Community Forestry Series

WARNELL
SCHOOL OF FORESTRY AND NATURAL RESOURCES
THE UNIVERSITY OF GEORGIA

WSFNR11-35 July 2011

Community Tree Canopy Loss:

Calculations & Perceptions

by Dr. Kim D. Coder, Professor of Tree Biology & Health Care

For many communities, self-image is centered around trees and green spaces. Communities sometimes believe they need to compromise between greenspace and economic development. This is not always reality. Unfortunately the pace of economic development, land use shifts, generational changes, and tree growth all progress at different rates. Nothing is as it has been and perceptions are always a bit out of sync with the reality of change.

If you can not see the whole picture (and its integral parts) in a community, then you understand community changes it only through a biased and limited sampling of areas where you live, work, shop, worship, and educate your children. The more compartmentalized you are within your community, the less effective you can be in understanding natural resource changes like trees impacting whole community life.

Parked Or Moving?

One critical feature of human perception regarding trees and greenspaces within a community is the state of any resource can be appreciated , measured, and debated. Perceptions are not as well adjusted for appreciating the rate of change for community tree resources. It is both the current state of natural resources like tree canopy coverage, and the rate of change of natural resources across a community into the future which are critical.

For example, seeing tree stems and canopy-covered areas are easily noted and approved, but any acceleration of tree decline and canopy loss is usually unrecognized until it is either rapid or severe. In many cases, communities and their leaders, retain an earlier vision of natural resource values which is not based on current reality. In other words, we all carry a "one moment in time" vision or photograph of how we think our community is fairing in our mind's eye. In actuality, tree values we enjoy may be declining beyond any reasonable point of recall before we notice or are activated to correct the direction of change..

Ecological Roulette

Ecological systems, of which our communities are a part, have many component processes and interacting organisms, each changing at its own unique rate. We summarize system complexity to allow for many

changes appearing to be occurring in unison. Throughout our simple perceptions, chaotic processes assure many resources (quality and quantity), and populations of many different creatures (plant, animal, and human demographics) are changing along different disjunct paths. We tend to perceive all these changes at a single crossroad in time.

The guiding controllers of ecological change are organism's reaction to stress, interference, disturbance, and succession. The more resources an organism (like a tree) can gather and control, the greater chances for biological success. The less disturbance and stress, the greater the chances for maintaining structural integrity. Sustainability is developing awareness for, and managing with, change.

A Community Vision

What is the change in your community trees? How fast are you accumulating trees and losing trees? At these rates, what will the community look like in 10, 20, and 50 years? If you travel away and come back in 25 years, would you recognize your community? How many trees which you now find majestic, massive and unique would still be present? If these big old trees are gone, what have they been replaced with – pavement, shrubs, barren soil, or new trees?

Envisioning Calculations

Let us calculate a vision for community trees. You will need an idea of total tree canopy cover a community (or a single area of a community) contains as a percent of all horizontal surfaces at the current time. Next you will need an idea of the total number of trees being planted in a community each year counted in number of stems (100 stems = 100 new trees). Finally, you will need an idea of the amount of tree canopy cover loss over a community (or a single area of a community) per year in a percent across all horizontal surfaces.

Another way to view what is needed in order to run a visioning calculation, if you already know the area of a community and its parts, is:

1) What tree canopy you have now?
2) How much tree canopy you are adding each year? and,
3) How much tree canopy is being lost per year?

A strong vision of the future requires knowing the state your tree resources are in now, plus the speed and direction of any change.

STEP 1: Total Tree Canopy as a percent of total community area. Many different parts of a community have radically different tree canopy percentages. Instead of using an average for the whole community, measuring different canopy percentages for different areas will be more helpful. For example, many industrial areas have less than 10% tree coverage while old, large lot, single family residential areas may have 45% tree canopy coverage. New subdivisions may currently have small tree canopy percentages but are planting to accelerate canopy coverage. Satellite imagery and aerial photography can be used to estimate current tree canopy percentages.

STEP 2: Trees Planted by number of stems for different classes of trees in different areas around a community must be determined. Trees generate a photosynthetic net which captures sunlight, evaporates water, and make a tree bigger. This canopy is an elevated energy exchange platform, requiring significant investments in sturdy structures and an effective resource gathering and control network. Values we like and demand from trees are derived primarily from the canopy and its interaction with the environment. When a tree is planted, it must gather and

control resources to survive then thrive. Small trees generate small canopies -- large trees generate large canopies. The species of tree and its cultivated form play a dominant role in how large any leaf canopy will be. What is planted directly impacts future canopy size, and so, future values realized.

Estimate the number of trees planted per year in the small (10-20 feet tall at 20 years), medium (21-50 feet tall at 30 years), and large (greater than 50 feet at 40 years) size class. Have community foresters / arborists help you estimate to which size class a tree species belongs.

