1 ✓ 2008

National Urban and Community Forestry Advisory Council
2008 Challenge Cost-Share Grant Program
Full Proposal Cover Sheet

CONTROL No.: **110-NA-C1-21**

PROJECT TITLE: Establishing a novel forest assessment method: The forestless volume indicator

NAME OF ORGANIZATION: The Research Foundation of State University of New York for and on behalf of State University of New York College of Environmental Science and Forestry

MAILING ADDRESS: 1 Forestry Dr., 419 Baker, Syracuse, NY, 13210

PROJECT CONTACT: Dr. Giorgos Mountrakis

PROJECT CONTACT'S: PHONE NO: (315) 470-4824 FAX NO: (315) 470-6958
E-MAIL: gmountrakis@esf.edu

Is this project being developed to reach a minority or underserved population? ☐ Yes ☑ No

Is this pre-proposal being submitted by a minority or underserved population (owned/operated/directed) business, organization or college/university? ☐ Yes ☑ No

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REQUESTED: $42,162 + MATCHING: $42,705 = TOTAL PROJECT: $84,866

Summarize the proposed project in 100 words or less.

This proposal investigates a novel geospatial visualization and analysis methodology to assess urban forest changes. We support a detailed insight on urban forest changes by ranking spatial uniqueness of changes as opposed to surrounding spatial distribution of forests. We use a typical GIS distance transformation, the distance to nearest forest (DTF). When DTF is integrated over an area it becomes an explicit measure of non-forested space for that area, which we call forestless volume (FV). We later use FV as an indicator to facilitate comparisons between different areas and assess importance of forest loss/gain (instead of simply identify changes).

ESTABLISHING A NOVEL FOREST ASSESSMENT METHOD: THE FORESTLESS VOLUME INDICATOR

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Keywords: Urban forest, change assessment, nationwide indicator, geospatial visualization, geospatial analysis, GIS.

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PROJECT NARRATIVE

1. Scope and Applicability/Justification

Forests have always been subjected to natural disturbances and, more recently, human-caused stresses. Across the US, forests are altered by harvesting, by fire management practices, by conversion to agriculture, through expansion of urban areas, roads, and recreation (National Assessment Synthesis Team, 2001). Recently, evidence is mounting that forests will be profoundly affected by climate change, such as increasing damage to forest health caused by the greater incidence of fire, pests and diseases.

Statistics of the Food and Agriculture Organization of the United Nations (2007) show that forested areas have actually increased in the United States of America from 298 million hectares to 302 million hectares from 1990 to 2000, and later to 303 million hectares for 2005. That is an optimistic trend, especially considering negative global trends mostly attributed to developing countries. However, the nationwide increase in forest areas is not equally distributed among rural and urban areas, with significant forest losses in urban and urbanizing areas.

To assess forest changes the process has to be broadly inclusive, drawing on inputs from academia, government, the public and private sectors, and interested citizens. However, forest change assessment methods are currently limited to simple spatial representations (i.e. maps) of observed changes (for example before and after visualizations). There is a clear need to *create more advanced but easily reproducible and interpretable indicators expressing forest changes through time.*

This proposal investigates a novel geospatial visualization and analysis methodology to assess urban forest changes, clearly falling under grant category one - assessment of the extent, health and function of urban forests. An important step towards effective management and policy decisions is the ability to quantify (not just monitor) urban forest changes. Our project's objective is to provide a geospatial methodology that will support a more detailed insight on urban forest changes by ranking the spatial uniqueness of these changes. By doing so we will move from general metrics such as 10% forest loss to more descriptive indicators that link the amount of forest loss/gained to the actual surrounding spatial distribution. For example, losing forests in urban neighborhoods without nearby forests is more critical than where other forests exist.

The proposed work is now feasible due the multi-temporal nationwide representations from the National Land Cover Dataset. Derived from early 1990s and 2000s satellite data, the National Land Cover Data (NLCD) is a land cover classification scheme applied consistently over the United States. Another update using imagery close to 2005-2006 is under development now. The spatial resolution of the data is approximately 30 meters. The dataset is freely available and potential users can download it from a variety of governmental, academic and non-profit websites making it ideal for scalable, nationwide applications.

The benefits of our methodology will be seen across organizations at several levels (local, regional, national) with applications in numerous disciplines. Our work can provide valuable insight to scientists, decisions makers and the public towards informed planning decisions. Some examples of potential beneficiaries include USDA, USGS, and EPA at the national government level, local/regional planning and environmental conservation organizations (e.g. state foresters) along with green industry (e.g. identify optimal clear cutting locations). Finally, our approach will stimulate new research paths enabling further research activities at educational institutions along with easy to develop teaching and outreach programs.

2. Literature Review

Currently there are several research threads investigating extent, health and function of urban forests. Most closely related to our project are efforts focusing on detection and prediction of forest changes.

In the detection category we can find field surveys coupled with remotely-sensed information (e.g. aerial photography, satellite imagery) with the goal of monitoring land use changes. The major motivation behind remotely-sensed mapping is to provide less costly ways for the Forest Service to obtain needed forest resource information. There is a plethora of scientific work in this area, for a summary discussing satellite-based forest mapping over the last three decades see Boyd and Danson (2005). Furthermore, the Forest Service realizing the potential value of remote sensing detection has created the Remote Sensing Applications Center (RSAC) in Salt Lake City, Utah targeting improved monitoring and mapping of natural resources.

