Natural Asset Management Value Guide Webinar

Credit Valley Conservation
inspired by nature

AMONTario
ASSET MANAGEMENT ONTARIO

Toronto and Region Conservation Authority

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Webinar

1. Asset Management & Natural Assets Introduction
2. Valuation Overview
3. Walk through the Guide
4. Street Tree Valuation
5. Forest Valuation
6. Key Takeaways & Looking Forwards
7. Questions

Green Infrastructure and Natural Assets

GREEN INFRASTRUCTURE (GI)

Nature-based Solutions (NbS)/Nature-based Climate Solutions

Natural Infrastructure (NI)

Low Impact Development (LID)

Green Infrastructure ONTARIO COALITION

NATURAL ASSETS:*
- Wetlands
- Forests
- Parks
- Meadows
- Lawns and gardens
- Soil

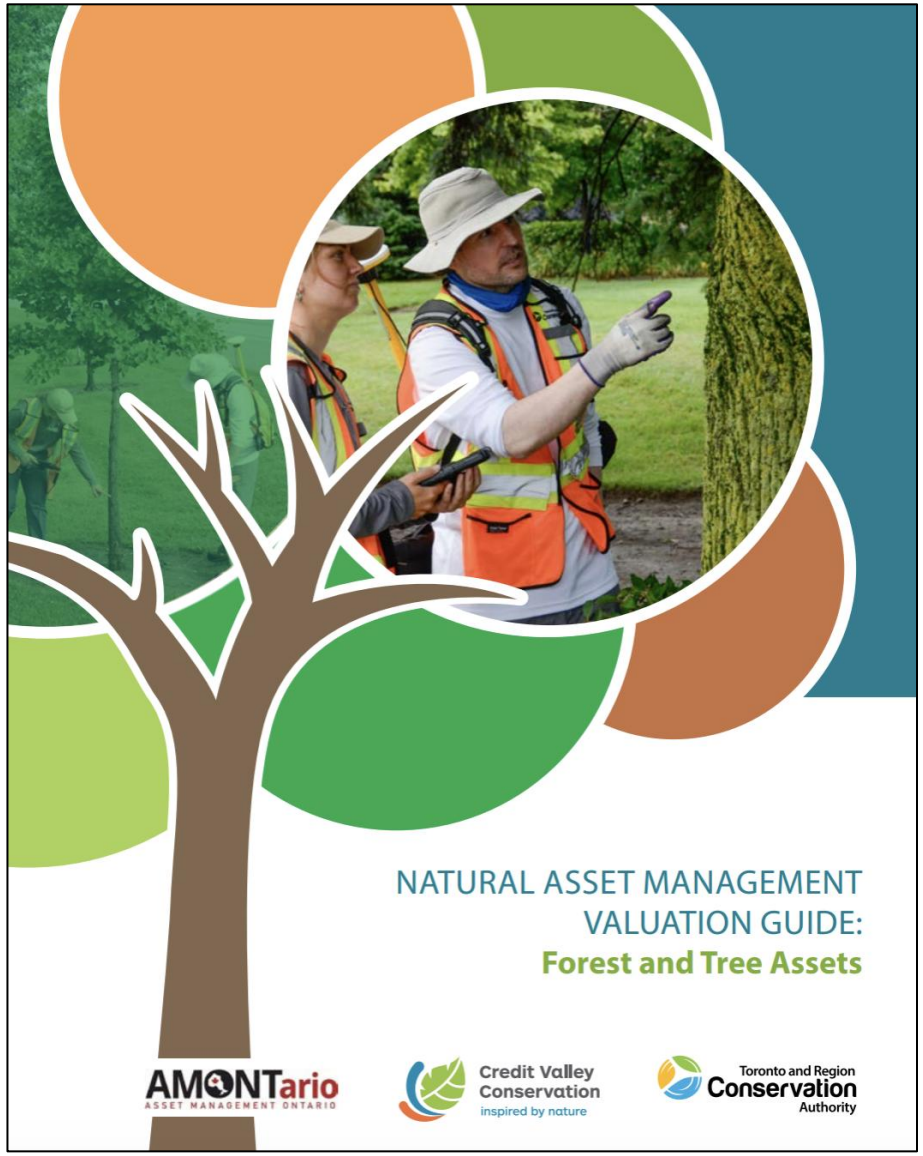
ENHANCED ASSETS:*
- Rain gardens
- Green roofs and walls
- Bioswales
- Urban trees
- Naturalized stormwater ponds

ENGINEERED ASSETS:*
- Permeable pavement
- Rain barrels
- Cisterns
- Perforated pipes
- Infiltration trenches

