



## Colorado Tree Observation Dashboard Handbook

### Introduction

Trees are a distinctive and prominent part of Colorado communities. Tree canopies provide welcome shelter from the elements and beauty in all seasons, and tree planting is one of the most common ways people improve their surroundings across the state. Over time, Coloradoans have played a central role in cultivating and sustaining the forests amid our communities. With few naturally occurring trees in most places, people have planted, watered, and maintained trees to informally develop an extensive forest over many years. Through informal trials and observations, we have also identified dependable trees suited to the state's harsh landscapes.

For many, the need for greater diversity in our community forests is clear. Global trade has introduced new pests and diseases, such as Dutch elm disease and emerald ash borer, causing catastrophic losses to forests. Amid a changing climate, trees are often stressed by heat and prolonged drought and, consequently, susceptible to more health problems. With such concerns, many people are hoping to increase tree diversity, but many communities have only made modest progress towards the goal. To facilitate cooperation on the topic, we have developed a new collaborative framework and digital platform for tree observation. Using the platform, anyone can record the growth and condition of novel or threatened tree species in a standardized manner, allowing for greater consistency among observations and clarity among summaries. Through the work, we hope to answer several important questions, including:

1. What are the survival rates for novel or threatened trees growing in Colorado communities?
2. How quickly do novel or threatened trees grow to a typical size in Colorado communities?
3. How do site conditions and stewardship affect survival, condition, and growth of novel or threatened trees?

The initial version of the system was built using Esri software tools, and it is accessible to anyone with an Esri license. When developing the system, we referenced several existing resources for urban tree monitoring efforts, including the Urban Forest Inventory and Analysis (FIA) protocol and Urban Tree Monitoring guides published by the US Forest Service, to adopt best practices for records and other details.

Ultimately, our judgments will be strengthened with more people making observations of trees growing in diverse settings. If you're interested in greater tree diversity, we hope you will consider partnering with us and sharing your observations with the broader public. On the following pages, you will find detailed instructions about contributing to the dashboard.

## Instructions

### Download the Field Maps mobile app

Download and install Field Maps on your mobile device from the Microsoft Store, App Store, or Google Play.

### Add a new tree

1. Open the Field Maps app and search for “Colorado Tree Observation Dashboard”. In the search results, find and open the correct item with a CSU logo. The map will open with an initial view determined by your current location or recent observations.
2. On the map, navigate to the new tree’s location and hold your finger on the map to add a new marker. While holding your finger on the map, a circle will appear showing a closer view of the site for fine adjustments of the position (Figure 1). When you’re satisfied, release your finger to select the tree’s final location.

Alternatively, you can tap the blue circle with a plus symbol to set the location based on your device’s GPS.

