

Beyond an Inventory – Taking Campus Tree Management to the Next Level

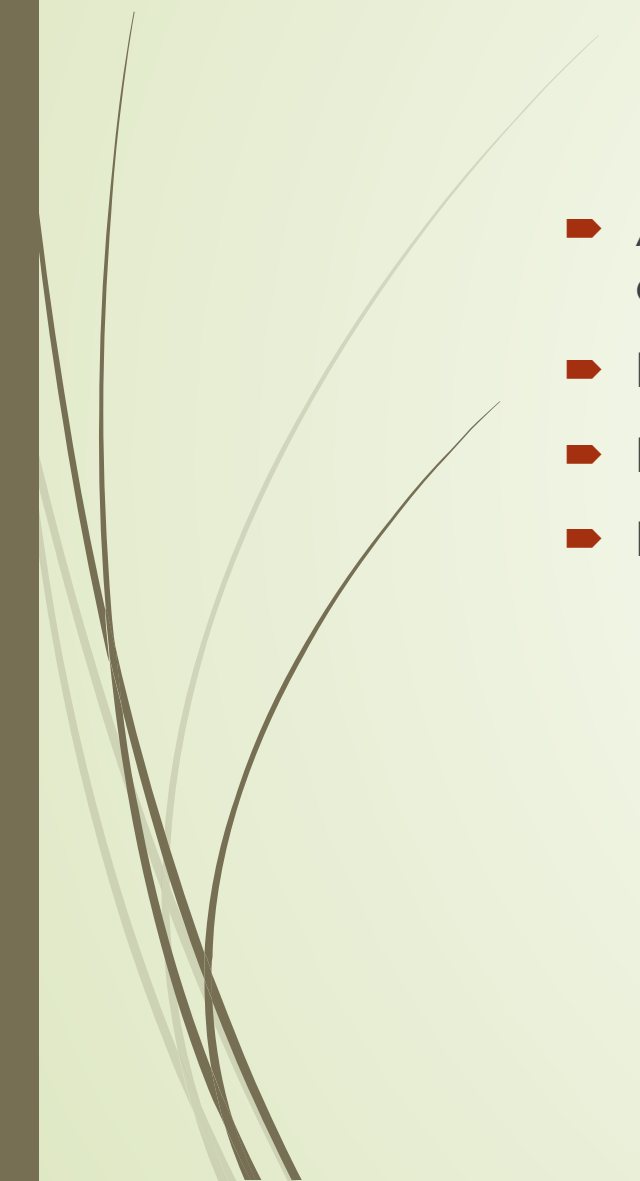
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Quick Poll

- ▶ Are you responsible for maintaining trees and other green infrastructure on campus? Other roles in the room?
 - ▶ Does your campus have a tree inventory of some sort?
 - ▶ How many Tree Campus USAs?
 - ▶ How many seeking that designation?
- 



Outline

- The Why
 - The How
 - Items to Consider
 - Takeaways
- 



The Why



— Davie Poplar, University of North Carolina at Chapel Hill, circa 1970 to early 1980s.



Common Reasons to Inventory Campus Trees

- ▶ reduce risk exposure
- ▶ increase/develop a budget
- ▶ know what you have, plan accordingly for the future
- ▶ public engagement – perhaps both students and non-students
- ▶ alumni relations, donor or sponsor a tree opportunities
- ▶ track canopy over time

Many more...





The How



Approaches

- ▶ complete inventory...whole campus or might be phased
- ▶ limited inventory (i.e location, species, DBH, condition only)
- ▶ sample plots (i.e. i-Tree Eco)
- ▶ top down only canopy assessment
- ▶ risk assessment – level 2; level 1; hybrid; no risk just basic attributes

Complete Inventory

PENN STATE MONT ALTO (112)

Tree Details for Elm-Chinese (Tree ID 486)

PREV

NEXT



TREE DETAILS

Common name: Elm-Chinese
Scientific name: *Ulmus parvifolia*
Height class: Medium
Diameter at breast height: 3.7 in.
Age class: Semi-mature
Canopy radius: 15 ft.
Condition: Good
Tree Asset Value: \$358.08
Location Information: [View](#)

TREE INFO

RECOMMENDATIONS

IMAGES

DEDICATION INFO

CUSTOM FIELDS

ADDITIONAL INFO

TREE & SHRUB WORK RECOMMENDATIONS

Record of recommendations for care and maintenance.

