Best Trees for the Most Benefits

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Figure 5-6. Scanning electron microscope micrograph of the abaxial surface of a 3-week-old London plane leaf showing stomates. Scale, 10 μm.

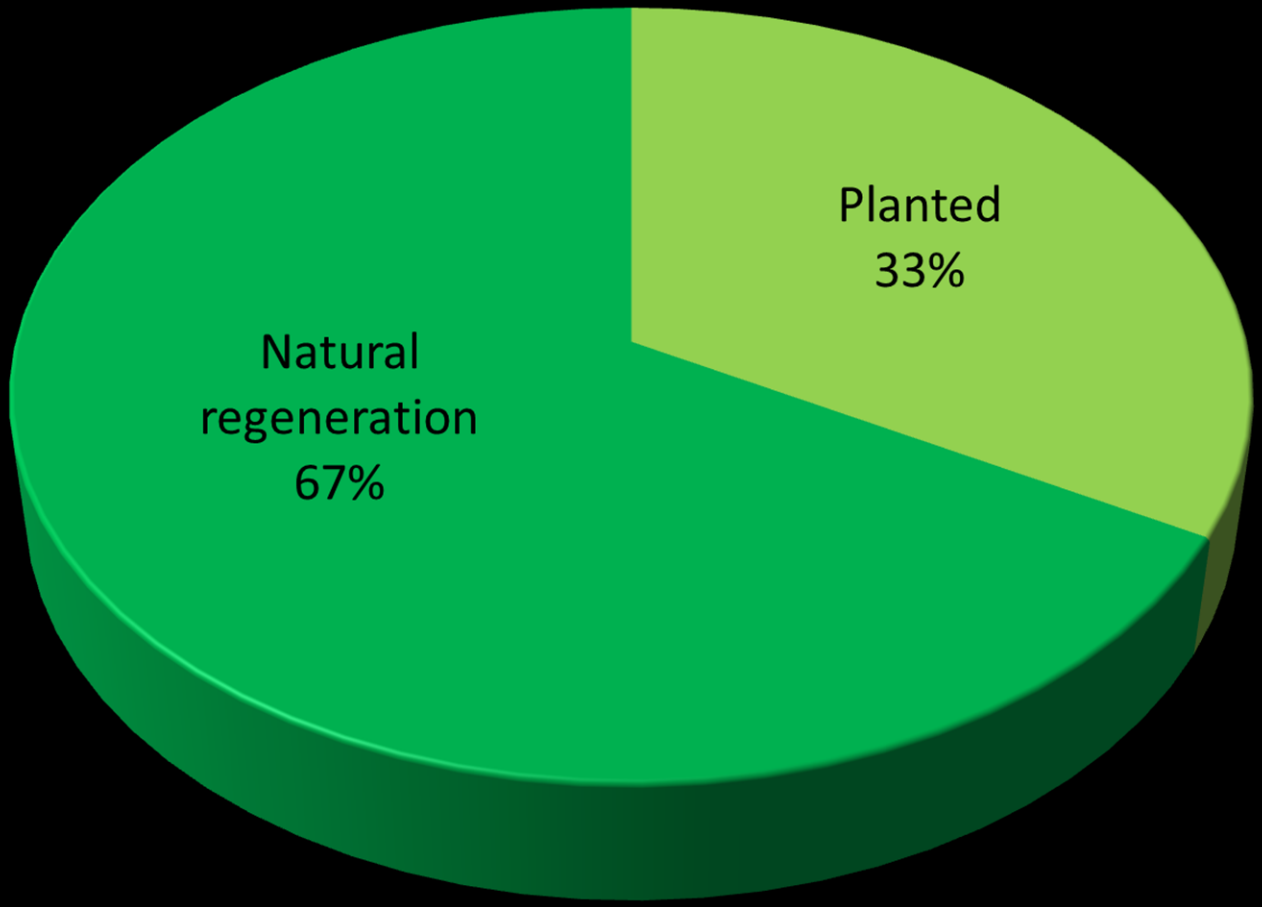
US Urban Forests

- What percent of trees in cities are planted?

There are an estimated 5.5 billion urban trees in the U.S.

US Urban Forests

- What percent of trees in cities are planted?



Nowak, D.J. 2012. Contrasting natural regeneration and tree planting in 14 North American cities. Urban Forestry and Urban Greening. 11: 374 – 382

