

# I-TREE SCIENCE UPDATE LOG



The Science Update Log represents a running summary of changes made to the science of i-Tree. In general, the changes add new functionality to the tools or change ecosystem service estimates. This document began as an internal tracking tool but as a service to our users and in the interest of maximum transparency we are sharing it publicly. Some of the language includes internal jargon and may lack clarity for the general user. We intend to improve this aspect of the document as we add additional updates going forward. For a detailed log of the software programming changes please see this document, [i-Tree Suite Software Change Log](#). For more complete descriptions of the i-Tree models and ecosystem service estimates please review the [Understanding i-Tree](#) document and associated references.

For questions please email [info@itreetools.org](mailto:info@itreetools.org).

SEPTEMBER 2021, CORRESPONDING TO I-TREE SUITE VERSION 6.1.37 AND I-TREE ECO VERSION 6.0.23

- 1) Wood density value applied before the leaf biomass is added to total tree biomass for evergreen trees.
  - a. Wood density adjustment should on be used to adjust leaf biomass
  - b. Applications impacted
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  
- 2) Height at maturity adjustment removed from the DBH growth equations and maximum DBH value increased for all species.
  - a. When calculating annual DBH growth tree growth slows based on the maximum DBH for the species. Growth no longer slowed based on height at maturity.
  - b. Applications impacted
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - c. Reason
    - i. DBH growth was slowing too soon for certain species resulting in lower than expected carbon values.
  
- 3) Cap the height value entered into the Crown Width equation.
  - a. The tree height value entered into the crown width equation does not change when the tree is forecasted forward.
  - b. Applications impacted
    - i. Eco
    - ii. Forecast

- iii. API (MyTree, Design, Planting)
  - c. Reason
    - i. Equations reached a point where crown width values were decreasing with DBH and height growth.
- 4) Cap carbon storage values.
  - a. Carbon storage values are capped at 7500kg (or less depending on the species) and after that increase at a species specific rate of kg/cm of DBH growth.
  - b. Applications impacted
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - c. Reason
    - i. Trees reached a max DBH and/or height at which point calculated carbon storage values decreased or became negative.
    - ii. Carbon storage values for very large trees exceeded a reasonable value.

#### **Additional Code Updates**

- 1) i-Tree Database submissions
- 2) Changes to species scientific names to reflect correct spelling and accepted species names vs synonyms.
  - a. Addition of Synonym lookup table to the Trees help text.
- 3) Pollution monitor station assignments added for County Subdivisions in Puerto Rico.
- 4) Pollution monitor station assignments corrected for Europe.

- 1) New carbon equations and new process to estimate carbon storage and sequestration using wood density
  - a. Further Detail - See CarbonEquations\_2020 document.
    - i. Values will go up and down
  - b. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - c. Reason
    - i. To get more species/genus specific equations.
    - ii. To adjust sequestration values for differing tree wood densities when an equation is not species specific.
- 2) Carbon equations are queried based on taxonomic hierarchy
  - a. SAS used to lookup species, genus and then average all softwood or hardwood values
    - i. This significantly impacts the carbon values in Eco
  - b. Applications impacted:
    - i. Eco
  - c. Reason
    - i. Increased accuracy
- 3) Tropical carbon equations based on location.
  - a. When a project location is classified as tropical application defaults to tropical equations based on Dry, Moist or Wet designation. Users can opt to use the standard species specific equations.
  - b. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - c. Reason:
    - i. To account for the fact that carbon sequestration rates are more dependent on climate than species in tropical locations.
- 4) Annual DBH growth rates based on species specific slow, moderate, and fast growth rate classifications, matching to the method of forecast and API.
  - a. Applications impacted:
    - i. Eco
  - b. Reason:
    - i. To improve carbon sequestration estimates.
- 5) Leaf area and leaf biomass adjusted based on actual dieback not categorical condition classes.
  - a. The maximum value between dieback and percent crown missing is used to adjust the values.