Tree & Shrub Work Phase: 3

Date	Name	Description	Completed By
	Root Collar Excavation		
	Pruning	Pruning Category: Maintenance Pruning System: Natural Pruning Goal 1: Develop branch structure Pruning Goal Other: Structural	

Limited Inventory

Treeid	Code	Genus Species	latitude	longitude	dbh1	dbhHeight	conditionClass
1	NYSY	<i>Nyssa sylvatica</i>	35.44639919	-80.83043183	26	4.5	Fair
2	QUAL	<i>Quercus alba</i>	35.44641263	-80.83056188	26	4.5	Poor
3	QUAL	<i>Quercus alba</i>	35.44630883	-80.8306297	25	4.5	Good
4	LITU	<i>Liriodendron tulipifera</i>	35.44627544	-80.83073677	24	4.5	Good
5	QRU	<i>Quercus rubra</i>	35.44646089	-80.83077547	26	4.5	Fair
6	FRPE	<i>Fraxinus pennsylvanica</i>	35.4465891	-80.83075129	32	4.5	Fair

Sample Plots



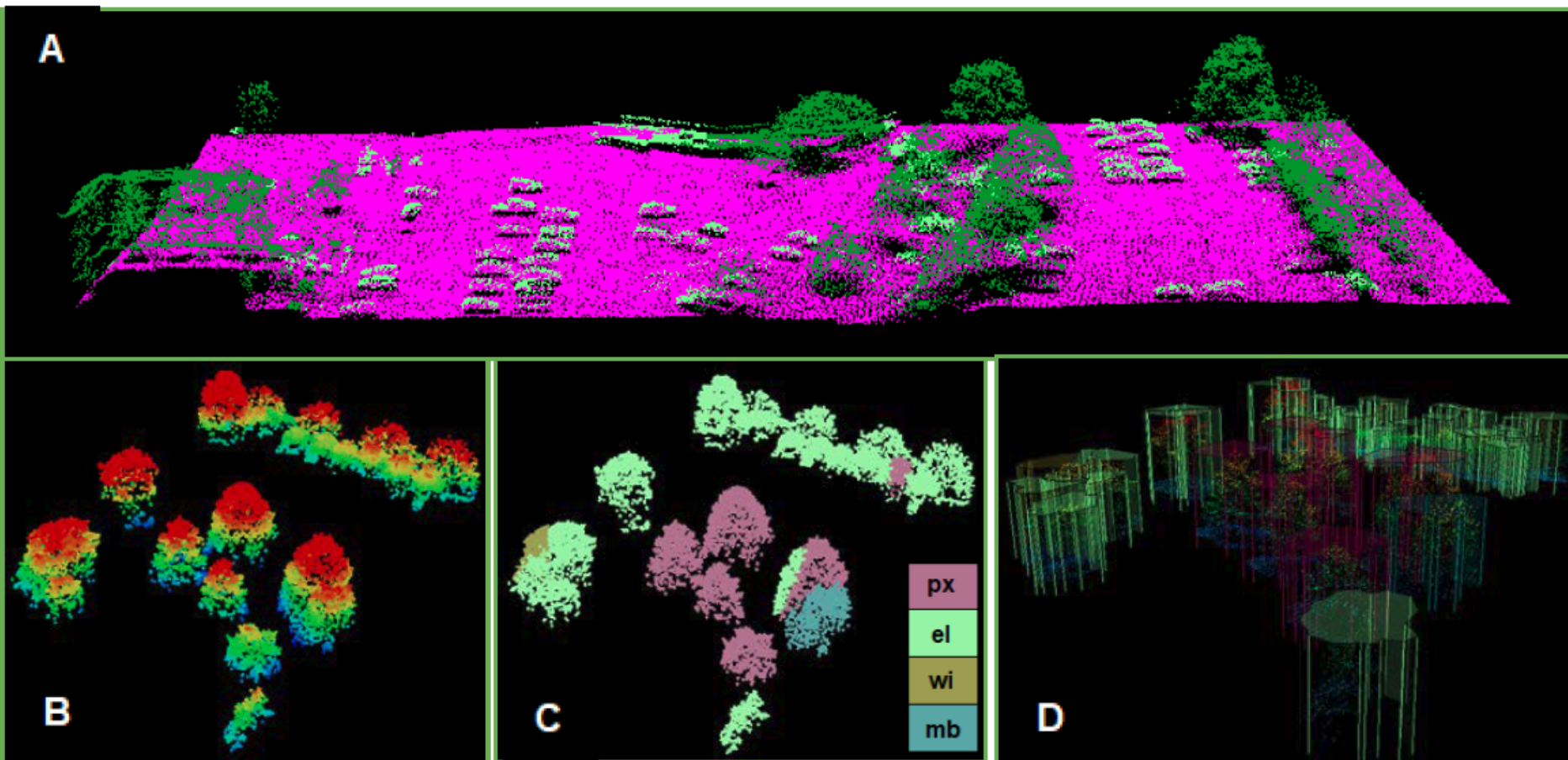
Ecosystem Service	Amount
Tree Cover	11.92 acres
Carbon Storage	352.6 tons
Carbon Storage Value	\$45,700
Carbon Sequestration	9.177 tons/year
Carbon Sequestration Value	\$1,190/year
Oxygen Production	24.47 tons/year
Avoided Runoff	18,760 cubic feet/year
Avoided Runoff Value	\$1,250/year
Pollution Removal	557.2 pounds/year
Pollution Removal Value	\$8,580/year