Syracuse - Natural regeneration dominates

Existing population

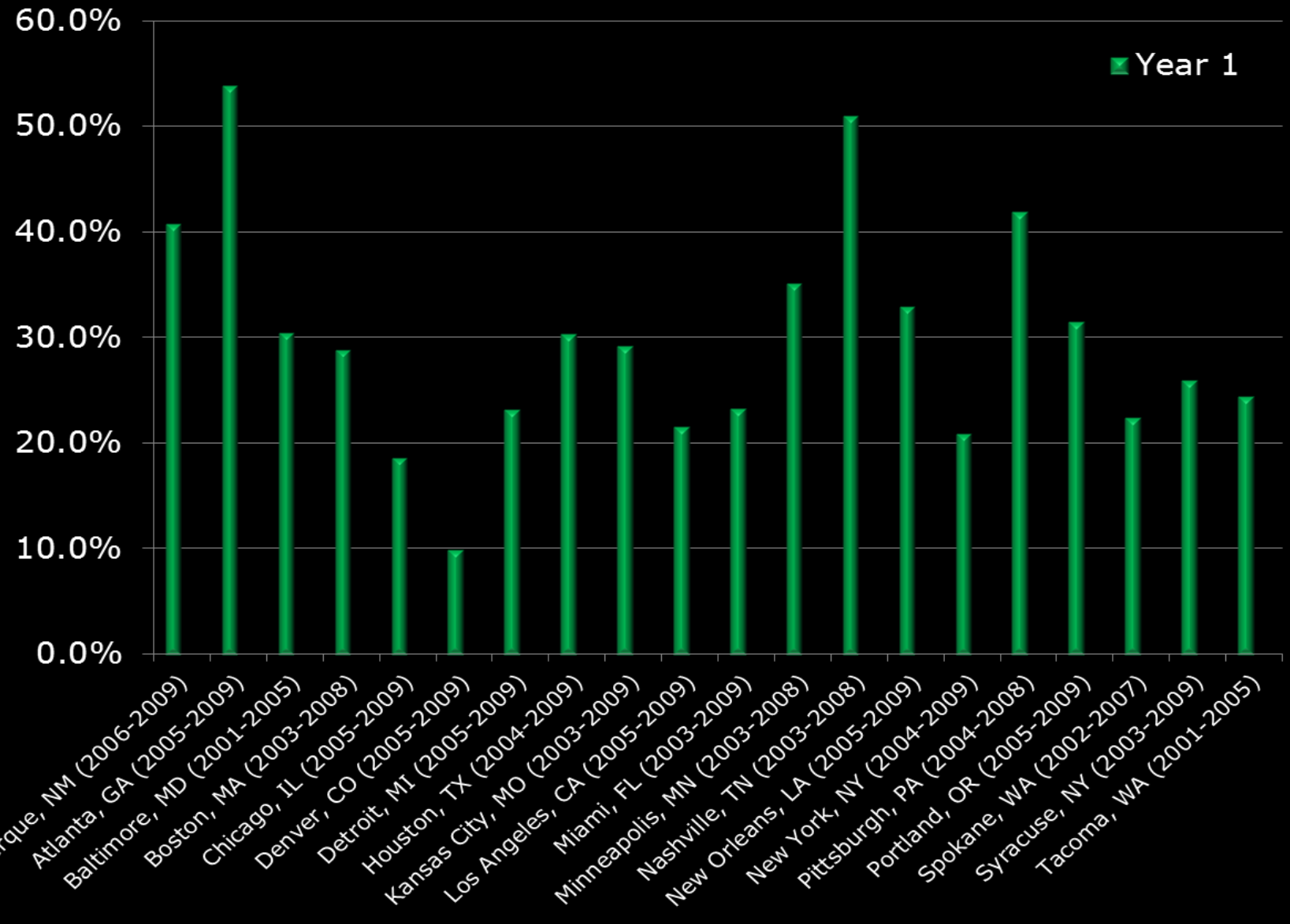
City	Land use	% Planted	SE	n
Syracuse, NY[a]	Residential	29.1	3.5	165
	Institutional	2.6	2.6	38
	Vacant	1.4	0.7	292
	Park/Cemetery/Golf	0.0	0.0	86
	Multi-family Residential	0.0	0.0	71
	Utilities/Transportation	0.0	0.0	21
	Total[b]	12.8	1.3	675

