What Role for Community Forestry in Post-Katrina Resilience?

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1. SCOPE and APPLICABILITY/ JUSTIFICATION
Introduction

> *For centuries, trees have served as memorials during times of mourning and recovery. They are a living tribute to renewal and regrowth, and they are absolutely essential to any community's recovery after a catastrophic storm...Planting trees not only aids in restoring a community's urban tree canopy cover, it helps in the human healing process...I can say with some degree of certainty that the vitality and health of a community is in many ways related to the health and care of its trees.[1]*

During June of 2007, NUCFAC sponsored the Catastrophic Storm and Urban Forests Public Forum in Biloxi, Mississippi. During the Forum, experts and ordinary citizens shared "ideas, best practices and first-person accounts about flooding in New Jersey, Hurricane Katrina in the Gulf region, ice storms in the Midwest, high winds in Washington State, devastating wildfires in Georgia and California, and other storm events."[2] They went on to discuss how they might urge FEMA to offer financial assistance to restore the urban forest canopy following disasters. After the Forum, NUCFAC conducted a survey of how catastrophic storms have impacted communities, the results of which will be used to develop a set of recommendations to the Secretary of Agriculture on a national strategy to mitigate the effects of storms on urban trees.[3]

Such attempts to influence federal disaster policy to incorporate tree planting and tree care will benefit from research-based information on the role of trees and urban forestry in the resilience[4] of cities post-disaster. Thus, the goal of this proposal is to more systematically document the

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[1] Steve Scott, State Forester of Tennessee, member of the Urban and Community Forestry Committee of the National Association of State Foresters. June 2007, Biloxi MS. Mr Scott went on to comment: "Maintaining or restoring this green infrastructure – the trees and forests within and surrounding urban areas – is essential to the overall recovery of communities after a catastrophic event… Because of their environmental, economic and social importance, the care of trees and urban forestlands must be a priority in both emergency preparedness planning and disaster recovery." http://www.stateforesters.org/testimony/NUCFAC-06-07.htm

[2] Joe Wilson, NUCFAC Chair, http://www.send2press.com/newswire/2007-06-0618-006.shtml

[3] http://www.asla.org/land/2007/0724/nucfac.html

[4] *Ecosystem resilience* is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state. In social systems, resilience has the added capacity of humans to anticipate, learn and plan for the future <www.resilience.org>. In practical terms, resilience of a city, or "urban socio-ecosystem," impacted by disaster is the ability of the city to regain the functioning of its social institutions and natural systems, and is facilitated by residents who are able to produce innovative solutions to challenges. *Human resilience* to loss and trauma pertains to "the ability of adults in otherwise normal circumstances who are exposed to an isolated and potentially highly disruptive event, such as death of a close relation or a violent life threatening situation, to maintain relatively stable, healthy levels of psychological and physical functioning" (Bonanno 2004). Both *socio-ecosystem resilience* and *human* resilience (also referred to as "recovery") are addressed in this proposal.

ways in which people engage with trees and forests in their efforts to rebuild New Orleans following the Hurricane Katrina disaster. To reach this goal, we will build on our preliminary research and observations from New Orleans and elsewhere on the role of trees, of tree planting, and of other "civic ecology"[5] activities in which ordinary citizens engage with nature for the benefit of their community (Tidball and Krasny 2007). We will also build on the considerable body of knowledge about the symbolic meaning of trees (Dwyer et al. 1991; Hull 1992), about the role of trees in human well-being (Kuo 2003), and about resilience in socio-ecosystems[6] (Folke et al. 2002).

Background
During fall 2005, just months after Hurricane Katrina, co-PI on this proposal Tidball joined a team of Cornell planners and New Orleans community groups conducting a participatory rapid assessment of neighborhood ecology in New Orleans' 9th Ward.[7] Although originally intending to focus on community gardens, parks, and other natural areas, Tidball soon realized that residents were most eager to share stories about trees. During short interviews on the street and organized focus group discussions, 9th Ward residents recounted many stories about the landscape prior to Katrina, the role that trees played in their lives, how they used trees as landmarks to find the place where their home once stood, and how the surviving trees gave them hope that they too would persevere and maintain their roots in the 9th Ward.

Similarly, in a survey of 185 residents of Charleston SC following Hurricane Hugo, over 30% of respondents identified urban forests as the most significant feature that was damaged by the hurricane (Hull 1992). Of the numerous values associated with the urban forest following Hugo, positive emotions evoked by trees were most important, followed by the importance of trees in defining Charleston as a community or "place." According to Hull (1992), "the role of urban forests as symbols of cherished meanings and memories needs to be emphasized as a major benefit deriving from urban forestry. This was one of the more frequently cited reasons why the urban forest was special to residents. Trees symbolize spiritual values, personal memories, reminders of the past, preservation and endurance. All these symbols are highly valued by the public" (p 3). A study conducted by Dwyer et al. (1991) in Chicago IL, supported these findings about the symbolic meaning of trees. According to these researchers, "urban trees are living, breathing organisms with which people feel a strong relationship, and in our planning and management we should not think of them just as air conditioners, providers of shade, and ornaments in the urban system. Failure to recognize the deep significance of trees to urbanites will most likely result in less effort being given to tree planting, care, and protection than the public desires" (Dwyer et al. 1991, p 9).

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[5] The term civic ecology refers to a variety of environmentally-related initiatives and actions that are organized and controlled locally, and that result in enhanced natural and social capital. Examples of civic ecology practices include urban community forestry, volunteer ecosystem restoration, and community gardening. Civic ecology theory integrates social and ecological systems approaches, and feedback loops between the human and natural aspects of the environment (*e.g.*, the positive impact of trees on humans, which in turn leads humans to plant more trees) (Tidball and Krasny 2007).

[6] Socio-ecosystems integrate social and biophysical attributes and are also referred to as "coupled" systems.

[7] This project, referred to as the New Orleans Planning Initiative, was the result of a collaboration between the Association for Community Organizations for Reform Now (ACORN) and Cornell University's Department of City and Regional Planning. See http://www.aap.cornell.edu/crp/outreach/nopi/index.cfm and http://www.sci-links.com/nola.html.

In spite of what we know from these studies about the symbolic meaning of trees in cities, including cities in which people have lost their homes and other parts of the built infrastructure through a natural disaster (Dwyer et al. 1991; Hull 1992), most disaster planning and recovery research focuses on the physical and institutional infrastructure (*e.g.*, housing, government relief). Those studies that have considered the role of natural resources in disaster generally have focused on the role of trees in: (1) reducing vulnerability (*e.g*., mangrove forests that protect coastal lands from storm surges, and hillside forests that stabilize soils reducing the likelihood or impact of landslides); and (2) providing food, fuel, and makeshift shelter to help people recover (Brown et al. 2006).

While the ecosystem services[8] and material resources provided by trees are critical, *we contend that natural resources, and trees in particular, may shape resilience before and following disaster in cities in ways not currently accounted for in the research literature*. In addition to the symbolic meaning of trees in post-disaster settings described above, we further contend that *the active engagement of ordinary people with trees through such civic ecology practices as tree planting, monitoring tree health, and caring for damaged trees, plays a crucial, yet often unrecognized, role in resilience to disasters in cities*.

Support for these contentions comes from our work in post-Katrina New Orleans, where in contrast to media reports that portrayed the city as paralyzed and helpless, or even worse descending into chaos, we observed ordinary citizens planting and caring for trees as a manifestation of their resilience. For example, volunteer community foresters working with Parkway Partners[9] have replanted over 3000 trees, Monique Pilié and her grassroots organization Hike for KaTREEna[10] have planted 1300 trees, and Replant New Orleans[11] has planted 204 trees. Such community-based activities are often carried out in conjunction with city and other government urban forestry initiatives. When we have spoken informally with the leaders of these New Orleans community organizations, all of whom are continuing these tree planting efforts and who are cooperators on this proposal, they talk about how trees mattered to people's ability to survive the storm, and how replanting trees has been important in bolstering people's resolve to rebuild their lives and their city in the wake of the disaster.

Research Questions and Outreach Objective

Through this proposal, we build on these preliminary observations to more systematically document the ways in which people engage with trees and forests in their efforts to rebuild their neighborhoods post-disaster. In particular, *we seek to understand the role of urban trees and urban community forestry in post-Katrina resilience in New Orleans.* We will answer three more specific research questions as follows:

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[8] Ecosystem services are the benefits people obtain from ecosystems. They include *provisioning services*, such as food, water, timber, and fiber; *regulating services* that affect climate, floods, disease, wastes, and water quality; *cultural services* that provide recreational, aesthetic, and spiritual benefits, and *supporting services* such as soil formation, photosynthesis, and nutrient cycling (Millennium Ecosystem Assessment 2005).
[9] See http://www.parkwaypartnersnola.org/ReLeafNewOrleansInitiative.html
[10] See http://www.hikeforkatreena.com/
[11] See http://www.replantneworleans.org/

Research Question 1. How can we characterize the <u>competencies, capabilities, and actions</u> exhibited by <u>community organizations and government agencies</u> involved in urban community forestry in post-Katrina New Orleans?