The second category of research activities focuses on understanding and predicting land use changes. Typically this is performed by establishing linkages between landscape changes and socioeconomic factors (e.g. population increase). This research is essential to establish stressor indicators for our forested land and its benefits are especially evident in urban forests. Such works have surfaced the past decade and a summary of such contributions can be found in Jones (2005).

The aforementioned research activities produce maps depicting current and/or future forest loss/gain. Their geospatial visualization methods are limited to before and after representations accompanied with some general statistics (e.g. 10% forest loss in the next 10 years). However, to make optimal use of these forest change representations current efforts miss an important characteristic in forest distribution, namely the fact that not all forest loss/gain is of equal significance. The spatial uniqueness of each forest patch (in terms of surrounding forest presence/absence) should also be considered in forest management decisions. Our method will not directly compete with existing methodologies; instead it will complement detection and prediction models through a powerful method of comparison.

We are currently not aware of a similar geospatial methodology that spatially relates forest loss to its surrounding forest distribution. Furthermore, after checking funded efforts from the Challenge Cost-Share Program we were not able to identify a similar effort based of spatial analysis that has the potential to create an intuitive, powerful yet simple nationwide indicator on forest uniqueness. A statistical method was developed by Watts et al (2007) and further investigated by Watts and Mountrakis (2008) as applied on road network expansion (see figures on next page). We will base our approach on that successful method, adjusting it where appropriately.

3. Organization/Methodology

Geographic Information Systems (GISs) allow visualization, exploration and analysis of geographic data. They have found numerous applications in a variety of disciplines, including environmental monitoring and mitigation. GIS software is used extensively in the private sector, local, state and federal agencies and universities. With this proposal we suggest building a tool for forest managers, scientists and practitioners to improve assessment of forest changes. Our tool will be based on spatial statistics analysis; however the results will be visualized in a manner easy to comprehend by non-experts (e.g. see figures 1 and 2).

In this proposal we take an alternative path towards assessment of urban forest changes. We do not use explicitly the forest presence on a spatial scene; instead our statistics are evaluating forest changes through forest absence. It is this different perspective that extends further the expressiveness of our approach. Looking into the specifics of our method, forest uniqueness is evaluated in a four step process:

- **Step ❶: Dataset preparation.**

We use the NLCD information to produce a binary (two class) map, where one class expresses forest presence and the other forest absence. Additionally, based on application requirements users can restrict the forest presence to more detailed forest characteristics, for example deciduous trees. Users will also have the option to filter out small isolated forest patches, in essence establish a minimum size and/or shape for a forest patch. From the technical perspective, this filtering will take place using morphological operators such as erosion and dilation, an established process for image segmentation algorithms.

- **Step ❷: Calculate distance to nearest forest (DTF).**

We use a typical GIS distance transformation as applied to the binary dataset from step 1. The produced result identified the distance to nearest forest (DTF) for every location on the landscape. The aforementioned distance function is embedded in most GIS software packages. A three dimensional representation of the distance transformation (in a road application) is shown in figure 1.

- **Step ❸: Integrate DTF over a user-selected area.**

This is a simple but powerful novelty of our methodology. Users select an area to investigate, for example fixed distance from point, a rectangle, county or state boundaries. At this step we integrate the DTF layer over the selected area. By doing so we produce an explicit measure of the space between forests for that area, which we call forestless volume (FV). We will build additional functionality to existing GIS software to calculate the forestless volume.

- **Step ❹: Use forestless volume to facilitate comparisons in space and time and assess alternative scenarios.**

The forestless volume is a strong indicator of forest spatial uniqueness. Users may select to compare the same study area over time through the multi-temporal NLCD representations (1990 and 2000, with a 2005 product expected soon). Alternatively, they may choose to compare different study areas. Finally, users may provide multiple scenarios of forest presence leading to specific FV metrics.