GREY INFRASTRUCTURE:*
- Bridges
- Roads
- Parking lots
- Culverts
- Pipes

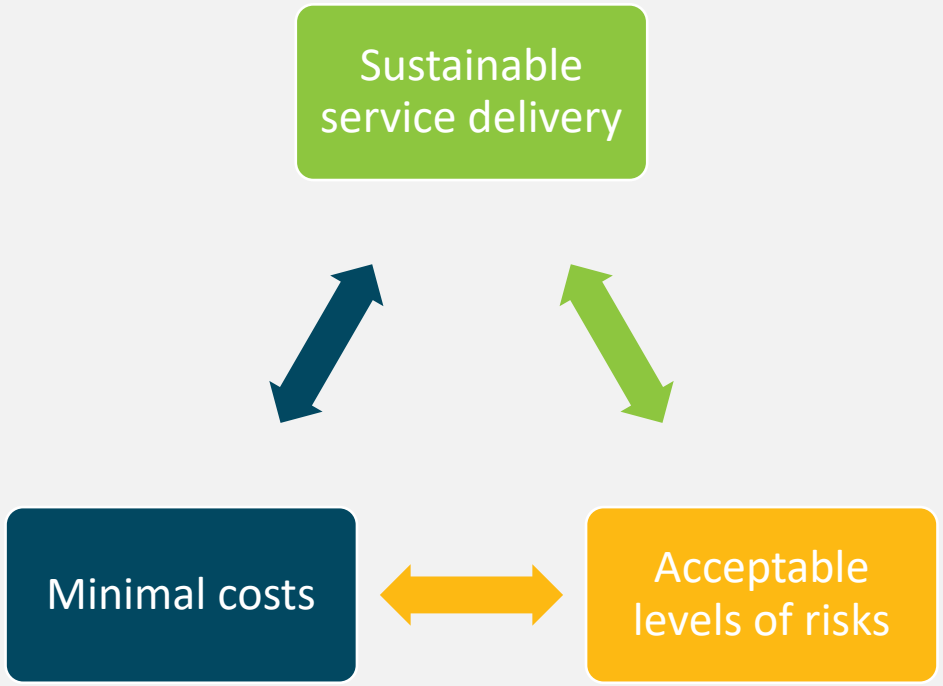
Valuation Guide

- Practitioner focused
- Outlines multiple methods, makes recommendations
- Step by step calculations

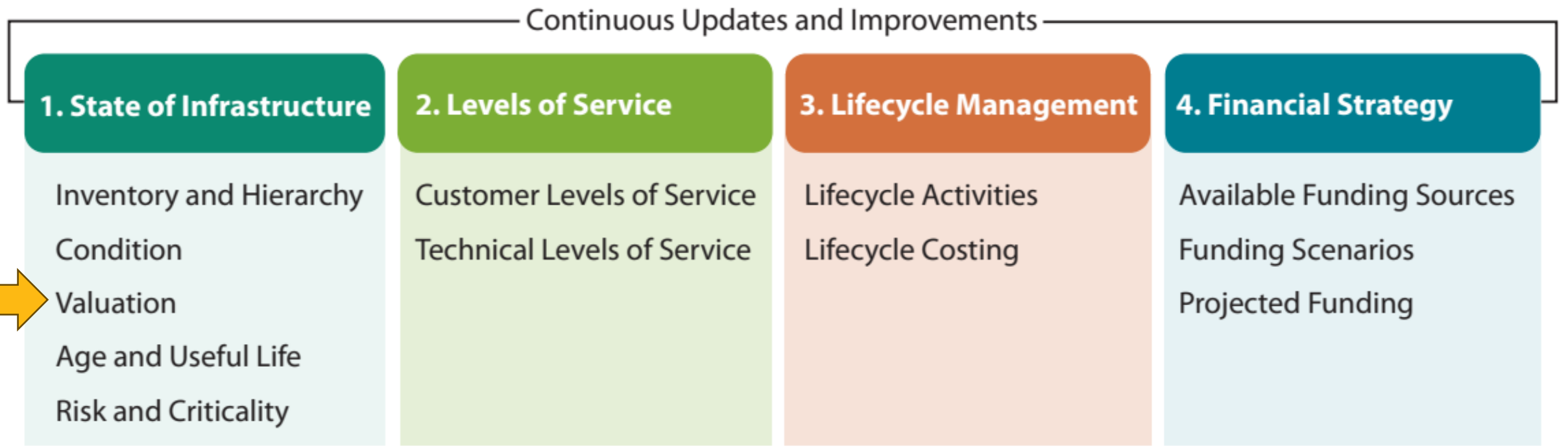


Asset Management Planning

A process that aims to balance:



Asset Management Planning



Purpose of Asset Value

Pipes

- 500 m
- Length
- **$550 K**

Street Trees

- 350 trees
- Units
- **$875 K**

Forests

- 5 ha
- Area
- **$791 K**

- **Apples-to-apples comparison measure across all green (natural) and grey (traditional) assets**
- Common unit of dollars, $

York Region Corporate AMP

Service Group	Service Area	Current Replacement Value ($M)
Community & Health Services	Housing Services	$821.3
	Paramedic Services	$20.8
	Seniors Services	$5.6
Corporate Management	Information Technology	$46.8
	Property Services	$439.4
Environmental Services	Energy Management	$1.6
	Forestry	$488.3
	Waste Management	$153.0
	Wastewater | CORE ASSET	$4,026.9
	Water | CORE ASSET	$1,941.1
Transportation Services	Roads | CORE ASSET	$3,552.2
	Transit	$557.3
York Regional Police	Police Services	$249.3
Total		$12,303.6

Forestry assets reported along side all other corporate assets

Current Replacement Value (CRV)

Determines an asset's value based on the total cost to replace it today. This includes:

1. Using modern and cost-effective methods and materials
2. Meeting the required level(s) of service
3. Incorporating any updated standards or regulatory requirements

