BIOECONOMIC MODELING OF INVASIVE SPECIES MANAGEMENT IN URBAN FORESTS

FINAL REPORT

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Executive Summary

Invasive shot hole borers may cause extensive damage to urban forests if not managed effectively. ISHB spread the fungi responsible for the disease Fusarium dieback. It is the combined effects of the beetles and their fungal pathogens that lead to tree dieback or death. Monitoring programs to detect and control ISHB early is part of any essential management program. This study compares the costs and benefits of a monitoring program for early detection of ISHB in Orange and Ventura Counties. It also developed estimates of sites that are most susceptible to ISHB invasion that can be used as part of an effective monitoring program.

The costs of tree loss include the removal of trees damaged by ISHB and replanting with new trees; lost ecosystem services such as pollution abatement, carbon sequestration and rain runoff control; and lost aesthetic values of trees. These costs were estimated assuming losses in 10% increments between 10% and 70%. The costs of the monitoring program were either $400,000 or $500,000 per year. The present value over a 10-year time horizon of ISHB spread was calculated for each scenario and the monitoring costs.

The total costs of tree death varied from $156 million when 10% of trees susceptible to FD are lost over the 10-year time horizon to just over $1.09 billion when 70% of susceptible trees were lost. Benefits of the monitoring program were estimated from the change in percentage killed over 10 years due to the monitoring program. This percentage varied from 10 percentage points to 60 percentage. The benefits did not vary by the starting percentage of trees killed. For example, for 10 percentage point change in the rate of tree death, the benefits were $156 million. This was the case whether the change was from 40% of susceptible trees dying with no monitoring program to 30% due to the monitoring program, or the rate went from 20% with no monitoring program to 10% with a monitoring program. The present value of monitoring costs was $3.09 million when the annual costs are $400,000 a year and $3.89 million when they were $500,000 year. In all cases the benefits of the monitoring program were greater than the costs.

The susceptibility analysis measured areas were ISHB were most likely to invade in Orange and Ventura Counties given climatic factors, and presence and abundance of tree species, including hosts and non-hosts. Values were estimated for 1-km^2 grids in both counties. The results show that many areas that are highly susceptible in both Counties are not covered by current monitoring programs.

INTRODUCTION
Invasive shot hole borers (ISHB) are an introduced pest that pose a significant threat to California's urban forests and to the ecosystem services and benefits urban forests provide to their communities. ISHB refers to the two species present in California: the polyphagous shot hole borer (*Euwallacea fornicatus*) and the Kuroshio shot hole borer (*Euwallacea kuroshio*). Each beetle species is associated with a specific symbiotic Fusarium fungal pathogen species and other auxiliary fungi: Polyphagous shot hole borer is associated with *Fusarium euwallaceae, Graphium euwallaceae,* and *Paracremonium pembeum*; Kuroshio shot hole borer is associated with *F. kuroshium*, and *G. kuroshium*. The beetles and fungi together cause the plant disease Fusarium dieback (FD) (Eskalen et al. 2013; Lynch et al. 2016; Na et al. 2018, Smit et al. 2019). The fungi colonize the vascular system of the tree and infested trees have trouble transporting water and nutrients up and down trunks. In many cases FD will lead to tree death.

Pest monitoring programs - including trapping, surveys, and treatments - can help identify infected areas and mitigate the possibility of catastrophic loss, but such programs are costly for local municipalities. However, removal of dead and dying trees affected by ISHB as well as the associated loss of ecosystem services and landscape aesthetic benefits also pose significant financial risks to municipalities. Whether the cost of urban tree loss outweighs the cost of implementing ISHB monitoring programs is unknown. This study seeks to estimate such monetary trade-offs in Orange and Ventura counties.

Effective ISHB monitoring programs will focus on areas within California that are susceptible to invasion. The susceptibility of a given area depends on the tree size and species composition of the urban forest as well as the suitability of climate for ISHB reproduction. The extent of areas vulnerable to ISHB invasion in California are unknown; thus, this study also aims to fill that gap by utilizing street tree inventories and climate data to assess vulnerability across the state.

BIOECONOMIC MODELING
A bioeconomic model was developed to assess the costs and benefits of the establishment of ISHB in Ventura and Orange Counties with and without a monitoring program. The model links costs to changes in tree populations and tree mortality rates associated with the spread of the ISHB-FD pest-disease complex. Total costs of the spread of the ISHB-FD complex over all regions j (for j = 1 … J), in period t (for t = 1 …. 10), is equal to the costs of managing trees infested with FD, C_m, plus the value of the loss of ecosystem services, C_e, plus the value of lost landscape asset values, C_l, plus the cost to replant lost trees, C_p, plus the cost of the public program to survey and monitor ISHB, C_s, so that

(1) $C_t = \sum_{j=1}^{J}\left(C_{mjt}(Y_{jt}) + C_{ejt}(Y_{jt}) + C_{ljt}(Y_{jt}) + C_{pjt}(Y_{jt}) + C_{sjt}\right).$

For this study management costs include tree removals. Ecosystem services include carbon sequestration, energy savings, rain runoff mitigation and pollution abatement. Landscape values are the inherent aesthetic values of having a specific species of tree located in a specific spot such as a street tree, yard tree, etc. For this study the assumption is that all trees that are removed are replanted with another landscape tree.

Management costs, the value of ecosystem services, landscape values and replanting costs all depend on the number of trees that die each year due to FD. Surveillance and monitoring costs reflect the scope of a public program.

Trees are classified into one of three categories: non-host, competent (a host tree for ISHB but not susceptible to tree death), and kill-competent (host tree and susceptible to tree death). The number of trees dying in time t depends on the diffusion of the pest and disease through the environment, and assumptions on the maximum percentage of kill-competent trees (KCT) that will be affected by the pest and disease over a 10-year time horizon (Figure 1).
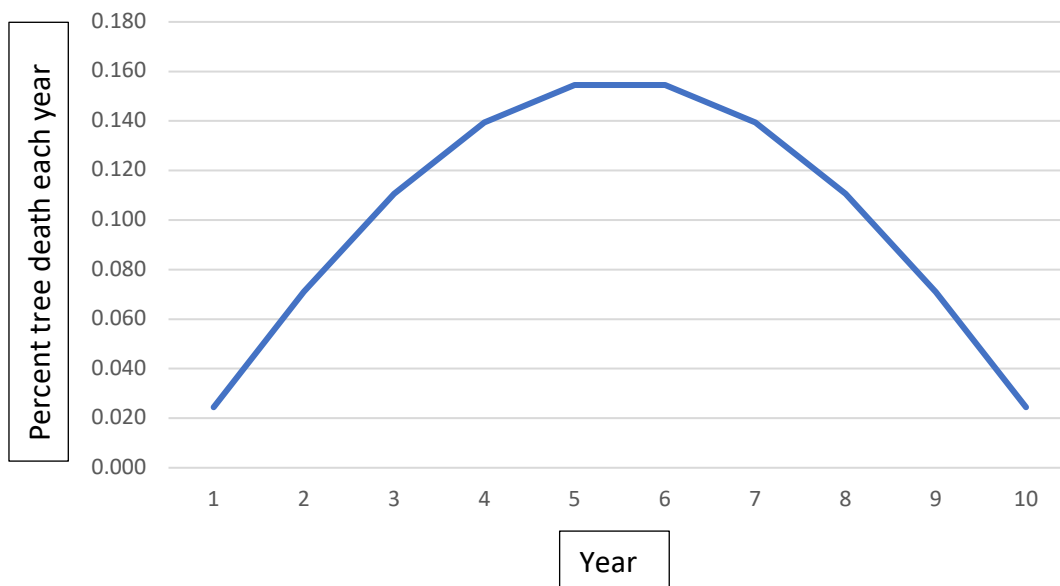

Figure 1. Spread as a share of susceptible trees affected

The diffusion model used for this study is $((\cos((t/10)*3.1417+3.1417)+1)/2)$. This formula creates a symmetrical spread rate with the greatest spread happening in years 5 and 6 (Figure 1).

The number of trees that die each year is $((\cos((t/10)*3.1417+3.1417)+1)/2$ * maximum percentage KCT * total number KCT. For this study the maximum percentage of KCT that die in total varies from 10% to 70%. Total costs over the total time horizon are

(2) $C = \sum_{t=1}^{T} C_t/((1+r)^t)$ where r is the discount rate and set equal to 5.0% for this study.

Cost data

Monitoring costs. A monitoring program is the public policy of interest for this study. Monitoring costs can vary by location depending on the total space that needs to be monitored and the distribution of host trees within that space. Total space can be a county or a city. The higher the number and share of host trees within a space, the

more susceptible is that space to ISHB invasion. Based on discussions with county and city managers of public ISHB management programs, two scenarios were evaluated to compare the costs and benefits for this study. The first was annual monitoring costs of $400,000 a year and the second was $500,000 a year.

Removal costs. Costs to remove diseased trees were provided by local tree management companies who participate with municipalities in public urban tree management programs. These companies provided costs both based on removing only one tree in the environment and removing a group of five trees. Removal costs were averaged over the companies that provided data.

Evaluation of ecosystem services, landscape asset values and replanting costs with iTree Eco

I-Tree Eco (version 6) was used to estimate the value of ecosystem services and landscape asset values provided by urban forests in Orange and Ventura counties. This software program is designed to use tree inventories and surveyed plot-based data in combination with meteorological data to quantify and value urban forest structures. The output calculated for each tree in the complete inventories included replacement value (landscape asset values), and the quantities and values for carbon storage, gross carbon sequestration per year, avoided runoff per year, and pollution removal per year based their size, species identity, and land use class. Definitions for each metric are listed in Appendix 1. Individual tree results from plot-based data included all the same values as the inventory results in addition to values associated with building energy savings (carbon avoided value per year and energy savings per year).

Preparation of urban forestry data: inventories and plot-based data sources

This study utilized tree data from the California Urban Forest Inventory (CUFI) to evaluate ecosystem services and landscape asset values in Ventura and Orange counties. With over 7 million individual tree records, the CUFI is the most comprehensive inventory of California's urban trees to date (Love et al., 2022; https://datastudio.google.com/u/0/reporting/880d448d-de26-48d3-b563-0c6317e456e4/page/jWHKB). The CUFI contains both public and private tree data aggregated from multiple publicly available inventories and data held by private arborist companies. These data mostly represent street trees with only a few backyard trees contained in the inventory.

Inventories from the following 17 cities were used to characterize the urban forest in Orange county: Anaheim (72,507 trees), Buena Park (12,658 trees), Costa Mesa (26,533 trees), Cypress (15,161 trees), Fullerton (42,411 trees), Garden Grove (16,887 trees), Huntington Beach (48,110 trees), Irvine (94,964 trees), La Habra (12,205 trees), Laguna Niguel (11,214 trees), Laguna Woods (39,941 trees), Newport Beach (34,611 trees), Orange (34,779), Placentia (10,228 trees), Rossmoor (5,328 trees), Santa Ana (59,661 trees), and Tustin (21,833 trees). Inventories from the following 4 cities were used to characterize the urban forest in Ventura County: Camarillo (38,433 trees), Fillmore (5,258 trees), Oxnard (52,194 trees), and Ventura (35,648 trees).

Tree plot data. This project also utilized plot-based data to characterize urban forests in Southern California. Plot-based data differ from inventory data in two key ways. First,

plot-based data include all trees in each plot surveyed – both public and private backyard trees – whereas inventory data mostly represent public street trees. Second, plot-based data include measurements from each tree to the nearest building, which allows for the evaluation of a given tree's effect on building energy use when using i-Tree Eco to estimate ecosystem services (see section below for description of the software i-Tree Eco).

Tree plot data were obtained for metropolitan areas within the Southern California Coast climate zone, including the Santa Barbara and Los Angeles UFORE (Urban Forest Effects model) collections from 2012 and 2008 respectively, the USFS FIA (US Forest Service Forest Inventory and Analysis *https://www.fia.fs.fed.us)* dataset from prior to 2014, and USFS Urban FIA data for San Diego from 2017. A total of 611 trees were extracted from the Santa Barbara dataset, 701 trees from the Los Angeles dataset, 835 trees from the older FIA collection, and 450 trees were extracted from the San Diego FIA dataset. For the San Diego FIA data, project collaborators were able to query their records and provide assignments of plots to land cover types as location information in the FIA data is obfuscated for public release. The individual tree records from the plot data were formatted for loading into iTree Eco, including species name, location, individual tree id, tree dbh, tree height, crown width, land cover type, and distance and azimuth to the nearest building.

For both the inventory and plot data trees were binned into one of seven diameter at breast height (DBH) classes: 0-6 inches, 6-12 inches, 12-18 inches, 18-24 inches, 24-30 inches, 30-36 inches, and 36+ inches. Each tree was then assigned one of seven land use classes based on its location: Commercial/Industrial, Multi-family residential, Residential, Park, Transportation, Water/wetland, or other. Finally, the competency of trees to ISHB were categorized as competent and killed, competent and not killed, or not competent based on tree species identity (Lynch et al., 2021). See Appendix 2 for a list of competent species.

Replanting costs were also estimated from the results of the i-Tree eco estimations. The formula used to estimate landscape tree replacement values is

(3) Tree Value = Cost of largest available nursery tree x Diameter at breast height x Species Class x Condition Class x Location Class.

See Appendix 1 for a definition of all items. Using the data on tree value, dbh, species factors, location class and an average condition class of 87%, an average cost of the largest available nursery tree was estimated and used for the costs of replanting. This was then rounded up to $250 to also reflect the costs to plant a new tree.

Because ecosystem services vary by climatic zones i-Tree Eco software requests that the user input a nearby weather station and target year. Climate data from PRISM (https://www.prism.oregonstate.edu/) was used to summarize two dimensions of climate (mean annual temperature and annual precipitation) across years ranging from 2001 to 2020 (Figure 2).
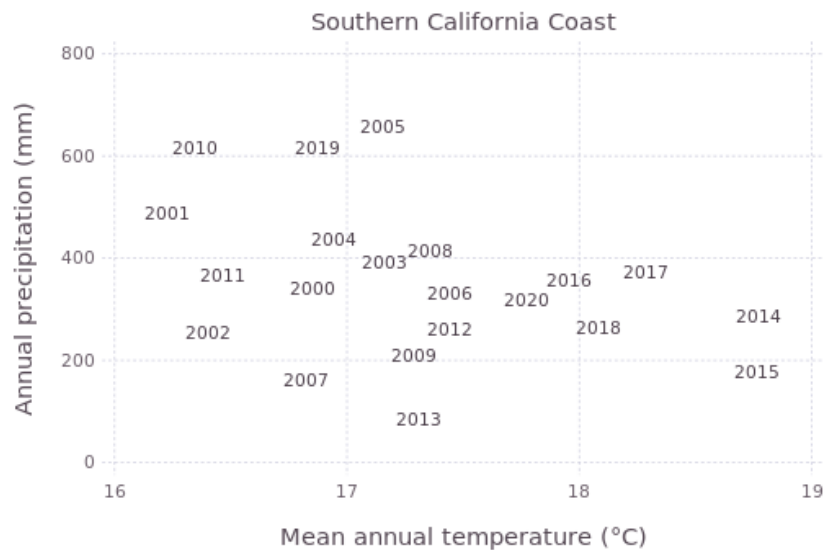
Figure 2. Mean annual temperature and precipitation for Southern California.

