# Chinese Tallowtree in East Texas

## Status and Trends

East Texas has 12.1 million acres of forestland and 7.2 billion trees. The predominant forest type is loblolly pine. Most of the forestland is privately owned — 10.9 million acres, or 90 percent. This information is available because of Forest Inventory and Analysis, a federal and state partnership to inventory forestlands in Texas. Chinese tallowtree is on the FIA list of invasive species for the South, so presence and cover information is recorded for it if it is found anywhere on a plot's accessible forestland. Within East Texas, Chinese tallowtrees cover approximately 673 thousand acres.

The map below shows plots with presence of Chinese tallowtree in 2007, 2012, and 2017. The year indicates the last year in the evaluation, or group of plots that form a complete measurement cycle. East Texas is measured on a five-year cycle, so the 2007 evaluation includes plots inventoried from 2003 to 2007, the 2012 evaluation includes plots inventoried from 2008 to 2012, and the 2017 evaluation includes plots inventoried from 2013 to 2017. This convention is used throughout the report with FIA data. A full-page version of the map is available at the end of the report.

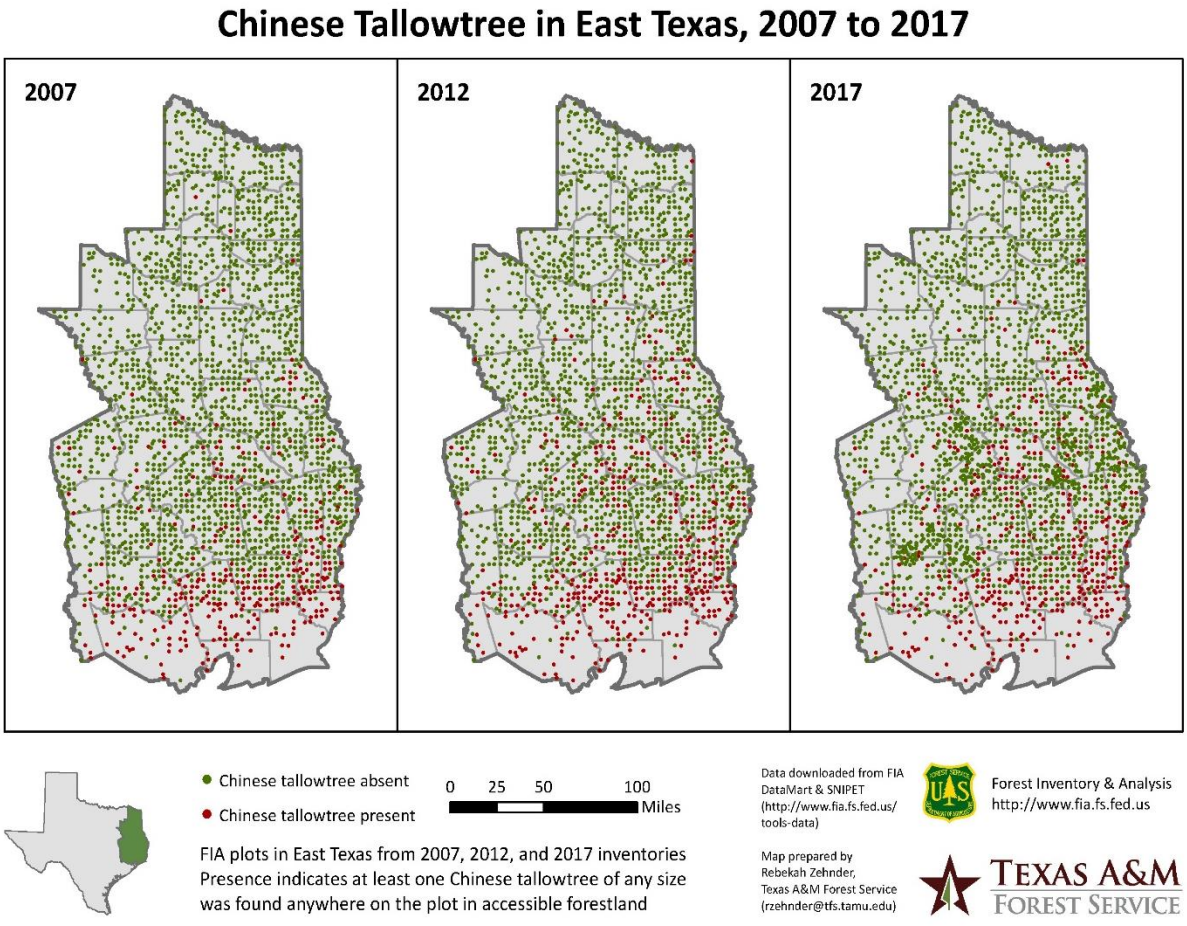



Figure 1. Map of Chinese tallowtree presence on FIA plots in 2007, 2012, and 2017.

Chinese tallowtree is also a tally tree, which means it is measured and recorded the same way species like loblolly pine are. Trees at least five inches in diameter are measured if they fall anywhere on a subplot; trees one to five inches in diameter are measured if they fall on a microplot, a subsection of a subplot; and seedlings are counted if they fall on a microplot. This provides more detailed, tree-level information than the invasives protocol, but the invasive species protocol captures Chinese tallowtree presence anywhere on the plot that is forest.

As of 2017, there are an estimated total of 343 million Chinese tallowtrees at least one inch in diameter on forestland in East Texas, with an additional 566 million seedlings (less than one inch in diameter). The estimated volume of Chinese tallowtrees at least five inches in diameter is 119 million cubic feet.

Using the number of Chinese tallowtrees per acre on each plot, the heat map below highlights areas with a high density of tallow. This map uses all the plots measured in the 2007 evaluation and all the plots measured in the 2017 evaluation, so there may be some that were measured only in 2007 and some that were only measured in 2017. They are scaled the same so the colors can be used for comparison between the two years. A full-page version is available at the end of the report.

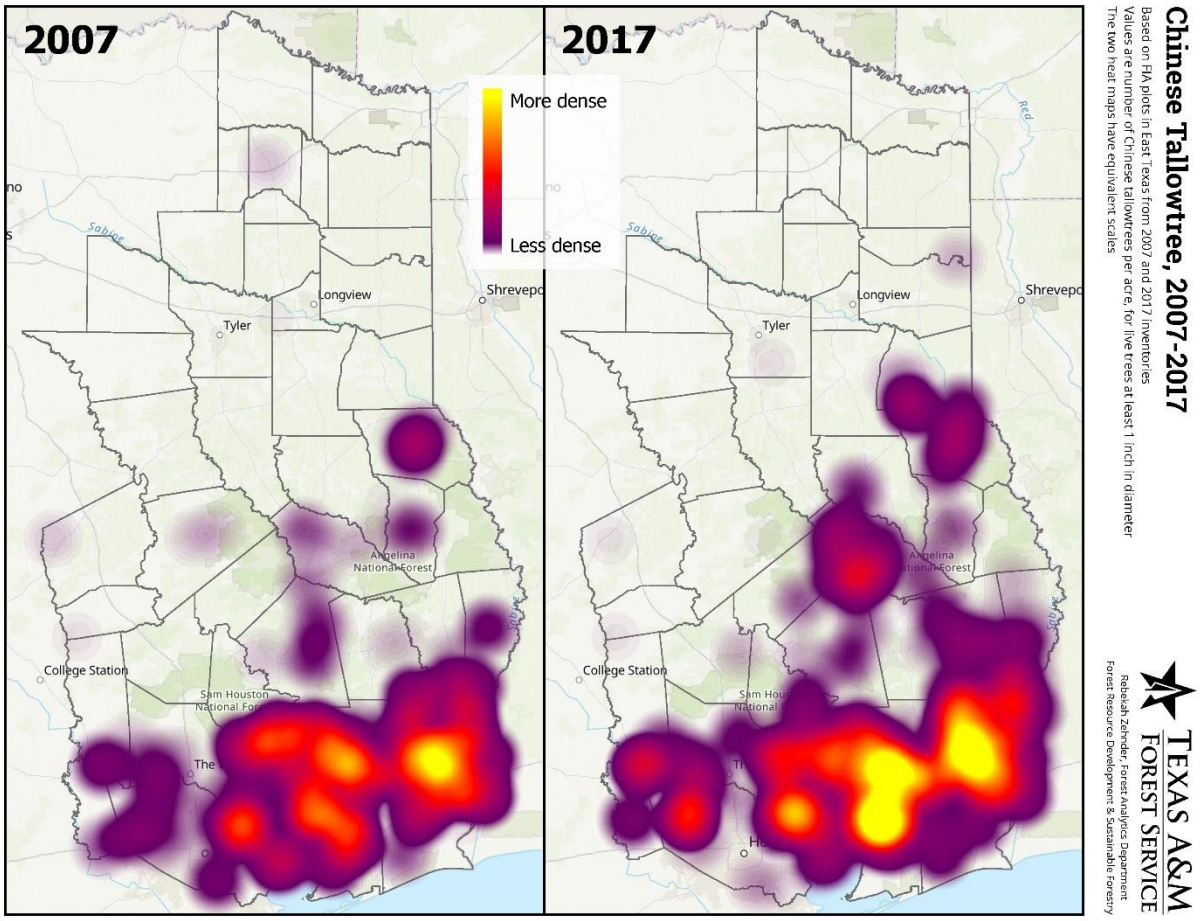



Figure 2. Heat map of Chinese tallowtree density on FIA plots in 2007 and 2017.