Research Question 2. How do <u>residents</u> describe the <u>role of trees and urban forests</u> in their ability to recover from Katrina?

Research Question 3. How do <u>"volunteer community foresters,"</u> or residents who are actively engaged in community initiated management of trees and forests (e.g., through monitoring damage, caring for damaged trees, tree planting), describe the <u>value of active engagement in urban forestry activities</u> in their ability to recover post-Katrina?

Through integrating the results of these three research objectives, *i.e.*, to characterize urban community forestry organizations and practices, to better understand the role of trees in recovery, and to determine how the actions people take regarding their urban forest contribute to their recovery, we will better understand how both the trees, and perhaps more importantly the *act* of meaningfully interacting with trees, enhance individual and socio-ecosystem resilience (Figure 1).

Figure 1. Trees, Tree Planting, and Resilience in Post-Katrina New Orleans
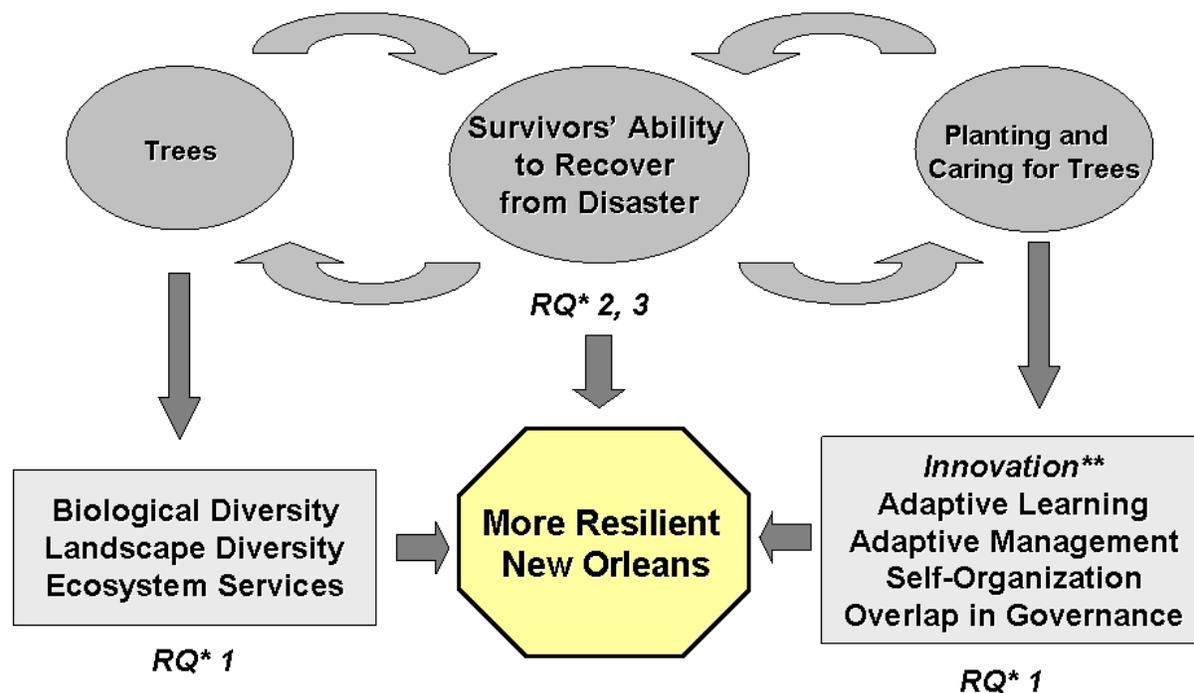
* RQ = Research Question. **Resilience indicator directly measured in this study; other resilience indicators in boxes addressed indirectly. Study also examines role of trees and tree planting in recovery of hurricane survivors (center oval).

We will integrate qualitative methods including interviews, photo-elicitation, and participant observation, GIS, and quantitative surveys in addressing the research objectives. A number of products will be generated through these methods, including photo-audio accounts of the role of planting trees in the recovery of Katrina survivors, maps showing neighborhoods where ordinary citizens have planted trees, and figures showing percentages of residents claiming trees played a role in their recovery, as well as journal articles, reports, and a project website. These products will be used to help reach our ***outreach objective, i.e., To disseminate to scientists, natural resource professionals, disaster planning and relief policy makers, New Orleans residents, and the general public research-based evidence for the role of urban forests and community forestry in urban, post-disaster resilience.***

2. LITERATURE REVIEW

NUCFAC has funded Dozier and Chambers to conduct research on tree response to hurricane-related flooding in northern Gulf Coast communities and Arnn[12] conducted a preliminary photographic assessment of 9/11 impacts on trees. Dozier and Chambers also received a grant from the TREE Fund for research on long-term impacts of storm related flooding on mature urban and community forests along the Gulf of Mexico coast. However, we are *not aware of any studies that expand on research about individual and community impacts of urban forestry to determine its role in the ability of a city to recover from disaster.*

Below we provide a short overview of the extensive research on the individual and community benefits of trees and plants, following which we review the literature on resilience in socio-ecological systems.[13] We conclude the literature review with a brief introduction to the theoretical framework and practice of civic ecology (Tidball and Krasny 2007), which seeks to explore how human interaction with nature builds neighborhood and socio-ecosystem resilience, particularly in urban areas.

Plants, Trees, and Humans

The following quote from the *NY Times* is typical of many media reports about the role of trees in recovery of individuals who have experienced a major disaster.

> *Maybe it's their size, their magnificence, their ability to outlive generations, but trees have always been symbols of strength and renewal. One living example is the Survivor Tree in Oklahoma City, an American elm that remained standing when the Alfred P. Murrah Federal Building was bombed in 1995. Trees are being planted everywhere now in honor of the victims of Sept. 11. There will be dogwoods on a bluff in New Jersey, smoke trees in Staten Island and crape myrtle at a park in the Rockaways, where people also watched the towers fall.*

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[12] See http://www.fs.fed.us/na/durham/living_memorials/about/ppt/impactsppt_files/frame.htm

[13] We use the term socio-ecosystem to emphasize the fact that humans play a role in all ecosystems and that a more thorough understanding of ecosystem processes will be gained if we integrate social and biophysical factors. This is particularly true in cities, or urban socio-ecosystems.

> *It was trees that inspired the United States Forest Service to set up the Living Memorials Project.[14] The Forest Service first responded to the attacks by supplying rescue workers. But when Matthew Arnn, a landscape architect working for the Forest Service in New York City, walked down Broadway two days after the attack, he could not stop looking at the devastated trees in City Hall Park. "I saw rescue workers at Battery Park City sitting on benches under the linden trees," Mr. Arnn said. The trees were shrouded in ash, he said, "but they still offered solace and an opportunity to get away from the pile."*
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> *He thought of E. B. White's words in "Here Is New York" about an old willow tree in Turtle Bay: "It is a battered tree, long suffering and much climbed, held together by strands of wire but beloved of those who know it. In a way it symbolizes the city: life under difficulties, growth against odds, sap-rise in the midst of concrete, and the steady reaching for the sun."[15]*

A second quote, from Louisiana State University forestry professor Hallie Dozier during an interview for National Public Radio, captures the dread people felt in facing possible loss of trees post-Katrina.

> *The loss of live oaks would just be untenable. It would be very, very difficult to handle just in terms of what it would do to the spirit of the people in the places where the trees are gone.[16]*

Whereas these and many other quotes provide testimony of the critical symbolic role of trees in helping people recover from disaster, research-based evidence for the role of trees in helping people and communities recover from disaster is limited. In a study of residents post-Hugo, 30% of survey respondents identified trees as the most significant feature that was damaged by the hurricane, and cited positive emotions evoked by the urban forest, followed by the importance of trees in defining Charleston as a community or "place," as being particularly important. Hull (1992) concluded that the role of urban forests as symbols of cherished meanings and memories needs to be emphasized as a major benefit deriving from urban forestry. Research studies that focus specifically on the role of tree planting or other actions related to trees on post-disaster recovery appear to be lacking.

Despite the paucity of studies specifically on the role of trees and tree planting in resilience, there is a considerable literature documenting people's opinions and attitudes regarding the values of trees (Gorman 2004). Studies have focused on people's attitudes toward specific species of trees (Sommer et al. 1990; Schroeder and Ruffolo 1996; Anderson 2004), and residents' attitudes and behavior regarding tree planting and care (Summit and McPherson 1998). Based on the results of research in Chicago IL, Dwyer et al. (1991) argued for an approach to urban forestry that "takes into consideration the deep psychological ties between people and urban trees and forests." Similarly, Appleyard (1980) characterized trees as "anchors of stability in the urban scene." Perceived economic benefits (Daily 1997), social benefits (Coley

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[14] See Svendsen and Campbell (2006) for more information on the USFS Living Memorials Project.
[15] Nature: Honoring loss with the power of green. *NY Times*, 9/5/02
http://query.nytimes.com/gst/fullpage.html?res=950DE5D7173EF936A3575AC0A9649C8B63
[16] National Public Radio, Day to Day- "Analysis: Battered oaks ready for New Orleans comeback" 10/12/05.

et al. 1997; Westphal 2003), symbolic importance (Smardon 1988), and psychological value (Ulrich 1984; Hull 1992) also have been researched and effectively documented.

