ALAS: Root zones are not circular like a drawing

- Determine the size of success
- Determine the soil situation
- Define the rooting depth of reasonableness
- Determine the soil volume needed
- Draw it as a semi-circle or a quarter circle
- Place your tree into it
- Adjust the arcs against the flat side to strengthen the distances perpendicular to the flat surface.

61

62

Dead Trees Don't Flower

- Normal lifespan is species dependent
- Specific life expectancy is also site dependent
- Trees can be expensive to purchase
- Trees take time to reach "design size" and are expected to live long periods once established

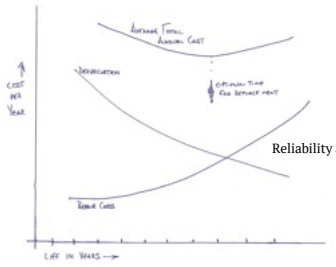
63

General management

- You need to know how something works before you can understand
  - how to manage it
  - how it breaks or
  - how/if it can be repaired
- As a capital expense or a component in the workings of a larger investment.. You could look at the question as one of depreciation…. knowing when to cut the cord is important
- Trees (plants) appreciate over time after transplanting, but then in decline they could fall into a value depreciation model

64

Urban trees as a capital investment



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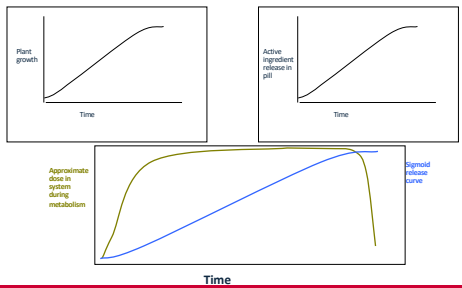

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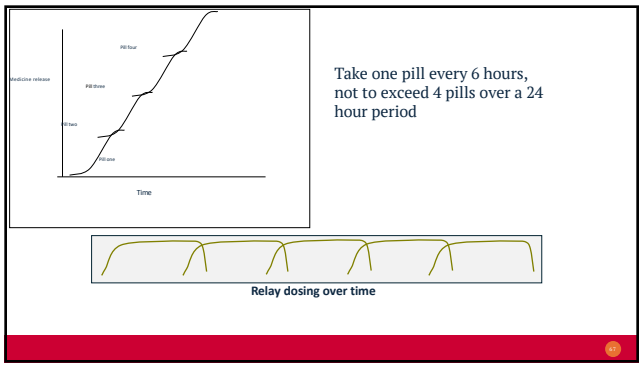
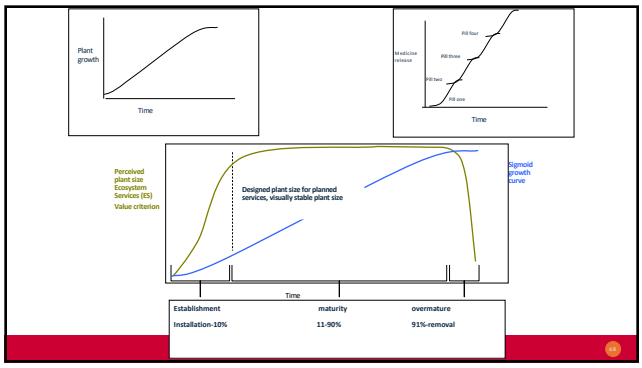
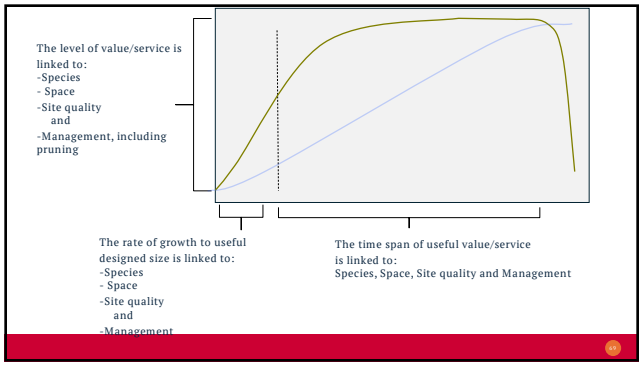

Medicine release
Pill four
Pill three
Pill two
Pill one
Time
Take one pill every 6 hours, not to exceed 4 pills over a 24 hour period
Relay dosing over time