Influx rate

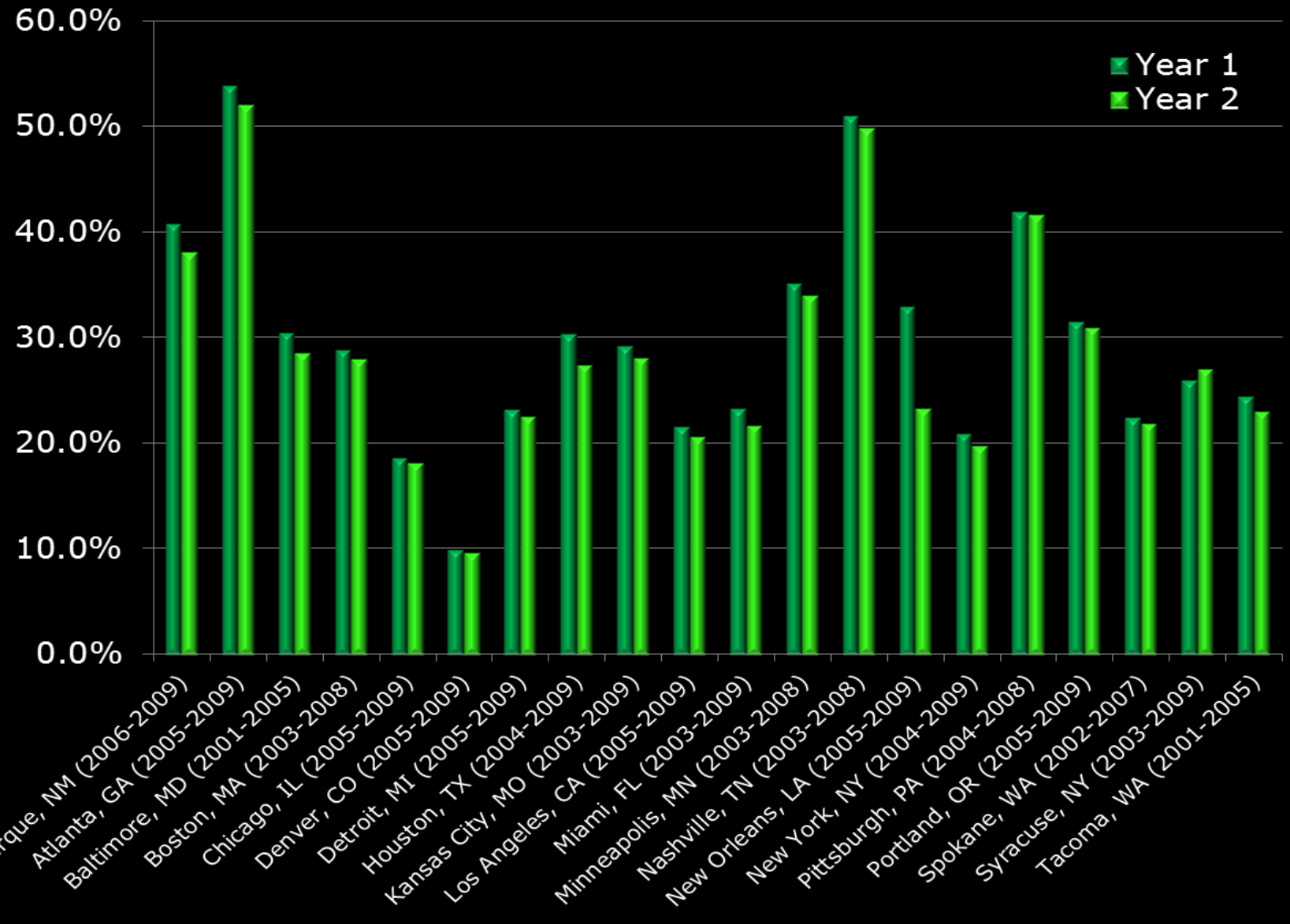
Annual tree influx rates (trees/ha/yr) by natural regeneration and tree planting for Syracuse, NY (2001–2009)

City	Land use	Total	SE	Regeneration	Planted
Syracuse	Vacant	29.2	10.3	29.2	0.0
	Multi-family Residential	13.7	13.7	13.7	0.0
	Park/Cemetery/Golf	12.9	8.1	12.9	0.0
	Institutional	9.8	5.1	9.5	0.3
	Utilities/Transportation	6.2	3.1	6.2	0.0
	Residential	5.7	1.2	4.0	1.7
	Commercial/Industrial	0.7	0.7	0.7	0.0
	City Total	8.6	1.7	7.9	0.7

Tree Cover Change



Tree Cover Change



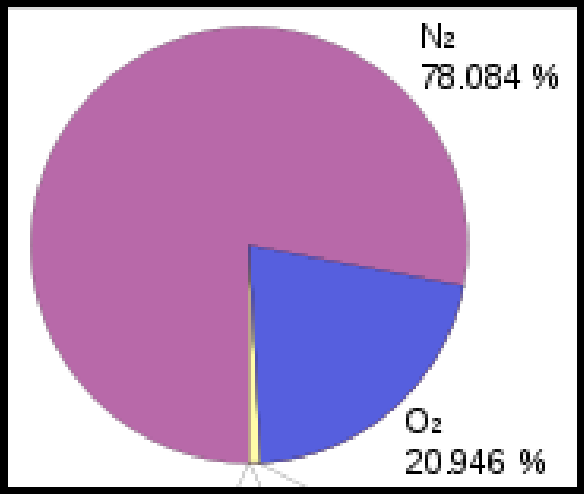

Urban Vegetation Benefits (Top 10)

Urban Vegetation Benefits

- (10) Oxygen production

Oxygen Production

- US Urban Forests = 67 million tons annually
- 2/3 US population consumption
- Negligible effect



Wikipedia.org

Urban Vegetation Benefits

- (9) Products
- Oxygen production

Product Potential

- Above ground d.w. biomass = 1.3 billion tons
- Waste wood (2% mortality) = 26 million tons
- Products: timber, palettes, fiber, chemicals (ethanol)
- Fruit and nut production
- Total leaf biomass = 39 million tons
  - 22.9 million t C
  - 715,000 t N
  - 310,000 t K
  - 67,000 t P

