Funding for North Carolina's Stewardship Program: Evaluating Current Costs, Estimating Future Expenditures, and Identifying a Proper Funding Model

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ABSTRACT

North Carolina's Stewardship Program (NCDENR Stewardship) is responsible for maintaining mitigation sites and conserved lands held by the state of North Carolina. These sites have associated endowments, which are invested to generate funds for stewardship activities. Unfortunately, low interest rates and high inflation rates present challenges to the endowment funding model. Furthermore, in the case of NCDENR Stewardship, a need exists to identify comprehensive costs associated with stewardship activities along with cost drivers to better predict true funding needs. As such, my analysis seeks to identify all current costs, develop a working template to determine future expenditures, and propose an appropriate funding model that considers economic factors such as inflation and interest rates and the institutional capabilities of NCDENR Stewardship. In this study, a thorough literature review was first conducted to determine comprehensive costs applicable to NCDENR Stewardship. Next, 64 sites managed by NCDENR Stewardship were evaluated to determine cost drivers of monitoring activities. NCDENR Stewardship's use of lump sum payments to outsourced land trusts resulted in land trusts explaining 59% of the deviance in annual cost. Regression analysis indicates that site characteristics such as perimeter length could be better incorporated into payment amounts to land trusts. Using my literature review, average site characteristics, and appropriate assumptions including a risk premium, annual costs per site are estimated to be $1,843 dollars. Two predictive models, one abbreviated and the other comprehensive, were developed to assist in determining future stewardship costs. Finally, my analysis concludes that a periodic fees model, rather than an endowment or hybrid model, currently represents the most viable funding model for NCDENR Stewardship. This is due to the model's ability to adjust for changing costs and economic factors such as interest rates and inflation.

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INTRODUCTION

WETLAND REGULATION AND COMPENSATORY MITIGATION

Wetland policies and regulations in the United States, originally designed to facilitate wetland destruction, have witnessed large changes that now afford greater protection to these ecosystems. Historically, the Swamp Land Acts transferred ownership of large swaths of wetland areas from federal to state ownership, with the intention of draining these sites. The Rivers and Harbors Act of 1899 gave the U.S. Army Corps of Engineers (USACE) permitting authority over the dredging or filling of wetlands in navigable waters, but wetlands were afforded little protection due to the fact that they were not considered part of navigable areas. USACE destroyed numerous wetlands as part of its efforts to provide flood control. In the Reclamation Act of 1902, the federal government accepted responsibility for draining wetlands through the use of public funds.

However, shifting attitudes resulting from factors such as appreciative literature and greater awareness of the recreational values of wetlands gradually produced a corresponding change in wetland regulation. Shifting regulations resulted in the passage of the Clean Water Act, which contained important legislation for the protection of wetlands. Section 404 of the Clean Water Act specifically authorizes USACE to regulate wetlands as a component of navigable waters. While some development-related activities are exempt from regulation, developers must now obtain permits for dredge and fill activities and, after proving that their impacts are unavoidable, must provide compensatory mitigation activities to rectify loss of wetland function in a given watershed.

Compensatory mitigation can be completed in several ways, including restoration of a degraded stream or wetland site, enhancement of an existing site, establishment of a new site, or preservation of an existing site.[1] North Carolina state programs also include mitigation for nutrient release and riparian buffers. There are three methods to conduct compensatory mitigation: permittee-responsible compensatory mitigation, mitigation banks, and in-lieu fee mitigation.[2] In permittee-responsible compensatory mitigation, the

permittee is responsible for completing the necessary mitigation due to the adverse impacts to wetlands that he has caused. The mitigation activities conducted can either be at the same location as the impacted wetland (this is known as on-site mitigation) or in a different location, which will generally be found within the same watershed (this is known as off-site mitigation). In-lieu fee programs may be administered by state or local governments.[3] In lieu-fee programs function by charging fees to permittees, and the fees are then used to implement mitigation activities. Here, by paying the requisite fee, the permittee transfers responsibility for mitigation to the in-lieu fee program. Mitigation banks, on the other hand, can be created by private, public, or non-profit mitigation bankers. Mitigation bankers are awarded credits based on their activities, which may then be sold to the permittee, who transfers liability to the banker.