More yellow in the 2017 map indicates more areas of high density. The low density area in Northeast Texas in 2007 that does not appear in 2017 was not measured in the 2017 inventory (it was either denied access for measurement or was nonforest). However, the two spots that appeared in 2017 — one just south of Tyler and the other around the Marion/Harrison County line — were measured in 2007 and do represent new areas of tally tree information (note that there was presence indicated via the invasive species protocol in the Marion/Harrison County area in 2007; see Figure 1). There is also higher density of Chinese tallowtree in Angelina County in 2017, between Davy Crockett National Forest and Angelina National Forest.

Looking at the plots that were measured forestland at multiple points in time, i.e. looking at the same plots in 2007, 2012, and 2017, provides a way to quantify Chinese tallowtree trends.

The number of live trees at least one inch in diameter on forestland increased from 2007 to 2017. The rate of increase is increasing on public land but decreasing on private land (see table 2).

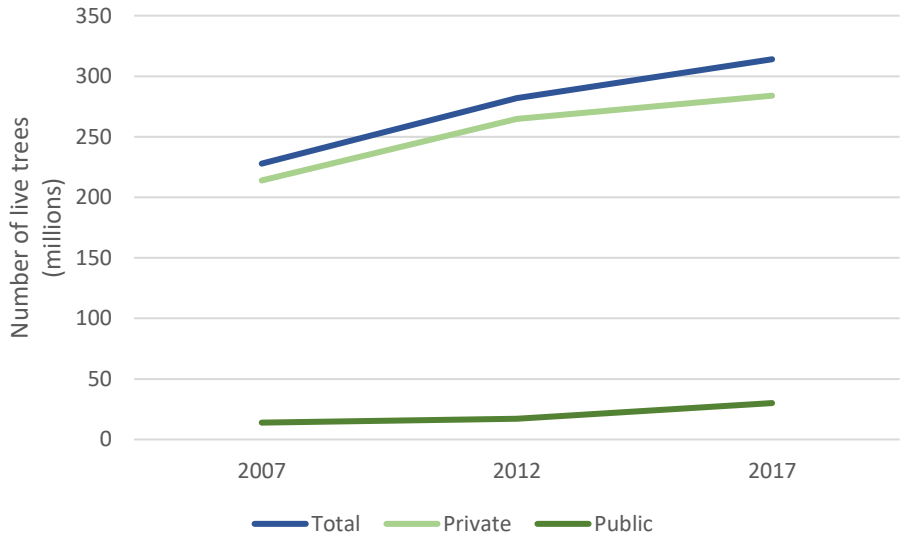



Figure 3. Number of live Chinese tallowtrees at least 1-inch d.b.h. on forestland in East Texas, 2007-2017.

Table 1. Number of live Chinese tallowtrees at least 1-inch d.b.h. on forestland in East Texas, 2007-2017, in millions.

| | Private | Public | Total |
|---|---|---|---|
| **2007** | 213.9 | 13.9 | 227.8 |
| **2012** | 264.7 | 17.1 | 281.8 |
| **2017** | 283.9 | 30.1 | 314.0 |

Table 2. Average annual increase of number of live Chinese tallowtrees at least 1-inch d.b.h. on forestland in East Texas, 2007-2017, in millions, and percent change.

| | Private | Public | Total | Private | Public | Total |
|---|---|---|---|---|---|---|
| | | *million trees* | | | *percent* | |
| **2007 to 2012** | 10.2 | 0.6 | 10.8 | 23.7 | 22.9 | 23.7 |
| **2012 to 2017** | 3.8 | 2.6 | 6.4 | 7.3 | 76.0 | 11.4 |

Net volume of Chinese tallowtrees at least five inches in diameter on East Texas forestland is also increasing, but at steadier rates than the number of trees. It has increased relatively steadily over the last 10 years at an average rate of about 3.3 million cubic feet per year.

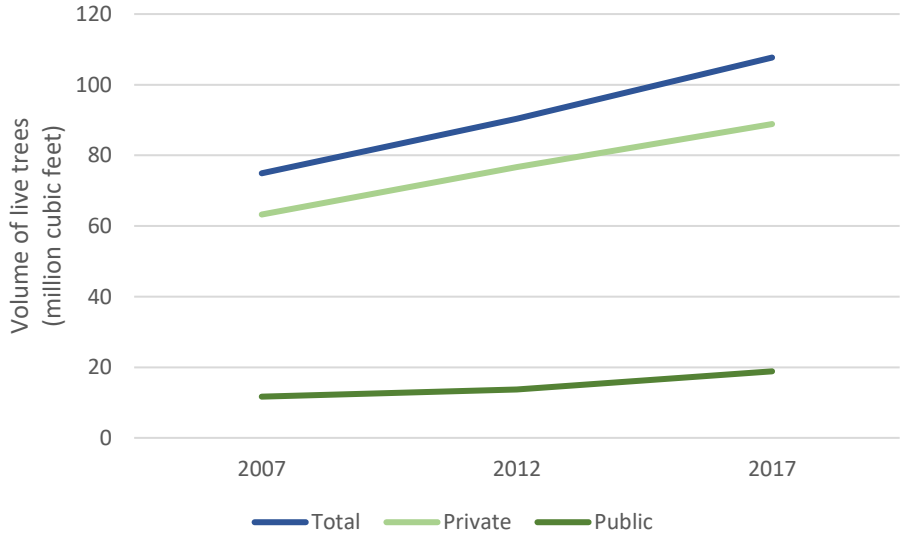



Figure 4. Net volume of live Chinese tallowtrees at least 5-inches d.b.h. on forestland in East Texas, 2007-2017.

Table 3. Net volume of live Chinese tallowtrees at least 5-inches d.b.h. on forestland in East Texas, 2007-2017, in million cubic feet.

| | Private | Public | Total |
|---|---|---|---|
| **2007** | 63.2 | 11.7 | 74.9 |
| **2012** | 76.6 | 13.7 | 90.3 |
| **2017** | 88.9 | 18.8 | 107.7 |

Table 4. Average annual increase of net volume of live Chinese tallowtrees at least 5-inches d.b.h. on forestland in East Texas, 2007-2017, in million cubic feet, and percent change.

| | Private | Public | Total | Private | Public | Total |
|---|---|---|---|---|---|---|
| | *million cubic feet* | | | *percent* | | |
| **2007 to 2012** | 2.7 | 0.4 | 3.1 | 21.2 | 17.2 | 20.6 |
| **2012 to 2017** | 2.4 | 1.0 | 3.5 | 15.9 | 37.7 | 19.2 |

Seedlings provide an indication of regeneration and spread potential. The number of Chinese tallowtree seedlings on East Texas forestland declined from 2007 to 2017. This is also the trend on private land, where most of the Chinese tallowtree on rural forestland occurs. On public land, however, the number of Chinese tallowtree seedlings increased from 2007 to 2017. All of the increase occurred between 2012 and 2017; there was actually a decline from 2007 to 2012. Public lands accounted for 4.0 percent of Chinese tallowtree seedlings in 2012, but accounted for 10.4 percent in 2017.

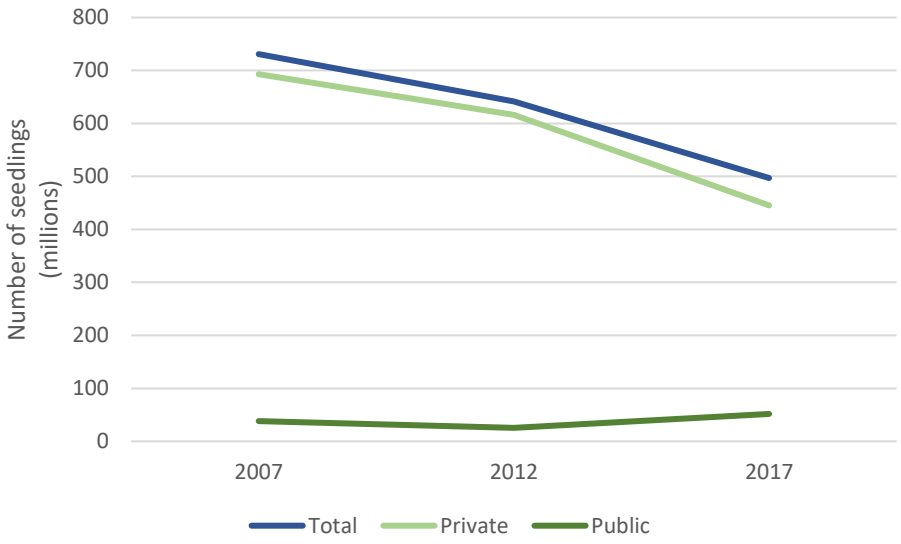



Figure 5. Number of live Chinese tallowtree seedlings (less than 1-inch d.b.h.) on forestland in East Texas, 2007-2017.