Asset Value vs Lifecycle Costing

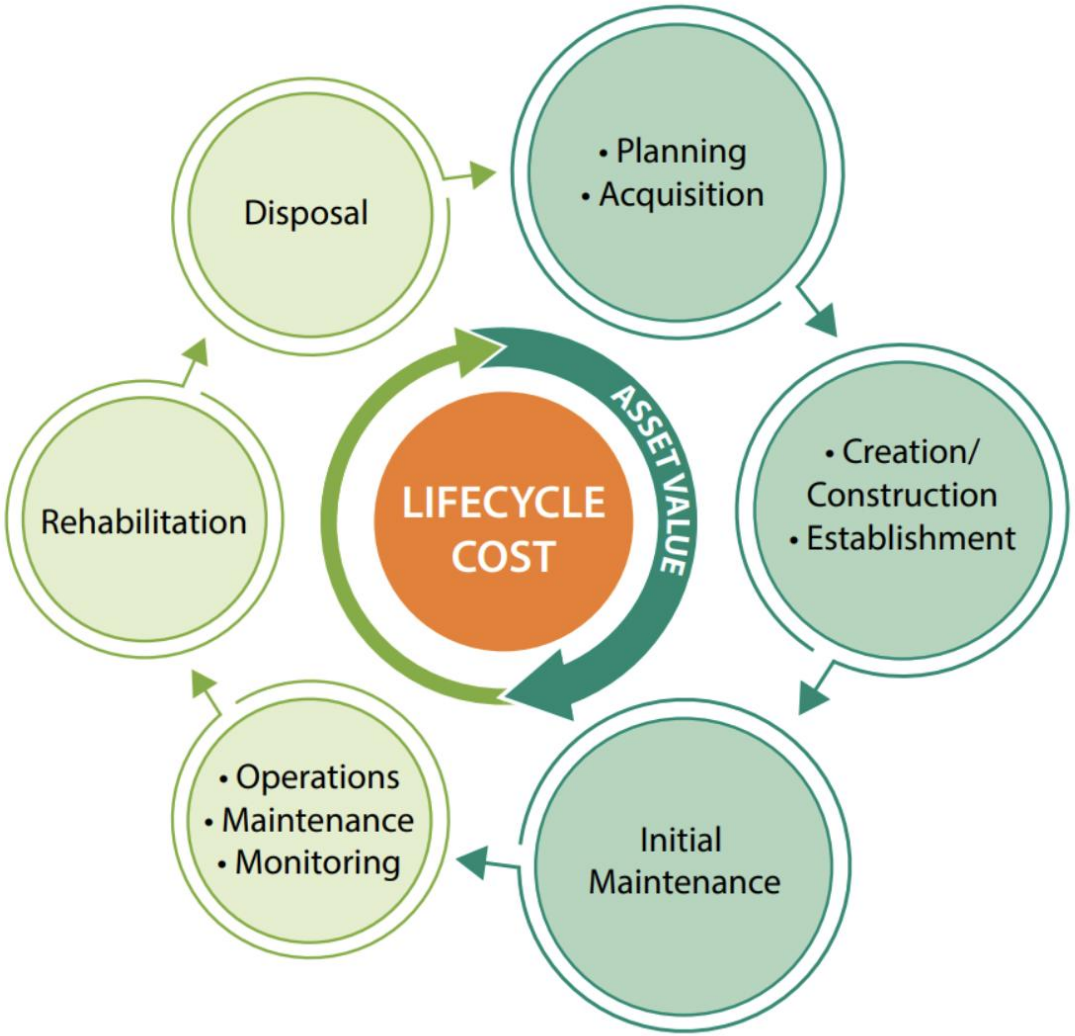


TABLE 14. COSTS AND PHASES ASSOCIATED WITH THE LIFECYCLE OF A FOREST ASSET

Lifecycle Phase	Current Replacement Value	Lifecycle Cost	Description
Plan and Acquire	$50,000	$50,000	Studies, project management, public engagement, planning, land acquisition *(if recent)*
Create and Establish *(from Table 11)*	$169,000	$169,000	Site preparation, tree planting, habitat installation, and 5 years of monitoring and maintenance *(e.g., watering, invasive species control)*
Operate and Maintain	-	$2,000,000 ($40,000/year x 50 yrs)	Invasive species control, pruning, thinning, hazard tree removal
Monitor	-	$500,000 ($10,000/year x 50 yrs)	Forest health monitoring, ecological assessments
Rehabilitate or Dispose	-	$0 (not applicable or minimal)	Not typically disposed, ideally shifts to natural succession
TOTAL	$219,000	$2,719,000	-
Multiplier	20 m^2/ha ÷ 5 m^2/ha = 4	-	A basal area of 20m^2/ha; lifecycle costs are not adjusted for age, they are based on actual costs
TOTAL *(Adjusted for natural asset age)*	**$876,000**	**$2,719,000**	-

Other Valuation Methods

Biodiversity Offsetting

Land Value

Ecosystem Service Valuation

Biodiversity Offsetting

- Often use similar theory
- TRCA's Guideline informed methods in the Guide
- Does not exist in many municipalities