Net Annual Benefits

\$11,021

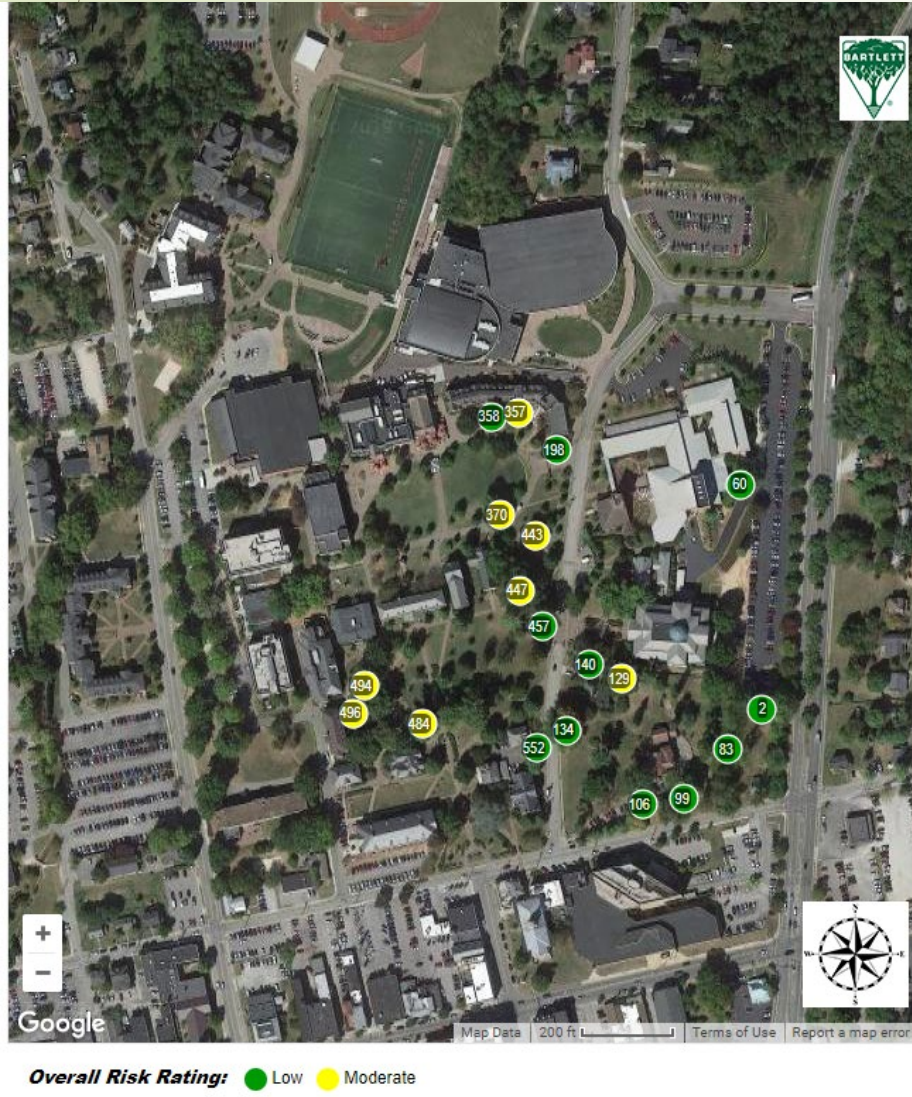
\$10.98/tree

CITY OF XXXXXXXXXX PHASE II DEMONSTRATION: TSI and i-Tree analysis of Subset Area 1



The full LiDAR of Subset 1 (A) can be seen above. As most trees within this subset occur on the righthand side of the parking lot, the three sub-images are focused there. The sub-images are broken down as follows: (B) LiDAR classified by elevation, (C) LiDAR classified by species, (D) LiDAR with TSI segmentation superimposed on top.

Risk Assessment Approaches



TREE RISK ASSESSMENTS AND MITIGATION (21 Trees)

Tree ID	Common Name	DBH	Condition	Overall Tree Risk Rating	Primary Target	Tree & Shrub Work Phase	Recommendation	Defect(s) or Observation(s)
109	Oak-Water	24	Poor	Moderate	Fence	ASAP	• Removal	• Dieback (severe)
79 *	Hackberry-Southern	31	Fair	Low	Driveway	1	<ul style="list-style-type: none"> • Level 3 Advanced Assessment: Stem • Prune: Reduce risk of branch stem and/or root failure • Prune: Reduce weight of branch ends 	<ul style="list-style-type: none"> • Suppressed • Co-dominant stems • Cavity-stem
82 *	Oak-Water	30	Fair	Low	Building	1	<ul style="list-style-type: none"> • Level 3 Advanced Assessment: Root • Prune: Reduce risk of branch stem and/or root failure 	<ul style="list-style-type: none"> • Dead branches >2 • Poor branch structure • Decay-Root flare • Fungi/conks
1443	Oak-White	27	Fair	Low	Deck	1	• Removal	<ul style="list-style-type: none"> • Dead branches >2 • Cavity-stem • Decay-Stem • Fungi/conks
1519 *	Ash-Green	27	Fair	Low	Path	1	<ul style="list-style-type: none"> • Level 3 Advanced Assessment: Stem • Prune: Reduce risk of branch stem and/or root failure 	<ul style="list-style-type: none"> • Dead branches >2 • Cavity-stem