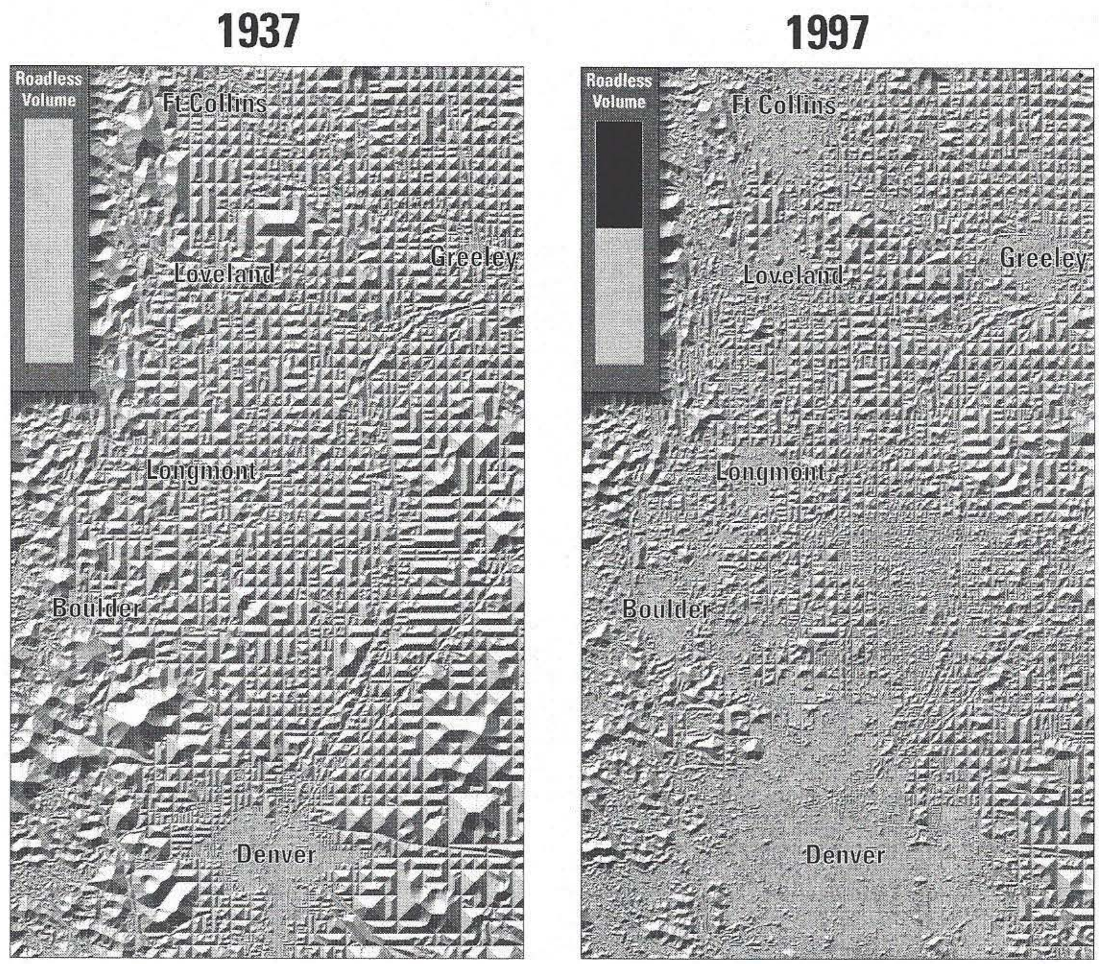

Figure 1. Spatial Distribution of Roadless Volume indicator from Watts and Mountrakis (2008)

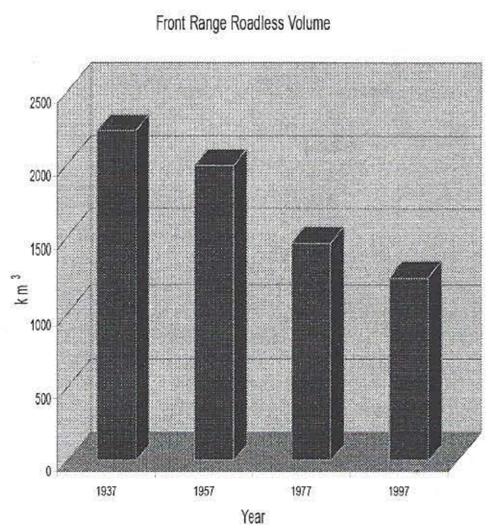

Figure 2. Roadless Volume Summary from Watts and Mountrakis (2008)

To demonstrate the expressiveness of our method we present here a simple artificial example. Let us assume that a decision maker and a scientist are assessing a forest change that took place from figure 3 to figure 4. The surrounding four rectangular forests remain intact, but the circular forest in the center was lost from time T to time T+Δt. The scientist applies our method and creates the distance to closest forest (DTF) map for both time periods (figures 5 and 6). This is step 2 from our earlier discussion. He/she then visualizes the DTF maps in three dimensions by representing the DTF value in the Z axes, leading to figures 7 and 8 respectively. At the next stage (step 3 from earlier discussion) he/she calculates the volume in both figures 7 and 8, which is the forestless volume (FV) indicator. For this particular example FV has increased from 777,880 m^3 to 1,275,200 m^3. Lower value corresponds to better spatial distribution. This metric provides an assessment relating to the uniqueness of the forest in the circular area. Alternative scenarios could be tested and this area could be compared with another study area by simply examining the percentage of FV increase. Furthermore, the visualizations of figure 7 and 8 can provide a powerful spatial representation of forest changes; they could also be subtracted from each other to create a FV change representation. The decision maker can quickly and accurately comprehend the statistics calculated by the scientist, gets excited by the visualizations and uses our software to test alternative scenarios.

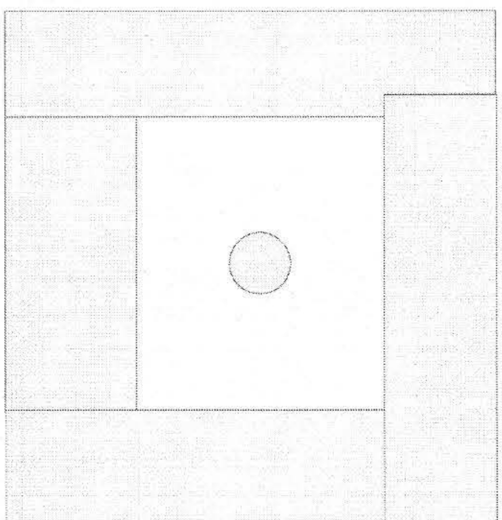

Figure 3: Forest representation in time T (four rectangles and a circle)