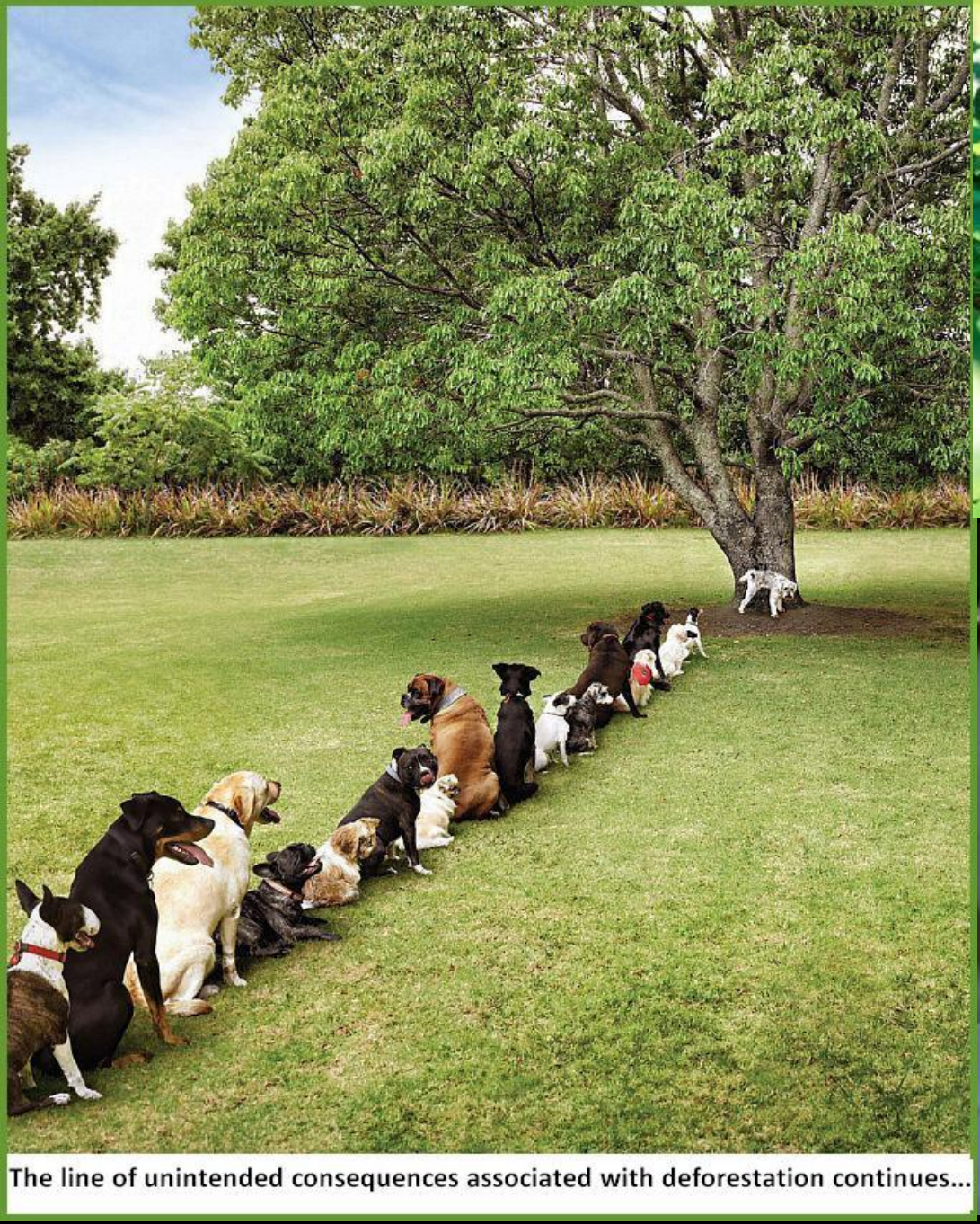
Urban Vegetation Benefits

- (8) Noise reduction
- Products: timber, food, fiber, ethanol
- Oxygen production


$ Value of noise reduction = unknown

Urban Vegetation Benefits

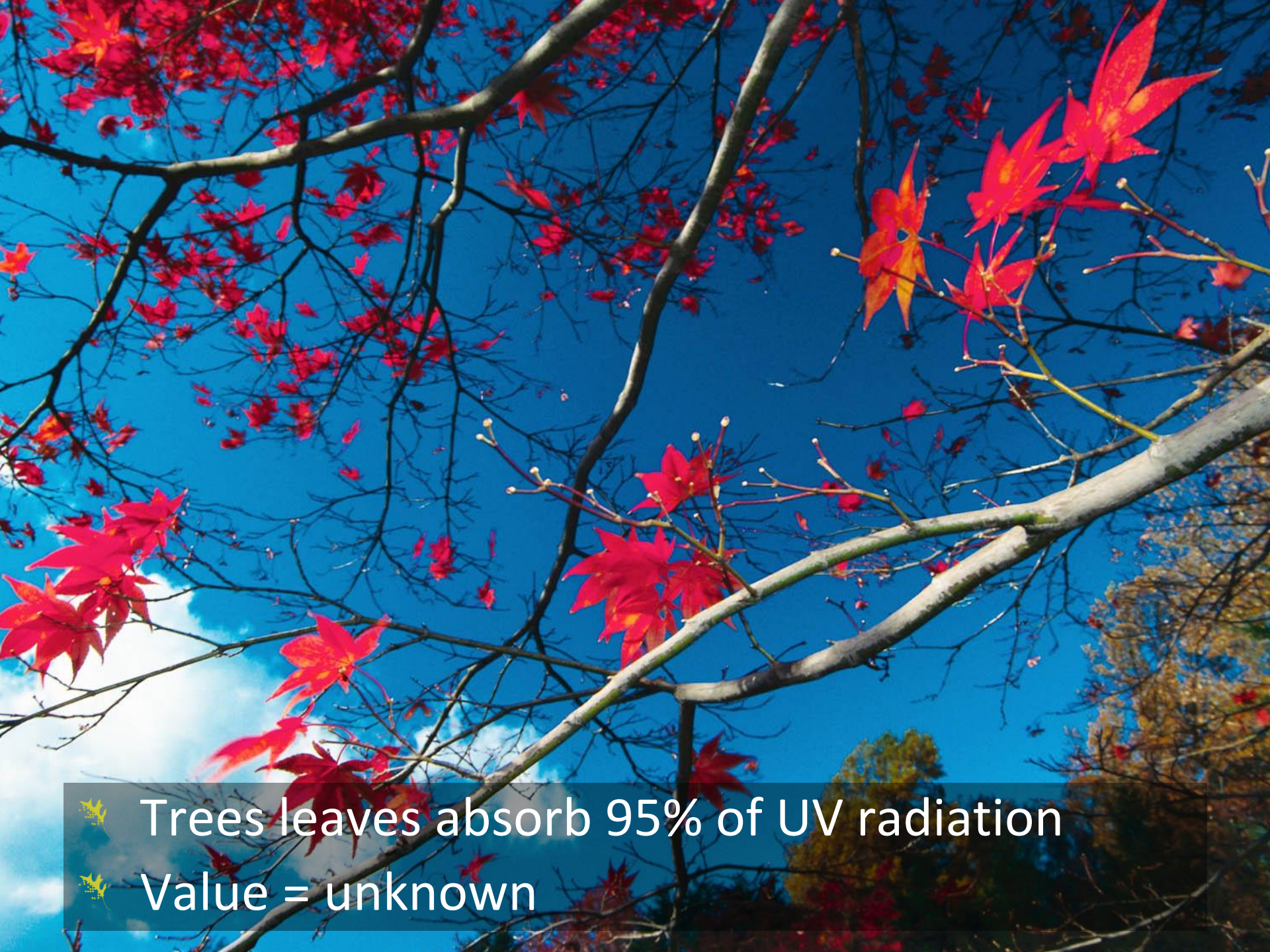
- (7) Wildlife habitat
- Noise reduction
- Products: timber, food, fiber, ethanol
- Oxygen production



