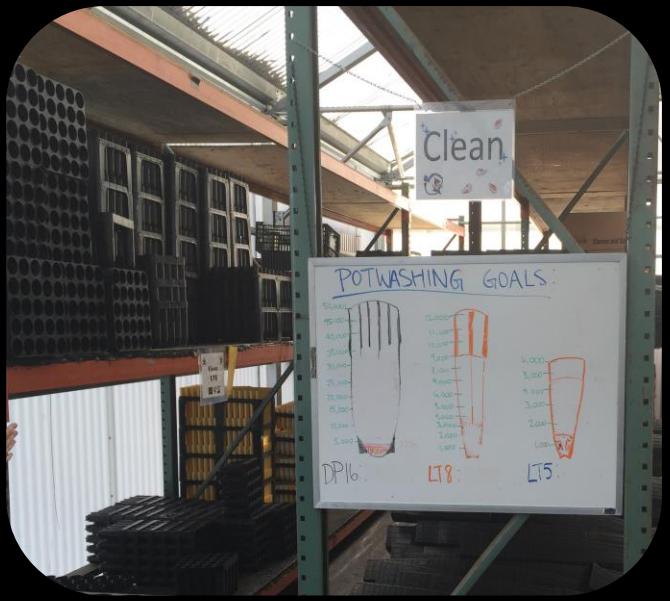
- Only use new pots or clean and sanitized pots
- Clean pots must be stored off the ground

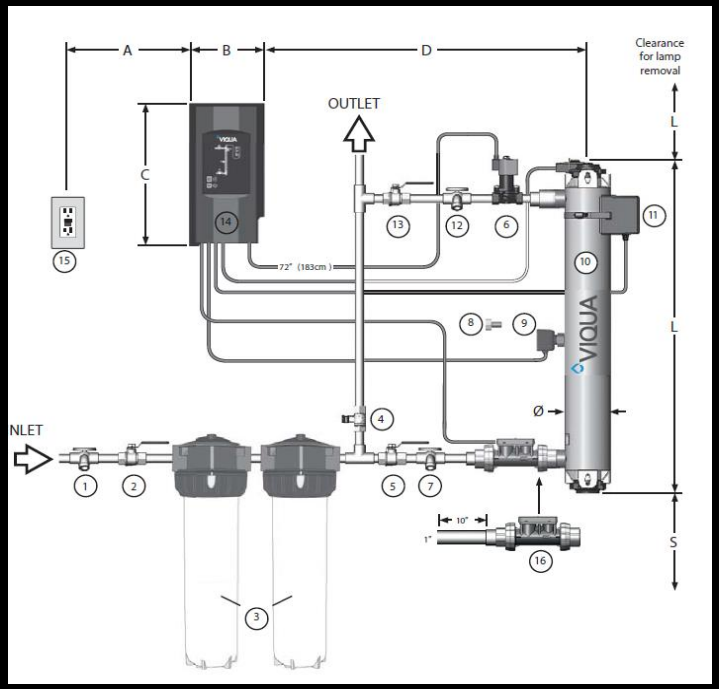
Media

- All potting media must be pathogen free and be handled and stored in a manner that precludes contamination.
- Soilless media may be used without treatment only if they are known to be free of contamination due to manufacture and handling conditions.

Temperatures required to kill various kinds of soil microorganisms based on a 30-minute exposure to moist heat. Modified from Baker, K. F. & Cook, R. J. (1974).




Clean
POTWASHING GOALS
DP16
LT8
LT5



Water & Irrigation

- Use only clean, pathogen-free water for irrigation and rinsing surfaces. Water should be from treated municipal water supplies or wells.
- If recycled or raw water is used, it must be treated with ozone, chlorine, UV, ultrafiltration.

Clean Practices for Workers, Volunteers, & Visitors

- All persons that work in or visit the nursery must consistently follow phytosanitary practices
- Clean clothing- no entry into clean areas wearing clothes that have soil from landscaped areas, field sites, trails, or other potentially contaminated areas.
- Footwear should be cleaned and sanitized before entering clean areas of the nursery.