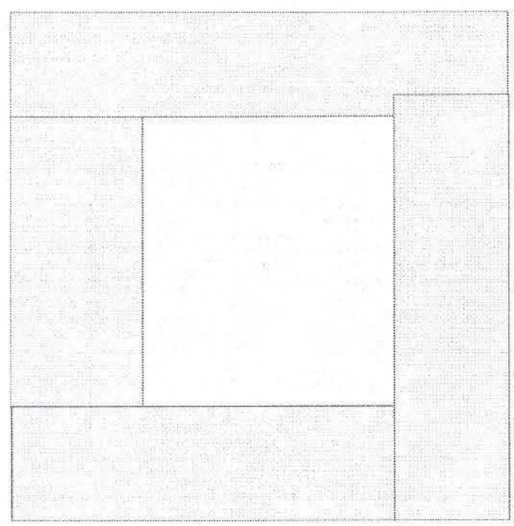

Figure 4: Forest representation in time T+Δt (four rectangles but no circle)

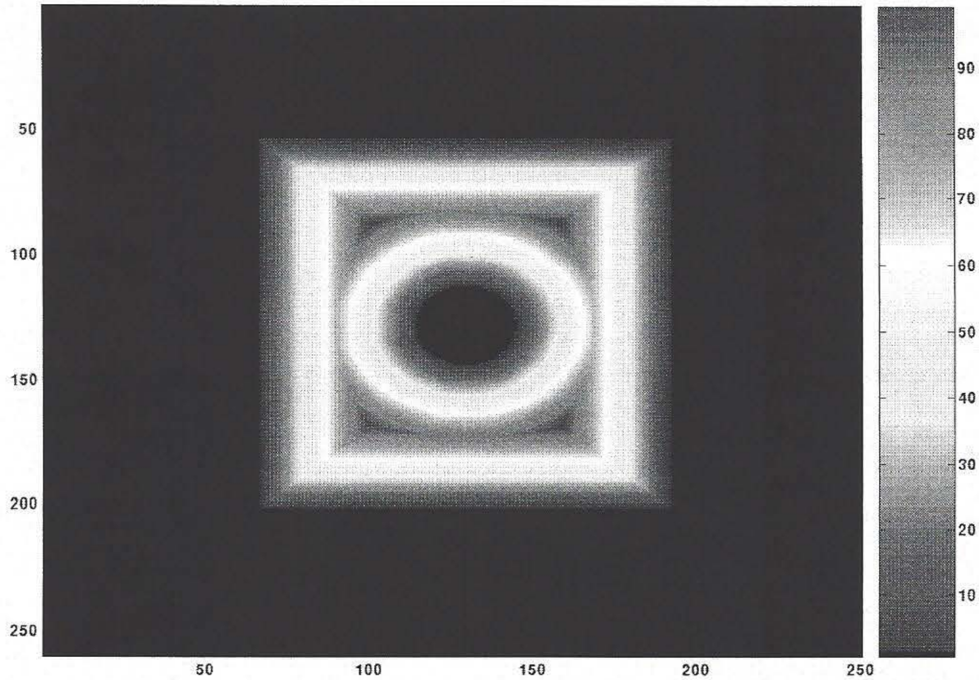

Figure 5: Distance to closest forest for time T

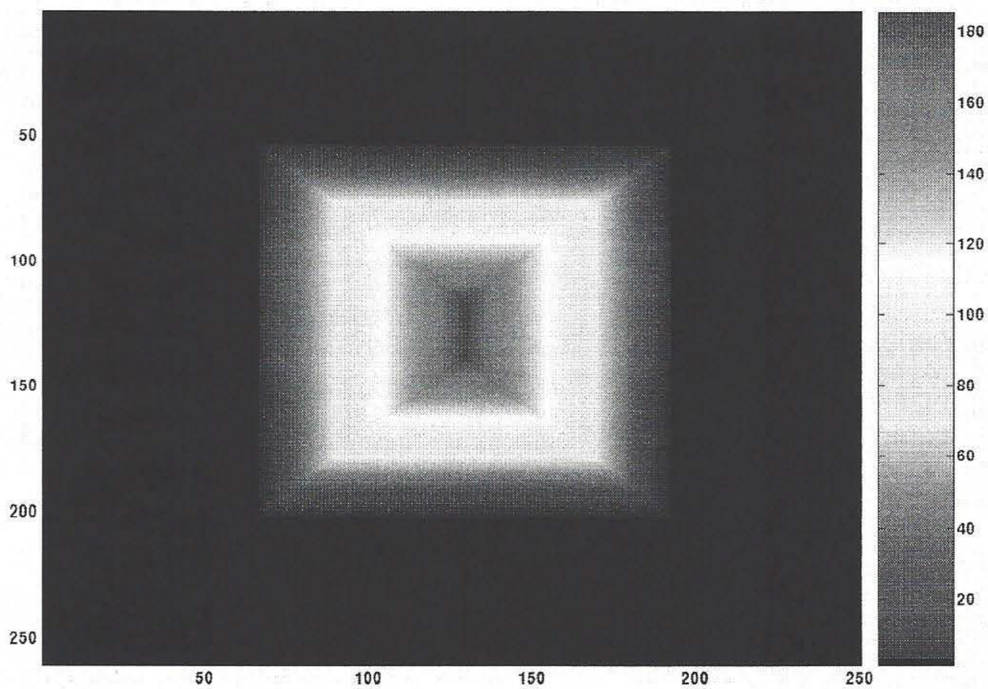

Figure 6: Distance to closest forest for time T+Δt

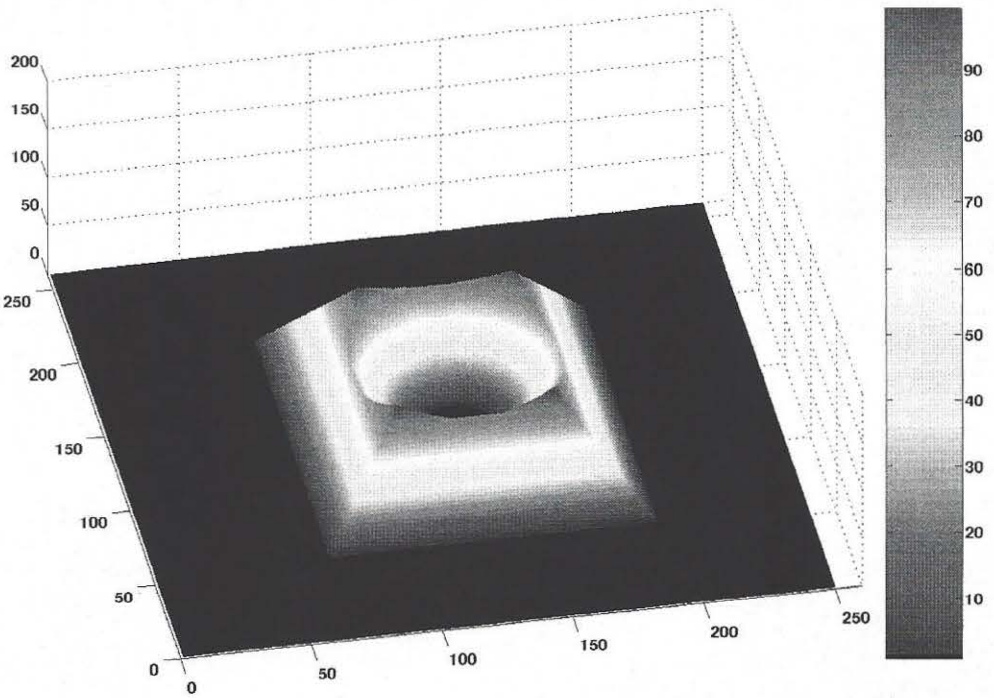

Figure 7: Distance to closest forest for time T in a three dimensional representation
Forestless Volume = 777,880 m^3

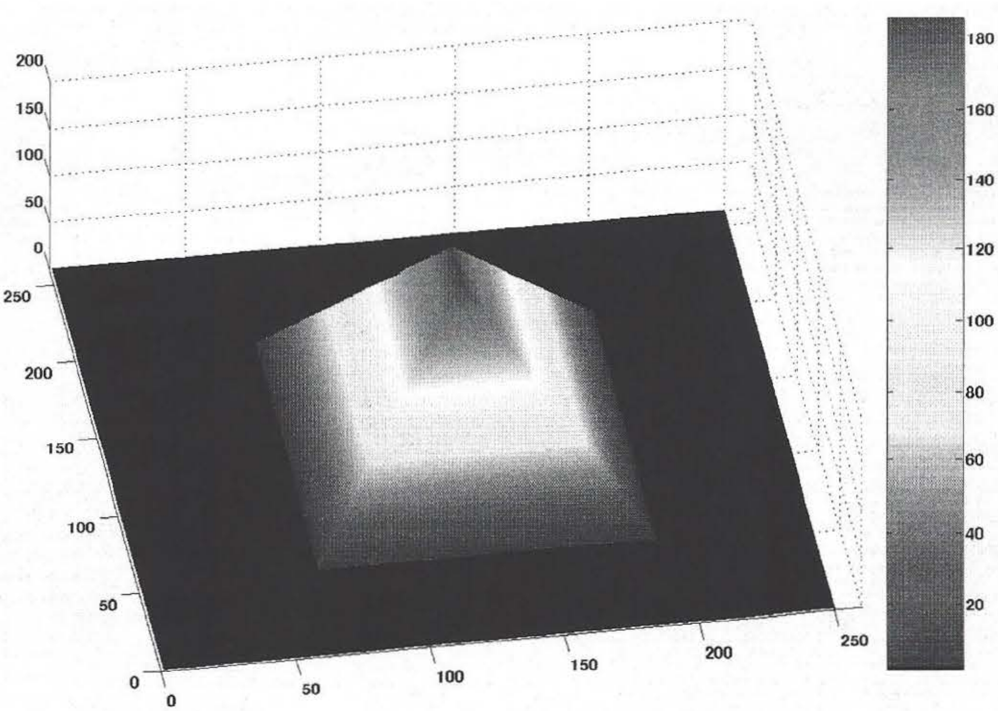

Figure 8: Distance to closest forest for time T+Δt in a three dimensional representation
Forestless Volume = 1,275,200 m^3

To summarize, with our spatial metrics, we can answer key questions such as:

- How much forestless volume is there in a particular county or in the conterminous 48 states of the United States? How can we facilitate comparisons at various temporal and spatial scales?
- When a forest is lost/added, how much forestless volume is gained/lost? What is the difference between adding a forest adjacent to an antecedent forest versus adding one that penetrates to the core of an otherwise forestless area?
- How can different forest change scenarios be evaluated in order to minimize forestless volume?

Our forestless volume indicator will find further usage when compared with socioeconomic data. This is outside the scope of our work for this project but the next logical step in our analysis. The FV indicator can be normalized with population data and produce a per capita representation. This can guide policy decisions to optimize number of citizens served. Furthermore, income and race statistics can be utilized to identify races and income levels under- or over-represented in forest accessibility.