The temperature and precipitation values for the individual years in each of the six different climate zones, were averaged across every pixel in the climate zone.

Weather and pollution data from 2016 in Orange County and 2011 in Ventura County were the default values entered into i-Tree eco to process the inventories. Both years represented climatically typical years based on the 20-year temperature and precipitation means.

The complete inventories representing Orange and Ventura counties were processed individually city-by-city. After processing, the individual tree benefits results table was downloaded from the i-Tree Eco program. Average values per kill-competent tree species were then calculated and applied to the estimates of the total number of susceptible trees to estimate the total costs of tree death.

Estimating total number of trees.
All costs but the monitoring costs are a function of tree populations, so information is needed on the number of susceptible trees affected each year as ISHB spreads throughout an area. The challenge for this study was that there was no data source that has the total number of trees by species available for a broadly defined geographical area. Consequently, the EarthDefine urban tree canopy dataset from 2018 (https://www.earthdefine.com/treemap/, available at https://www.fs.usda.gov/detailfull/r5/communityforests/?cid=fseprd647442) was combined with an estimate for the number of trees per unit area of canopy cover from the Laguna Woods city tree inventory. The Laguna Woods municipal tree inventory has a complete inventory of every tree in that small city. The tree points from the Laguna Woods inventory were overlaid on the raster canopy cover layer after masking by the extent of the tree inventory. Figure 3 below shows the tree points (small x's) and the EarthDefine canopy cover layer (in green) across a portion of Laguna Woods.
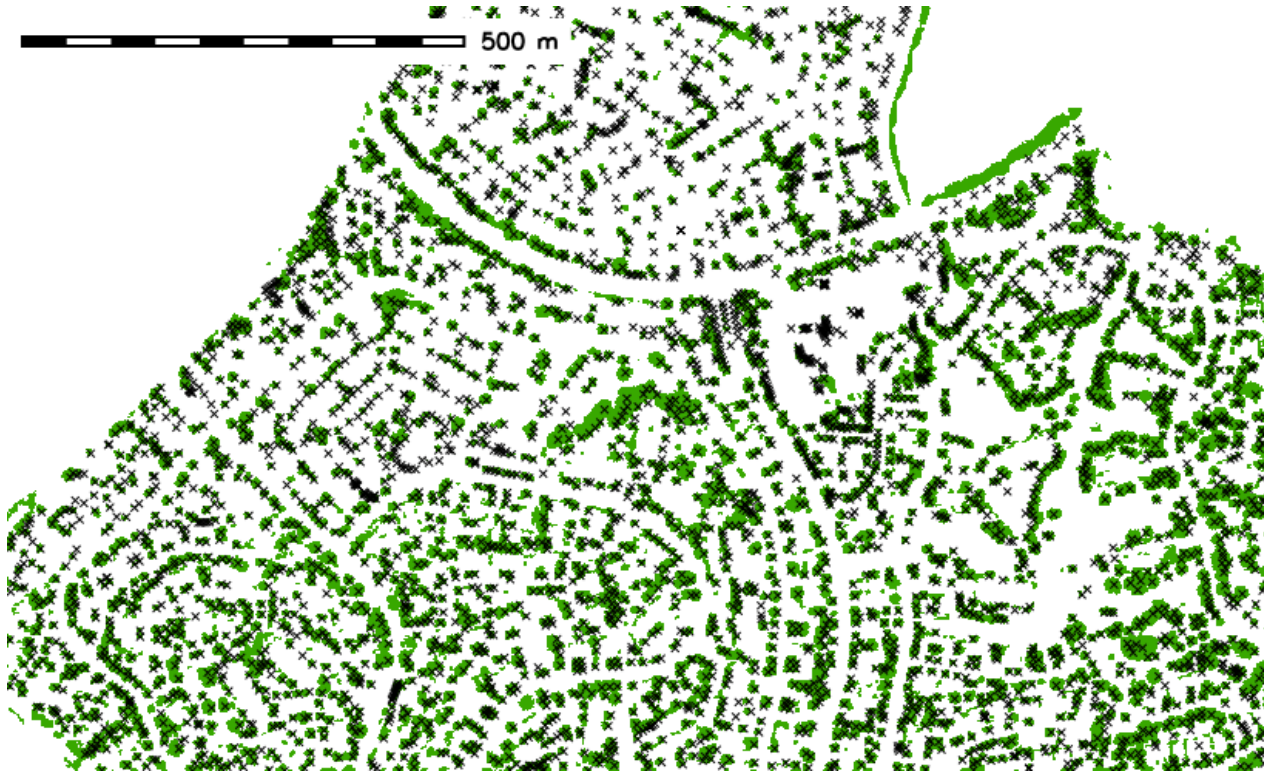
Figure 3. Inventory points and canopy points for Laguna Woods

This calculation resulted in an estimate of 190 trees per hectare of mapped EarthDefine canopy cover, with a spatially based standard deviation of 22 trees per hectare. Applying this estimate to the Orange County study area yields a total tree count of 5,049,000 trees (±597,000 trees (1 SD)) and to the Ventura study area yields a total tree count of 2,433,000 trees (±285,000 trees (1 SD)).

The McPherson et al. 2017 study came up with a tree density estimate of 76.9 trees/ha over the entire Southern California Coast climate zone. This is substantially higher than estimates using this value from the Laguna Woods inventory (37.2 trees/ha for Orange County and 41.9 trees/ha for Ventura County using the EarthDefine urban data boundaries), but this discrepancy may be due to spatial differences in data boundaries. A simple comparison of the Laguna Woods tree count to the Laguna Woods inventory area (i.e., not incorporating the EarthDefine dataset in any way) gave a density estimate of 56.3 trees/ha.

RESULTS AND DISCUSSIONS

Tree Counts

Of the 559,074 trees from the inventories in Orange County, 48,262, or 8.63% are susceptible to tree death if infested with ISHB transmitted Fusarium dieback (Table 1). In Ventura County 14,221 trees, or 10.81% of the tree inventories are susceptible to tree death. Applying this to the estimated total number of trees in each county, there are

439,617 trees susceptible to tree death in Orange County due to FD and 263,071 in Ventura County.

Table 1. Tree Counts for Orange and Ventura County

County	Inventory Count of Trees	Count of ISHB killed competent trees	Share ISHB kill competent	Estimated total trees in each county	Estimated trees ISHB kill competent
Orange	559,074	48,262	8.63%	5,094,050	439,617
Ventura	131,533	14,221	10.81%	2,433,592	263,071

Mean individual tree values from inventory and plot-based data

The total average value of a tree was $4,626 in Orange County and $4,780 in Ventura County (Table 2). The landscape asset value accounted for most of the costs at $3,655 a tree in Orange County and $3,819 in Ventura County. Tree removal costs were the next highest category, followed by replanting, then ecosystem services.

Table 2. Average costs per tree death by county

	Orange County	Ventura County
Tree Removal	603	597
Ecosystem Services	68	64
Replanting	250	250
Asset Value	3655	3819
Total	4626	4780

Total costs due to ISHB infestations

Total costs for lost trees in Orange County varied from $156 million when only 10% of kill competent trees were assumed killed by FD, to $1.091 billion when 70% of susceptible trees were lost. For Ventura County costs ranged from $96 million for 10% of susceptible trees lost to $675 million at 70% of susceptible trees lost (Table 3). The total costs for Orange County are much higher than for Ventura County even though per tree costs are slightly higher in Ventura County as Orange County has more trees.

Table 3. Total costs due to ISHB infestations in Orange and Ventura Counties in $US millions

County	Percent Susceptible Trees Killed	Number of trees killed over 10 years	Removal Costs	Asset Costs	Ecosystem costs	Replanting	Total
Orange	10%	43,974	21	124	8	2	156
Orange	20%	87,949	43	247	17	5	312
Orange	30%	131,923	64	371	25	7	467
Orange	40%	175,897	86	494	34	9	623
Orange	50%	219,872	107	618	42	11	779
Orange	60%	263,846	129	742	51	14	935
Orange	70%	307,820	150	865	59	16	1091
Ventura	10%	26,311	13	77	5	1	96
Ventura	20%	52,623	25	155	10	3	193
Ventura	30%	78,934	38	232	15	4	289
Ventura	40%	105,245	51	309	20	5	386
Ventura	50%	131,557	64	386	25	7	482
Ventura	60%	157,868	76	464	30	8	578
Ventura	70%	184,180	89	541	35	9	675

Monitoring Costs

An effective monitoring and management program can keep the losses from ISHB in the lower ranges. Early detection and removal of severely infested trees can keep ISHB populations low, and slow the spread of FD. Because it is uncertain how much a monitoring and management program will slow the spread of ISHB, the costs and benefits of a monitoring program were simulated over a range of values. Benefits were estimated for a change in the percentage of susceptible trees that would die over 10 years due to ISHB. These benefits ranged from a change of only 10 percentage points, to a change of up to 60 percentage. Costs were estimated for two monitoring programs: one valued at $400,000 a year and another at $500,000 a year. The present value of monitoring costs over the 10-year period are $3.09 million when annual costs are $400,000 a year and $3.86 million when annual costs are $500,000 a year.

Cost benefit analysis of monitoring costs.

For a 10-percentage point change in the share of susceptible trees that will die due to ISHB/FD infestations, the benefits were $156 million in Orange County (Table 4). This value went up proportionately as the percent change in the rate of tree death increased by 10 percentage points. Thus, the benefits for a 20-percentage point change were $312 million, the benefits for a 30-percentage point change were $467 million, etc.

Table 4. Monitoring costs versus tree loss costs for Orange County

Percent change in the rate of tree death	Benefits per percent change in millions	Monitoring Costs		Rate of Return	
		$400,000/ year	$500,000/ year	$400,000/ year	$500,000/ year
10%	156	3.09	3.86	50.45	40.36
20%	312	3.09	3.86	100.89	80.72
30%	467	3.09	3.86	151.34	121.07
40%	623	3.09	3.86	201.79	161.43
50%	779	3.09	3.86	252.24	201.79
60%	935	3.09	3.86	302.68	242.15

When the benefits are compared to the costs, the benefits are always higher than the costs. The rate of return on one dollar invested in monitoring activities returns $40.36 in benefits for the smallest percentage point change when the annual monitoring costs are $500,000 a year. This increases to $242.15 in benefits for every dollar spent on monitoring.

Table 5. Monitoring costs versus tree loss costs for Ventura County

Percent change in the rate of tree death	Benefits per percent change in millions	Monitoring Costs		Rate of Return	
		$400,000/ year	$500,000/ year	$400,000/ year	$500,000/ year
10%	96	3.09	3.86	31.21	24.96
20%	193	3.09	3.86	62.41	49.93
30%	289	3.09	3.86	93.62	74.89
40%	386	3.09	3.86	124.82	99.86
50%	482	3.09	3.86	156.03	124.82
60%	578	3.09	3.86	187.23	149.79

For Ventura County the benefits are also always greater than the costs of a monitoring program even though the benefits are lower (Table 5). Benefits in Ventura County

range from $96 million to $578 million depending on the percentage change in the rate of tree death in susceptible trees. Correspondingly, the rate of return varies from $24.96 to $149.79 for every dollar spent on a monitoring program when the cost of the monitoring program is $500,000 a year.

CONCLUSION
Invasive shot hole borers can and do cause urban forest tree loss. This loss results in substantial economic losses due to the costs to manage dying trees and the lost aesthetic values of urban trees. An effective monitoring program that may include trapping, surveys, etc., can effectively mitigate tree losses. Under all scenarios considered in this study the benefits of a monitoring program are greater than the costs.

ASSESSING SUSCEPTIBILITY TO SHOT HOLE BORER

ISHB-FD susceptibility estimates were developed for sites throughout California to help stakeholders prioritize time and resources devoted to ISHB-FD management and monitoring. The initial estimates are based on host composition and microclimate, which are two important constraints for beetle development and establishment (Umeda & Paine 2018; Dodge & Stouthamer 2021; Lynch et al. 2021; Lynch et al. *in prep*).

Urban forest tree size and species composition in California

This study used California Urban Forest Inventory data to assess species composition and tree size in urban areas of California. Individual tree data from the Inventory were aggregated to 1-km² grids across the extent of California. A total of 17,965 grid cells were constructed across the spatial extent of the CUFI data. To assess species composition, the number of trees representing each species was summed for each 1 km² grid cell. A total of 7,063,333 trees were aggregated to the grid cells to assess species composition

To assess tree size, the basal area of each tree species was summed in each 1-km² grid cell. Basal area represents the trunk area at breast height in m². Because not all individual trees in the CUFI were measured for DBH, fewer trees were included in this analysis. A total of 6,605,005 trees were aggregated to grid cells to assess tree size as measured by basal area.