Table 5. Number of live Chinese tallowtree seedlings (less than 1-inch d.b.h.) on forestland in East Texas, 2007-2017, in millions.

| | Private | Public | Total |
|---|---|---|---|
| **2007** | 693.0 | 37.9 | 730.9 |
| **2012** | 616.5 | 25.4 | 641.9 |
| **2017** | 445.3 | 51.7 | 497.0 |

Table 6. Average annual change of number of live Chinese tallowtree seedlings on forestland in East Texas, 2007-2017, in millions, and percent change.

| | Private | Public | Total | Private | Public | Total |
|---|---|---|---|---|---|---|
| | | *million seedlings* | | | *percent* | |
| **2007 to 2012** | -15.3 | -2.5 | -17.8 | -11.0 | -32.9 | -12.2 |
| **2012 to 2017** | -34.2 | 5.3 | -29.0 | -27.8 | 103.3 | -22.6 |

A map of just the re-measured, persistently forested plots gives a sense of where change is occurring. It also shows that though tallow density and volume are increasing overall, there are plots with decreases in tallow abundance. This map paints a picture of fluidity in tallow, reflecting both eradication efforts and spread. Plots in green experienced a decrease in the number of Chinese tallowtrees per acre from the 2007 inventory to the 2017 inventory. The encircled green plots had some tallow in 2007 but none in 2017. Plots in red experienced an increase in the number of Chinese tallowtrees per acre from the 2007 inventory to the 2017 inventory. The encircled red plots did not have any tallow present in 2007 but did in 2017. This map can be used in conjunction with Figure 1 and Figure 2 to check whether a plot was measured in both inventories — if a plot does not appear on this map, it was only measured in one or the other. There is a full-page version of the map at the end of the document.

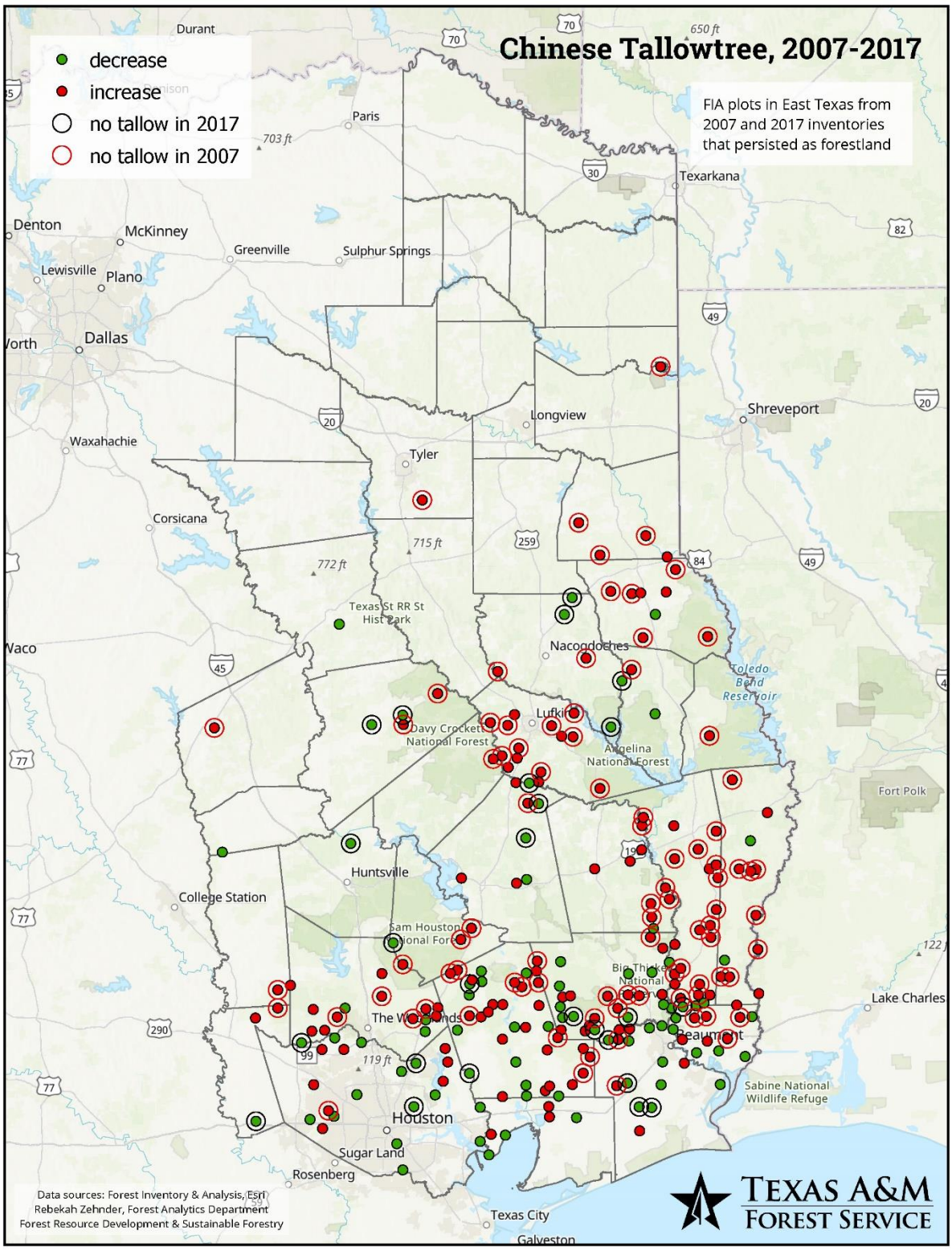



Figure 6. Map of change in Chinese tallowtree density on re-measured FIA plots in 2007 and 2017.

## Site Characteristics

FIA data includes ancillary information in addition to tree and forest measurements, which is useful in determining characteristic attributes of sites with Chinese tallowtree.

### Physiographic Class

The bulk of Chinese tallowtree, by volume (59 percent), number of trees (72 percent), and number of seedlings (69 percent), occurs on flatwoods: flat or fairly level sites outside of flood plains excluding deep sands and wet, swampy sites. It also occurs in rolling uplands, broad floodplains/bottomlands, and narrow floodplains/bottomlands.

The majority of other trees grow on rolling uplands, and the percentages by volume, number of trees, and number of seedlings are more consistent (67, 68, and 71 percent, respectively).

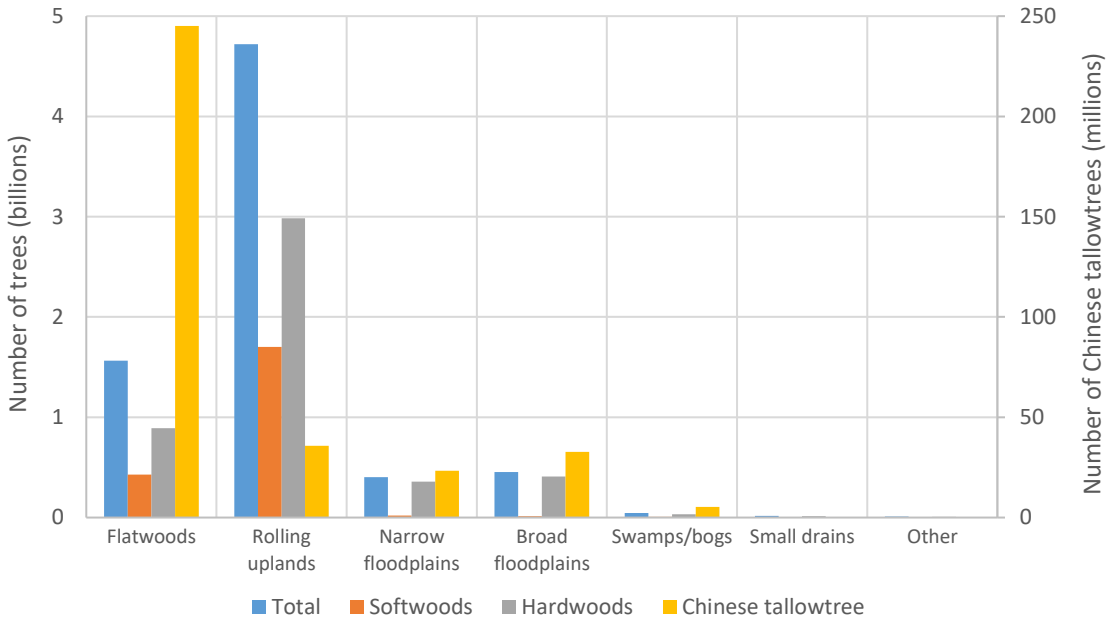



Figure 7. Number of live trees at least 1-inch d.b.h. on forestland in East Texas by physiographic class and species, 2017.

### Slope

The vast majority (99 percent) of Chinese tallowtrees occur on flat land (slope ≤ 1%). This is the case for number of trees, volume, and number of seedlings.