4. Product

In accordance with the RFP's broad national scope, our project will deliver a geospatial methodology capable of nationwide application. From the dataset perspective, the National Land Cover Data (NLCD) from two temporal periods (1990s and 2000s) cover the whole U.S. and are free for download from numerous sources. As for algorithmic constraints, our methods will easily scale to nationwide efforts as other applications have already demonstrated (e.g. see Watts and Mountrakis, 2008).

Within the funded period we will perform a forestless volume assessment for two temporal periods (1990s and 2000s) for the states of New York, Wisconsin, Texas, Michigan and Oregon. These states are targeted as a representative sample of forest changes to demonstrate the applicability and expressiveness of our method. We should clarify that our pre-proposal identified only New York state as our study area. In the mean time we have established a key collaboration with Dr. Watts (see his commitment letter) and since he will be sharing with us some of his statistical programming code we can confidently now extend our study area to include additional four states for the same budget.

[*In addition to the five selected states, we propose nationwide implementation with additional NUCFAC commitment, please see the second year extension part at the end of this document as we did not want to deviate from our original pre-proposal scope and budget*].

In terms of project deliverables, we will provide the following:

- A GIS database with input data, intermediate map layers (e.g. the distance to forest), and final forestless volume metrics for the selected four states in two temporal periods.
- Software capable of calculating the forestless volume indicator at arbitrary spatial scale (municipality, county, state, country). Our software will also support comparisons between multiple input layers as selected by users. These layers may use existing NLCD information provided by our software or user provided alternative scenarios.
- At least one scientific paper describing our methodology and results.
- Fact sheets explaining the value of urban forests along with maps and text explaining our forest change indicator, all written in layman's terms.

- Powerpoint presentations for non-experts showing the expressiveness of our method under different scenarios.
- A website where the public can freely access the aforementioned information (GIS database, software, research papers, fact sheets, powerpoint presentations). We will also use this website as an outreach mechanism by providing information on urban forest importance and existing stressors.

The timeline below describes activities for the duration of the project.

Activities	**Project Timeline (Months)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Coordinate with USDA Forest Service Urban and Community Forestry Program Regions/Stations	■	■	■	■	■	■	■	■	■	■	■	■
Build GIS database for four states	■	■										■
Develop software		■	■	■	■	■	■	■	■	■	■	■
Write scientific paper(s)								■	■	■	■	■
Produce fact sheets and presentations										■	■	
Develop/update project website	■	■	■	■	■	■	■	■	■	■	■	■
High school outreach											■	■
Project evaluation		■	■							■	■	■
Nationwide dissemination of results										■	■	■

Table 1: Project Timeline

5. National Distribution/Technology Transfer of Your Findings

We believe that in addition to the general public, scientists and policy makers from numerous disciplines will benefit from this grant. A significant component of our project will involve distribution of our results and methods. The following activities are planned:

- Develop a website for the project.

The website will act as the first point of contact. It will be designed for the layman in mind with appropriate subsections targeting scientific, industrial and governmental audience. All our products (GIS database, software, research papers, and fact sheets) will be freely available for download. A special section will be developed for the high school audience (see below).

- Engagement of high school students from underrepresented groups.

We will employ a prominent SUNY ESF Outreach program in this project, *ESF in the High School*. *ESF in the High School* is a concurrent enrollment (or dual credit) program that allows qualified students to take ESF college courses while still in high school, helps them make a successful transition to college, and encourages their interest in science and engineering careers. Formal *ESF in the High School* partnerships now span eight Upstate/Central New York counties and represent over twenty school districts, including five urban, three Board of Cooperative Educational Services (BOCES), five rural and six suburban districts. This is an extraordinary opportunity to engage and encourage teachers and students, especially a significant number of students from underrepresented groups. We will coordinate with teachers and seek their assistance in the design, development, evaluation, and dissemination of our results.

- Forward findings to all USDA Forest Service Urban and Community Forestry Program Regions/Stations.

We will inform all region coordinators of our activities and ask them to act as ambassadors of our work. We will forward them short but intriguing material, provide them with our project website and contact information for further inquiries. We expect the region coordinators to further disseminate our findings within the Forest Service and we will be available to assist them with any questions regarding incorporation of our forestless indicator into existing or future products. By doing so we can target both scientists and decision makers at the right places. Our ultimate goal is to have our simple but powerful indicator act as the basis for discussion between scientists and decision makers. Furthermore, we will coordinate with Dr. Nowak and investigate how our software's functionality and products can be incorporated in the i-Tree software package. The i-Tree suite of software tools help users - regardless of community size or technical capacity - identify and manage the structure, function, and value of urban tree populations (www.itreetools.org). It's primary goal is to release ecosystem assessment tools to the public.

- Disseminate our results to the industry and potential users outside the Forest Service.

One of our collaborators, Dr. Nowak, has extensive experience in urban forest studies. We will seek his input to help us establish a network of interested parties from the private and public sector. A subsection of our website will be devoted to industrial applications of our methodology (e.g. in clear cutting) and another subsection will target urban planners (e.g. showing examples of alternative scenarios for forest changes).

- Investigate possible distribution of produced data using the nationwide Seamless Data Distribution System at USGS.

Their servers have recently been updated to incorporate a distance to closest road dataset (developed by one of our collaborators, Dr. Watts). Dr. Watts will help us approach USGS managers and convince them of the value of a distance to closest forest dataset. We should note that we cannot guarantee success of this attempt as the final decision is beyond our control. However, based on prior success of our collaborator we are optimistic for the outcome.