Annual number of ISHB generation estimates in California

Sites that are more often within the optimal temperature range for ISHB development are expected to support more generations of beetles. Such sites in turn are more likely to be vulnerable to beetle establishment and severe impacts. A degree-day model was used to estimate the mean annual number of beetle generations across 20 years (2001-2020) within 1-km² grids across California. We ran the degree day algorithm over a data stack giving minimum and maximum temperature as a statewide raster for every day in the time interval of interest. For this data stack, we used Daymet data (https://daac.ornl.gov/DAYMET/guides/Daymet_Daily_V4.html) (Thornton et al. 1997, 2020, 2021) which is available at a 1-kilometer resolution in NetCDF format. We opted to run the algorithm over the period 2001-2020. Because of the large size of this data stack (46 GB, 365 days x 20 years x 552,000 pixels statewide), we ported the original R script to the Julia language for performance reasons. The number of degree-days accumulated (CDD) for each day were calculated using the sine wave model developed by Higley et al. (1986) with ISHB threshold temperatures (T_{min}= 13 °C; T_{max}= 32 °C) determined from previous experimental work (Dodge & Stouthamer 2021; Umeda & Paine 2018). The CDD accumulated in each year was then divided by the experimentally derived thermal constant parameter K (318 degree days) (Dodge & Stouthamer 2021; Umeda & Paine 2018) to estimate the annual number of ISHB generations that could occur within each grid. Annual estimates were averaged across 20 years for each grid to produce a single statewide bioclimatic raster surface of beetle generation estimates as a proxy for climatic suitability (Figure 4).
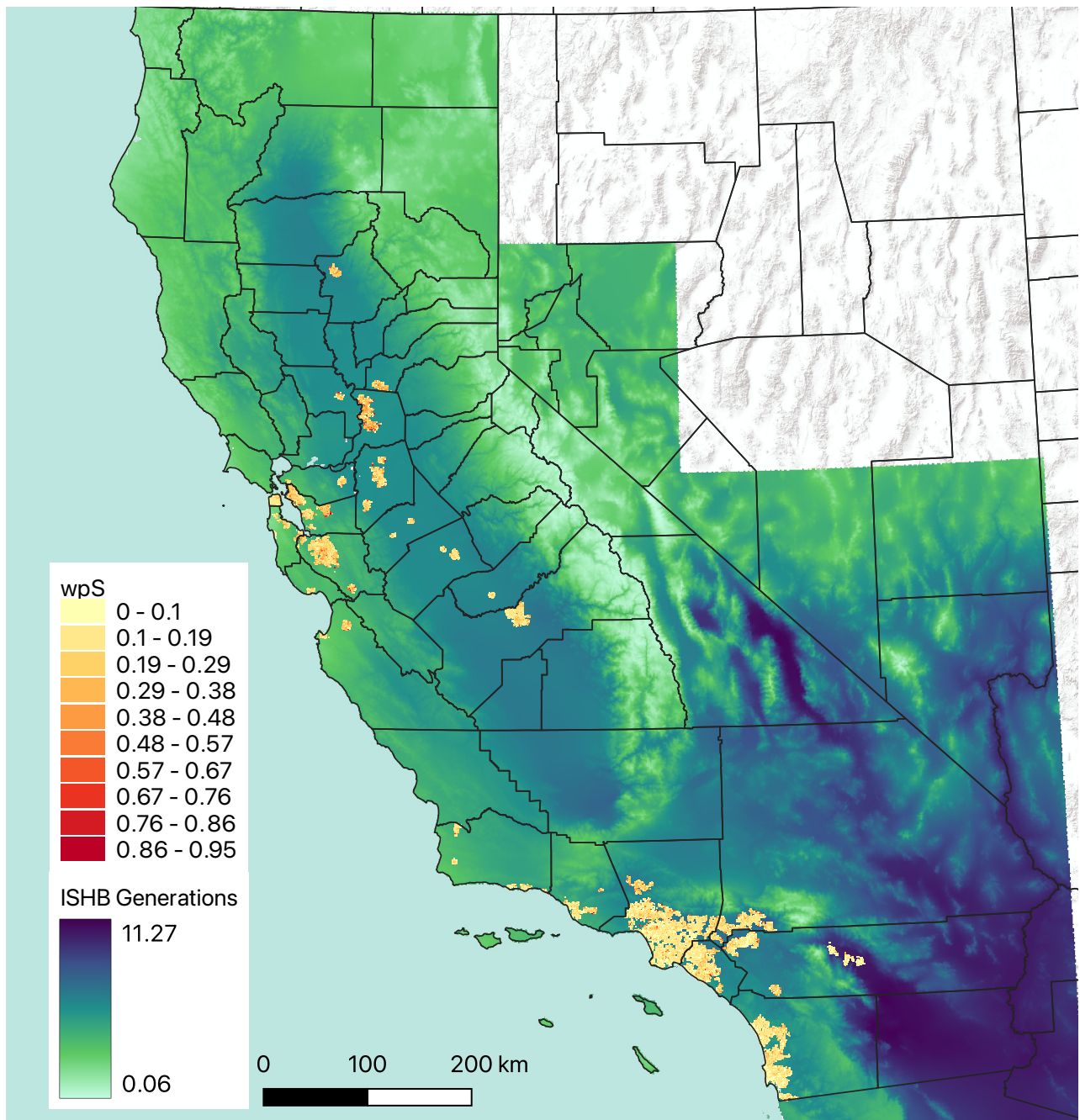
Figure 4. Annual number of ISHB generations by zone in California

Site susceptibility estimates based on host composition in California

The combined effects of ISHB and their fusaria symbionts have killed or caused dieback on 77 tree species on which the beetles can reproduce, but the beetles make attempted attacks on an additional 247 tree species (Eskalen et al., 2013; Lynch et al., 2021). These host species occur across complex landscapes whose composition widely varies across urban and wildland forests. Critically, there is a strong and progressive phylogenetic signal in the severity of impacts on those host species: severe disease develops on a small and phylogenetically predictable subset of the host species that can be colonized by the fungi and/or beetles (Lynch et al., 2021). Through other ISHB-funded CISAC projects (Lynch & Eskalen, Award No. 19-0885-000-SG), this phylogenetic signal and data from 15,000 trees in 260 0.25-ha monitoring plots throughout Southern California have been used to develop a predictive *PhyloEpi* model of FD-ISHB site susceptibility, which shows that susceptibility increases with a greater abundance of closely related hosts (Lynch *in prep*). Here, we estimated site susceptibility within 9,430 of the aforementioned 1-km² grids in 170 of California's major cities (Appendix 3). These cities have a complete tree inventory in iTree Eco (Love et al. *in review*) and represent locations where ISHB-FD could be introduced via human-mediated movement of plant material. They also represent centers from where these new introductions could spread. A total of 5,280,301 individual trees in 1,037 species were evaluated (Appendix 3 and 4).

We estimated site susceptibility within each grid cell (wpS) based on the interaction between phylogenetic structure and host abundance. Adapting the *PhyloSusceptibility* model from Parker et al. (2015), we first calculated susceptibility (S) to the ISHB-FD pest-pathogen for tree species i as a function of its phylogenetic distance PD from a killed-competent host j:

$$\text{logit}(S)_{ij} = 3.38 - 3.68 * \log_{10}(PD_{ij} + 1) \qquad (1)$$

The logistic regression coefficients in this equation ($\beta_0 = 3.38$, $\beta_1 = -3.68$) represent coefficients identified for the ISHB-FD pest-pathogen complex (Lynch et al. *in prep*). Here, the probability that tree species i is susceptible ($p(S)_i$) based on its phylogenetic distance from host j is:

$$p(S)_{ij} = \frac{\exp\left[logit(S)_{ij}\right]}{1 + \exp\left[logit(S)_{ij}\right]} \qquad (2)$$

and the overall probability that tree species i is a host ($p(H)_i$) is the complement of the product of probabilities that tree species i is not susceptible to each of the 18 killed-competent host species j:

$$p(H)_i = 1 - \prod_{j=1}^{18}(1 - p(S)_{ij} \qquad (3)$$

This $p(H)_I$ is weighted by the relative abundances (RA) for each species i within each grid cell k:

$$wp(H)_i = p(H)_i * RA_i \qquad (4)$$

and the overall estimate of site susceptibility $wp(S)_k$ is the sum of the weighted host probabilities within each grid k:

$$wp(S)_k = \sum_{i=1}^{n} wp(H)_i \qquad (5)$$

Application of maps and future directions
The risk maps developed in this project show which locations are most vulnerable to ISHB-FD establishment at the 1-km scale and, as a first approximation, serve as a powerful tool for prioritizing monitoring and management activities. The host composition-based susceptibility estimates were applied to complete tree inventory data in 170 cities in California using a *PhyloEpi* model that was developed and validated with a large and robust monitoring dataset (Lynch et al. *in prep*). On average, the *PhyloEpi* model correctly predicted susceptible sites with 70% accuracy (Lynch et al. *in prep*), which is highly effective given that predictability is based on local host-composition alone and other factors (i.e., microclimate and landscape traits) are expected to influence site susceptibility. Preliminary analysis suggests an interaction between local host composition and microclimate in that sites become more susceptible where warmer air temperatures favor more beetle generations (Lynch et al. *in prep*). For this reason, we included the estimated number of beetle generations across sites in California to guide decision-making in locations without complete tree inventories, and to use in conjunction with host composition- based susceptibility estimates at sites with complete tree inventories (Figures 5 - 7). Additional tree inventories in urban and wildland forests will fill in critical gaps to our current risk assessments and, more importantly, will improve models of beetle spread through time under different climate change and management scenarios. Additional analysis will also be required to integrate host-composition and microclimate into this adaptive model and add important landscape considerations.
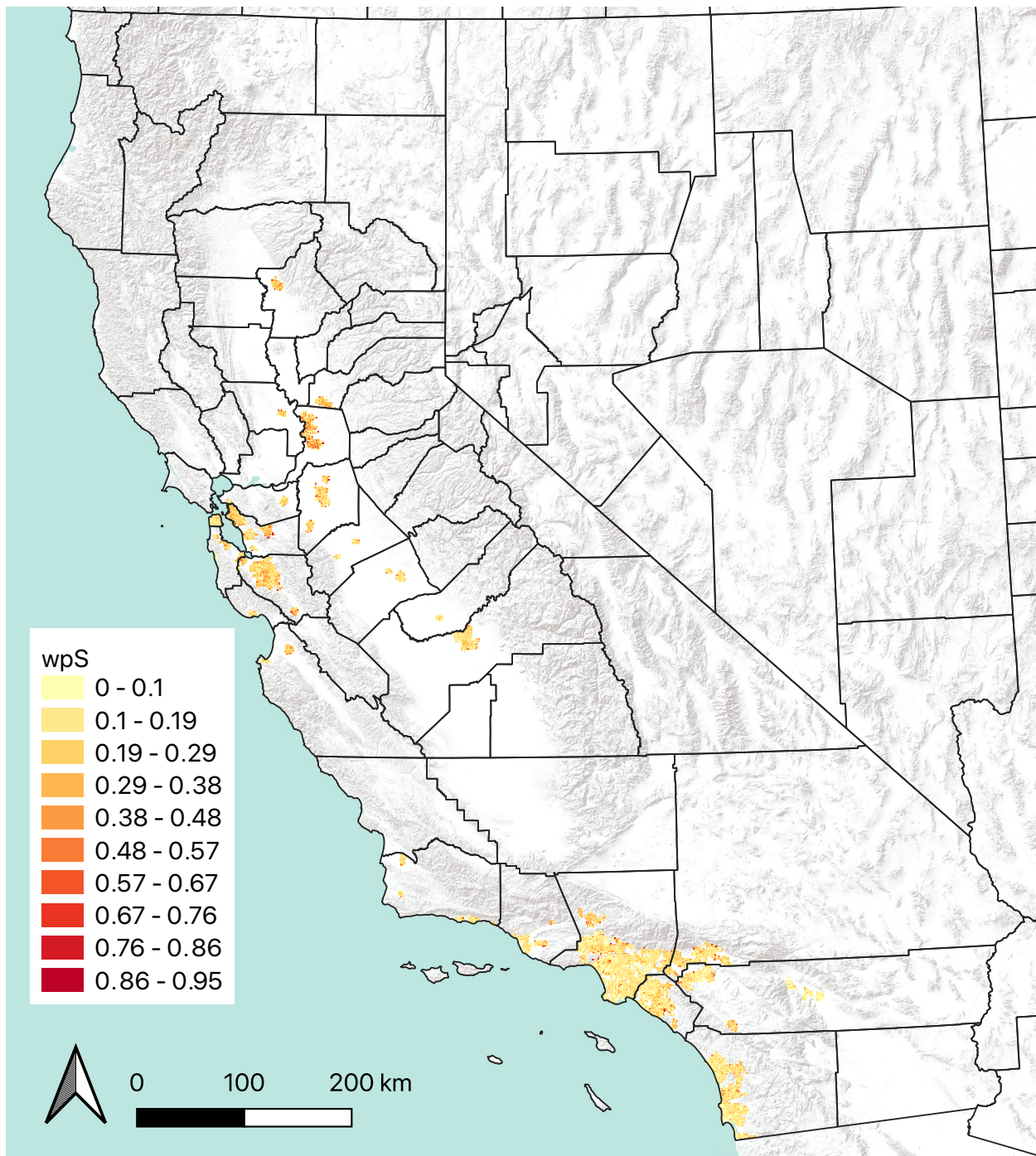
Figure 5. Susceptibility estimates (wpS) for all areas in California with complete tree inventories.
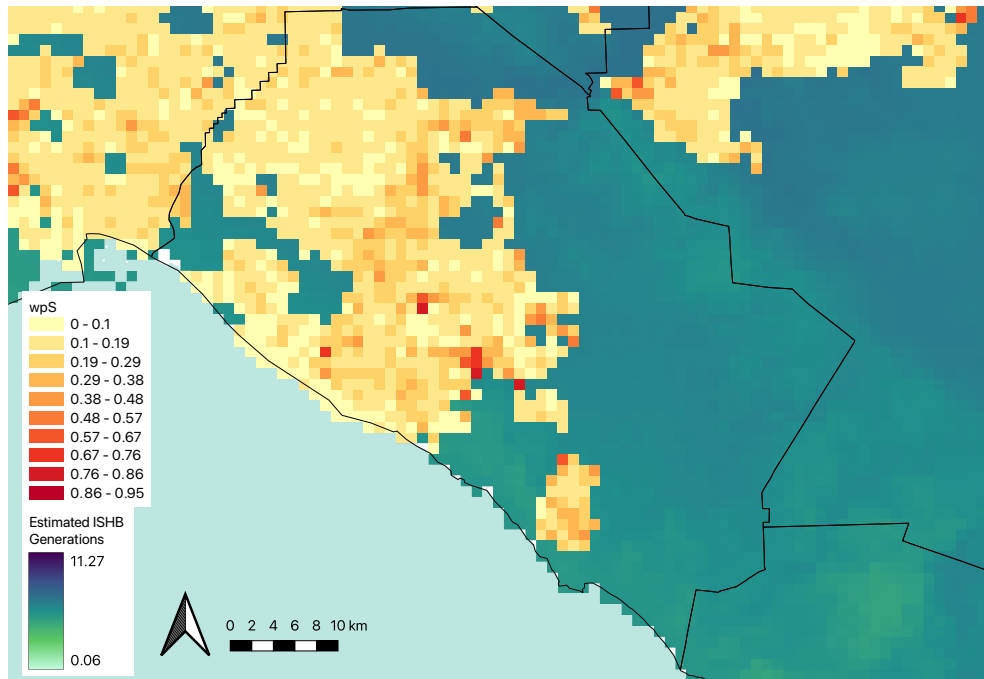
Figure 6. Generation map and susceptibility estimates (wpS) for Orange County
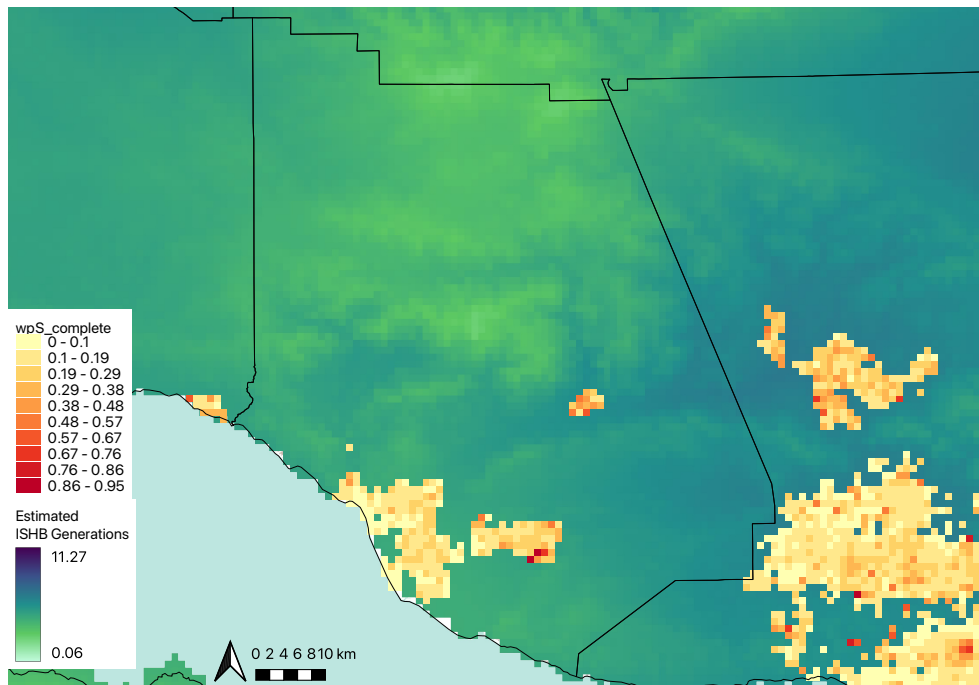
Figure 7. Generation map and susceptibility estimates (wpS) for Ventura County

FUTURE WORK

Mapping of ISHB observation data. We obtained data from Hannah Vasilis of UC ANR giving ISHB point observations from surveys and trapping efforts. These data cover the period 2014 to 2021 and include a variety of individual survey efforts, e.g., the 6 cycles of the ISHB surveys performed by Orange County Parks from 2016 to 2021. We mapped this observation data to learn about general patterns of ISHB spread and occurrence, especially the degree to which occurrences are localized. The map below presents ISHB observation data from 2020 to 2021 from a set of trapping locations in Ventura County. The points in green had no ISHB occurrences, whereas the points in red or orange had presence of ISHB. This information will be used in future ISHB spread modeling.