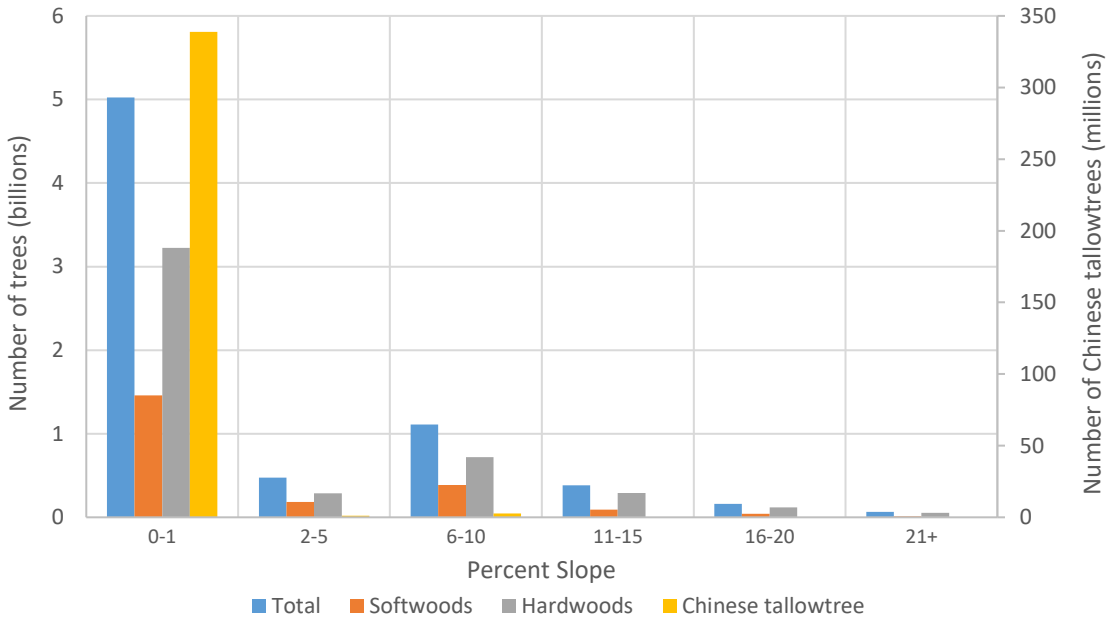



Figure 8. Number of live trees at least 1-inch d.b.h. on forestland in East Texas by slope and species, 2017.

## Elevation

Eighty-seven percent of Chinese tallowtrees are at 200 feet above sea level or lower, with 66 percent at or below 100 feet above sea level. Other species' tree numbers tend to increase with increasing elevation. This may be an artifact of Chinese tallow being introduced in southeast Texas near the coast.

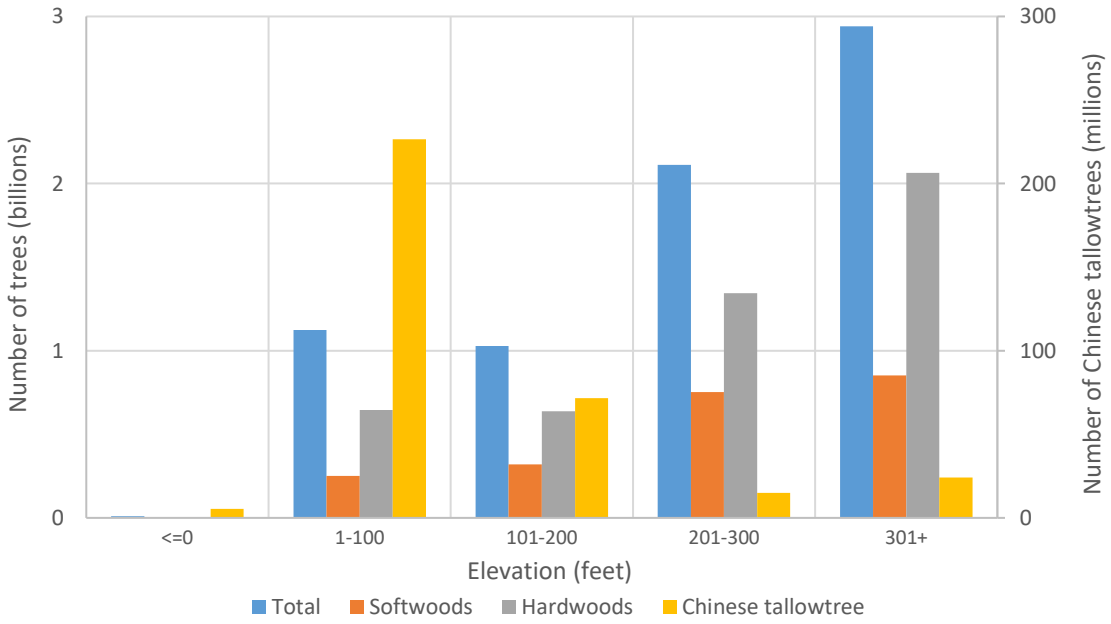


Figure 9. Number of live trees at least 1-inch d.b.h. on forestland in East Texas by elevation and species, 2017.

## Site Productivity

Most Chinese tallowtrees (89 percent) are on moderately productive sites, capable of producing 50 to 119 cubic feet per acre per year. Other trees follow a similar pattern but with a lower percentage on the lower end of the productivity range.

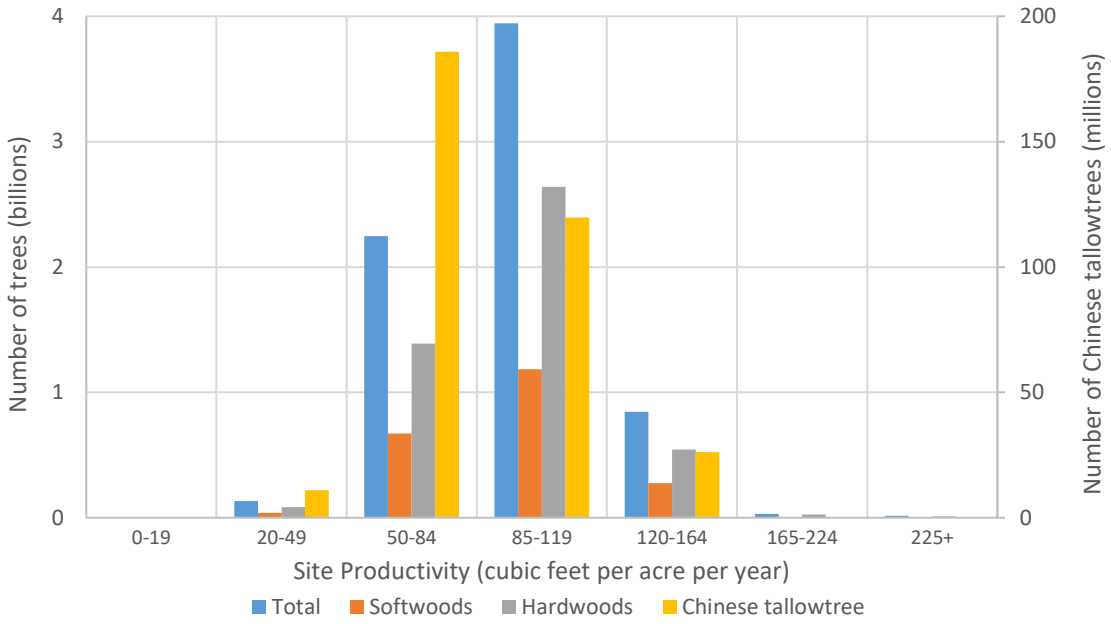



Figure 10. Number of live trees at least 1-inch d.b.h. on forestland in East Texas by site productivity and species, 2017.

Volume and number of seedlings do not follow quite the same distribution as number of trees — they have an approximately equal split between the 50 to 84 cubic feet per acre per year and 85 to 119 cubic feet per acre per year productivity classes. They are still concentrated in those two classes, though, with 87 percent of the volume and 90 percent of the seedlings occurring on sites with productivity from 50 to 119 cubic feet per year.

## Stand Origin

Approximately 13 percent of Chinese tallowtrees occur on artificially regenerated stands, while 26 percent of other trees occur on artificially regenerated stands. This means 87 percent of Chinese tallowtrees are on naturally regenerated stands. The difference is even more stark for volume — 94 percent of all Chinese tallowtree volume occurs on natural stands while 80 percent of other trees' volume occurs on natural stands. This shows that forest management helps keep Chinese tallowtree in check and prevent them from growing to maturity.