$ Value = unknown

Urban Vegetation Benefits

- (6) UV radiation reduction
- Wildlife habitat
- Noise reduction
- Products: timber, food, fiber, ethanol
- Oxygen production



- Trees leaves absorb 95% of UV radiation
- Value = unknown

Urban Vegetation Benefits

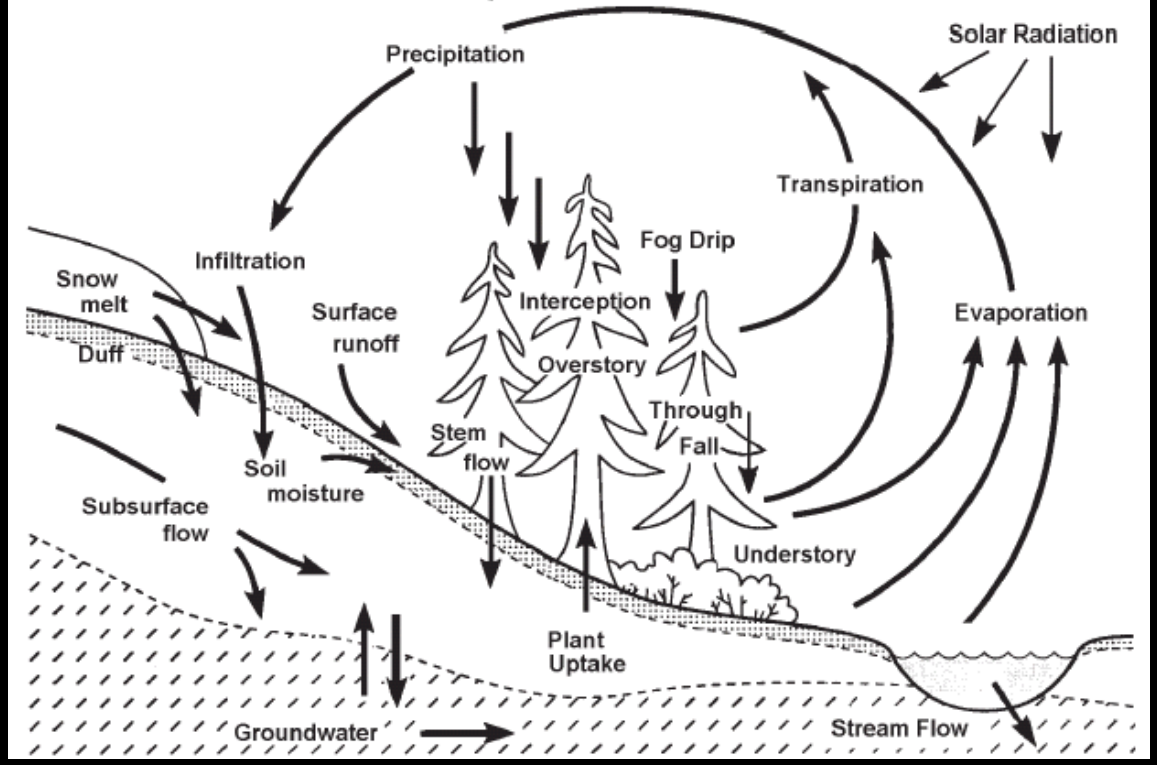
- (5) Greenhouse gas reduction
- UV radiation reduction
- Wildlife habitat
- Noise reduction
- Products: timber, food, fiber, ethanol
- Oxygen production