References

Bjorkman, J., J.H. Thorne, A. Hollander, N.E. Roth, R.M. Boynton, J. de Goede, Q. Xiao, K. Beardsley, G. McPherson, J.F. Quinn. March, 2015. Biomass, carbon sequestration and avoided emission: assessing the role of urban trees in California. Information Center for the Environment, University of California, Davis

Dodge, C., Stouthamer, R. 2021. Effect of temperature on fecundity, development, and emergence of the invasive ambrosia beetle *Euwallacea kuroshio* (Coleoptera: Scolytinae). *Agricultural and Forest Entomology* 23(1): 79-86. http://dx.doi.org/10.1111/afe.12407

i-Tree Eco. iTree Software suite v6.0. Accessed February 22, 2022 to March 14, 2022. http://www.itreetools.org

i-Tree Eco User's Manual v6.0. 2021. https://www.itreetools.org/documents/275/EcoV6_UsersManual.2021.09.22.pdf

Love, N.L.R., V. Nguyen, C. Pawlak, A. Pineda, J.L. Reimer, J.M. Yost, G. A. Fricker, J.D. Ventura, J.M. Doremus, T. Crow, M.K. Ritter. 2022. Diversity and structure in California's urban forest: What over six million data points tell us about one of the world's largest urban forests. Under Review in Urban Forestry & Urban Greening [Manuscript submitted 7 February 2022].

Love, N.L.R., V. Nguyen, C. Pawlak, A. Pineda, J.L. Reimer, J.M. Yost, G. A. Fricker, J.D. Ventura, J.M. Doremus, T. Crow, M.K. Ritter. 2022. Under review. Diversity and structure in California's urban forest: What over six million data points tell us about one of the world's largest urban forests. Urban Forestry & Urban Greening [Manuscript submitted 7 February 2022].

Lynch, S. C., Twizeyimana, M., Mayorquin, J. S., Wang, D. H., Na, F., Kayim, M., Kasson, M. T., Thu, P. Q., Bateman, C., Rugman-Jones, P., Hulcr, J., Stouthamer, R., Eskalen, A. (2016). Identification, pathogenicity and abundance of *Paracremonium pembeum* sp. nov. and *Graphium euwallaceae* sp. nov.—two newly discovered mycangial associates of the polyphagous shot hole borer (*Euwallacea* sp.) in California. *Mycologia*, 108(2), 313–329 https://doi.org/10.3852/15-063

Lynch, S.C., A. Eskalen., and G.S. Gilbert. 2021. Host evolutionary relationships explain tree mortality caused by a generalist pest-pathogen complex. *Evolutionary Applications* 14(4): 1083-1094**.** https://doi.org/10.1111/eva.13182

McPherson, E. Gregory, Qingfu Xiao, Natalie S. van Doorn, John de Goede, Jacquelyn Bjorkman, Allan Hollander, Ryan M. Boynton, James F. Quinn, and James H. Thorne. 2017. "The Structure, Function and Value of Urban Forests in California Communities." *Urban Forestry & Urban Greening* 28 (Supplement C): 43–53. https://doi.org/10.1016/j.ufug.2017.09.013.

Na, F., Carrillo, J. D., Mayorquin, J. S., Ndinga-Muniania, C., Stajich, J. E., Stouthamer, R., Huang, Y.-T., Lin, Y.-T., Chen, C.-Y., Eskalen, A. (2018). Two novel fungal symbionts *Fusarium kuroshium* sp. nov. and *Graphium kuroshium* sp. nov. of Kuroshio shot hole borer (*Euwallacea* sp. nr. *fornicatus*) cause Fusarium dieback on woody host species in California. *Plant Disease*, 102(6), 1154–1164. https://doi.org/10.1094/PDIS-07-17-1042-RE

Smith, S. M., Gomez, D. F., Beaver, R. A., Hulcr, J., Cognato, A. I. (2019). Reassessment of the species in the *Euwallacea fornicatus* (Coleoptera: Curculionidae: Scolytinae) complex after the rediscovery of the "lost" type specimen. *Insects*, 10(9), 261–272. https://doi.org/10.3390/insects10090261

Thornton, M.M., R. Shrestha, Y. Wei, P.E. Thornton, S. Kao, and B.E. Wilson. 2020. Daymet: Daily Surface Weather Data on a 1-km Grid for North America, Version 4. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1840

Thornton, P. E., R. Shrestha, M. Thornton, S.-C. Kao, Y. Wei, and B. E. Wilson. 2021. Gridded daily weather data for North America with comprehensive uncertainty quantification. Scientific Data 8. https://doi.org/10.1038/s41597-021-00973-0

Thornton, P.E., Running, S.W., White, M.A. 1997. Generating surfaces of daily meteorological variables over large regions of complex terrain. Journal of Hydrology 190: 214 - 251. https://doi.org/10.1016/S0022-1694(96)03128-9

Umeda, C., Eskalen, A., and Paine, T.D. 2016. Polyphagous Shot Hole Borer and Fusarium Dieback in California. Chapter 26 in Insects and Diseases of Mediterranean Forest Systems. Timothy D. Paine and François Lieutier, Editors. Springer International Publishing Switzerland. DOI 10.1007/978-3-319-24744-1 https://www.researchgate.net/profile/Edmundo-Sousa/publication/309052281_The_Pine_Wood_Nematode_and_Its_Local_Vectors_in_the_Mediterranean_Basin/links/5a6724830f7e9b76ea8d6812/The-Pine-Wood-Nematode-and-Its-Local-Vectors-in-the-Mediterranean-Basin.pdf#page=755. Accessed 04/14/22.

Umeda, C., and Paine, T. 2019. Temperature can limit the invasion range of the ambrosia beetle *Euwallacea* nr. *fornicatus. Agricultural and Forest Entomology* 21(1): 1-7. http://dx.doi.org/10.1111/afe.12297

Appendix 1. Definitions of each ecosystem serviced quantified in iTree Eco. Definitions are from the i-Tree Eco User's Manual.

Avoided runoff value – A functional value provided by the trees (i.e., a value that results from an environmental function of trees). This is the monetary value of stormwater runoff that is avoided because of rainfall interception by trees. This value is estimated based on the economic damages associated with runoff and costs of stormwater control.

Carbon storage value – A replacement value based on the tree itself. This is the monetary value associated with tree effects on atmospheric carbon. This value is estimated based on the economic damages associated with increases in carbon or carbon dioxide emissions.

Carbon avoided value – The monetary value of increases or decreases in carbon emissions from power plants as a result of changes in energy use. This value is estimated based on the economic damages associated with increases in carbon or carbon dioxide emissions.

Energy savings value – The monetary value of increased or decreased energy costs as a result of a tree's effect on residential building energy use. This value is estimated based on the dollar value per MBTU or MWH.

Gross carbon sequestration value – A functional value provided by the trees (i.e., a value that results from an environmental function of trees). This is the monetary value associated with tree effects on atmospheric carbon. This value is estimated based on the economic damages associated with increases in carbon or carbon dioxide emissions.

Pollution removal value – A functional value provided by the trees (i.e., a value that results from an environmental function of trees). This is the monetary value associated with tree effects on atmospheric pollution. This value is estimated based on the economic damages associated with increases in pollution emissions and/or the impact of air pollution on human health.

Replacement (compensatory) value – A replacement value based on the tree itself. The compensatory value is based on the cost of having to replace a tree with a similar tree

Appendix 2. Competency status of urban tree species to invasive shothole borer (ISHB). This table lists only competent species and whether they are killed by ISHB or not. All other tree species were categorized as not competent. Competency status sourced from Lynch et al., 2021.

Species	Family	Order	Competency Status
Acacia mearnsii	Fabaceae	Fabales	not killed
Acacia melanoxylon	Fabaceae	Fabales	not killed
Acacia sp.	Fabaceae	Fabales	not killed
Acer buergerianum	Sapindaceae	Sapindales	killed
Acer macrophyllum	Sapindaceae	Sapindales	killed
Acer negundo	Sapindaceae	Sapindales	killed
Acer palmatum	Sapindaceae	Sapindales	killed
Acer paxii	Sapindaceae	Sapindales	not killed
Aesculus californica	Sapindaceae	Sapindales	not killed
Ailanthus altissima	Simaroubaceae	Sapindales	not killed
Albizia julibrissin	Fabaceae	Fabales	not killed
Alectryon excelsus	Sapindaceae	Sapindales	not killed
Alnus rhombifolia	Betulaceae	Fagales	not killed
Archontophoenix cunninghamiana	Arecaceae	Arecales	not killed
Baccharis pilularis	Asteraceae	Asterales	not killed
Baccharis salicina	Asteraceae	Asterales	not killed
Bauhinia variegata	Fabaceae	Fabales	not killed
Brachychiton populneus	Malvaceae	Malvales	not killed
Camellia semiserrata	Theaceae	Ericales	not killed
Castanospermum australe	Fabaceae	Fabales	not killed
Casuarina equisetifolia	Casuarinaceae	Fagales	not killed
Cercidium floridum subsp. floridum	Fabaceae	Fabales	not killed
Cercidium sonorae	Fabaceae	Fabales	not killed
Cocculus laurifolius	Menispermaceae	Ranunculales	not killed
Combretum kraussii	Combretaceae	Myrtales	not killed
Corymbia ficifolia	Myrtaceae	Myrtales	not killed
Cupaniopsis anacardioides	Sapindaceae	Sapindales	not killed
Dombeya cacuminum	Malvaceae	Malvales	not killed
Erythrina caffra	Fabaceae	Fabales	not killed
Erythrina coralloides	Fabaceae	Fabales	not killed

Erythrina falcata	Fabaceae	Fabales	not killed
Fagus crenata	Fagaceae	Fagales	not killed
Ficus altissima	Moraceae	Rosales	not killed
Ficus carica	Moraceae	Rosales	not killed
Gleditsia triacanthos	Fabaceae	Fabales	not killed
Harpullia pendula	Sapindaceae	Sapindales	not killed
Howea forsteriana	Arecaceae	Arecales	not killed
Ilex cornuta	Aquifoliaceae	Aquifoliales	not killed
Jacaranda mimosifolia	Bignoniaceae	Lamiales	not killed
Koelreuteria bipinnata	Sapindaceae	Sapindales	not killed
Liquidambar styraciflua	Altingiaceae	Saxifragales	killed
Magnolia grandiflora	Magnoliaceae	Magnoliales	not killed
Magnolia virginiana	Magnoliaceae	Magnoliales	not killed
Parkinsonia aculeata	Fabaceae	Fabales	killed
Persea americana	Lauraceae	Laurales	not killed
Platanus acerifolia	Platanaceae	Proteales	killed
Platanus mexicana	Platanaceae	Proteales	not killed
Platanus racemosa	Platanaceae	Proteales	killed
Podalyria calyptrata	Fabaceae	Fabales	not killed
Populus fremontii	Salicaceae	Malpighiales	killed
Populus nigra	Salicaceae	Malpighiales	killed
Populus tremuloides	Salicaceae	Malpighiales	not killed
Populus trichocarpa	Salicaceae	Malpighiales	killed
Prosopis articulata	Fabaceae	Fabales	not killed
Psoralea pinnata	Fabaceae	Fabales	not killed
Pterocarya stenoptera	Juglandaceae	Fagales	not killed
Ptychosperma elegans	Arecaceae	Arecales	not killed
Quercus agrifolia	Fagaceae	Fagales	not killed
Quercus chrysolepis	Fagaceae	Fagales	not killed
Quercus engelmannii	Fagaceae	Fagales	not killed
Quercus lobata	Fagaceae	Fagales	killed
Quercus macrocarpa	Fagaceae	Fagales	not killed
Quercus robur	Fagaceae	Fagales	killed
Quercus suber	Fagaceae	Fagales	not killed
Ricinus communis	Euphorbiaceae	Malpighiales	killed
Salix alba	Salicaceae	Malpighiales	not killed
Salix babylonica	Salicaceae	Malpighiales	not killed
Salix gooddingii	Salicaceae	Malpighiales	killed

Salix laevigata	Salicaceae	Malpighiales	killed
Salix lasiolepis	Salicaceae	Malpighiales	killed
Salix mucronata	Salicaceae	Malpighiales	not killed
Spathodea campanulata	Bignoniaceae	Lamiales	not killed
Tamarix ramosissima	Tamaricaceae	Caryophyllales	not killed
Virgilia oroboides	Fabaceae	Fabales	not killed
Wisteria floribunda	Fabaceae	Fabales	not killed
Xylosma congesta	Salicaceae	Malpighiales	not killed

Appendix 3. Total number of grids with ISHB-FD site susceptibility estimates within each city in California.