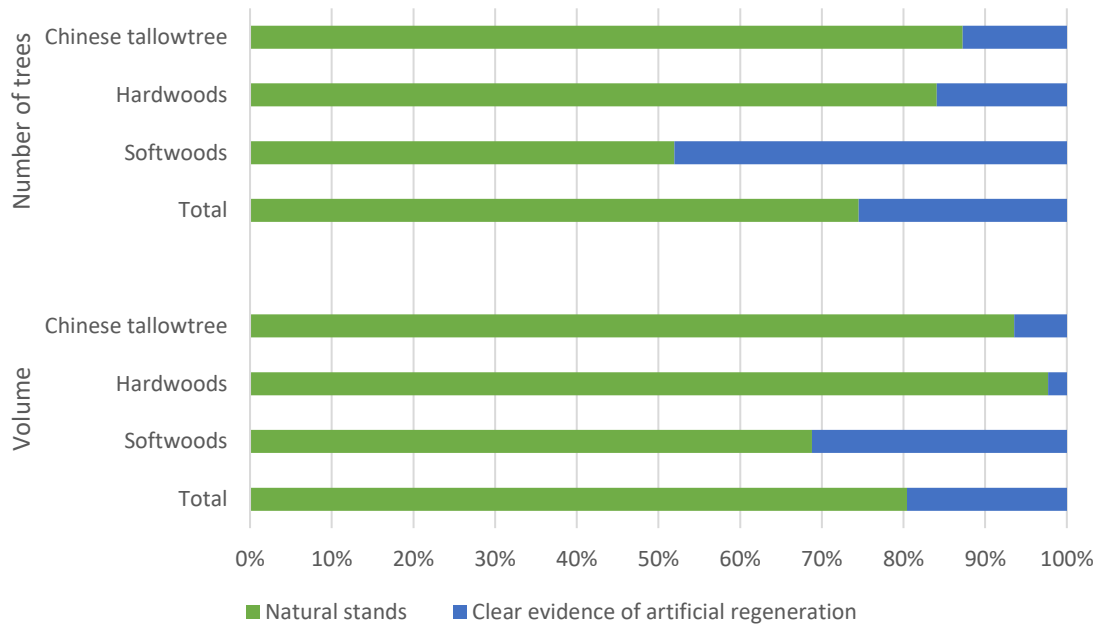



Figure 11. Percent of live trees at least 1-inch d.b.h. and volume of live trees at least 5-inches d.b.h. on forestland in East Texas by stand origin and species, 2017.

## Treatment

The majority of Chinese tallow (89 percent) were found on plots with no observable stand treatments within five years. Treatments indicate active forest management.

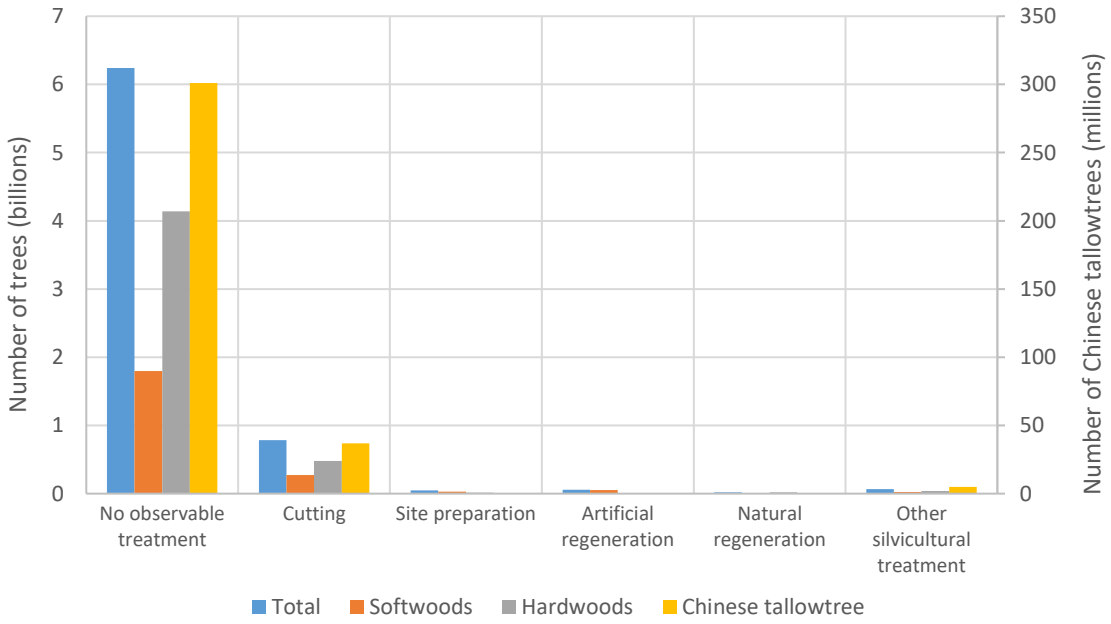



Figure 12. Number of live trees at least 1-inch d.b.h. on forestland in East Texas by primary stand treatment and species, 2017.

## Disturbance

Chinese tallowtree appears to have taken advantage of some disturbances to establish. Of the Chinese tallowtree volume in East Texas, 29 percent occurs on disturbed sites, while 14 percent of other species' volume occurs on disturbed sites. Some sites may have experienced more than one disturbance; if so, the primary one is addressed here. Eighteen percent of Chinese tallowtree volume is on forestland that has experienced weather disturbance. Notable portions of this are due to wind, which includes hurricanes and tornados, and drought. Ten percent of tallow volume is on wind-disturbed sites as opposed to only 1.5 percent of other species' volume. Drought, which struck more evenly across the region and generally affected individual trees rather than whole stands, accounts for 6.4 percent of tallow volume and 5.2 percent of other volume. The other main disturbance Chinese tallowtree appears to have exploited is domestic animal/livestock, which includes grazing — accounting for 8.4 percent of tallow volume versus 0.2 percent of other species' volume.

The Chinese tallowtree volume in the 'Other' category is attributed to vegetation (suppression, competition, vines). In these cases, Chinese tallowtree may have been the cause of the disturbance.

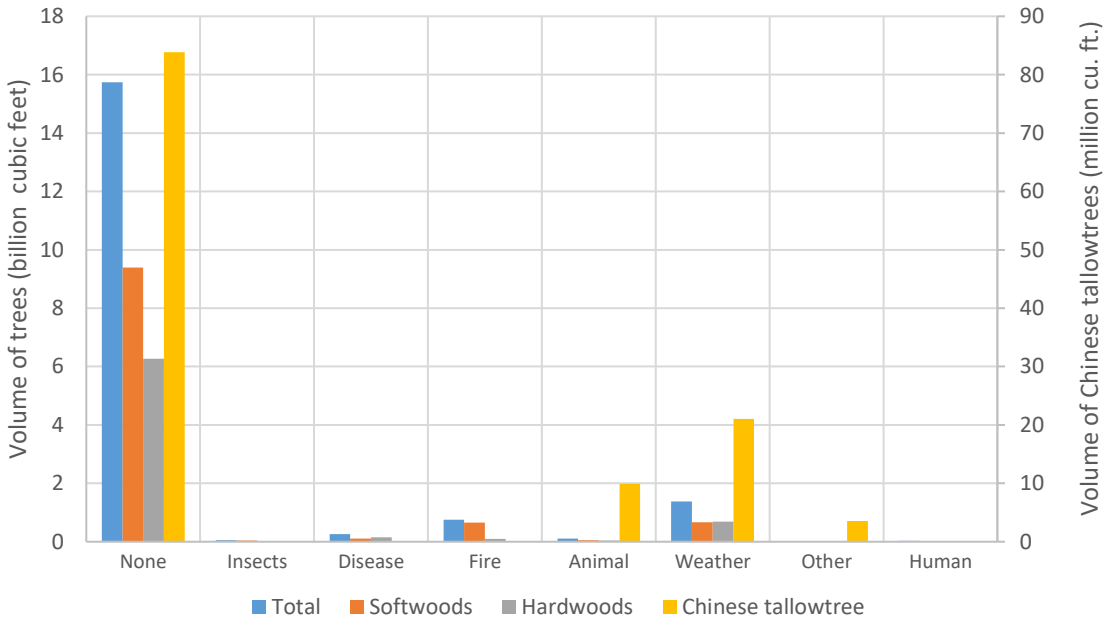



Figure 13. Volume of live trees at least 5-inches d.b.h. on forestland in East Texas by primary disturbance and species, 2017.

## Invasion Potential

Key site characteristics identified as favorable to Chinese tallowtree provide a sense of invasion potential. Mapping FIA plots with these characteristics gives a basic idea of the spatial distribution of sites that may be prone to invasion. This map shows plots with favorable stand origin, physiographic class, site productivity, treatments, and slope with elevation in the background. A full-page version is available at the end of this report.

