New Hampshire ENVIROTHON 2015

Current Issue Challenge: *New Hampshire's Community Forests*

Introduction

Urban and community forestry can be defined as the art, science, and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits that trees provide society (Bloniarz, 2000) . This includes trees along streets, in yards and parks, around business and other urban areas which are owned both publicly and privately. The management of community forests is typically approached systematically; the focus is on the ecosystem as a whole and not necessarily on individual trees or shrubs. Some of the challenges associated with the management of urban and community forests include damage from insects and disease, wildfire, natural catastrophic events (*e.g.*, ice storms), invasive plants, climate change, air and water pollution, limited rooting space for trees, vandalism, wrong tree planted in wrong place, and land development. Some of the positive aspects of urban and community forests include increased privacy, reduced noise pollution, increased property values, attraction of business and tourism, and an improved sense of community.

Forested areas in our New Hampshire communities are associated with both costs and benefits. The costs are fairly well known and include purchasing, planting, and maintaining community forests. The benefits, on the other hand, are not as well know and include many *ecosystem services* such as regulating climate, regulating air pollution, provision of wildlife habitat, and providing aesthetic values. Community and urban forests also provide shading for buildings (which can reduce energy demand for cooling), reduce the urban heat island effect, and intercept water runoff (helping to control stormwater overflow) (Stark, 2011; Thomas & Geller, 2013). It has been shown that the benefits of community and urban forests outweigh the costs; for example, a study in the city of Portland, Oregon found that for every dollar invested in forest management, $3.80 worth of benefits were returned (Portland Parks & Recreation, 2007).

Valuing ecosystem services, as referenced above, is an effective way to heighten awareness of the benefits of community forests. Many of the ecosystem services that are generated by natural processes are not accounted for in markets because they are often a shared resource. For example, citizens do not pay for flood control and water filtration provided by a wetland near their community. By valuing ecosystem services, monetary values can be used by environmental advocates to influence public policy on conservation of natural resources. For instance, your local planning board may hear of the economic value of a new shopping center from developers, but the board seldom hears about the economic value of the ecosystem services that would be lost due to a proposed development.

The Challenge

You and your teammates are assuming the role of members of an environmental consulting firm that has been hired by your local community officials to quantify, assess, and raise awareness concerning the forested areas in your community. You should begin by determining what department or individuals are responsible for managing your community's public trees. This may be a Tree Warden, a Department of Public Works supervisor, or a Conservation Commission. Next, your firm should find out if facts such as forested extent, dominant tree species, current tree health, and other important information are available for your community. Then, your team will use tools developed by the U.S. Forest Service to quantify tree cover and value ecosystem services of the trees in the area of interest. Lastly, your team will prepare an education and outreach plan to raise awareness of the benefits of community trees.

The first step in valuing ecosystem services provided by community forests is to accurately measure the vegetation within the area of interest. The U.S. Forest Service has developed a software suite (***iTree***) that provides urban and community forestry analysis and benefits assessment tools (http://www.itreetools.org/index.php). One of the software packages is called iTree-Canopy which is designed to allow users to easily and accurately estimate tree and other cover classes within their community (*e.g.*, grass, building, roads, etc.). This tool randomly lays points (number determined by the user) onto *Google Earth* imagery and the user then classifies what cover class each point falls upon; the more points that are interpreted, the more accurate the estimate. The user can define any cover classes that they like and the program will show estimation results throughout the interpretation process.

The next step in valuing ecosystem services is to use another tool in the iTree suite called iTree-Design (http://www.itreetools.org/design.php). This tool allows the user to estimate the benefits provided by individual trees using inputs of location, species, tree size, and condition. The ecosystem services quantified by the tool are stormwater regulation, energy conservation in buildings, air quality regulation, and carbon sequestration (storing carbon). Urban and community trees can affect climate change by directly storing carbon within their tissues and by reducing carbon emissions from power plants through lowered building energy use. They can also improve air quality by removing air pollutants through their leaves, and intercept and slow the flow of precipitation and stormwater runoff (Nowak, *et.al.*, 2010).

The following questions and activities will help your team to organize the research that needs to be completed, and guide you through organizing your presentation.

A. Current community forest management officials or organizations
    1) Who is responsible for the community forest?
    2) What role do they play?
    3) What are their primary activities?
    4) Are there other people or organizations that should be involved?
    5) Other?

B. Facts about your community forests

1) Have tree inventories or surveys been done in your community in the past?
2) Is there a community forest management plan?
3) Is there a budget for tree planting, protection, maintenance, and removal?
4) Is there a public tree ordinance or policy for the Town?
5) Is there an annual Arbor Day celebration?
6) Are there dominant species of trees?
7) Has the health of community trees been established?
8) Other?

C. Quantifying tree cover in your community (see i-Tree Canopy guide below)

1) Identify an area of about one square mile that covers a part of the town area in your community.
2) Use a good local map and outline the area using streets as the boundary.
3) This area should not include a lot of rural or forested land, but instead will be mostly business, residential, or other developed land.
4) Go to the iTree-Canopy website and follow the directions using the guide provided below. Classify at least 400 points and identify several different cover classes.
5) Remember to save your work often.
6) Produce a report and save results for your presentation.