Barrie

Ecological Offsetting Fee Table Example Calculation with Tree Removal Permit			
Item	**Replacement Rate***	**Total Area or Quantity****	**Total ($)**
Woodlot Tree Removal Compensation Fee	$57,500 / ha	2.7 ha	$155,250
Individual Tree Compensation Fee	$500 / tree	3	$1,500.00
	Total Offsetting Fee Payment		**$156,750**
Ecological Offsetting Fee Table Example Calculation Without a Tree Removal Permit			
Item	**Replacement Rate***	**Total Area or Quantity****	**Total ($)**
Woodlot Tree Removal Compensation Fee – No Permit	$140,500 / ha	2.7 ha	$379,350
Individual Tree Compensation Fee – No Permit	$1,220 / tree	3	$3,660.00
	Total Offsetting Fee Payment		**$383,010**

* Rate from the Fees By-law at the time of policy approval, to be amended annually.
** Example of development removal of 2.7 ha of woodland plus 3 individual trees

Land Value

- Not included in traditional asset CRV
- Market value is volatile
- Zoning impacts

Ecosystem Service Valuation

Ecosystem services valuation

- Economic Valuation
- Useful for making a business case for protecting and managing green infrastructure
- Does not align with the valuation method used for traditional assets

Asset value for asset management planning

- Current replacement value
- Asset focused
- Consistent across all assets in an asset management plan

Ecosystem Services

Types of services:

- Stormwater Management /flood mitigation
- Avoided healthcare costs
- Property Value Increases
- Recreational use
- Carbon Storage and Sequestration
- Air Quality Improvements

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Street and Park Trees

- Individual trees, inventoried and managed as such
- Planted or naturally seeded
- Typically along road rights-of way, road allowances, or in parks
- Urban and rural

Asset Value Guiding Principles

Set up the inventory to support valuation	Be efficient
Value calculation method needs to be feasible, replicable, and establish a process for regular updates	Don’t make it too complex
Alignment with Corporate Asset Management approach	Apples-to-apples comparison
New or better information can emerge, this can impact value estimates	Continuous improvement

Value Calculations

Current Replacement Value = Tree Unit Cost x Number of Trees

Unit Cost ($ per tree) = Average Tree Price + Installation Cost + Establishment Cost (3 years)

- **Tree price:** the average nursery cost for the plant (a caliper-sized tree)
- **Installation cost:** includes the planting labour, transportation, any basic design fees, and/or shipping expenses of a tree
- **Establishment costs:** include the costs for tree establishment, including initial mulching and watering (for a 2-year warranty period), and mulching and watering for at least one additional year
- Typically NO tree or stump removal costs

Unit Cost Sources

- Internal tender or contract documents
  - Or similar from neighbouring municipality or conservation authority
- Local tree nursery costs for caliper-sized trees
- International Society of Arboriculture Ontario's (ISAO) "Ontario Supplement" cost table

TABLE 4. AVERAGE TREE PRICES FOR TEN COMMON TREE SPECIES IN SOUTHERN ONTARIO[4]
(Soured from ISA cost table, inflated from 2021 to 2025 CAD using a rate of 15.88%)

Botanical Name	Common Name	Number of Nurseries with Prices	Rounded Average Caliper (mm)	Average Tree Price (inflated to 2025 costs)
Acer x freemanii	Freeman maple	2	90	$429
Celtis occidentalis	Hackberry	5	80	$370

Remember to inflate all costs to current year

Accounting for Age

- Current replacement value assumes the replacement is delivering the same services (**like-for-like replacement**)
- Built assets may provide services immediately after construction, but **natural assets take time to establish**
  - For example, the services provided by a 50-year-old tree cannot be matched by replacing it with a young, small tree.

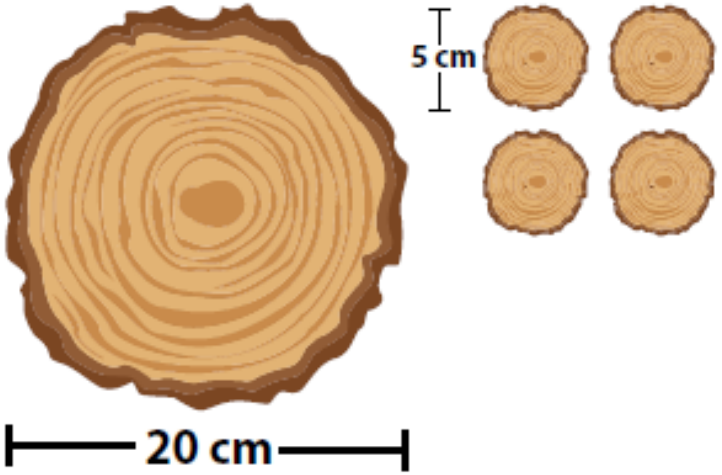
➢ Recommended approach is to account for the age or size of the asset by **using a multiplier to increase the replacement cost of mature assets** (e.g., estimating the cost of replacing a single mature tree with multiple small trees)