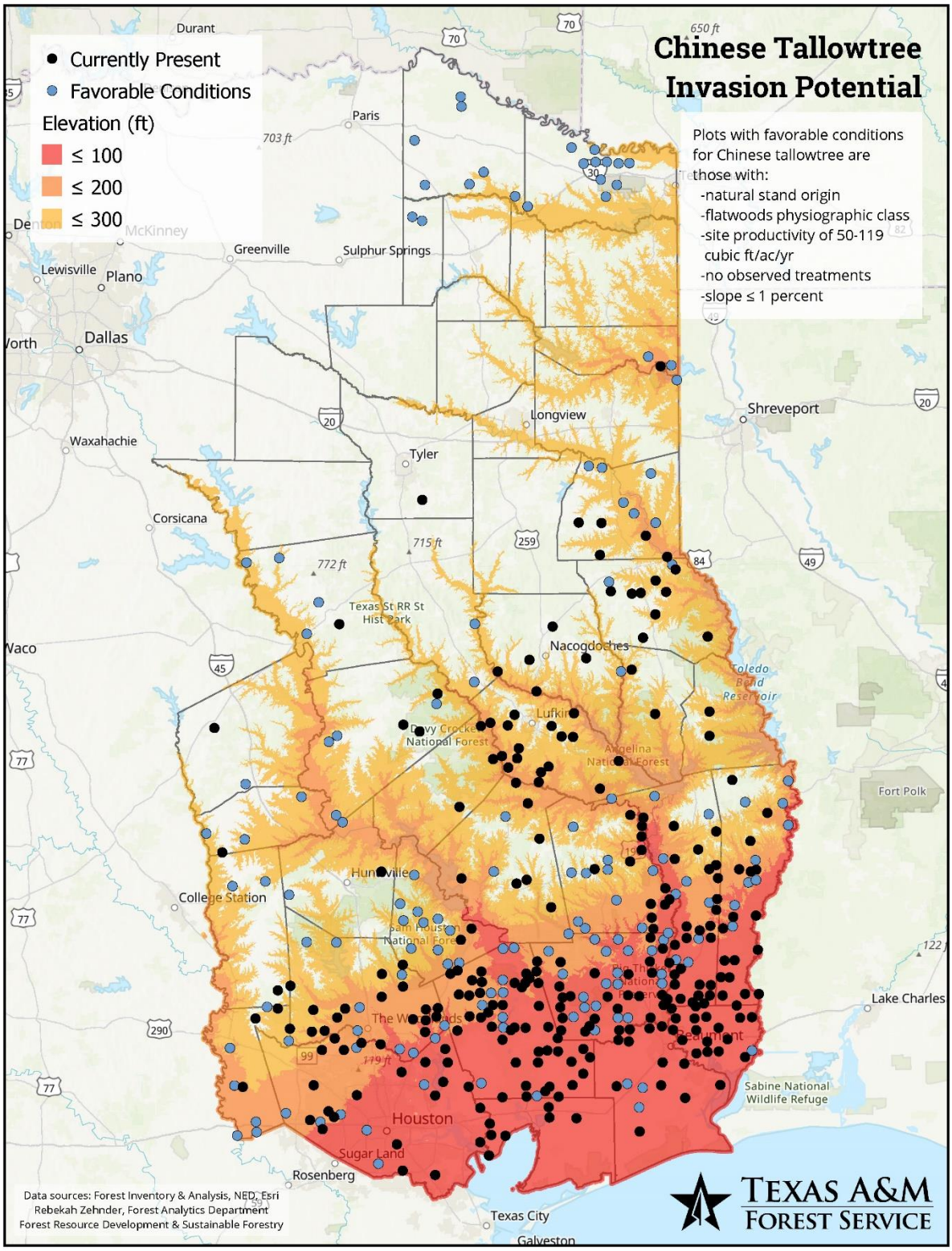



Figure 14. Map of Chinese tallowtree invasion potential based on FIA plots with favorable site characteristics.

## Urban Invasion

Chinese tallowtree is not only a rural forest problem; it is also invading urban areas. Houston has about 5.7 million Chinese tallowtrees at least one inch in diameter, accounting for 17 percent of its overall tree population. Of these, 4.6 million — 81 percent — are on public land.

Table 7. Number of live trees at least 1-inch d.b.h. in Houston, 2015, in millions.

| | All live | Chinese tallowtree | Percent Chinese tallowtree |
|---|---|---|---|
| **Public** | 14.0 | 4.6 | 33.1% |
| **Private** | 19.2 | 1.1 | 5.5% |
| **Total** | 33.3 | 5.7 | 17.1% |

Volume shows less of a discrepancy between public and private ownership. This indicates that a substantial portion of the number of Chinese tallowtrees on public land are small trees (less than five inches d.b.h.).

Table 8. Volume of live trees at least 5-inches d.b.h. in Houston, 2015, in million cubic feet.

| | All live | Chinese tallowtree | Percent Chinese tallowtree |
|---|---|---|---|
| **Public** | 36.0 | 3.1 | 8.5% |
| **Private** | 90.4 | 4.7 | 5.2% |
| **Total** | 126.4 | 7.8 | 6.2% |

Several of the public plots with high Chinese tallowtree density are concentrated on the west side of Houston. This area includes Bear Creek Pioneers Park and George Bush Park. Plots with privately owned Chinese tallowtree are scattered across the city. The map below shows the distribution. A full-page version is available at the end of the report.

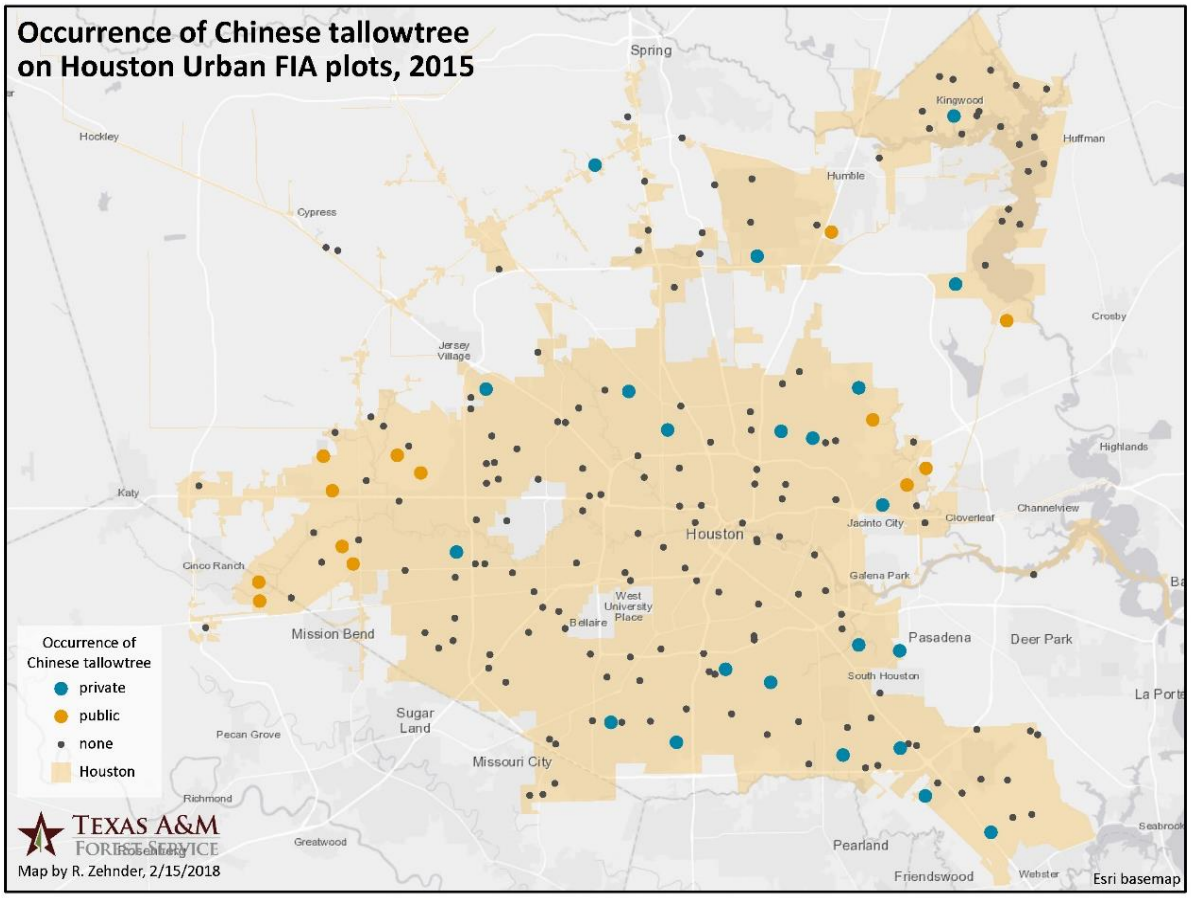
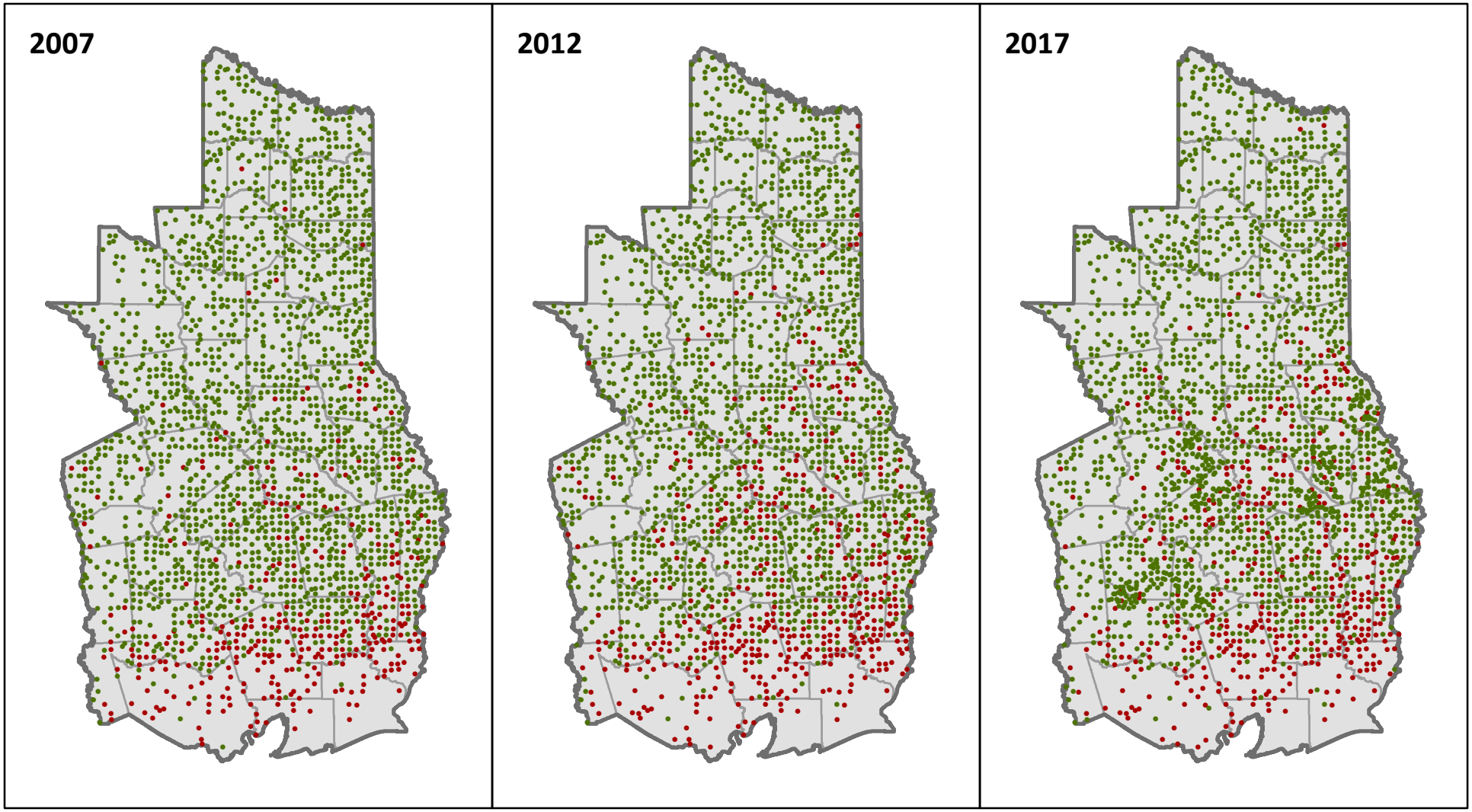
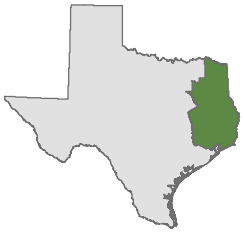



