Identified Benefits of Community Trees and Forests

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Community trees and forests are valuable. To the 75% of the United States population that now live in urban and suburban areas, trees provide many goods and services. Values are realized by the people that own the trees, by people nearby, and by society in general. People plant, maintain, conserve, and covet trees because of the values and benefits generated.

Tree benefits can be listed in many forms. The bottom-line is humans derive not a single-user value from community trees and forests, but a multi-product / multi-value benefit. Some of these benefits stem from components and attributes of a single tree, while other benefits are derived from groups of trees functioning together. What is the value of these multiple benefits? A 1985 study concluded that the annual ecological contribution of an average community tree was $270.

Values, functions, goods and services produced by community trees and forests can be evaluated for economic and quality of life components. While quality of life values are difficult to quantify, some of the economic values can suggest current and future negative or positive cash flows. In assessing changes in dollar values, concerns for tree evaluation are most prevalent within: risk management costs (liability and safety); value-added / capital increases to tree values; appreciation of tree and forest assets; maintenance costs of tree and forest assets; and, level of management effectiveness and efficiency (total quality management of community trees and forests -- TTQM).

Below are listed a selected series of goods, services, and benefits community trees across the nation and forests provide. These bullets of information are taken from a diversity of individual research projects and, as such, are individually meaningless except under similar conditions. These items together do suggest trends and concepts of value.

OUTLINE OF SELECTED BENEFITS

Environmental Benefits

Temperature and Energy Use
- Shade
- Wind Control
- Active Evaporation

Air quality
- Oxygen Production
- Pollution Reduction
- Carbon Dixoide Reduction

Hydrology
- Water Run-Off
- Water Quality / Erosion

Noise Abatement
- Glare Reduction
- Animal Habitats

Economic / Social / Psychological Benefits
- Economic Stability
- Property Values
- Product Production
- Aesthetic Preferences
- Visual Screening
- Recreation
- Health
- Human Social Issues

Environmental Benefits

Temperature and Energy Use

Community heat islands (3 to 10 degrees F warmer than surrounding countryside) exist because of decreased wind, increased high density surfaces, and heat generated from human associated activities, all of which requires addition energy expenditures to off-set. Trees can be successfully used to mitigate heat islands. Trees reduce temperatures by shading surfaces, dissipating heat through evaporation, and controlling air movement responsible for advected heat.

Shade

- **20** degrees F lower temperature on a site from trees.
- 35 degrees F lower hard surface temperature under tree shade than in full summer sun.
- 27% decrease in summer cooling costs with trees.
- 75% cooling savings under deciduous trees.
- 50% cooling energy savings with trees. (1980) 20 degrees F lower room temperatures in uninsulated house during summer from tree shade.
- $242 savings per home per year in cooling costs with trees.
- West wall shading is the best cooling cost savings component.
- South side shade trees saved $38 per home per year.
- 10% energy savings when cooling equipment shaded (no air flow reduction).
- 12% increase in heating costs under evergreen canopy
- 15% heating energy savings with trees, (1980)
- 5% higher winter energy use under tree shade
- $122 increase in annual heating costs with south and east wall shading off-set by $155 annual savings in cooling costs.
- Crown form and amount of light passing through a tree can be adjusted by crown reduction and thinning.
- Shade areas generated by trees are equivalent to $2.75 per square foot of value (1975 dollars).

Wind Control

- 50% wind speed reduction by shade trees yielded 7% reduction in heating energy in winter.
- 8% reduction in heating energy in home from deciduous trees although solar gain was reduced.
- $50 per year decrease in heating costs from tree control of wind.
- Trees block winter winds and reduces “chill factor.”
- Trees can reduce cold air infiltration and exchange in a house by maintaining a reduced wind or still area.
- Trees can be planted to funnel or baffle wind away from areas -- both vertical and horizontal concentrations of foliage can modify air movement patterns.
- Blockage of cooling breezes by trees increased by $75 per year cooling energy use.