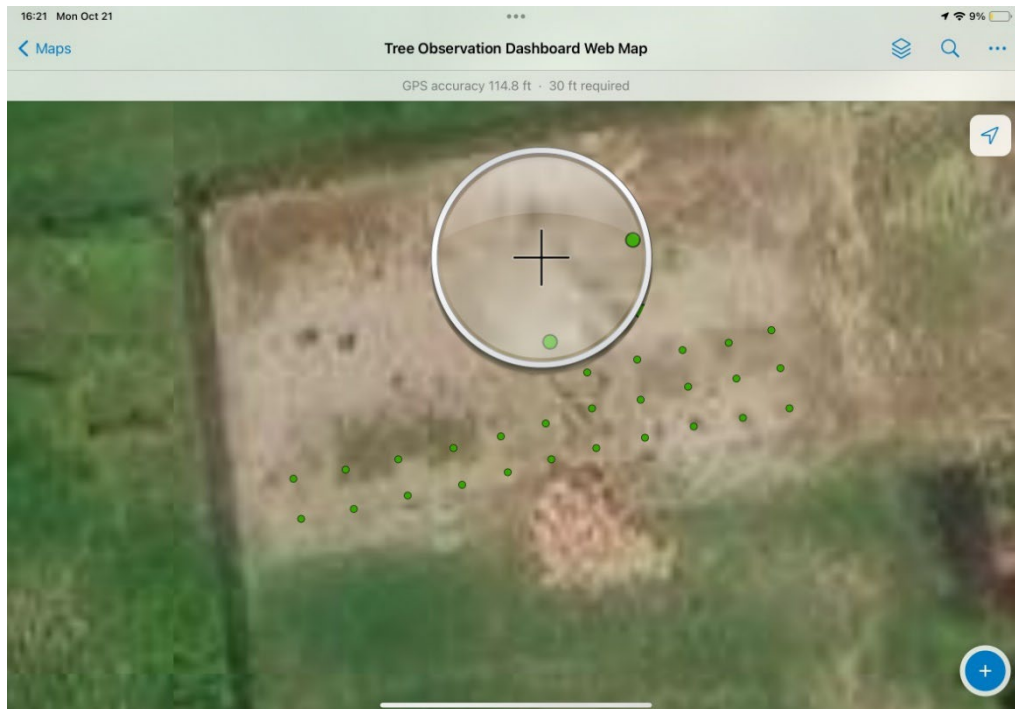


Figure 1: To add a new tree location to the map, hold your finger on the map and remove it when you’re satisfied with the location.

3. On the marker popup, tap “Collect Here” to confirm the location for the point (Figure 2). To discard the marker, simply tap the “x” to close the popup.

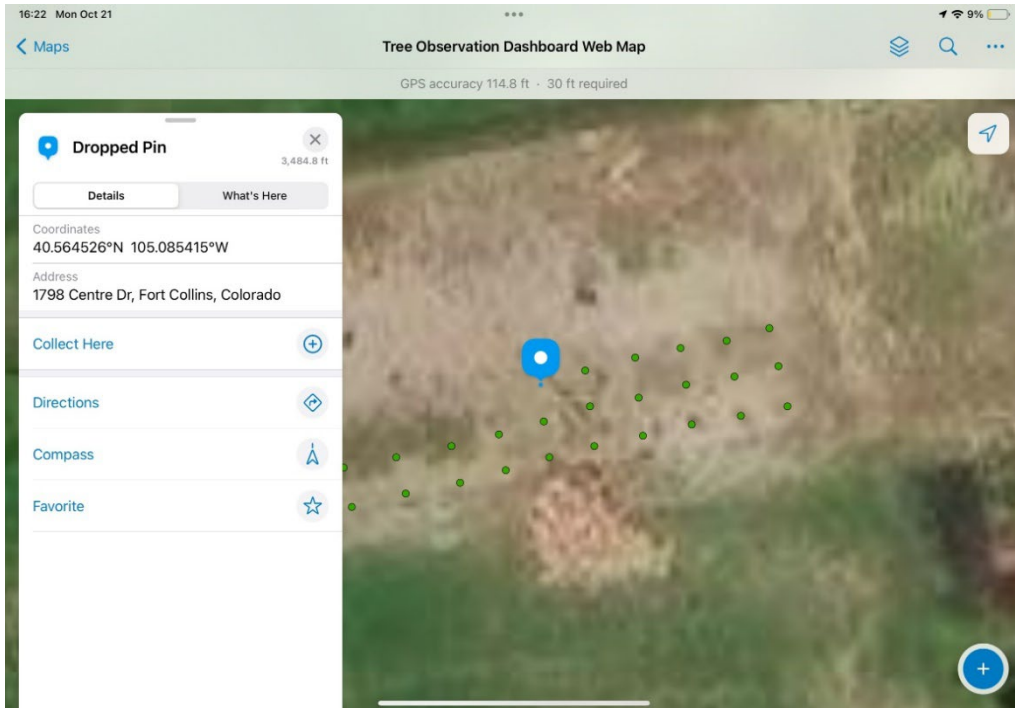


Figure 2: After dropping a temporary pin for a new entry, tap “Collect Here” to confirm the location and enter basic details about the tree.

4. After confirming the location, the tree will be automatically assigned a unique identifier for tracking. Complete the remaining fields on the form by providing basic information about the tree (Figure 3), including:
  - i. Scientific name\* (Required): Record the species using standard botanical names, according to the International Code of Nomenclature for Cultivated Plants. Omit trade designations, such as trademark names, used for marketing.
  - ii. Common name\* (Required): List common name(s) for the tree using commas to separate multiple names.
  - iii. Affiliation (Optional): Record individuals or organizations affiliated with the tree, such as the owner or sponsor.

16:22 Mon Oct 21

Cancel Collect Submit

GPS accuracy 114.8 ft - 30 ft required

**Trees**

40.564526°N 105.085415°W

Update Point

Take Photo Attach

Tree ID \*

202400028

Scientific Name \*

e.g., *Pice pungens*

Record the complete botanical name according to the International Code of Nomenclature for Cultivated Plants. Omit trade designations used for marketing.

