Handling Emerald Ash Borer in the Western States

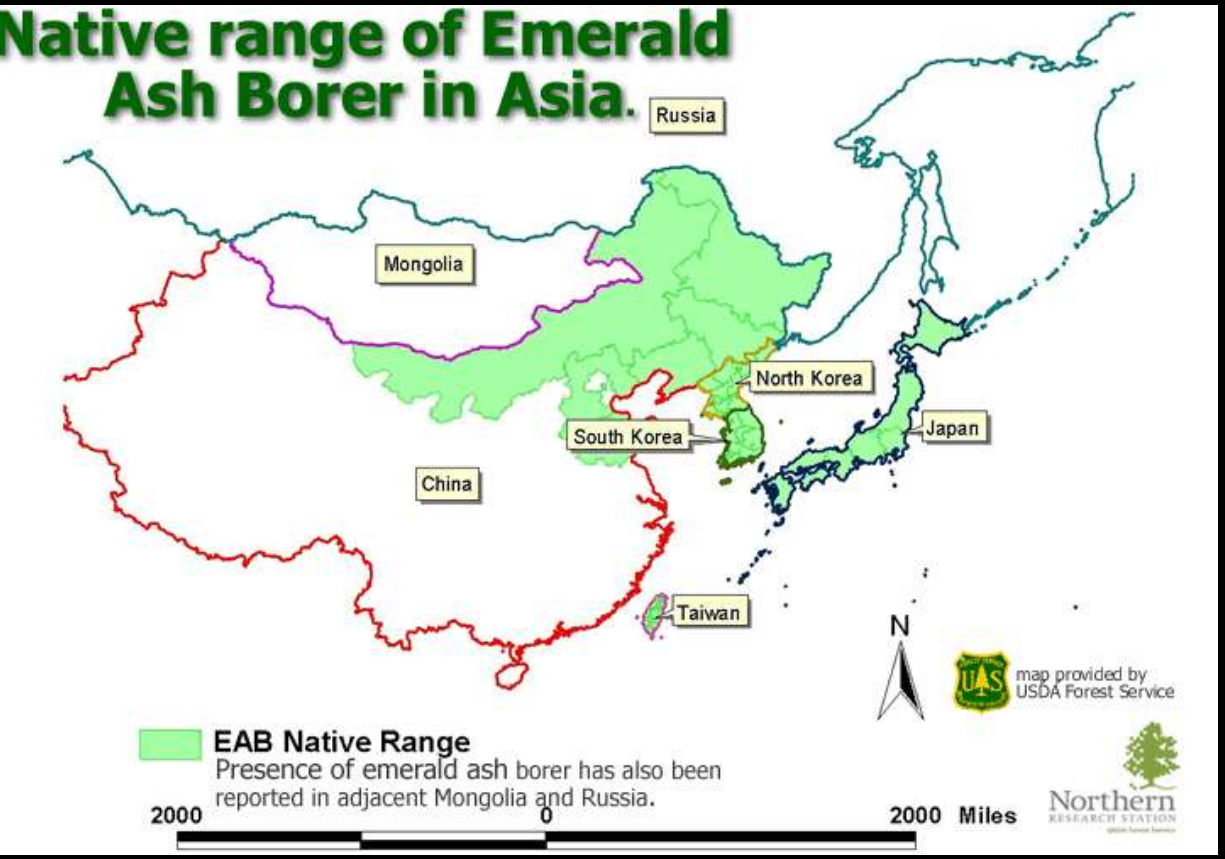
USU InService Training Session – September 21, 2017

Whitney Cranshaw, Colorado State University

Emerald ash borer (EAB) is a green-colored beetle…….

…that develops in ash trees (*Fraxinus* species)…

……and is Native to Asia



Larvae tunnel under the bark girdling the cambium.

Photo by Edward Czerwinski

Effects of larval tunneling are cumulative, and ultimately lethal to the tree. Most trees are dead within 5 years after the initial colonization.

Photograph by Art Wagner

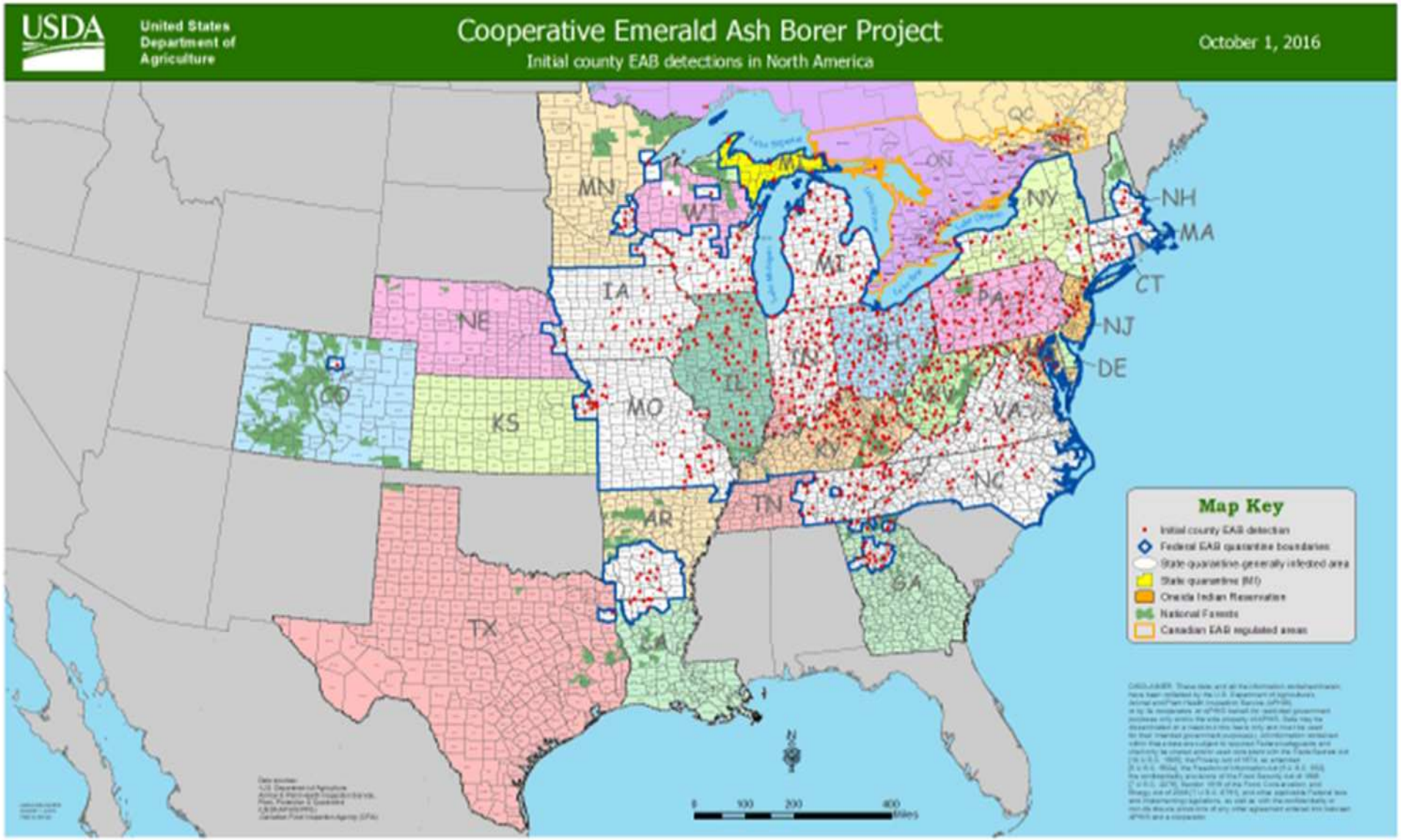
Photograph by MI Department of Agriculture

How will plant condition affect rate of EAB injury?

More stressed trees will very likely die more rapidly than healthier trees.

Photograph by MI Department of Agriculture

Emerald ash borer was accidentally introduced into and has since spread through North America



Lilac/Ash Borer does not equal Emerald Ash Borer!

Lilac/ash borer, a clearwing borer moth

Emerald ash borer, a metallic wood borer/ flatheaded borer

Photograph by Debbie Miller

Emerald ash borer

Agrilus plannipennis

Photograph by David Cappaert

Order Coleoptera (beetles)

Family Buprestidae (metallic wood borers, flatheaded borers

Lilac/Ash Borer

Podosesia syringae

Order: Lepidoptera (Moths and butterflies)
Family: Sesiidae (Clearwing borers)

Emerald ash borer larvae create meandering tunnels in the cambium that produce girdling wounds.

Note: **Attacks can occur throughout the crown and on the trunk of the tree.**

Photograph by Eric Day

Photograph by
David Cappaert

Lilac/ash borer larvae create irregular gouging wounds that extend often into the heartwood.

Attacks are concentrated at the lower trunk of the tree

EAB adults chew through the bark, producing D-shaped exit holes

Extruded pupal skin

Lilac/ash borer emerges from *irregularly round holes*. The pupal skin is pulled out when the adult emerges.

Damage potential to its host

10 – EAB now defines an aggressive tree killing insect in North America.

Damage potential to its host

2, maybe 3 – Lilac/ash borer has far lower ability to seriously damage its host

Emerald ash borer ***is devastating to all species of ash that are native to North America***

Green ash

White ash

Why is EAB so destructive to ash trees in North America?