Figure 15. Map of Chinese tallowtree occurrence in Houston based on Urban FIA plots, 2015.

# Chinese Tallowtree in East Texas, 2007 to 2017



- Chinese tallowtree absent
- Chinese tallowtree present

0 25 50 100 Miles

FIA plots in East Texas from 2007, 2012, and 2017 inventories
Presence indicates at least one Chinese tallowtree of any size was found anywhere on the plot in accessible forestland

Data downloaded from FIA DataMart & SNIPET (http://www.fia.fs.fed.us/tools-data)

Forest Inventory & Analysis
http://www.fia.fs.fed.us

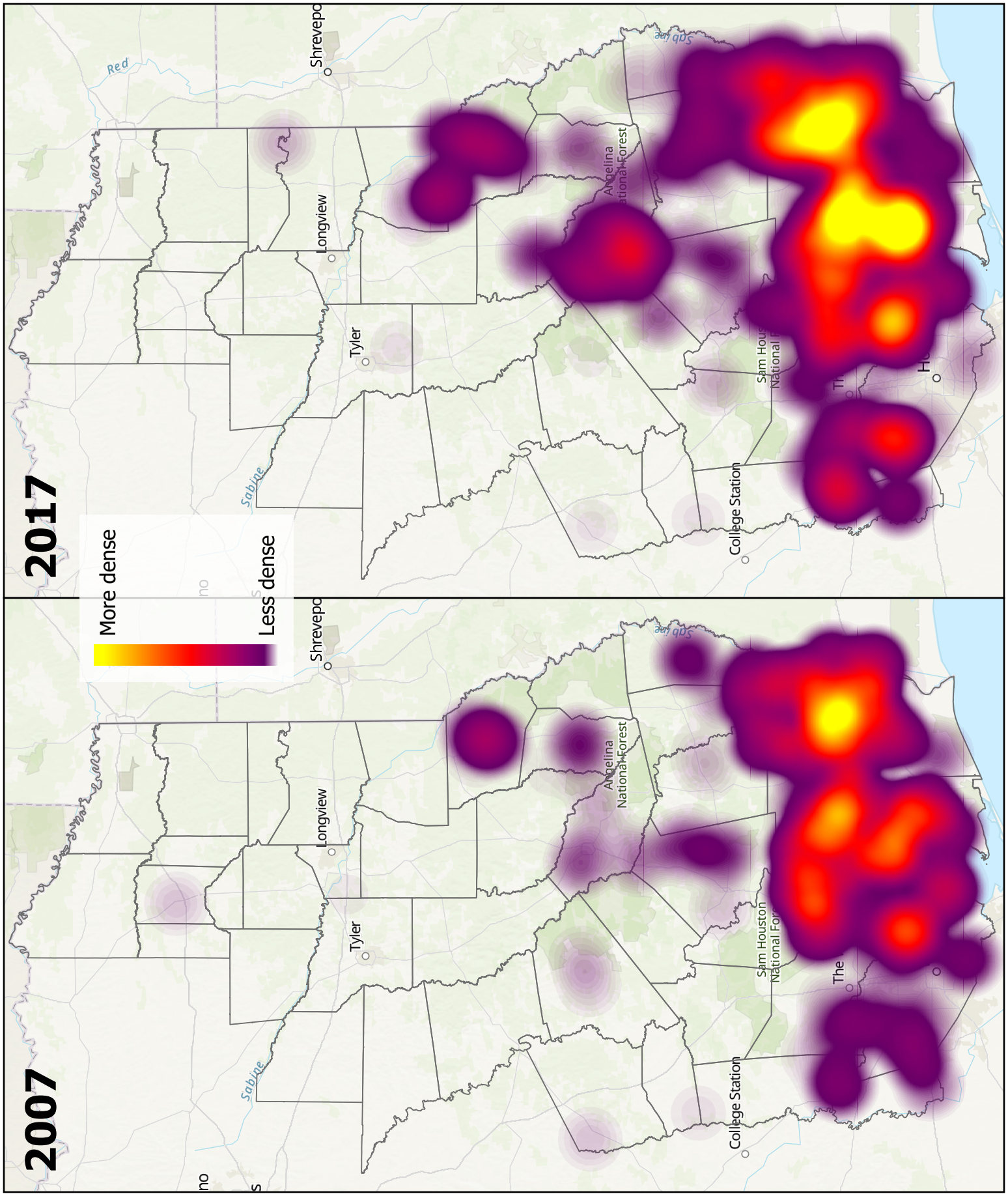
Map prepared by
Rebekah Zehnder,
Texas A&M Forest Service
(rzehnder@tfs.tamu.edu)

