ABSTRACT

ALEXANDER, LOUISE BOATWRIGHT. Measuring Conservation Success: An Investigation of Land Trusts in North Carolina. (Under the direction of Dr. George Hess.)

Local land trusts in North Carolina protect land to conserve natural resources and biodiversity, and to provide public benefits, such as clean air and water. However the success of their efforts is commonly reported in terms of the amount of land protected or money raised in support of conservation rather than in measures that describe whether or not conservations goals have been achieved. In order to determine if the lands protected by local land trusts are meeting the goals they were intended to serve, I reviewed published research, literature and methodologies to identify common practices used to measure conservation success. Findings indicate three fundamental processes that allow organizations to evaluate the effectiveness of their interventions which are; 1) conducting status assessments that include articulating specific goals and describing the project context; 2) identifying threats to conservation targets; and 3) identifying, developing, and monitoring specific indicators whose status is a measurable reflection of the conservation targets and interventions. I also surveyed 24 land trusts in North Carolina to determine why they protect lands, what activities they perform that would allow them to evaluate the conservation impact of their work, and how success is reported to the public. From the survey, I conclude that land trusts in North Carolina are unable to determine if the lands they have protected are meeting their conservation goals because they are not consistently setting measurable goals, indentifying specific conservation targets, or monitoring indicators that would reflect conservation impact, processes identified in the literature review as necessary to evaluate conservation projects. I identify the Open Standards for the Practice of Conservation framework as an applicable tool for local land trusts to use to focus their conservation efforts and develop measurable goals and report their conservation success.

Measuring Conservation Success: An Investigation of Land Trusts in North Carolina

by
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DEDICATION

For my grandmother, Louise Boatwright Alexander, who instilled in me a love of nature and mischief.

"I love the places where man has not meddled"

BIOGRAPHY

I grew up in Charlotte, NC, when it still thought of itself as a small town. I spent most of childhood stomping through creeks, climbing trees, building forts, scraping my knees, and reading. My love of literature and the outdoors continued through college. I graduated from North Carolina State University in 2002 with a degree in English, a minor in Forestry, and very few ideas of what I wanted to do for a career. In an attempt to rectify this problem, I applied to and was accepted into an AmeriCorps program working with a nonprofit focused on environmental restoration in Seattle, Washington.

This began one of the most exciting periods of my life. During the four years I lived in Washington State, I continued stomping through creeks, climbed mountains instead of trees, and continued to cultivate a curiosity about biology and ecological processes. When I couldn't imagine working in any other field, I applied to graduate school and returned to North Carolina and to NC State University to earn a M.S. in Natural Resource Management.

My experience in graduate school has furthered my knowledge and also increased my respect for all things wild. I am thankful for my education and all of the opportunities it has afforded me. I will continue to stomp, to climb, and to wonder.

ACKNOWLEDGEMENTS

I would be remiss if I did not also express my appreciation, respect, and thanks to the land trusts across the state of North Carolina. Their work is invaluable to the land and the people they serve. I am in awe.

Lastly, I would like to thank my parents for their encouragement, love, and support. Thank you for letting me wander.

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ABSTRACT

Protecting open space is a strategy used by conservation organizations around the world

to conserve biodiversity and maintain ecosystem functions. Historically, the success of

conservation efforts has been reported in terms of acres protected, the amount of funds

raised and spent, and anecdotal descriptions of conservation success stories. Yet the

quantity of land conserved does not reflect the quality of environments or maintained

populations of native and rare species: common reasons for land protection. I

investigated published research, literature and methodologies focused on evaluating the

ecological impact of land conservation to identify trends and common practices used to

measure conservation success. Findings indicate three fundamental processes that allow

organizations to evaluate the effectiveness of their interventions; 1) conducting status

assessments that include articulating specific goals and describing the project context; 2)

identifying threats to conservation targets; and 3) identifying, developing, and monitoring

specific indicators whose status is a measurable reflection of the conservation targets and

interventions. I focus on the Open Standards for the Practice of Conservation framework

because it incorporates the three processes necessary to evaluate conservation projects,

and is used by large international land conservancies. I present this framework as the

best available methodology for local land trusts to use to measure their own conservation

success.

INTRODUCTION

"You cannot overcome poor quality with greater quantity"

Paul Ferraro, Money for Nothing? A Call for Empirical Evaluation of Biodiversity.

Conservation Investments. PLOS Biology, 2006.

Land trusts around the world protect open space through fee simple acquisition or

conservation easements to preserve biodiversity and ecosystem function (Conservation

International 2009; The Nature Conservancy 2009; WWF 2009). Their actions are

predicated on the assumption that, through the minimization of anthropogenic disturbances to

protected land, ecological systems and processes will thrive (Hansen & DeFries 2007;

DeFries et al. 2007) and provide public benefits such as potable water (Hockings 2003).

Land trusts frequently report their success through the "bucks and acres" metrics: the amount

of funds raised in support of conservation and the number of acres protected from

development (Howard & Magretta 1995). While important information on an organizational

level, the amount of land protected and funds raised are not, by themselves, indicative of the

ecological integrity or of ecosystem services provided to the local public.

It is often difficult for conservation practitioners to quantify the results of their

activities given that lands are often protected to serve multiple goals and provide multiple

benefits within dynamic, complex and changing contexts (Brooks et al. 2006; Margoluis et

al. 2009). There is no single measure that addresses all ecological processes and nuances,

and land stewards and managers may be at a loss to determine what should be measured, how

it represents success, and how to evaluate naturally changing processes through time (Noss

1990). However, the call to assess whether lands are meeting the goals they are protected to serve is becoming more widespread (Kleiman et al. 2000).

Since the 1990s there has been a growing demand from donors and government agencies for more results-based evidence that conservation activities have a positive ecological impact. But few reports provide evaluations of effects and many practitioners are unsure how to measure the consequences of their work (Kleiman et al. 2000; Ferraro & Pattanayak 2006; Brooks et al. 2006). For example, in the late 1990s The Nature Conservancy was asked by a potential donor how it would be determined that a specific tract of land would provide critical habitat in the future (Christensen 2003). The Nature Conservancy was forced to answer they did not have a way to measure if the property would support its intended goal (Christensen 2003). This question reflected a subject of internal discussion following observations that populations of species of concern had declined on protected properties (Sawhill & Williamson, 2001). In response to donor inquiries and in the interest of improving their practice of conservation, TNC and other large land conservancies (e.g., World Wildlife Fund, Conservation International) began developing practices to measure their impact and answer the question, "are conservation efforts really conserving what they say they are" (Christensen, 2003).

PURPOSE AND SUMMARY OF FINDINGS

The purpose of this analysis was to investigate the research literature to determine how conservation success can be determined, identify common themes and patterns, and determine the best available methodologies for use by local land trusts. I sought the key

elements necessary to evaluate conservation interventions and to determine their applicability

to local land conservancies with limited resources. I identified three fundamental processes

that, either as standalone methods or in combination, allow organizations to evaluate the

effectiveness of their interventions. They are:

    (1) conducting status assessments that include articulating specific goals and describing

    the project context;

    (2) identifying threats to the conservation targets; and

    (3) identifying, developing, and monitoring specific indicators whose status is a

    measurable reflection of the conservation targets and interventions (Parrish et al. 2003).

       Many of the larger land conservancies (e.g., The Nature Conservancy, World Wildlife

Fund) are using and contributing to the Open Standards for Conservation (Conservation

Measures Partnership 2007), which provides a framework that incorporates these three

fundamental processes. I concluded that this framework is comprehensive and flexible

enough to be applied by local land trusts interested in reporting the impact of their

conservation efforts.

METHODS

       I reviewed literature focused on monitoring and evaluating conservation lands as well

as research that examined the use of biological indicators and assessments of ecosystems. I

searched Web of Science and Google Scholar using the following key terms: *conservation*

success, monitoring and evaluation, indicators, status assessments, threats to conservation,

and *threat assessments*. I reviewed the journal database of Foundations of Success

(http://www.fosonline.org/Site_Page.cfm?PageID=19, viewed in the spring 2008), a non-profit with the mission to learn and teach the best practices of conservation. Finally, I investigated frameworks developed by larger, international land conservancies such as The Nature Conservancy, World Wide Fund for Nature, and Conservation International. I reviewed a total of 48 journal articles, organization websites, and published frameworks (Table 1). My search included literature and research from 1990 to 2009 and was conducted from the fall of 2007 to the fall of 2009.