County/City	Total Grids (n)
Alameda	**414**
Alameda	36
Berkeley	37
Dublin	35
Emeryville	7
Hayward	80
Newark	21
Oakland	140
Pleasanton	58
Butte	**82**
Chico	82
Contra Costa	**67**
Brentwood	52
El Cerrito	15
Fresno	**314**
Fresno	314
Los Angeles	**2,603**
Alhambra	23
Altadena	28
Artesia	5
Avocado Heights	9
Azusa	22
Baldwin Park	21
Bell	9
Bell Gardens	8
Bellflower	20
Beverly Hills	23
Burbank	46
Carson	51
Castaic	21
Cerritos	20
Citrus	2
Claremont	34
Commerce	17
Compton	24
Covina	19
Culver City	24
Diamond Bar	38
Downey	27
Duarte	16
East Los Angeles	16
East Pasadena	6
East Rancho Dominguez	4
East San Gabriel	4
El Monte	28
El Segundo	14
Florence-Graham	12
Gardena	17
Glendale	77
Glendora	31
Hacienda Heights	31
Hidden Hills	10
Inglewood	31

County/City	Total Grids (n)
La Cañada Flintridge	23
La Crescenta-Montrose	8
La Mirada	24
La Puente	7
La Verne	23
Ladera Heights	6
Lakewood	25
Lawndale	7
Lomita	7
Long Beach	137
Los Angeles	839
Manhattan Beach	16
Mayflower Village	2
Maywood	4
Monrovia	18
Monterey Park	17
Norwalk	28
Pico Rivera	26
Pomona	63
Rancho Palos Verdes	46
Rosemead	16
San Fernando	10
San Gabriel	10
Santa Clarita	132
Santa Monica	34
Signal Hill	6
South Gate	26
South Pasadena	11
South San Jose Hills	4
South Whittier	14
Temple City	11
Topanga	36
Torrance	59
Vernon	10
View Park-Windsor Hills	6
Vincent	3
West Covina	43
West Hollywood	8
West Puente Valley	8
Whittier	42
Madera	**30**
Madera	30
Merced	**94**
Atwater	26
Merced	68
Monterey	**94**
Monterey	29
Salinas	65
Orange	**891**
Anaheim	128
Buena Park	25
Costa Mesa	40
Cypress	19
Fullerton	59

County/City	Total Grids (n)
Garden Grove	49
Huntington Beach	92
Irvine	145
La Habra	22
Laguna Niguel	39
Laguna Woods	14
Newport Beach	66
Orange	68
Placentia	15
Rossmoor	6
Santa Ana	75
Tustin	29
Placer	**108**
Roseville	108
Riverside	**601**
Corona	98
Indio	48
Norco	36
Palm Desert	56
Palm Springs	55
Riverside	228
Temecula	80
Sacramento	**369**
Elk Grove	103
Sacramento	266
San Bernardino	**626**
Chino Hills	61
Fontana	116
Montclair	12
Ontario	121
Redlands	73
Rialto	69
San Bernardino	131
Upland	43
San Diego	**1,306**
Carlsbad	97
Coronado	15
Encinitas	56
Escondido	112
Imperial Beach	10
La Mesa	27
National City	22
Oceanside	108
San Diego	730
San Marcos	71
Vista	58
San Francisco	**128**
San Francisco	128
San Joaquin	**291**
Lodi	43
Stockton	185
Tracy	63
San Mateo	**127**
Burlingame	16

County/City	Total Grids (n)
East Palo Alto	8
Half Moon Bay	16
Menlo Park	27
San Bruno	20
San Mateo	40
Santa Barbara	**176**
Carpinteria	15
Goleta	27
Lompoc	23
Santa Barbara	57
Santa Maria	54
Santa Clara	**644**
Cambrian Park	1
Gilroy	43
Los Gatos	33
Milpitas	40
Palo Alto	49
San Jose	386
Santa Clara	40
Sunnyvale	52
Santa Cruz	**42**
Santa Cruz	42
Stanislaus	**47**
Ceres	28
Patterson	19
Ventura	**246**
Camarillo	64
Fillmore	14
Oxnard	83
San Buenaventura	85
Yolo	**40**
Woodland	40
Grand Total	**9,340**

Appendix 4. Urban forest tree species list used in this study to estimate FD-ISHB site susceptibility).

Family	Species	n
Adoxaceae	*Sambucus canadensis*	1
Adoxaceae	*Sambucus nigra*	1,269
Adoxaceae	*Sambucus sp.*	69
Adoxaceae	*Viburnum odoratissimum*	77
Adoxaceae	*Viburnum sp.*	154
Adoxaceae	*Viburnum tinus*	89
Altingiaceae	*Liquidambar formosana*	1,025
Altingiaceae	*Liquidambar orientalis*	439
Altingiaceae	*Liquidambar styraciflua*	182,145
Anacardiaceae	*Cotinus coggygria*	725
Anacardiaceae	*Harpephyllum caffrum*	2,301
Anacardiaceae	*Malosma laurina*	467
Anacardiaceae	*Mangifera indica*	136
Anacardiaceae	*Pistacia atlantica*	237
Anacardiaceae	*Pistacia chinensis*	163,980
Anacardiaceae	*Pistacia khinjuk*	57
Anacardiaceae	*Pistacia vera*	30
Anacardiaceae	*Rhodosphaera rhodanthema*	3
Anacardiaceae	*Rhus integrifolia*	198
Anacardiaceae	*Rhus ovata*	340
Anacardiaceae	*Rhus sp.*	85
Anacardiaceae	*Schinus molle*	58,642
Anacardiaceae	*Schinus polygama*	660
Anacardiaceae	*Schinus terebinthifolia*	44,971
Anacardiaceae	*Searsia lancea*	29,325
Anacardiaceae	*Searsia pendulina*	4
Annonaceae	*Annona cherimola*	392
Annonaceae	*Annona squamosa*	3
Apocynaceae	*Cascabela thevetia*	621
Apocynaceae	*Cascabela thevetioides*	13
Apocynaceae	*Nerium oleander*	7,977
Apocynaceae	*Pachypodium lamerei*	15
Apocynaceae	*Plumeria rubra*	755
Apocynaceae	*Rauvolfia sumatrana*	19
Aquifoliaceae	*Ilex aquifolium*	529
Aquifoliaceae	*Ilex cassine*	1
Aquifoliaceae	*Ilex cornuta*	117
Aquifoliaceae	*Ilex glabra*	1
Aquifoliaceae	*Ilex opaca*	18
Aquifoliaceae	*Ilex sp.*	321
Aquifoliaceae	*Ilex wilsonii*	823
Araliaceae	*Cussonia spicata*	22
Araliaceae	*Meryta sinclairii*	2
Araliaceae	*Schefflera actinophylla*	604
Araliaceae	*Schefflera arboricola*	172
Araliaceae	*Schefflera elegantissima*	5
Araliaceae	*Schefflera pueckleri*	370
Araliaceae	*Tetrapanax sp.*	1
Araliaceae	*Trevesia palmata*	1
Araucariaceae	*Agathis robusta*	58
Araucariaceae	*Araucaria angustifolia*	2
Araucariaceae	*Araucaria araucana*	91
Araucariaceae	*Araucaria bidwillii*	187
Araucariaceae	*Araucaria columnaris*	1,923

Family	Species	n
Araucariaceae	*Araucaria heterophylla*	3,001
Araucariaceae	*Wollemia nobilis*	3
Arecaceae	*Archontophoenix alexandrae*	36
Arecaceae	*Archontophoenix cunninghamiana*	30,616
Arecaceae	*Bismarckia nobilis*	84
Arecaceae	*Brahea armata*	1,144
Arecaceae	*Brahea brandegeei*	159
Arecaceae	*Brahea edulis*	3,639
Arecaceae	*Butia odorata*	993
Arecaceae	*Caryota mitis*	44
Arecaceae	*Caryota obtusa*	20
Arecaceae	*Caryota urens*	348
Arecaceae	*Chamaedorea glaucifolia*	2
Arecaceae	*Chamaedorea seifrizii*	16
Arecaceae	*Chamaedorea sp.*	12
Arecaceae	*Chamaerops humilis*	5,311
Arecaceae	*Dypsis cabadae*	13
Arecaceae	*Dypsis decaryi*	579
Arecaceae	*Dypsis lutescens*	84
Arecaceae	*Howea belmoreana*	56
Arecaceae	*Howea forsteriana*	1,264
Arecaceae	*Hyophorbe lagenicaulis*	29
Arecaceae	*Jubaea chilensis*	204
Arecaceae	*Livistona australis*	23
Arecaceae	*Livistona chinensis*	110
Arecaceae	*Livistona decora*	156
Arecaceae	*Parajubaea torallyi*	2
Arecaceae	*Phoenix canariensis*	30,801
Arecaceae	*Phoenix dactylifera*	14,894
Arecaceae	*Phoenix loureiroi*	15
Arecaceae	*Phoenix reclinata*	778
Arecaceae	*Phoenix roebelenii*	10,735
Arecaceae	*Phoenix rupicola*	109
Arecaceae	*Phoenix sylvestris*	44
Arecaceae	*Pritchardia remota*	2
Arecaceae	*Raphia australis*	8
Arecaceae	*Ravenea rivularis*	1,267
Arecaceae	*Rhapidophyllum hystrix*	7
Arecaceae	*Rhapis excelsa*	11
Arecaceae	*Rhopalostylis baueri*	11
Arecaceae	*Rhopalostylis sapida*	7
Arecaceae	*Roystonea regia*	226
Arecaceae	*Sabal palmetto*	66
Arecaceae	*Sabal sp.*	91
Arecaceae	*Syagrus oleracea*	1
Arecaceae	*Syagrus romanzoffiana*	188,667
Arecaceae	*Trachycarpus fortunei*	9,462
Arecaceae	*Trachycarpus takil*	6
Arecaceae	*Trithrinax acanthocoma*	63
Arecaceae	*Washingtonia filifera*	38,817
Arecaceae	*Washingtonia robusta*	193,168
Arecaceae	*Wodyetia bifurcata*	316
Asparagaceae	*Agave americana*	73
Asparagaceae	*Agave attenuata*	2
Asparagaceae	*Agave vivipara*	88

Family	Species	n
Asparagaceae	*Beaucarnea gracilis*	13
Asparagaceae	*Beaucarnea recurvata*	206
Asparagaceae	*Beaucarnea stricta*	10
Asparagaceae	*Cordyline australis*	2,496
Asparagaceae	*Cordyline indivisa*	6
Asparagaceae	*Dasylirion wheeleri*	12
Asparagaceae	*Dracaena draco*	595
Asparagaceae	*Dracaena fragrans*	7
Asparagaceae	*Dracaena marginata*	13
Asparagaceae	*Dracaena sp.*	3
Asparagaceae	*Nolina sp.*	44
Asparagaceae	*Yucca brevifolia*	4
Asparagaceae	*Yucca gigantea*	1,542
Asparagaceae	*Yucca gloriosa*	4,885
Asparagaceae	*Yucca sp.*	3,848
Asteraceae	*Baccharis pilularis*	12
Asteraceae	*Baccharis salicina*	141
Asteraceae	*Baccharis sp.*	2
Asteraceae	*Montanoa leucantha*	1
Asteraceae	*Olivaea sp.*	297
Asteraceae	*Senecio praecox*	44
Asteraceae	*Vernonia amygdalina*	1
Berberidaceae	*Berberis aquifolium*	26
Betulaceae	*Alnus cordata*	1,522
Betulaceae	*Alnus glutinosa*	42
Betulaceae	*Alnus rhombifolia*	12,109
Betulaceae	*Alnus rubra*	140
Betulaceae	*Alnus sp.*	1,874
Betulaceae	*Betula glandulosa*	1,481
Betulaceae	*Betula nigra*	1,506
Betulaceae	*Betula occidentalis*	2
Betulaceae	*Betula papyrifera*	650
Betulaceae	*Betula pendula*	17,502
Betulaceae	*Betula utilis*	498
Betulaceae	*Carpinus caroliniana*	3,719
Betulaceae	*Corylus colurna*	11
Betulaceae	*Corylus sp.*	42
Betulaceae	*Ostrya virginiana*	7
Bignoniaceae	*Catalpa bignonioides*	179
Bignoniaceae	*Catalpa sp.*	202
Bignoniaceae	*Catalpa speciosa*	2,056
Bignoniaceae	*Chilopsis linearis*	2,541
Bignoniaceae	*Chitalpa tashkentensis*	13,136
Bignoniaceae	*Handroanthus chrysotrichus*	2,840
Bignoniaceae	*Handroanthus impetiginosus*	20,178
Bignoniaceae	*Jacaranda mimosifolia*	107,640
Bignoniaceae	*Jacaranda sp.*	2,302
Bignoniaceae	*Kigelia africana*	11
Bignoniaceae	*Markhamia lutea*	314
Bignoniaceae	*Podranea ricasoliana*	6
Bignoniaceae	*Radermachera sinica*	209
Bignoniaceae	*Spathodea campanulata*	598
Bignoniaceae	*Tabebuia aurea*	21
Bignoniaceae	*Tecoma capensis*	137
Bignoniaceae	*Tecoma smithii*	29

Family	Species	n
Bignoniaceae	*Tecoma stans*	323
Boraginaceae	*Cordia boissieri*	51
Boraginaceae	*Ehretia anacua*	2
Boraginaceae	*Ehretia tinifolia*	3
Burseraceae	*Bursera hindsiana*	27
Burseraceae	*Bursera microphylla*	3
Burseraceae	*Commiphora africana*	1
Buxaceae	*Buxus microphylla*	6
Buxaceae	*Buxus sempervirens*	31
Buxaceae	*Buxus sp.*	7
Cactaceae	*Opuntia sp.*	24
Cactaceae	*Pereskia grandiflora*	19
Cannabaceae	*Celtis australis*	3,400
Cannabaceae	*Celtis bungeana*	2
Cannabaceae	*Celtis laevigata*	740
Cannabaceae	*Celtis occidentalis*	3,603
Cannabaceae	*Celtis pallida*	3
Cannabaceae	*Celtis sinensis*	33,145
Cannabaceae	*Celtis sp.*	1,393
Caricaceae	*Carica papaya*	163
Casuarinaceae	*Allocasuarina verticillata*	218
Casuarinaceae	*Casuarina cunninghamiana*	4,364
Casuarinaceae	*Casuarina equisetifolia*	1,951
Casuarinaceae	*Casuarina glauca*	460
Celastraceae	*Euonymus japonicus*	69
Celastraceae	*Euonymus sp.*	11
Celastraceae	*Maytenus boaria*	9,033
Celastraceae	*Maytenus sp.*	1
Cercidiphyllaceae	*Cercidiphyllum japonicum*	119
Combretaceae	*Combretum apiculatum*	1
Cornaceae	*Cornus capitata*	14
Cornaceae	*Cornus florida*	754
Cornaceae	*Cornus kousa*	98
Cornaceae	*Cornus mas*	4
Cornaceae	*Cornus nuttallii*	33
Cornaceae	*Cornus sericea*	24
Cornaceae	*Cornus sp.*	285
Cornaceae	*Davidia involucrata*	3
Cornaceae	*Griselinia littoralis*	30
Cornaceae	*Nyssa sylvatica*	8,063
Corynocarpaceae	*Corynocarpus laevigatus*	8
Cunoniaceae	*Cunonia capensis*	35
Cupressaceae	*Calocedrus decurrens*	3,990
Cupressaceae	*Chamaecyparis lawsoniana*	98
Cupressaceae	*Chamaecyparis obtusa*	190
Cupressaceae	*Cryptomeria japonica*	101
Cupressaceae	*Cupressus arizonica*	1,076
Cupressaceae	*Cupressus cashmeriana*	18
Cupressaceae	*Cupressus funebris*	9
Cupressaceae	*Cupressus goveniana*	7
Cupressaceae	*Cupressus guadalupensis*	36
Cupressaceae	*Cupressus leylandii*	1,952
Cupressaceae	*Cupressus macnabiana*	36
Cupressaceae	*Cupressus macrocarpa*	6,088
Cupressaceae	*Cupressus sargentii*	1

