Landscape Life Cycle Analysis Tool

User Guide

August 2026

The Landscape Life Cycle Analysis Tool (LLCA Tool) is an Excel based model that calculates financial cost, water and energy resource utilization, maintenance inputs, and carbon sequestration (hydrocarbon balance) associated with landscapes designs. The purpose of the tool is to provide municipalities, utilities, water practitioners, and landscape professionals with a tool to evaluate landscapes through a comprehensive lens that considers the tangible and intangible inputs and outputs of a landscape over its lifecycle.

The LLCA Tool allows for direct comparison of three landscape designs from an economic and environmental accounting perspective. The model includes a wide range of common landscape features, but also allows users to customize inputs to align with their specific landscape designs.

The LLCA Tool is informed by field-based and documented research. Case Study 1 provides information on the landscapes used to inform the model. As more field-based information is collected, the model with be updated.

The Life Cycle Analysis Tool includes Visualization, Cost Summary, calculation, and data library sheets. Users are only required to provide information about their landscape on the Cost Summary sheet. All other sheets associated with the tool act as functions to calculate outputs on the Cost Summary Sheet or store data.

Calls to specific data may be modified in the data library tabs in orange cells. All calculation and datasheets are protected. The user can choose to unprotect and modify these sheets.

How to Cite

The Life Cycle Analysis Tool was developed from and improved upon the Value Landscape Engineering Tool by Rosenberg and colleagues (2011). The Life Cycle Analysis Tool was developed at Utah State University as part of the Alliance for Water Efficiency's Resource Positive Landscapes project funded by The Scotts Miracle Gro Foundation. Please use the following sources when reference the tool:

Alliance for Water Efficiency & Utah State University. *Landscape Life Cycle Analysis Tool*. Chicago, IL: Alliance for Water Efficiency, 2026.

Rosenberg, David, Kelly Kopp, Heidi Kratsch, Larry Rupp, Paul Johnson, and Roger Kjelgren. 2011. Value landscape engineering: Identifying costs, water use, labor, and impacts to support landscape choice. Journal of the American Water Resources Association. 47:635-649. DOI: 10.1111/j.1752-1688.2011.00530.x.

Users must enable Excel Macros and ActiveX Commands to use all tool functions.

Tool Navigation

The table provides a list of all sheets included in the Life Cycle Analysis Tool. In the Tool, each sheet includes a text box with instructions for the user.

SHEET NAME	PURPOSE
READ ME	Documentation and Guidance Sheet
VISUALIZATION	Visual output of Life Cycle Analysis Summary
DECISION TREE	Decision tree to support users in prioritizing costs
COST SUMMARY	Data input and landscape specification sheet
CALCULATION SHEETS	*No Data Input*
WATER	Water resource calculations
LABOR	Labor resource calculations
FUEL	Fuel resource calculations
CO2	Carbon emissions calculations
ENERGY	Energy resource calculations
DUST	Dust generation calculation
REPLACEMENT COSTS	Replacement costs calculations
FERTILIZER	Fertilizer resource calculations
PESTICIDE	Pesticide resource calculations
DATA SHEETS	*No Data Input*
DATA	Data values for calculations across all calculation sheets
DATA – IRRIGATION	Data values for Water calculation and Cost Summary sheets
DATA – LIGHTS	Data values for Cost Summary sheet
DATA – EQUIPMENT	Data values for Fuel calculation and Cost Summary sheets
DATA - LABOREQUIPMENT	Data values for Cost Summary, Labor and Fuel calculation sheets

Cost Summary Page Navigation

All data input and output are conducted on the Cost Summary sheet. The following section walks users through the seven sections of the Cross Summary sheet.

Cell Color Orientation

Orange cells are input fields that include
- Manual inputs
- Inputs drawn from Data sheets

Blue cells are calculated values

Dark blue cells are sum calculations

Reset Default Buttons

- Set all inputs to default values. Values reverted to default include [cells]:
  - Initial Assumptions [E5:E21]
  - Purchase Price ($/Unit) [E74:E127]
  - Lifespan (Years) [G74:G127]
- Set All Initial Assumption to Default Values [E5:E21]
- Set All Unit Prices to Default Values [E74:E127]
- Set All Life Spans to Default Values [G74:G127]

I. Initial Assumptions

- Values [E5:E21] can be manually modified to reflect variables metrics associated with the user's landscape and climate.
- Default values for Initial Assumptions are housed in the Data sheet. If the user wishes to modify the initial assumptions reset values, the user must unprotect the Data sheet and change the set values.
- Sensitivity Analysis allows users to determine how input variables affect model results. A sensitivity value of 1 (the default value) represents a typical landscape. A sensitivity value of 2 reflects the most conservative application of the model, making assumptions that are likely to underestimate landscape costs and model outputs. A sensitivity value of 3 reflects the least conservative application of the model, making assumptions that are likely to overestimate the landscape costs and model outputs.