The Federal Register also details the need to set aside funding for site maintenance, where a "long-term management plan should include a description of long-term management needs, annual cost estimates for these needs, and identify the funding mechanism that will be used to meet those needs."[4] This plan must also include the necessary aspects for a project's long-term financing, with acceptable financing including "non-wasting endowments, trusts, contractual arrangements with future responsible parties, and other appropriate financial instruments."[5] Furthermore, when a public agency becomes responsible, it must provide a plan to ensure the site's long-term financing, and for permittee-responsible mitigation, financing must be approved before any adverse impacts to wetlands occur.[6]

ECOSYSTEM ENHANCEMENT PROGRAM

The purpose of North Carolina’s Ecosystem Enhancement Program (EEP) is to allow development to occur while simultaneously protecting North Carolina's natural resources. Prior to EEP, compensatory mitigation in North Carolina was conducted through permit applicants, where the same entity adversely impacting wetlands would provide the necessary wetland compensatory mitigation activities. However, given the failures of

permittees, in particular the North Carolina Department of Transportation (NCDOT), to construct adequate compensatory mitigation sites, a large number of sites failed to meet specifications. Created in 2003, EEP would provide a new in-lieu fee program specifically tailored to address the mitigation needs of NCDOT, where advance mitigation would occur prior to the awarding of NCDOT permits. EEP would also provide a watershed-based approach, and allow existing programs to be folded into the new organization.

Currently, EEP operates on a widespread scale in North Carolina and has provided extensive compensatory mitigation while allowing development to proceed without delay (J. Stanfill, North Carolina Department of Environment and Natural Resources, personal communication). The program has allowed $8 billion worth of infrastructure projects to proceed without delay through simplifying and expediting the permitting process. In paying in-lieu fees, developers no longer face the numerous challenges inherent in the development of a mitigation site. A key feature of the program remains its ability to provide compensatory mitigation on a large scale prior to the occurrence of associated impacts. EEP's size allows for economies of scale that can result in lower costs charged to permittees, and the stable pricing can remove uncertainty in developers' planning processes. The program is also voluntary and self-sustaining in that it receives no legislative funding. While the majority of compensatory mitigation occurs in anticipation of NCDOT's activities, permittees can also include other entities such as private developers.

Currently, EEP provides four compensatory activities, which relate to wetlands, streams, riparian buffers, and nutrient release. These include the following:

1. NCDOT Stream and Wetland In-Lieu Fee Program
2. Statewide Stream and Wetland In-Lieu Fee Program
3. Riparian Buffer Mitigation In-Lieu Fee Program
4. Nutrient Offset In-Lieu Fee Program

In total, the program has approximately 600 sites, which are mostly comprised of stream or wetland restoration sites. Projects, conducted in compliance with current regulations, develop in stages including site identification, design, construction, monitoring, and management and are outsourced to EEP's partners in the private sector. As an example of the program's large size, during the 2010-2011 fiscal year, almost $25 million was paid to these private firms.

STEWARDSHIP TASK FORCE

In 2004, a group labeled the Stewardship Task Force convened to develop recommendations relating to the management and stewardship of state held conservation sites. The charter of the Stewardship Task Force was the following:

> "The North Carolina Department of Environment and Natural Resources has convened this Task Force to evaluate monitoring fees and provide recommendations for long-term management and perpetual monitoring, and to provide recommendations to the Secretary for the most cost-effective mechanisms for ensuring protection and management of land interests associated with acquired or secured properties…"[7]

The Stewardship Task Force had eleven meetings during a period of 5-months, which culminated in the creation of NCDENR Stewardship in 2004. While the Stewardship Task Force was chaired by EEP, other participants included organizations such as the Piedmont Land Conservancy, the Nature Conservancy, and the Clean Water Management Trust Fund. In light of the recommendations made by the participants, the Secretary established NCDENR Stewardship, nested in the Office of Conservation and Community Affairs. The report stated that "Staffing levels of this office will be increased over time to administer and track long-term monitoring reports, review invoices and approve payments for contracted out monitoring efforts."[8] EEP and the Office of Conservation and Community Affairs signed an interagency Memorandum of Agreement in 2006 to describe methods of conveyance and endowment rates for EEP sites.[9]