The research-based evidence for the role of trees and other plants in human and community well-being is particularly well-documented. On an individual level, gardening or the ability to see or experience green space is reported to help people recover from grief (Relf 1998), deal with the trauma of war (Helphand 2006), reduce domestic violence (Sullivan and Kuo 1996), quicken healing times and reduce stress (Ulrich 1984), improve physical health (Ulrich 1984; Verderber and Reuman 1987; West 1986; Tennessen and Cimprich 1995), and bring about cognitive and psychological benefits for children and adults (Kaplan 1973; Kaplan and Kaplan 1989; Taylor et al. 1998; Wells 2000; Taylor et al. 2001). These individual benefits may result in positive impacts on organizations and communities including increased worker productivity (Kaplan 1993), potentially increased consumer traffic and thus purchases in business districts (Wolf 2003), increased property values resulting in greater municipal revenues (Wachter 2004), and creating a sense of connectedness to the community and thus reducing crime (Kuo et al. 1998).

Dwyer et al. (1991) distinguished between the impacts of trees per se and tree planting in their study of urban residents in Chicago. According to Dwyer et al. (1991), "commitment to tree planting suggests that it has benefits in and of itself that go beyond the expected benefits of the resulting trees (*i.e*., tree planting is a good thing to do even if the trees don't survive!)." Possible explanations for this strong commitment to tree planting include: (1) the value of tree planting as a demonstration of commitment to the future, (2) the act of tree planting as a significant impact on the landscape over time, and (3) tree planting as a means of improving the environment (Dwyer et al. 1991). Similarly, Miles et al. (1998) examined the individual level impacts of engagement with nature through participation in volunteer natural area restoration efforts in Chicago, and found that those volunteers who were more active experienced greater satisfaction. According to Miles et al. (1998), "restoration is a form of involvement with nature that combines the benefits usually associated with nature activities with the benefits associated with volunteer conservation and leisure activities" (p 59).

In short, the testimony of disaster survivors reported by the media, and studies on the symbolic, health, and community value of trees, together provide strong support for a hypothesis regarding the importance of trees and tree planting in recovery from disaster. However, direct research-based evidence for the role of trees and tree planting in helping residents and their communities recover from disaster is limited.

Resilience in Socio-Ecological Systems
Whereas the literature discussed above is useful in understanding how trees might help *individuals* recover from disaster, we are also interested in the relationship of people's engagement with nature to resilience of *socio-ecosystems*. In this section, we briefly review the literature on socio-ecosystem resilience focusing on theory and applications, and on resilience measures.

Socio-Ecosystem Resilience Theory and Disaster Management Applications
According to the Resilience Alliance, "Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a

different set of processes. A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans to anticipate and plan for the future."[17] Other authors have emphasized the critical role of innovation and learning in the ability of socio-ecosystems to recover from disaster (Walker and Salt 2006; Tidball and Krasny 2007).

The resilience literature focuses largely on forest, aquatic, marine, agricultural, and other more rural socio-ecological systems (Baskerville 1995; Carpenter and Cottingham 1997; Anderies et al. 2002). Recently, Alberti and Marzluff (2004) applied resilience theory to resource management in an urban context, and we have applied resilience theory to urban systems focusing on community-designed green spaces (*e.g.*, community gardens, community forests, Tidball and Krasny 2007).

Ecosystems researchers have cited three attributes as being fundamental to the ability of a society to respond to changes such as disaster and conflict, including: (1) the amount of change the system can undergo and still retain the same controls on function and structure (which depends heavily on the biological and socio-economic diversity present in the system), (2) the degree to which the system is capable of self-organization, and (3) the ability to build and increase the capacity for learning and adaptation (Folke et al. 2002). We discuss each of these briefly below.

Diversity is fundamental to retaining functional and structural controls in the face of disturbance and thus to buffering the impact of catastrophic and other changes (Folke et al. 2002; Perrings 2006; Walker and Salt 2006). Biological diversity provides functional redundancy, so that if one species declines (*e.g.*, a nitrogen-fixing species), other species providing the same ecosystem services will continue to function (Levin 2005). Similarly, when diverse groups of stakeholders, including resource users from different socio-economic classes or ethnic groups, scientists, community members with local knowledge, non-profit organizations, and government officials, share the management of an urban forest or other natural resource, decision-making may be better informed, stakeholders may be more invested in and supportive of the decisions, and more options exist for testing and evaluating policies (Olsson et al. 2004).

Self-organization refers to the emergence of macro-scale patterns from smaller-scale rules, such as the emergence of ecosystem patterns related to nutrient cycling or plant size distributions as a result of evolution acting at the species level (Levin 2005), or the development of a market economy in laissez-faire political systems. Participation of local residents in managing their own resources also may be viewed as a form of self-organization and can lead to adaptive learning and eventually greater resilience (Olsson et al. 2004). For example, following a hurricane on the island of Montserrat, local people undertook development projects such as building a community center and implementing new farming practices (Vale and Campanella 2005), and refugees living in camps in Somalia and Kenya learned new methods of growing food which they took back to their communities following resettlement (Smit and Bailkey 2006). Community forestry post-Katrina also provides an example of local people reclaiming blighted areas in cities, and thus embodying a form of community-based self-organization that presents an alternative to dependence on formal institutions (Folke et al. 2002). Volunteer community foresters engaged in tree planting and similar activities also may create or join advocacy groups to conserve the trees

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[17] Resilience Alliance, www.resalliance.org

and urban forests they have planted. Throughout this process, they may be learning adaptively from their forestry and advocacy activities (*c.f.*, Gunderson et al. 2006).

Walker and Salt (2006) list nine rather than three attributes that we would expect to find in resilient socio-ecosystems, including diversity, ecological variability, modularity, tight feedbacks, social capital, innovation, overlap in governance, and ecosystem services. We can envision some of these additional attributes playing a role in community forestry in New Orleans. For example, the civic ecology practices that emerged to address how to care for damaged trees can be considered an "innovation," and individuals who are engaged in tree planting and caring for trees may have built new social networks and become leaders in civic associations, both of which are aspects of social capital. Further, the involvement of both non-profit organizations and government agencies in tree planting and caring for trees represents overlap in governance, and the trees themselves enhance diversity and ecological variability, as well as provide ecosystem services.

The Montserrat, African, and New Orleans cases provide examples of positive feedback loops, which are also critical to resilience theory. In taking the initiative to manage local natural resources, people acquire skills and new knowledge, and apply them to enhancing community development, food security, and the local environment. This, in turn, should create a system that is more resilient in the face of a new disturbance or disaster. One challenge for planners is how to foster local leadership and action leading to positive feedback loops that enhance resilience. This is in contrast to some post-disaster or post-conflict interventions that result in destructive feedback loops, such as when lack of meaningful employment opportunities for men leads to violence, which in turn leads to destruction of infrastructure and even fewer employment opportunities (Tidball and Krasny 2007; Weinstein and Tidball 2007).

Building resilience through nurturing diversity, self-organization, adaptive learning, innovation, and constructive positive feedback loops is consistent with calls for a shift in disaster relief thinking from identifying what is missing in a crisis (needs, hazards, vulnerabilities) to identifying the strengths, skills, and resources that are already in place within communities (IFRC 2004). Applied to New Orleans, this would imply that policies should help foster the positive civic activity associated with tree planting. However, tools and policies that are consistent with asset-based approaches to building resilience in cities are often lacking.

Measuring Socio-Ecosystem Resilience
Carpenter et al (2001) point out two issues that face researchers trying to develop measures of resilience. First, it is critical to *define resilience of what, to what*? In our research, we focus on resilience *of individuals* in New Orleans *to Hurricane Katrina*, and through an examination of innovation related to community forestry practices, we also address several indicators of *resilience of the New Orleans socio-ecosystem to Hurricane Katrina*.

Second, whereas several *direct measures* of socio-ecosystem resilience have been developed, they are difficult to implement (Carpenter et al 2001). Thus most studies focus on measuring *indicators* of resilience. For example, drawing from Walker and Salt (2006), we can assume that innovations are an indicator of social resilience, and biological and landscape diversity are

indicators of ecosystem resilience. Thus, if we measure innovation and diversity, we will have at least a partial measure of resilience of the socio-ecological system.