NA ash species lack ability to ability to resist EAB

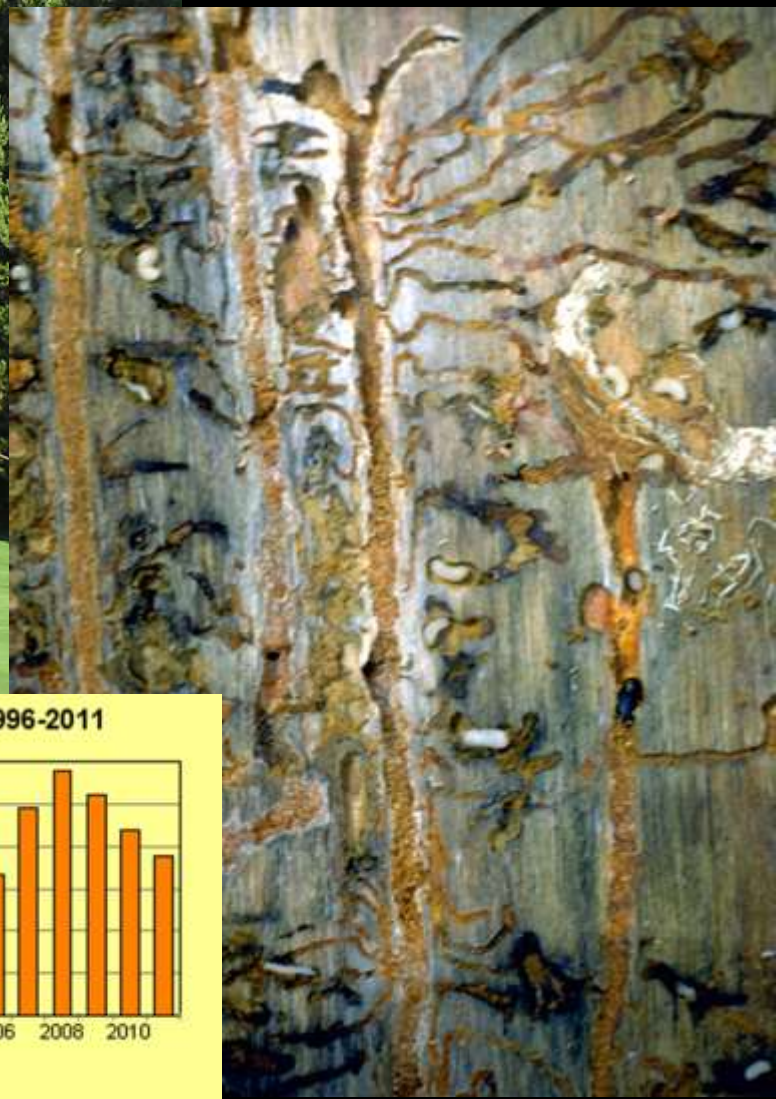
Ash that are native to Utah

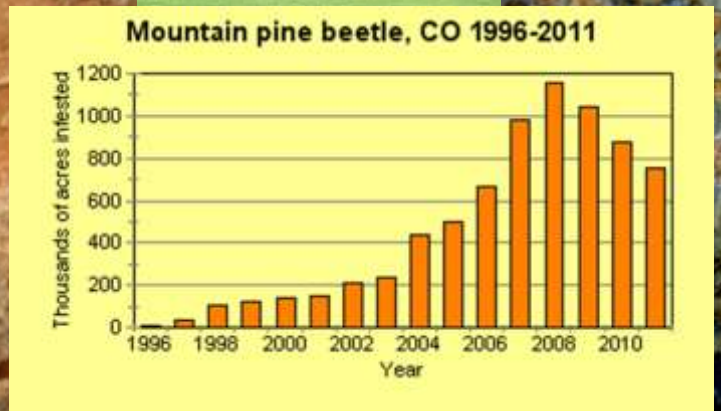
Singleleaf ash
Fraxinus anomala

Velvet ash
Fraxinus velutina

EAB Will Kill All Unprotected Ash

Common question: How is this different from mountain pine beetle? MPB killed a lot of trees.





Chestnut blight – Devastated American chestnut in early 1900s, caused by a fungus

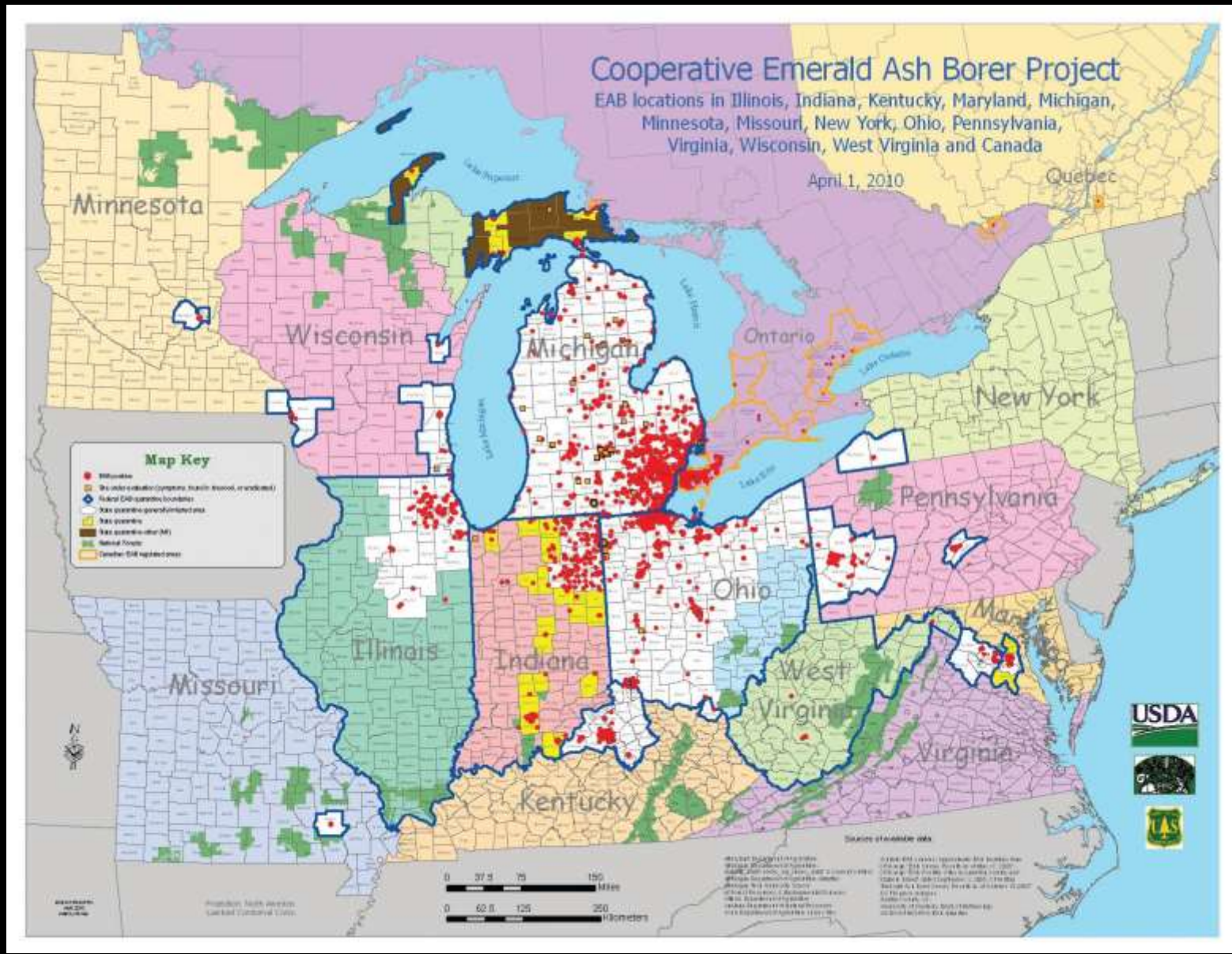
Dutch elm disease – Devastated American elm in mid century. Caused by a fungus, vectored by a bark beetle