The Memorandum of Agreement defines NCDENR Stewardship's mandate as "…the protection of the ecological integrity of conservation properties, and has three major components: monitoring, legal protection and defense, and biological management activities." Activities also include landowner outreach and education. All current sites represent properties transferred to NCDENR Stewardship as part of EEP's mitigation activities. In general, sites have little management activities associated with them: As sites are generally designed to be self-sustaining once the regulatory authorities have determined that a mitigation site is successful, sites generally requires no additional activity unless a long-term management plan is specified as part of the project.[10]

As part of the Department of Environment and Natural Resources (DENR), NCDENR Stewardship has one employee, Eric Galamb, the Stewardship Director. The original goal of NCDENR Stewardship was the transfer and maintenance of state-owned properties beginning with properties held by EEP but also potentially including properties from other programs. NCDENR Stewardship is responsible for compiling and maintaining a database of all properties. Monitoring activities are almost entirely outsourced to land trusts, with one property monitored by the Stewardship Director. The program currently monitors 101 properties, but the option remains to add additional properties. Violations are addressed by the Stewardship Director, who estimates that 5 to 10 violations occur per year (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). Legal services required for enforcement would be conducted in cooperation with the Department of Justice and would also require coordination with land trusts involved in monitoring efforts. To date, no legal action has yet been taken against violators. While it was also expected that DENR would provide administrative support to NCDENR Stewardship, the current goal is for NCDENR Stewardship to be self-sufficient through fees charged to clients of the program (such as EEP).

CURRENT FUNDING MODEL

Initially, it was determined that funding for NCDENR Stewardship would be established through a non-reverting endowment fund, approved by the State Treasurer. Funds transferred to NCDENR Stewardship for the purpose of maintaining properties are deposited in the Conservation Grant Fund, which is managed by the State Treasurer and invested in low-risk, highly liquid debt securities for the purpose of generating income. This income is then used to fund NCDENR Stewardship's functions. Funds for NCDENR Stewardship are currently broken up into several accounts: This includes the 6704, 6705, and 2410 accounts. The 6704 account houses the endowment, while the 6705 account houses the interest generated from the endowment. Account 2410 includes an operating account, which initially had $81,379 in start-up funding. The Stewardship Director managed to utilize these funds for several years, but they have now been depleted to zero.

OBJECTIVES

The primary objective of this analysis involves assisting NCDENR Stewardship in becoming self-sufficient. Identifying comprehensive costs per site and an appropriate funding model will help ensure that sufficient funds exist for NCDENR Stewardship to continue properly safeguarding conserved properties while eliminating the need to receive funding from EEP. In identifying site costs, it will also be important to evaluate how outsourced land trusts charge fees for their monitoring activities and analyze whether costs vary predictably with site parameters such as area or perimeter length. If costs do not correlate with site characteristics, it may be indicative of land trusts overcharging NCDENR Stewardship. Furthermore, if monitoring costs are to be accurately predicted in the future (which is important for funding security), NCDENR Stewardship should seek to negotiate payments that correlate closely with site characteristics.

Specifically, this analysis is intended to assist NCDENR Stewardship with the following four objectives:

1.) Conduct a thorough literature review to identify all relevant costs associated with NCDENR Stewardship, including administrative and legal expenses, landowner interactions, on-site monitoring, enforcement, and any other relevant costs. Only monitoring costs were readily available as data from NCDENR Stewardship, necessitating a more comprehensive analysis of total costs associated with the program.
2.) Evaluate NCDENR Stewardship site characteristics such as size, perimeter, and distance between the site and monitoring agency. Identify the relationship between these site characteristics and monitoring costs through the use of statistical software and cost data from the program's database. Evaluate the appropriateness of these relationships and improvements that could be made to the current payment structure.
3.) Develop appropriate models for determining future costs for site monitoring, using information from 1.) and 2.) above. Develop both a comprehensive and

abbreviated model for predicting future costs and evaluate their appropriateness for calculating future costs based on a balance between convenience and accuracy.

4.) Evaluate different funding models for NCDENR Stewardship including the current endowment model, a periodic fees model, or a hybrid model, which would contain elements of both an endowment model and annual fees model.

Currently, only costs associated with site monitoring are readily available as data to evaluate. As such, a literature review will be conducted to identify all applicable costs related to NCDENR Stewardship's activities and institutional structure. One of the goals in NCDENR Stewardship's founding was its eventual growth to encompass greater staff, which will result in additional costs that must be incorporated into the program's funding structure to achieve self-sufficiency.