6. Project Evaluation

We will use our change detection visualizations to stimulate interest from the public on changes in our urban forests. Through our outreach website we will establish a temporal record of forest changes in our test sites. We will track the visitors to our website as an indicator for success in regard to heightening the public's awareness. We will also compile a list of organizations using our products in their analysis and/or outreach programs.

Furthermore, we will develop a detailed assessment questionnaire and request evaluation of our software and data. We will use employees of the Forest Service and USGS and graduate students and faculty from SUNY ESF and other institutions. We will also develop a simpler version of our assessment questionnaire and together with the fact sheets (designed for the layman) we will submit them to the Forest Service region coordinators for further evaluation.

7. Experience/Personnel/Adequacy of Resources

The project will be performed by Dr. Mountrakis with the help of one graduate student and scientific input from Dr. Nowak and Dr. Watts. Dr. Nowak has agreed to share datasets collected from the Forest Service and Dr. Watts will share his experience and code in spatial statistics. They will both help us identify dissemination methods for our results and provide input throughout the duration of the project. It should be noted that Dr. Nowak and Dr. Watts will not receive any funds from this grant and their commitment is not calculated towards SUNY ESF's cost share. Finally, SUNY ESF will provide the necessary office space, personnel and equipment through its cost-share. Short biographies of our research and outreach project group follow.

Dr. Giorgos Mountrakis is an Assistant Professor for the Department of Environmental Resources and Forest Engineering of the State University of New York College of Environmental Science and Forestry. He is the recipient of several awards in recognition of his academic and research achievements including a National Academies of Science award to do research with the United States Geological Survey. He holds a Dipl. Eng. Degree from the National Technical University of Athens, Greece and a M.Sc. and Ph.D. from the University of Maine. His dissertation was in the area of geospatial information retrieval using intelligent methods and his postdoctoral research focused on remote sensing analysis. His expertise includes GIS Spatiotemporal Modeling, Spatial Statistics, Land Use Change Modeling, Image Analysis, and Machine Learning. Dr. Mountrakis has published in numerous journals and books and has presented his work in various international conferences. He is presently teaching courses in Digital Image Analysis, Spatial Statistics and Remote Sensing. His current active research includes two research grants, one from the National Science Foundation and another from the Syracuse Center of Excellence. He is currently a Guest Editor for a Special Issue on "Artificial Intelligence in Remote Sensing" for the Photogrammetric Engineering & Remote Sensing Journal. For more information please visit: www.aboutgis.com.

Dr. David Nowak is a Project Leader with the USDA Forest Service, Northern Research Station in Syracuse, NY. Dr. Nowak received a B.S. and M.S. from SUNY College of Environmental Science and Forestry, and a Ph.D. from the University of California, Berkeley. He has authored over 150 publications and given over 275 presentations. Dr. Nowak is a recipient of the American Forests' Urban Forest Medal recognizing outstanding national contributions in urban forest research, the Distinguished Science Award of the Northeastern Research Station, and the 2007 Nobel Peace Prize for Research on Climate Change as part of the Intergovernmental Panel on Climate Change. His research investigates urban forest structure, health, and change, and its effect on air quality and greenhouse gases.

Dr. Raymond Watts is a Research Physical Scientist at the Rocky Mountain Geographic Science Center of the U.S. Geological Survey, stationed at the USGS Fort Collins Science Center in Colorado. He holds a Ph.D. in Physics (Geophysics) from the University of Toronto. Dr. Watts leads USGS efforts to study interactions of the road network of the United States with surrounding lands; He is currently pursuing studies of interactions between roads, traffic, and wildlife in collaboration with National Park Service, Bureau of Land Management, Forest Service, and Colorado Division of Wildlife. He is author, co-author, or presenter of 70 scientific reports and presentations. From 1984 to 1989 Dr. Watts served as Deputy Assistant Director for Research of USGS. He was Executive Secretary of the Interagency Committee on Earth and

Environmental Sciences (CEES) during the time that CEES organized the U.S. Global Change Research Program. For these contributions, he received the Department of the Interior's Meritorious Service Award. He returned to research in 1990.

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BUDGET

Applicant: The Research Foundation of SUNY for and on behalf of SUNY Environmental Science and Forestry
Project: Establishing a Novel Forest Assessment Method: The Forestless Volume Indicator
Total Cost: $84,866

Category	Federal Funds (Requested)	Non-Federal Match Cash	In-kind	Total	Source of Matching Funds
Personnel:					
PI: Giorgos Mountrakis - 11% AY *	1,375	6,188	0	7,563	SUNY ESF
1.5 Months Summer Salary *	11,458	0	0	11,458	
1- Other Professional - 1 month **	0	5,091	0	5,091	SUNY ESF
1- Graduate Student @ 50% CY ***	16,000	0	0	16,000	
Fringe Benefits:					
SUNY State, 45.53%	626	2,817	0	3,444	SUNY ESF
Summer, 16%	1,833	0	0	1,833	
Regular Employee, 38.5%	0	1,960		1,960	SUNY ESF
Graduate Student, 12.5%	2,000	0	0	2,000	
Total Salaries, Wages and Fringe	**33,293**	**16,056**	**0**	**49,349**	
Travel	**0**	0	0	**0**	
Supplies	**0**	0	0	**0**	
Other Direct Costs:					
Tuition *****	**8,869**	0	0	**8,869**	
Total Other Direct Costs	**8,869**	**0**	**0**	**8,869**	
Total Direct Costs	**42,162**	**16,056**	**0**	**58,218**	
Indirect Costs - 54% MTDC (waived)	**0**	**0**	**26,648**	**26,648**	SUNY ESF
Total Cost	**42,162**	**16,056**	**26,648**	**84,866**	
		Total Match=	**42,705**		

Budget Notes:
* PI Mountrakis will spend 11% of his time during the academic year as well as 1.5 months in the summer working on the project. Nine percent of the 11% academic year time will be cost-shared by SUNY-ESF.
** One month of an Instructional Support Specialists' time will be cost-shared by SUNY-ESF.
*** A graduate student will be hired to work on the project.
**** Funds are allocated for a full tuition scholarship for the graduate student.
Project duration will be one year.