Benches & Growing Areas

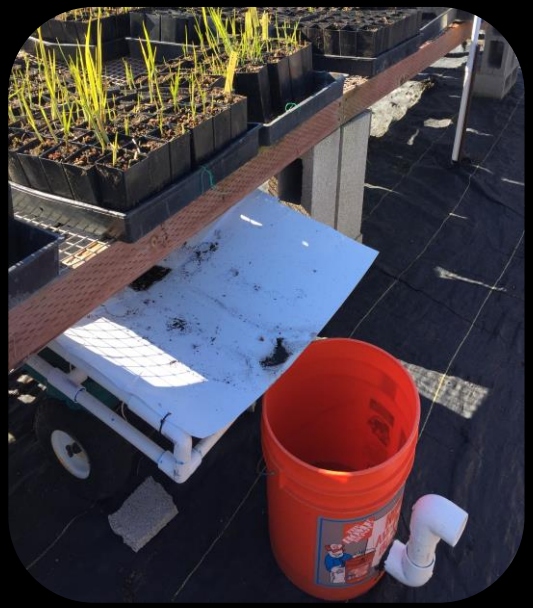
- Minimize the space between plants and potential sources of contamination to reduce the risk of contamination via water splash.
- All plants on benches are at least 2 ft above the underlying surface (3 ft preferable) to minimize splash.
- Bench tops are made of expanded wire mesh (nonporous open materials).
- Plywood, wood pallets, or similar solid surfaces that allow water to pool or run laterally are not acceptable.
- Surfaces underneath benches, walkways, and driveways are maintained to prevent puddles, eliminate splash potential, and remain free of weedy vegetation.
- Maintain adequate drainage and use gravel, landscape fabric, pavers, concrete, or other materials to avoid having exposed wet soil or mud.

Amendments and Chemicals

- No amendments unless we have reliable documentation that they(a) are free of Phytophthora and other pathogens and (b) have been stored and handled in a way to prevent contamination.

- No application of systemic oomycete suppressive compounds (commonly called “fungicides”) because these compounds suppress Phytophthora and interfere with Phytophthora detection but do not eliminate Phytophthora infections