Table 1. A comprehensive list of literature, organizations, and frameworks reviewed

Literature Reviewed:

Anthony (2008), Brooks et al. (2006), Carignan & Villard (2002), Christenson (2003), DeFries et al. (2007), Donnelly et al. (2007), Ferraro & Pattanayak (2006), Groves et al. (2002), Hansen et al. (1999), Hansen & DeFries (2007), Hockings (1998), Hockings (2003), Howard & Margretta (1995), Kleiman et al. (2000), Knight et al. (2007), Lee (1993), Margoluis & Salafsky (1998), Margoluis et al. (2008), Margules & Pressey (2002), McKerrow et al. (2006), Mezquida et al. (2005), Nicholson et al. (2009), Niemi & McDonald (2004), Noss (1990), Parrish & Braun (2003), Poiani & Richter (2000), Salafsky & Margoluis (1999), Salafsky et al. (2002), Salafsky et al. (2003), Salafsky et al (2008), Sanderson (2006), Sawhill & Williamson (2001), Stem et al. (2005), Tear & Kareiva (2005), Timko & Innes (2009), Wilhere (2008), Walters & Holling (1990)

Organizations Reviewed:

Conservation International (undated), Conservation Measures Partnership (2004), The Nature Conservancy (undated), World Wildlife Fund (undated), Land Trust Accreditation Commission (2009)

Table 1. (Continued)

Frameworks Reviewed:

Whole Measures (The Center for Whole Communities 2007), The Open Standards for the Practice of Conservation (Conservation Measurs Partnership 2007), State of the Nations Ecosystem (Heinz Center 2008), National System Planning for Protected Areas (Davey 1998), Conservation by Design (The Nature Conservancy 2006), Rapid Assessment and Prioritization of Protected Area Management (World Wildlife Fund 2003).

While examining frameworks developed by larger, international land trusts, I became aware of the Open Standards for the Practice of Conservation. The Open Standards for the Practice of Conservation incorporated many of the elements described in the research literature and due to its use as a tool among international land trusts, I stopped looking at other frameworks and focused on this methodology.

RESULTS

The Open Standards for the Practice of Conservation framework (hereafter Open Standards) was developed by the Conservation Measures Partnership, a collaboration among large, international land conservancies and researchers dedicated to understanding how to improve the practice of conservation. I focus on this framework and offer it as an applicable tool for local land trusts to measure conservation success based on its use by larger, international land conservancies which include The Nature Conservancy, Conservation International, the World Wide Fund for Nature/ World Wide Fund, and the National Fish and

Wildlife Foundation. Land trusts differ in the geographic range of their activities and the

resources available to them, but the essence of their strategy is protecting natural lands to

conserve natural resources, biodiversity, and ecological functions. Given this similarity and

because the Open Standards framework is available at no cost, I believe local land trusts can

use this tool to evaluate their conservation efforts.

The Open Standards framework provides a multi-step guide to conceptually organize

conservation efforts, link specific actions to outcomes, and monitor indicators to gauge the

persistence and health of specific conservation targets (Conservation Measures Partnerhsip

2007). Rooted in adaptive management (Walters & Holling 1990; Lee 1993), this framework

directs practitioners to outline their assumptions and monitor specific indicators whose

biological conditions reflect the overall state of the property. Below, I review each of the

three fundamental processes I found within my review of literature and research as critical to

performance evaluation – status assessment, threat assessment, and indicators – and discuss

how each is addressed by the Open Standards.

Status Assessments:

Factors influencing ecosystems, species, and ecological processes targeted for

protection often originate outside conserved areas and changes in surrounding land uses can

significantly alter natural functions within protected areas (Hansen & DeFries 2007).

Therefore, beyond simply securing land, it is important to understand the relationship

between surrounding land uses and their influence on conservation lands. This requires

knowledge of surrounding landscapes and relevant ecological relationships. *Status

assessments* identify key mechanisms influencing a property's condition by capturing the

natural condition of a property, what is realistic to expect in terms of what it can sustain, and noting the ecological relationships that will influence its success (Hansen et al. 1999).

Status assessments are integral in developing an understanding of the habitats and ecosystems of a property and identifying management goals. Status assessments are used in conservation to determine the current state of a property (Stem et al. 2005). Defined as "assessing the condition or status of a particular conservation entity (e.g., species, population, or ecosystem), generally irrespective of a specific intervention" (Stem et al. 2005), they are the "starting point" of a project (Salafsky et al. 2002) and provide a consistent process to identify goals, determine ecological boundaries of influence where land use patterns could impact a property, and specify why the property is important to protect. Most importantly, performing a status assessment allows land managers to articulate what should be measured to determine conservation success and helps to organize a conservation project around the primary focus of conservation (the targets), identify factors that may interfere with the success of the targets (the threats), and recognize the ecological influences that will affect the outcomes (the context).

Within the research literature, there are several methodologies and associated critiques for collecting information to assess the status of an ecosystem. Stem et al. (2005) review rapid assessments, population monitoring, state of the environment monitoring, and conservation score cards and note that while these tools are capable of generating good data, there are also inherent disadvantages. For example, population monitoring requires a large expenditure of time, is expensive to conduct, and requires biological expertise to perform and to analyze results (Stem et al. 2005). Rapid assessments, which are used by Conservation

International, World Wildlife Fund, and The Nature Conservancy, are quickly performed

biological analyses of areas but are critiqued for their limitations in scope and sample size as

well as also requiring biological or ecological expertise to perform and to analyze results

(Stem et al. 2005). Other tools like environmental score cards and report cards are mainly

used to communicate broad information to the public and are most effective when

considering large protected areas or regions scales (Stem et al. 2005).

Given the resource constraints smaller land trusts typically face, these tools may be

difficult to implement in a cost and expertise standpoint. Also, available spatial data are

often presented at scales unusable by organizations that protect smaller properties across a

fragmented landscape. For example, The Nature Conservancy often sets conservation

priorities at ecoregional scales much larger than the properties that smaller land

conservancies protect (The Nature Conservancy 2005). The Nature Conservancy may use

programs such as the Gap Analysis Program, which is widespread across the United States

and quantifies landscape habitats through geographic mapping (NC GAP Final Report 2006).

However vegetated land cover is represented through pixels projected as 30x30 meter cells, a

coarse scale difficult to analyze on a pixel-by-pixel basis (NC GAP Final Report 2006). The

GAP program also assigns only one habitat class to a pixel (.09 hectares) and there is an

associated error rate depending on the habitat assigned and processing of spatial information.

Therefore the GAP analysis is not an appropriate tool to inform local land conservancies

about the presence of important small-scale habitats that may exist on their properties.

Status Assessments and Open Standards: Vision, Scope, & Targets

The first step in the Open Standards is defining the vision, scope, and targets for a property – which essentially performs the basic role of a status assessment. The *vision* of a property is the desired state or condition that signifies success (Conservation Measures Partnership 2007). For instance, a plausible vision of success for a bottomland forest could be "a healthy bottomland forest serving as a riparian buffer with high quality ecosystems for aquatic and terrestrial species." This condition implies the specific, desired ecosystem functionality and structural characteristics to be maintained and communicates a common idea of success among stakeholders. With a bit more specificity (e.g., what species are desired), it also provides a measurable target.

The *scope* is the defined area of the conservation property itself and surrounding lands that may influence the ultimate success of the project (Conservation Measures Partnership 2007). Creating the scope involves clearly delineating property boundaries as well as the ecosystem boundary of influence that encompasses factors influencing the success of the property. For example, ecosystem boundaries can be identified by flows of movement or processes supporting populations, such as in the Greater Serengeti Ecosystem where the ecosystem boundaries were determined by the migratory patterns of the wildebeest or in the Greater Everglades Ecosystem where the flow of freshwater seaward through southern Florida spatially defined a boundary (Groves et al. 2002). Although a single boundary will rarely encompass all components of an ecosystem, determining an area of influence for protected lands allows conservation practitioners to develop strategies with an understanding of how their goals of biodiversity and maintaining natural functions can be influenced by

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outside land uses (Groves et al. 2002). For smaller land trusts responsible for areas within a

fragmented landscape, watersheds and natural disturbance regimes can determine effective

ecosystem boundaries (Hansen & DeFries 2007). Other research suggests identifying the

ecological requirements of a target species and setting the area required to sustain them as the

ecosystem boundary of influence (Parrish et al. 2003).

     The *targets* of the property are a limited set of "specific species, ecological

systems/habitats, or ecological processes" around which the conservation of a property is

focused (Conservation Measures Partnership 2007). Developing targets for a property

provide goals and a basis on which to develop management strategies and measure ecological

impact (Conservation Measures Partnership 2007). The Open Standards guides practitioners

to articulate the desired status of targets, which provides an objective for conservation

strategies. For example, if a target is defined as a rare plant species, a land manager can

create a goal of increasing or maintaining the population. This offers a measurable goal on

which success can be evaluated as well as creating a focus on which to base management

strategies. Within the research literature there is substantial support for developing clear

goals and creating measurable objectives as integral to ensure that a vision for a conservation

plan or project is successful (Tear & Kareiva 2005). Although a subjective process, goals are

a necessary tool to definitely state the purpose of the project (Margules & Pressey 2000).