Carbon Storage and Sequestration

- US urban forests
  - 919 million tons stored ($119 billion)
  - 37.0 million tons sequestered per year ($4.8 billion/year)

Urban Vegetation Benefits

- (4) Water quality improvement
- Greenhouse gas reduction
- UV radiation reduction
- Wildlife habitat
- Noise reduction
- Products: timber, food, fiber, ethanol
- Oxygen production



From Pike 1998

NYC Value = $47 million / year

Urban Vegetation Benefits

- (3) Air quality improvement
- Water quality improvement
- Greenhouse gas reduction
- UV radiation reduction
- Wildlife habitat
- Noise reduction
- Products: timber, food, fiber, ethanol
- Oxygen production

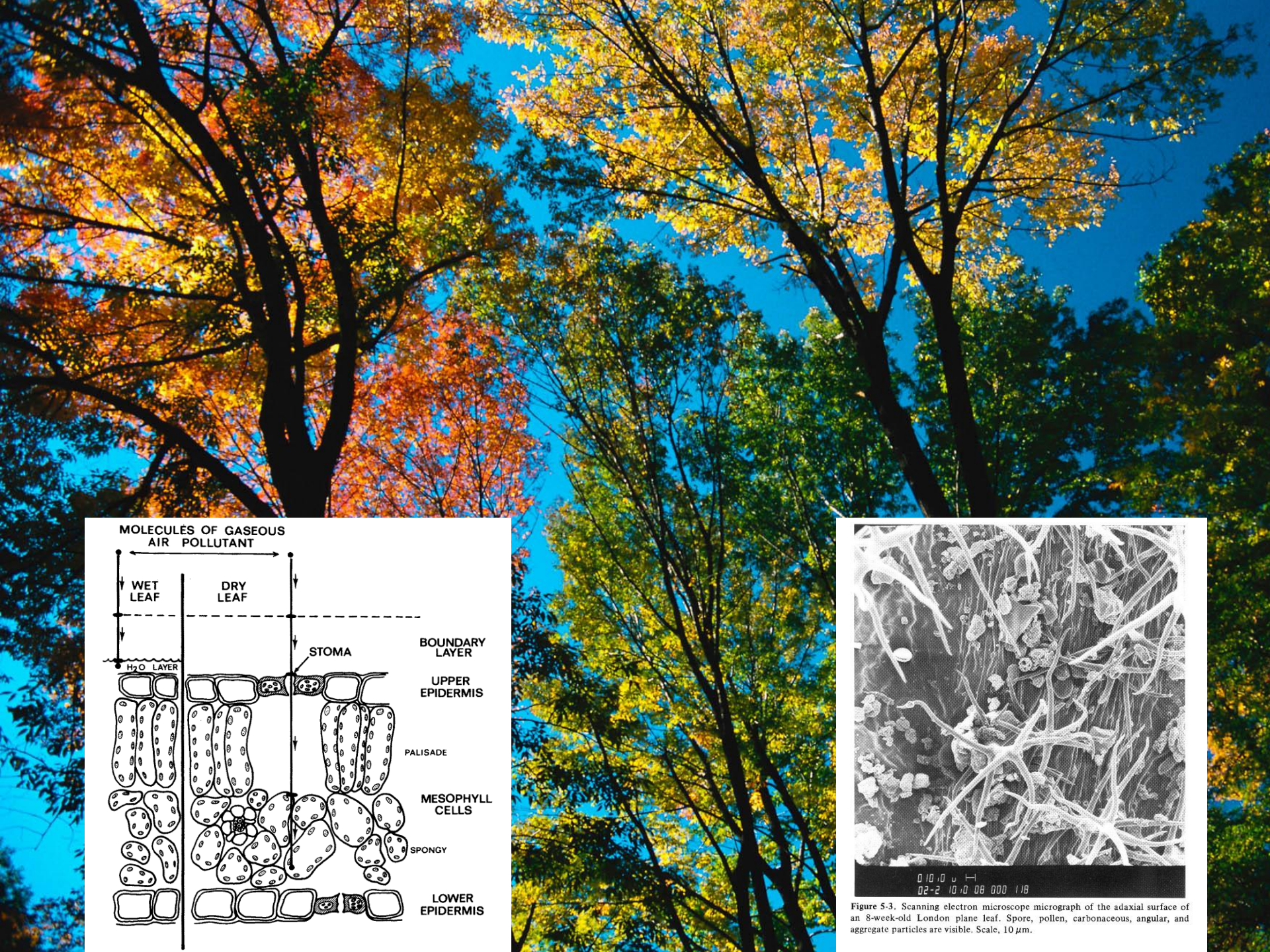


Figure 5-3. Scanning electron micrograph of the adaxial surface of an 8-week-old London plane leaf. Spore, pollen, carbonaceous, angular, and aggregate particles are visible. Scale, 10 μm.

