Assessment of Risk & Benefits of Large Trees in Urban Landscapes

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Where the Trees Meet the Seas

URBAN TREE GROWTH & LONGEVITY

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The Official Arboretum of the Commonwealth of Pennsylvania

The Morris Arboretum's Urban Forestry Consultants

- Workshops, Courses, Training
- Tree & Natural Resource Inventory/assessment
- Computer-based Mapping
- Cost Estimation and Planning
- Soil Testing and Tree Diagnostics
- Specification/Ordinance Writing/Development

OUTLINE

- **Tree benefits in urban areas**
- **Tree-related risk**
- **Risk impacts in urban areas**
- **Balancing risk/benefits**

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URBAN AREAS

- **Last year, there were 7.25 billion of us on the planet, of which the global urban population is 3.9 billion, about 54%**
- **About 82 percent of the population of the United States lives within the boundaries of an urbanized area (2010)**

URBAN AREAS

- **Worldwide, urban areas are increasing in population and expanding in size**
- **This expansion is causing a panoply of problems; pollution, flooding, disruption of ecosystem services, etc.**
- **Realization that trees provide value and benefits that offset urbanization:**
  - **Environmental, Social, Economic, and Aesthetic**

TREES HAVE VALUE

- **"Feel Good" Value: Aesthetics**
- **Environmental Value**
- **Social Value**
- **Economic Value**

Aesthetic Value of Trees

- **Define space**
- **Screen unsightly views**
- **Frame desirable views**
- **Provide canopy over space**
- **Make us feel good**

Ornamental/Specimen plants are like painting or tapestry we hang on our walls

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Environmental Value of Trees

- Reduce Heat island effect
- Air pollution abatement
- Reduce non-point source pollution
- Noise abatement

Environmental Value of Trees

- Wildlife value

- Sequester carbon
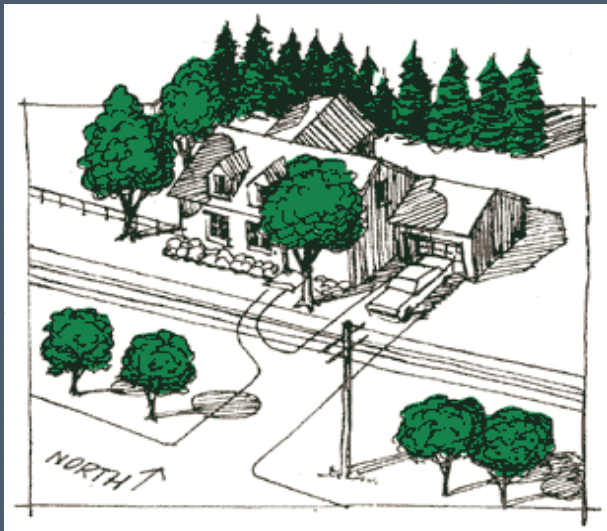
- Provide oxygen

- Reduce greenhouse effect

Photo by Brian MacGowan

Economic Value of Trees

- **Reduced heating and cooling costs**

- **Fewer waste-water treatment facilities**

- **Reduced healthcare costs**

- **Employees are more productive and report fewer absences**

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Trees Increase Property Value

- **Large specimen trees can add 10% or more to property values**

- **A newly planted tree within 50 ft of your home can increase property value by 9%**

- **Tree value appreciates with time**

Business – Economic Benefits

In tree-lined commercial districts

- **More frequent shopping**
- **Longer shopping trips**
- **Shoppers spend more for parking**
- **Shoppers spend 12% more for goods**

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Social Value of Trees

- **Tree-filled neighborhoods:**
  - **Lower levels of domestic violence**
  - **Are safer and more sociable**
- **Tree-filled landscapes reduce our stress**
- **Trees decrease need for medication and speed recovery times**

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14

Trees Pay Us Back

100 Community Trees Over 40 Years

Benefits = $411,000

Energy

Air Quality

Runoff

Real Estate

Costs = $115,000

Planting - Pruning

Removal/Disposal

Irrigation

Sidewalk Repair

Litter

Legal - Admin

Pay Off: $296,000

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TREE BENEFITS

- **Large maturing trees provide greater value**

from McPherson, E.G.; et. al. 2003. Northern mountain and prairie community tree guide: benefits, costs and strategic planting. Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service.