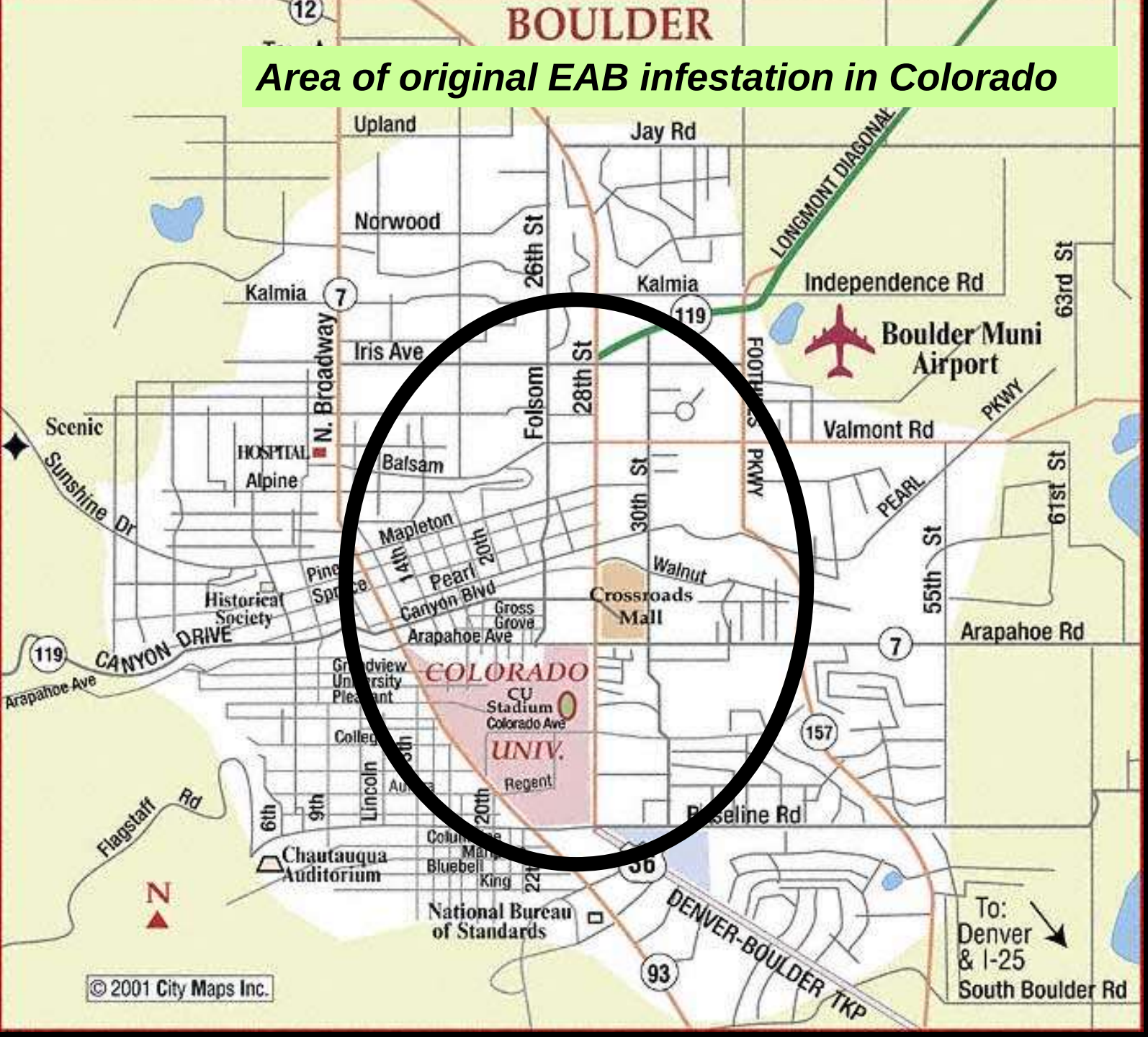
Colorado EAB Tree #1

Located near the intersection of 30th and Valmont, Boulder

September 23, 2013

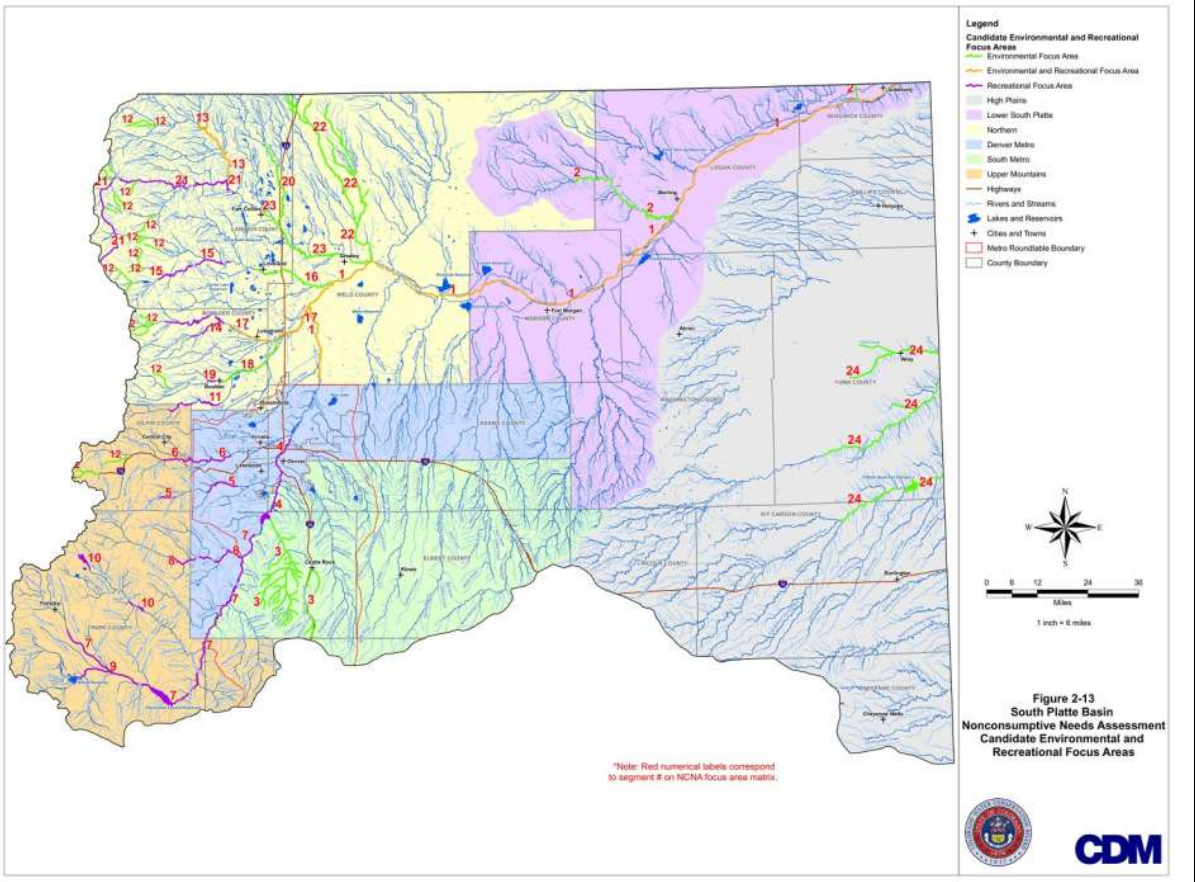
Known positive locations of emerald ash borer as of April, 2010




BOULDER
Area of original EAB infestation in Colorado
Upland
Jay Rd
LONGMONT DIAGONAL
Norwood
26th St
Kalmia
Kalmia
Independence Rd
63rd St
Boulder Muni Airport
Iris Ave
N. Broadway
Folsom
28th St
Scenic
Sunshine Dr
HOSPITAL
Alpine
Balsam
Valmont Rd
PKWY
30th St
PEARL
61st St
55th St
Mapleton
14th
20th
Pearl
Canyon Blvd
Walnut
Crossroads Mall
Historical Society
Gross Grove
Arapahoe Ave
Arapahoe Rd
CANYON DRIVE
COLORADO
CU Stadium
Colorado Ave
UNIV.
Regent
Lincoln
6th
9th
20th
Flagstaff Rd
Baseline Rd
Chautauqua Auditorium
Bluebell
King
National Bureau of Standards
DENVER-BOULDER TKP
To: Denver & I-25
South Boulder Rd
N
© 2001 City Maps Inc.

Unlike states to the east, Colorado is highly compartmentalized due to its geography

The current infestation is an infestation of the South Platte River drainage, not the State of Colorado



Within the next five years, emerald ash borer *will* move out of Boulder into the surrounding counties

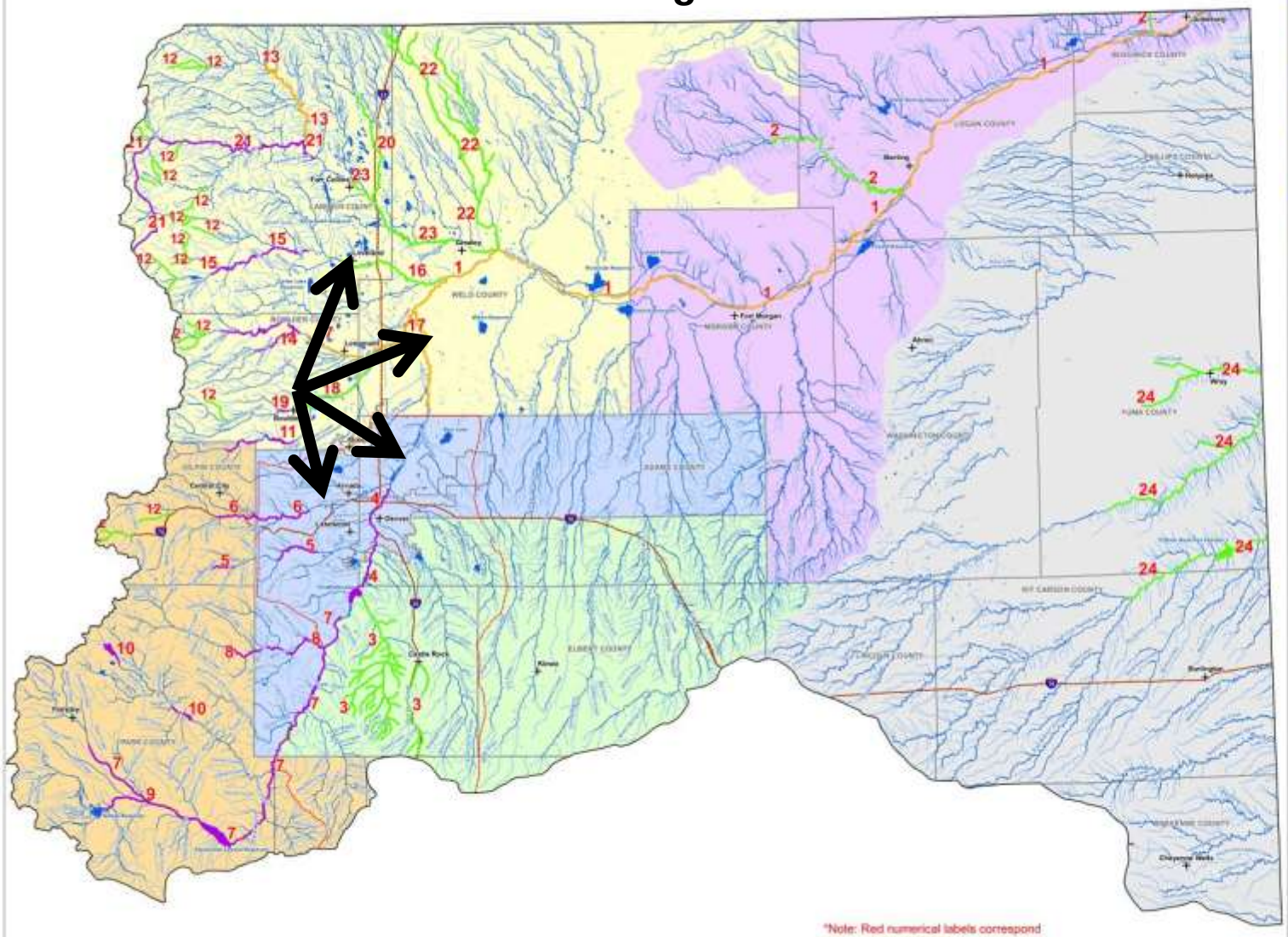
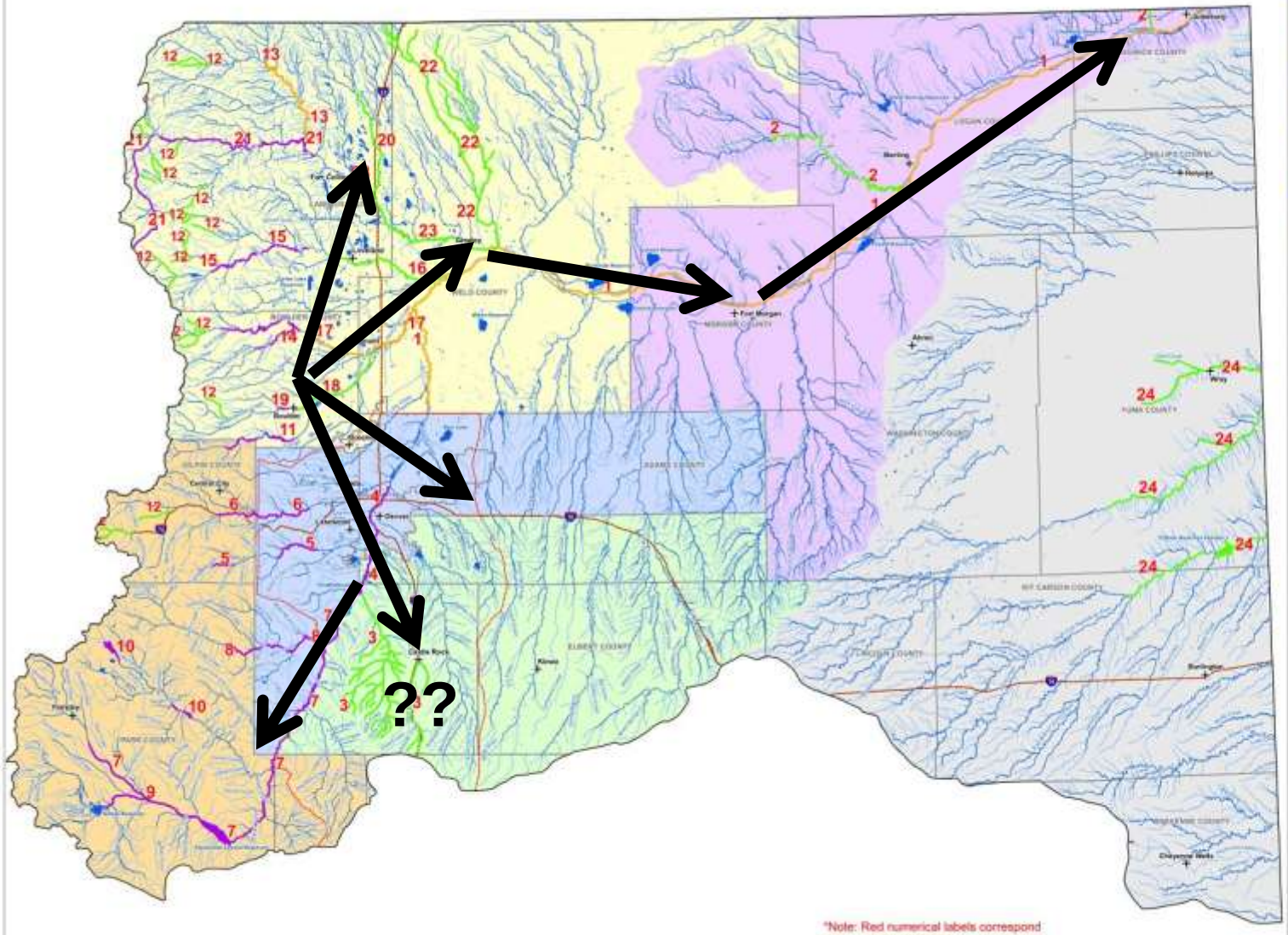