Common Name \*

e.g., Colorado blue spruce

List any common name(s) for the tree using commas to separate names.

Affiliation

e.g., Colorado State University

Record individuals or organizations affiliated with the tree, such as the owner.

Figure 3: Basic tree details can be recorded in the form. Required fields are denoted with an asterisk (\*).

5. After completing the form, tap “Submit” to complete the new entry.

### Add observations for an existing tree

1. To add a new observation for an existing tree, tap the tree marker on the map and confirm the selection with the information displayed in the popup (Figure 4). On the popup, select “Tree Observations” to view any related observations for the tree.

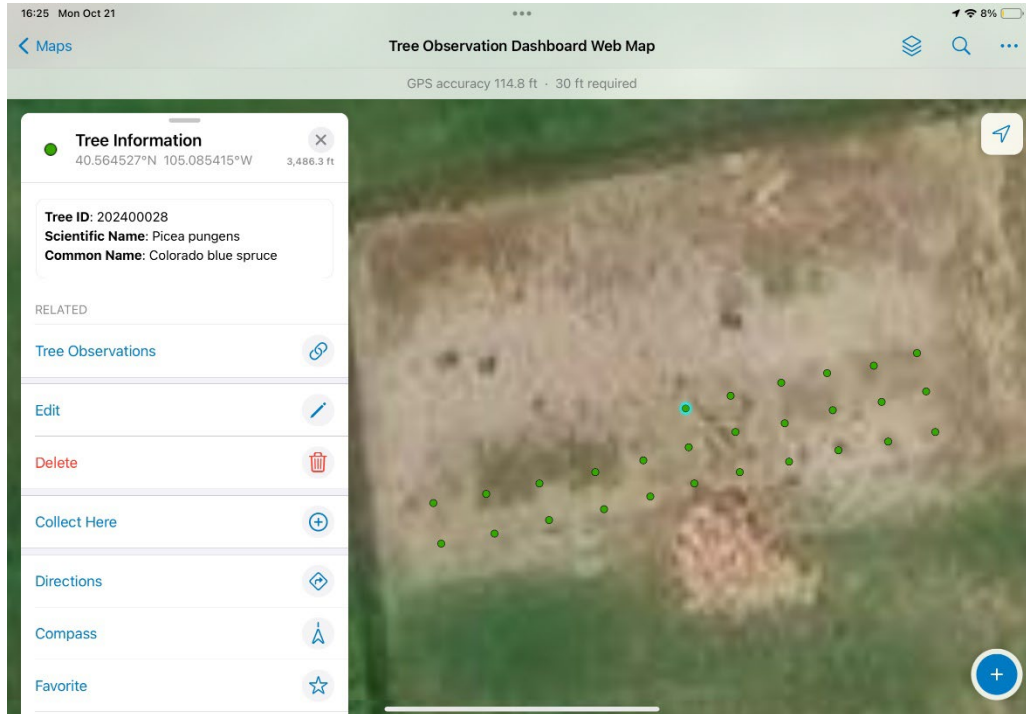


Figure 4: After selecting a marker, you can view basic information and all related observations for the tree.

2. If earlier observations were submitted, the date of observation for existing records will be listed. To add a new observation, tap the blue “Add” button (Figure 5).