II. Plant Coverage and Configuration

- Comparison of Landscapes [I26:K69]
  - Values are manually entered as percentages
  - Boxes are manually checked [I66:K69]
- Landscape Area (total square feet from percentages entered) [O26:Q49]
  - No entry needed – values are calculated from manual entries in Comparison of Landscapes [I26:K69]

III. Capital Expenditures

- Purchase Price ($/Unit) [E74:E127]
  - Values reset to default values through buttons
- Life Span (Years) [G74:G127]
  - Values reset to default values through buttons
- Required Units [I74:K136]
  - No input necessary for blue cells, inputs required for orange cells
- Site Preparation Price [E129:E132]
- Site Preparation Required Units [I129:K132]
  - Inputs required for orange cells – these cells are **not** reset to default by buttons

IV. Desired Maintenance Level

- **Conventional:** Represents conventional landscape management with more common labor, water, and other inputs.
- **Intense:** Represents more intense landscape management including more labor, water, and other inputs to achieve a desired aesthetic. If the intense maintenance level is selected, higher data values of data ranges are used for model calculations.

V. Annual Operating and Maintenance Costs

- No entry needed - $/Unit Inputs [E143:E153] are pulled from manual inputs in Initial Assumption Values

VI. Replacement Costs

- No entry needed – Data pulled from Replacement Costs sheet

VII. Investment Analysis

- No entry needed – Data pulled from Labor, Fuel, and Cost Summary Initial Assumptions

VIII. Life Cycle Analysis

- Final Output
- No entry needed – Calculations of Life Cycle costs for financial investment, water use, energy, fertilizer use, pesticide use, labor, fuel, particular matter, hydrocarbon output
- Data are displayed in the Visualization tab.

Visualization Navigation

This datasheet is protected. Users can choose to unprotect this worksheet to modify figures. Figure data is controlled in the Cost Summary sheet Life Cycle Analysis (Section VIII).

Life Cycle Output Data

- Data from three landscape life cycle analysis cells on the Cost Summary sheet cells [I169:K178] populate the 10 graphs on the Visualization sheet.
- Name of landscapes from Cost Summary sheet cells [I24:K24] are populated
- Economic Lifespan of Landscapes from Cost Summary sheet cell [F6] is populated

Figures

- **Financial Cost & Labor** figure shows financial cost, owner labor, and hired labor
- **Landscape Resources** figure shows water, fertilizer, pesticide, and fuel use
- **Climate Impact** figure shows energy use, particulate matter production, and hydrocarbon output

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Decision Tree & Landscape Comparative Summaries

This sheet includes a decision tree and a comparative summary of each landscape. All information in the sheet is informed by the Cost Summary sheet Life Cycle Analysis (VIII) section. Users do not need to modify this spreadsheet. This sheet is protected, and modification may result in comparison disruption.

Decision Tree

- The decision tree is divided into three categories: **(1)** Financial Cost and Labor, **(2)** **L**andscape Resources, and **(3)** Climate Impacts
- The decision tree is designed assist the user in choosing a preferred landscape based on a cost analysis for all variables
- Information from three landscape life cycle analysis cells on the Decision Tree sheet cells [N9:O18], [T9:U18], [Z9:AA18], are considered for the decision tree
- Each section lists the landscape with the lowest resource cost per variable
- If two landscapes have the same cost, the output "L1 & L2 Equal" or "L1 & L3 Equal" or "L2 & L3 Equal"

Landscape Comparative Summaries

- Data from three landscape life cycle analysis cells on the Cost Summary sheet cells [I169:K178] populate the landscape comparative summaries
- Each cost is directly compared to the other landscapes and is rated as “low”, “medium”, “high” or “N/A”, indicating that a rating is not applicable because all values are zero
- If two landscapes have equal values, those two landscapes are denoted as equal. The shorthand of L1, L2, and L3 are used for Landscape 1, 2, and 3, respectively.
- Cost comparisons among landscapes are only in reference to each other

Data Sheets

Data sheets include a series of assumed data values that are supported by scientific or industry findings. Values are derived from field work conducted at Utah State University, personal communication with field experts, and a literature review. References from literature review are listed on the sheet.

Data values are pulled for calculations across all calculation sheets. Data may be modified by the user. New data should only be entered into the orange boxes. All other cells are locked and protected. It is recommended that these cells stay locked to preserve the integrity of the tool.

Once a data assumption is changed it cannot be reverted to the original assumption. It is highly recommended that a user save a separate copy if they plan to change assumptions.

Data Sheet Modification

- **Data:** Opportunity to modify data listed in orange cells
- **Data-Irrigation:** Opportunity to modify data listed in orange cells
- **Data-Lights:** No opportunity to modify data
- **Data-Equipment:** Opportunity to modify data listed in orange cells
- **Data-LaborEquipment:** Opportunity to modify data listed in orange cells

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