Carpenter et al. (2001) include both ecological and social indicators of resilience in their research. Similarly, international development professionals attempting to measure resilience in developing countries have integrated sustainable livelihood and environmental management factors that may foster resilience in the face of climate change (Elasha et al. 2005). However, most resilience measures used by government authorities and researchers in developed countries are limited to social indicators of resilience. For example, the Auckland Region Civil Defense Emergency Management Group in New Zealand has defined social resilience as the capacity of people, communities and organizations to adapt to, manage, and learn from the demands, challenges and changes encountered during emergencies, and has identified 11 social measures for their model of resilience (*e.g.*, community participation, leadership, social support; see Paton et al. 2006). Similarly, researchers at the Multidisciplinary Center for Earthquake Engineering Research define resilience as "the ability of social units (*e.g.*, organizations, communities) to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future disasters," and have identified four dimensions of resilience: the technical, organizational, social, and economic (Bruneau et al. 2003). Finally, measures used in the "Toolkit for Health and Resilience in Vulnerable Environments" are clustered into four categories: built environment, social capital, services and institutions, and structural factors (Prevention Institute 2004). There is a need for measures of resilience that integrate these social indicators with ecological indicators.

Nature and Resilience: Developing a Civic Ecology Research Agenda
Adger (2000) describes a scenario in which communities that depend on natural resources exploit and deplete those resources to the point where social resilience is also depleted. For example, communities dependent on forest resources cut down the forest, which results not only in depletion of the forest resource but also the collapse of social relations among individuals and deterioration of social institutions such as schools. In this view, resource dependency is negatively correlated with socio-ecosystem resilience. In contrast, Robards and Alessa (2004) describe how diverse and changing use coupled with stewardship of resources (*e.g.*, wild foods, wildlife) by arctic peoples can foster ecosystem and social resilience over long-term time scales.[18] In this scenario, resource dependency is viewed not as exploitation, but instead as resource use coupled with protection, enhancement, and regeneration of the resource.

In contrast to people in the arctic, people in cities are only minimally dependent on resources for food and shelter. However, research on the impact of exposure to trees and other forms of nature on people's mental and physical well-being (see page 7 above) suggests that city residents may have another type of resource dependency, which could be characterized as psychological rather than material. Further the literature suggests that when people have the opportunity to engage

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[18] In a statement illustrating both the "coupling" of natural and social components of the arctic socio-ecological system and the role of adaptability and innovation, Robards and Alessa (2004) state, "the longevity of many Arctic cultures has been facilitated by adaptive responses such as migrations, rapid subsistence shifts, the development of new technologies, new economic practices, ecological manipulation, and other social and cultural transitions (Berkes and Folke, 2001; CAFF, 2001)."

with trees in cities through tree planting and related activities, they may end up more healthy individuals, and more able to recover following a disaster.

In addition to the literature cited above, we draw from de Tocqueville's (1956) descriptions of America's community builders[19] in arguing that *urban community forestry and other civic ecology approaches that integrate natural, human, and social capital in cities, and that encompass diversity, self-organization, innovation, and adaptive learning and management leading to positive feedback loops, have the potential to reduce risk from disaster in cities through helping communities to develop resilience before a disaster, and to demonstrate resilience after disaster strikes* (Tidball and Krasny 2007). We realize that an emphasis on community forestry and other forms of greening may be counterintuitive, given that many urban residents have unmet fundamental needs including sanitation, personal safety, and land tenure, and that cities are often considered as wastelands devoid of nature. However, we contend that some individuals and communities take it upon themselves to improve their environment even under the most difficult conditions, and that such action not only is part of resilience but should be incorporated into asset-based community development and disaster relief policies and practices (Tidball and Krasny 2007; Krasny and Tidball 2008).

Conclusion
In conclusion, we make two points and then pose several questions. First, the evidence for our contention about engagement with nature and resilience comes from three sources: (1) testimony about how presence of trees and people's relationships with trees was a strong factor in people's recovery following Hurricanes Hugo and Katrina, and following other disasters such as 9/11 and the Oklahoma City bombing; (2) the literature on human and community benefits from nature; and (3) the literature on socio-ecosystem resilience, which suggests that community members coming together to plant and care for trees helps to foster multiple attributes of resilient socio-ecological systems, including biological diversity, ecological services, self-organization of community members, multiple forms of governance, creating innovations, and adaptive learning. However, *these three lines of evidence are circumstantial in that none directly focuses on the role of community tree planting and other civic ecology practices in resilience following disaster.*

Second, whereas a number of researchers and government agencies are attempting to develop measures of resilience, these efforts are still in the formative stage. Further, most existing measures focus on either social or ecosystem resilience. The relatively few attempts to integrate social and ecosystem measures generally make separate lists, one for social measures and the other for ecosystem measures. *What is lacking are resilience measures that reflect the interactions or feedback loops between people and nature. Further, existing measures of socio-ecosystem resilience generally focus on community-level variables and ignore what is important to individual humans in the resilience or recovery process.* Understanding how humans, as one among many organisms in a socio-ecosystem, experience recovery is an important aspect of understanding overall system resilience.

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[19] What de Tocqueville found most unique about America was that people gathered together in small self-appointed groups or "associations" to identify problems, to organize and develop new approaches to solve the problems, and in so doing to build local society (Kretzmann and McKnight 1993).

Finally, a question we have begun to ask through our Initiative for Civic Ecology is: In what ways might the organizations that foster residents' engagement with nature (civic ecology) be fostering biological and landscape diversity, innovation, and learning, as indicators of socio-ecosystem resilience? Further, we ask whether people's dependence on trees and nature in cities, and their engagement in enhancing this resource, facilitate personal recovery from disaster. Finally, we ask: What is the relationship of personal recovery from disaster as mediated by nature and involvement with nature, to socio-ecosystem resilience? This proposal is a first step in answering these critical questions about people, trees, and resilience.

3. ORGANIZATION/ METHODOLOGY
Introduction
The goal of this research is to determine the role of urban trees and community forestry activities in post-Katrina resilience in New Orleans. By approaching this goal using three research objectives -- (1) characterization of community forestry organizations and their practices, (2) determining the value of *trees and urban forests* in recovery, and (3) determining the value of *active engagement in urban forestry activities* in recovery -- we will better understand both how trees, and perhaps more importantly how the act of meaningfully interacting with trees, enhance individual and socio-ecosystem resilience in cities following disaster. Figure 2 provides an overview of the methods used to address the research questions and phases within each question.

The research approach for question 1 draws from institutional analysis methods used in forestry studies, which allow us to view post-Katrina community forestry practices as an innovation. The methods entail interviews and document review and use of GIS. The approach for questions 2 and 3 draws from research focused on people's responses to plants, and includes qualitative interviews, photo-elicitation, focus groups, and quantitative surveys. Through integrating quantitative and qualitative approaches within each research question, and across all the stages of the research process, our research approach goes beyond simple mixed methods approaches that use a blend of quantitative and qualitative methods (Mingers J 1997), and can be described as a "mixed models" approach (Tashakkori and Teddlie 2003). Our rationale for using this mixed models approach is informed by Greene et al. (1989), who outline five features of such an approach that help to ensure validity of research results, including triangulation, complementarity, development, initiation, and expansion.[20] For example, in our particular study, qualitative methods will be used to inform the sample population, survey implementation, and the development of measures for the quantitative survey (development), as well as to elaborate, enhance, illustrate, and clarify the results from the quantitative aspects of the study (complementarity). We will triangulate various sources of data to discover contradictions and

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[20] *Triangulation* seeks convergence, corroboration, and correspondence of results from different methods. *Complementarity* seeks elaboration, enhancement, illustration, and clarification of the results from one method with the results of another method. *Development* seeks to use the results of one method to help develop of inform the other method, where development is broadly construed to include sampling and implementation, as well as measurement decisions. *Initiation* seeks the discovery of paradox and contradiction, new perspectives or frameworks, and the recasting of questions or results from one method with questions or results from another method. *Expansion* seeks to extend the breadth and range of inquiry by using different methods for different inquiry components (Greene et al 1989).

develop new perspectives on conceptual models, and will use different study components to extend the breadth and range of inquiry (expansion) (Tashakkori and Teddlie 2003).

Figure 2. Research Methods Overview

Research Question 1. Urban community forestry organizations/agencies and their practices.
Phase 1. *In-depth Interviews* with 5 organization/agency leaders, *Document Analysis* of organization/agency reports and strategic plans
Phase 2. *GIS Maps* of urban forestry activities

Research Question 2. Trees and Recovery
Phase 1. *Exploratory Interviews* with 30 residents
Phase 2. *In-depth Interviews and Photo-Elicitation* with 5 residents
Phase 3. *Quantitative Survey* of 300 residents

Research Question 3. Tree Planting and Recovery
Phase 1. *Exploratory Interviews* with 30 volunteer community foresters
Phase 2. *Participant Observation* of tree planting, caring, removal, and monitoring activities over 2-week period
Phase 3. *In-depth Interviews and Photo-Elicitation* with 5 volunteer community foresters
Phase 4. *Focus Group* with 7-10 volunteer community foresters
Phase 5. *Quantitative Survey* of 200 volunteer community foresters

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In addition to the means for helping to ensure validity described above, we will "member check" or systematically seek feedback from the study subjects at each stage of the research (Maxwell 1996). Through this participatory approach, the research process will be informed by and calibrated with the people who live in New Orleans. We also will follow federal, state, and Cornell University regulations for the use of Human Subjects in answering the research questions.