Air Pollution Removal and Health Effects

- US Urban Forests: 822,000 tons/year ($5.4 billion/year)
  - Reduction in incidences of:
    - >580 deaths / year
    - >485,000 acute respiratory symptoms / year

Nowak, D.J. and E.J. Greenfield. 2018. U.S. urban forest statistics, values and projections. J. For. 116(2):164–177

Design is Important

Urban Vegetation Benefits

- (2) Socio-economic / Aesthetics
- Air quality improvement
- Water quality improvement
- Greenhouse gas reduction
- UV radiation reduction
- Wildlife habitat
- Noise reduction
- Products: timber, food, fiber, ethanol
- Oxygen production

Aesthetics

$ Value = unknown

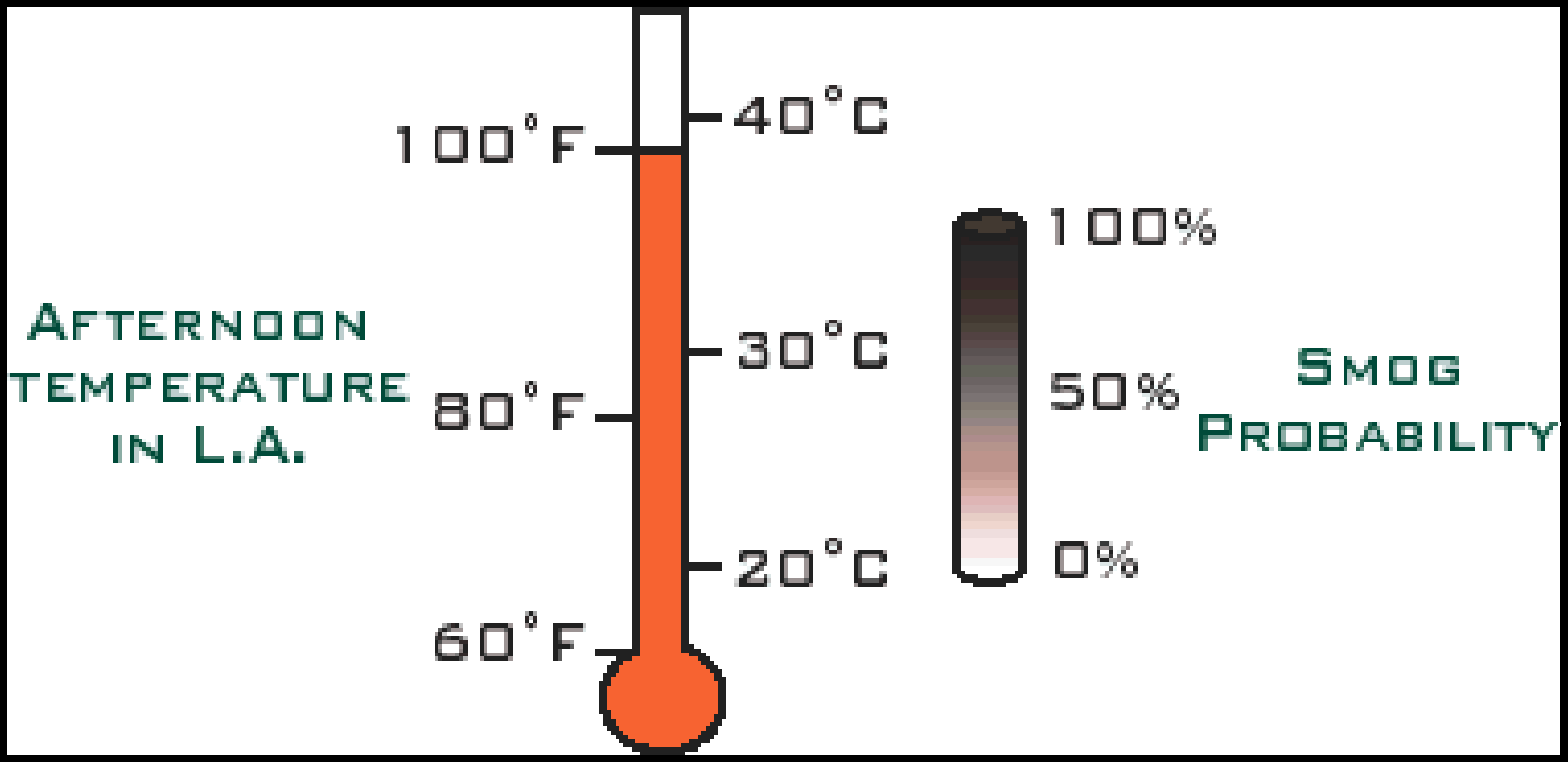
Physiological Effects

- Improved:
  - immune system response
  - cognitive functioning
  - ability to concentrate
  - work productivity
  - job satisfaction
- Reduced:
  - ADD symptoms
  - stress
  - depression
  - glucose levels in diabetics