Figure 2-13
South Platte Basin
Nonconsumptive Needs Assessment
Candidate Environmental and Recreational Focus Areas

CDM

Over time the South Platte River Drainage will be colonized by emerald ash borer



*Note: Red numerical labels correspond to segment # on NCNA focus area matrix.

Legend

Candidate Environmental and Recreational Focus Areas

- Environmental Focus Area
- Environmental and Recreational Focus Area
- Recreational Focus Area
- High Plains
- Lower South Platte
- Northern
- Denver Metro
- South Metro
- Upper Mountains
- Highways
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- Metro Roundtable Boundary
- County Boundary

N W E S

0 6 12 24 36

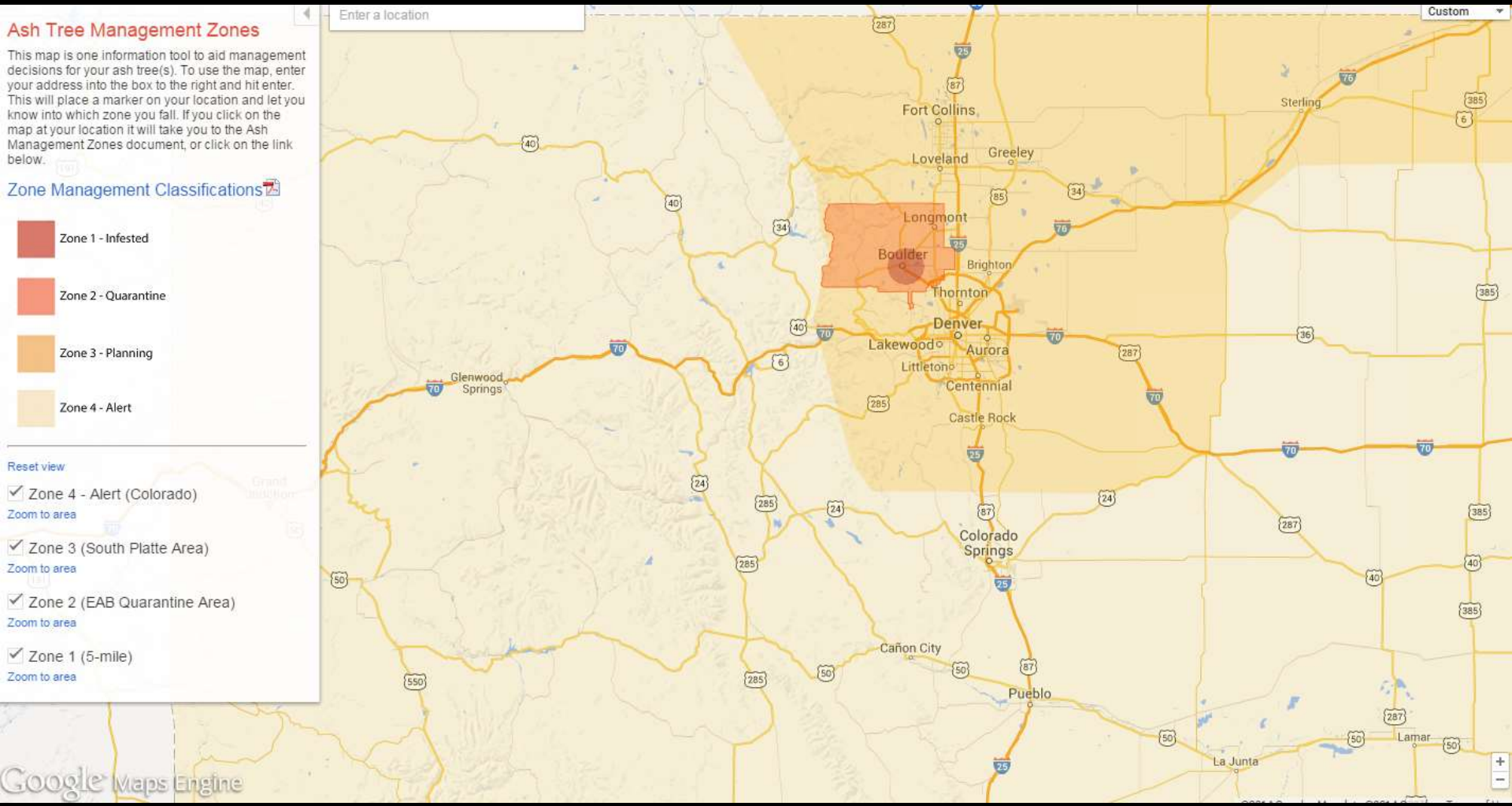
Miles

1 inch = 6 miles

Figure 2-13
South Platte Basin
Nonconsumptive Needs Assessment
Candidate Environmental and Recreational Focus Areas

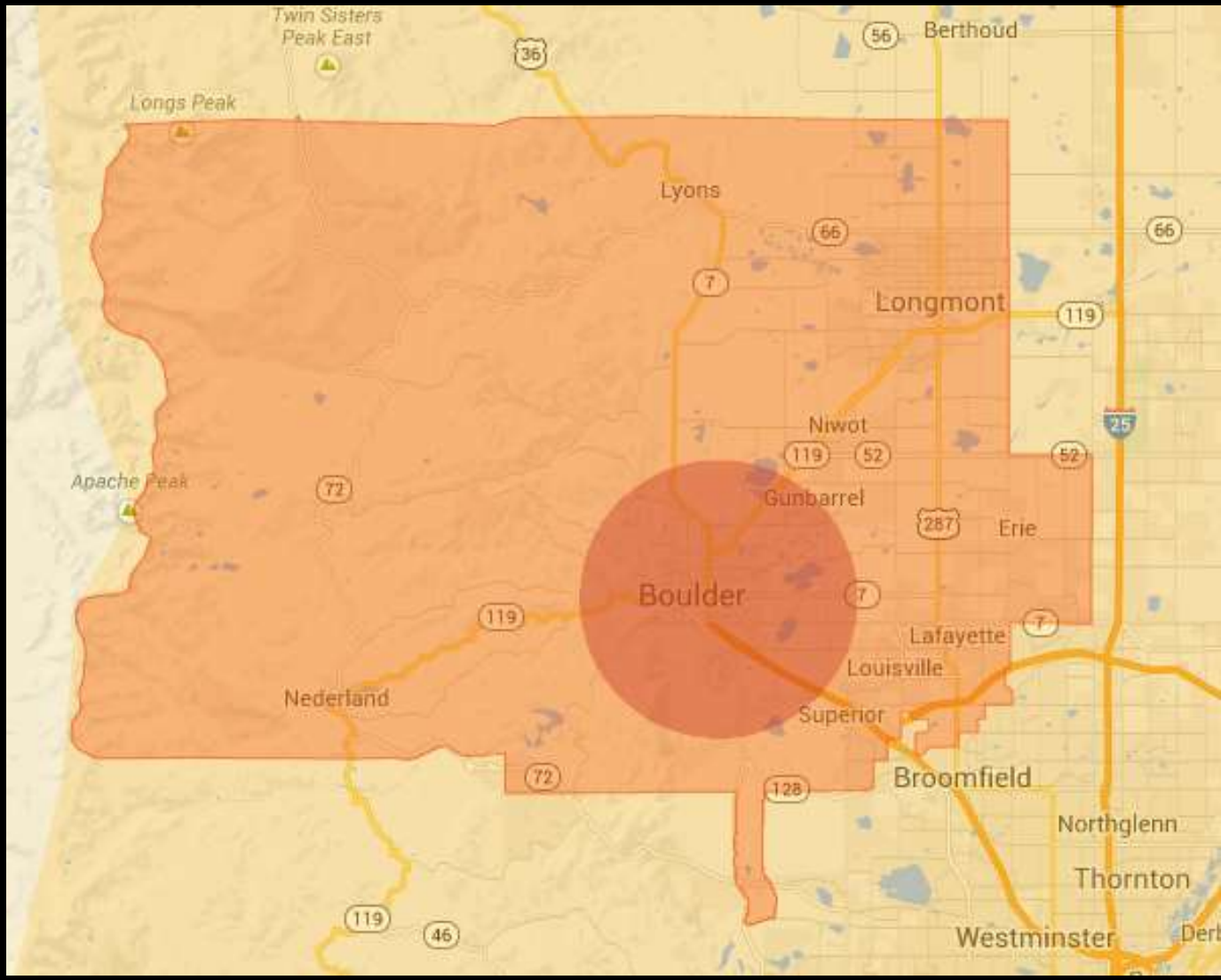
CDM

Important Note: Emerald ash borer is an insect that is falls under federal quarantine laws.