     Small land conservancies can use information they already collect about their

properties to conduct status assessments. For example, local land trusts and government

agencies often prepare a baseline document report, a document that describes the condition of

a property at the time of protection. These reports are required for conservation easements

and must be prepared before the completion of an easement and adhere to the US Department of Treasury Regulations (Land Trust Accreditation Commission 2009). Baseline document reports often include maps of the property and surrounding lands, catalogue soil profiles, delineate building envelops, and note significant plant and wildlife occurrences. Although a status assessment is a more comprehensive and consistent process than a baseline document report, the primary intent of which is to provide legal documentation of the state of the property and rarely articulate management goals and objectives, they can support the necessary data collection for a status assessment. For example, analyzing maps and spatial information about the lands surrounding a property and noting the hydrology of the watershed the property exists within can contribute to developing the scope of the property and build a better understanding of what factors may influence the goals of the project.

Status assessments reflect how open space projects interact within a larger landscape and define what should be measured to evaluate conservation success. Similarly, the process of noting what is on a property that merits conservation reveals relevant biological processes (e.g., habitat fragmentation) and provides insight into factors that will influence the vision for a property (Noss 1990). The Open Standards framework is a valuable guide for land managers to articulate the vision, scope, and targets of a property to provide a basis for building strategies to measure direct ecological impact.

Threat Assessments:

Although little data has been collected concerning the evaluation of conservation interventions (Ferraro 2006), there is documented evidence of the degradation of natural resources within protected areas (Margoluis et al. 2008; Hockings 2003; Anthony 2008).

Evaluating threats as an approach to measure the success of conservation efforts is becoming popular among larger land trusts, and management plans often include strategies to mitigate threats to conservation targets (Salafsky et al. 2002). A threat is defined as an anthropogenic activity "that has caused, is causing, or may cause the destruction, degradation, and/or impairment of biodiversity and natural processes" (Salafsky et al. 2003). The US Environmental Protection Agency, The World Conservation Union (IUCN), The Nature Conservancy, and the World Wide Fund (Hockings 2003) all identify, rank, and evaluate threats as a tool to develop monitoring and evaluation practices and to measure the ecological effects of conservation interventions. For local land conservancies and government agencies, threat assessments are an inexpensive and cost effective strategy that can be used as a standalone approach, but tend to be more effective when linked directly to conservation targets as part of a larger framework to determine conservation success.

Threat assessments help conservation organizations develop a deeper understanding of the overall status of a property, design management and monitoring programs to reduce threats, and measure the effectiveness of conservation interventions (Hockings 2003). Monitoring threats to conserved lands has been a popular approach among land managers because they are often easier to quantify and monitor than the biological systems they threaten (Salafsky & Margoluis 1999). Salafsky and Margoluis (1999) developed a Threat Reduction Assessment, a standalone approach and an alternate method to measure the effectiveness of conservation interventions by identifying specific threats and ranking their severity through time. Threat Reduction Assessments assume all threats to a project are anthropogenic, can be identified and ranked in terms of severity, do not require sampling or

baseline data, and are inexpensive and quick to perform (Salafsky & Margoluis 1999).

However the method is subjective because it relies heavily on the bias of the participant due

to their reliance on the interpretation and estimation of the causes of threats and the degree to

which a threat has changed through time (Anthony 2008). Although the IUCN has

developed a classification system of direct threats (Anthony 2008), currently there is no

accepted criterion to identify threats; therefore users of this tool may identify different threats

according to their backgrounds and experiences and may also assign different levels of

severity making the process of scoring threats difficult to replicate across different users

(Nicholson et al. 2009).

TRAs also assume that all relationships and influencing factors concerning the

ecological state of the target are known and directly influence its condition (Parrish et al.

2003). Under the Threat Reduction Assessment approach the state of a conservation target is

assumed to correlate with management strategies, but when used as a sole strategy to

measure impact, Threat Reduction Assessments are not sensitive enough to determine the

effectiveness of management actions, making it difficult to measure overall conservation

success. Yet when applied as part of a larger process, where threats are directly related to

specific conservation targets and causal links clearly mapped, threat assessments can be key

components for measuring success.

Open Standards: Explicit Linkage of Threats, Management, & Conservation Targets

Several methodologies include threat assessments as part of a status assessment to

diagnose the state of a protected area and management activities are based around the

mitigation of threats (Salafsky & Margoluis 1999). The Open Standards framework also

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includes identifying threats and their relationships to a conservation target. However, the Open Standards framework, as characteristic of adaptive management philosophies, direct practitioners to articulate their explicit assumptions about how the management activity will mitigate a threat and state the desired outcome (Conservation Measures Partnership 2007). Managers must monitor the state of conservation targets and essentially test their assumptions (Conservation Measures Partnership 2007). These assumptions are mapped visually and can improve communication with stakeholders and other practitioners by providing a transparent process that can be recorded. Also, over time the impact of management and new management activities can be designed based on the results.

Although threat assessments should not be used as a standalone approach because they do not provide enough information about the cause of the threat, they can provide information about the state of a property in a larger ecological context. Often, local land conservancies and agencies protect small areas more likely to be influenced by changes in the surrounding landscape where the stress of surrounding land uses will inevitably impact conservation targets. Identifying threats allows land conservancies to articulate what factors (e.g., an invasive species) can negatively affect a conservation target, understand what is causing the threat to occur (e.g., localized disturbances), and develop strategies that can be measured in their effectiveness to minimize the threat (e.g., developing strategies to reduce local disturbance). However, to further demonstrate this theoretical link requires monitoring indicators that reflect changes in the status of a conservation target.

Indicators

        Determining what to measure to assess the effect of conservation strategies can be

challenging. Monitoring lands without knowing what characterizes success has been

described as "blind data gathering," and collecting copious amounts of ecological

information without direction does not allow for better analysis of conservation efforts (Noss

1990). The use of indicators as a tool to monitor the status of focal targets to assess larger

systems is a widely accepted practice (Noss 1990; Carignan & Villard 2002; Timko & Innes

2009) and is used by the European Environmental Agency, the US Environmental Protection

Agency, the US Geological Survey (Donnely et al. 2007), and the Parks Canada Agency to

assist in the policy and management decision process (Timko & Innes, 2009). For a land

trust operating within a specific region and protecting lands in a fragmented landscape,

indicators might be a cost and time effective tool to measure the impact of conservation

strategies (Donnely et al. 2007).

        Indicators are measurable surrogates for environmental elements or conditions whose

characteristics reflect the current status of a system and, when measured periodically, can

reflect changes through time (Parrish et al. 2003) and alterations in site conditions (Margoluis

& Salafsky 1998). For example, animal habitat is often measured instead of estimating

population size, because measuring the extent of a particular habitat type is often easier than

counting animals that are rare, secretive, and move around the landscape. But this approach

may assume that a species is present when it is not or that a species is restricted to a

particular habitat when it has a wider range. Noss (1990) describes a good environmental

indicator as one that is sensitive to change, occurs ubiquitously across a habitat, is easy to

monitor, and does not require sophisticated analysis. While criticized as being inconclusive of the overall habitat quality and environmental trends, when tied to specific goals and objectives indicators provide concise information about conservation targets and the effectiveness of conservation strategies (Noss 1990).

Selecting an indicator depends on the conservation target. By articulating targets, goals, and objectives for a property (the first step), the list of plausible indicators is reduced (Conservation Measures Partnership 2007), and can provide better information overall when applied in concert with status and trend assessments (Timko & Innes 2009). In cases where objectives for targets are set, indicators can be derived directly from the goals (Conservation Measures Partnership 2007). For example, if a conservation target is defined as a Piedmont prairie grassland, and the vision is "an early successional grassland with predominantly warm-season (C4) grasses with a large oak or persimmon occurring approximately every five acres," an indicator of this target is the percentage of desired grass cover. Similarly, a direct threat that would interfere with the success of the target is a lack of an appropriate fire regime. Hence, fire frequency is an indicator of an ecological process that is a key element occurrence for this conservation target.