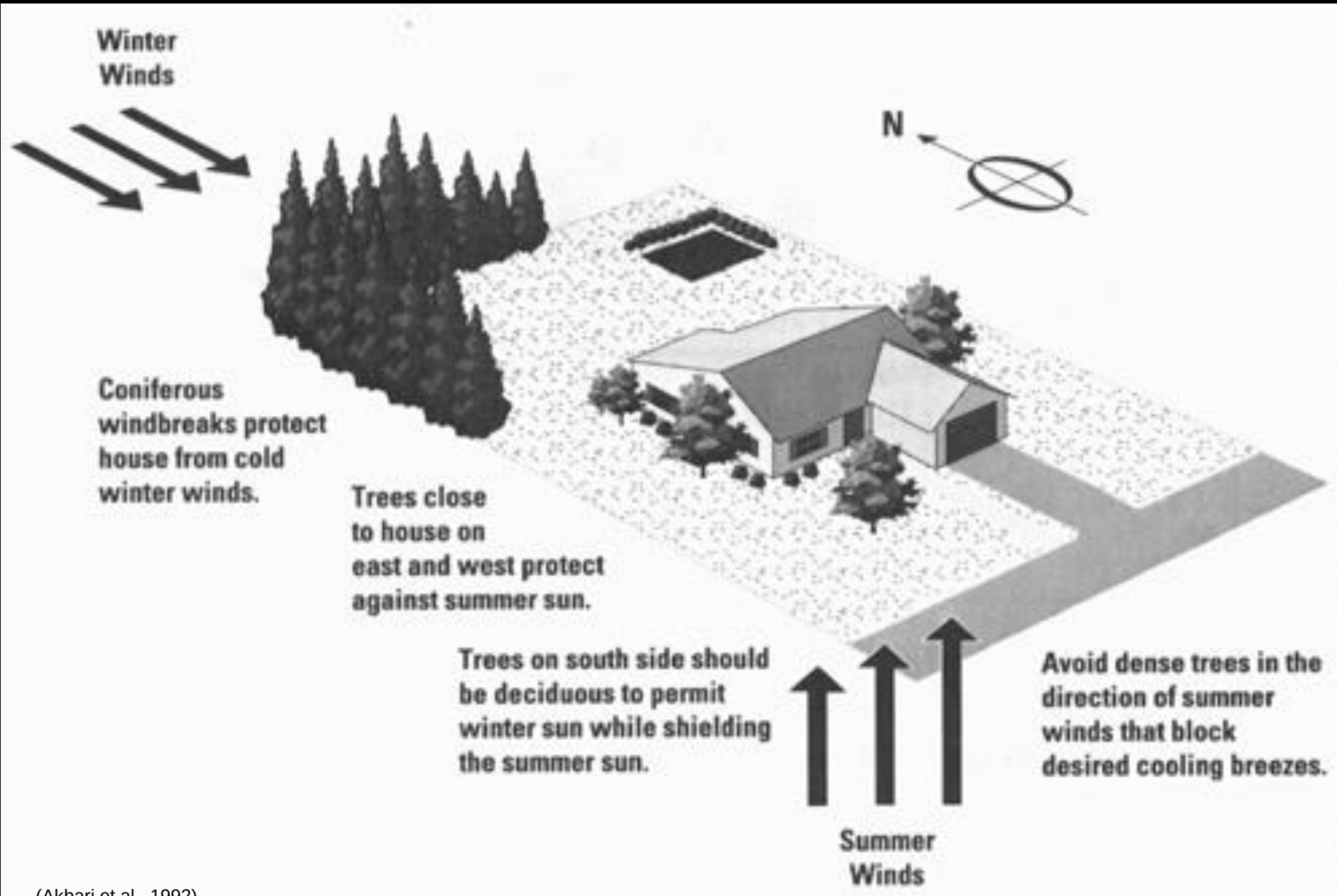
Urban Vegetation Benefits

- (1) Cooler air temperatures / energy effects
- Socio-economic / Aesthetics
- Air quality improvement
- Water quality improvement
- Greenhouse gas reduction
- UV radiation reduction
- Wildlife habitat
- Noise reduction
- Products: timber, food, fiber, ethanol
- Oxygen production

Air Temperature Cooling



Affects: air quality, energy use, water cycles, human comfort and health...



(Akbari et al., 1992)

U.S. Building Energy Conservation

- US Energy savings = $5.4 billion / year
- US Avoided emissions = $2.7 billion / year
- 7.2% reduction in residential energy use

Nowak, D.J., N. Appleton, E. Ellis, E. Greenfield. 2017. Residential building energy conservation and avoided power plant emissions by urban and community trees in the United States. Urban Forestry and Urban Greening. 21: 158–165

Nowak, D.J. and E.J. Greenfield. 2018. U.S. urban forest statistics, values and projections. J. For. 116(2):164–177

Which tool should I use?

For forests and many trees:

Eco

(desktop app)

Flagship tool that quantifies the structure of, threats to, and benefits and values provided by forest populations globally.

Landscape

(web app)

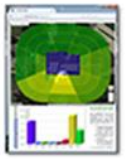
Quickly assess human and forest population information & threats to help prioritize areas for tree planting & protection.

Canopy

(web app)

Quickly estimate tree canopy and benefits using aerial photographs.

For individual and small amounts of trees:



Design

(web app)

Parcel level analysis of current and future tree benefits.

MyTree

(web app)

Easily assess the value of one to several trees in a mobile web browser.

For recommendations on what species to plant:

Species

(web app)

Determine the best species that meet your desired benefits.

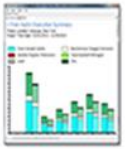
For benefits of new tree planting projects:

Planting

(web app)

Estimate long-term environmental benefits and values of a tree planting project.

For effects on stream flow & water quality:



Hydro

(desktop app)

Quantify the effects of tree canopy and impervious cover on water quantity and quality.

i-Tree

i-Tree is a Cooperative Initiative

USFS · DAVEY · Arbor Day Foundation · SMA Society of Municipal Arborists · ISA · Casey Trees · ESF


Questions?
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