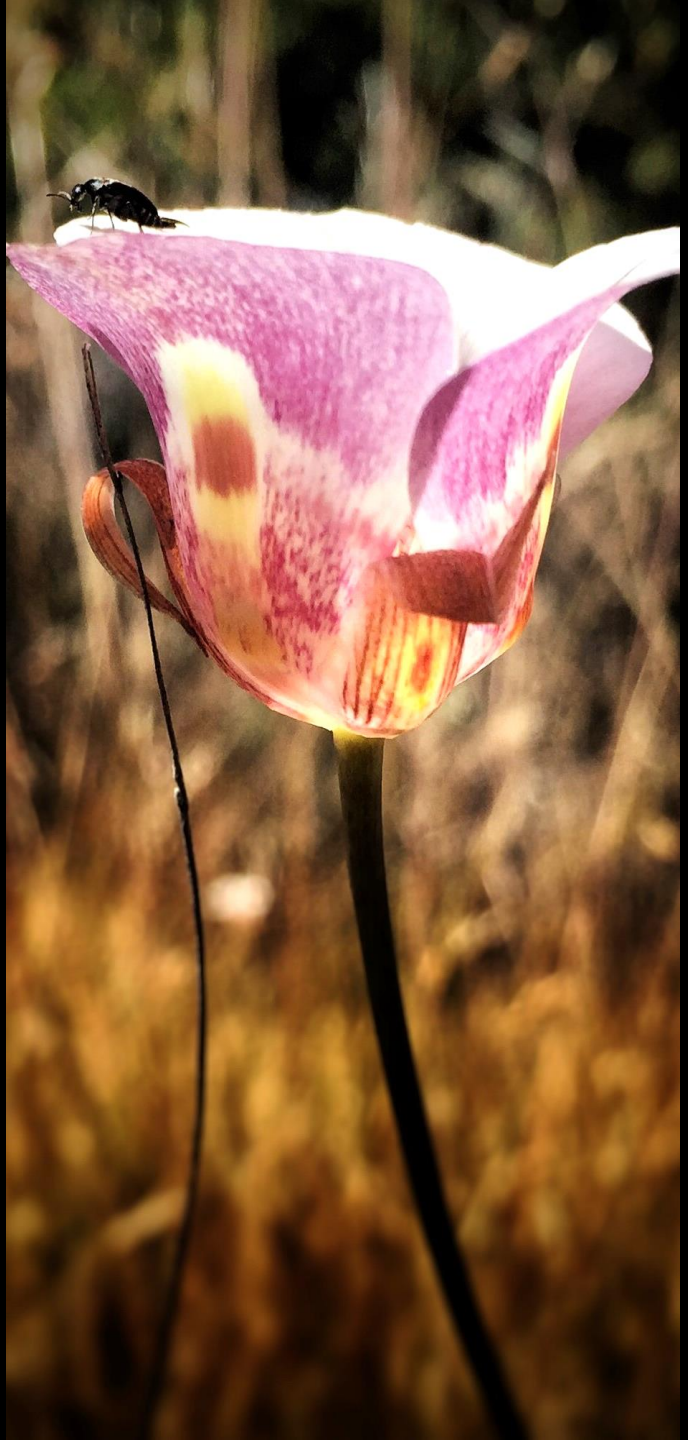
Inspection and Testing



- Identify potentially diseased material at the earliest possible stage to prevent further spread in the nursery.
- Regular bench-level testing to in blocks of asymptomatic plants.

Phytophthoras in Native Habitats Work Group

- California Department of Food and Agriculture
- California Native Nursery Network
- California Native Plant Society
- Central Coast Wilds Nursery
- Elkhorn Slough National Estuarine Research Reserve
- Marin Municipal Water District
- Monterey County Agriculture Department
- National Ornamentals Research Site at Dominican University of California
- National Park Service
- Golden Gate National Recreation Area
- Phytosphere Research
- Presidio Trust
- San Francisco Public Utilities Commission
- Santa Clara County Water District
- The Watershed Nursery
- Midpeninsula Regional Open Space District
- University of California, Berkeley - Forest Pathology and Mycology laboratory
- University of California, Davis - Department of Plant Pathology
- UC Cooperative Extension
- USDA Forest Service, Forest Health Protection



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LONGWOOD GARDENS

Virus Management In A Chrysanthemum Collection

Jim Harbage

June 8, 2018

Chrysanthemums at Longwood Gardens

Timeline

- Present in the Conservatories since opening in 1921
- Longwood Chrysanthemum Festival evolved 1923-present
- John Creech – USDA plant exploration in Japan in 1956
  - 1921 - Cascades and exhibition types
  - 1956 - 118 new cv.s from Japan
  - 1961 – baskets, columns, curtains
  - 1960s - training into shapes (table, chairs, animals)
  - 1969 - chandelier, 1971 - basket mobile
  - 1972 – standards (tree forms)
  - 1976-1994 – themed displays (Alice in Wonderland)
  - 1994 (2006) – 1000 blooms, shields, arches, spirals
  - 2011 – Chinese pagoda towers

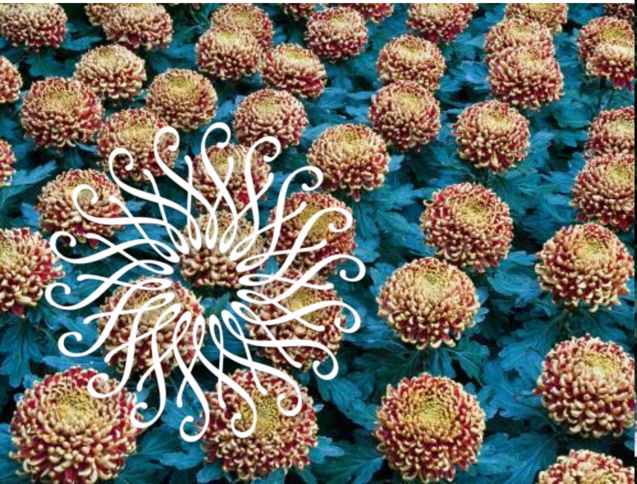

Kiku
ARCTIC OCEAN
Greenland
Arctic Circle
ASIA
NORTH
MERICA
f Cancer
ATLANTIC
PACIFIC
Equator
AFRICA
INDIAN
OCEAN
OCEAN
SOUTH
AMERICA
f Capricorn
OCEAN
AUSTRALIA
Antarctic Circle
ANTARCTICA
120°
80°
40°
0°
40°
80°
120°