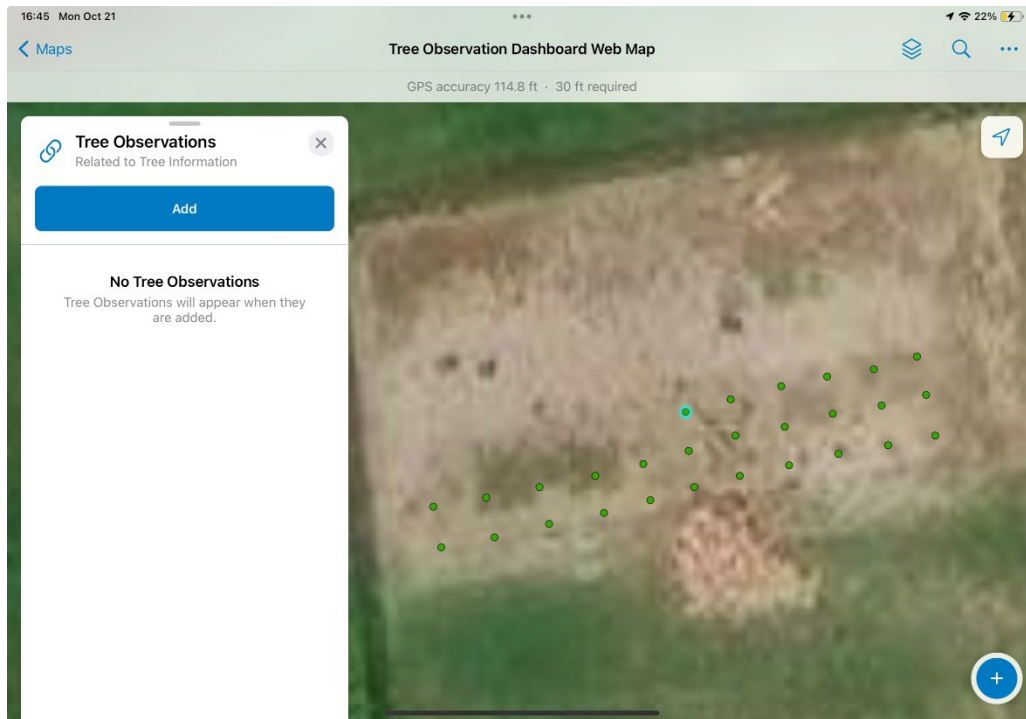


Figure 5: All existing observations for a tree will be shown in a list of related records. To add a new observation, tap the “Add” button”. To view an existing record, tap on the date of the observation.

3. Complete the entire observation form for the tree. In the general information section, all of the fields will be automatically populated by the system (Figure 6):

### **General Information**

- i. Tree ID\* (Required): [Automatically populated]
- ii. Date Observed\* (Required): [Automatically populated]

The screenshot displays a mobile application interface for recording tree observations. At the top, the status bar shows the time as 16:26 on Monday, October 21, with a battery level of 8%. The app's header includes a 'Cancel' button on the left, a 'Collect' title in the center, and a 'Submit' button on the right. Below the header, a GPS accuracy notification reads 'GPS accuracy 114.8 ft · 30 ft required'. The main content area is divided into two parts: a form on the left and a background image on the right. The form is titled 'Tree Observations' and features a 'Take Photo' button with a camera icon and an 'Attach' button with a paperclip icon. The form is organized into three collapsible sections: 'GENERAL INFORMATION \*' (expanded), 'SITE INFORMATION \*' (collapsed), and 'TREE INFORMATION \*' (collapsed). The 'GENERAL INFORMATION \*' section contains two fields: 'Date \*' with the value '21/10/24' and 'Tree ID \*' with the value '202400028'. The background image shows a close-up of a tree trunk with several green dots scattered across its surface, indicating observation points. A small blue arrow icon is visible in the top right corner of the image area.

Figure 6: Tree observations can be recorded in a form with collapsible sections for general, site, and tree information. Required fields are denoted with an asterisk (\*).

4. Next, record basic information about the tree's site, including:

**Tree Information**

**Site Information**

i. Site Type\* (Required): Choose a site type most closely matching the tree's immediate location.

Sidewalk cutout	SC
Sidewalk planting strip	SP
Median	M
Planter box	PB
Other hardscape	OH
Front yard	FY
Side yard	SY
Back yard	BY
Maintained park	MP
Other maintained landscape area	OM
Natural area	NAT

ii. Land Use\* (Required): Choose the most appropriate land use category most closely matching the current use of the property at the parcel level.

Single-family residential – detached	SFR-D
Single-family residential – attached	SFR-A
Multi-family residential	MFR
Mixed use	MIX
Commercial	COMM
Industrial	IND
Institutional	INST
Maintained park	MP
Natural area	NAT
Cemetery	CEM
Golf course	GC
Agricultural	AG
Utility	UT
Water or wetland	W
Transportation	TR
Vacant lot	V
Other	O

iii. Irrigation\* (Required): Record the type of irrigation used to water the tree.

None	N	No irrigation.
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Overhead Sprinklers	OS	Applicators, such as nozzles or impact heads, spray water over large areas containing trees.
Microirrigation	MI	Low-pressure applicators, such as drip emitters or bubblers, apply water directly to the root zone.

5. Last, record the tree's current size, ornamental features, and current condition:

### **Tree Information**

#### **Size Measurements**

- i. DBH\* (Required): Measure trunk diameter (inches) 4.5 ft above ground level.
- ii. Height (Optional): Measure total tree height (feet) vertically from the ground to the top of the live (green) crown using a clinometer, hypsometer, or a height pole.