Throughout the various phases of the research, we will create multiple products that can be used in outreach. These include audiovisual files of the in-depth interviews for posting on our website, GIS maps, and graphs and tables summarizing the quantitative aspects of the study.

Co-PI Tidball will assume overall responsibility for the field research. He will regularly discuss each aspect of the research and analysis with PI Krasny and will work closely with Dr Krasny to develop the interview and survey instruments, analyze the data, write up the results, and produce the outreach products. Sr Scientist Broussard will provide consultation on social sciences forestry research methods and forestry outreach. We will train university students to help code the qualitative data and help develop the GIS maps, and we will train individuals associated with

our New Orleans partner organizations to implement the written surveys for research questions 2 and 3.

Below we describe the methods for each research question.

Research Question 1 (RQ 1). How can we characterize the competencies, capabilities, and actions exhibited by community organizations and government agencies involved in urban community forestry in post-Katrina New Orleans?

To answer questions about community organizations and government agencies, we will first conduct in-depth interviews and review documents to develop an understanding of competencies, capabilities, and actions as perceived by the leaders of these institutions (phase 1, RQ 1). Next we will work with the partner organizations to develop GIS layers of the tree planting and related activities they are conducting in partnership with volunteer community foresters (phase 2, RQ 1). The results from RQ 1 will provide direct measures of innovation as well as more indirect indicators of biological and landscape diversity, adaptive learning and resource management, self-organization, and overlap in governance, all of which are indicators of socio-ecosystem resilience (Figure 1). RQ 1 also will generate two products: (1) descriptions of the processes through which community organizations and government agencies create urban forestry innovations in response to catastrophic tree and human loss; and (2) GIS maps showing the location of trees, urban forestry activities, and social and demographic factors.

Phase 1 (RQ 1). Institutional analysis focusing on innovations. We will adapt the methods used by Wolf and Primmer (2006) in their study of the processes through which non-profit organizations and government agencies working to conserve forest biodiversity pursue conservation innovations. The aim of Wolf and Primmer's (2006) research was to identify positive models of innovation, which the authors define as new ways of producing services and goods that enhance the environment. Because innovations and related adaptive learning and adaptive management are critical to the resilience of socio-ecological systems (Walker and Salt 2006), using a method for institutional analysis that focuses on innovation will provide critical indicators of social resilience (Carpenter and Cottingham 1997).[21] Further, a framework emphasizing innovations and adaptive learning is particularly appropriate for a situation such as post-Katrina New Orleans, where the extreme conditions faced by foresters and citizens requires new ways of thinking, managing, and learning. Finally, by capturing the innovative ways in which New Orleans community organizations and government agencies have addressed disaster, we will collect information that will be useful for other cities preparing for and responding to catastrophes.

We will conduct structured, in-person interviews with leaders of the three community organizations that are cooperators on this project (Parkway Partners, Hike for KaTREEna, and

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[21] Note that although the Wolf and Primmer (2006) method focuses on innovative practices, through analyzing the process by which urban forestry community organizations and government agencies respond to disaster, we also will obtain information on learning, adaptive management, self-organization (how community-driven initiatives emerge after a disaster), and overlap in governance (roles of community organizations and government). Furthermore, through the GIS mapping also carried out as part of this objective (see below), we will gain ecosystem measures of resilience, including diversity of tree species and of landscapes.

Replant New Orleans) and with the State of Louisiana and City of New Orleans urban foresters.[22] Based on our current knowledge, these five organizations/agencies represent the major formal players in urban community forestry in New Orleans. Should these five interviews identify additional organizations playing a critical role in urban community forestry in New Orleans, we will expand the interviews to include these additional players.

The interview protocol will include measures of the organizations' or agencies': (1) internal competencies, including human capital (*e.g*., education level) and organizational routines (*e.g*., mission statements); (2) external competencies or linkages to resources of external actors (*e.g*., ability of community organization to access government provided trees); (3) capabilities, or ability to do new things or do things differently to conserve natural resources (*e.g*., organizational ability to switch from pre-Katrina nature protection to post-Katrina restoration); and (4) action, which is referred to as "multi-functionality" or "derivation of multiple benefits by a set of diverse actors in a temporally and spatially defined context" (*e.g.*, tree planting, tree care, tree health monitoring, and tree removal; and number, species, and locations of trees planted and cared for, Wolf and Primmer 2006; see Figure 3). After developing measures for each of these factors, we will provide a list of interview topics to each interviewee prior to the interview.
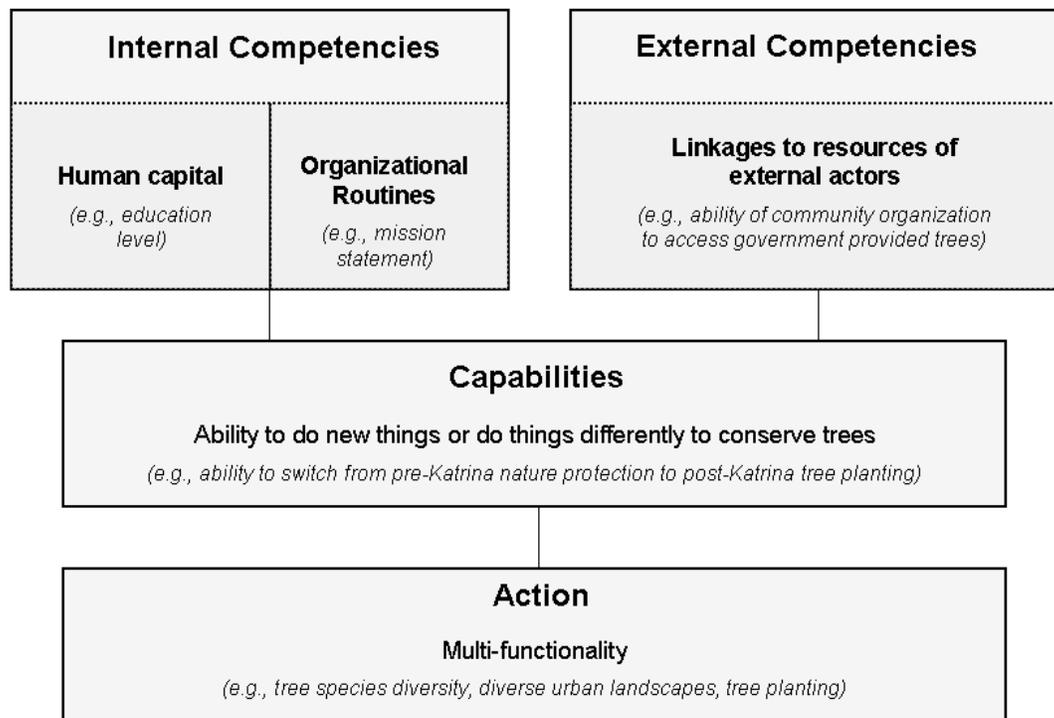
During the interviews, which will take place at the subject's office, we also will collect organizational documents describing organizational mission, resources, and accomplishments, as well as any maps showing locations of tree planting and other forestry efforts. The organizational documents and transcriptions of the interviews will be analyzed for content and coded (Maxwell 1996), and will be used to develop separate narratives, summary tables, and organizational diagrams describing the processes by which each organization or agency achieves innovations related to urban forest conservation and restoration in post-Katrina New Orleans.

Phase 2 (RQ 1). GIS Maps. We use existing data and data collected through this project to create maps showing locations of trees and of tree planting, tree care, tree monitoring, and tree removal activities. These maps will be used to construct GIS layers showing the spatial location of the urban community forestry practices in New Orleans. The data layers will be added onto publicly available GIS layers[23] of demographic and social data, including such variables as income and population (*e.g*., how many residents have returned since the storm), as well as forest data, including degree of damage to trees and tree cover by neighborhood pre- and post-Katrina. Wherever possible, we will use existing data layers that embody variables used in studies to characterize resilience in socio-ecosystems (*e.g.*, presence of civic organizations, diversity of tree species). Using the GIS layers, we will be able to correlate post-Katrina tree planting activity with pre- and post-Katrina demographic, social, and tree data in a manner that helps us to better understand the role of community forestry in post-Katrina resilience.

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[22] We have agreements to participate in this study from the three community organizations and the LA state urban forester (see letters of support). We have spoken several times to staff in the City of New Orleans urban forester's office and hope to receive his permission to be interviewed soon.