Multipliers – Diameter or Basal Area

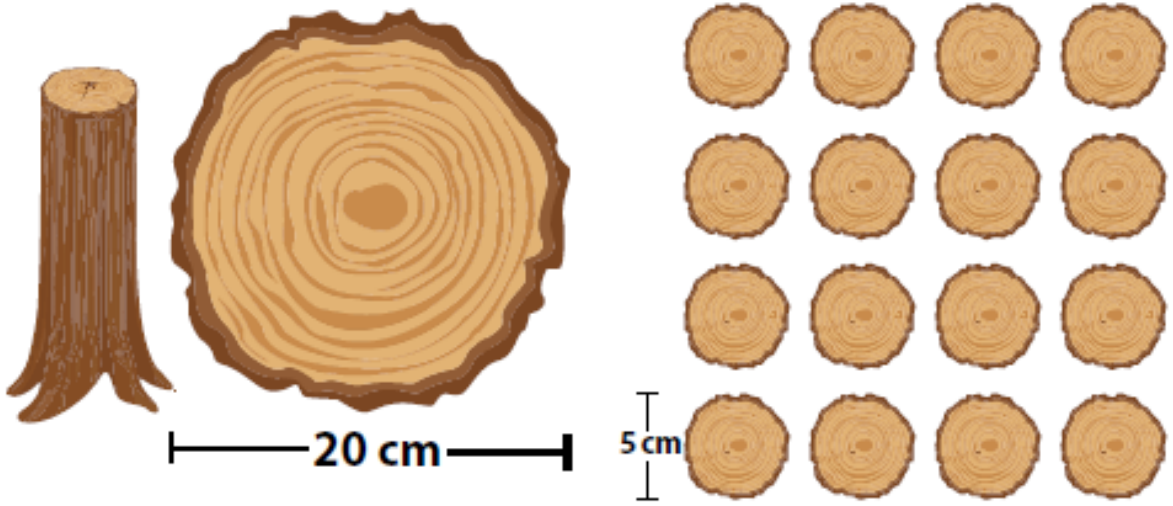
Current Replacement Value = Tree Unit Cost x Number of Trees*

*Quantity of Replacement Trees – based on tree **diameter** or **basal area**

Trunk Diameter Replacement Tree



Basal Area Replacement Tree



Basal Area = πr^2 = 314.1 cm²

Basal Area = πr^2 = 19.6 cm²

Size-based Street and Park Tree Valuation Methods

- **CTLA Trunk Formula**
- Trunk Diameter
- Trunk Basal Area

Description	Data Required	Advantages
Assumes one tree is 'replaced' by several trees which together have the same basal area but then depreciates the value of the tree based on its location, functionality, and condition	• Tree diameter at breast height (DBH) • Unit cost per tree • Condition • Functional limitations • External limitations	• Accounts for the exponentially larger service level of bigger trees • An internationally recognized tree replacement cost valuation method

Disadvantages

- Manual is proprietary and purchasing the manual has an associated cost
- Data intensive
- Complicated to calculate, high risk of miscalculation errors
- Very specific to each tree, whereas asset management valuation attempts to use general/average costs
- Depreciation not included for other traditional assets
- Considers tree condition, which is not included in valuation of traditional assets

Size-based Street and Park Tree Valuation Methods

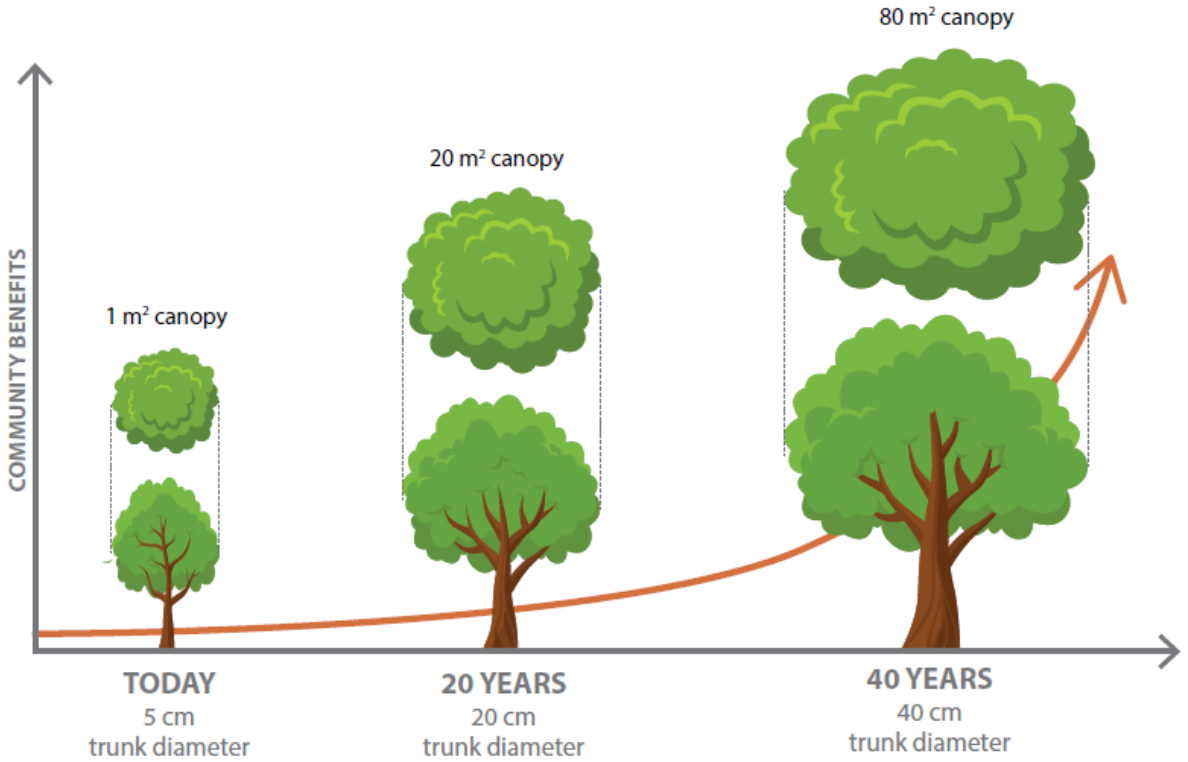
- CTLA Trunk Formula
- **Trunk Diameter**
- **Trunk Basal Area**