Active Evaporation

- 65% of heat generated in full sunlight on a tree is dissipated by active evaporation from leaf surfaces.
- 17% reduction in building cooling by active evaporation by trees.
- One acre of vegetation transpires as much as 1600 gallons of water on sunny summer days.
- 30% vegetation coverage will provide 66% as much cooling to a site as full vegetation coverage.
- A one-fifth acre house lot with 30% vegetation cover dissipates as much heat as running two central air conditioners.

Air Quality -- Trees help control pollution through acting as biological and physical nets, but they are also poisoned by pollution.

Oxygen Production -- One acre of trees generates enough oxygen each day for 18 people.

Pollution Reduction

- Community forests cleanse the air by intercepting and slowing particulate materials causing them to fall out, and by absorbing pollutant gases on surfaces and through uptake onto inner leaf surfaces.
- Pollutants partially controlled by trees include nitrogen oxides, sulfur dioxides, carbon monoxide, carbon dioxide (required for normal tree function), ozone, and small particulates less than 10 microns in size.
- Removal of particulates amounts to 9% across deciduous trees and 13% across evergreen trees.
- Pollen and mold spore, are part of a living system and produced in tree areas, but trees also sweep out of the air large amounts of these particulates.
- In one urban park (212 ha), tree cover was found to remove daily 48 lbs particulates, 9 lbs nitrogen dioxide, 6 lbs sulfur dioxide, and 1/2 lbs carbon monoxide. ($136 per day value based upon pollution control technology).
- 60% reduction in street level particulates with trees.
- One sugar maple (one foot in diameter) along a roadway removes in one growing season 60 mg cadmium, 140 mg chromium, 820 mg nickel and 5200mg lead from the environment.
- Interiorscape trees can remove organic pollutants from indoor air.

Carbon Dioxide Reduction

- Approximately 800 million tons of carbon are currently stored in US community forests with 6.5 million tons per year increase in storage ($22 billion equivalent in control costs).
- A single tree stores on average 13 pounds of carbon annually.
- A community forest can store 2.6 tons of carbon per acre per year.

Hydrology

- Development increases hard, non-evaporative surfaces and decreases soil infiltration -- increases water volume, velocity and pollution load of run-off -- increases water quality losses, erosion, and flooding.

- Community tree and forest cover intercepts, slows, evaporates, and stores water through normal tree functions, soil surface protection, and soil area of biologically active surfaces.

Water Run-Off

- **7%** of winter precipitation intercepted and evaporated by deciduous trees.
- 22% of winter precipitation intercepted and evaporated by evergreen trees.
- 18% of growing season precipitation intercepted and evaporated by all trees.
- For every 5% of tree cover area added to a community, run-off is reduced by approximately 2%
- 7% volume reduction in six-hour storm flow by community tree canopies.
- 17% (11.3 million gallons) run-off reduction from a twelve-hour storm with tree canopies in a medium-sized city ($226,000 avoided run-off water control costs).

Water Quality / Erosion

- Community trees and forests act as filters removing nutrients and sediments while increasing ground water recharge.
- 37,500 tons of sediment per square mile per year comes off of developing and developed landscapes -- trees could reduce this value by 95% ($336,000 annual control cost savings with trees).
- 47% of surface pollutants are removed in first 15 minutes of storm -- this includes pesticides, fertilizers, and biologically derived materials and litter.
- 10,886 tons of soil saved annually with tree cover in a medium-sized city.

Noise Abatement

- 7db noise reduction per 100 feet of forest due to trees by reflecting and absorbing sound energy (solid walls decrease sound by 15 db)
- Trees provide “white noise," the noise of the leaves and branches in the wind and associated natural sounds, that masks other man-caused sounds.

Glare Reduction

- Trees help control light scattering, light intensity, and modifies predominant wavelengths on a site.
- Trees block and reflect sunlight and artificial lights to minimize eye strain and frame lighted areas where needed for architectural emphasis, safety, and visibility.

Animal Habitats

- Wildlife values are derived from aesthetic, recreation, and educational uses.
- Lowest bird diversity is in areas of mowed lawn -- highest in area of large trees, greatest tree diversity, and brushy areas.