[23] We will use data available through the Greater New Orleans Community Data Center, www.gnocdc.org, the State of Louisiana's Hurricane Katrina information clearinghouse, http://www.katrina.louisiana.gov/index.html, and other sources.

Figure 3. Competence-based framework for natural resources innovations applied to community forestry in New Orleans (adapted from Wolf & Primmer 2007).

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│    Internal Competencies     │   │    External Competencies     │
│ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─  │   │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─  │
│              │               │   │                              │
│ Human capital │ Organizational│   │    Linkages to resources of  │
│              │    Routines   │   │        external actors       │
│ (e.g., education│ (e.g., mission│   │ (e.g., ability of community  │
│    level)    │  statement)   │   │ organization to access       │
│              │               │   │ government provided trees)   │
└──────────────────────────────┘   └──────────────────────────────┘
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Capabilities

Ability to do new things or do things differently to conserve trees

(e.g., ability to switch from pre-Katrina nature protection to post-Katrina tree planting)

Action

Multi-functionality

(e.g., tree species diversity, diverse urban landscapes, tree planting)

Research Question 2 (RQ 2). How do residents describe the role of trees and urban forests in their ability to recover from Katrina?

The research to address RQ 2 will be conducted in three phases: (1) "Exploratory Interviewing and Item Generation," (2) "Narratives and Individual Accounts" (Weller 1998), and (3) quantitative surveys. Throughout the three phases, we will engage New Orleans residents in a participatory fashion, through helping to identify study questions and carrying out surveys.

The results of RQ 2 and of RQ 3 (see below) will provide rich qualitative and quantitative data that will help us to develop a deeper understanding of the role of trees and of community-initiated tree planting and related activities in the recovery of individuals from Hurricane Katrina. This understanding of individual level recovery is unique among studies of socio-ecosystem resilience, and will be a critical piece of the puzzle in our understanding of overall socio-ecosystem resilience (see Figure 1). This aspect of the study also is unique among resilience research in its integration of social and ecosystem measures into one construct (community initiated tree planting and related volunteer community forestry practices). Finally, questions 2 and 3 will provide multiple sources of data for use in outreach products.

Site Selection (RQ 2)
To guide the choice of study locations for RQ 2, we will work with our community partner organizations, and use GIS maps compiled through RQ 1. In particular, we will identify study populations for the RQ 2 interviews and surveys who reside in neighborhoods varying in demographics, tree canopy pre- and post-Katrina, and tree planting activities.

Phase 1 (RQ 2). Exploratory Interviews. During phase 1, "Exploratory Interviewing and Item Generation" (Weller 1998), we will conduct 30 short (5-10 minute), exploratory interviews of New Orleans residents affected by the storm, selected through convenience sampling within neighborhoods varying in the tree canopy, tree replanting, and demographic factors as described under site selection above. These interviews will contribute to development of the quantitative surveys in phase 3 (RQ 2), by helping us gain a better grasp of factors important to New Orleans residents and of terminology they use to describe their experiences. Thus, the exploratory interviews will enable us to adapt and learn how to phrase our research questions to be relevant and resonant (rather than off-putting and alienating) to the sample population. Questions asked during these short interviews might include: "Can you tell me about trees in your neighborhood?" "Have trees been important to you during your recovery from Katrina? If so, can you explain how?"

We will transcribe and code these data. Codes will be inductively generated from the transcripts as opposed to fitting data into predetermined categories. Next we will construct matrices from the data to identify patterns and paradoxes, and to be able to readily compare these data with data from other aspects of the study (Maxwell 1996). Through analyzing the data independently of other phases of the research, we will be able to arrive at commonalities and themes in post-Katrina trees and recovery discourses; in this way these data will "complement" and "expand" on other phases of the study (Greene et al. 1989; Tashakkori and Teddlie 2003). The data from the short interviews also will be used to develop questions for the in-depth interviews in phase 2 (RQ 2).

Co-leader Tidball will assume overall responsibility for conducting these interviews and analyzing the data. We will identify two other members of our lab to independently code the data so as to help ensure validity of the results (Maxwell 1996).

Phase 2 (RQ 2). *In-depth Interviews and Photo-Elicitation.* Phase 2 (RQ 2) will be informed by Weller's (1998) "Narratives and Individual Accounts." During this phase, we will conduct expanded, in-depth, unstructured and exhaustive interviews of five individuals who referenced trees as part of their recovery during the 30 short exploratory interviews from phase 1 (RQ 2). We will record and transcribe the interviews, and analyze and code the data as described for phase 1 (RQ 2) above. These interviews will provide a rich source of data, which will serve to complement and expand other sources of data, and to help ensure validity of the overall study. Further, the results of this phase will be used along with the results of phase 1 (RQ 2) to develop survey questions for phase 3 (RQ 2).

In addition to collecting the narratives, we will provide the five interviewees with a camera and ask them to "photo-essay" their response to the question: "How do trees matter to me after

Katrina?" We will code the photographs for emergent themes. This qualitative research method, known as "photo-elicitation,"[24] will be used to suggest possible interconnections and relationships across themes derived from the interviews, and to seek elaboration, illustration, and clarification of the results of other aspects of the survey.

The audio recordings and participatory photo-essays also will provide a source for documentation of real "stories" for website and other research and outreach products. Project Co-PI Tidball will conduct and analyze the data from this aspect of the study, with assistance from student coders as appropriate.

Phase 3 (RQ 2). Quantitative Surveys. During phase 3 (RQ 2), we will use close-ended, written surveys, which will be administered in-person to 300 New Orleans residents, selected through systematic sampling.[25] By administering the survey to a large number of residents from different New Orleans neighborhoods, and by comparing results to patterns discerned from GIS maps generated in RQ 1, we will be able to develop correlations and see patterns among the various ways in which residents characterize the role of trees in their recovery, and neighborhood tree, tree planting, and demographic variables.

We will use the results of phases 1 and 2 (RQ 2), as well as a small, informal focus group of residents selected from the original 30 residents interviewed, to develop the close-ended survey. Although at this point we cannot accurately anticipate the results of phases 1 and 2 (RQ 2) and how they will determine the items on this close-ended survey, we can reasonably surmise that the survey will reflect the following kinds of questions: Does the presence or absence of trees in your neighborhood: (1) help you define the character of your neighborhood? (2) contribute meaning to your life? (3) help connect you to your past? (4) help you connect to other residents? (5) help you feel more secure/ healthy? (6) help you recover from Katrina? The survey will utilize a Likert scale (Likert 1932) to indicate the strength of each factor and to facilitate data analysis. Results from the survey will be analyzed using standard statistical software, and will be compiled into tables for journal articles and figures for presentation to lay audiences.

Project Co-PI Tidball will train personnel identified by one of our community forestry partners to administer this survey through knocking on selected people's doors in selected neighborhoods. We expect each survey will take approximately 15 minutes to complete. Funds for our community partner to cover the costs of administering the survey are included in the proposal budget, and both Parkway Partners and Walk for KaTREEna have expressed interest in conducting the surveys.

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[24] John Bliss, Professor and Associate Department Head, Department of Forest Resources, Oregon State University, personal communication. http://www.cof.orst.edu/cof/fr/facultypages/bliss.php

[25] For example, we will select every 10th name from the list of residents in a particular neighborhood. Assuming the list is randomized, this is a type of probability sampling. It is easy to implement and the stratification induced can make it efficient (http://www.socialresearchmethods.net/kb/sampnon.php).

Research Question 3 (RQ 3). How do volunteer community foresters, or residents who are actively engaged in community initiated management of trees and forests (e.g., through monitoring damage, caring for damaged trees, tree planting), describe the value of active engagement in urban forestry activities in their ability to recover post-Katrina?

Similar to RQ 2, RQ 3 will integrate both qualitative and quantitative methods. However, because it is more difficult to build an understanding of how people value an *activity* such as volunteer tree planting, as opposed to how they value an *object* such as a tree, this aspect of the research will involve five instead of three phases of data collection. In addition to the three phases used in RQ 2, the methods for RQ 3 will include participant observation to help us develop a better understanding of volunteer community forestry practices, and more formal focus group interviews to help us develop the written survey. New Orleans residents will be invited to participate throughout RQ 3, through helping to address study questions and administering the written surveys.

Site Selection (RQ 3)
To guide the choice of study locations for question 3, we will work with our community partner organizations, and use GIS maps compiled through RQ 1. In particular, for the RQ 3 interviews and surveys we will identify study populations who conduct volunteer community forestry activities in neighborhoods varying in demographics and in tree canopy pre- and post-Katrina.