Family	Species	n
Cupressaceae	*Cupressus sempervirens*	46,059
Cupressaceae	*Cupressus sp.*	2,838
Cupressaceae	*Cupressus sp.*	28
Cupressaceae	*Juniperus californica*	300
Cupressaceae	*Juniperus chinensis*	12,934
Cupressaceae	*Juniperus communis*	62
Cupressaceae	*Juniperus deppeana*	2
Cupressaceae	*Juniperus monosperma*	23
Cupressaceae	*Juniperus occidentalis*	32
Cupressaceae	*Juniperus scopulorum*	517
Cupressaceae	*Juniperus sp.*	6,193
Cupressaceae	*Juniperus squamata*	1
Cupressaceae	*Juniperus virginiana*	168
Cupressaceae	*Metasequoia glyptostroboides*	482
Cupressaceae	*Platycladus orientalis*	2,782
Cupressaceae	*Sequoia sempervirens*	72,631
Cupressaceae	*Sequoiadendron giganteum*	517
Cupressaceae	*Taxodium distichum*	367
Cupressaceae	*Taxodium huegelii*	474
Cupressaceae	*Thuja occidentalis*	1,145
Cupressaceae	*Thuja plicata*	218
Cyatheaceae	*Sphaeropteris cooperi*	85
Cycadaceae	*Cycas sp.*	1,191
Ebenaceae	*Diospyros kaki*	720
Ebenaceae	*Diospyros lotus*	1
Ebenaceae	*Diospyros nigra*	2
Ebenaceae	*Diospyros virginiana*	129
Elaeagnaceae	*Elaeagnus sp.*	58
Elaeocarpaceae	*Crinodendron patagua*	55
Elaeocarpaceae	*Elaeocarpus floribundus*	1
Elaeocarpaceae	*Elaeocarpus sylvestris*	460
Ericaceae	*Arbutus menziesii*	248
Ericaceae	*Arbutus unedo*	24,151
Ericaceae	*Arctostaphylos glauca*	3
Ericaceae	*Arctostaphylos manzanita*	37
Ericaceae	*Arctostaphylos sp.*	155
Ericaceae	*Erica lusitanica*	1
Ericaceae	*Rhododendron sp.*	41
Escalloniaceae	*Escallonia rubra*	59
Euphorbiaceae	*Croton congestus*	7,609
Euphorbiaceae	*Euphorbia cotinifolia*	289
Euphorbiaceae	*Euphorbia ingens*	5
Euphorbiaceae	*Euphorbia pulcherrima*	4
Euphorbiaceae	*Euphorbia sp.*	58
Euphorbiaceae	*Euphorbia tirucalli*	605
Euphorbiaceae	*Euphorbia umbellata*	19
Euphorbiaceae	*Jatropha dioica*	2
Euphorbiaceae	*Manihot esculenta*	5
Euphorbiaceae	*Ricinus communis*	68
Euphorbiaceae	*Triadica sebifera*	19,310
Fabaceae	*Acacia aneura*	957
Fabaceae	*Acacia baileyana*	3,311
Fabaceae	*Acacia binervia*	2
Fabaceae	*Acacia cognata*	56
Fabaceae	*Acacia craspedocarpa*	31

Family	Species	n
Fabaceae	*Acacia cultriformis*	52
Fabaceae	*Acacia cyclops*	217
Fabaceae	*Acacia dealbata*	257
Fabaceae	*Acacia decurrens*	1,274
Fabaceae	*Acacia longifolia*	1,058
Fabaceae	*Acacia melanoxylon*	9,405
Fabaceae	*Acacia pendula*	131
Fabaceae	*Acacia podalyriifolia*	12
Fabaceae	*Acacia pycnantha*	12
Fabaceae	*Acacia redolens*	80
Fabaceae	*Acacia retinodes*	88
Fabaceae	*Acacia salicina*	1,147
Fabaceae	*Acacia saligna*	239
Fabaceae	*Acacia sp.*	5,127
Fabaceae	*Acacia stenophylla*	2,373
Fabaceae	*Acacia subporosa*	13
Fabaceae	*Acacia verticillata*	9
Fabaceae	*Acacia vestita*	3
Fabaceae	*Acrocarpus fraxinifolius*	166
Fabaceae	*Albizia adianthifolia*	60
Fabaceae	*Albizia amara*	11
Fabaceae	*Albizia julibrissin*	8,844
Fabaceae	*Albizia lebbeck*	2
Fabaceae	*Bauhinia anamesa*	503
Fabaceae	*Bauhinia blakeana*	5,272
Fabaceae	*Bauhinia forficata*	208
Fabaceae	*Bauhinia galpinii*	7
Fabaceae	*Bauhinia purpurea*	46
Fabaceae	*Bauhinia tomentosa*	7
Fabaceae	*Bauhinia variegata*	10,651
Fabaceae	*Bolusanthus speciosus*	1
Fabaceae	*Caesalpinia cacalaco*	103
Fabaceae	*Caesalpinia ferrea*	3
Fabaceae	*Caesalpinia gilliesii*	56
Fabaceae	*Caesalpinia mexicana*	30
Fabaceae	*Caesalpinia pluviosa*	78
Fabaceae	*Caesalpinia pulcherrima*	5
Fabaceae	*Caesalpinia spinosa*	129
Fabaceae	*Calliandra californica*	3
Fabaceae	*Calliandra haematocephala*	58
Fabaceae	*Calliandra surinamensis*	4
Fabaceae	*Calliandra tweedii*	23
Fabaceae	*Cassia bicapsularis*	21
Fabaceae	*Cassia brewsteri*	1
Fabaceae	*Cassia fistula*	383
Fabaceae	*Cassia leptophylla*	10,536
Fabaceae	*Castanospermum australe*	18
Fabaceae	*Ceratonia siliqua*	14,923
Fabaceae	*Cercidium floridum floridum*	2,295
Fabaceae	*Cercidium microphyllum*	190
Fabaceae	*Cercis canadensis*	27,158
Fabaceae	*Cercis chinensis*	1,907
Fabaceae	*Cercis occidentalis*	5,446
Fabaceae	*Cladrastis kentukea*	28
Fabaceae	*Cladrastis sp.*	2

Family	Species	n
Fabaceae	*Dalbergia sissoo*	273
Fabaceae	*Delonix regia*	83
Fabaceae	*Dichrostachys cinerea*	1
Fabaceae	*Ebenopsis ebano*	215
Fabaceae	*Erythrina abyssinica*	1
Fabaceae	*Erythrina bidwillii*	6
Fabaceae	*Erythrina caffra*	3,076
Fabaceae	*Erythrina coralloides*	573
Fabaceae	*Erythrina crista-galli*	132
Fabaceae	*Erythrina falcata*	15
Fabaceae	*Erythrina humeana*	52
Fabaceae	*Erythrina latissima*	7
Fabaceae	*Erythrina lysistemon*	18
Fabaceae	*Erythrina poeppigiana*	1
Fabaceae	*Erythrina sandwicensis*	1
Fabaceae	*Erythrina sp.*	1,282
Fabaceae	*Erythrina sykesii*	6
Fabaceae	*Erythrina variegata*	1
Fabaceae	*Genista canariensis*	3
Fabaceae	*Gleditsia triacanthos*	18,698
Fabaceae	*Gymnocladus dioica*	201
Fabaceae	*Indigofera dregeana*	1
Fabaceae	*Inga affinis*	63
Fabaceae	*Inga edulis*	39
Fabaceae	*Inga feuilleei*	6
Fabaceae	*Inga pilosula*	7
Fabaceae	*Inga sp.*	698
Fabaceae	*Laburnum anagyroides*	46
Fabaceae	*Leucaena esculenta*	211
Fabaceae	*Leucaena leucocephala*	778
Fabaceae	*Lonchocarpus capassa*	2
Fabaceae	*Lysiloma microphylla*	260
Fabaceae	*Mariosousa willardiana*	228
Fabaceae	*Olneya tesota*	342
Fabaceae	*Pararchidendron pruinosum*	1
Fabaceae	*Paraserianthes lophantha*	115
Fabaceae	*Parkinsonia aculeata*	1,925
Fabaceae	*Parkinsonia praecox*	423
Fabaceae	*Parkinsonia sp.*	2,273
Fabaceae	*Peltophorum africanum*	2
Fabaceae	*Pithecellobium dulce*	1,568
Fabaceae	*Prosopis alba*	357
Fabaceae	*Prosopis chilensis*	1,008
Fabaceae	*Prosopis glandulosa*	217
Fabaceae	*Prosopis pubescens*	3
Fabaceae	*Prosopis sp.*	1,317
Fabaceae	*Prosopis velutina*	103
Fabaceae	*Robinia ambigua*	2,570
Fabaceae	*Robinia pseudoacacia*	12,624
Fabaceae	*Schizolobium parahyba*	1
Fabaceae	*Schotia afra*	2
Fabaceae	*Schotia brachypetala*	5
Fabaceae	*Schotia latifolia*	7
Fabaceae	*Senegalia berlandieri*	85
Fabaceae	*Senegalia greggii*	117

Family	Species	n
Fabaceae	*Senna corymbosa*	27
Fabaceae	*Senna didymobotrya*	115
Fabaceae	*Senna hirsuta*	38
Fabaceae	*Senna macranthera*	4
Fabaceae	*Senna mexicana*	2
Fabaceae	*Senna pendula*	27
Fabaceae	*Senna sp.*	36
Fabaceae	*Senna spectabilis*	32
Fabaceae	*Senna splendida*	60
Fabaceae	*Senna surattensis*	23
Fabaceae	*Sophora secundiflora*	20
Fabaceae	*Sophora sp.*	2
Fabaceae	*Styphnolobium japonicum*	3,870
Fabaceae	*Tamarindus indica*	30
Fabaceae	*Tipuana tipu*	21,821
Fabaceae	*Vachellia abyssinica*	1
Fabaceae	*Vachellia constricta*	14
Fabaceae	*Vachellia farnesiana*	975
Fabaceae	*Vachellia pennatula*	1
Fabaceae	*Vachellia schaffneri*	18
Fabaceae	*Vachellia xanthophloea*	10
Fabaceae	*Wisteria floribunda*	9
Fabaceae	*Wisteria sinensis*	28
Fabaceae	*Fabaceae a*	7
Fagaceae	*Castanea dentata*	102
Fagaceae	*Castanea mollissima*	36
Fagaceae	*Chrysolepis chrysophylla*	5
Fagaceae	*Fagus sp.*	19
Fagaceae	*Fagus sylvatica*	378
Fagaceae	*Lithocarpus edulis*	5
Fagaceae	*Notholithocarpus densiflorus*	55
Fagaceae	*Quercus acutifolia*	10
Fagaceae	*Quercus acutissima*	198
Fagaceae	*Quercus agrifolia*	114,764
Fagaceae	*Quercus alba*	32
Fagaceae	*Quercus arizonica*	11
Fagaceae	*Quercus berberidifolia*	357
Fagaceae	*Quercus bicolor*	3
Fagaceae	*Quercus buckleyi*	40
Fagaceae	*Quercus canariensis*	2
Fagaceae	*Quercus castaneifolia*	51
Fagaceae	*Quercus chrysolepis*	703
Fagaceae	*Quercus coccinea*	4,973
Fagaceae	*Quercus douglasii*	3,588
Fagaceae	*Quercus dumosa*	142
Fagaceae	*Quercus emoryi*	1
Fagaceae	*Quercus engelmannii*	1,907
Fagaceae	*Quercus frainetto*	172
Fagaceae	*Quercus fusiformis*	41
Fagaceae	*Quercus garryana*	25
Fagaceae	*Quercus hypoleucoides*	11
Fagaceae	*Quercus ilex*	61,078
Fagaceae	*Quercus imbricaria*	304
Fagaceae	*Quercus kelloggii*	537
Fagaceae	*Quercus laceyi*	2

Family	Species	n
Fagaceae	*Quercus laurifolia*	7
Fagaceae	*Quercus lobata*	31,664
Fagaceae	*Quercus macrocarpa*	340
Fagaceae	*Quercus michauxii*	25
Fagaceae	*Quercus muehlenbergii*	120
Fagaceae	*Quercus nigra*	67
Fagaceae	*Quercus palustris*	4,708
Fagaceae	*Quercus petraea*	1
Fagaceae	*Quercus phellos*	377
Fagaceae	*Quercus polymorpha*	5
Fagaceae	*Quercus robur*	738
Fagaceae	*Quercus rubra*	14,377
Fagaceae	*Quercus rugosa*	24
Fagaceae	*Quercus rysophylla*	3
Fagaceae	*Quercus shumardii*	3,174
Fagaceae	*Quercus sp.*	6,177
Fagaceae	*Quercus stellata*	1
Fagaceae	*Quercus suber*	10,550
Fagaceae	*Quercus texana*	3
Fagaceae	*Quercus tomentella*	283
Fagaceae	*Quercus virginiana*	23,442
Fagaceae	*Quercus wislizeni*	3,774
Fouquieriaceae	*Fouquieria columnaris*	2
Fouquieriaceae	*Fouquieria splendens*	1
Garryaceae	*Garrya elliptica*	16
Ginkgoaceae	*Ginkgo biloba*	40,114
Grossulariaceae	*Ribes sanguineum*	1
Juglandaceae	*Carya illinoinensis*	3,292
Juglandaceae	*Carya ovata*	1
Juglandaceae	*Juglans californica*	778
Juglandaceae	*Juglans hindsii*	3,250
Juglandaceae	*Juglans nigra*	1,034
Juglandaceae	*Juglans regia*	2,310
Juglandaceae	*Juglans sp.*	553
Juglandaceae	*Pterocarya fraxinifolia*	3
Juglandaceae	*Pterocarya stenoptera*	16
Lamiaceae	*Vitex agnus-castus*	606
Lamiaceae	*Vitex lucens*	25
Lamiaceae	*Vitex negundo*	68
Lamiaceae	*Vitex trifolia*	16
Lauraceae	*Cinnamomum camphora*	101,257
Lauraceae	*Cinnamomum glanduliferum*	54
Lauraceae	*Cinnamomum sp.*	4
Lauraceae	*Cryptocarya rubra*	117
Lauraceae	*Laurus nobilis*	12,303
Lauraceae	*Machilus thunbergii*	2
Lauraceae	*Neolitsea sericea*	25
Lauraceae	*Persea americana*	5,243
Lauraceae	*Persea borbonia*	36
Lauraceae	*Persea indica*	36
Lauraceae	*Sassafras albidum*	2
Lauraceae	*Umbellularia californica*	3,655
Lythraceae	*Lagerstroemia fauriei*	67
Lythraceae	*Lagerstroemia sp.*	330,930
Lythraceae	*Lagerstroemia speciosa*	3