67


Plant growth
Time
Medicine release
Pill four
Pill three
Pill two
Pill one
Time
Perceived plant size Ecosystem Services (ES) Value criterion
Designed plant size for planned services, visually stable plant size
Sigmoid growth curve
Time
Establishment
maturity
overmature
Installation-10%
11-90%
91%-removal

68


The level of value/service is linked to:
-Species
- Space
-Site quality and
-Management, including pruning
The rate of growth to useful designed size is linked to:
-Species
- Space
-Site quality and
-Management
The time span of useful value/service is linked to:
Species, Space, Site quality and Management

69

Viable Soil Volumes Impact Establishment Success: You also need to define acceptable growth to evaluate success – or – space for trees is needed below ground

70

- Soil Volume and Tree Size Are Linked to Management Intensity
- Define and plan for a successful tree and then provide appropriate space for the future tree

71

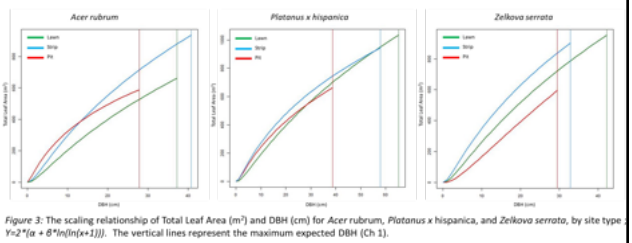


Figure 3: The scaling relationship of Total Leaf Area (m^2) and DBH (cm) for *Acer rubrum*, *Platanus x* hispanica, and *Zelkova serrata*, by site type. $Y=2*(\alpha + \beta*\ln(\ln(x+1)))$. The vertical lines represent the maximum expected DBH (Ch 1).

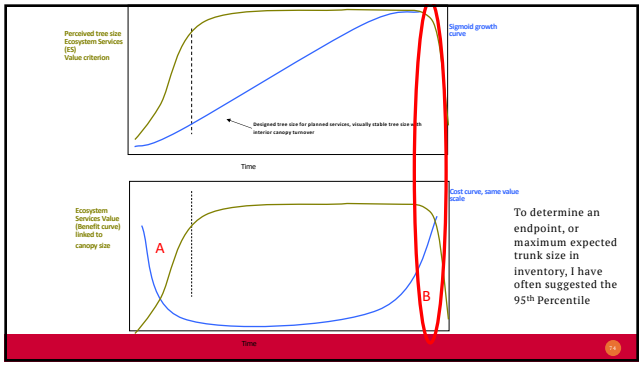
Figures: Richard Leopold, USDA FS Doctoral Dissertation, Rutgers University: GROWTH RATES AND MORPHOLOGY OF STREET TREES: AN ANALYSIS OF DIFFERENT SITE TYPES OF URBAN AREAS IN NEW JERSEY

72

Thick trunks don't always mean large trees or big canopies.

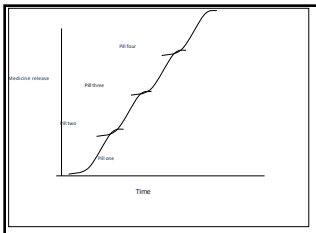
The size of the canopy often relates directly to environmental service capacity or "value"

73

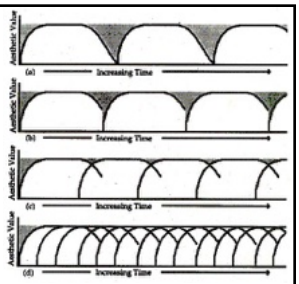


To determine an endpoint, or maximum expected trunk size in inventory, I have often suggested the 95th Percentile

74



Relay dosing over time



Source: Palmer M D. 2004. The management of tree replacement in mature urban landscapes. PhD Dissertation Burnley College University of Melbourne. adapted from Cobham 1984 p 12 and Hitchmough 1994a p 270.