#### **Ornamental Features**

- i. Fall Color (Optional): Rate the visual appearance of fall color.

Vivid	V	Leaves appear in bright colors (e.g., red, orange, yellow) before dropping.
Dull	D	Leaves appear in dull, muted colors (e.g., yellow, brown) before dropping.
None	N	Leaves do not noticeably change color before dropping.

- ii. Flowering (Optional): Rate the visual appearance of flowers.

Vibrant	V	Tree displayed many attractive flowers for a noticeable period of time.
Sparse	S	Tree displayed a few attractive flowers for a noticeable period of time.
Dull	D	Tree displayed unnoticeable flowers or flowered briefly.
None	N	Tree did not flower.

- iii. Fruiting (Optional): Rate the visual appearance of fruit.

Heavy	H	Tree bore a heavy amount of normal fruit.
Sparse	S	Tree bore sparse normal fruit.
None	N	Tree did not produce any fruit.

#### **Tree Condition**

- i. Tree status\* (Required): Record the current status of the tree. If any part of the tree remains alive, the entire tree should be considered alive.

Alive	A
Dead	D
Removed	R
Stump	S
Unknown	U

- ii. Crown Vigor\* (Required): Holistically assess overall crown health based on foliage problems and major branch loss.

Healthy	H	Tree appears to be in reasonably good health; no major branch mortality or large broken branches; less than 10 percent cumulative fine twig dieback, foliage discoloration, and/or defoliation.
Slightly unhealthy	SLU	Fine twig dieback, foliage discoloration, and/or defoliation in 10 to 25 percent of the crown; broken branches or crown area missing based on visual evidence of large broken (not pruned) or dead branches 25 percent or less.
Moderately unhealthy	MU	Fine twig dieback, foliage discoloration, and/or defoliation present in 26 to 50 percent of the crown; broken branches or crown area missing based on visual evidence of large broken (not pruned) or dead branches 50 percent or less.
Severely unhealthy	SEU	Fine twig dieback, foliage discoloration, and/or defoliation present in more than 50 percent of the crown, but foliage is still present to indicate that tree is alive; broken branches or crown area missing based on visual evidence of large broken (not pruned) or dead branches more than 50 percent.
Dead	D	

- iii. Biotic damage (Optional): Record serious health problems (conditions likely to inhibit survival, impair condition, or reduce growth) caused by living organisms. Do not record minor health conditions or cosmetic issues. It can be difficult to reliably diagnose the cause of tree health problems using symptoms and other evidence, and the use of a guide, such as *Insects and Diseases of Woody Plants in Colorado*, can often help avoid misdiagnosis. If necessary, write a more detailed description of the problem(s) or causal agent(s) in the comments section.

No damage	ND	No observed damage.
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General insects	GI	Insect damage that cannot be placed in any of the listed categories.
Defoliating insects	DI	Feeding damage caused by insects that chew or tunnel into the foliage of trees, such as Japanese beetle, elm leafminer, and Douglas fir tussock moth. General symptoms of defoliation damage include large amounts of missing foliage, browning foliage, extensive branch mortality, or dead treetops.
Sucking insects	SI	Feeding damage caused by insects that suck fluids from plants, such as adelgids, scales, and aphids. Severe infestations may stress trees from the removal of large amounts of sap. Conspicuous, unattractive sooty mold may colonize the sticky honeydew excreted by the insects.
Gall-making insects	GA	Abnormal growths induced by the presence of small organisms, such as fungi, bacteria, insects, and mites. Many leaf galls are not damaging, but some twig galls, such as the rough bulletgall, can be problematic if they interfere with resource movement in the tree.
Bark beetles	BB	Feeding damage caused by phloem-feeding insects, such as Ips beetle, that bore through the bark and create extensive galleries between the bark and the wood. Symptoms of beetle damage include crown dieback, sap tubes or sap streaks on the bark, extensive egg burrows underneath bark, boring dust in the bark crevices or at the base of the tree. Bark chipping by woodpeckers may be conspicuous.
Boring insects	BI	Tunneling damage caused by insects boring into woody tissue, such as the Emerald ash borer and Gambel oak borer. Symptoms of wood borer damage include crown dieback, exit holes on the bark, boring dust in the bark crevices or at the base of the tree, and large tunnels or excavated chambers in the wood.
General diseases	GD	Disease damage that cannot be placed in any of the listed categories.
Foliage diseases	FD	Foliage infections caused by fungi, bacteria, or viruses, such as needle casts, foliar rusts, powdery mildew, and leaf spots. Symptoms