京都府


2,175輪

Chrysanthemums at Longwood


FLAIR
PINK DUKE
GILLETTE
PLUSH RED
KENBU
KISHINONISHI
EDO 06
SHAMROCK
GOLDEN RAIN
CANDID



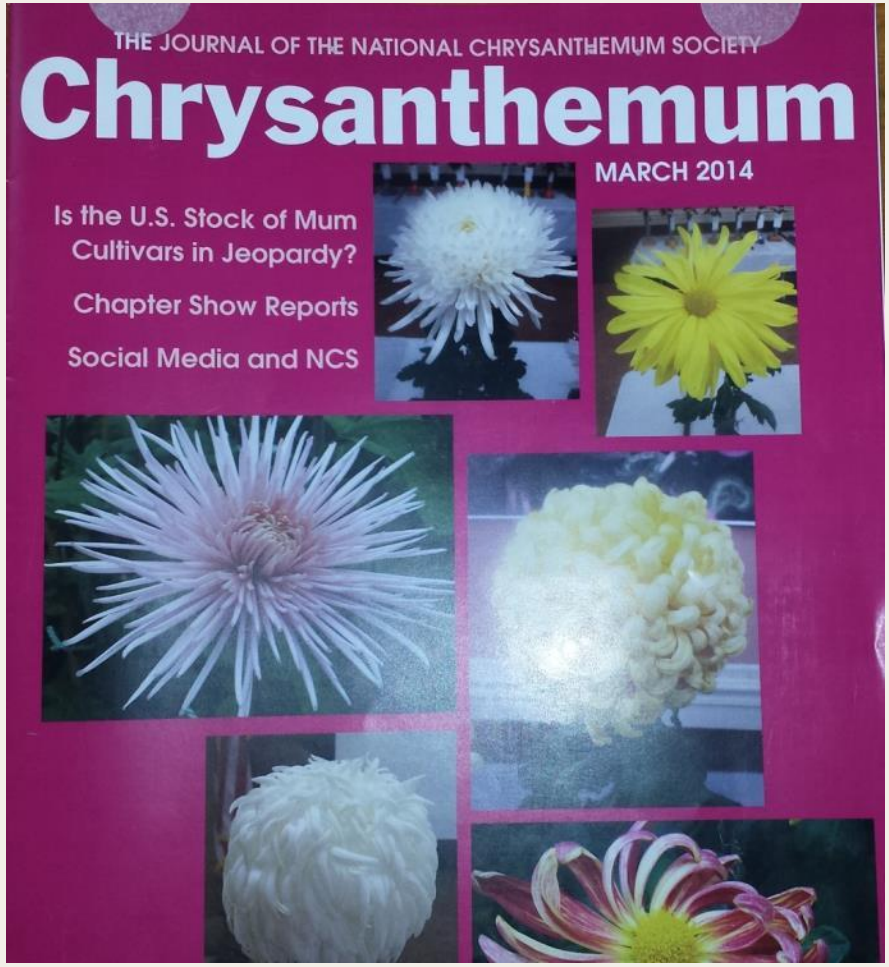
Chrysanthemums – Disappearing Art Form

- Participation is generational
  - Labor intensive
  - Long training requirement
  - Low wage value
- Festivals are shrinking
- Number of supply nurseries decreasing

Chrysanthemums – Specialty Cultivar Supply

Fragile supply chain

- Single supply nursery
- Collections limited
- Inventories are not common knowledge
- Limited inter-institutional distribution