Along the same vein, it will also be helpful to evaluate current site characteristics and drivers of current costs. Relevant site attributes such as size and perimeter, along with other variables such as the distance from a land trust to a given site, are appropriate methods of estimating monitoring costs. If these site attributes are not reflected in costs, NCDENR Stewardship may wish to reconsider its payment methods to land trusts. Other factors such as number of landowners, rural versus urban location, and surrounding land use may also influence costs. Unfortunately, data constraints in this project preclude a comprehensive analysis of surrounding influences on a given parcel's costs. As such, my analysis will identify available site characteristics and develop two models for predicting costs for future sites transferred to NCDENR Stewardship. One model contains a comprehensive array of factors and assumptions used to predict future costs. The second model attempts to abbreviate elements of the first model into a more convenient format. The benefits and drawbacks to both will be discussed.

Unfortunately, the Stewardship Task Force identified that accurately predicting the proper funds necessary to support NCDENR Stewardship's activities and defense may be impossible, thus calling into question the appropriateness of endowments for funding the

program's activities. The initial funds allocated for NCDENR Stewardship needs were $14,000 per site (though this amount was raised substantially in subsequent property and endowment transfers to NCDENR Stewardship). It was assumed that, invested in securities with a 4.5% interest rate, a $14,000 endowment would produce sufficient funds for the program's activities while also maintaining the endowment's purchasing power. However, these assumptions must be questioned through a comprehensive analysis of the program's costs and also an evaluation of economic factors: Specifically, interest rates, variable by nature, carry the risk of falling, which will lower the funds available to NCDENR Stewardship. Inflation may also rise, eroding an endowment's purchasing power. Assuming that interest rates and inflation will remain static may be a flawed assumption that must be evaluated. Furthermore, as the program's funds are invested in low-yielding, low-risk investments of the Short-Term account at the State Treasurer's office, an estimated yield of 4.5% may have been too high of an assumption for returns.

Therefore, due to these questions surrounding NCDENR Stewardship's current endowment model, my report will also include an evaluation of alternative funding models. Alternative models include a periodic fees model and a hybrid model containing elements of the endowment model and periodic fees model. Each model has potential benefits and drawbacks that will be considered including administrative needs and flexibility in adjusting to economic factors.

STEWARDSHIP COSTS AND FUTURE OPTIONS

In general, stewardship activities involve the protection of conservation lands through the sound use of financial resources, as conservation organizations recognize that merely acquiring a property does not mean that it will be adequately protected in perpetuity.[11] Conservation properties must be protected to ensure that the site's objectives and/or legal terms are upheld. If this does not occur, the efforts spent to acquire the parcel will be wasted.[12] Given that adequate financial resources are needed to support such activities, the financial assessment of conservation funds and proper management are critical to ensuring the success of any stewardship program.[13]

As such, determining accurate stewardship costs is critical to ensuring the viability of conservation sites. Every year, millions of dollars are used to acquire conservation properties, but very little money is actually allocated for their maintenance.[14] Stewardship activities, which continue in perpetuity, include regular monitoring, landowner communication and relations, forming relationships with new landowners, responding to easement violations, overseeing landowners' exercise of reserved rights, and site management activities if required.[15] Costs will also differ between organizations that have in-house staff to perform various functions versus smaller groups who must contract out to fulfill services.[16]

With regards to NCDENR Stewardship, costs and activities are spread out between different agencies both within and outside the North Carolina Department of Environment and Natural Resources. For example, overhead and salaries for NCDENR Stewardship are currently paid for by EEP, which utilizes funding from in-lieu fees paid by permittees participating in one of EEP's in-lieu fee programs. Monitoring activities are generally outsourced and conducted by land trust organizations. Furthermore, the North Carolina Department of Justice is responsible for legal enforcement that could arise from major violations on sites. While these different groups may or may not share funding sources, it remains necessary to accurately identify all costs related to NCDENR Stewardship to allow the program to become self-sufficient.