Description	Data Required	Advantages
Assumes one tree is 'replaced' by several caliper-sized trees which together have the same trunk diameter as the tree being assessed	• Tree diameter at breast height (DBH) • Unit cost per caliper tree	• Simple to calculate • Accounts for increased services of larger trees **Disadvantages** • Underestimates the true size and results in a lower value per tree in comparison to the Trunk Basal Area and CTLA Trunk Formula methods
Assumes one tree is 'replaced' by several caliper-sized trees which together have the same basal area as the tree being assessed	• Tree diameter at breast height (DBH) • Unit cost per caliper tree	**Advantages** • Fairly simple to calculate, involves a basic equation • Accounts for the exponentially larger service level of bigger trees **Disadvantages** • Can result in very high valuation for large trees

Street and Park Tree Valuation Method Comparison

TABLE 6. METHOD COMPARISON BY TREE SIZE

METHOD	VALUATION			
Tree DBH*	5 cm	10 cm	30 cm	50 cm
Trunk Diameter	$1,000	$2,000	$6,000	$10,000
Trunk Basal Area	$1,000	$4,000	$36,000	$100,000



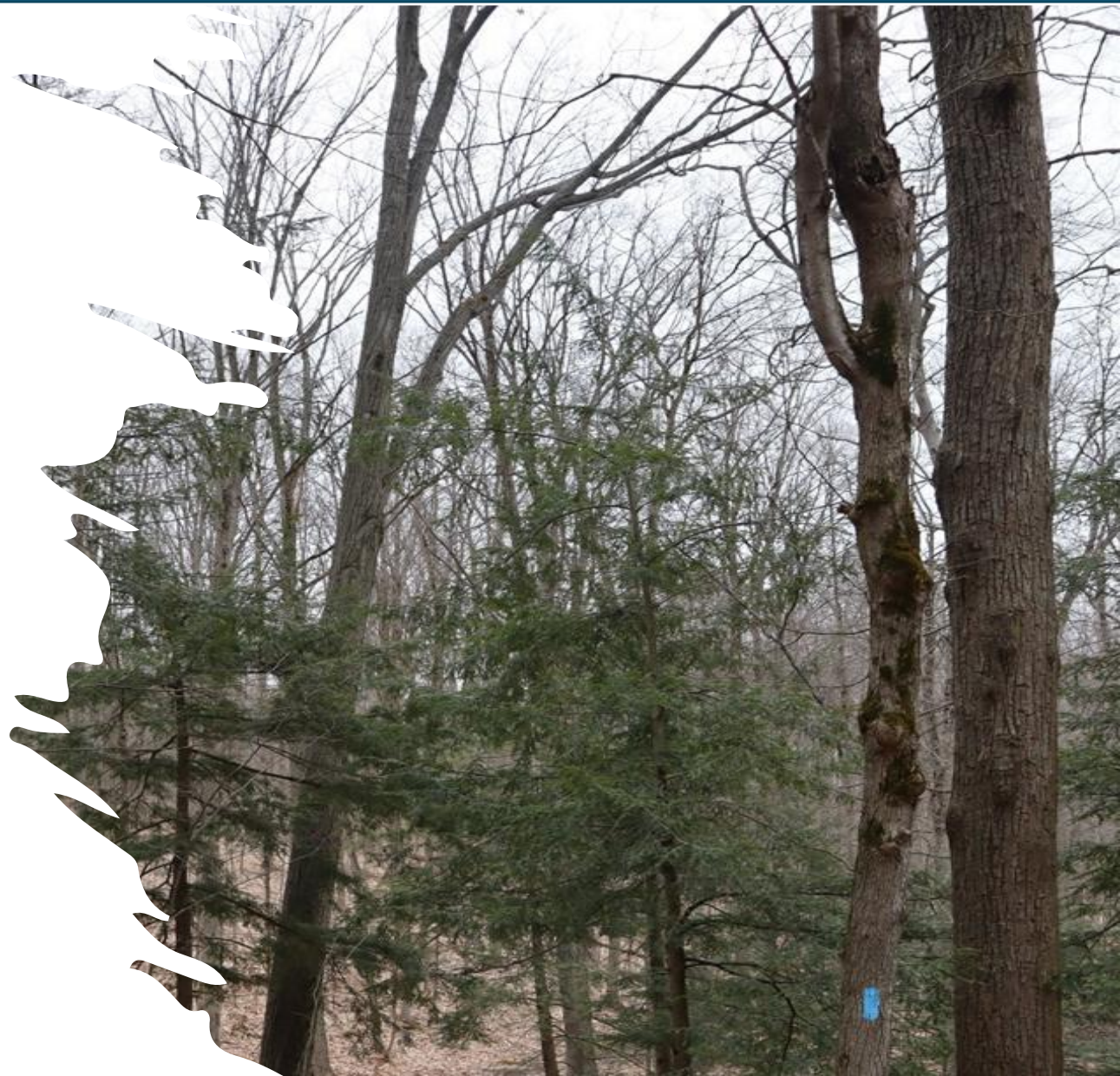
Recommendations

	Trunk Basal Area	Trunk Diameter	CTLA Trunk Formula	One-to-One
Efficient	✓	✓		✓
Not too complex	✓	✓		✓
Apples-to-apples with grey infrastructure	✓	✓		✓
Accounts for **exponentially** higher services of large trees	✓	✓	✓	
Area for continuous improvement		✓	✓	✓

Valuation Approaches for Forests

What are Forests?

