

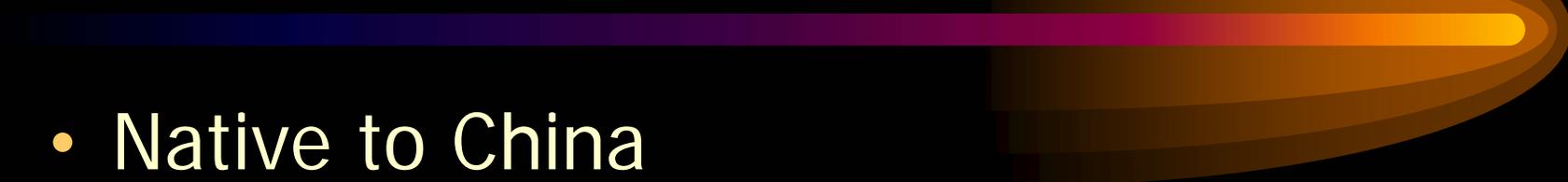
Tree-of-Heaven  
*(Ailanthus altissima)*



Phil Pannill, Forester  
Maryland Forest Service

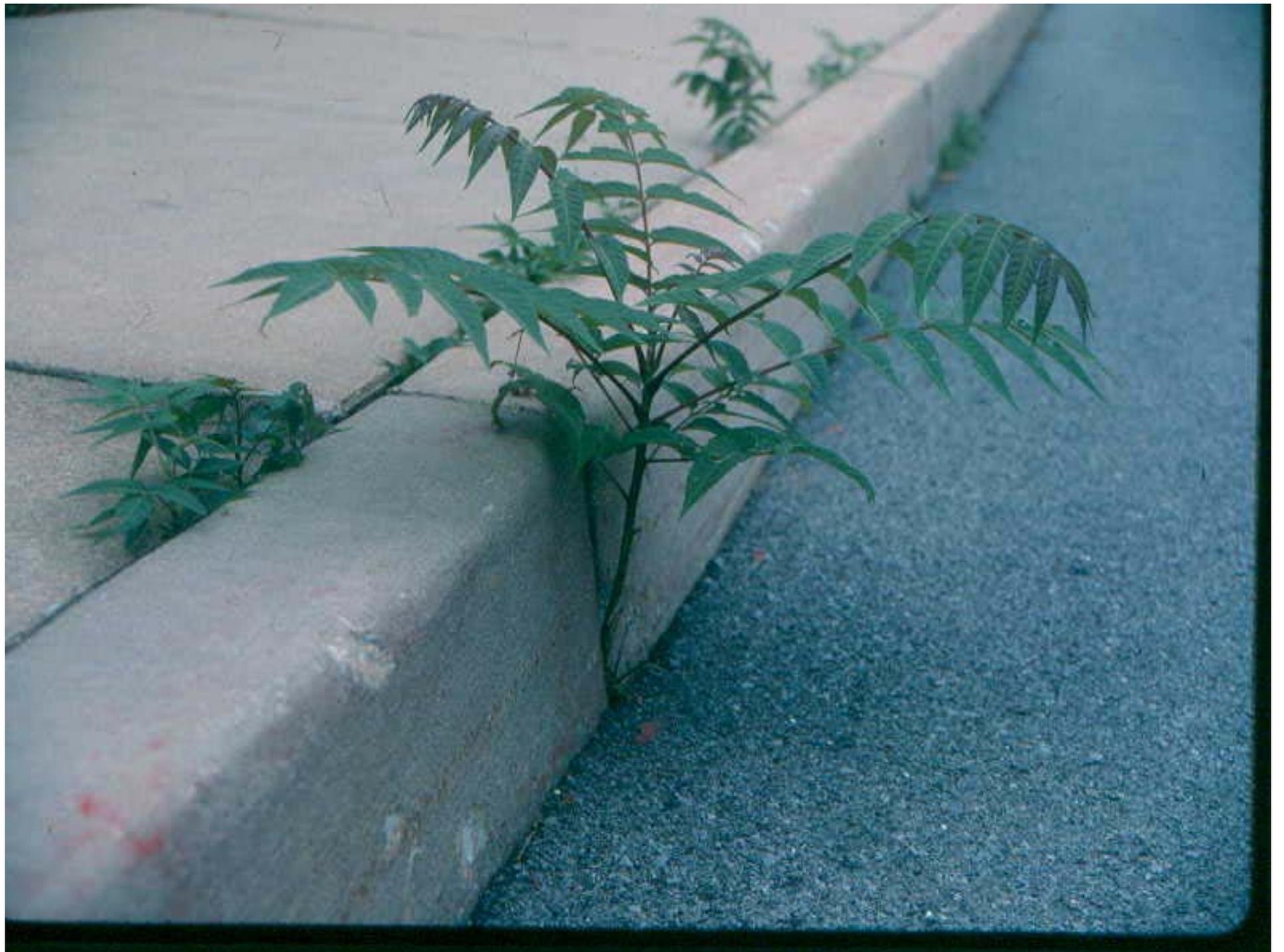


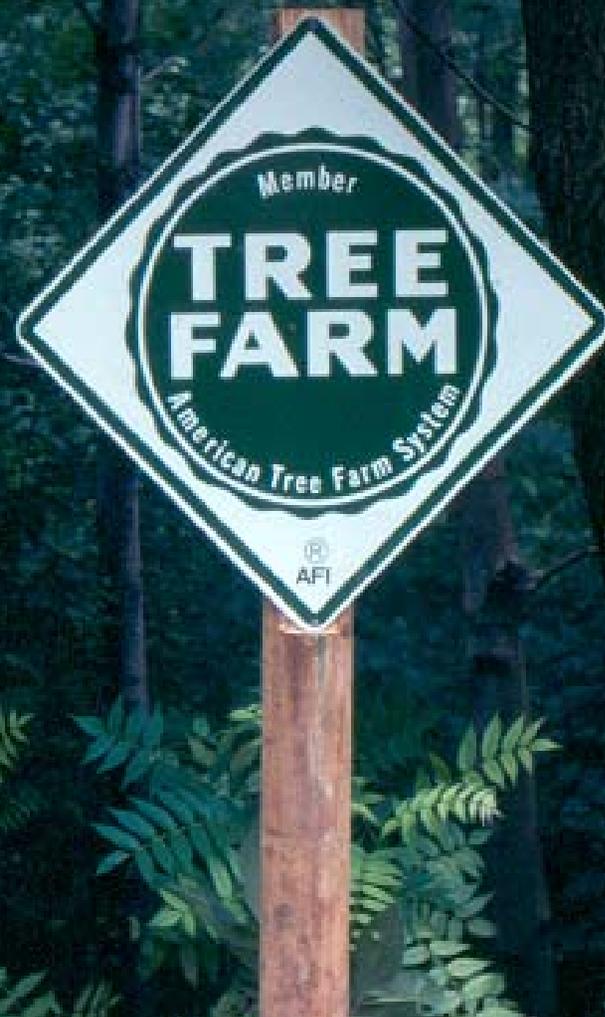
## *Where is it?*



- Native to China
- In eastern U.S. since late 1700's
- Was planted here as curiosity, shade tree
- Now all over U.S. and much of world
- Increasing greatly in eastern U.S.
- Can grow in poor conditions, if not wet







## *Why is it a Problem?*

- Displaces native trees and other plants
  - Fast growth
  - Heavy shade
  - Allelopathy (chemical warfare)
- Low economic and wildlife value
- Difficult to control
  - Re-sprouts and root suckers when cut

# *Identification*



- Leaves
  - Alternate arrangement
  - Long, compound leaves (15 – 29 leaflets)
  - Leaflets opposite, smooth edge except for tooth at each side near bottom, with translucent gland

*Underside of  
Tree-of-Heaven Leaf ,  
with basal teeth and  
gland*



## *Identification - continued*



- Twigs
  - Green, turning to brown, then gray
  - Smooth (not fuzzy)
  - Thick, blunt
  - Alternate branching
  - Large, shield-shaped leaf scars

## *Identification - continued*



- Stems
  - Smooth, gray, thin bark
  - Often in multiple-stemmed groups
    - Result of root suckering

## *Identification - continued*



- Flowers and Seeds
  - Dioecious – male and female flowers on different trees
  - Flowers have bad odor
  - Seeds
    - Clusters of twisted papery samaras with seed in center
    - Seeds hang on female trees into winter



## *Identification - continued*



- Odor
  - All parts of plant
  - More from leaves and twigs
  - Most from flowers
  - Unpleasant nutlike odor
    - Likened to peanut butter, or cashews, only burnt or bitter