75

Theoretical Modeling of Ecological Services

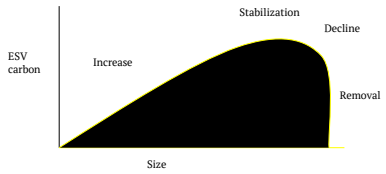


Fig. 1. Simple Conceptual Model of Ecological Services Value: Carbon storage in bole //major branches of tree w-o damage

Slide credit: Alan Seivert; Forester Ohio DNR

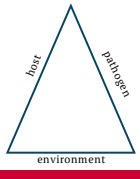
76

Wow! That was messy, let's take a breath

77

There are often times when a choice is made: Whether to treat or to condemn …

the decline spiral and the disease triangle
a jumping off point for the discussion on *being attentive to predisposing factors and avoiding or minimizing them*, and when it's too late to effectively put efforts into saving a tree or community of trees



78

Notice, that many of the predisposing and inciting factors are soil conservation in development and maintenance

- This ought to inform our understanding of how common abiotic and biotic agents force trees beyond the threshold from stress to decline and death in urban landscapes.
- The key is, where….or if…..you can interrupt the spiral?

79

The big problem which needs some solution: how much time do you have left? Ans. Know your inventory

- Look for natural size distributions in your area based on the site type.
- Define the largest expected tree,
- Figure or estimate growth rate
- Figure your time left with the tree in question

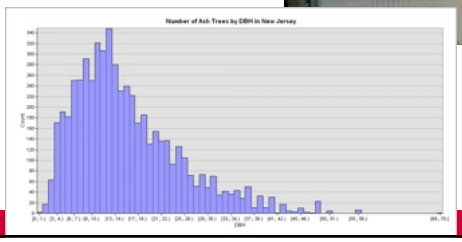
80

- Voorhees Mall, Rutgers College Avenue Campus
- *Ulmus americana*
- Initial trees planted 1880s
- Life expectancy
  - 175-200 years (300 on good sites)

81

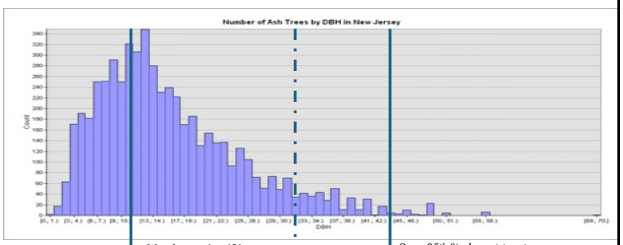
Emerald Ash Borer in NJ

- Rapid Ash Survey Team



82

Emerald Ash Borer in NJ



Small trees, feed through chipper and replace asap

Worth treating if in good condition and of value

Will not live through treatment period, expensive to treat, phase out

Over 95th %, do not treat, manage removals by safety

83

Choosing to treat

- It is too often a fast and automatic response to a client's request.
- Often we go through a process without pausing to reflect on the process, or how to best defend our opinions resulting from that process.
- Some folks hesitate to ask for a professional in fear or assumption of a person selling their preferred option as product versus objective solution

84

85

Ownership can drive different decision-making factors

Understanding the client can inform your management response

- Ask questions on timing
- Listen for cues on tolerance….. Total control versus thresholds and tolerances
- Why does the client make the call, concern for preservation, fear of liability, aesthetics over function……image?
- Some folks want answers, others want options
- All groups benefit with information supporting your informed decision to understand the costs/investments
- What type of client do you have……

86

- **Arboricultural choice**
  - Science
  - Economics
  - Ethics

Landscape management, tree care, nursery production alike

- The craft (art) is in the application of knowledge toward a purpose…. we can call that "practice".
- The *Practice* is guided and informed by research findings, a sober appraisal of cost and a guiding balance on the short term versus long term result… to return value to the client and the environment

87

- Arboricultural choice
  - Science
  - Economics
  - Ethics
- **Personal Taste**

- Beauty is in the eye of the beholder.
- What one person finds attractive another will find ugly.
- I am very much against the use of Crimson King Norway Maples.

88

- Arboricultural choice
  - Science
  - Economics
  - Ethics
- Personal Taste
- **Emotional**

- Each person has a unique history with a tree or species.
- It may be good or bad.
- ***Neither personal taste nor emotional decision are ever wrong***.