Identify Targets
Piedmont Prairie Grassland

Identify Key Ecological Attributes
• Appropriate Vegetation Species Composition and Structure
• Fire Regime

Indicators
• % of C4 Native Grasses
• % of Invasive Species
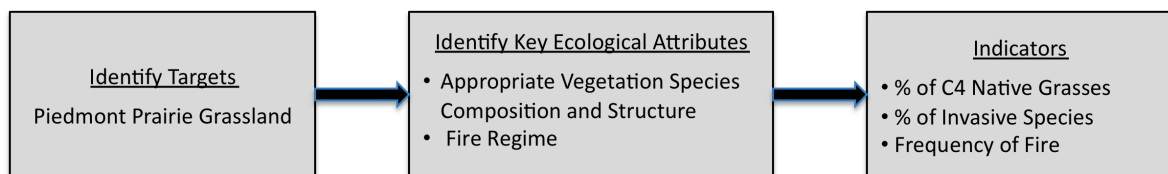• Frequency of Fire

Figure 1 Identifying a finite number of conservation targets and their associated KEAs helps narrow the focus of selecting indicators from an otherwise large number of possibilities

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Few studies examine the effectiveness of selecting indicators to measure conservation success, and it is important to note problems with using indicators. Timko and Innes (2009) used ecological indicators in six national parks in Canada and South Africa to assess whether protected areas were meeting their conservation goals of maintaining ecological integrity. Ecological integrity was determined by evaluating biodiversity, ecological processes, and adaption to or mitigation of threats. Indicators representing each of the ecological criteria were defined through a state of parks report, a status or trend assessment, or through interviews with park staff. Indicators for biodiversity included specific species listed in the "State of Parks" report, while average fire frequency, forest productivity, and coastal erosion were used for ecosystem processes. For threats, the study examined stressors such as non-native vegetation and water pollution.

Although monitoring indicators provided accurate assessments of the conservation strategies and management, many indicators did not have associated data collected, therefore no final assessment could be made (Timko & Innes 2009). This situation outlines a potential problem: too many indicators that are too difficult to monitor. To determine conservation success, monitoring indicators must take into account an organization's available expenditure of resources. The consensus among researchers is to select indicators based on the objectives of the conservation target(s), that are within the means of an organization to measure, and that have the ability to yield consistent information that contributes to decision-making (Niemi & McDonald 2004).

Open Standards: Developing Indicators

The Open Standards framework provides guidance for selecting, monitoring, and analyzing indicators as well as linking them to conservation targets and strategies (Conservation Measures Partnership 2007). If conservation targets are determined and their desired status is articulated, the list of possible indicators that represent their success is narrowed (The Nature Conservancy 2006). Also, Open Standards encourages defining the key ecological attributes of targets. Key ecological attributes are biological characteristics or elements of a target that are central to its success (The Nature Conservancy 2006). For example, the success of a Piedmont grassland prairie target is dependent on frequent fire disturbance to keep the environment in a specific state (early successional), to encourage the seed dispersal and growth of desired grasses, and to suppress competitors. Therefore fire frequency can be considered an indicator and is easy to measure and interpret.

Setting conservation targets and defining the key ecological attributes of a conservation target simplifies the use of indicators for practitioners by filtering out the large number of possibilities that can be overwhelming. Land conservancies differ at what scale they protect and manage landscapes, but the strategy of monitoring indicators to determine conservation success can be applied to all programs (Carignan & Villard 2002).

CONCLUSION

Land trusts range from those that attempt to protect ecosystems over thousands of square miles to those that protect a few acres here and there, with larger conservancies often concentrating their efforts around biodiversity hot spots and areas of broad regional

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importance. Local land trusts fulfill an important niche in the conservation community by protecting areas of local importance, endemic species, and unique landscapes. Smaller conservancies are also representing a growing percentage of the organizations actively conserving land within the United States. Their work contributes to a multi-scale ecological matrix within the larger landscape and is an important component of biodiversity and ecosystem function (Poiani et al. 2000). This contribution alone merits local conservancies measuring their conservation success and evaluating the impact of their strategies and, if necessary, modifying those strategies.

Also, given a trend of increasing demands for accountability, I believe it is imperative that local land trusts begin to address their success in terms of ecological impact, in addition to the capacity and activity measures they have reported for so long (Sawhill & Williamson 2001). To that end, I have proposed a two-part research effort: (1) determine how local land trusts in North Carolina think about success and measure their own efforts and (2) to contribute to ongoing research by applying the Open Standards framework to the Triangle Land Conservancy, a local land trust in North Carolina.

Although many of the frameworks and methodologies used by larger, well-established conservation organizations are developed on a regional scale or for larger conservation projects, smaller land conservancies and government agencies can apply the Open Standards framework to their programs. Status assessments, threat assessments, and monitoring environmental indicators are common themes within existing frameworks and research literature concerning the evaluation of conservation success. Conservation practitioners will have to tailor methodologies to their own programs. Several steps

described in this chapter are contingent on the decisions of staff within land conservancies and agencies, from articulating the goals of a property, to selecting what indicators best reflect the health of a conservation target. The guidance provided in the Open Standards for the Practice of Conservation framework provides practitioners with a way to organize projects that allow for consistent measurement of impact.

Literature Cited

Anthony, B. P. 2008. Use of modified threat reduction assessments to estimate success of conservation measures within and adjacent to Kruger national park, South Africa. Conservation Biology **22:** 1497-1505.

Brooks, J.S., Franzen, M.A., Holmes, C.M., Grote, M.N., and Mulder, M.B. 2006. Testing hypotheses for the success of different conservation strategies. Conservation Biology 20: 1528-1538.

Carignan, V., Villard, M.A. 2002. Selecting indicator species to monitor ecological integrity: A review. Environmental Monitoring and Assessment 78: 45–61.

Christensen, J. 2003. Auditing conservation in an age of accountability. Conservation Magazine 4:.

Conservation International. Arlington, VA. Available from http://www.conservation.org (accessed November 2009).

Conservation Measures Partnership. 2004. Washington, DC. Available from http://www.fosonline.org/CMP/About.cfm (accessed September 2008).

Conservation Measures Partnership. 2007. The open standards for the practice of conservation. Washington, DC. Available from http://www.conservationmeasures.org/CMP/Site_Docs/CMP_Open_Standards_Version_2.0.pdf.

DeFries, R., Hansen, A., Turner, B.L., Reid, R., and J Liu. 2007. Land use change around protected areas: Management to balance human needs and ecological function. Ecological Applications 17: 1031-1038.

Donnelly, A., Jones, M., O'Mahony, T., and Byrne, G. 2007. Selecting environmental indicator for use in strategic environmental assessment. Environmental Impact Assessment Review 27: 161–175

Ferraro, P. J., and Pattanayak, S.K. 2006. Money for nothing? A call for empirical evaluation of biodiversity conservation investments. PLoS Biology 4: e105.

Groves, C.R, Jensen, D.B., Valutis, L.L, Redford, K.H, Shaffer, M.L, Scott, J.M., Baumgartner, J.V., Higgins, J.V., Beck, M.W., Anderson, M.G. 2002. Planning for biodiversity conservation: Putting conservation science into practice. Bioscience 52: 499-512.

Hansen, A.J., Rotella, J.J., Kraska, M.P.V., and Brown, D. 1999. Dynamic habitat and population analysis: An approach to resolve the biodiversity manager's dilemma. Ecological Applications 9: 1459-76.

Hansen, A.J. and DeFries, R. 2007. Land Use Change around Nature Reserves: Implications for Sustaining Biodiversity. Ecological Applications 17: 972-973.

Hockings, M. 2003. Systems for assessing the effectiveness of management in protected areas. BioScience 53: 823-32.

Howard, A. and Margretta, J. 1995. Surviving success: an interview with the Nature Conservancy's John Sawhill. Long Range Planning 28: 127-127.

Kleiman, D.G., Reading, R.P., Miller, B.J. 2000. Improving the evaluation of conservation programs. Conservation Biology 14: 356-365

Knight, A.T., Smith, R.J., Cowling, R.M., Desmet, P.G., Daniel, P., Ferrier, S., Gelderblom, C.M., Grantham, H., Lombard, A.T., Maze, K., Nel, J.L., Parrish, J.D., Pence, G., Possingham, H.P., Reyers, B., Rouget, M., Roux, D., Wilson, K. 2007. Improving the key biodiversity areas approach for effective conservation planning. BioScience 57(3): 256-261.

Land Trust Accreditation Commission. Saratoga Springs, NY. Available from http://www.landtrustaccreditation.org/pdf/11BGuidanceDocument.pdf (accessed November 2009).

Lee, K.N. 1993. Compass and gyroscope: Integrating science and politics for the environment. Island Press, Washington D.C.

Margoluis, R. and Salafsky, N. 1998. Measures of success: Designing, managing, and monitoring conservation and development projects. Island Press, Washington D.C.

Margoluis R., Stem, C., Salafsky, N., Brown, M. 2008. Using conceptual models as a planning and evaluation tool in conservation. Evaluation Program Planning 32: 138-47

Margules, C.R., and Pressey, R.L. 2002. Systematic conservation planning. Nature 405: 243-253.