		often include leaf discoloration, leaf spotting, and premature defoliation.
Twig diseases	TD	Twig infections caused by fungi, bacteria, or viruses, such as fireblight and aspen shoot blight. Symptoms often include curled young shoots and dead leaves hanging on water-soaked or darkened twigs.
Cankers (non-rust)	CA	A canker, a sunken lesion on the stem caused by the infection of outer layers, may weaken or kill the affected portion of the tree. Cankers may be caused by various agents, but most are caused by fungi. Cankers originate on the bark surface of stems, progress inwards through underlying tissue, and often slowly expand outwards to nearby areas.
Rusts	RU	Stem or twig infections caused by fungi with a dependence on specific hosts for part of their life cycle. Symptoms may include abnormal growth or swelling, cankers, or a dense proliferation of small branches (“witches’ brooms”).
Decay	DE	Root or stem infections caused by wood decay fungi, including many species in the Basidiomycota, Ascomycota. General symptoms include crown dieback, discolored foliage, and excessive swelling of decayed parts. Fungal reproductive structures, such as mushrooms and conks, may be observed near infected areas.
Decline complexes	DC	Tree damage caused by an interacting set of biotic (living) or abiotic (non-living) factors, rather than a single causal agent.
Vascular wilts	VW	Infections of the conducting vascular tissue caused by fungi, such as Verticillium wilt, Dutch Elm Disease, and oak wilt. Symptoms often include sudden wilting of leaves on individual branches, discolored vascular tissue, and death of the entire tree.
Wild animals	WA	Feeding damage or physical wounds caused by wild animals, such as squirrels, woodpeckers, or deer.
Domestic animals	DA	Feeding damage, soil contamination, or physical wounds caused by domestic animals, such as dogs or chickens.

Unknown damage	UD	Damage unattributable to a general or specific agent.
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iv. Abiotic damage (Optional): Record serious health problems (conditions likely to inhibit survival, impair condition, or reduce growth) *not* caused by living organisms. Do not record minor health conditions or cosmetic issues. It can be difficult to reliably diagnose the cause of tree health problems using symptoms and other evidence, and the use of a guide, such as *Insects and Diseases of Woody Plants in Colorado*, can often help avoid misdiagnosis. If necessary, write a more detailed description of the problem(s) or causal agent(s) in the comments section.

No damage	ND	No observed damage.
General abiotic	GA	Damage not caused by other organisms that cannot be placed in any of the listed categories.
Winter damage	WD	Physical injury caused by freezing temperatures or freeze-thaw cycles, including winter sunscald, frost cracks, or freeze damage. Winter sunscald commonly develops on young trees with thin bark on sunny winter days, especially on the side of the trunk exposed to the sun.
Storm damage	SD	Physical injury or damage from the forces created by severe wind, ice, or snow loads. The type of damage may include broken branches, dislodged roots, or large cracks.
Mechanical damage	MD	Physical injury caused by impact with equipment or vehicles, such as lawn mowers, or girdling from synthetic materials, such as trunk wrap.
Fire damage	FD	Physical injury caused by fire. Symptoms may include singed leaves, dry inner bark, or charred outer bark.
Chemical toxicity	CT	Physiological injury caused by excess nutrients, pollutants, or other contaminants, such as ozone, sodium, or herbicides.
Nutrient deficiency	NDE	Physiological injury caused by a lack of essential nutrients in the soil or the unavailability of nutrients, especially iron or manganese, due to soil pH.
Water deficiency	WDE	Physiological injury caused by a lack of water. Symptoms often include wilted leaves, scorched leaf edges, or shedding interior leaves.

Poor soil structure

PS Physiological injury caused by dense soils without adequate pore space for water or air movement, often created by surface compaction.

- v. Invasive potential: Rate the invasive potential of the tree based on its propensity to spread in managed landscapes.

High

H Spreads readily and aggressively in managed landscapes.

Moderate

M Spreads occasionally and slowly in managed landscapes.

Insignificant

I Rarely spreads in managed landscapes.

6. At the end of the form, you can record other important observations about the tree, such as the causal agent for a health problem or noteworthy aesthetic features, in the comments field. You can also attach images to the observation by tapping on the “Take Photo” button at the top of the form.
7. After completing the form, tap on the “Submit” button to save your observations.