*Similar Species  
Don't mistake:*

- Sumacs (staghorn, smooth, shining)
- Black Walnut
- Devil's Walking Stick
- Hickory (esp. bitternut)
- Ash





## *Characteristics Relating to Control*

- Grows fast
  - “normal” growth about 3 ft./yr.
- Re-sprouts from stump or root collar
  - Can grow 15 ft. first year
- Root-suckers from extensive root system
  - Can grow 6 ft. first year, often hundreds from one tree
- Doesn't stay within sprayable height for long

## *Characteristics Relating to Control - continued*

- Root Suckers
  - Suckers some whenever established
  - Suckers greatly whenever cut or damaged
  - Often great distance from original tree
  - Often several hundred suckers per tree

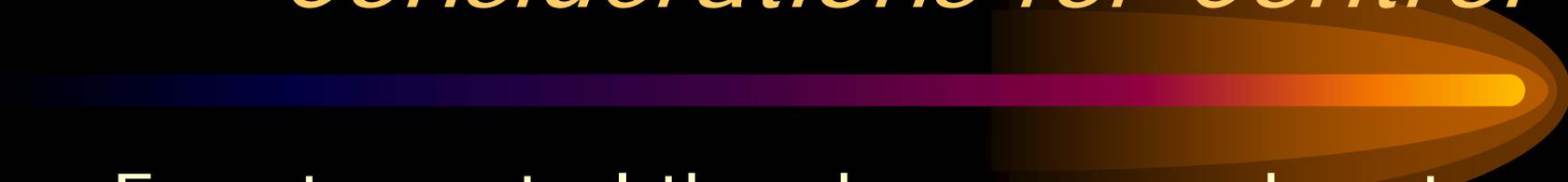
## *Characteristics Relating to Control - continued*

- Fairly intolerant of shade, about like N. Red Oak or White Ash
  - Closed canopy works against it
- Leafs out late
  - Not receptive until early summer

## *Characteristics Relating to Control - continued*

- Thin, smooth bark
  - Easily penetrated
- Ring porous wood
  - Spaced injection works well
- Dry Wood, doesn't "bleed"
  - Cut surfaces readily absorb, regardless of season

# *Considerations for Control*



- Easy to control the above-ground part of the tree, which accomplishes little
- Must kill the root system
- Not all things labeled or recommended work
  - Correct product, rate, timing, are vital

## *Considerations for Control - continued*

- Root suckering may occur a year or more after initial treatment
  - Don't declare victory too soon
- Once root suckering is initiated by cutting or ineffectual herbicide treatment it will continue for several years
  - Make your first control effort effective

## *Considerations for Control - continued*

- Logging, tree mortality, or other disturbance can greatly increase the amount present
  - Increase in available sunlight
  - Disturbed seedbed
  - Cut or damaged TOH will root sucker
- Eliminate TOH 2 - 3 years before harvest
  - Important Change!*
  - Change in way we do things
  - Inconvenient, more work, but vital

# *Control Options*



- Manual & Mechanical
- Foliar Spray
- Basal Bark
- Cut Surface

## *Manual & Mechanical*

- Pulling small seedlings (not root suckers)
- Cutting
  - Without use of herbicides
  - Usually very counter-productive due to re-sprouting and root-suckering
- Not recommended



# *Foliar Spray*



- High-Volume, Low Volume, Ultra-Low Volume, Aerial
- Generally most effective, and most cost-effective method to use, where applicable
- Must be able to spray the top of tree, without spraying applicator, desirable trees, etc.
- Or where everything gets sprayed



## *Foliar Spray – continued*

- Many products that normally kill trees will kill TOH
- Excellent
  - metulfuron (Escort)
  - triclopyr (Garlon 3A or 4), can mix w/ 2,4-D
  - dicamba (ex. Vanquish), can mix w/ 2,4-D
  - imazapyr (Arsenal)