D. Sample Inventory of Street Trees (see NH common tree table and inventory sheet)

1) Choose two or three streets within your study area where you will perform a tree survey. The streets should be representative of the entire study area.
2) Select a section of each street that you will survey (the section should be at least 2 or 3 blocks long).
3) Walk each street section, and tally all accessible trees within 12 feet of the road. Remember to ask permission before entering private property. Identify the tree species, measure their diameters, and note their condition.
4) Develop a summary table of the trees that you surveyed.

E. Valuing ecosystem services provided by community forested areas (see i-Tree Design guide below)

1) Go to iTree-Design and input your tree survey data that is representative of study area. You may not have to input all of the trees you have surveyed.
2) Have the software look at 2 years and then at 20 years (and any other number of years you think would be interesting).
3) Compare and contrast how different species (or conifer vs. deciduous) provide different ecosystem services.
4) Produce report and save results for your presentation.

F. Devise a strategy to educate your community on the benefits of forested areas

1) Use the information from iTree-Design, the street tree survey, and iTree-Canopy to summarize the make-up of your community forest and estimate the total benefits of your study area.
2) How can this information be conveyed to community members?
3) What recommendations can your team make to improve species distribution, plant selection, or maintenance and protection needs?
4) What recommendations does your team have for increasing the ecosystem services provided by community forests?
5) Is there a sufficient amount of tree cover in your community?

Your presentation should concisely summarize what is currently known about your community's trees, the extent of tree canopy and other cover classes in your study area from i-Tree Canopy results, an estimate of the ecosystem services that your community's trees supply from i-Tree Design results and the inventory of street trees results, recommendations to the community officials who have hired your firm, and a plan on how to educate your community on the benefits of forested areas.

References

Bloniarz, D. (2000), *A Guide: Developing a Street And Park Tree Management Plan*, U.S. Forest Service, 15 pp. Retrieved 12/15/14, http://www.na.fs.fed.us/urban/inforesources/mgmtplanguide/mgtplanguide.pdf

Nowak, David J.; Stein, Susan M.; Randler, Paula B.; Greenfield, Eric J.; Comas, Sara J.; Carr, Mary A.; Alig, Ralph J. 2010. *Sustaining America's Urban Trees and Forests: A Forests on the Edge Report.* Gen. Tech. Rep. NRS-62. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 27 p. Retrieved 12/15/14, http://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf

Portland Parks & Recreation (2007), *Portland's Urban Forest Canopy, Assessment and Public Tree Evaluation,* City Nature Urban Forestry, Portland, Oregon, 79 pp. Retrieved 12/28/14, http://www.portlandonline.com/shared/cfm/image.cfm?id=171829.

Stark, Kevin J. 2011. *Using GIS to Characterize Urban Tree Canopy Values, Change, and Ownership: A Case Study in the City of Winona, MN USA*. Volume 13, Papers in Resource Analysis. 24 pp. Saint Mary's University of Minnesota University Central Services Press. Winona, MN. Retrieved 1/15/15, http://www.gis.smumn.edu.

Thomas, K. and Geller, L. (2013), *Urban Forestry: Toward an Ecosystem Services Research Agenda: A Workshop Summary*. National Research Council of the National Academies, Washington, D.C. 76 pp. Retrieved 1/20/15, http://www.nap.edu/catalog/18370/urban-forestry-toward-an-ecosystem-services-research-agenda-a-workshop.

Presentation Guidelines

1. All five team members must participate in the presentation. Your team will have exactly 15 minutes to make your presentation, followed by 5 minutes of questions by the judges. Plan and rehearse your presentation accordingly.

2. Visual aids for your presentation will be limited to hard-copy charts, handouts, and displays. Your presentation may not involve any audio or video players, projectors or computers, but you may use computers to prepare materials that can be printed on 8.5" x 11" or 8.5" x 14" paper. Neat hand-drawn posters and visuals are fully acceptable.

3. Work on the challenge is restricted to the five team members and two alternates. You may seek additional information from any source, but you are not permitted to get help on your solution to the challenge (your analysis, proposed project, the proposal itself, or any handouts or displays) from parents, teachers, advisors, consultants, professionals or anyone else. Teams will be asked to certify that they have complied with this rule. You may, and should, get help and guidance in rehearsing your presentation.

4. You can meet with scientists, educators, and other career professionals about the subject matter for the current issue challenge. You must not ask the professional specific questions about the challenge; but, you are encouraged to discuss the topic with them in general terms and to learn about the issue from their perspective.

