

USDA Forest Service

# URBANFOREST CONNECTIONS

*webinar series*

Second Wednesdays | 1:00 – 2:15 pm ET

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Forest Service  
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# BREEDING AND RESTORING THE NEXT GENERATION AMERICAN ELM



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# Breeding and restoring the next generation American Elm

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RNGR = Reforestation, Nurseries, and Genetic Resources

RNGR is funded through State and Private Forestry



# Invasive species are a new reality for urban and natural forests

Your choices for management:

- Spray or inject pesticides.
- Hope for a biocontrol.
- Replace with a different species.
- Find a cultivar or seed source bred for resistance.

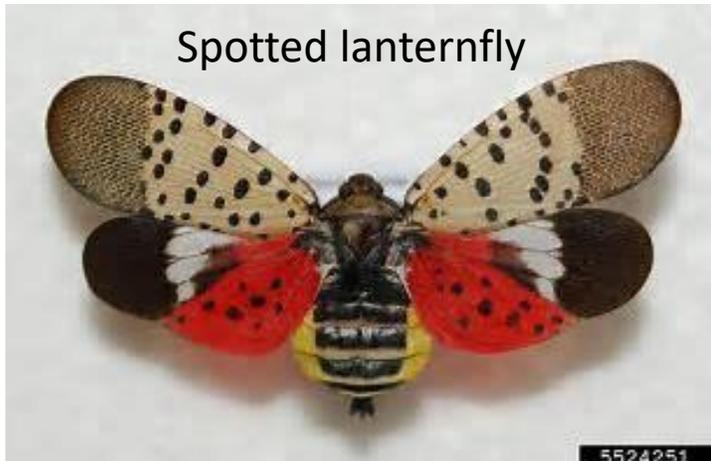


Chestnut blight

UGA5053097



Butternut canker



Spotted lanternfly

5524251



White pine blister rust



Hemlock woolly adelgid



Emerald ash borer

UGA9000019

# How do we 'breed' for resistance?

We identify candidate trees in natural forests that have favorable traits.

We conserve the tree 'genotypes' by storing seed, planting the seed into a common garden, or making a graft of the candidate tree.

Later, we can make controlled crosses among top candidate trees.

Ideally, after one or more generations, genes for favorable traits are stacked together.



Black walnut selection. Photo credit: Jim Warren.

# We often use common garden studies to evaluate trait expression

Screening eastern white pine for resistance to white pine blister rust disease at Oconto River Seed Orchard, USDA Forest Service, Langlade WI. Photo by C. Pike.



These two studies have one feature in common: the pedigree of each tree is known and tracked.



Measuring a trial of northern red oak to improve timber quality at Purdue University. Photo credit: Jim Warren

**Right now, we can only screen American elm trees that are 5-7 years old.**

# When all else fails, genetically modified organisms might be needed to save a species

What is a Genetically Modified Organism (GMO)?

A novel genotype created by moving genes for desired traits between organisms that normally wouldn't breed in nature.

GMO plants are created in the laboratory and require decades of research to develop.

Government regulations to release new transgenics are rigid and restrictive.

**American elm is not a candidate for a GMO!**

≡



American chestnuts were once a dominant tree, and a major source of food, in the forests of eastern North America. ANDREW NEWHOUSE

To save iconic American chestnut, researchers plan introduction of genetically engineered tree into the wild

Science magazine, 2018. doi:10.1126/science.aav2573

# What is that tree? Nursery jargon 101:

## “Cultivar”

A ‘variety’ of a plant (native or not) that is produced by selective breeding and usually sold as a clone.

Cultivars grown at  
Forrest Keeling  
nursery, Elsberry MO  
--->  
Photo by C. Pike



- Latin name for species
- Cultivar name
- Common name
- Family



# What is that tree? Nursery jargon 101:



Aster seed collection plot at Greenbelt Native Plant Center, Staten Island NY. Photo by C. Pike

## “Nativar”

Beach plum at  
Pineland Native  
Plant nursery,  
Columbus NJ.  
→  
Photo by C. Pike



A native plant ‘variety’ selected for some horticultural trait (flower color, stature, etc). Typically sold as seed.