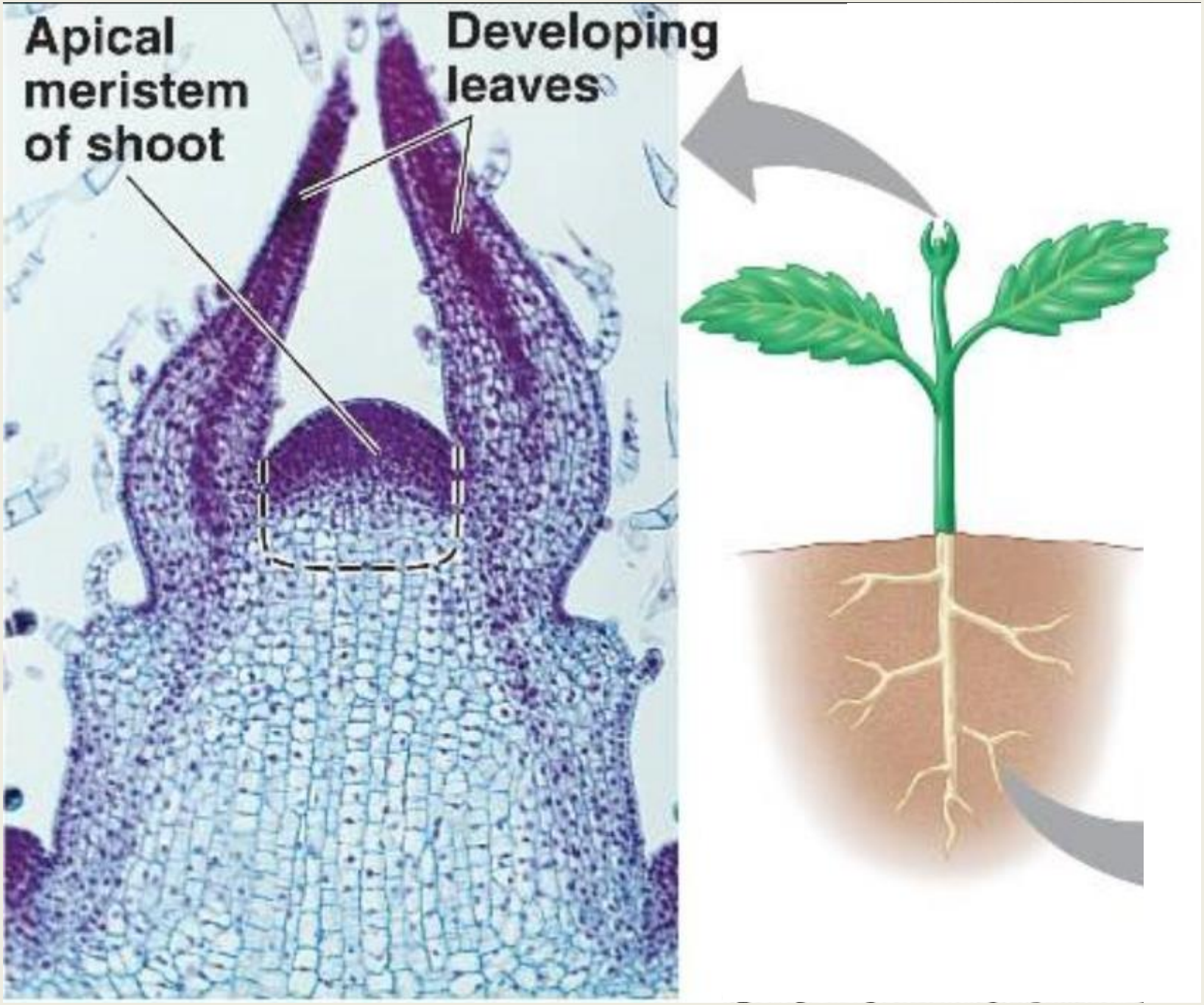
Chrysanthemum Core Collection – Initial Development

- Board approved Collection Management Plan in April 2014
- Total Collection: 200+ accessions
- Core Collection: 47 accessions
- Core Collection Focus:
  - Bonsai - 8
  - Cascade - 30
  - Doll - 2
  - Thousand Bloom - 7

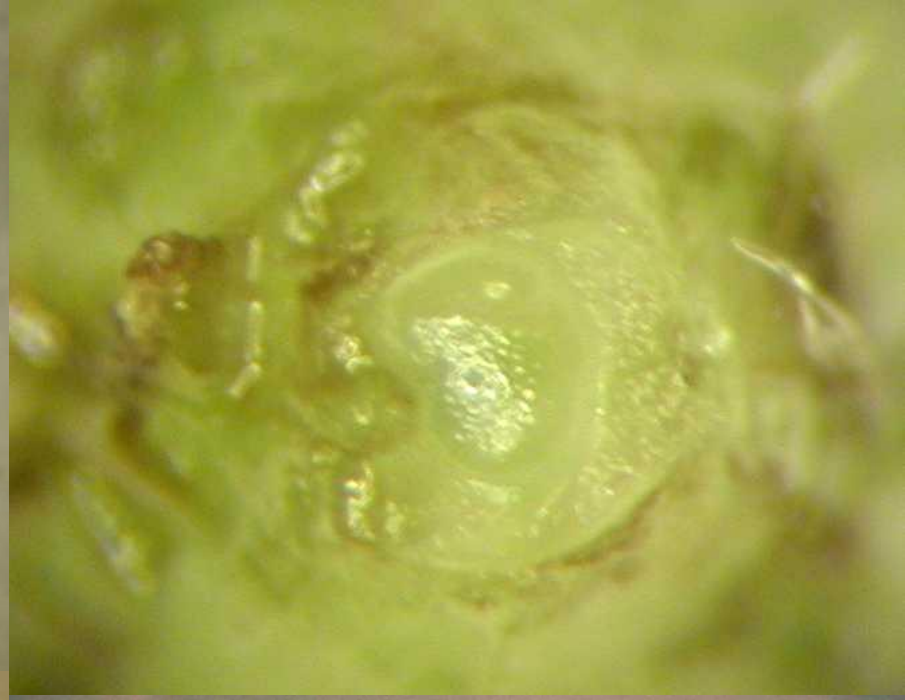
Chrysanthemum Core Collection – Plant Collections Network Review