In addition, you must separately account for where trees are planted in a community. Tree planting in inner core, downtown, parking lots, high density housing complexes, malls, industrial, heavy service business areas are considered zone 1 (high tree stress). Tree planting along streets and in heavy use parks, strip malls, intensive recreational sites, small parking space areas, multi-family housing, surrounding business buildings, and public landscapes around government buildings are considered zone 2 (moderate tree stress). Tree planting in single family residences, extensive recreational sites, green belts, forests, woodlands are considered zone 3 (low tree stress). See Figure 1 for a Community Tree Planting Worksheet. Figure 2 provides a formula for determining new community tree canopy generated.

STEP 3: Tree Canopy Area Loss as a percent of total community area needs to be determined. Tree loss and removal by whatever means can be seen through remote sensing like satellite imaging, aerial photography, or by using site clearance planning maps. For the total area within a community (or the area you are working with), determine the annual loss of tree canopy as a percent. Low tree canopy loss rates are 1% and less. Moderate tree canopy loss rates are 2% to 3%, while high loss rates are above 4%. Tree planting areas gained in each tree stress zone can help offset some loses. It should be obvious the loss of an ancient and huge tree on the courthouse lawn can not be compensated for by planting five crapemyrtles at a local park.

Effective Tree Canopy Coverage Change – By measuring current tree canopy coverage in a community, and adding or subtracting tree canopy gains and losses, a community can estimate tree canopy changes. Figure 3. In addition, a community can change the course they are on by changing gains and losses in tree canopy area. Note the area measures used for community zones and the whole community must always be in acres, not square miles or hectares, due to tree canopy calculations being derived in square feet and acres. Also, understand future trends in community tree canopy coverage are estimated from actions occurring this year in planting and canopy loss. A community can change its future tree canopy trend by significantly changing canopy gains and losses next year.

If the **Effective Tree Canopy Coverage Change** is a negative value, the calculated absolute value of this number is the approximate number of years remaining until complete canopy loss occurs. If a positive value is calculated, no significant community tree canopy losses are projected for the future, if new and existing trees are: a) adequately maintained; b) provided enough resource space in which to grow; and c) any tree damage is minimized. A zero value denotes a community currently balanced between future tree canopy loss and gain. Change in community tree canopy coverage should be a subject of discussion when developing a sustainable community.

Conclusions

Unless your community does something now, how many years will it be until its image, reputation, and quality of community life are unrecoverably changed? How many years until your community is denuded? Recognizing a problem, and calculating its rate of change impacting tree canopy values is a great means for stimulating and motivating action.

Figure 1: Community tree planting worksheet.

ZONE 1: High Tree Stress Sites

size class	number of stems planted this year		area factor	crown canopy area
SMALL TREES	= _____	X	0.02	= _____
MEDIUM TREES	= _____	X	0.2	= _____
LARGE TREES	= _____	X	0.4	= _____

total zone 1 canopy area value = _____

Zone 1 Canopy = total zone 1 canopy area value / acres of zone 1 = _____

ZONE 2: Moderate Tree Stress Sites

size class	number of stems planted this year		area factor	crown canopy area
SMALL TREES	= _____	X	0.006	= _____
MEDIUM TREES	= _____	X	0.05	= _____
LARGE TREES	= _____	X	0.2	= _____

total zone 2 canopy area value = _____

Zone 2 Canopy = total zone 2 canopy area value / acres of zone 2 = _____

ZONE 3: Low Tree Stress Sites

size class	number of stems planted this year		area factor	crown canopy area
SMALL TREES	= _____	X	0.002	= _____
MEDIUM TREES	= _____	X	0.02	= _____
LARGE TREES	= _____	X	0.06	= _____

total zone 3 canopy area value = _____

Zone 3 Canopy = total zone 3 canopy area value / acres of zone 3 = _____

Tree species size classes are: small = 10-20 feet tall at 20 years; medium = 21-50 ft tall at 30 years; large = >50 ft tall at 40 years. Be sure to use decimal percent in calculations – for example, use 0.35 not 35%. Crown area factors are derived from expected canopy area, expected life span, and values / benefits generated over time by tree size.

Figure 2: Calculation formula for determining new community tree canopy area percent generated through tree planting.

{ [(Zone 1 Acres / Total Community Acres) X Zone 1 Canopy]

+

[(Zone 2 Acres / Total Community Acres) X Zone 2 Canopy]

+

[(Zone 3 Acres / Total Community Acres) X Zone 3 Canopy] }

X 100

= _____ %

New Community Canopy Generated

Figure 3: Community visioning calculation helping to gauge the state & change rate of tree canopy coverage.

STEP #1:
TOTAL TREE CANOPY COVERAGE OF COMMUNITY (%)

= _____% (tree canopy area / total community area)

STEP #2:
ANNUAL NEW COMMUNITY TREE CANOPY FROM PLANTING (%)

= _____% (tree canopy area gained / total tree canopy area)

STEP #3:
ANNUAL COMMUNITY TREE CANOPY COVERAGE LOSS (%)

= _____% (tree canopy area loss / total tree canopy area)

[#1 / (#2 - #3)]

=

Effective Tree Canopy Coverage Change

Negative value number is approximate number of years until complete canopy loss.

Positive value means community tree canopy values increasing into the future.

Zero value means a balance currently exists between future tree canopy loss and gain.