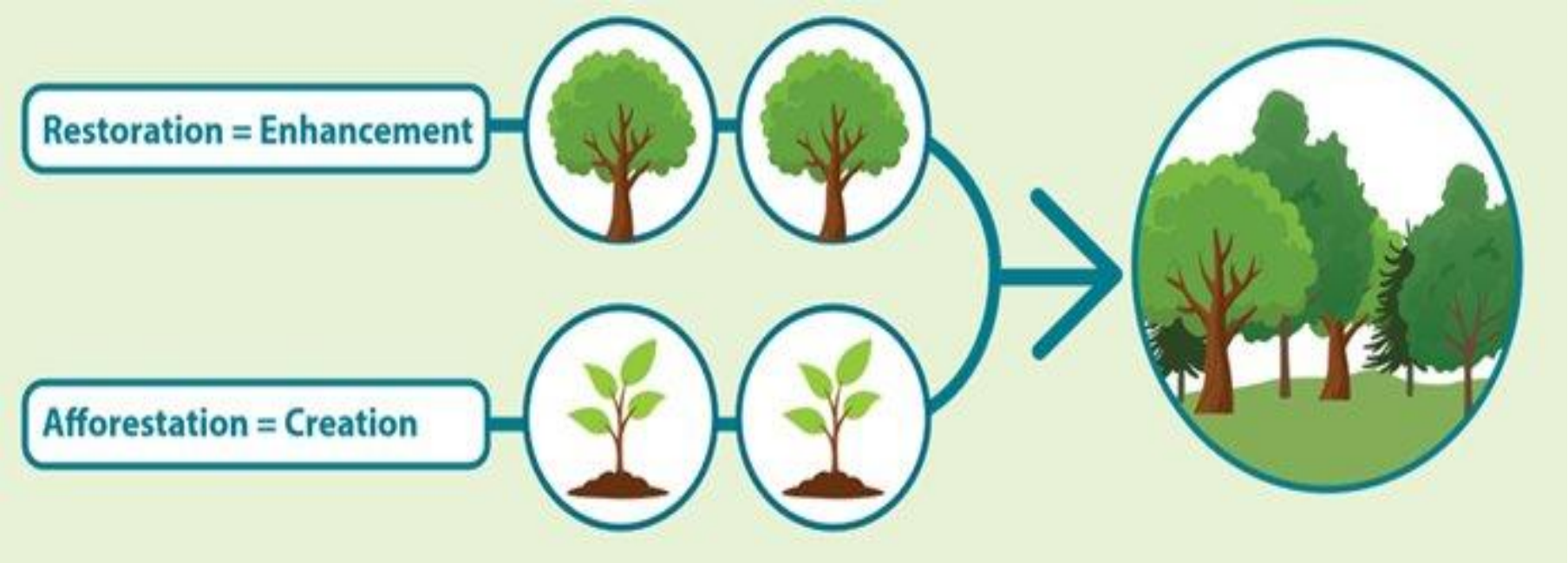
- A treed community: tree canopy cover > 25% in terrestrial or wetland ecosystems, e.g., savannahs or treed swamps
- Woodland: A terrestrial tree community with canopy cover > 35% and <= 60%
- Forest: A terrestrial tree community with canopy cover is > 60%



Forest Valuation

Current Replacement Value =
Afforestation/Restoration Cost per Ha x Area of the Forest Asset

Restoration vs. Afforestation



Options for Forest Valuation

- **Option 1:** Afforestation Cost Method

Current Replacement Value = Afforestation Cost per Ha x Asset Area

- **Option 2:** Afforestation Cost Method with Multiplier to Account for Age

Current Replacement Value = Afforestation Cost per Ha x Asset Area x Multiplier

Forest Valuation Methods: Overview and Data Requirements

Method	Description	Data Required
Afforestation Cost Method	A per unit area afforestation cost rate is estimated and applied to the area of the asset to obtain a total replacement value	• Forest area (hectares) • Afforestation cost rate
Afforestation Cost with Basal Area Multiplier	The Afforestation Cost Method is used to calculate a base replacement cost. This value is appreciated by applying a multiplier which takes into account the stand basal area of the asset, where basal area is used as an indicator of the structure and function of the forest	• Forest area (hectares) • Afforestation cost rate • Stand basal area

Forest Valuation Methods: Pros and Cons

Method	Advantages	Disadvantages
Afforestation Cost Method	• A standard approach applicable to all asset types • Simple to calculate • The replacement cost represents the cost of creating an asset of the same size	• Does not account for age
Afforestation Cost with Basal Area Multiplier	• Partially accounts for forest age • Benchmark afforestation cost rate and base replacement cost can still be used for lifecycle costing as needed • Stand basal area can be assessed objectively, quickly and cost-effectively using a wedge prism, widely used by foresters	• More steps to apply, more data to collect • Basal area is an imperfect indicator of forest structure and function • The quality of the species comprising the basal area are not directly accounted for • Thinning can result in a sudden drop in basal area and therefore value

Choosing Afforestation Approach

Traditional vs. Enhanced

- Using a tractor to machine-plant coniferous species over a large area.
- Does not aim to create a natural forest in the short term, but rather to establish forest conditions (shade, soil health, and wind protection)
- Pros: inexpensive, quick to start, and does not require as much site preparation or after care
- Cons: takes longer to start providing the same levels of service as a mature natural forest; can be more susceptible to disease and pests.