## *Foliar Spray – continued*

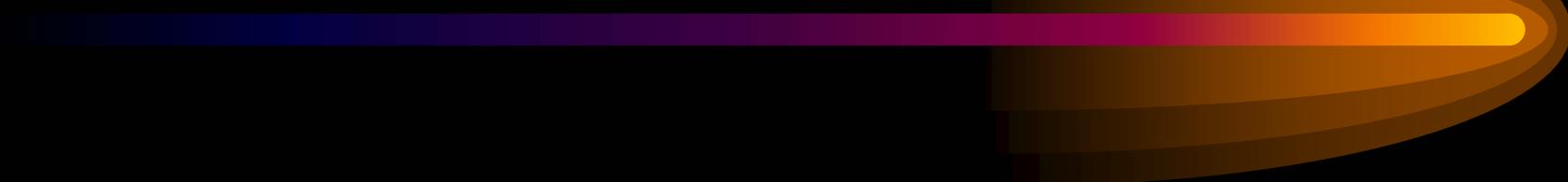


- Satisfactory
  - glyphosate (Roundup, Accord)
    - Thorough coverage, esp. at top
    - May need to re-treat
    - Better for TOH mixed w/ metsulfuron or imazapyr
- Foliar applications normally mixed with water and surfactant

## *Foliar Spray – continued*

- Season
  - Wait until leaves are fully out, about mid June
  - Treat at least 2 weeks before frost
- June-August – triclopyr, dicamba
- June-September – metsulfuron
- July-September - imazapyr, glyphosate

*Foliar Spray – continued*



Best method to use  
for follow-up treatments

## *Basal Bark*

- Oil-soluble herbicide mixed with oil
  - Diesel, fuel oil, mineral oil, vegetable oil
  - Specially-made basal oil, usually mineral oil or vegetable oil based
- Use low-volume method, spray to wet bark all around, but not to run-off
- Spray height 12-18 inches, more on larger trees





## *Basal Bark – continued*

- Good method to use for many small trees too tall to foliar treat
  - Can be used on TOH of all sizes, but most efficient on trees 1-6 inches dbh
- Small amount of off target spray
- Use higher mix rate of herbicide
- Need good sprayer, dedicated to this use or cleaned very thoroughly

## *Basal Bark – continued*

- Works best at killing TOH and preventing re-growth applied in growing season
  - Best: June – September
  - Satisfactory: February – March



## *Basal Bark – continued*

- Best herbicide = triclopyr, ester form
  - Garlon 4, 20% of mix
  - Pathfinder II, pre-mixed, ready to use
- Add in other herbicides??
  - Stalker, no advantage over Garlon alone
  - Tordon K, better control of root suckers, esp when applied in dormant season, but greatly increases risk of off-target effects



# *Cut Surface*



## Cut surface methods

- Cut stump and treat outer edge
  - Time consuming, laborious, dangerous
  - Less effective at killing root system
- Complete frill or girdle and treat
  - Not needed or desirable for TOH control
- Spaced injection –best method

# *Injection*

- Concentrated, water-soluble herbicide “injected” into trunk through wound
  - Specially made tools, capsules, etc.
  - “Hack and Squirt” with hand-axe and squirt bottle
    - Cheap, easy, effective
- Can be used on trees of all sizes, including very small trees, but most efficient on trees over 4” dbh



## *Injection – continued*

- Forester Phil's Rules of Thumb for Spaced Injection:
  - Number of cuts =  $\text{dbh} + 1$ 
    - 4 inch dbh tree = 5 cuts
  - Amount of herbicide = 1 milliliter per cut
    - Slightly less on small trees < 4 inches
    - Slightly more on larger trees, up to 2 ml per cut for large trees (larger cuts made)



## *Injection – continued*

- Use water-soluble herbicide
- Best
  - dicamba (Vanquish) 50% with water
  - triclopyr, amine form (Garlon 3A) 100% (or 50% used more liberally)
  - picloram + 2,4-D (Pathway), 100% (pre-mixed product)





## *Injection – continued*



- Don't use
  - Ester form of triclopyr (Garlon 4, Crossbow, Pathfinder, etc.)
  - 2,4-D
  - Glyphosate (Roundup, Accord)
  - All of these will kill top of tree, but do little to kill root system

## *Injection – continued*



- Season
  - Growing season, not dormant season
    - June-October – Vanquish (this is esp. good in Sept.-Oct.)
    - June-September – Garlon 3A, Pathway
- Pathway has ability to affect sensitive plants nearby where heavily used

## *Follow-up*



- All control programs should include plans for follow-up treatments during next year or two
  - Check and re-treat as needed
  - Foliar applications usually best for follow-up treatment of any re-growth

## *Follow-up – continued*



Promote the development of a good cover of vegetation, especially trees, that will help keep Tree-of-Heaven from re-invading.

Invasive plant control is a process, not a project.