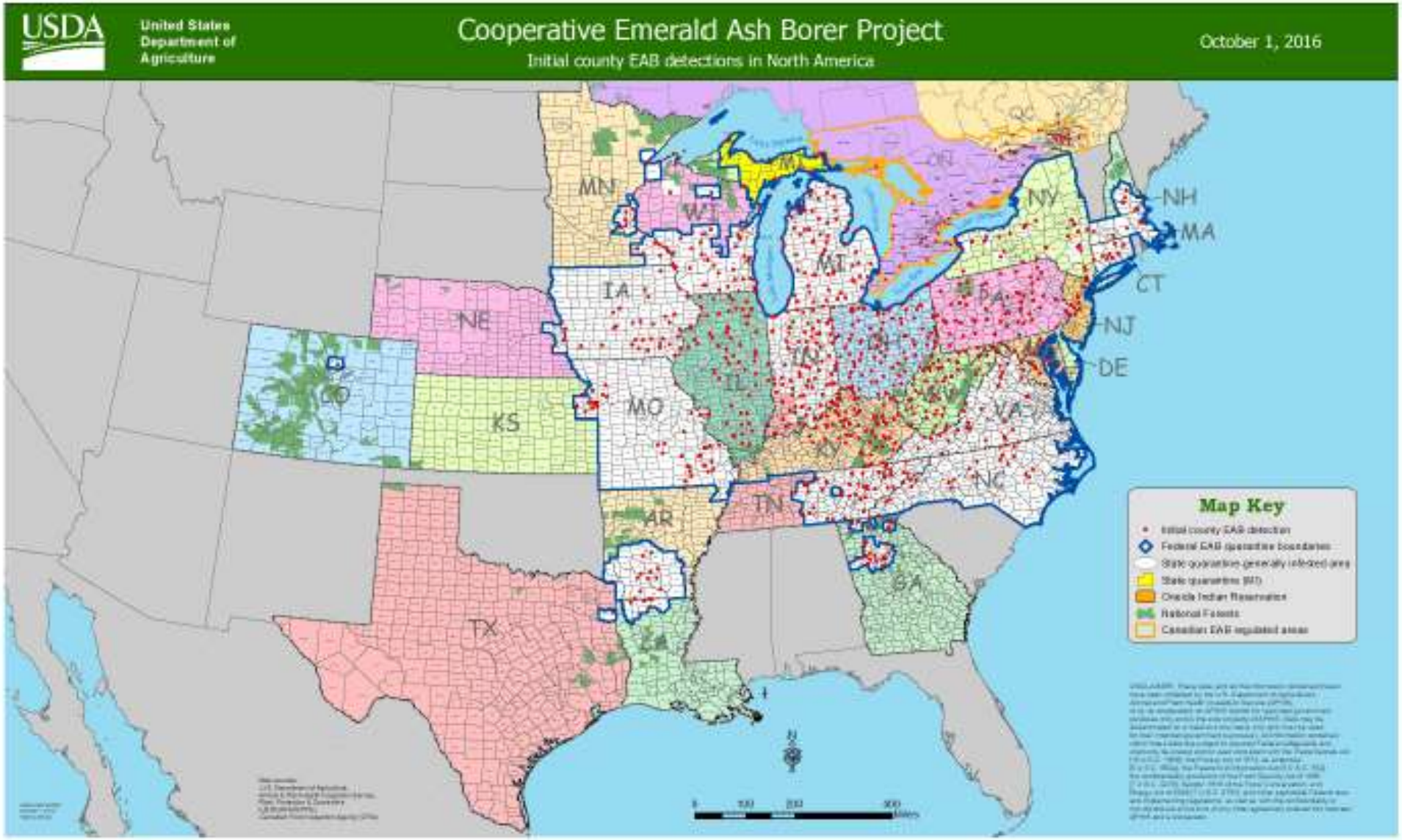
Counties with EAB infestations are subject to restrictions on movement of many wood products outside county borders.

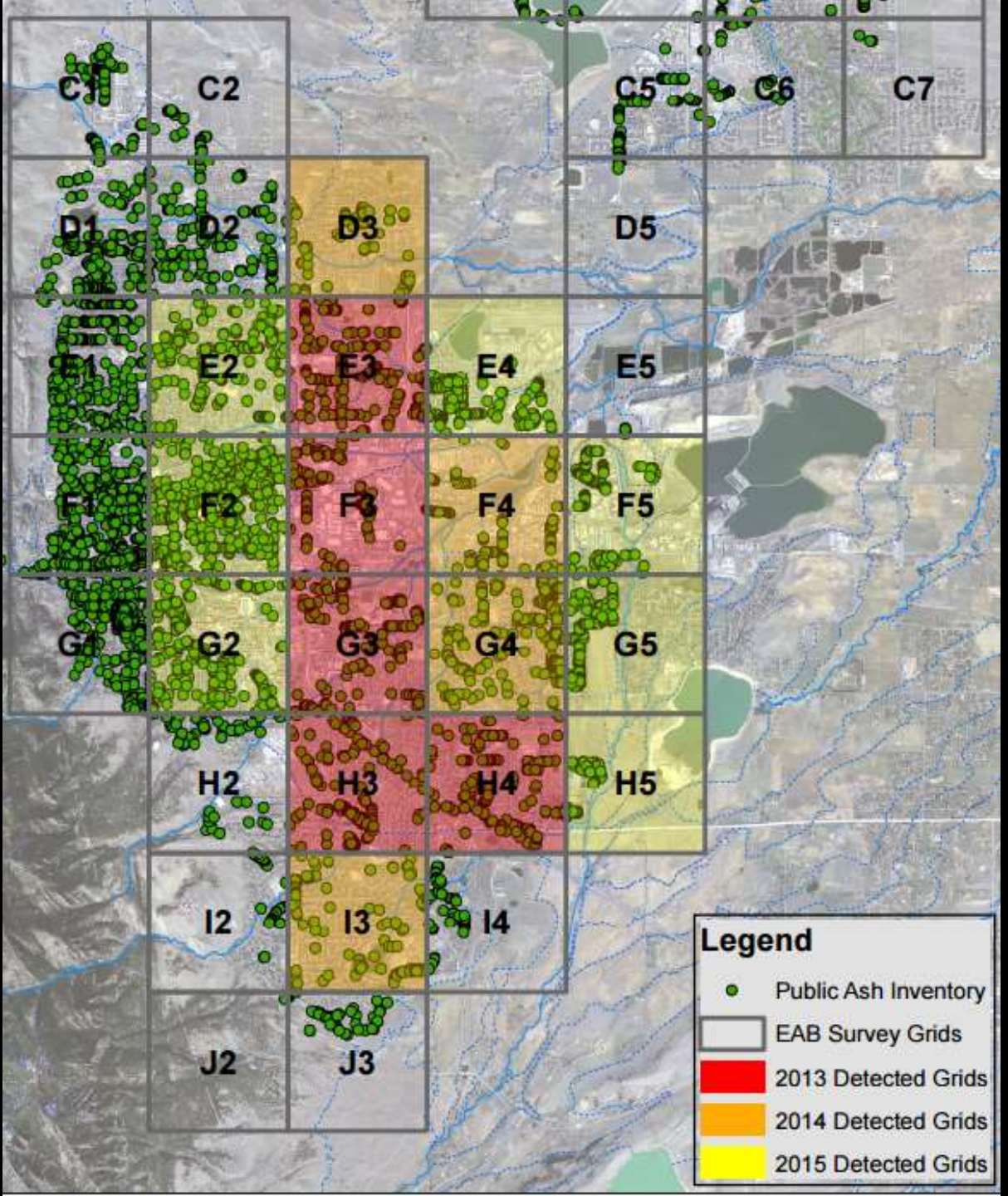
Present EAB quarantine area in Colorado



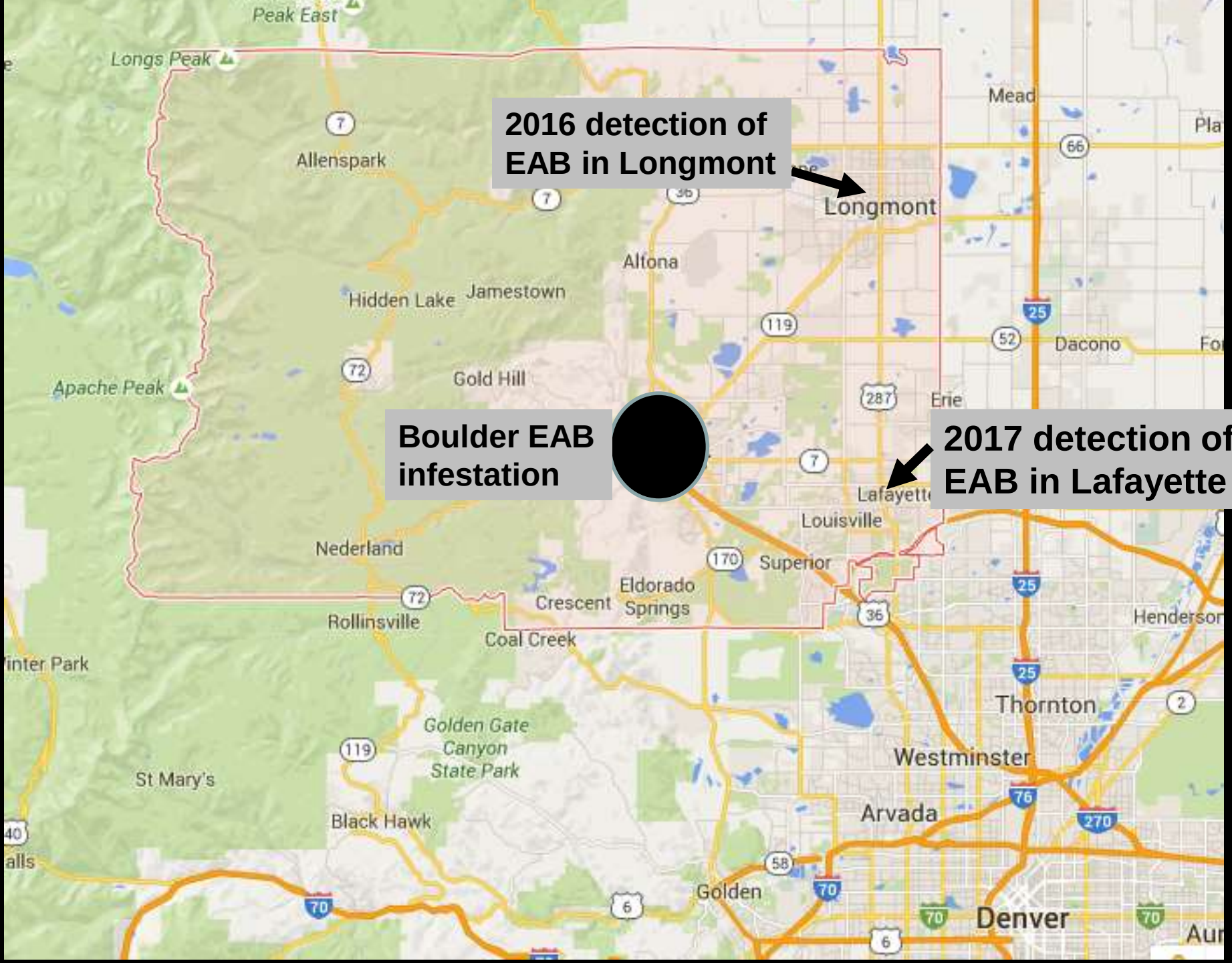
*** Plus some areas of Jefferson, Weld and Larimer Counties that include landfills used by Boulder County**