McKerrow AJ, Williamson SG, Collazo JA. 2006. The North Carolina Gap Analysis Project. U.S. Geological Survey. Report nr Final.

Mezquida JAA, Fernandez JVL, Yanguas AM. 2005. A framework for designing ecological monitoring programs for protected areas: A case study of the Galachos del Ebro Nature Reserve. Environmental Management 35: 20.

Nicholson, E., Keith, D., Wilcove, D. Assessing the threat status of ecological communities. Conservation Biology 23: 259-274.

Niemi, G.J. and McDonald, M.E. 2004. Application of Ecological Indicators. Annual Review of Ecology, Evolution, and Systematics **35:** 89-111.

Noss, R.F., 1990. Indicators for monitoring biodiversity: A hierarchical approach. Conservation Biology 4: 355-364.

Parrish, J.D., Braun, D.P., Unnasch, R.S. 2003. Are we conserving what we say we are? Measuring ecological integrity within protected areas. Bioscience 53: 851-60.

Salafsky, N. and Margoluis, R. 1999. Threat reduction assessment: a practical and cost-effective approach to evaluating conservation and development projects. Conservation Biology 13: 830-841.

Salafsky, N., Margoluis, R., Redford, K., and Robinson, J.G. 2002. Improving the practice of conservation: a conceptual framework and research agenda for conservation science. Conservation Biology 16: 1469-1479.

Salafsky, N. D., Salzer, J., Ervin, T., Boucher, W.O. 2003. Conventions for defining, naming, measuring, combining, and mapping threats in conservation: An initial proposal for a standard system. Foundations of Success, Bethesda, Maryland.

Salafsky, N., Salzer, D., Stattersfield, A., Hilton-Taylor, C., Neugarten R, Butchart S, Collen B, Cox N, Lawrence M, O'Connor S. 2008. A standard lexicon for biodiversity conservation: Unified classifications of threats and actions. Conservation Biology 22(4): 897.

Sanderson, E. 2006. How many animals do we want to save? The many ways of setting population target levels for conservation. BioScience 56: 911-922.

Sawhill, J. and Williamson, D. 2001. Measuring what matters in nonprofits. McKinsey Quarterly 2: 98-107.

Sawhill J and Williamson D. 2001. Mission impossible?: Measuring success in nonprofit organizations. Nonprofit Management and Leadership 11(3): 371-386.

Stem, C., Margoluis, R., Salafsky, N., Brown, M. 2005. Monitoring and Evaluation in Conservation: a Review of Trends and Approaches. Conservation Biology 19: 295-309

Tear, T.H., Kareiva P., et al. 2005. How much is enough? The recurrent problems of setting measurable objectives in conservation. BioScience 55: 835-848

The Nature Conservancy. Arlington, VA. Available from http://www.nature.org/aboutus/ (accessed November 2009).

The Nature Conservancy. 2006. Conservation by Design: A Strategic Framework for Mission Success. Arlington VA

Timko, J.A. and Innes, J. 2009. Evaluating ecological integrity in national parks: Case studies from Canada and South Africa. Biological Conservation 142: 676-688.

Wilhere, G.H. 2008. The how-much-is-enough myth. Conservation Biology 22(3): 514-517.

World Wide Fund (WWF). Washington, DC. Available from http://www.panda.org/ (accessed November 2009).

Walters, C. and Holling, C.S. 1990. Large-scale management experiments and learning by doing. Ecology 71: 2060-2068.

CHAPTER 2

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Are Local Land Trusts Attaining Their Conservation Goals? A Case Study in North Carolina

Abstract

Local land trusts in North Carolina protect land to conserve natural resources and biodiversity, and to provide public benefits, such as clean air and water. However, land trusts frequently report success in terms of the amount of land protected or money raised in support of conservation rather than in impact measures that describe whether or not conservation goals have been achieved. This begs the question, "Are these lands meeting the conservation goals for which they were protected?" We surveyed 24 land trusts in North Carolina to determine why they protect lands, what activities they perform that would allow them to evaluate the conservation impact of their work, and how success is reported to the public. The 22 land trusts that responded reported that their conservation efforts were focused on water quality and quantity, farmlands, natural resources, significant plant and wildlife habitat, lands that reflect a cultural or historical significance, and scenic viewsheds. Land trusts in North Carolina are unable to determine if the lands they have protected are meeting their conservation goals because they are not consistently setting measurable goals, indentifying specific conservation targets, or monitoring indicators that would reflect conservation impact. We found no strong correlation between the demographics of an organization and the frequency with which they performed activities that would allow them to evaluate their conservation success. We identified the Open Standards for the Practice of Conservation as a tool that local land trusts can use to evaluate their conservation efforts by

developing measurable goals and report their conservation success.

Keywords: conservation success, evaluation, monitoring, assessment, land trusts

Introduction

Land trusts and many local governments conserve land as a strategy to protect natural resources and biodiversity, as well as to provide ecosystem services such as clean air and water (Hockings 2003). These efforts are supported by the public as demonstrated by financial donations, volunteerism, and approval of government programs supporting conservation. The number of land trusts in the United States grew from 1,263 in the year 2000 to 1,667 in 2005 (Aldrich & Wyerman 2006). During this time, land trusts also experienced an increase of 63% in involvement through volunteer programs, and a 61% increase in membership (Aldrich & Wyerman 2006). In 2008, voters across the United States approved $7.3 billion in state and municipal bonds for the preservation of parks and open space, despite a poor economy (The New York Times 2008). Similarly, the 2005 National Land Trust Census reported $1 billion in endowments was dedicated to the stewardship of lands protected by land trusts (Aldrich & Wyerman 2006). Despite the funds and effort going toward land trusts, it remains unclear whether they are achieving their conservation goals.

Land trusts are nonprofit organizations that work to fulfill their mission through conserving natural lands by purchasing land for conservation goals, acquiring easements from willing landowners that restrict the use of privately-owned land for conservation purposes, and through continued environmental stewardship (Aldrich & Wyerman 2006;

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Conservation Trust for NC 2009). There are more than 1,660 land trusts in the United States collectively have protected more than 37 million acres of land (Aldrich & Wyerman 2006), which is about the size of the US state of Illinois. To further put land trust holdings in context, the US National Park Service manages almost 90 million acres of land, ocean, lakes, and reservoirs (National Park Service 2008) and the USDA Forest Service manages 193 million acres of forest and grassland (USDA Forest Service 2009).

Land trusts differ in the geographic range of their activities and the resources available to them. Some land trusts operate internationally, focusing their efforts on biodiversity hotspots, while other organizations operate on a national, statewide, or local scale. For example, The Nature Conservancy's mission is to conserve the world's biodiversity. They raised $1.1billion to support their operations in 2008, employ a large staff that includes more than 700 scientists, and have protected some 119 million acres of land and 5,000 miles of river worldwide (The Nature Conservancy 2009). Local land trusts operate on smaller scales with fewer resources. For example, the Smith Island Land Trust protects land on a single barrier island off the coast of North Carolina and is run by a few part time staff and volunteers (Suzanne Dorsey, Executive Director of Bald Head Island Conservancy, personal communication). But for conservancies of any scale the essence of their strategy is protecting natural lands to conserve natural resources, biodiversity, and ecological functions.

Local land trusts fill an important niche in the conservation community by protecting areas of local importance, endemic species, and unique landscapes. Their work contributes to building a multi-scale ecological matrix within the larger landscape, which has growing importance in the face of climate change (Poiani, et al. 2000). In North Carolina, land trusts

have conserved over 228, 524 acres, an area greater than the NC State Park system's 204,847 acres (North Carolina State Parks 2009). Local conservancies also facilitate and influence important relationships among private land owners, the public, and policy makers by serving as advocates for local conservation, and protect habitats and areas outside the purview of larger organizations, such as farmland and locally significant natural heritage sites.

With funds and resources expended by land trusts to protect lands comes the expectation of evidence indicating that conservation lands are meeting the goals for which they are protected. However, land trusts frequently report success in terms of the amount of land protected or money raised in support of conservation rather than in impact measures that describe whether or not conservation goals have been achieved (Howard & Magretta 1995; Aldrich & Wyerman 2006).

In 1995 John Sawhill, then director of The Nature Conservancy, noted that most land trusts, including The Nature Conservancy, commonly reported success to donors and the public through the "bucks and acres" metric – a tally of acreage protected and funds raised (Howard & Magretta 1995). This metric was appropriate for their "Noah's Ark" approach to conservation – buying as much land as possible with the expectation that species and ecological functions would also be protected (Howard & Magretta, 1995). Yet, in their experience, this approach did not yield results that brought The Nature Conservancy closer to meeting its mission of preserving plants, animals, and natural communities that represent the earth's biodiversity (Howard & Magretta, 1995). There were still reports of extinction and, in some cases, observations that species of concern had declined and habitats degraded on lands protected by The Nature Conservancy (Howard & Magretta, 1995).