Total Costs

Annual stewardship costs vary widely between different properties and depend on the goals, objectives and activities on a given site. Land trust organizations calculate costs differently, with some calculating costs based on average costs per easement, others by variables such as acreage and complexity of restrictions, and still others calculating costs based on a percentage of land or easement value.[17] As such, total costs vary widely and unfortunately cannot be accurately relied on to produce an average estimate of stewardship costs that could then be applied to NCDENR Stewardship. For example, one organization found that average annual stewardship costs totaled $786/easement, ranging between $431 to $1,500.[18] These costs included baseline documentation, installing signs, monitoring, landowner communication, reserved rights, enforcement, easement amendments, and indirect costs. Another study, taken in 1999, found an average cost of $190 per easement, with a range of between $10 and $10,000 (The authors also included a preferred average of $267 dollars, which they believed would be the average costs for established organizations routinely conducting monitoring activities).[19] Adjusting for inflation, the average cost for the 1999 study at $267 would equal approximately $349 in 2010. However, the authors of this study acknowledged that it was difficult for participating land trusts to accurately identify factors included in overhead costs. Due to this large variety in average easement costs between organizations, it becomes necessary to identify specific costs resulting from applicable activities that could be then be applied to NCDENR Stewardship.

Staff/Administrative Costs

For this analysis, a reasonable estimation for annual salary for both land trust personnel and NCDENR Stewardship staff would be $60,000. This is due to the fact that the median annual wages for conservation scientists in 2008, as reported by the Bureau of Labor Statistics, was $58,720.[20] In addition, Colorado Open Lands estimates that per hour costs for overhead can be estimated at $10/hour.[21] Together, these estimates can be used to calculate per hour staffing costs. Assuming 2,000 working hours in a year (50 weeks multiplied by 40 hours a week), minus seven holidays (totaling 56 hours of lost

productivity time) gives 1,944 hours per year. Dividing $60,000 by 1,944 gives $30.86/hour, which sums to $40.86/hour when administrative costs are added.

The Land Trust Alliance suggests that one staff person could reasonably monitor 50-100 properties/year, though this does depend on the characteristics of the different properties and how complex the easements are.[22] One study of San Francisco Bay Area land trusts found that the average time spent monitoring an easement is 10 hours per year though many staff state that it generally takes "one day per easement."[23]Some studies have revealed considerable debate in whether or not volunteers can benefit stewardship efforts, with some land trusts using volunteers on a limited basis while other organizations believe it is more efficient to conduct stewardship activities with only paid staff.[24] While an organization may utilize volunteers for part of its stewardship activities, costs should be calculated on the assumption that paid staff will complete the necessary tasks, given that volunteers may not always be available or may not be found in sufficient numbers to complete all stewardship activities.[25]

Monitoring Costs

Regular monitoring is important in identifying site problems or early stages of a violation and in developing strong relations with landowners.[26] Monitoring involves contacting the landowner in advance, compiling and reviewing materials related to the site, conducting the actual monitoring, and preparing a monitoring report.[27] The time spent contacting landowners to schedule visits will increase with a greater number of landowners per site. Numerous factors can influence the length of time it takes to monitor an easement including topography and hydrology of a site. Additionally, other considerations such as property size, easement complexity, and permitted land use, and number of home sites on a land can also influence monitoring time.[28] The Land Trust Alliance estimates that the average time for monitoring was the following: 1 hour to prepare for a monitoring visit (this includes file review and contacting the landowner), 2 hours for the monitoring visit itself including travel time, and 3 hours for post-monitoring.[29] However, the Stewardship Director believes that 1 hour of post-monitoring activity is sufficient (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication).

Aerial and satellite monitoring is also a potential option and can be the most cost effective means of monitoring.[30]

Site characteristics can influence the time it takes to monitor a property and, therefore, overall costs. Some properties may be difficult to access from roads or possess hydrological characteristics that make walking the property more time consuming. Not surprisingly, one study found that larger properties are more costly to monitor than smaller properties.[31] However, the author states that costs to monitor each additional acre also diminish with property size, due to a combination of fixed costs and variable costs. Data from NCDENR Stewardship shows that average walking speed when monitoring is 0.5mph (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). The monitoring time and associated costs should be calculated by determining the site's perimeter and multiplying this amount by the amount of time the staff member needs to walk the perimeter. It is assumed that walking the entire perimeter on an annual basis is a reasonable goal for effective monitoring.