Reported emerald ash borer distribution - one year ago





Areas known to be infested with emerald ash borer in Boulder (original site of Colorado establishment)


2016 detection of EAB in Longmont
Boulder EAB infestation
2017 detection of EAB in Lafayette
Peak East
Longs Peak
Allenspark
Mead
Longmont
Altona
Hidden Lake
Jamestown
Dacono
Apache Peak
Gold Hill
Erie
Lafayette
Louisville
Nederland
Superior
Eldorado Springs
Crescent
Rollinsville
Coal Creek
Thornton
Golden Gate Canyon State Park
Westminster
St Mary's
Black Hawk
Arvada
Golden
Denver

Known CO distribution of emerald ash borer as of today

- Known infestation is still presently confined to areas within Boulder County limits
  - Steady expansion has occurred within the original areas of infestation
    - Tree decline symptoms are advancing as predicted in core area of infestation
  - Detections have been made in two adjacent communities

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  - Steady expansion has occurred within the original areas of infestation
    - Tree decline symptoms are advancing as predicted in core area of infestation
  - Detections have been made in two adjacent communities
  - ***Extensive trapping and surveys conducted in 2017 have still not detected EAB anywhere outside Boulder County***

How will EAB spread once established?

- Wind-blown dispersal of adults
  - Peak period of adult dispersal is late May through late July
- Butt-heads that move wood containing developing stages

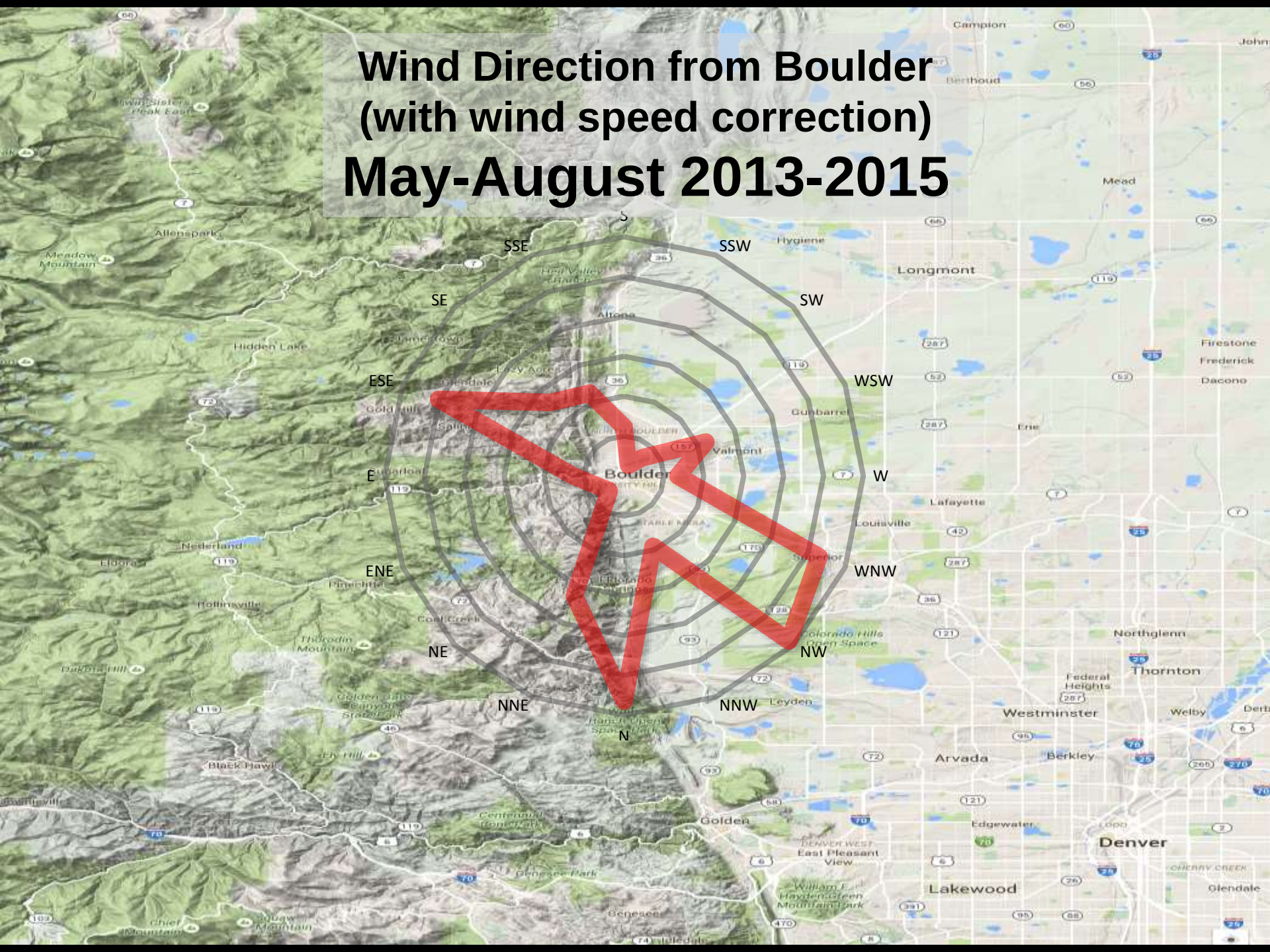
Photograph by David Cappaert

EAB likely will emerge sometime in mid-late May.

Most eggs will be laid in June, egg laying will continue through summer

Photograph by Dan Herms

Wind Direction from Boulder
(with wind speed correction)
May-August 2013-2015



How far away is emerald ash borer from your community?

How far away is emerald ash borer from your community?

One truckload

Detecting Emerald Ash Borer

Symptom that will develop as EAB injuries accumulate –
Progressive dieback of the crown

0%

10%

20%

30%

40%

50%

ADIOS condition of regional ash greatly complicates EAB detection

ADIOS - Ash Decline of Idiopathic Origins

- Residual effects of drought
- Residual effects of freezing injuries
- Cumulative effects from secondary pests
  - Ash bark beetles
  - Cytospora cankers
- ??????

Possible symptom of EAB injury – irregular yellowing of the foliage

Leaf size decreases in EAB affected trees

Meandering tracks under the bark of ash always indicate some flatheaded borer. They will *almost always* indicate emerald ash borer.

Bark cracking **can be a good clue that EAB may be present in a tree**

A good place to look is the underside of limbs, particularly in the area near the trunk

Peeling the bark away from a cracked area may reveal earlier larval tunneling

Detecting Emerald Ash Borer in Colorado

Look for D-shaped exit holes in ash trees

Detecting Emerald Ash Borer

The presence of the insect is a positive detection

Can you control EAB once it gets here?

- How do you define control?

- Will you be able to eliminate it from the state?
- Will you be able to slow its spread?
- Will you be able to protect individual trees?

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- Will you be able to slow its spread?
  - **Yes. Insecticide treatment of trees can control the insect. Removal of infested trees can decrease EAB population build-up. Strict enforcement of restrictions on ash wood movement will slow spread to new areas.**

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- Will you be able to slow its spread?
  - **Yes. Insecticide treatment of trees can control the insect. Removal of infested trees can decrease EAB population build-up. Strict enforcement of restrictions on ash wood movement will slow spread to new areas.**
- Will you be able to save individual trees?
  - **Definitely yes. There are some highly effective treatments – but they are $$$ and must be sustained for the life of the tree.**

Main Points About Emerald Ash Borer in Colorado Today

- **Known infestation presently confined to areas within Boulder City limits and a limited areas of Longmont, Lafayette**
  - In time will spread throughout South Platte drainage
- **Treatments are available that can protect individual trees once they first become infested**
  - Each treatment option involves decisions balancing costs, environmental hazards, effectiveness, and ease of application

Control Options for Management of Emerald Ash Borer

Ash Tree Treated
For Emerald Ash Borers
Untreated Ash Tree

Important note regarding EAB control

Present controls can allow trees to recover if EAB-induced crown thinning has not exceeded 30-50%

0%

10%

20%

30%

40%

50%

60%

70%

80%

90%

100%

Smitley, Davis and Rebek. 2008. Progression of ash canopy thinning … in Southeast Michigan. J. Econ. Entomol. 101: 1643 – 1650.

Emerald Ash Borer Control Options

- Soil applications with systemic insecticides
  - imidacloprid, dinotefuran
- Non-invasive trunk sprays of systemic insecticides
  - dinotefuran
- Trunk injections of systemic insecticides
  - Emamectin benzoate (TREE-Age), azadirachtin (TreeAzin), imidacloprid

Adults as they feed on foliage

Young larvae that tunnel in the phloem and cambium

Target Life Stages for EAB Treatments

Emerald Ash Borer Insecticides

- Imidacloprid (Merit, Xytect, Criterion, etc.)
  - Soil drench, possible trunk injection
- Dinotefuran (Safari, Zylam)
  - Basal trunk spray, possible soil drench
- Emamectin benzoate (Tree-Age, others)
  - Trunk injection only
- Azadirachtin (Treeazin, Azasol, others)
  - Trunk injection only

Soil application option – imidacloprid applied as drench or injection

Primary method of imidacloprid application – soil applications for root uptake

Basal trunk spray with dinotefuran (Safari, Zylam)

DoMyOwnPestControl.com

Basal Trunk Sprays of Dinotefuran

- Enters tree through thin areas of bark
- Can be expected to reach peak levels in foliage in about 2-3 weeks
- Adjuvant? – May help some to increase deposition into trunk fissures, slow drying

What is the Incidence of Ash Pollen Collection from Honey Bees?