Large Tree
- Total benefits/year = $55
- Total costs/year = $18
- Net benefits/year = $37
- Life expectancy = 120 years
- Lifetime benefits = $6,600
- Lifetime costs = $2,160
- Value to community = $4,440

Medium Tree
- Total benefits/year = $33
- Total costs/year = $17
- Net benefits/year = $16
- Life expectancy = 60 years
- Lifetime benefits = $1,980
- Lifetime costs = $1,020
- Value to community = $960

Small Tree
- Total benefits/year = $23
- Total costs/year = $14
- Net benefits/year = $9
- Life expectancy = 30 years
- Lifetime benefits = $690
- Lifetime costs = $420
- Value to community = $270

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Where the Trees Meet the Seas

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TREE BENEFITS

- **Large maturing trees provide greater value**

value/LE year

Bar chart with y-axis from 0 to 80 (in increments of 10) and x-axis categories: Small Tree, Medium Tree, Large Tree, Xtra Large Tree. Small Tree ≈ 9, Medium Tree ≈ 16, Large Tree ≈ 37, Xtra Large Tree ≈ 72, with an exponential trend curve overlaid.

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17

TREE RISK

- **Large maturing trees increase potential risk**

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Risk?

Risk = (probability of event occurring)

x (impact of event occurring)

Reiss (2004), "The presence of risk is not intrinsically harmful: Risk is simply a measurement of potential for deviation from an expected outcome, and the consequences of this deviation may be either good (resulting in opportunity) or bad (resulting in loss).

The process of dealing with this uncertainty, and trying to achieve the best outcome,…in a changing environment, is the essence of risk management."

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Risk = Target + Defect
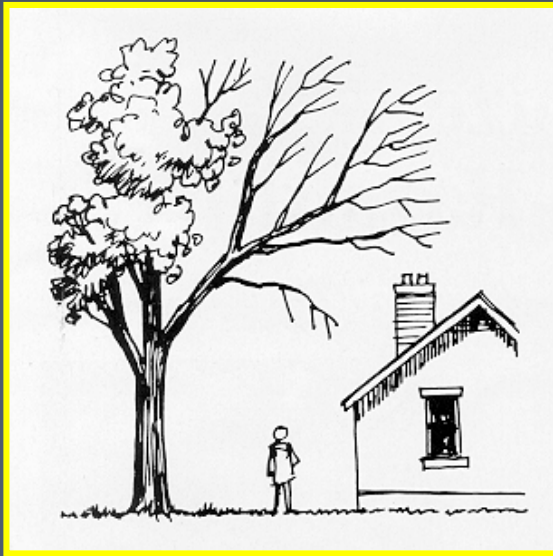
HIGH RISK — over — **LOW RISK**

Risk = (probability of event occurring) x (impact of event occurring)

Tree Risk = (probability of a tree/tree part failing and striking a defined target) x (assessing the consequence from that event)

Risk: perceived vs. actual

According to HSE[1] 'Management of Risks from Falling Trees', statistics of tree related deaths in public spaces are so low (1:20,000,000) (HSE, 2007) that the risk could be considered insignificant; lower in risk terms than being struck by lightning (1:18,700,000) and certainly far lower than being killed in a car accident (1 in 16,800).

In the US:
• Tree related deaths in all spaces - 1:690,000
• Being struck by lightning - 1:576,000
• Being killed in a car accident - 1:18,585
• Odds of dating a supermodel - 1: 88,000

[1]*Health and Safety Executive's (HSE) job is to protect people against risks to health or safety arising out of work activities.*

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ISA TRAQ

Tree Risk Assessment Qualification

- TRAQ is an **ISA qualification program** that trains arborists how to use the methodologies outlined in the ISA Best Management Practices for Tree Risk Assessment.