Landowner Relations

Easement holders must be available to answer questions from landowners and meet with new landowners.[32] One survey found that average annual costs for landowner relations was 1.7 hours of time and $25.50 in material cost.[33] Included in this cost for this study were a variety of activities including meeting with a landowner at the time monitoring is completed, maintaining a website, educational publications, a newsletter, annual landowner events, and tracking changes in ownership. Landowner relations generally increase following ownership changes due to the fact that easement holders must spend greater amounts of time fielding questions.[34]

Enforcement

Enforcement can be divided into minor and major violations, differentiated by whether or not they necessitate legal action.[35] One study found that 7% of easements held by land trusts had experienced violations, with the majority being minor.[36] However, even if a violation does not demand legal recourse, responding to violations takes time to resolve

and may involve costly repairs. For NCDENR Stewardship, this includes contacting a landowner to resolve the violation, writing a letter describing the violation, potentially traveling to a property to inspect the violation, and possibly meeting with the landowner to come to a resolution.[37] The Stewardship Director estimates that approximately 5-10% of sites have violations in a given year (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). One study found that average time for responding to a violation was 22.5 staff hours, 2.3 site visits, for a total cost of $1,241, with a likelihood of this happening in a given year of 12%.[38] The Colorado Open Lands estimates that violations generally take 20 hours to resolve, with one site visit.[39] One study found that easements providing wildlife habitat see greater violations and have higher enforcement expenses than easements with working land and open space, and easements that permit public access have a slightly higher risk of violation.[40]

While rarer, major violations requiring litigation can be extremely expensive. In advocating for its Conservation Defense Insurance program, the Land Trust Alliance estimates that litigation costs would be $70,000 to $100,000 for trial, $35,000 for summary judgment, and $150,000 for appeal.[41] They state that the average historic cost of a claim was $38,000 though they argue that this understates the true risk stemming from total costs. While NCDENR Stewardship has not yet been forced into litigation, this is still a large risk that must be considered within the context of stewardship costs.

Reserved Rights

Subdivision of a parcel through the exercising of a reserved right can dramatically increase the costs of stewardship, with some reporting that dividing a property in two can almost double the costs of stewardship.[42] In this instance, liabilities for landowner relations and easement enforcement effectively double.[43] Travel costs may not necessarily double, but this may also rely on time expended for effective coordination between the different landowners.[44] Currently, the only reserved right on the properties of NCDENR Stewardship include the ability to hunt and fish and experience the property in a non-harmful way (E. Galamb, North Carolina Department of Environment and Natural

Resources, personal communication). While limited, some sites managed by EEP (but not currently monitored by NCDENR Stewardship) do have reserved rights related to stream crossings, where roads could potentially be built across streams. Therefore, these properties may eventually be accepted by NCDENR Stewardship, and the possibility of reserved rights should be included as a possible liability.

Invasive Species

It is well known that invasive species can lead to reductions in biodiversity due to their ability to outcompete native species. Restoration activities may lead to disturbances that allow invasive species to establish, and exotic species may be part of a confluence of factors (particularly in urban areas) that interfere with ecosystem and community development.[45] One study indicated that removal of Japanese Stiltgrass from restoration sites increased species diversity, but that this species was quick to reestablish and thus consistent efforts to monitor and maintain a property are necessary.[46]

It is difficult to estimate the costs per year needed to effectively eradicate invasive species, given species' differing resistance to eradication efforts and ability to reestablish a given site. Overall, invasive species control can be extremely expensive. One study estimated that California agencies including land trusts, state and federal agencies spent $82 million on invasive weed projects, which likely understates the true amount.[47] Unfortunately, the academic literature has limited information regarding the costs of removing invasive species.[48] The information that is available suggests that costs of eradication of even one species can be prohibitive. One study looking at costs relative to area found that the costs of eradication and re-vegetation of invasive Tamarisk in Texas and parts of the southwest ranged from $500/hectare to $12,000/hectare over several years. Here, the author stated that much of the variation in cost is due to differing needs of watering native transplants between different geographic areas.[49] Included in this study were costs from site evaluation, eradication, revegetation, and monitoring. Cogongrass infestations in Alabama are estimated to cost $300 per acre over several years.[50] Another study[51] evaluating the costs of the exotic species Yellow Bush Lupine found that the most effective method of removal was with a brush rake, followed by removal of duff and leaf

litter with a plough blade. While the experiment was conducted on small plots, the contractor charged with conducting the removal estimated that total costs would be over $30,000/hectare in 1998 dollars.