USDA United States Department of Agriculture | Forest Service | Northern Research Station | 5 Moon Library SUNY-ESF Syracuse, NY 13210

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Date: January 22, 2008

Nancy Stremple
National Urban and Community Forestry Advisory Council
USDA Forest Service
Sidney Yates Building (1- Central)
201 14th Street S.W., MS-1151
Washington, DC 20250-1151

Dear NUCFAC Review Panel,

This letter is in support of Dr. Mountrakis' NUCFAC proposal titled "Establishing a Novel Forest Assessment Method: The Forestless Volume Indicator". This proposal will integrate well with the urban forest ecosystem research we are currently conducting and has applications nationally from the local to regional scale. This proposal will allow scientists and decision-makers a new way to assess forest resource distribution and aid in future resource planning.

We will be happy to supply Dr. Mountrakis with any data that we may have that will help facilitate his research and assist him with the extension and implementation of his research. We will also test his new application and provide feedback on any possible improvements. Furthermore, his proposed research tool could easily fit within the i-Tree (www.itreetools.org) software suite to facilitate distribution of this tools and aid forest managers in the future. Various agencies and groups (e.g. state forester agencies, U.S. Forest Service, U.S.G.S., local and regional forest managers) could use his proposed research to aid in urban and non-urban forest management. I am excited about the potential collaboration on this project and will provide project assistance at no cost.

Please let me know if you have any questions.

Sincerely,

David J. Nowak
Project Leader

Caring for the Land and Serving People

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Fort Collins Science Center
2150 Centre Ave Bldg C
Fort Collins CO 80526-8118

18 January 2008

Nancy Stremple
National Urban and Community Forestry Advisory Council
USDA Forest Service
Sidney Yates Building (1-Central)
201 14th Street SW, MS-1151
Washington, DC 20250-1151

Dear NUCFAC Review Panel:

I am writing this letter to express my support and commitment for Dr. Mountrakis' proposal *Establishing a novel forest assessment method: the forestless volume indicator*. I believe his nationwide scalable approach to assess uniqueness of our urban forests will find fruitful ground with practitioners, scientists and decision makers.

The space devoted to forests is a fundamental metric of national land management for which we lack an effective indicator. I have been working on a closely related problem—the amount of roadless space—and in a recent *Science* paper (4 May 2007) introduced the volumetric concept of space measurement. The two problems have much in common, particularly the usefulness of a metric that responds to interruption of continuous space. I am eager to participate in the extension of my work to forest applications, and will share my geographic analysis methods, computer codes, and experience with Dr. Mountrakis in order to speed his analyses. I believe that forested space measured in novel ways is relevant to fire risk, and have many fire research contacts in USGS and elsewhere with whom we may extend and test the new indicator in an important application.

I have collaborated extensively with Dr. Mountrakis in the past and I have no doubt that he will deliver excellent timely results. My activities will be entirely supported by USGS. Please do not hesitate to contact me with any questions.

Sincerely,

Raymond D. Watts
Research Physical Scientist
Email rwatts@usgs.gov
Phone 970.226.9378

ADDITIONAL WORK SCOPE AND FUNDING REQUEST

Since we submitted our pre-proposal we had several discussions with Forest Service personnel and other scientists. Furthermore, we have established a key collaboration with Dr. Watts from USGS. In these discussions we were motivated to take an additional step and perform the nationwide implementation of the proposed method.

With the current budget ($42,162 requested from NUCFAC) we propose to develop software capable of scaling nationwide and produce the forestless volume indicator for five states. For additional NUCFAC funds of $17,792 (with equal or higher match from SUNY ESF) we will produce the forestless volume indicator for the 48 contiguous states. The ability to have a comprehensive indicator developed by the same standards, processes and supervision will make our product directly comparable throughout the U.S. Furthermore, it will guarantee not just the nationwide scope of the project but also a nationwide product, directly available for use by the end of the project period.

$42,162 in NUCFAC funds (pre-proposal budget)	$42,162 + $17,792 = $59,954 in NUCFAC funds (budget with additional work scope)
Duration: One year	Duration: Two years
Project Activities as described in prior pages	Project Activities as described in prior pages with the addition of the nationwide product for the forestless volume indicator

*One to one matching funds from SUNY ESF will be available for both budgets.
** For a 42% budget increase we will increase our final product from five to forty eight states.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Fort Collins Science Center
2150 Centre Ave Bldg C
Fort Collins CO 80526-8118

18 January 2008

Nancy Stremple
National Urban and Community Forestry Advisory Council
USDA Forest Service
Sidney Yates Building (1-Central)
201 14th Street SW, MS-1151
Washington, DC 20250-1151

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Raymond D Watts

Digitally signed by Raymond D Watts
DN: cn=Raymond D Watts, c=US, o=USGS, ou=Geography, email=rwatts@usgs.gov
Reason: I am the author of this document
Date: 2008.01.18 09:41:18 -07'00'

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