Since 1995 The Nature Conservancy, other conservancies interested in preserving global habitats, and researchers have developed several methods to evaluate conservation success (Conservation Measure Partnership 2007). As a result of their efforts, the Open Standards for the Practice of Conservation framework has emerged, a five-step guide to conceptually organize conservation that includes articulating a vision of success for a project, as well developing appropriate goals, objectives, and strategies to achieve that vision (Conservation Measures Partnership 2007).

Rooted in the adaptive management school of thought (Walters & Holling 1990; Lee 1993), this framework directs practitioners to outline their assumptions, link specific actions to outcomes and monitor specific indicators whose biological conditions reflect the overall state of the conserved property (Conservation Measures Partnership 2007). Many of the larger land trusts using this framework are in the preliminary stages of implementation and focusing on the first two steps of the process: defining goals and a vision of success, and planning actions and monitoring strategies (M Brown, Senior Programs Manager for Foundations of Success, personal communication). As a result, these land trusts are instituting operational changes to their organizations (M Brown, Senior Programs Manager for Foundations of Success, personal communication).

Little is known about how smaller, local land trusts evaluate their progress or if they have learned from the experiences of larger organizations, as many local land trusts communicate progress using the "bucks and acres" approach. For example, the Land Trust Alliance, an umbrella organization for land trusts in the US, reports success as an increased amount of acreage conserved and funds raised, and through organizational growth (Aldrich

& Wyerman 2006). To report ecological impact, however, local land trusts must answer the question "Are our lands meeting the conservation goals for which they were protected?" This requires setting goals and defining conservation targets (ecosystems, species, and ecological processes) for which land is protected, and periodically evaluating results.

To determine how local land trusts evaluate their progress, we surveyed 24 conservancies that actively conserve land and are responsible for stewardship in North Carolina to document why they protect lands, what activities they perform that allow them to evaluate their conservation impact, and how success is reported to the public. Our survey population represents organizations of various longevity, operating budgets, organizational development, and staff; thus we believe the trends observed in this case study could extend to land trusts across the US.

Methods

We surveyed 24 land trusts operating within North Carolina. We developed our population by drawing on organizations listed by the Conservation Trust for North Carolina, a non-profit consortium of the state's local land trusts (http://www.ctnc.org), or by the Land Trust Alliance (http://www.landtrustalliance.org) in September 2008. We excluded organizations that also operated outside North Carolina and that did not hold land or easements at the time of the survey, which we determined by reviewing their websites and contacting organizations.

Survey questions were developed through a focus group of staff from five different land trusts across the state. The 90-minute focus group was conducted during the 2008

Southeast Land Trust Conference in Montreat, NC. Survey questions probed why organizations conserve land, how goals for protected properties are identified and defined, and how organizations evaluate their success and effectiveness (Appendix A). The Institutional Review Board for human subjects research at North Carolina State University approved our survey methodology, including the focus group activities.

We administered the survey using Survey Monkey, an internet-based survey program (http://www.surveymonkey.com). We sent an electronic mail message containing a description of the study, an informed consent form, and a link to the survey to each respondent on August 6, 2008. We sent the survey to one staff member per organization, identified in consultation with Kevin Brice, President of Triangle Land Conservancy, and by their professional title as the most knowledgeable about land management and conservation strategies. This included Executive Directors, Directors of Land Conservation, or stewardship and land protection personnel. We sent reminders via electronic mail to each respondent on August 21, 2008, September 4, 2008 and September 17, 2008. The survey closed at 5:00 pm September 17, 2008.

From the responses, we calculated the percentage of land trusts performing activities necessary to measure impact. We used Kendall's Tau correlation, a nonparametric measure of concordance (Agresti 2002), to test relationships between demographic characteristics of land trusts and activities that would support evaluation of ecological success. If the response for one of the pair of variables being correlated was omitted, we removed that record from the analysis; thus, sample size varied among correlations.

Results

   Twenty-two land trusts responded to our survey, a 92% response rate. Six common themes emerged as primary areas of focus in the 22 land trust mission statements we evaluated: water quality and quantity (n=10), farmlands (n=9), natural resources (n=8), significant plant and wildlife habitat (n=7), lands that reflect a cultural or historical significance (n=7), and scenic viewsheds (n=5). (Mission statements frequently identify more than one focus area, which is why these sum to more than 22.)

   When asked to list their top five reasons for land protection, land trusts reported conserving natural habitats, such as natural heritage sites and ecologically important landscapes, as well as protecting water quality as their primary reasons for conservation (Table 1). The majority of land trusts develop conservation goals for their protected properties, but to varying degrees. Of the 22 land trusts that responded to this survey, eight reported developing goals for at least 91% of their properties while three reported not developing goals at all (Fig. 1a). Land trusts also vary in how often they identify conservation targets (Fig. 1b). Interestingly, land trusts indicated they identify threats to protected properties more often than they set conservation goals or indentify specific conservation targets (Fig. 1c).

   Eighteen land trusts reported creating baseline documentation reports for 91–100% of their properties (Fig. 1d). These reports describe the condition of a property at the time of protection, must be prepared before the completion of an easement, and must adhere to the US Department of Treasury Regulations (Land Trust Accreditation Commission 2009). Baseline reports state the conservation values of a property and can be used to develop goals

and objectives. However, land trusts create ecological inventories – detailed descriptions about species populations, habitats, and ecosystem processes – much less frequently (Fig. 1e).

No land trusts reported monitoring water quality for all of their properties. In fact, the majority of land trusts either do not monitor water quality at all or do so for only a small percentage of their properties (Fig. 1f). Monitoring biological indicators occurs with only slightly greater frequency (Fig. 1g). The majority of our respondents reported having never or rarely been asked to provide evidence that conservation goals for their properties have been met (Fig 2).

There is little evidence that these activities are related to the age, size, or budget of a land trust. Most of the Kendall's Tau correlations were weak and not statistically significant (Table 2). Land trusts with more full time staff tended to define specific conservation goals ($\tau=0.41$, $p=0.03$) and develop lists of conservation targets ($\tau=0.34$, $p=0.06$) for a larger proportion of their properties. Paradoxically, older land trusts tended to define specific conservation goals for fewer of their properties ($\tau=-0.34$, $p=0.05$).

Discussion

If asked, "Are your lands meeting the conservation goals for which they were protected?" it would seem most land trusts would have to respond, "We don't know." Drawing on the mission statements submitted and reasons to protect land (Table 1), measuring the conservation impact of a land trust would entail quantifying the outcomes of their conservation activities, such as how much clean water is available, how many farms are

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contributing to the local economy and continue to exist, how many rare species populations have viable populations, and what ecological functions are being maintained or improved. Yet most land trusts in NC, as well as organizations outside the state, report success in terms of "bucks and acres" (Aldrich and Wyerman 2006; Sawhill & Williamson 2001).

Most of the land trusts we surveyed are not consistently stating goals, identifying conservation targets, or engaging in monitoring activities that would allow them to evaluate the effectiveness of their strategies. Most do not monitor water quality (Fig. 1f) or biological indicators that provide insight into the state of the natural resources or ecological functions (Fig. 1g), even though these are the stated, primary reasons for land protection (Table 1).

We found few correlations between monitoring activities and a land trust's age, size of full time staff, or budget (Table 2). In fact, the demographic characteristics vary widely among the few land trusts that did report monitoring water quality and biological indicators for the majority of their properties. Organization A (land trusts that participated in this survey are anonymous) reported monitoring water quality and biological indicators for 75 – 90% of their properties. This organization had no more than 3 full-time employees, an annual operating budget of $175,000 for fiscal year 2007, and had protected approximately 8,600 acres of land. Of the two other land trusts (Organizations B and C) who reported monitoring biological indicators for more than 91% of their properties, Organization B had protected 7,500 acres of land, had between six to ten full time staff members, one to two part time employees, more than ten regular volunteers, and an annual budget of $722,000. Organization C had protected approximately 120 acres, had one to two part time staff, six to ten regular volunteers, and an operating budget of $7,000.

The degree to which these organizations preformed monitoring activities may be described by characteristics we did not measure, such as access to universities or the types of volunteers they worked with. For example, Organization B is near a large university and Organization C is a subsidiary of another organization that engages in scientific, environmental research and may benefit from volunteer expertise from that relationship.