- b. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - c. Reason
    - i. Increased accuracy
  - d. Notes: SAS was using the percent dieback (not categorical condition codes) in the last couple releases, but for this one we changed it to percent canopy missing and that really changed the results because most trees have percent missing recorded even when there is 0% dieback. We have now reverted to dieback adjustment to along all codes.
- 6) Leaf biomass to area values queried based on taxonomic hierarchy
- a. Values impacted
    - i. Leaf biomass, leaf area and leaf area index
    - ii. Carbon storage/sequestration results for evergreen trees
  - b. Applications Impacted:
    - i. Eco
  - c. Reason
    - i. Increased accuracy
- 7) New shading coefficient values based on species and dbh.
- a. This change impacts the leaf biomass, leaf area and leaf area index values.
  - b. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - c. Reason:
    - i. To improve leaf area, leaf biomass and LAI estimates
- 8) In the leaf biomass/area calculation remove Beers Law which adjusted values based on crown competition.
- a. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
- 9) Add leaf biomass to total tree biomass when a tree is evergreen or semi-evergreen.
- a. This will impact carbon storage/sequestration for evergreen and semi-evergreen trees
  - b. Applications impacted:
    - i. Forecast
    - ii. API (MyTree, Design, Planting)
  - c. Reason
    - i. The carbon storage equations do not include leaf biomass.
- 10) Updated procedure for calculating leaf area if crown height is not between 1 and 12 or crown width is not between 1 and 14.

- a. This change impacts leaf area, leaf biomass, leaf area index and carbon storage for evergreen/semi-evergreen trees when either of these variables are out of range.
  - b. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - c. Reason
    - i. Initially forecast/API was changed mimic the Eco process in which values came from a lookup table based on shading factor and height to width ratio
    - ii. Eco values were incorrect so the table was updated to also account for the adjusted crown height and crown width.
- 11) New crown width equations based on species groups (Westfall, 2020)
- a. Reason:
    - i. To improve crown width calculations
  - b. Applications impacted
    - i. Forecast
    - ii. API (MyTree, Design, Planting)
- 12) All SAS used common input files are lined up with location species database.
- a. SAS uses up-to-date files whenever location species database is updated.
  - b. Applications impacted:
    - i. Eco
  - c. Reason
    - i. To avoid out of date values in SAS

### **Additional iTree Updates**

- 1) Corrected PM2.5 removal rate values for 109 locations
  - a. This change will result in a significant increase in removal rates for these locations.
  - b. Applications impacted:
    - i. Forecast
    - ii. API (MyTree, Design, Planting)
  - c. Reason:
    - i. Bug
- 2) Pollution, health incidence and hydrologic benefit values changed for 3 counties in the Puget Sound area.
  - a. The values for these counties were updated based on the Puget Sound UTC analysis.
  - b. Counties impacted:
    - i. King
    - ii. Pierce
    - iii. Snohomish
  - c. Applications impacted:

- i. Forecast (hydrologic benefits only)
    - ii. API (MyTree, Design, Planting)
    - iii. Landscape
    - iv. Canopy
  - d. Reason
    - i. Underlying canopy data is more accurate (WA DNR).
- 3) Update the cost of electricity values for the US only to 2020.
  - a. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
- 4) Updated height at maturity values for several species.
  - a. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - b. Reason – Values were too high for the species
- 5) Removal of Live Oak subgenus
  - a. Calculated values could change when genus based averages are used.
  - b. Applications impacted:
    - i. Eco
    - ii. Forecast
    - iii. API (MyTree, Design, Planting)
  - c. Reason
    - i. Live oak is not an actual genus but just an evergreen oak
- 6) Additions to invasive species list
  - a. Applications impacted:
    - i. Eco
- 7) Additions to pest host list
  - a. Applications impacted:
    - i. Eco
    - ii. Forecast
- 8) Changes to compensatory values in Canada
  - a. Removal of duplicate values (average) and outliers.
  - b. Applications impacted:
    - i. Eco
  - c. Reason – Outliers were skewing some results.
- 9) Changes to VOC values
  - a. Removal of bioemissions outliers and changed genus values to average of all species.
  - b. Applications impacted:
    - i. Eco
  - c. Reason – Outliers were skewing results.