- Accredited November 2017
- Continued collection development: Shigeharu Matsuda and Kokka'en Nursery
- Research will continue to isolate meristems, virus test stock plants and produce virus-free cuttings
- USDA Quarantine site for Chrysanthemum importations?

Virus Elimination In Chrysanthemums Meristem Culture


Apical meristem of shoot
Developing leaves

Meristem Culture

Virus Testing

Testing Report

Activity: 2001121107 ReportNum: 1 Page 1

	Plant Type	Sample ID	ArMV	results	CVB	results
1	Chrysanthemum	Golden Pinwheel	0.012	Negative	**4.000**	**Positive**
2	Chrysanthemum	Golden One Mericlone	0.011	Negative	0.018	Negative
3	Chrysanthemum	Golden Two Mericlone	0.010	Negative	0.015	Negative
4	Chrysanthemum	Golden Three Mericlone	0.010	Negative	0.016	Negative
5	Iris	'Blue Diamond'	0.011	Negative	0.019	Negative
6	Iris	'White Wedgewood'	0.014	Negative	0.017	Negative
Pos Ctl			**4.000**	**Positive**	**4.000**	**Positive**

1	Chrysanthemum	Golden Pinwheel	0.025	Negative	0.040	Negative	0.013	Negative
2	Chrysanthemum	Golden One	0.024	Negative	0.033	Negative	0.013	Negative
3	Chrysanthemum	Golden Two	0.026	Negative	0.044	Negative	0.016	Negative
4	Chrysanthemum	Golden Three	0.019	Negative	0.050	Negative	0.016	Negative
5	Iris	'Blue Diamond'	0.020	Negative	0.026	Negative	0.019	Negative
6	Iris	'White Wedgewood'	0.031	Negative	0.035	Negative	0.022	Negative
Pos Ctl			**4.000**	**Positive**	**2.293**	**Positive**	**4.000**	**Positive**

Trueness-To-Type

- Lundy Yellow – petals deformed, should be reflex form

- Edo 25 – a few yellow flowers mixed with pink, should be pink

Trueness-To-Type

- Wisp of Pink – only 1 plant in pot flowered
- Edo 38 – only one plant in pot flowered

Trueness-To-Type

- Brookside Garden – both spoon and daisy petals on same plant
- Plush Red – mix of two cultivars in same pot

Protecting Clean Collection

- On-Site
  - Tissue culture
  - Greenhouse stock plants

- Off-site
  - King's Mums https://www.kingsmums.com/
  - Cornell Plantations

- Virus test full collection annually

- Quarantine all newly acquired material

Collaborations

- Public Gardens - US
  - US Botanical Garden
  - Phipps Conservatory
  - Brookside Botanical Garden
  - Chicago Botanic Garden
  - New York Botanical Garden
  - Elizabeth Gardner Museum and Garden
  - Bellingrath Gardens and Home
  - Smith College Lyman Conservatory
  - Lauritzen Garden's Omaha

- Callaway Gardens
- Hillwood Estate Museum and Gardens
- Highland Botanical Park
- Marjorie McNeely Conservatory
- Arnold Arboretum
- Fredrik Meijer Gardens
- Vander Veer Botanical Park
- Penn State Campus Arboretum
- Baltimore Conservatory

Chrysanthemum Festival

About this Display

Our horticulture expertise shines during Chrysanthemum Festival.

We begin more than a year in advance to grow thousands of chrysanthemums meticulously nurtured and trained into giant orbs, spirals, columns, pagodas, and other unique forms. The Thousand Bloom Mum takes center stage in our East Conservatory, showcasing the skill of our talented team of horticulturists, who grow one plant bearing more than 1,000 perfect blooms on a single stem.

Dates & Price

On View October 25
–November 18, 2018

Free with Gardens Admission

Buy Before You Arrive

Sell Out Likely

LONGWOOD
GARDENS

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