- Highest native bird populations in areas of highest native plant populations.
- Highly variable species attributes and needs must be identified to clearly determine tree and community tree and forest influences.
- Trees are living systems that interact with other living things in sharing and recycling resources -- as such, trees are living centers where living thing congregate and are concentrated.

Economic / Social / Psychological Benefits

Economic Stability Community

- Community trees and forests provide a business generating, and a positive real estate transaction appearance and atmosphere.
- Increased property values, increased tax revenues, increased income levels, faster real estate sales turn-over rates, shorter unoccupied periods, increased recruitment of buyers, increased jobs, increased worker productivity, and increased number of customers have all been linked to tree and landscape presence.
- Tree amenity values are a part of real estate prices.

Property Values -- Real Estate Comparisons

- Clearing unimproved lots is costlier than properly preserving trees.
- 6% ($2,686) total property value in tree cover.
- $9,500 higher sale values due to tree cover.
- 4% higher sale value with five trees in the front yard -- $257 per pine, $333 per hardwood, $336 per large tree, and $0 per small tree.
- $2,675 increase in sale price when adjacent to tree green space as compared to similar houses 200 feet away from green space.
- $4.20 decrease in residential sales price for every foot away from green space.
- 27% increase in development land values with trees present.
- 19% increase in property values with trees. (1971 & 1983)
- 27% increase in appraised land values with trees. (1973)
- 9% increase in property value for a single tree. (198 1)

Property Values – Tree Value Formula (CTLA 8th edition)

- Values of single trees in perfect conditions and locations in the Southeast range up to $100,000.
- $100 million is the value of community trees and forests in Savannah, GA
- $386 million is the value of community trees and forests in Oakland, CA (59% of this value is in residential trees).

Product Production

- Community trees and forests generate many traditional products for the cash and barter marketplace that include lumber, pulpwood, hobbyist woods, fruits, nuts, mulch, composting materials, firewood, and nursery plants.

Aesthetic Preferences

- Conifers, large trees, low tree densities, closed tree canopies, distant views, and native species all had positive values in scenic quality.
- Large old street trees were found to be the most important indicator of attractiveness in a community.
- Increasing tree density (optimal 53 trees per acre) and decreasing understory density are associated with positive perceptions.
- Increasing levels of tree density can initiate feelings of fear and endangerment -- an optimum number of trees allows for visual distances and openness while blocking or screening developed areas.
- Species diversity as a distinct quantity was not important to scenic quality.

Visual Screening

- The most common use of trees for utilitarian purposes is screening undesirable and disturbing sight lines.
- Tree crown management and tree species selection can help completely or partially block vision lines that show human density problems, development activities, or commercial/ residential interfaces.

Recreation

- Contact with nature in many communities may be limited to local trees and green areas (for noticing natural cycles, seasons, sounds, animals, plants, etc.) Trees are critical in this context.
- $1.60 is the willing additional payment per visit for use of a tree covered park compared with a maintained lawn area.

Health

- Stressed individuals looking at slides of nature had reduced negative emotions and greater positive feelings than when looking at urban scenes without trees and other plants.
- Stressed individuals recuperate faster when viewing tree filled images.
- Hospital patients with natural views from their rooms had significantly shorter stays, less pain medicine required, and fewer post-operative complications.
- Psychiatric patients are more sociable and less stressed when green things are visible and immediately present.
- Prison inmates sought less health care if they had a view of a green landscape.

Human Social Interactions

- People feel more comfortable and at ease when in shaded, open areas of trees as compared to areas of hardscapes and non-living things.
- People's preferences for locating areas of social interactions in calming, beautiful, and nature-dominated areas revolve around the presence of community trees and forests.
- Trees and people are psychologically linked by culture, socialiition, and coadaptive history.

Reference for most of this material: Literature Review for the QUANTITREE computer program -- "Quantifiable Urban Forest Benefits and Costs; Current Findings and Future Research." In a white paper entitled Consolidating and Communicating Urban Forest Benefits. Davey Resource Group, Kent, OH. 1993. Pp.25.

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