The land trusts we surveyed identify threats to their properties more often than they develop conservation goals and targets (Fig 1c). This may be a response to the rapid growth and urbanization of certain areas in North Carolina and a corresponding sense of urgency to protect land before it is developed. As of 2008, there were more than 9 million people living in North Carolina, a 14.6% increase from the year 2000 (US Census Bureau 2009). The population is projected to exceed 12 million during the next 20 years (US Census Bureau 2009). Land trusts may be more concerned with protecting undeveloped, natural lands while they are available than setting detailed conservation goals and instituting monitoring programs.

There appears to be little incentive for land trusts to report more than "bucks and acres" given the small numbers of grantors and funders requiring outcomes-based measurements. Eighteen land trusts have rarely or never been asked to provide evidence that their protected lands were meeting their conservation goals, and only two have been asked regularly for such evidence (Fig 1h). But this trend may change given the growing emphasis on accountability and performance measurement among government agencies and the public. Mulvaney et al. (2006) described the legislative incentives and rise in demand for accountability and providing performance measurements within federal government. The

types of groups who did request outcomes-based results from the 11 land trusts who reported having been asked include the NC Clean Water Management Trust Fund, NC Ecosystem Enhancement Program, the US Department of Agriculture, the Environmental Protection Agency, the US Fish and Wildlife Service, and the IRS – all government organizations.

Conclusion and A Way Forward

It is often difficult for conservation practitioners to quantify the effects of their activities, because resources are always limited and lands are often protected to provide multiple benefits within dynamic, complex and changing contexts (Margoluis et al., 2009). We found most land trusts in North Carolina are unable to determine if the lands they have protected are meeting their conservation goals because they are not consistently indentifying specific conservation targets, setting measurable goals for those targets, and monitoring the effects of their land management.

Through a review of research literature and methodologies used by large land conservancies to develop goals and impact measures, we found that there are tools available that can help local land trusts establish and monitor measurable impact goals (Alexander 2010). We recommend the Open Standards for the Practice of Conservation (Conservation Measures Partnership 2007), developed by the Conservation Measures Partnership, a group of large, international conservancies and researchers dedicated to understanding how to improve the practice of conservation. The Open Standards, available at no cost, provides guidance for organizing projects and evaluating the impact of conservation strategies using a five-step adaptive management framework: (1) conceptualize, (2) plan actions and

monitoring, (3) implement actions and monitoring, (4) analyze, use, adapt, and (5) capture

and share learning. Because the goals and strategies of land trusts working at various scales

are similar, we believe that local land trusts could adopt this framework. We note several

advantages for local land trusts to use the Open Standards framework including the adoption

of a similar lexicon, which could improve communication across the conservation discipline,

increased potential for partnerships, and its availability.

As part of ongoing research, we are investigating the applicability of the Open

Standards to smaller land trusts by working with Triangle Land Conservancy (Raleigh, NC)

as it adopts the framework. Triangle Land Conservancy has worked through much of the

conceptualization phase, during which it developed a new vision and redefined its focus as

the public benefits of its conservation activities: clean water, local farms and food, wildlife

habitat, and connecting people with nature. This has changed fundamentally the way the

organization thinks about conservation (Kevin Brice, President, personal communication).

For example, Triangle Land Conservancy recently received a bequest from Elinor Irvin of

269 acres to be used for wildlife habitat and conservation; 40 acres of the tract was

abandoned pasture. Under the "bucks & acres" accounting system, the Conservancy would

have crafted a wildlife management plan and moved on to accumulate more acres. Because

of the focus on impacts – wildlife habitat *and* connecting people with nature, in this case –

the Conservancy went further and established the Irvin Learning Farm in partnership with a

local group of environmental educators. The Farm hosts educational programs that reconnect

5-13-year-old children with wildlife and the natural world and, through tending a vegetable

garden, the source of the food they eat. In addition to the educational impact, the

Conservancy has found that a whole new group of potential donors, those focused on education, are now interested in their activities.

It is quite likely that the land trusts we surveyed are achieving significant, positive results in their communities. But inability to demonstrate the conservation impact of their work is a lost opportunity for lands trusts to engage the public, entice new donors, leverage funding for additional conservation activities, and influence public policy. For example, imagine how much stronger arguments for additional funding and policy changes could be if land trusts demonstrated water quality is indeed being maintained or improved. When goals are articulated and there is a clear vision of what success actually means, land trusts are likely to be more effective and influential within their communities.

Scientists have often been called upon to guide policy in support of conserving biodiversity and to improve our understanding and use of natural resources (Lubchenco 1998; Miller et al. 2008). Conservation biologists have an opportunity to expand their role and improve the practice of conservation by working with local land trusts that fulfill an important role by preserving areas of local importance and actively working with communities. Biologists can engage with local land trusts in their area by examining annual reports, determining how conservation success is evaluated, becoming familiar with the Open Standards for Conservation and by volunteering their expertise. Local land trusts are key players in the conservation movement and their success is important both to the communities they are trying to serve and to the health of the large-scale ecosystems and regions to which they contribute.

Acknowledgements

Literature Cited

Agresti, A. 2002. Categorical data analysis. Wiley–Interscience, New York. 710

Aldrich, R. and Wyerman, J. 2006. 2005 National land trust census report. Land Trust Alliance, Washington, DC.

Conservation Measures Partnership. 2007. Open standards for the practice of conservation. Conservation Measures Partnership, Bethesda, MD.

Conservation Trust for North Carolina. Raleigh, NC. Available from http://www.ctnc.org/site/PageServer?pagename=land_what (accessed November 2009).

Conservation Trust for North Carolina. Raleigh, NC. Available from http://www.ctnc.org/site/PageServer?pagename=land_ltmap (accessed September 2008).

Hockings, M. 2003. Systems for assessing the effectiveness of management in protected areas. BioScience 53: 823-32.

Howard, A. and Margretta, J. 1995. Surviving success: an interview with the Nature Conservancy's John Sawhill. Long Range Planning 28: 127-127.

Land Trust Accreditation Commission. Saratoga Springs, NY. Available from http://www.landtrustaccreditation.org/pdf/11BGuidanceDocument.pdf (accessed November 2009).

Lee, K.N. 1993. Compass and gyroscope: Integrating science and politics for the environment. Island Press, Washington D.C.

Lubchenco, J. 1998. Entering the Century of the Environment: A New Social Contract for Science. Science 279: 491-491

Margoluis R., Stem, C., Salafsky, N., Brown, M. 2009. Using conceptual models as a planning and evaluation tool in conservation. Evaluation Program Planning 32: 138-47.

Miller, J., Groom, M., Hess, G., Steelman, T., Stokes, D., Thompson, J., Bowman, T., Fricke, L., King, B., and Marquardt, R. 2008. Biodiversity conservation in local planning. Conservation Biology 23: 53-63.

Mulvaney, R., Zwahr, M., and Baranowski, L. 2006. The trend toward accountability: What does it mean for HR managers?. Human Resource Management Review 16: 431-442.

North Carolina Division of Parks and Recreation. 2009. System wide plan for North Carolina's state parks. Raleigh, NC.

Poiani, K.A., Richter, B.D., Anderson, M.G., Richter, H.E. 2000. Biodiversity conservation at multiple scales: Functional sites, landscapes, and networks. BioScience 50: 133-146.

Sawhill J and Williamson D. 2001. Mission impossible?: Measuring success in nonprofit organizations. Nonprofit Management and Leadership 11: 371-386.

The Land Trust Alliance. Washington, DC. Available from http://www.ltanet.org/landtrustdirectory/alpha.tcl?state_id=northcarolina37#local (accessed September 2008)

The Nature Conservancy. 2008. Conservation connections. Annual report. Available from http://www.nature.org/aboutus/annualreport/files/annualreport2008.pdf (accessed November 2009).

The Nature Conservancy Arlington, VA. Available from http://www.nature.org/aboutus/ (accessed November 2009).

The New York Times. A resounding vote for open space. New York Times, Nov 18 2008: A34.

United States Census Bureau. Washington, D.C. Available from http://quickfacts.census.gov/qfd/states/37000.html (accessed November 2009).

United States Forest Service. 2009. Washington, D.C. Available from http://www.fs.fed.us/aboutus/ (Accessed November 2009).

Waldren, S. 2008. National Park Service Director's Report. U.S. National Park Service, Washington, DC.

Walters, C. and Holling, C.S. 1990. Large-scale management experiments and learning by doing. Ecology 71: 2060-2068.