Green Ash

Fraxinus pensylvanica

White Ash

Fraxinus americana

Male flowers of green ash

North American species of ash are dioecious, and, primarily, wind pollinated

Female flowers of green ash

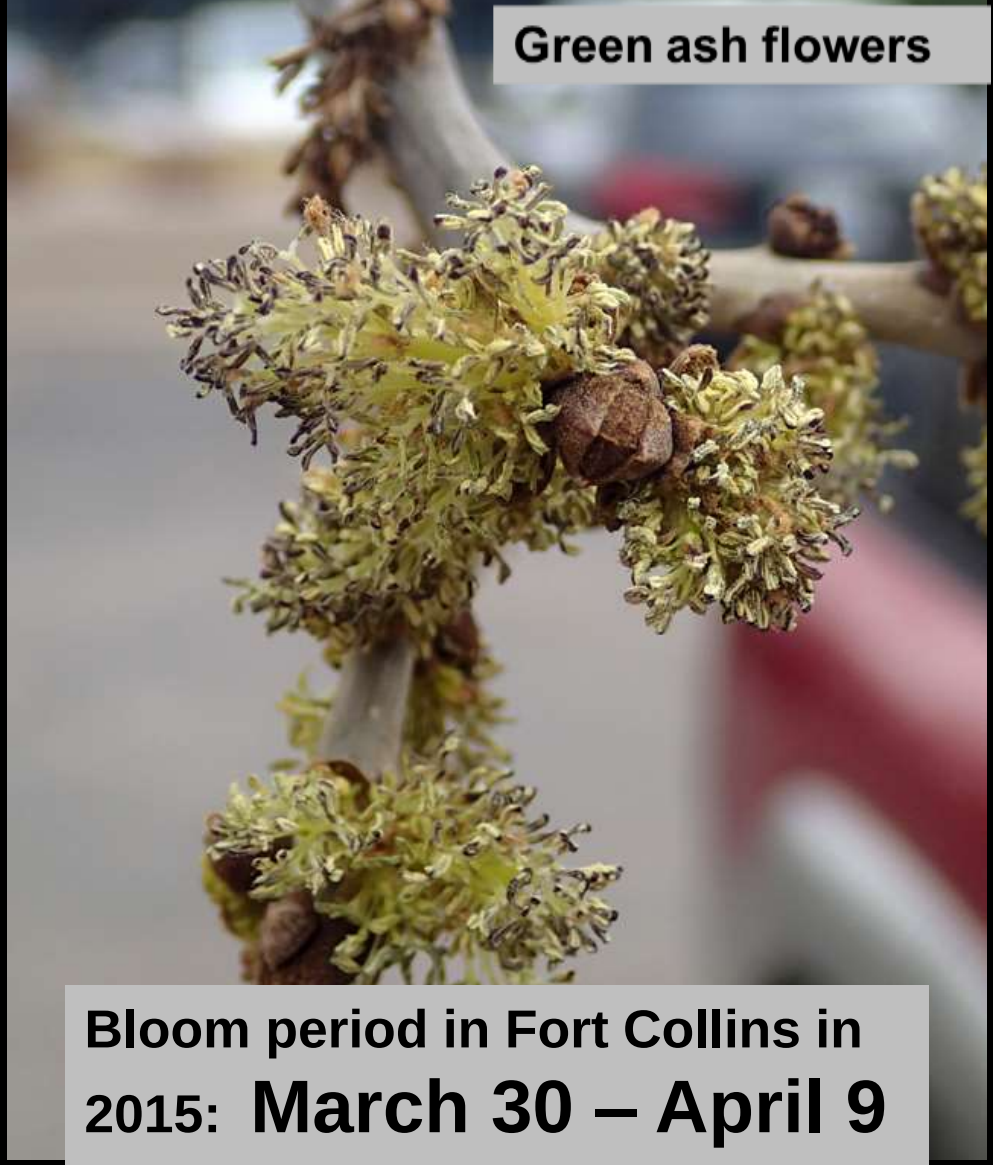
Male flowers produce pollen that may be collected by bees

White ash flowers

Green ash flowers

The period when pollen is being produced is brief, about 7 to 10 days

Bloom period in Fort Collins in 2015: **April 20-29**



Bloom period in Fort Collins in 2015: **March 30 – April 9**

Colorado March-April Pollen Collections in Urbanized Areas

- **In 2014 *no ash pollen was identified in any samples during standard pollen analysis***
  - Presence of ash pollen was indicated by PCR
    - Collection incidence <1%

Colorado Spring Pollen Collections in Urbanized Areas

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- **In 2015, ash pollen was detected in three samples of thirteen collected when ash was in bloom**
  - Ash pollen constituted 3%, 8% and 11% of the total in these three samples, respectively

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  - Presence of ash pollen was indicated by PCR
    - Collection incidence <1%
- **In 2015, ash pollen was detected in three samples of thirteen during standard pollen analysis**
  - Ash pollen constituted 3%, 8% and 11% of the total in these two samples, respectively
- **Average incidence of pollen collection during period of ash bloom was 3.6%**

Primary Flowering Plants Present During Green Ash Bloom in 2015

- Norway maple
- Nanking cherry
- *Prunus sargentii*
- Flowering pear
- Hackberry
- Willow
- Iris
- Dandelions
- Violets
- Candytuft
- Grape hyacinth
- Crocus
- Yellow alyssum

Green ash grown in association with flowering pear and cherry, downtown Boulder

Primary Flowering Plants Present During White Ash Bloom in 2015

- Crabapple, apple
- **Many** *Prunus*
- Honeysuckle
- Redbud
- Serviceberry
- Japanese flowering quince
- Common lilac
- Catmint
- Candytuft
- Grape hyacinth, hyacinth
- Daffodils
- Basket-of-gold
- Blue mustard
- Dandelion

Ash grown in association with redbud, downtown Boulder, a few blocks away

What are is the Incidence of Pollen Collection by Honey Bees?

- Ash pollen is collected by honey bees

What are is the Incidence of Pollen Collection by Honey Bees?

- Ash pollen is collected by honey bees
- Incidence of ash pollen collection appears to be greater on earlier blooming green ash versus white ash
  - Use of ash as a pollen source is small and occurs during a brief period

What are is the Incidence of Pollen Collection by Honey Bees?

- Ash pollen is collected by honey bees
- Incidence of ash pollen collection may be greater on earlier blooming green ash versus white ash
- **Incidence of ash pollen collection is likely correlated with availability of other pollen sources**
  - Resource rich sites (urbanized areas) may depend less on ash pollen

Can We Manage the Emerald Ash Borer Disaster and Conserve the Honey Bee?

Photograph by Steven Valley

I think we can.

Trunk Injections

Trunk injection with emamectin benzoate (TREE-age)

New formulations of emamectin benzoate are coming onto the market. This should decrease costs.

Trunk injection with azadirachtin (TreeAzin, Azasol, AzaGuard, etc.)

Ash Biopsies

We are injecting more trees due to emerald ash borer – what is the effect on the tree?

Arboriculture & Urban Forestry 2011. 37(1): 6–12

Tree Wound Responses Following Systemic Insecticide Trunk Injection Treatments in Green Ash (*Fraxinus pennsylvanica* Marsh.) as Determined by Destructive Autopsy

Joseph J. Doccola, David R. Smitley, Terrance W. Davis, John J. Aiken, and Peter M. Wild

Abstract. Trunk injection of systemic insecticides or fungicides is an effective way to manage destructive insects or diseases of trees, but many arborists are still reluctant to inject trees because of the potential for infection by pathogens, structural damage, or adverse effects on tree health. The authors of the following study examined wound responses of green ash (*Fraxinus pennsylvanica* Marsh.) for two years following trunk injection, by sectioning tree trunks to look for evidence of infection associated with injection sites, and by collecting data on annual radial growth and rate of closure around injection sites. All healthy trees successfully compartmentalized injection wounds without any signs of infection, decay, or structural damage. Wound closure was positively correlated with the tree health as measured by annual radial growth.

Key Words. Canopy Dieback; Decline; Emerald Ash Borer; Stem Injection; Systemic Insecticide; Tree Health; Wound Closure; Woundwood.

“wound closure rates are strongly dependent on tree health as expressed by ring growth.”

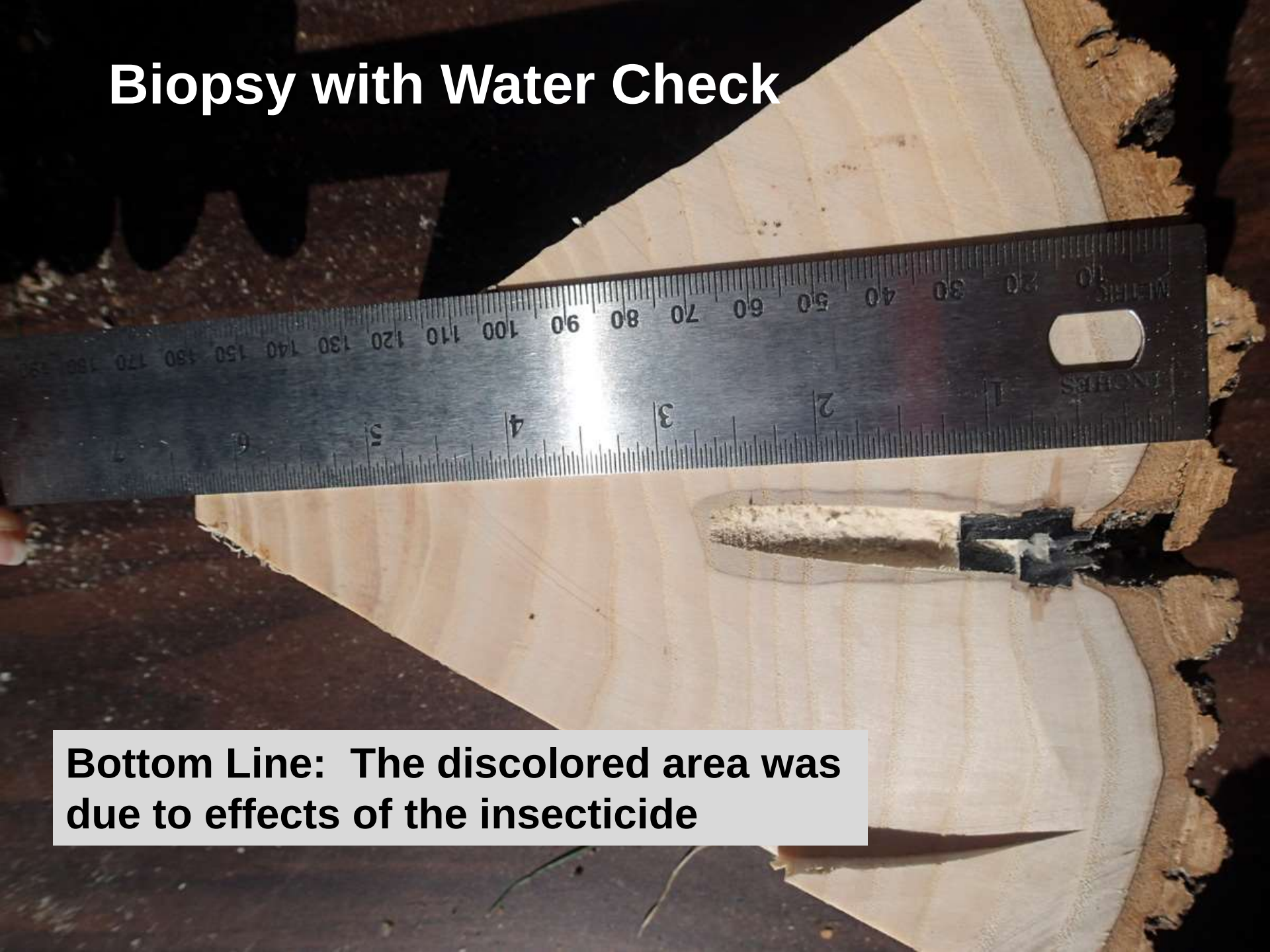
Biopsies of Green Ash Trunk Injected in June 2014

Discoloration is present in areas where the insecticide was injected

Internal discoloration associated with another tree injection

A column of the discoloration typically extended at least a foot above the injection site

Biopsy with Water Check



Bottom Line: The discolored area was due to effects of the insecticide

In the trees dissected in September 2015 good wound closure was noted and there was no evidence of decay.