- Planting a greater diversity of species by hand, in varying densities and patterns, and adding habitat features.
- Pros: produce naturalized forests that provide variety of services faster; more resilient to disease and pests; long-term savings on maintenance and management costs.
- Cons: expensive

Identifying Activities

Activities/Costs	Traditional Afforestation
Project Management	Project initiation, planning, execution, control, and closing
Planning and Design	Site assessment, species selection, development of a planting plan
Site Preparation	Soil preparation, site grading and hydrological restoration, and removal of vegetation as needed
Planting	Seedlings
Monitoring	• Monitoring of vegetation for at least 3 - 5 years • Optional fauna monitoring
Establishment Activities	• Including follow-up infill planting, and competition control

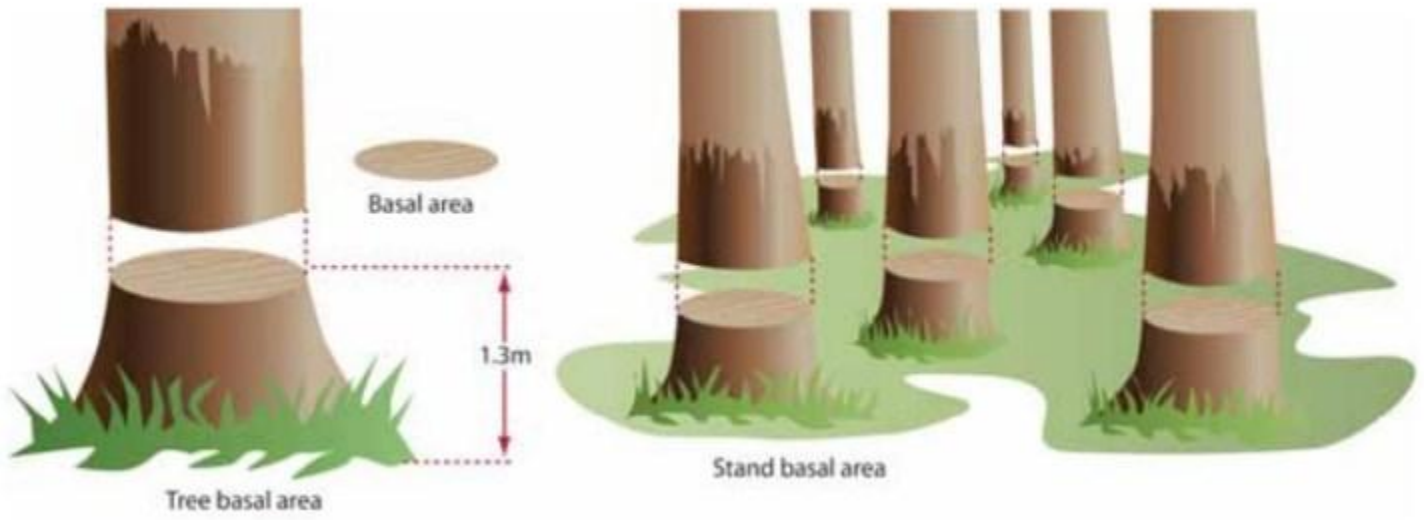
Calculating Afforestation Unit Cost Rate

Activities	Traditional Coniferous Afforestation (1 ha)	Enhanced Afforestation Planting (1 ha)
Project Management	$5,000	$5,000
Site Preparation	$2,000	$17,000
Deer Fence	$0	$38,000
Planting	$10,000	$65,000
Plant Replacement	$2,500	$18,000
Habitat Installation	$0	$26,000
Monitoring/Site Assessment	$5,000	$5,000
TOTAL	**$24,500**	**$174,000**

Forest Basal Area Multiplier

Mature forests assumed to have larger basal area than younger forests

$$BA = \pi \times (DBH/2)^2$$



Current Replacement Value =
Afforestation/Restoration Cost per Ha x Asset Area x Multiplier

Calculating Forest Basal Area Multiplier

Average basal area (m^2/ha)	Basal area of 10-year-old restoration site (m^2/ha)	Multiplier
10	5	**2**
12	5	**2.4**
15	5	**3**
18	5	**3.6**
50	5	**10**
55	5	**11**

- 10 years after planting, a stand basal area of 5 m^2/ha is expected
- Multiplier = $\frac{\textbf{Stand basal area}}{\textbf{5 m}^2\textbf{/ha}}$

Key Takeaways

- If possible, consider valuation approach before collecting inventory data to capture inputs necessary for valuation (e.g., DBH, forest basal area)
- Apply straightforward valuation approach that reflects size/age
  - Accounting for age can be an area for improvement if data are not currently available
- Valuation for natural assets should be aligned in approach with grey/traditional infrastructure to ensure consistency

Opportunities for Advancement

- Develop Standardized Guidelines
- Create Detailed Valuation Guidance on Other Natural Asset Types
- Collaborate on an Approach for Invaluable Assets
- Develop Tools
- Conduct Training


Questions?