Phase 1 (RQ 3). Exploratory Interviews. As in research RQ 2, phase 1 (RQ 3) will use Weller's (1998) qualitative method "Exploratory Interviewing and Item Generation," only in this case we will conduct 30 short (5-10 minutes) exploratory interviews of volunteer community foresters rather than of any resident. The interviewees will be identified through a combination of conversations with the New Orleans community forestry partners on this proposal and snowball sampling.[26] These interviews will contribute to development of quantitative surveys in Phase 5 (RQ 3), by helping us gain a better grasp of factors important to New Orleans residents and of terminology they use to describe their experiences. Thus, the exploratory interviews will enable us to adapt and learn how to phrase our research questions to be relevant and resonant (rather than off-putting and alienating) to the sample population. Questions asked during these short interviews might include: "Can you tell me about tree planting in your neighborhood?" "Can you tell me about tree removal in your neighborhood?" "Has caring for trees been important to you during your recovery from Katrina? If so, can you explain how?"

Data analysis methods will be similar to those for phase 1 of RQ 2 described above. We will transcribe and code the data. Codes will be inductively generated from the transcripts rather than fitting data into predetermined categories. Next we will construct matrices from the data to identify patterns and paradoxes, and to be able to readily compare these data with data from other aspects of the study (Maxwell 1996). Through analyzing the data independently of other

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[26] In snowball sampling, you begin by identifying someone who meets the criteria for inclusion in your study. You then ask them to recommend others who they may know who also meet the criteria. Although this method would hardly lead to representative samples, there are times when it may be the best method available. Snowball sampling is especially useful when you are trying to reach populations that are inaccessible or hard to find (http://www.socialresearchmethods.net/kb/sampnon.php).

phases of the research, we will be able to arrive at commonalities and themes in post-Katrina volunteer community forestry and recovery discourses; in this way these data will "complement" and "expand" on other phases of the study (Tashakkori and Teddlie 2003). The data from the short interviews also will be used to develop questions for the in-depth questions in phase 5 (RQ 3).

Co-leader Tidball will assume overall responsibility for conducting these interviews and analyzing the data. We will identify two other members of our lab to independently code the data so as to help ensure validity of the results (Maxwell 1996).

Phase 2 (RQ 3). Participant Observation. In phase 2 (RQ 3), we will engage in predominantly ethnographic "fieldwork" focusing on participant observation, which is accepted almost universally as the central and defining method of research in cultural anthropology (Mead 1928; Malinowski 1929; Evans-Pritchard 1940; Geertz 1984; DeWalt et al. 1998). Participant observation entails explicitly recording information about behaviors gained from participating and observing (DeWalt et al. 1998), and implies a particular approach to carefully and extensively recording observations in field notes. The information the ethnographer gains through participation is considered critical to social scientific analysis, similar to more formal research techniques like interviewing, structured observation, and the use of surveys. Detailed, descriptive note taking about specific, concrete events observed will help to ensure validity (Maxwell 1996).

Co-PI Tidball will engage in participant observation with volunteer community foresters for a period of two weeks, during which he will compile comprehensive field notes. He will accompany community forestry volunteers as they plant or otherwise care for trees, engage in processes to secure additional resources, participate in informal gatherings, etc. Although anthropologists have historically cast a very wide net in their ethnographic work, this research will attempt to limit the scope of behavioral observation to targeted activities, *i.e*., those directly or indirectly related to volunteer community forestry. For example, we expect to be exploring such phenomena as symbolism of tree planting, tree planting ritual and tradition, and sub-cultural norms and mores related to volunteering. The recorded observations will be collections of textual descriptions to be coded by Tidball and student assistants using categories developed once the participant observations are completed. The results of this phase will be tacit and implicit knowledge of cultural behavior of volunteer community foresters.

Phase 3 (RQ 3). In-depth Interviews and Photo-Elicitation. Phase 3 (RQ 3) will be informed by Weller's (1998) "Narratives and Individual Accounts." During this phase, we will conduct expanded, in-depth, unstructured and exhaustive interviews of five individuals who referenced tree planting, caring for trees, and removing dead trees as part of their recovery during the 30 short exploratory interviews from phase 1 (RQ 3). We will record and transcribe the interviews, and analyze and code the data as described for phase 2 of RQ 2 above. The interviews will provide a rich source of data, which will serve to complement and expand other sources of data, and to help ensure validity of the overall study. Further, the results of this phase will be used along with the results of phase 1 (RQ 3) to develop survey questions for phase 5 (RQ 3) (below).

In addition to collecting the narratives, we will provide the five interviewees with a camera and ask them to "photo-essay" their response to the question: "How does tree planting, tree care, and tree removal matter to me after Katrina?" We will code the photographs for emergent themes. This qualitative research method, known as "photo-elicitation,"[27] will be used to suggest possible interconnections and relationships across themes derived from the interviews, and to seek elaboration, illustration, and clarification of the results of other aspects of the survey.

The audio recordings and participatory photo-essays also will provide a source of real "stories" for website and other research and outreach products. Project Co-PI Tidball will conduct and analyze the data from this aspect of the study, with assistance from student coders as appropriate.

Phase 4 (RQ 3). Focus Group. During phase 4 (RQ 3), we will use discourse-based valuation (Wilson and Howarth 2002) within a focus group of 7-10 volunteer community foresters to develop agreed upon values or orderings for multiple entities derived from phases 1-3 (RQ 3). The participants will create an agreed-upon preference ordering of entities or concepts, but will not develop relationships among variables or value entities. The results of the discourse-based valuation will assist in making decisions about the survey instrument for phase 5.

Phase 5 (RQ 3). Quantitative Survey. Finally, in phase 5 (RQ 3), we will use the results of Phases 1-4 (RQ 3) to develop a close-ended survey to be administered to 200 community forestry volunteers, selected through purposive expert sampling (Patton 1990).[28] The survey will be administered during times when volunteer community foresters assemble for their tree planting and other activities. Though we cannot accurately anticipate the results of Phases 1 through 4 and how they will determine the questions in this close-ended survey, sample questions might include: Does participation in volunteer tree planting: (1) help demonstrate your commitment to the future? (2) enhance the urban landscape? (3) reduce pollution or greenhouse gases? (4) demonstrate your civic involvement? (5) show that you are managing and learning how to manage urban forests? (6) demonstrate your ability to solve problems yourself? (7) demonstrate the ability of the city to continue functioning as it did pre-Katrina? The survey will utilize a Likert scale (Likert 1932) to indicate the strength of each factor and to facilitate data analysis. Results from the survey will be analyzed using standard statistical software, and will be compiled into tables for journal articles and figures for presentation to lay audiences.

Project Co-PI Tidball will train personnel identified by the community forestry partners on this proposal (Parkway Partners, Hike for KaTREEna, Replant New Orleans) to administer this survey during tree planting/ tree caring events. We expect each survey will take approximately 15 minutes to complete. Funds for community partners to cover the costs of administering the survey are included in the proposal budget, and the community partners have agreed to cooperate in this aspect of the study.

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[27] John Bliss, Professor and Associate Department Head, Department of Forest Resources, Oregon State University, personal communication. http://www.cof.orst.edu/cof/fr/facultypages/bliss.php

[28] Subjects are selected because of some characteristic, in this case participation in volunteer community forestry (Patton 1990).

4. PRODUCTS
We will compile the study results into a suite of products to achieve our **outreach goal, i.e.,** *To disseminate to scientists, natural resource professionals, disaster planning and relief policy makers, New Orleans residents, and the general public research-based evidence for the role of urban forests and community forestry in urban, post-disaster resilience.* Products and associated audiences are listed below.

Refereed Journal Articles*. Audience: scientists and natural resource managers (including forestry professionals).* We will publish the results in journals, such as Journal of Forestry, Journal of Arboriculture, Journal of Extension, Society and Natural Resources, and Ecology & Society. In cases where the journal grants permission, we will post the articles on the project website. Reprints will be available for free upon request.

Guidelines for Fostering Urban Community Forestry in Disaster Planning and Relief*. Audience: disaster planning and relief policy makers.* We will produce a report summarizing our findings in the form of guidelines for policy makers. This report will draw heavily on the information we gather from the community organizations and government agencies, as well as the volunteer community foresters engaged in tree planting and care. It will emphasize how through instituting policies that foster such community-initiated urban forestry practices prior and in response to disaster, policy makers can foster resilience in communities stricken by disaster. The Guidelines will be available as a PDF file downloadable from the project website. They also will be available at cost for printing and mailing upon request.

Brochures*. Audience: Policy makers and natural resource managers and educators (including forestry professionals and Cooperative Extension professionals).* We will produce short, color illustrated brochures summarizing our findings in a manner readily understood by policy makers and other professionals. The brochures will be available as a PDF file downloadable from the project website; print copies will be available at cost of printing and mailing upon request.

Audio-photo Testimonies from Katrina Survivors*. Audience: Policy makers; natural resources professionals; New Orleans project cooperators, volunteer and professional community foresters, and residents; and general public.* The personal stories of the role of trees and tree planting in recovery from Katrina will be posted on the project website as downloadable MP3 files and will be available for cost of reproduction and mailing as CDs upon request.[29]

GIS Maps*. Audience: Policy makers; planners, New Orleans project cooperators, volunteer community foresters, and other residents*. We will post GIS maps showing locations of tree planting and related activities in study neighborhoods in New Orleans.