Family	Species	n
Lythraceae	*Punica granatum*	1,574
Magnoliaceae	*Liriodendron tulipifera*	19,558
Magnoliaceae	*Magnolia acuminata*	59
Magnoliaceae	*Magnolia alba*	20
Magnoliaceae	*Magnolia campbellii*	2
Magnoliaceae	*Magnolia champaca*	210
Magnoliaceae	*Magnolia delavayi*	1
Magnoliaceae	*Magnolia doltsopa*	298
Magnoliaceae	*Magnolia figo*	3
Magnoliaceae	*Magnolia grandiflora*	183,614
Magnoliaceae	*Magnolia hodgsonii*	3
Magnoliaceae	*Magnolia kobus*	18
Magnoliaceae	*Magnolia liliiflora*	21
Magnoliaceae	*Magnolia macrophylla*	12
Magnoliaceae	*Magnolia soulangeana*	2,693
Magnoliaceae	*Magnolia sp.*	5,896
Magnoliaceae	*Magnolia stellata*	581
Magnoliaceae	*Magnolia tripetala*	1
Magnoliaceae	*Magnolia virginiana*	90
Magnoliaceae	*Michelia alba*	1
Malvaceae	*Abutilon hybridum*	7
Malvaceae	*Adansonia digitata*	1
Malvaceae	*Bombax ceiba*	2
Malvaceae	*Brachychiton acerifolius*	3,306
Malvaceae	*Brachychiton australis*	1
Malvaceae	*Brachychiton bidwillii*	3
Malvaceae	*Brachychiton discolor*	719
Malvaceae	*Brachychiton gregorii*	2
Malvaceae	*Brachychiton populneus*	34,409
Malvaceae	*Brachychiton rupestris*	62
Malvaceae	*Ceiba insignis*	40
Malvaceae	*Ceiba sp.*	1
Malvaceae	*Ceiba speciosa*	4,714
Malvaceae	*Chiranthodendron pentadactylon*	11
Malvaceae	*Dombeya autumnalis*	1
Malvaceae	*Dombeya cacuminum*	8
Malvaceae	*Dombeya cayeuxii*	7
Malvaceae	*Dombeya wallichii*	13
Malvaceae	*Firmiana simplex*	73
Malvaceae	*Fremontodendron californicum*	29
Malvaceae	*Fremontodendron mexicanum*	43
Malvaceae	*Grewia occidentalis*	6
Malvaceae	*Hibiscus elatus*	4
Malvaceae	*Hibiscus rosa_sinensis*	348
Malvaceae	*Hibiscus sp.*	254
Malvaceae	*Hibiscus syriacus*	322
Malvaceae	*Lagunaria patersonia*	1,341
Malvaceae	*Luehea divaricata*	1
Malvaceae	*Pachira aquatica*	22
Malvaceae	*Pseudobombax ellipticum*	7
Malvaceae	*Robinsonella cordata*	3
Malvaceae	*Sterculia quadrifida*	9
Malvaceae	*Tilia americana*	752
Malvaceae	*Tilia cordata*	5,464
Malvaceae	*Tilia euchlora*	2

Family	Species	n
Malvaceae	*Tilia europaea*	44
Malvaceae	*Tilia sp.*	373
Malvaceae	*Tilia tomentosa*	658
Meliaceae	*Cedrela fissilis*	43
Meliaceae	*Khaya nyasica*	3
Meliaceae	*Melia azedarach*	3,855
Melianthaceae	*Greyia sutherlandii*	2
Menispermaceae	*Cocculus laurifolius*	427
Monimiaceae	*Peumus boldus*	1
Moraceae	*Broussonetia papyrifera*	608
Moraceae	*Broussonetia sp.*	22
Moraceae	*Ficus auriculata*	9
Moraceae	*Ficus benjamina*	20,256
Moraceae	*Ficus bubu*	1
Moraceae	*Ficus carica*	2,731
Moraceae	*Ficus cordata*	1
Moraceae	*Ficus craterostoma*	1
Moraceae	*Ficus drupacea*	22
Moraceae	*Ficus elastica*	986
Moraceae	*Ficus glumosa*	1
Moraceae	*Ficus ingens*	6
Moraceae	*Ficus lutea*	10
Moraceae	*Ficus lyrata*	147
Moraceae	*Ficus maclellandii*	107
Moraceae	*Ficus macrophylla*	1,440
Moraceae	*Ficus microcarpa*	49,466
Moraceae	*Ficus natalensis*	2
Moraceae	*Ficus petiolaris*	9
Moraceae	*Ficus polita*	1
Moraceae	*Ficus racemosa*	2
Moraceae	*Ficus religiosa*	26
Moraceae	*Ficus rubiginosa*	6,170
Moraceae	*Ficus rumphii*	4
Moraceae	*Ficus sp.*	4,030
Moraceae	*Ficus stuhlmannii*	1
Moraceae	*Ficus sur*	5
Moraceae	*Ficus sycomorus*	7
Moraceae	*Ficus tettensis*	1
Moraceae	*Ficus trichopoda*	3
Moraceae	*Ficus watkinsiana*	6
Moraceae	*Maclura pomifera*	27
Moraceae	*Morus alba*	17,927
Moraceae	*Morus nigra*	79
Moraceae	*Morus rubra*	221
Moraceae	*Morus sp.*	1,763
Moringaceae	*Moringa oleifera*	228
Musaceae	*Ensete ventricosum*	7
Musaceae	*Musa acuminata*	358
Myricaceae	*Morella cerifera*	1
Myricaceae	*Myrica californica*	41
Myricaceae	*Myrica sp.*	2
Myrtaceae	*Acca sellowiana*	720
Myrtaceae	*Agonis flexuosa*	4,865
Myrtaceae	*Angophora costata*	74
Myrtaceae	*Callistemon citrinus*	23,688

Family	Species	n
Myrtaceae	*Callistemon linearis*	8
Myrtaceae	*Callistemon rigidus*	2,042
Myrtaceae	*Callistemon salignus*	3,681
Myrtaceae	*Callistemon viminalis*	9,980
Myrtaceae	*Corymbia aparrerinja*	772
Myrtaceae	*Corymbia calophylla*	43
Myrtaceae	*Corymbia citriodora*	23,337
Myrtaceae	*Corymbia ficifolia*	9,014
Myrtaceae	*Corymbia maculata*	9,106
Myrtaceae	*Corymbia torelliana*	1
Myrtaceae	*Eucalyptus amplifolia*	122
Myrtaceae	*Eucalyptus botryoides*	249
Myrtaceae	*Eucalyptus bridgesiana*	2
Myrtaceae	*Eucalyptus camaldulensis*	36,009
Myrtaceae	*Eucalyptus cephalocarpa*	3
Myrtaceae	*Eucalyptus cinerea*	359
Myrtaceae	*Eucalyptus cladocalyx*	30,064
Myrtaceae	*Eucalyptus cornuta*	165
Myrtaceae	*Eucalyptus cosmophylla*	9
Myrtaceae	*Eucalyptus crebra*	37
Myrtaceae	*Eucalyptus dalrympleana*	62
Myrtaceae	*Eucalyptus deglupta*	59
Myrtaceae	*Eucalyptus erythrocorys*	133
Myrtaceae	*Eucalyptus globulus*	24,911
Myrtaceae	*Eucalyptus grandis*	1,096
Myrtaceae	*Eucalyptus grossa*	1
Myrtaceae	*Eucalyptus gunnii*	66
Myrtaceae	*Eucalyptus kruseana*	9
Myrtaceae	*Eucalyptus lehmannii*	2,579
Myrtaceae	*Eucalyptus leucoxylon*	2,028
Myrtaceae	*Eucalyptus longifolia*	13
Myrtaceae	*Eucalyptus macrandra*	10
Myrtaceae	*Eucalyptus macrocarpa*	55
Myrtaceae	*Eucalyptus melliodora*	71
Myrtaceae	*Eucalyptus microcarpa*	1
Myrtaceae	*Eucalyptus nicholii*	4,692
Myrtaceae	*Eucalyptus occidentalis*	77
Myrtaceae	*Eucalyptus odorata*	357
Myrtaceae	*Eucalyptus paniculata*	39
Myrtaceae	*Eucalyptus pauciflora*	10
Myrtaceae	*Eucalyptus platypus*	6
Myrtaceae	*Eucalyptus polyanthemos*	18,671
Myrtaceae	*Eucalyptus pulverulenta*	82
Myrtaceae	*Eucalyptus rhodantha*	1
Myrtaceae	*Eucalyptus robusta*	683
Myrtaceae	*Eucalyptus rudis*	10,844
Myrtaceae	*Eucalyptus saligna*	22
Myrtaceae	*Eucalyptus sideroxylon*	39,934
Myrtaceae	*Eucalyptus sp.*	32,404
Myrtaceae	*Eucalyptus spathulata*	530
Myrtaceae	*Eucalyptus steedmanii*	1
Myrtaceae	*Eucalyptus tereticornis*	636
Myrtaceae	*Eucalyptus torquata*	784
Myrtaceae	*Eucalyptus viminalis*	2,114
Myrtaceae	*Eugenia involucrata*	37

Family	Species	n
Myrtaceae	*Eugenia myrtifolia*	3
Myrtaceae	*Eugenia sp.*	51
Myrtaceae	*Eugenia uniflora*	484
Myrtaceae	*Leptospermum laevigatum*	921
Myrtaceae	*Leptospermum scoparium*	846
Myrtaceae	*Lophostemon confertus*	119,396
Myrtaceae	*Luma apiculata*	6
Myrtaceae	*Melaleuca armillaris*	195
Myrtaceae	*Melaleuca decora*	187
Myrtaceae	*Melaleuca decussata*	28
Myrtaceae	*Melaleuca ericifolia*	489
Myrtaceae	*Melaleuca lanceolata*	4
Myrtaceae	*Melaleuca leucadendra*	78
Myrtaceae	*Melaleuca linariifolia*	3,830
Myrtaceae	*Melaleuca nesophila*	1,938
Myrtaceae	*Melaleuca quinquenervia*	28,750
Myrtaceae	*Melaleuca sp.*	5,582
Myrtaceae	*Melaleuca styphelioides*	589
Myrtaceae	*Metrosideros sp.*	25,087
Myrtaceae	*Myrtus communis*	114
Myrtaceae	*Plinia edulis*	1
Myrtaceae	*Psidium cattleianum*	207
Myrtaceae	*Psidium guajava*	2,086
Myrtaceae	*Syncarpia glomulifera*	2
Myrtaceae	*Syzygium australe*	5,401
Myrtaceae	*Syzygium cumini*	71
Myrtaceae	*Syzygium floribundum*	1
Myrtaceae	*Syzygium jambos*	21
Myrtaceae	*Syzygium malaccense*	6
Myrtaceae	*Syzygium samarangense*	3
Myrtaceae	*Syzygium smithii*	40
Myrtaceae	*Syzygium sp.*	844
Myrtaceae	*Taxandria juniperina*	5
Myrtaceae	*Tristaniopsis laurina*	21,401
Nyctaginaceae	*Bougainvillea sp.*	2
Oleaceae	*Chionanthus retusus*	5,943
Oleaceae	*Chionanthus virginicus*	1
Oleaceae	*Fraxinus americana*	10,325
Oleaceae	*Fraxinus angustifolia*	40,904
Oleaceae	*Fraxinus anomala*	2
Oleaceae	*Fraxinus dipetala*	4
Oleaceae	*Fraxinus excelsior*	516
Oleaceae	*Fraxinus griffithii*	1
Oleaceae	*Fraxinus latifolia*	149
Oleaceae	*Fraxinus malacophylla*	17
Oleaceae	*Fraxinus ornus*	38
Oleaceae	*Fraxinus pallisae*	3,247
Oleaceae	*Fraxinus pennsylvanica*	1,944
Oleaceae	*Fraxinus sp.*	14,115
Oleaceae	*Fraxinus uhdei*	39,466
Oleaceae	*Fraxinus velutina*	50,717
Oleaceae	*Ligustrum japonicum*	1,666
Oleaceae	*Ligustrum lucidum*	30,942
Oleaceae	*Ligustrum ovalifolium*	37
Oleaceae	*Ligustrum sinense*	36

Family	Species	n
Oleaceae	*Ligustrum sp.*	3,941
Oleaceae	*Ligustrum vulgare*	69
Oleaceae	*Olea europaea*	32,708
Oleaceae	*Olea sp.*	29
Oleaceae	*Osmanthus fragrans*	34
Oleaceae	*Phillyrea latifolia*	4
Oleaceae	*Schrebera alata*	4
Oleaceae	*Syringa reticulata*	91
Onagraceae	*Fuchsia arborescens*	2
Passifloraceae	*Adenia mannii*	1
Paulowniaceae	*Paulownia tomentosa*	358
Phyllanthaceae	*Bischofia javanica*	108
Phyllanthaceae	*Glochidion ferdinandii*	1
Phytolaccaceae	*Phytolacca dioica*	7
Pinaceae	*Abies balsamea*	12
Pinaceae	*Abies cephalonica*	1
Pinaceae	*Abies concolor*	220
Pinaceae	*Abies grandis*	41
Pinaceae	*Abies magnifica*	4
Pinaceae	*Abies pinsapo*	4
Pinaceae	*Abies procera*	15
Pinaceae	*Abies sp.*	49
Pinaceae	*Cedrus atlantica*	2,236
Pinaceae	*Cedrus deodara*	22,010
Pinaceae	*Cedrus libani*	64
Pinaceae	*Picea abies*	50
Pinaceae	*Picea engelmannii*	8
Pinaceae	*Picea glauca*	41
Pinaceae	*Picea pungens*	394
Pinaceae	*Picea sitchensis*	2
Pinaceae	*Picea sp.*	252
Pinaceae	*Pinus attenuata*	15
Pinaceae	*Pinus brutia*	39,079
Pinaceae	*Pinus canariensis*	131,407
Pinaceae	*Pinus cembroides*	609
Pinaceae	*Pinus contorta*	89
Pinaceae	*Pinus coulteri*	158
Pinaceae	*Pinus densiflora*	130
Pinaceae	*Pinus edulis*	704
Pinaceae	*Pinus elliottii*	7
Pinaceae	*Pinus flexilis*	3
Pinaceae	*Pinus halepensis*	50,996
Pinaceae	*Pinus jeffreyi*	14
Pinaceae	*Pinus lambertiana*	4
Pinaceae	*Pinus monophylla*	5
Pinaceae	*Pinus montezumae*	8
Pinaceae	*Pinus monticola*	1
Pinaceae	*Pinus mugo*	32
Pinaceae	*Pinus muricata*	85
Pinaceae	*Pinus nigra*	121
Pinaceae	*Pinus palustris*	15
Pinaceae	*Pinus patula*	67
Pinaceae	*Pinus pinaster*	138
Pinaceae	*Pinus pinea*	17,987
Pinaceae	*Pinus ponderosa*	221