Ash biopsy showing wound closure after 5 years in Michigan.

Wound closure will differ among trees, largely due to site/health of the tree. And effects of trunk injections could be cumulative.

And when injections cause cracking and produce poorly closing wounds ????

There are several tree injection systems

Emerald Ash Borer – Some Summary Points

- Emerald ash borer is the real deal – a non-native species with a clear track record of being able to cause extreme damage.
  - ***The question of its appearance in Utah is when it will appear, not if it will appear.***

Emerald Ash Borer – Some Summary Points

- Emerald ash borer is the real deal – a non-native species with a clear track record of causing extreme damage.
- Preparations should be made now for its ultimate arrival
  - **Resources are best directed to efforts that *can mitigate effects of EAB***

THIS ASH TREE IS AT RISK OF BEING KILLED BY THE EMERALD ASH BORER

(ACTUAL SIZE ⟶)

If you see dying ash trees in your neighborhood, submit a report to:
WWW.MASSNRC.ORG/PESTS

For more information about emerald ash borer and the damage this invasive pest causes, visit:
WWW.EMERALDASHBORER.INFO

This tree was tagged on _____ by: _____

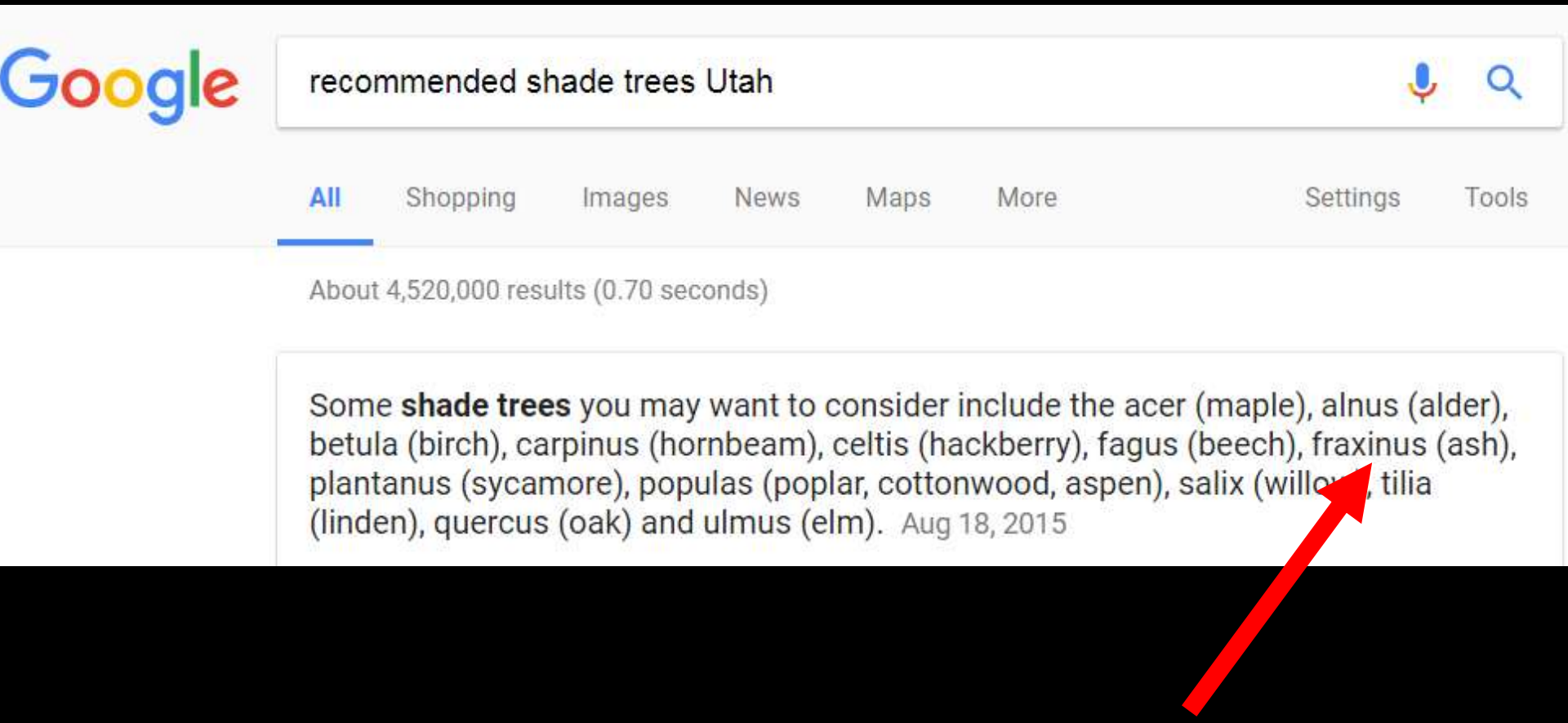
MDAR

Note on a Definition

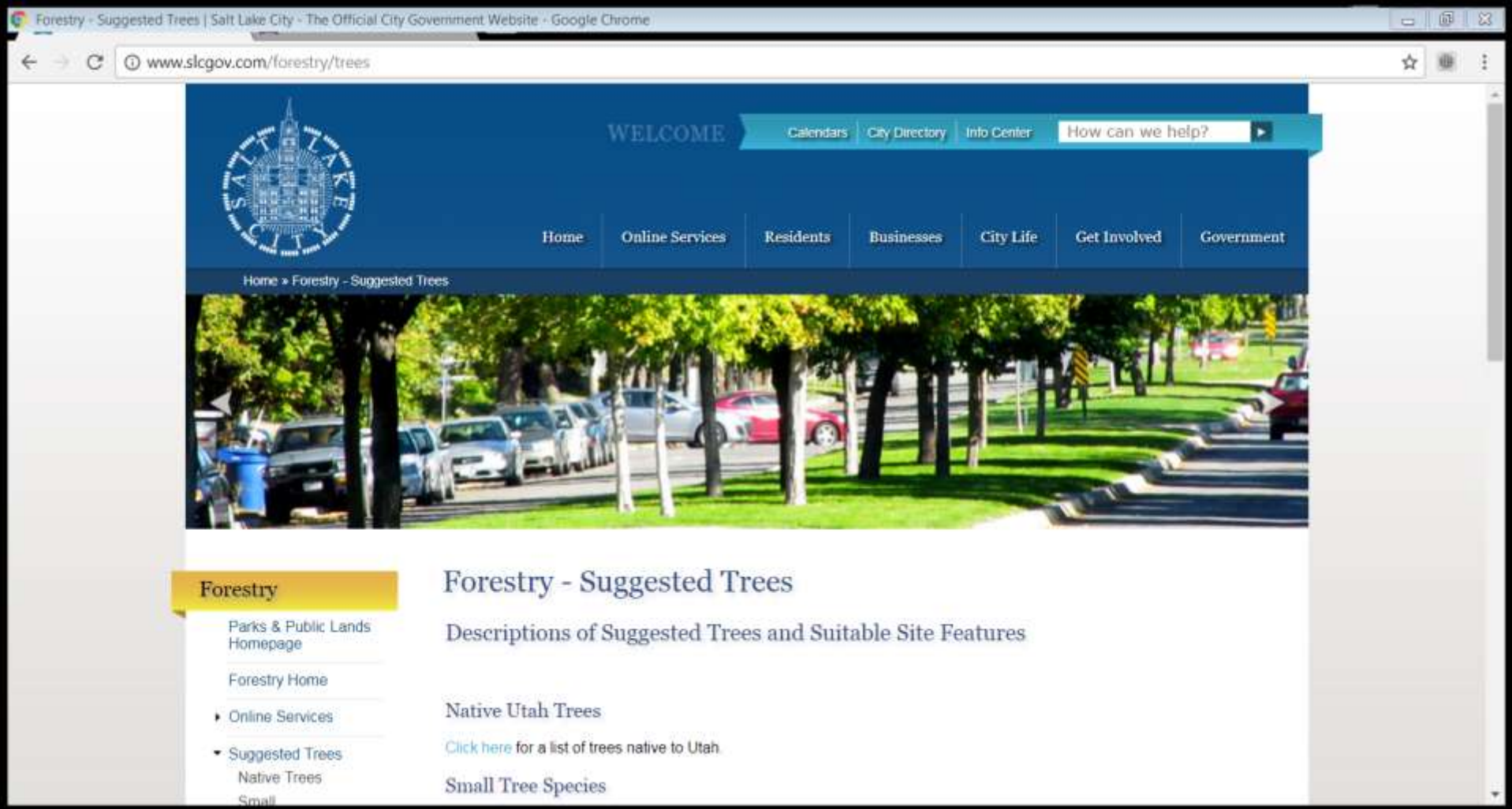
Triage - **(in medical use)** ***the assignment of degrees of urgency to wounds or illnesses*** **to decide the order of treatment of a large number of patients or casualties**

TREE-age **– an emamectin benzoate insecticide formulation widely used as a trunk injection to control emerald ash borer and other insects**

Should ash be recommended for planting in Utah?



Salt Lake City Forestry Website *does not* include ash as a suggested tree



Emerald Ash Borer – Some Summary Points

- Emerald ash borer is the real deal – a non-native species with a clear track record of causing extreme damage.
- Preparations should be made now for its ultimate arrival
- Individual trees can be protected from EAB by use of insecticides – but EAB can not be eliminated once established
  - **Controls involve the use of insecticides that will have to be sustained for the desired life of the trees**

Entertaining visitors from the East this year? – Tell them you will provide all the firewood they need.