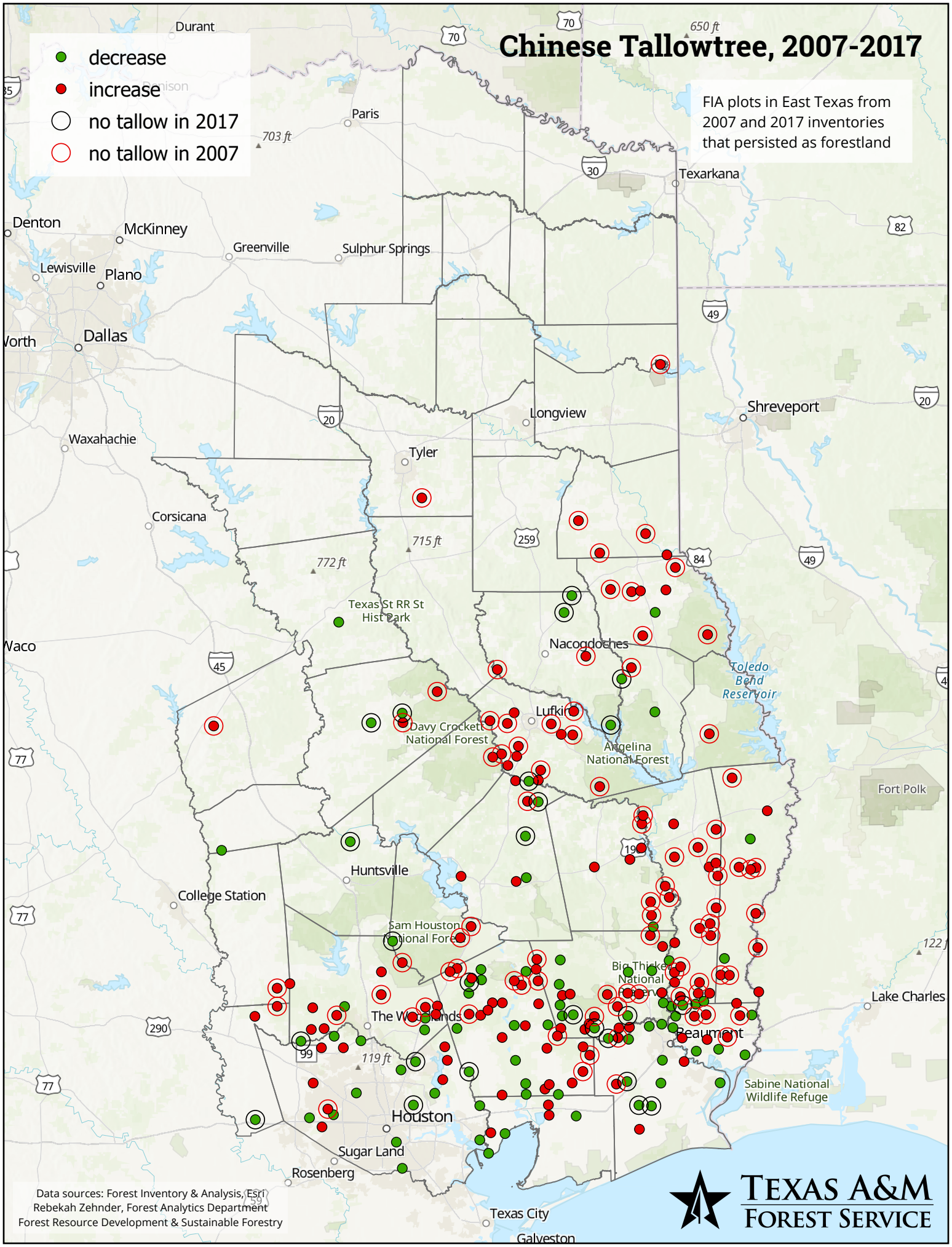
TEXAS A&M FOREST SERVICE

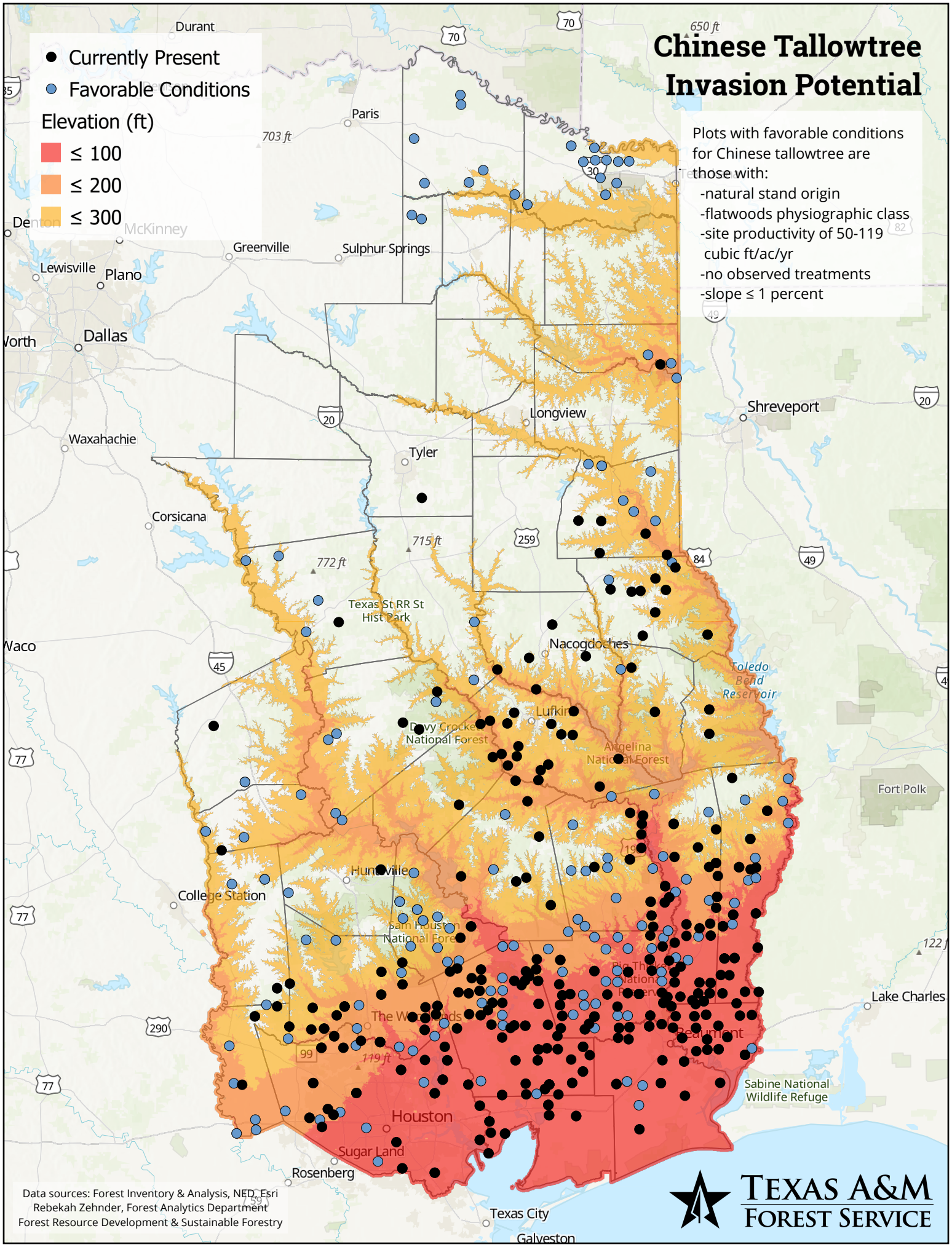
# Chinese Tallowtree, 2007-2017

Based on FIA plots in East Texas from 2007 and 2017 inventories
Values are number of Chinese tallowtrees per acre, for live trees at least 1 inch in diameter
The two heat maps have equivalent scales

Texas A&M Forest Service
Rebekah Zehnder, Forest Analytics Department
Forest Resource Development & Sustainable Forestry




Chinese Tallowtree, 2007-2017
decrease
increase
no tallow in 2017
no tallow in 2007
FIA plots in East Texas from 2007 and 2017 inventories that persisted as forestland
Durant
Paris
Texarkana
Denton
McKinney
Greenville
Sulphur Springs
Lewisville
Plano
Dallas
Waxahachie
Longview
Shreveport
Tyler
Corsicana
Waco
Nacogdoches
Toledo Bend Reservoir
Lufkin
Davy Crockett National Forest
Angelina National Forest
Fort Polk
Huntsville
College Station
Sam Houston National Forest
The Woodlands
Beaumont
Lake Charles
Sabine National Wildlife Refuge
Houston
Sugar Land
Rosenberg
Texas City
Galveston
703 ft
650 ft
715 ft
772 ft
119 ft
Texas St RR St Hist Park
Data sources: Forest Inventory & Analysis, Esri
Rebekah Zehnder, Forest Analytics Department
Forest Resource Development & Sustainable Forestry
Texas A&M Forest Service


Chinese Tallowtree Invasion Potential
Currently Present
Favorable Conditions
Elevation (ft)
≤ 100
≤ 200
≤ 300
Plots with favorable conditions for Chinese tallowtree are those with:
-natural stand origin
-flatwoods physiographic class
-site productivity of 50-119 cubic ft/ac/yr
-no observed treatments
-slope ≤ 1 percent
Durant
Paris
Denton
McKinney
Greenville
Sulphur Springs
Lewisville
Plano
Dallas
Waxahachie
Corsicana
Waco
Tyler
Longview
Shreveport
Nacogdoches
Lufkin
Toledo Bend Reservoir
Davy Crockett National Forest
Angelina National Forest
Fort Polk
Huntsville
College Station
Sam Houston National Forest
The Woodlands
Beaumont
Lake Charles
Sabine National Wildlife Refuge
Houston
Sugar Land
Rosenberg
Texas City
Galveston
650 ft
703 ft
715 ft
772 ft
119 ft
Texas St RR St Hist Park
Data sources: Forest Inventory & Analysis, NED, Esri
Rebekah Zehnder, Forest Analytics Department
Forest Resource Development & Sustainable Forestry
Texas A&M Forest Service

# Occurrence of Chinese tallowtree on Houston Urban FIA plots, 2015