Items to Consider


Exhibit A - List of Attributes

Name	Field	Comments
TREE ID	Integer	Unique ID for each tree to match metal tag on tree (if tags are installed), no need to keep numbers in current inventory
POINT X	Real	State Plane X coordinate
POINT Y	Real	State Plane Y coordinate
CREATED CREATION DATE	Date	Date the tree is entered into the data set, the first attributes will be ID, X, and Y
CREATED BY	Text	Person and Organization who entered the data for first time
CREATED SOURCE	Text	Source for data that is entered (Field Inspection, Bartlett, Aerial, etc.) significant source of descriptive information
BOTANICAL NAME	Text	Trees are identified by genus and species using both botanical
COMMON NAME	Text	As there may be multiple common names, one name should consistently applied based on genus and species.
TREE TYPE	Text	Deciduous, Conifer, or Deciduous Conifer
SPECIES NOTE	Text	Note if the tree form is not typical for a tree of this species.
DIAMETER	Real	Diameter is measured to the nearest inch in 1-inch size classes at 4½ feet above ground, or diameter at breast height (DBH), using a Biltmore Stick. Diameter of largest Trunk/Stem if multiple trunks/stems
TRUNKS	Integer	Number of tree trunks if a tree has multiple stems on trunks splitting less than 1 foot above ground level.
AGE CLASS	Text	New Planting, Young, Early Mature, Mature, Advanced Age
CONDITION	Text	Consider stress, poor structure, damage, soil and root problems, disease, and pests for assigning Good, Fair, Poor, or Dead.
PRIMARY MAINTENANCE	Text	Assignment of maintenance needs; None, Remove, Prune, Train, Stump Removal
DEFECTS AND PESTS	Text	Structural defects and record the most significant condition; Dead and dying parts, Broken/hanging branches, Cracks, Weakly attached branches/codominant stems, Missing or decayed wood, Tree Architecture, Root problems, Borers, Root Rot, Vines, Etc.
RISK	Text	Tree poses a risk to people/property (Low, Moderate, High, and Extreme), state method of classification, i.e. International Society of Arboriculture Tree Risk Matrix
RISK NOTES	Long Text	Describe likelihood of failure (Imminent, Probable, Possible, Improbable) of area of concern (Branches, Crown, Roots, Stem) for targets (Building, Lighting, etc.) associated likelihood of impacting the targets (High, Medium, Low, Very Low) and the resulting consequences (Severe, Significant, Minor, or Negligible)
MAINTENANCE NOTES	Long Text	Notes describing proposed maintenance including date and who has made the recommendation and actions taken including who did the work and date
FURTHER INSPECTION	Text	Tree requires additional and/or future inspections due to a variety of issues; Recent damage inspection, Advanced risk assessment, Insect/disease monitoring, None
DATE OF ASSESSMENT	Date	The date data are collected is recorded
OVERHEADWIRES	Y/N	
LOCATION	Text	A location type designation, for example: campus lawn, street tree, in tree well, etc. (We need to develop a pick list of designations)
EXPOSEDROOTFLARE	Y/N	Indicates if the root flare of the tree is visible.

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to that goal
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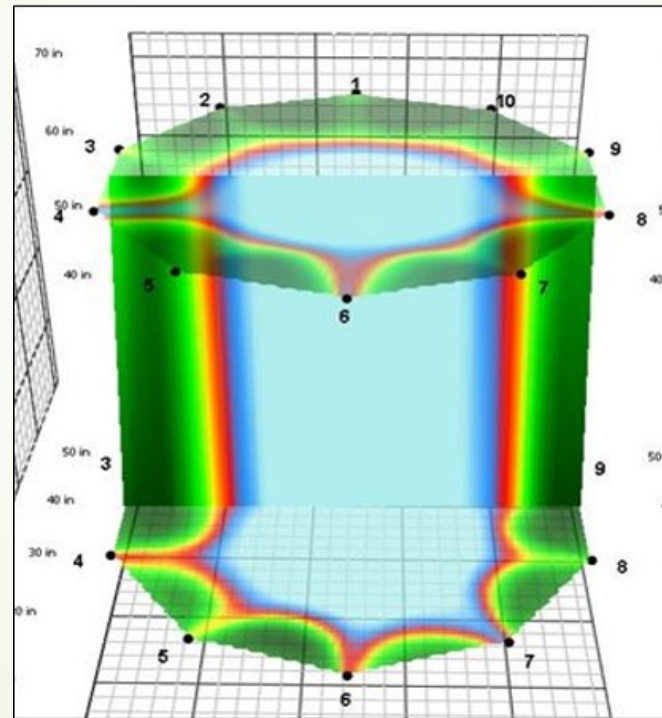
Lessons Learned

- ▶ **Clearly define the goal of your campus tree inventory and ensure your data collection approach is well-suited to that goal**
 - ▶ **Attribute/field selection – the less free text the more searchable and filterable your data is**
 - ▶ **Know your data's limitations**
- 

Who is assessing your trees?