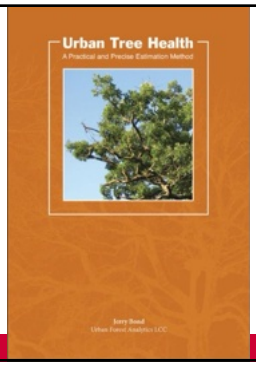
89

- Arboricultural choice
  - Science
  - Economics
  - Ethics
- Personal Taste
- Emotional

- With a private tree….. people with some level of similar taste and common background and one household income make their tree decision based on all three types of choices.
- Sometimes they even agree
- With a public tree, the urban forester has to "read the room" then inform on the best action

One should consider all three types in developing the sale and information transfer to guide the client to informed/preferred choices

90



We talk a good deal about tree health, but how to assess it?

- Ratio: live canopy: height
- Opacity: light through canopy zones
- Vitality: growth to tips
- Growth: annual shoot extension
- Quality: conformance to normal (leaf)

91

Ok, getting to the process

- Is this a biotic problem (insect or disease) or an abiotic problem (flooding, heat, exhaust)
- Is this an acute event or a recurring situation; recurring with what level of likelihood?
- Are you dealing with the issue or with a symptom? You're usually called to deal with symptoms.
- Go through a full diagnostic process even if you feel it is obvious

- What is the treatment supposed to accomplish: curative, therapeutic, prophylactic
- IS it worth the fight or no?
  - Economics of the treatment if over many trees
  - Provide the backup for recommendation, develop options
- Precision versus pragmatism
- Systematic planning is preferable to a reaction to the week's issues

92

Steps Involved in Plant Problem Diagnosis

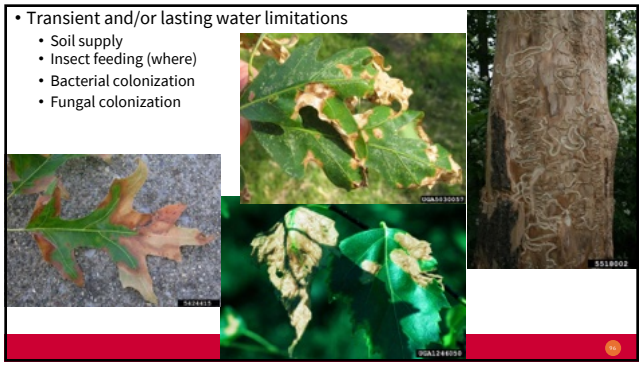
1. Define the problem
   1. Identification
   2. What is normal (at that time)
   3. Signs versus symptoms
   4. Examine the plant and the community
2. Look for patterns
3. Define the time-scale of the development of the damage pattern
4. Query –or- investigation
5. Synthesis of information to determine probable cause

93

Symptom versus sign: Leaves wilting

94

95



96

So a list

1) Is the tree worth it?
   - Y/N
   - Species/site linkage, then condition: biological and mechanical
2) Define the timeline in play
   - Client timeline
   - Issue timeline
   - Tree lifespan timeline
3) Choose primary and alternative values
4) Define the client's attitudes and link to values/benefits over the chosen treatment and expected tree life cycle
5) Define the costs of treatment of the cycle
6) You need a growth curve, or look up a likely curve from i-Tree or other resource
7) Try to link DBH to chosen value, unless you can get a direct tie to a different measure
8) Scale treatment costs by DBH
9) Play out benefits over time versus costs

97

To treat or remove is a false dichotomy for municipalities or large communities of trees on a contract…and often to the residential client

- Privately owned trees
- People move….a lot……. So, an average home ownership cycle is….
- What is the tree contribution to sale value or turn-over time at competitive home price point?
- Where is the tree in its normal lifespan; based on its size for the species and the site?

- Cost benefit of treating
  - If you can treat for a full treatment cycle (like 15+ years for EAB) for the less than or the same cost as removal.
  - But then, you must sell your home before the end of the treatment cycle.
  - If you don't sell, you did not save money.
  - Otherwise, you have to rely on pointing to specific services: I-Tree design may be useful tool
  - A nice sales conversation add-on to raise your client's opinion of your guidance

98

Treat or remove is not very useful or appropriate for municipalities

- Publicly owned
  - The presumption is that the tree lives and provides value exceeding the cost to save it after treatment is completed OTHERWISE
  - If you can treat for 24 years for the same cost as removal…
  - Then you must sell the park or city property sooner than 24 years
  - If you don't sell you did not save money
- Cities are not selling property
- The values are in the common interest, not solely in a market interest
- BUT stormwater contributions may well show a fiscal argument for treatment, especially for larger trees worthy of treatment

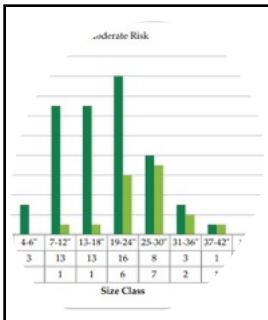
- All city ash trees will die.
- All city trees will die.
- All trees will die and will have to be removed.
  - or picked up off of someone or something
- For Cities it is Treat **and** remove.