Table 1. Reasons for protecting land. All land trusts were given the opportunity to report the five top reasons they protect land, though not all provided five reasons. We report here the actual responses from the survey (right-hand column) and our aggregation of these responses into broader categories (left-hand column). (N=21 land trusts, Responses = 94)

Aggregated Categories	Actual Responses from Survey
Protect wildlife, natural communities, natural heritage, natural resources, and ecologically important landscapes (24 Responses)	• Protection of natural heritage / endangered species, wildlife and important habitats (18 Responses) • Preserve natural communities and natural resources (2 Responses) • To create wildlife corridors (2 Responses) • To benefit of wildlife and a healthy environment (2 Responses)
Protect water quality and water resources (19 Responses)	• To protect water quality and water resources (15 Responses) • Preserve the ecology of rivers, streams, and watersheds • (4 Responses)
Preserve agriculture, working landscapes and rural communities (12 Responses)	• To preserve productive farms, forests, and working lands (8 Responses) • To preserve rural communities (2 Responses) • Agricultural values (2 Responses)
Preserve open space for public recreation, historical, and cultural values (11 Responses)	• Public recreation (6 Responses) • Historical / cultural values (3 Responses) • To acquire public conservation lands (2 Responses) • Provide a legacy for future generations
Preserve viewsheds and aesthetically pleasing landscapes (8 Responses)	• Scenic landscapes and views (8 Responses)
Preserve land in a natural state (6 Responses)	• Preserve land in a natural state / as open space (4 Responses) • Preserve open space in urban areas (2 Responses)
Other (14 Responses)	• Ecosystem services (2 Responses) • Proximity to protected lands (2 Responses) • Public education, health, and outreach (2 Responses) • Prevent pollution from spreading (1 Response) • To empower a community living and growing in harmony with our natural resources (1 Response) • To protect mountains, forests, farmland and greenspaces (1 Response) • Alternative transportation (1 Response) • Barrier island sustainability (1 Response) • Conservation values (1 Response) • Privacy (1 Response) • Tax incentives (1 Response)

Table 2. Kendall's Tau correlation (τ) and p-values for significance of the correlation between pairs of variables. The rows represent activities of land trusts that would support the **measurement** of ecological success; questions asked respondents to categorize the proportion of their properties on which these activities are performed. Columns are demographic data about the land trusts. Number of observations (n) varies because not all respondents answered all questions.

	Age of Trust (in 2009)	Budget (FY 2007-2008)	Number of Full Time, Paid Staff	Acres Protected§
Define specific conservation goals	τ=-0.34 p=0.05**† (n=21)	τ=0.26 p=0.14 (n=20)	τ=0.41 p=0.03** (n=20)	τ=0.18 p=0.30 (n=21)
Develop list of conservation targets	τ=-0.13 p=0.45 (n=21)	τ=0.21 p=0.23 (n=20)	τ=0.34 p=0.06* (n=20)	τ=0.08 p=0.64 (n=21)
Prepare ecological inventories	τ=0.24 p=0.16 (n=21)	τ=0.24 p=0.16 (n=20)	τ=0.15 p=0.41 (n=20)	τ=0.08 p=0.62 (n=21)
Identify threats to conservation	τ=-0.05 p=0.77 (n=21)	τ=0.27 p=0.13 (n=20)	τ=0.18 p=0.33 (n=20)	τ=0.11 p=0.51 (n=21)
Monitor water quality	τ=0.08 p=0.69 (n=20)	τ=-0.05 p=0.77 (n=20)	τ=0.05 p=0.79 (n=20)	τ=-0.03 p=0.88 (n=20)
Monitor bioindicators	τ=0.11 p=0.56 (n=19)	τ=0.21 p=0.27 (n=19)	τ=0.10 p=0.61 (n=19)	τ=0.26 p=0.16 (n=19)

** Significant at alpha=0.05   * Significant at alpha=0.10

§ Acres protected includes lands the trust holds an easement on or owns fee-simple.

† One land trust is 125 years old; the next oldest is 42 years.; mean of the remaining is 19 and median is 17. If the 125-year-old land trust is excluded from the test, τ=-0.32, p=0.08 (n=20).

A. Develop Specific Conservation Goals

B. Identify Conservation Targets

C. Identify Threats

D. Create Baseline Report Documents

E. Ecological Inventories

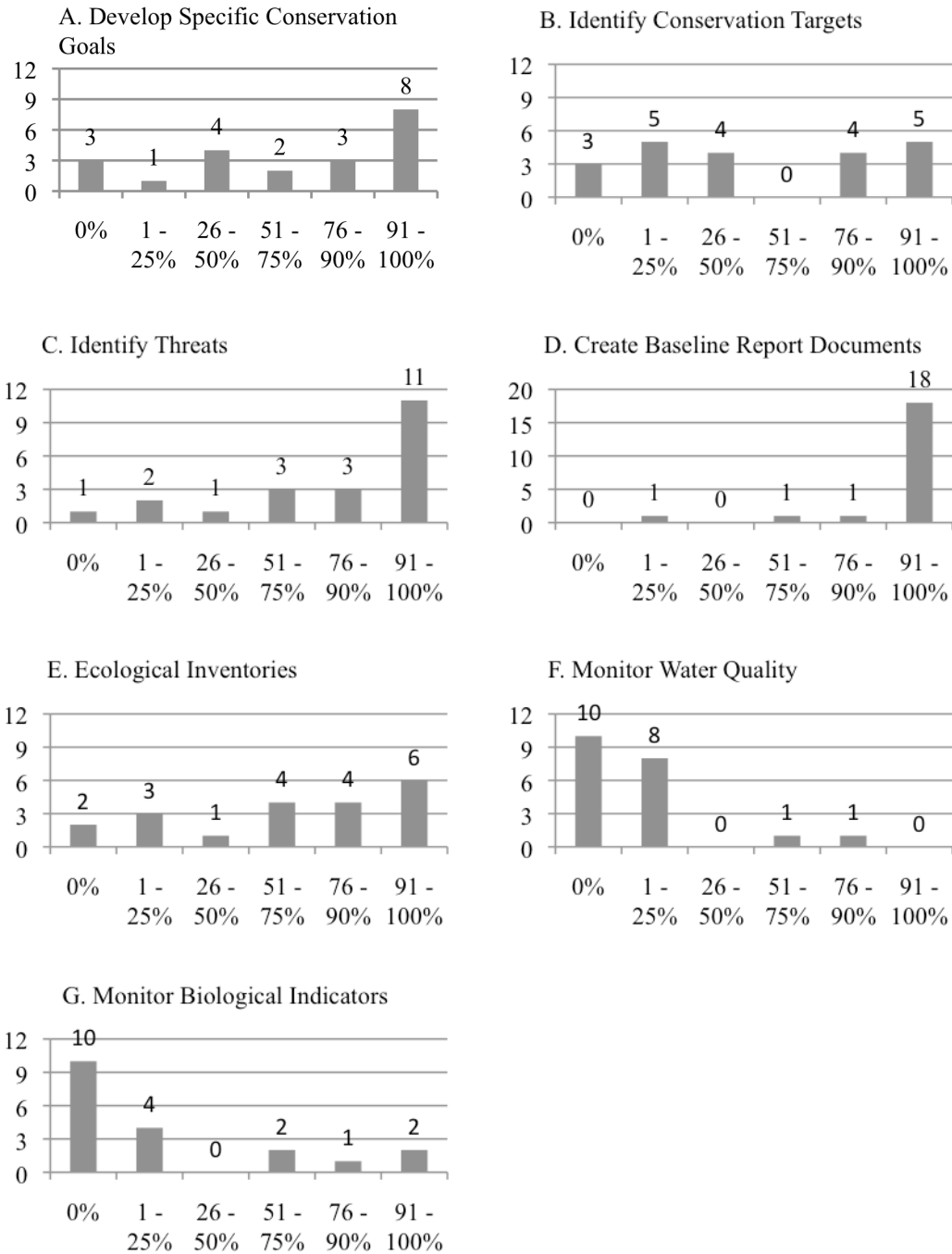**F. Monitor Water Quality**

G. Monitor Biological Indicators

Figure 1. Percentage of properties on which land trusts perform activities relevant to the ability to report the impact of their conservation efforts (a-g). Y-axis is number of land trusts for all graphs.
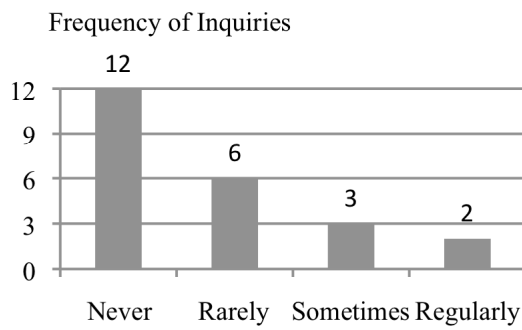
Figure 2. The frequency with which land trusts are asked to evaluate whether the lands it protects are meeting the conservation goal(s) for which they were protected. Y-axis is number of land trusts for all graphs. Y-axis is number of land trusts for all graphs.