- This qualification promotes the safety of people and property by providing a **standardized and systematic process** for assessing tree risk.

- The results of a tree risk assessment can provide tree owners and risk managers with the **information to make informed decisions** to enhance tree benefits, health, and longevity.

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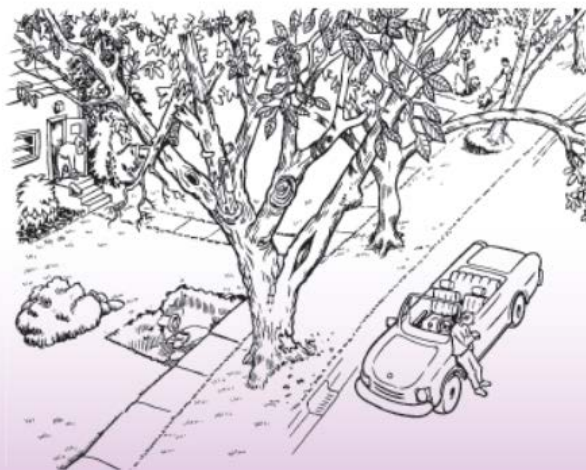University of Pennsylvania

ISA TRAQ Methodology

- Matrix-based, qualitative methodology from the *Best Management Practices: Tree Risk Assessment*

- Developed by tree risk assessment experts and risk scientists in accordance with International Standards Organization (ISO) standards

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TRAQ Matrix

- Likelihood of Failure

   - Improbable, Possible, Probable, Imminent

- Likelihood of Impacting a Target

   - Very low, Low, Medium, High

Likelihood of Failure	Likelihood of Impact			
	Very Low	*Low*	*Medium*	*High*
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

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TRAQ Matrix

■ Consequences of Failure
   - Negligible, Minor, Significant, Severe

Likelihood of Failure or Impact	Consequences of Failure			
	Negligible	*Minor*	*Significant*	*Severe*
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

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Likelihood of Failure	Likelihood of Impact			
	Very Low	*Low*	*Medium*	*High*
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Likelihood of Failure or Impact	Consequences of Failure			
	Negligible	*Minor*	*Significant*	*Severe*
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

RISK RATING

So, comparing large trees in rural vs. urban areas:

Likelihood of Failure is increased by urban stressors

Likelihood of Impact is usually greatly elevated

Consequences: depends on tree size and configuration

**Risk = (probability of event occurring) x
(impact of event occurring)**

Reducing Risk In Urban Areas

"The best protection…is for the municipality (or tree owner) to have a reasonable program for observing, inventorying and correcting dangerous conditions of trees under its care, custody and control".

-Gilbert P. High, Jr. Esquire
From Liability Concerns in Planting and Maintaining the Urban Forest

Any tree risk management program should include a proactive component – choosing the right tree for the right spot, grinding pavements, etc.

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Conclusions - Risk

- To live with trees is to live with risk.

- Tree-related risk can be managed, but trees are organic structures that can fail in ways we cannot anticipate.

- It's important that the public understands the tree risk-benefit equation. Continued public education and outreach (by you) is vital.

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Conclusions - Benefits

- As urban green infrastructure, large-maturing trees with long life expectancies provide the greatest environmental, economic, and social benefits.

- Trees appreciate in value as they age – like a good investment. To fully realize this value, the community needs to invest $ up front and throughout the tree's lifecycle

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Conclusions - Management

- Tree-related risk should be proactively managed throughout a tree's lifecycle

- Reactive tree management usually results in loss of your tree 'investment'', and so is not preferred.

Conclusions - Management

- Plan for large-maturing trees

- Plant large-maturing trees where appropriate (RT-RP-RR)

- Educate tree owners/managers on how to reduce tree-related risk, and reduce perceived risk

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Thank You!

Plant and Care for Large-Maturing Trees in Urban Areas!