Common Reasons to Inventory Campus Trees



Common Reasons to Inventory Campus Trees

TEN HIGHEST VALUED TREES

Estimated Tree Asset Value

As part of the Bartlett inventory process, we have included an Estimated Tree Asset Value for each tree and a cumulative total for all trees inventoried. We use an average per square inch nursery price, size (DBH), species factor, condition factor, and location factor to estimate the tree asset value. This is not intended to replace a tree appraisal.

The following data fields are used in this formula:

Data Field	Description
Average Per Square Inch Nursery Price	Based on the average nursery prices for two common tree species and one exotic tree species within a region, then taking the average of those three as the average per square inch price for the region
Size	Based on tree DBH (4.5 feet above grade)
Species Factor	Relative species desirability based on 100% for the tree in that geographical location. In most cases, species desirability ratings, published by the International Society of Arboriculture, are used for adjustment.
Condition Factor	Rating of the tree's structure and health based on 100%
Location Factor	Average rating for the site and the tree's contribution and placement, based on 100%

$$\text{Estimated Tree Asset Value} = (\text{Average Per Square Inch Nursery Price} * \text{Size}) * \text{Species Factor} * \text{Condition Factor} * \text{Location Factor}$$

The estimated cumulative total value for all trees inventoried is **\$8,867,507.89**. The following table lists the ten trees with the highest Tree Asset Values:

Common Reasons to Inventory Campus Trees

TREE SPECIES IDENTIFIED

Relative Performance Index: A relative performance index (RPI) was calculated for the tree species inventoried. This protocol was adopted from the Vibrant Cities Lab (www.vibrantcitieslab.com) and provides a metric of the benefits a tree species provides in a community. For a single species, the percentage of trees in good condition are divided by the percentage of all trees in good condition throughout the entire population. This system states that tree species with a RPI of 1.0 or higher will generally provide more benefits to the community, which may make them a better choice for new plantings. The RPI for all species that make up 2% or more of the total number of trees inventoried are summarized.

Tree Species Breakdown Total Trees: 130 (17)

Genus	Species	Common Name	Additional Taxonomy	Count	% Distribution Total	Relative Performance Index
Acer	rubrum	Maple-Red		12 (6)	9%	3.82
Acer Total				12	9%	
Carya	tomentosa	Hickory-Mockernut		2 ()	2%	0.00
Carya Total				2	2%	
Diospyros	virginiana	Persimmon		2 ()	2%	0.00
Diospyros Total				2	2%	
Fagus	grandifolia	Beech-American		4 ()	3%	0.00
Fagus Total				4	3%	
Fraxinus	pennsylvanica	Ash-Green		3 ()	2%	0.00
Fraxinus Total				3	2%	
Liquidambar	styraciflua	Sweetgum		14 ()	11%	0.00
Liquidambar Total				14	11%	
Liriodendron	tulipifera	Tuliptree		38 (5)	29%	1.01
Liriodendron Total				38	29%	
Nyssa	sylvatica	Tupelo-Black		1 ()	1%	
Nyssa Total				1	1%	
Oxydendrum	arboreum	Sourwood		1 ()	1%	
Oxydendrum Total				1	1%	
Quercus	alba	Oak-White		18 (4)	14%	1.70
	falcata	Oak-Southern Red		12 (1)	9%	0.64
	rubra	Oak-Northern Red		23 (1)	18%	0.33
Quercus Total				53	41%	
Grand Total				130	100%	





Takeaways

- ▶ Clearly define your goals
- ▶ Determine how and to what extent you want to share the data
- ▶ Identify and empower relevant stakeholders – both data collectors/maintainers & decision makers
- ▶ Reassess, refine & repeat

Wrap Up

Thank you for your time today, happy to answer any questions.

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