Project Website*. Audiences: Multiple*. We will compile all the project resources along with a summary of the project accomplishments on the project website.

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[29] For an example of how this can be done, see http://www.aap.cornell.edu/crp/people/rosa-exhibit.cfm

5. NATIONAL DISTRIBUTION/ TECHNOLOGY TRANSFER of FINDINGS
Key words: urban forestry, community forestry, resilience, disaster, civic ecology
We will use two methods to disseminate our findings. First we will present the results at professional conferences, including those sponsored by the Society of American Foresters, Ecological Society of America, Resilience Alliance, Community Forestry Research Fellows, National Urban and Community Forestry Council, and Cooperative Extension professionals. Second, we will publish short summaries of the results and notices announcing the availability of the products described above (*e.g*., guidelines for policy makers, brochures) in electronic and print newsletters and other communications of professional disaster and forestry associations and networks (*e.g*., the Extension Disaster Education Network, Disaster Resistant Communities Association, American Planning Association, Joint Center for Sustainable Communities, Society of American Foresters, National Arbor Day Foundation, state Urban and Community Forestry Councils).

6. PROJECT EVALUATION
To determine the impact of this project on the policy makers', professionals', and the public's awareness of the importance of urban and community forestry, we will keep records of website hits and responses to interactive website features, and of demands for products (*e.g*., number of downloads of guidelines for policy makers, number of requests for copies of brochures). Although not within the scope of this study, subsequent studies may focus on any changes in practice on the part of policy makers and mangers as a result of this project.

7. EXPERIENCE/ PERSONNEL/ ADEQUACY of RESOURCES
We have put together a project team that together have the educational qualifications, research expertise, and experience working in urban community forestry and policy settings, including in New Orleans, to be able to carry out this project. PI M Krasny and co-PI K Tidball will work closely in planning all stages of the project, in analyzing and presenting the data, and in compiling the results into the outreach and research products. Co-PI Tidball will assume major responsibility for all aspects of the field research, drawing on expertise from Drs Krasny and Broussard, and on the help of community partners and student assistants. Sr Scientist Broussard will contribute her expertise in human dimensions research applied to forestry, and in forestry outreach to policy makers.

Cornell University, together with our New Orleans project partners, will provide the resources above those which are requested from NUCFAC to support this project. For example, we will utilize Cornell's free statistical consulting services, seek advice where needed from faculty in Cornell's Department of City and Regional Planning who have led post-Katrina planning efforts in New Orleans, take advantage of work study and other funds to support student researchers who assist in the project, and access software (*e.g*., GIS, SPSS) for which Cornell has a site license and/or provides technical support. Our New Orleans community partners, including Parkway Partners, Hike for KaTREEna, and Replant New Orleans, will help us to access study audiences and existing GIS and other data, and will administer the written surveys to New Orleans residents and to the volunteer community foresters.

PI Marianne Krasny is Full Professor and Chair of the Department of Natural Resources at Cornell University. She holds a BA degree in human development from Cornell University, a BS in botany from the University of Washington, and MS and PhD degrees in forestry from the University of Washington. She has published in the areas of tree seedling regeneration and forest ecology, university outreach, science education, and environmental education in the Journal of Forestry, Journal of Extension, Bioscience, Journal of Environmental Education (for which she serves as consulting editor), and Environmental Education Research, among others. With funding from the National Science Foundation, USDA, USGS, NYS Department of Environmental Conservation, and elsewhere, she has directed science and agricultural outreach programs in urban and rural communities focusing on the use of remote sensing technologies in environmental problem solving, invasive species, urban wildlife, the sugar maple industry, fisheries and aquatic resources, and community gardening. Her print and multi-media outreach and teacher publications have received numerous media awards, and she was the recipient of the NYS College of Agriculture and Life Sciences Promotion of Cultural Diversity Inaugural Award. As leader of the Cornell Initiative for Civic Ecology, she conducts research and outreach focusing on the role of community environmental engagement in building social and natural capital, and on social learning approaches to natural resources education and management. She is experienced heading up research and outreach teams of graduate students and professionals. (See Krasny website, <http://krasny.dnr.cornell.edu/>)

Co-PI Keith Tidball is a full-time Extension Associate in the Department of Natural Resources at Cornell University and is the Associate Director of Cornell's Initiative for Civic Ecology. He works to connect people with plants and animals in urban contexts for purposes of education, community restoration and regeneration, and biodiversity conservation through Civic Ecology programs. His research in Environmental Security & Peacemaking, Community Based Approaches to Urban Natural Resource Management, and Civic Ecology pursues questions such as: What role might natural resources play in restoring societal equilibrium and community resilience in urban environments? How might community based natural resources management knowledge and approaches be adopted for use in field expedient conflict resolution "tool kits," especially for use in urban contexts? Tidball is also a part-time PhD student pursuing his degree through the Employee Degree program. He holds a BA degree in cultural anthropology from the University of Kentucky, and an MA degree in International Development (Natural Resources and Agriculture) from the George Washington University. His research on the role of community greening in resilience in New Orleans, for which he recently was awarded a Community Forestry Research Fellowship, as well as similar research in New York City, South Africa, and in trans-boundary peace parks, integrates 15 years of experience in community natural resources management, urban greening, and post-conflict/post-disaster recovery. (See Tidball cv, <http://www.sci-links.com/files/Master_CV_1-08.rtf>)

Sr Scientist Shorna R. Broussard is an Associate Professor of Human Dimensions of Natural Resource Management at Cornell University. She received her PhD in Forest Resources from Oregon State University, her MS degree in Forest Resources from Penn State University, and her BS degree in Environmental Resource Management from Penn State University. Her research and extension program at Cornell focuses on understanding human attitudes, motivations, and behavior related to resource conservation and management. The specific objectives of her research are to characterize the current attitudes, knowledge, opinions, and behavior of private

landowners and other key stakeholder groups as it relates to natural resource management and natural resource conservation, identify and investigate innovative policy alternatives for natural resource conservation, and translate research findings into accessible outputs to aid landowners, citizens, and others in decision-making related to natural resource management. Prior work related to community and urban forestry has included a national program evaluation of Natural Resource Extension programs, environmental education curriculum development and evaluation with inner-city youth, innovative program design and development to reach underserved audiences, and documenting the role of forestry in building community. Dr. Broussard was the Communications and Education editor for the Journal of Forestry for 3 years (2002-2005) and received the Search for Excellence Award-Leadership in Educational Programming in 2000 from the Oregon State University Extension Association. (See Broussard website, <http://www.dnr.cornell.edu/people/faculty/profiles/broussard.html>)

We have formed an advisory group composed of the following individuals, all of whom have sent letters of support included with this proposal:

Tom Campbell, Urban Forester, LA Department of Agriculture and Forestry
Theo Eliezer, Executive Director, Replant New Orleans
Karen Engel, Program Manager, Urban and Community Forestry, NYS Department of
    Environmental Conservation
Jean Farr, Executive Director, Parkway Partners
Monique Pilie, Founding Director, Walk for KaTREEna
Erika Svendsen, Research Social Scientist, USFS Living Memorials, NYC

Additionally, we will invite Bob Goodrich, New Orleans urban forester, to join the advisory committee. We have been in contact with his office but have not been able to reach him directly as of the submission time of this proposal.

Project Timeline

RQ/P* Products	Task	2008		2009				2010			
		*Su**	*F**	*W**	*Sp**	*Su*	*F*	*W*	*Sp*	*Su*	*F*
RQ1-3											
	Review research plan with advisory committee members and partners via phone meetings	▓									
	Refine and revise methods, based on feedback from advisory committee and participants			▓	▓	▓	▓				
RQ1											
P1	Conduct interviews and document review for 5 organizations/ agencies			▓							
P2	Create GIS maps			▓							
P1-2	Data analysis				▓	▓					
RQ2											
P1	Conduct exploratory interviews with 30 residents				▓						
P2	Conduct 5 in-depth interviews and photo-elicitations with residents										
P3	Implement quantitative survey of 300 residents					▓					
P1-3	Data analysis				▓	▓	▓				
RQ3											
P1	Conduct 30 exploratory interviews with volunteer community foresters				▓						
P2	Conduct participant observations throughout period of fieldwork in New Orleans				▓						
P3	Collect 5 in-depth interviews and photo-elicitations with volunteer community foresters				▓						
P4	Conduct discourse based focus group				▓						
P5	Implement quantitative survey of 200 volunteer community foresters					▓					
P1-5	Data analysis				▓	▓	▓				
Products											
	Refereed journal articles							▓	▓	▓	▓
	Guidelines for community forester in disaster relief							▓	▓		
	Brochures							▓	▓		
	Audio-photo testimony					▓	▓				
	GIS Maps					▓					
	Project Website				▓	▓	▓				

* RQ=Research Question, P=Phase; W=Winter, Sp=Spring, Su=Summer, F=Fall

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