Latin name for species

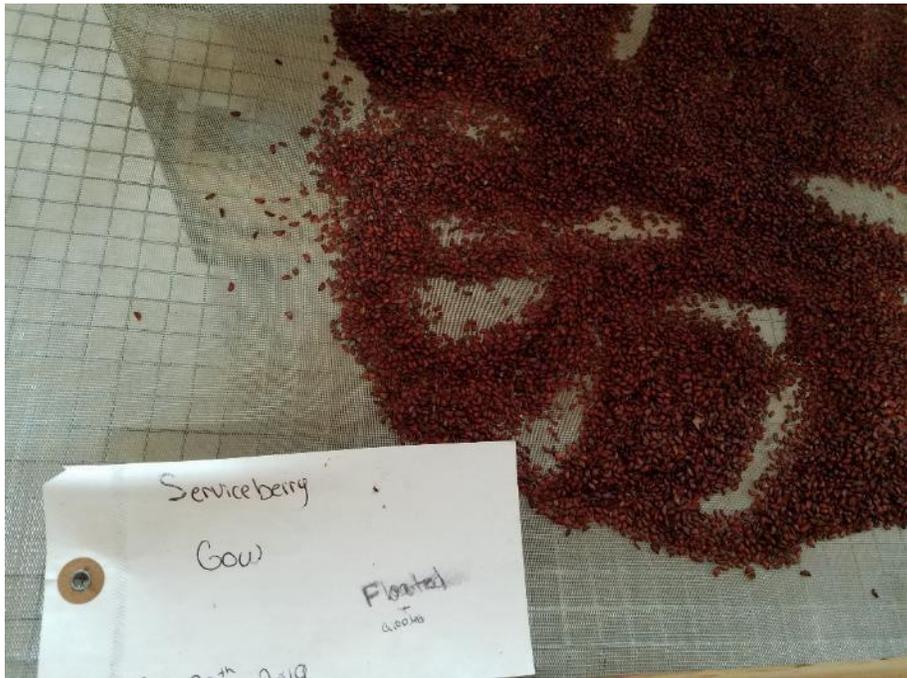
Common name

Family

# What is that tree? Nursery jargon 101:

## Seed source / Seedlot

A collection of wild-pollinated seed, presumably not selected for any specific trait.



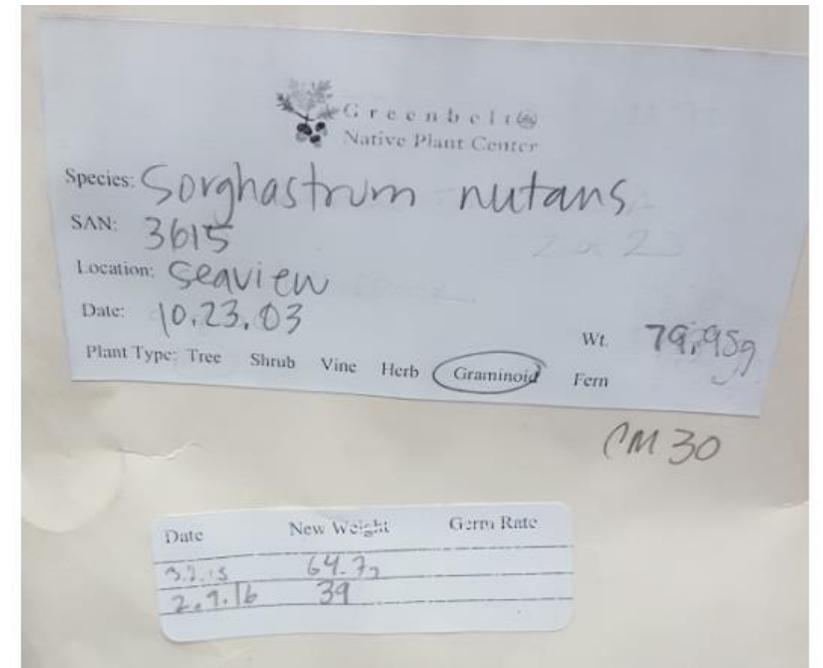
Serviceberry seedlot at Missouri State nursery, Licking MO.

## Source-identified seed:

A collection of wild-pollinated seed from a native (presumably) species of where the geographic origin of the seed was tracked.



Tulip poplar bed at Pineland nursery, NJ.



Seed label at Greenbelt Native Plant center.

# Does source identification matter?

It depends.

- In urban areas, usually no. WHY?
  - Most urban forests are populated with cultivars that are bred for, or selected to tolerate, urban conditions – high heat, anaerobic soil conditions. They are not expected to self-perpetuate.
- In natural forests, YES. WHY?
  - Because our goal in restoration is for plants/trees to become naturalized: they need to reproduce on their own, which requires that they are synchronized with other plants of the same species on that site.



# Elm is a model species for resistance breeding and cultivar development

- It can be grafted or propagated from cuttings fairly easily.
- It produces copious amounts of seed from a young age.
- Seed is orthodox – it can be stored in a cooler for years.
- Several cultivars have been developed for urban markets which is GREAT.
- BUT, we want a population with improved resistance to plant in wild forests that will be self-perpetuating.

