ECO GUIDE TO
Data Limitations

i-Tree Eco v6.0 has been modified so that users are now required to collect only two measurements of trees (species and diameter at breast height or DBH) to complete an Eco project. The reduction in required data fields has been made to accommodate users with existing street tree inventory data, which oftentimes does not include all of the previously required tree measurements. However, while this streamlined approach enables these users to run i-Tree Eco, it also has substantial limitations, described below. For that reason, in addition to the required species and DBH data, we strongly recommend that users beginning a new inventory also collect the following tree measurements:

- Land use
- Total tree height
- Crown size
    - Height to live top
    - Height to crown base
    - Crown width
    - Percent crown missing
- Crown health
- Crown light exposure

Tip

Please keep in mind that the eight variables listed in this guide are highly recommended because they directly impact model calculations. Depending on the goals of your i-Tree Eco project, additional variables may be necessary to complete the analyses that you are interested in. We strongly encourage you to read **Phase III** of the **User's Manual** to ensure that you collect all of the data necessary for the intended use of your project.

The limitation of not collecting those highly recommended variables is that, without the actual data for each tree, the Eco model will use various approaches to fill in the missing variables. Some of these approaches use a default value, meaning all trees will be assigned the same value. Where defaults are not used, the model will use regression equations to fill in the other missing values. The following is a brief synopsis of how the additional recommended variables are estimated and used by the model if they are not collected in the field:

The letters in parentheses after each description below indicate the ecosystem service or model function affected by the data. Each of these components, excluding energy effects and wildlife suitability, will be calculated using estimated or default data variables if any or all of the highly recommended fields are not collected. Energy effects (E) and avian habitat suitability (H) are extra model components that require additional data and cannot be estimated if you do not collect distance and direction of the tree to buildings for energy or ground cover composition and percent shrub cover for wildlife (see the **User's Manual** for more information).

A = air pollution removal; C = carbon sequestration/storage; E = energy effects; F = Forecast, R = avoided runoff; S = structural or compensatory value; V = volatile organic compound emissions; H = avian habitat suitability

- Land use – defaults to residential (C, S, H)
- Total tree height – predicted from a regression equation (A, C, E, F, R, V, H)
- Height to live top – assumed to be the same as total height
- Height to crown base – predicted from a regression equation (A, R, V)
- Crown width – predicted from a regression equation (A, R, V)
- Percent crown missing – assumed to be 13% crown missing (A, E, R, V)
- Crown health – assumed to be 13% dieback (87% condition) (C, F, S, H)
- Crown light exposure – defaults to class 2-3 (C, F)

As you can see, the eight highly recommended variables, along with species and DBH data, are critical to estimating ecosystem services. Therefore, the quality of the model outputs will be enhanced by the extent of the data collection. As an example of one of the limitations of working with default values, if tree crown health is not measured, the model defaults to a dieback of 13 percent (87% condition). Using this default crown health for all trees will classify dead trees and trees in poor health as healthy and growing. In this scenario, the model will overestimate carbon sequestration.

The regression equations used to estimate tree measurements, including total tree height, height to crown base, and crown width, are selected based on the collected tree species data. Where no species level equation exists, a genus level equation is used and so on up the taxonomic scale until an equation is found. These regression equations use the collected DBH data to predict the tree variables that are not measured for each tree.

One of the caveats of using regression equations (e.g., predicting tree height from DBH) is that the model will tend to predict toward an average, meaning particularly tall or short trees will be under- or overestimated respectively. This limitation is more prominent at the individual tree scale. For estimates of large population totals, the over- and underestimates are more likely to offset each other. However, this assumption may not be true depending on the population and equations used. As an example, suppose a model is developed to predict a person's height based on age. For a large population, the predicted cumulative height will likely be fine, but the height of an individual person will be off. When a tall basketball player is estimated, the height

will be under-predicted. In estimating the cumulative height of an entire basketball team, the model will substantially under-predict height.

Thus we strongly recommended that users collect land use, total tree height, height to live top, height to crown base, crown width, percent crown missing, crown health, and crown light exposure data for each of the trees measured. The accuracy of ecosystem service estimates can be improved significantly by providing these highly recommended tree measurements and the model outputs will better capture the structure and function of the urban forest in your study area.