99

- If you begin to treat then stop you still are faced with **all** of the removal cost you had when you started treating.
  - Ok if the idea is to spread removal costs over time
  - Otherwise it is an added expense from poor follow-through
- Removal is not failure unless it is not warranted for the situation, to the detriment of the larger values in place.

100

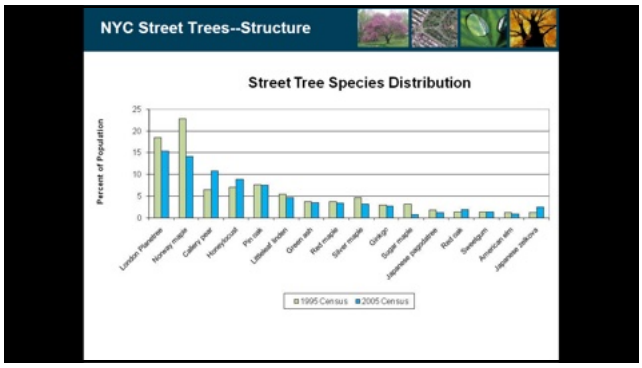
101



Inventory

- Species
- DBH
- Current/Potential Height in categories (Small/Med/Large)
- Condition (Good/Fair/Poor/Very Poor/Dead)
- Location
- Notes

102

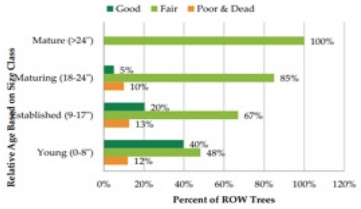


103

Key Metrics derived from an Urban Tree Inventory

Data to inform management and planning

- Stocking
- Species Composition
- Diameter Distribution
- Age Structure
- Relative Condition
- Prioritized Maintenance Needs



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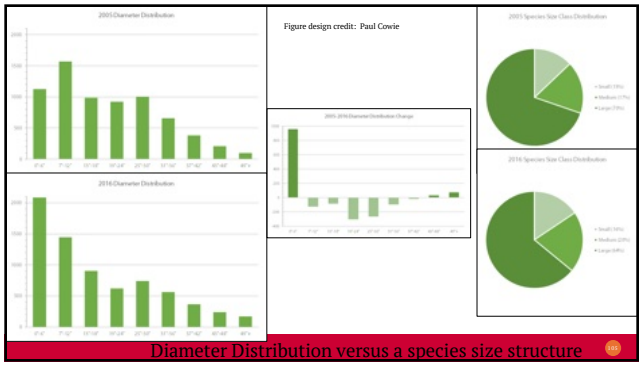

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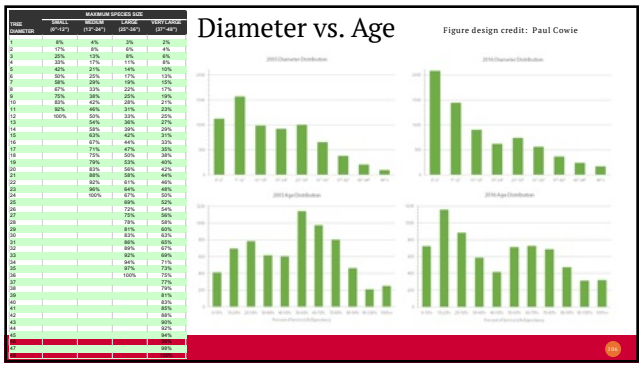