Family	Species	n
Pinaceae	*Pinus quadrifolia*	1
Pinaceae	*Pinus radiata*	13,356
Pinaceae	*Pinus resinosa*	74
Pinaceae	*Pinus roxburghii*	193
Pinaceae	*Pinus sabiniana*	108
Pinaceae	*Pinus sp.*	22,036
Pinaceae	*Pinus strobus*	8
Pinaceae	*Pinus sylvestris*	211
Pinaceae	*Pinus thunbergii*	6,374
Pinaceae	*Pinus torreyana*	9,414
Pinaceae	*Pseudotsuga macrocarpa*	1
Pinaceae	*Pseudotsuga menziesii*	418
Pinaceae	*Tsuga heterophylla*	2
Pinaceae	*Tsuga sp.*	13
Piperaceae	*Piper nigrum*	5
Pittosporaceae	*Auranticarpa rhombifolia*	1,692
Pittosporaceae	*Hymenosporum flavum*	3,917
Pittosporaceae	*Pittosporum crassifolium*	1,602
Pittosporaceae	*Pittosporum eugenioides*	581
Pittosporaceae	*Pittosporum napaulense*	34
Pittosporaceae	*Pittosporum sp.*	2,677
Pittosporaceae	*Pittosporum tenuifolium*	614
Pittosporaceae	*Pittosporum tobira*	1,767
Pittosporaceae	*Pittosporum undulatum*	14,388
Pittosporaceae	*Pittosporum viridiflorum*	300
Platanaceae	*Platanus hispanica*	239,866
Platanaceae	*Platanus mexicana*	2,255
Platanaceae	*Platanus occidentalis*	4,232
Platanaceae	*Platanus orientalis*	374
Platanaceae	*Platanus racemosa*	77,151
Platanaceae	*Platanus sp.*	1,246
Platanaceae	*Platanus wrightii*	68
Poaceae	*Arundo donax*	18
Poaceae	*Bambusa beecheyana*	1
Poaceae	*Bambusa oldhamii*	68
Poaceae	*Bambusa sp.*	1,033
Poaceae	*Phyllostachys sp.*	50
Poaceae	*Pseudosasa japonica*	3
Poaceae	*Saccharum officinarum*	1
Podocarpaceae	*Afrocarpus falcatus*	64,453
Podocarpaceae	*Afrocarpus gracilior*	1,363
Podocarpaceae	*Podocarpus elongatus*	18
Podocarpaceae	*Podocarpus henkelii*	1,775
Podocarpaceae	*Podocarpus latifolius*	192
Podocarpaceae	*Podocarpus macrophyllus*	8,623
Podocarpaceae	*Podocarpus nagi*	723
Podocarpaceae	*Podocarpus totara*	9
Polygalaceae	*Polygala myrtifolia*	1
Proteaceae	*Banksia integrifolia*	17
Proteaceae	*Banksia verticillata*	1
Proteaceae	*Grevillea robusta*	8,752
Proteaceae	*Hakea laurina*	33
Proteaceae	*Hakea suaveolens*	137
Proteaceae	*Leucadendron argenteum*	5
Proteaceae	*Leucadendron sp.*	8

Family	Species	n
Proteaceae	*Leucospermum cordifolium*	1
Proteaceae	*Leucospermum sp.*	1
Proteaceae	*Macadamia integrifolia*	268
Proteaceae	*Macadamia tetraphylla*	73
Proteaceae	*Stenocarpus sinuatus*	1,903
Quillajaceae	*Quillaja saponaria*	165
Rhamnaceae	*Ceanothus arboreus*	23
Rhamnaceae	*Ceanothus sp.*	557
Rhamnaceae	*Ceanothus thyrsiflorus*	55
Rhamnaceae	*Frangula californica*	30
Rhamnaceae	*Rhamnus alaternus*	515
Rhamnaceae	*Rhamnus caroliniana*	2
Rhamnaceae	*Rhamnus cathartica*	7
Rhamnaceae	*Rhamnus sp.*	12
Rhamnaceae	*Ziziphus jujuba*	184
Rhamnaceae	*Ziziphus mucronata*	4
Rosaceae	*Cercocarpus montanus*	10
Rosaceae	*Cotoneaster buxifolius*	162
Rosaceae	*Cotoneaster glaucophyllus*	2
Rosaceae	*Cotoneaster lacteus*	100
Rosaceae	*Cotoneaster pannosus*	43
Rosaceae	*Cotoneaster salicifolius*	13
Rosaceae	*Cotoneaster sp.*	202
Rosaceae	*Crataegus douglasii*	5
Rosaceae	*Crataegus laevigata*	1,705
Rosaceae	*Crataegus lavallei*	482
Rosaceae	*Crataegus monogyna*	42
Rosaceae	*Crataegus phaenopyrum*	2,172
Rosaceae	*Crataegus sp.*	964
Rosaceae	*Cydonia oblonga*	26
Rosaceae	*Eriobotrya deflexa*	11,015
Rosaceae	*Eriobotrya japonica*	10,975
Rosaceae	*Heteromeles arbutifolia*	2,968
Rosaceae	*Lyonothamnus floribundus*	1,138
Rosaceae	*Malus domestica*	865
Rosaceae	*Malus floribunda*	3,759
Rosaceae	*Malus fusca*	8
Rosaceae	*Malus ioensis*	184
Rosaceae	*Malus pumila*	18
Rosaceae	*Malus purpurea*	74
Rosaceae	*Malus sp.*	3,615
Rosaceae	*Malus sylvestris*	981
Rosaceae	*Photinia bodinieri*	152
Rosaceae	*Photinia fraseri*	3,803
Rosaceae	*Photinia glabra*	674
Rosaceae	*Photinia sp.*	9
Rosaceae	*Prunus americana*	270
Rosaceae	*Prunus angustifolia*	1
Rosaceae	*Prunus armeniaca*	1,335
Rosaceae	*Prunus autumnalis*	9
Rosaceae	*Prunus avium*	2,365
Rosaceae	*Prunus blireiana*	3,342
Rosaceae	*Prunus campanulata*	384
Rosaceae	*Prunus caroliniana*	10,330
Rosaceae	*Prunus cerasifera*	59,478

Family	Species	n
Rosaceae	*Prunus cistena*	4
Rosaceae	*Prunus domestica*	3,311
Rosaceae	*Prunus dulcis*	2,047
Rosaceae	*Prunus ilicifolia*	2,938
Rosaceae	*Prunus laurocerasus*	263
Rosaceae	*Prunus lusitanica*	135
Rosaceae	*Prunus maritima*	1
Rosaceae	*Prunus mume*	15
Rosaceae	*Prunus nigra*	2
Rosaceae	*Prunus persica*	5,155
Rosaceae	*Prunus salicina*	139
Rosaceae	*Prunus sargentii*	19
Rosaceae	*Prunus serotina*	133
Rosaceae	*Prunus serrulata*	11,465
Rosaceae	*Prunus sp.*	4,571
Rosaceae	*Prunus subcordata*	1
Rosaceae	*Prunus subhirtella*	273
Rosaceae	*Prunus triloba*	1
Rosaceae	*Prunus virginiana*	52
Rosaceae	*Prunus yedoensis*	504
Rosaceae	*Pyracantha coccinea*	158
Rosaceae	*Pyracantha sp.*	234
Rosaceae	*Pyrus betulifolia*	328
Rosaceae	*Pyrus calleryana*	151,495
Rosaceae	*Pyrus communis*	437
Rosaceae	*Pyrus kawakamii*	51,498
Rosaceae	*Pyrus pyrifolia*	4,551
Rosaceae	*Rhaphiolepis indica*	4,853
Rosaceae	*Rosa sp.*	22
Rubiaceae	*Canthium inerme*	2
Rubiaceae	*Gardenia brighamii*	1
Rubiaceae	*Gardenia jasminoides*	3
Rubiaceae	*Gardenia thunbergia*	1
Rutaceae	*Calodendrum capense*	1,414
Rutaceae	*Casimiroa edulis*	479
Rutaceae	*Citrus aurantiifolia*	408
Rutaceae	*Citrus limon*	4,298
Rutaceae	*Citrus paradisi*	590
Rutaceae	*Citrus reticulata*	904
Rutaceae	*Citrus sinensis*	5,679
Rutaceae	*Citrus sp.*	4,335
Rutaceae	*Geijera parviflora*	40,383
Rutaceae	*Murraya paniculata*	36
Rutaceae	*Tetradium daniellii*	1
Rutaceae	*Vepris undulata*	3
Salicaceae	*Azara microphylla*	13
Salicaceae	*Dovyalis caffra*	9
Salicaceae	*Olmediella betschleriana*	63
Salicaceae	*Populus alba*	360
Salicaceae	*Populus balsamifera*	234
Salicaceae	*Populus canadensis*	828
Salicaceae	*Populus deltoides*	229
Salicaceae	*Populus fremontii*	5,883
Salicaceae	*Populus nigra*	4,606
Salicaceae	*Populus sp.*	2,152

Family	Species	n
Salicaceae	*Populus tremuloides*	62
Salicaceae	*Populus trichocarpa*	285
Salicaceae	*Salix alba*	18
Salicaceae	*Salix amygdaloides*	3
Salicaceae	*Salix arizonica*	24
Salicaceae	*Salix babylonica*	1,705
Salicaceae	*Salix caprea*	3
Salicaceae	*Salix discolor*	16
Salicaceae	*Salix exigua*	14
Salicaceae	*Salix gooddingii*	253
Salicaceae	*Salix laevigata*	1,154
Salicaceae	*Salix lasiandra*	24
Salicaceae	*Salix lasiolepis*	2,304
Salicaceae	*Salix lutea*	6
Salicaceae	*Salix nigra*	583
Salicaceae	*Salix sp.*	2,732
Sapindaceae	*Acer buergerianum*	7,435
Sapindaceae	*Acer campestre*	181
Sapindaceae	*Acer circinatum*	19
Sapindaceae	*Acer freemanii*	3,577
Sapindaceae	*Acer glabrum*	14
Sapindaceae	*Acer griseum*	45
Sapindaceae	*Acer macrophyllum*	602
Sapindaceae	*Acer negundo*	1,019
Sapindaceae	*Acer oblongum*	104
Sapindaceae	*Acer palmatum*	10,615
Sapindaceae	*Acer paxii*	404
Sapindaceae	*Acer platanoides*	5,731
Sapindaceae	*Acer pseudoplatanus*	87
Sapindaceae	*Acer rubrum*	27,613
Sapindaceae	*Acer saccharum*	6,497
Sapindaceae	*Acer sp.*	4,119
Sapindaceae	*Acer tataricum*	326
Sapindaceae	*Acer truncatum*	740
Sapindaceae	*Aesculus californica*	1,336
Sapindaceae	*Aesculus carnea*	1,250
Sapindaceae	*Aesculus hippocastanum*	654
Sapindaceae	*Alectryon excelsus*	10
Sapindaceae	*Cupaniopsis anacardioides*	106,654
Sapindaceae	*Dodonaea viscosa*	1,616
Sapindaceae	*Harpullia arborea*	9
Sapindaceae	*Harpullia pendula*	8
Sapindaceae	*Koelreuteria bipinnata*	47,049
Sapindaceae	*Koelreuteria elegans*	308
Sapindaceae	*Koelreuteria paniculata*	16,343
Sapindaceae	*Litchi chinensis*	17
Sapindaceae	*Sapindus rarak*	2
Sapindaceae	*Sapindus saponaria*	33
Sapindaceae	*Ungnadia speciosa*	3
Sapotaceae	*Manilkara zapota*	4
Sapotaceae	*Sideroxylon lanuginosum*	1
Sciadopityaceae	*Sciadopitys verticillata*	4
Scrophulariaceae	*Buddleja davidii*	23
Scrophulariaceae	*Myoporum laetum*	9,472
Scrophulariaceae	*Myoporum sandwicense*	2

Family	Species	n
Scrophulariaceae	*Myoporum tenuifolium*	24
Simaroubaceae	*Ailanthus altissima*	5,098
Solanaceae	*Brugmansia insignis*	244
Solanaceae	*Lycianthes rantonnetii*	748
Solanaceae	*Nicotiana glauca*	48
Solanaceae	*Solanum aviculare*	1
Solanaceae	*Solanum crinitum*	66
Solanaceae	*Solanum crispum*	79
Solanaceae	*Solanum ellipticum*	6
Solanaceae	*Solanum jasminoides*	65
Solanaceae	*Solanum mauritianum*	2
Solanaceae	*Solanum sp.*	8
Stilbaceae	*Nuxia floribunda*	2
Strelitziaceae	*Ravenala madagascariensis*	15
Strelitziaceae	*Strelitzia nicolai*	1,829
Strelitziaceae	*Strelitzia reginae*	577
Tamaricaceae	*Tamarix aphylla*	724
Tamaricaceae	*Tamarix chinensis*	434
Tamaricaceae	*Tamarix parviflora*	122
Tamaricaceae	*Tamarix sp.*	91
Taxaceae	*Taxus baccata*	431
Taxaceae	*Taxus brevifolia*	45
Taxaceae	*Taxus media*	27
Theaceae	*Camellia japonica*	33
Theaceae	*Camellia reticulata*	7
Theaceae	*Camellia sasanqua*	105
Thymelaeaceae	*Dais cotinifolia*	4
Ulmaceae	*Ulmus alata*	7
Ulmaceae	*Ulmus americana*	4,160
Ulmaceae	*Ulmus crassifolia*	5,207
Ulmaceae	*Ulmus davidiana*	862
Ulmaceae	*Ulmus minor*	1,953
Ulmaceae	*Ulmus parvifolia*	94,667
Ulmaceae	*Ulmus pumila*	4,534
Ulmaceae	*Ulmus rubra*	140
Ulmaceae	*Zelkova serrata*	35,094
Verbenaceae	*Aloysia sp.*	1
Verbenaceae	*Duranta erecta*	164
Vitaceae	*Cissus javana*	4
Vitaceae	*Parthenocissus quinquefolia*	1
Xanthorrhoeaceae	*Aloe arborescens*	47
Xanthorrhoeaceae	*Aloe barberae*	75
Xanthorrhoeaceae	*Aloe sp.*	3
Xanthorrhoeaceae	*Xanthorrhoea arborea*	5
Zamiaceae	*Bowenia spectabilis*	1
Zamiaceae	*Encephalartos lehmannii*	1
Zamiaceae	*Encephalartos natalensis*	1
Zamiaceae	*Encephalartos sp.*	1
	Total	5,280,301