Resources (supplement to North American ENVIROTHON resource list)

USDA Forest Service

http://www.fs.fed.us/

Urban Natural Resources Stewardship

http://www.nrs.fs.fed.us/urban/

Centers for Urban and Interface Forestry

http://www.urbanandinterfaceforests.org/

U.S. Forest Service Northeastern Area – Urban and Community Forestry Partners List

http://na.fs.fed.us/urban/partners/partners.shtm

Alliance for Community Trees

http://actrees.org/

American Forests

http://www.americanforests.org/

Arboricultural Research and Education Academy

http://area.isa-arbor.com/

Tree Care Industry Association

http://tcia.org/

Society of American Foresters

http://www.safnet.org/

Tree City USA

http://www.arborday.org/programs/treecityusa/

Strategic Tree Planting Initiative

http://www.arborday.org/programs/stpi-grant/

Northeast Urban & Community Forestry Resources Index (U-Find Index)

http://na.fs.fed.us/urban/inforesources/index.shtm

Community Tree Plans: A Guide for Tree Commissions and Environmental Advisory Councils

http://pubs.cas.psu.edu/FreePubs/pdfs/uh182.pdf

National Arborist Association

http://www.NATLARB.com

International Society of Arboriculture

http://www.ag.uiuc.edu/~isa/

A Guide to Street Tree Inventory Software

http://www.na.fs.fed.us/spfo/pubs/uf/streettree/toc.htm

Recognize Hazardous Defects in Trees

http://www.na.fs.fed.us/spfo/pubs/howtos/ht_haz/ht_haz.htm

Ecosystem Valuation

http://www.ecosystemvaluation.org/index.html

Guide for Using i-Tree Design and i-Tree Canopy

i-Tree Design

i-Tree Design allows anyone to make a simple estimation of the benefits provided by individual trees. With inputs of location, species, tree size, and condition, users will receive an understanding of tree benefits related to greenhouse gas mitigation, air quality improvements, and storm water interception. With the additional step of drawing a building footprint – and virtually "planting" or placing a tree – tree effects on building energy use can be evaluated.

For basic video training;
Go to the i-Tree website at; www.itreetools.org
Click on the resources tab, and then click on Video Resources – Learn More.
Click on; i-Tree Design intro and walkthrough
This provides a 30 min. video which demonstrates Design and provides examples of how Design can be used for various community projects.

To start the software and exercise;
Go back to the Home Page, click on Applications and then click on i-Tree Design.
Enter the street address for a public site in your community area such as your school or library, and do an iTree Design analysis for a portion of the tree you have surveyed. Print a report for each tree.

The report will show the value of the ecosystem services that the tree is providing. You can also use iTree Design as a tool to help decide where to plant trees in the future to provide the most benefits.

i-Tree Canopy

i-Tree Canopy offers a quick and easy way to produce a statistically valid estimate of land cover types (*e.g.*, tree cover; impervious surfaces; water bodies; etc.) using aerial images available in Google Maps. Canopy has been expanded to include calculations of the value of the canopy in reducing air pollution and capturing atmospheric carbon. Canopy can be used by urban forest managers to estimate tree canopy cover, set canopy goals, and to monitor canopy change over time.

For basic video training;
Go to the i-Tree website at www.itreetools.org
Click on the resources tab, and then click on Video Resources – Learn More.
Click on; i-Tree Canopy Overview - 5 min.
This video introduces the online i-Tree Canopy application and discusses how it may be utilized.

There are also 5 other short videos that provide more detail on using Canopy. View as many as needed to become comfortable with the software.

To start the software and exercise;
Go back to the Home Page, click on Applications and then click on i-Tree Canopy
Step 1. Click on "Define Project Area". Enter your community's name and State. An aerial image of your community will show on the screen. Using the drawing tool define your project area by drawing a boundary around an irregular area approximately 1 mile square in size. The area should include your Town's downtown. Ideally use roads, or other geographical features as the boundaries. Double click to close the polygon. Click Finish.

Step 2. Click on "Configure and Begin Survey".
Create the cover classes you will identify in your survey. Two classes are already created; Tree and Non-Tree. Delete (or edit) these and create the nine classes below:

1) Tree in Urban Area – **TU**
2) Tree in Forested Area – **TF**
3) Turf/Grass – **TG**
4) Farm Fields/Crops – **AG**
5) Other Vegetation – **OV** (Brushy, open area with no trees)
6) Pavement/Concrete – **PC**
7) Building – **BU**
8) Water – **WA**
9) Others – **OT**

Click Next.

Here you can set the parameters for your project.
For Project Location check your State.
For Selected Location check All.
For Benefit Options check – the TU class
For Currency and Units, leave the default selections.

Click on Begin Survey, and wait a moment for the project to load.
The software will start to show random aerial images around your project area. In the middle of the photo you will see a yellow cross hair. Identify the cover class there (Water, Building, Etc.) by opening the drop down menu under Class and clicking on the correct class.
Go down to the next row and click on the "+" symbol to generate the next random plot, and again identify the cover class under the cross hair. Continue this process until you have done at least 400 points. The more points you do the better the accuracy. Periodically save your Data and give it a file name. This file can be loaded at another time and can be worked on by different people.

When done, you can click on the Report Tab to generate a summary. The report will tell you what % of the surface area in your community is in each class. Tree cover varies by State and the size of the Community, and can be used as an indicator of the Health of the Urban Forest. The report also provides a summary of the value of ecosystem services provided by the community forest in your project area. If you click on Resources and Project Profiles, you will see reports from Cities around the country.

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