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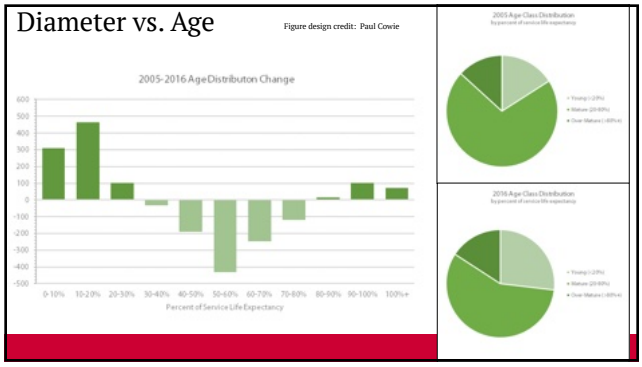


107

Working on keeping what you have in the inventory

- How many municipal trees do you have in the community?
- How many people are in the community?
- Trees/people?
- So what does $0.50 or $1.00 per person per year look like for your tree budget compared to now?
- What do your trees provide to the community?
- Would an outreach campaign get folks to urge for your budget come Arbor Day 2025?

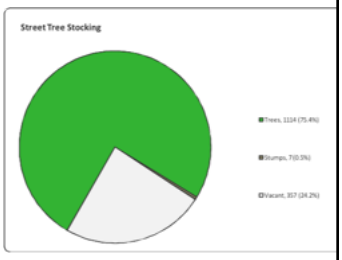
108

Stocking

Figure and initial slide design credit: Paul Cowie

- Trees + Stumps + Vacant Spots
- Maximum stocking
- Maximum practical stocking

- Street tree spacing; is more better?
- Placement and hardscape conflicts



109

Figure and initial slide design credit: Paul Cowie

Planting Rate Calculation

$$\frac{\text{Annual Removals} + (\text{Vacant Sites} / \text{Years})}{\text{Planting Survival Rate}} = \text{No. of Trees to Plant per Year}$$

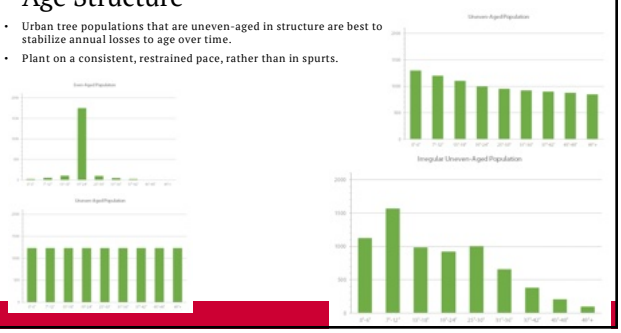
50 + (1200 / 35) = 94

Planting Survival Rate: 90%

110

• Age Structure

- Urban tree populations that are uneven-aged in structure are best to stabilize annual losses to age over time.
- Plant on a consistent, restrained pace, rather than in spurts.



111

Diversity, diversity, diversity

- Diversity helps insulate the tree population from catastrophic losses to (usually) biotic problems.
- 30 – 20 – 10 Rule (???)
- 15 – 10 – 5 is better, but is it enough?
- Cultivars
- Local monocultures OK, but build diversity town-wide.

112

Resource Management

A.
What Do
We Have???

113

Resource Management

A.
What Do
We Have???

B.
What Do
We Want???

114

Resource Management

A.
What Do
We Have???

B.
What Do
We Want???

115

Resource Management

A.
What Do
We Have???

Tree
Inventory

B.
What Do
We Want???

116

Resource Management

A.
What Do
We Have???

Tree
Inventory

B.
What Do
We Want???

Community
Forestry
Management Plan
Goals

117

Resource Management

A.
What Do
We Have???

Tree
Inventory

→ Objectives + Management Decisions

B.
What Do
We Want???

Community
Forestry
Management Plan
Goals

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Resource Management

- The shortest distance between two points is a straight line.
- Every decision you make and every project you undertake should be based on what you have and take you one step closer to what you want.
- Every decision you make and every project you undertake should be deliberate and focused on achieving your goals; no detours.

119

Questions

120

Some random examples of Species Composition Goals

- "Reduce maples from 38% to 20% in 15 years."
- "Eliminate all native ash within 10 years, while introducing up to 2% Manchurian ash (Fraxinus mandshurica)."
- "Increase up to 2% each those species that are currently <1% and performing well."
- "Introduce at least 5 new species by 2021."
- "Plant at least 5 cultivars of red maple and/or plant seed-source trees."
- "Vary species planted from year to year to maintain species diversity across all age classes."

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