Therefore, large-scale removal of exotic invasives is prohibited by cost and dubious effectiveness.[52] Nevertheless, it may be possible to conduct small-scale removal of some species such as Chinese Privet at low cost during the same site visit in which monitoring occurs (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). The Stewardship Director believes that such small-scale removal can effectively remove such species before they invade an entire property, and thus invasive removal can occur on a case-by-case basis. Materials costs for herbicides should be low and are estimated at $15 per site, and it is further assumed that such small-scale removal would only take approximately 1 hour per site. Therefore, total costs for light invasive species removal should be relatively low.

Management Activities

While generally not applicable to NCDENR Stewardship, management activities can introduce large costs to stewardship activities. While approved compensatory mitigation sites are generally assumed to need no active management (S. Horton, North Carolina Department of Environment and Natural Resources, personal communication), management activities could potentially occur with sufficient funding (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). Therefore, it is worth at least considering potential costs. One survey conducted by the Center for Natural Lands Management found a tremendous range of costs associated with conservation management practices related to 28 preserves found in Arizona, California, and Oregon.[53] Their analysis found that management costs for 28 sites averaged $51/acre per year, with costs ranging from $6/acre to $2,100/acre. The study also found economies of scale pertaining to management activities (though the authors stipulated that their numbers are not statistically valid), with costs ranging from $1,000 per acre for smaller parcels to $100 acre for larger parcels. Given these high costs, it is likely that significant

management activities will not be included in NCDENR Stewardship's activities and will not be further analyzed in this report.

METHODS

This project relied on both a quantitative and qualitative approach. A qualitative approach was used to conduct a comprehensive evaluation of all aspects of stewardship costs. Only data directly related to monitoring costs and associated expenses was quantitatively evaluated. To supplement this lack of information and identify comprehensive costs, I conducted a thorough literature review regarding all aspects relating to stewardship costs. This involved identifying surveys and studies of land trusts and other conservation organizations that had aggregated costs related to a variety of activities including conducting baseline surveys, monitoring and posting signs, dealing with reserved rights, enforcing minor violations, and larger costs associated with larger legal disputes. Such costs were then evaluated from the framework of NCDENR Stewardship.

Data analysis involved collecting and analyzing monitoring costs and site characteristics for 64 sites, with the data provided by NCDENR Stewardship. Monitoring costs include all monitoring and related expenses charged by land trust organizations. Monitoring costs were included in this analysis when cost data was available for the year 2010 or 2011, with 2011 data used when both years were available. If 2010 data was the most recent data available, then this data was used. When sites did not have this current data available they were excluded to avoid the confounding effects of inflation. Also excluded from this analysis (though included in this report) are sites monitored by a private contractor, given that it was assumed that the contractor's cost structure would differ from land trust organizations, which could skew the data. Monitoring costs were cross-referenced with site characteristics available on EEP's website. These characteristics included area and perimeter. Perimeter to area ratio was calculated by simply dividing perimeter to area, as some members of EEP suspects that this relationship is likely to affect the number of violations that can be expected to occur on a given site. Adjacent land uses and number of neighboring landowners may also affect violations, but these factors are not included in this study due to data constraints and time limitations. Finally, Google Maps was used to estimate the distance from the site to the monitoring land trust, as I assumed that this distance would affect driving time and thus total expenses charged.

Using cost data and site characteristics, I performed a statistical evaluation of project and monitoring data in order to identify predictive variables and evaluate the current payments made to land trusts. Such relationships could be evaluated on their own merits and also as predictors of costs for future sites that might eventually be transferred to NCDENR Stewardship. Specifically, I evaluated the relationship between a property's area, perimeter, participating land trust, and distance from land trust to the property with the property's monitoring costs. Using the statistical package R, I evaluated both individual variables and variables in various combinations to identify groupings with the greatest predictive power. Categorical variables were constructed relating to participating land trust organizations. This was done to evaluate whether or not specific organizations had an effect on cost. It could logically be assumed that certain organizations would charge more or less due to a variety of reasons including, but not limited to, efficiency, staff salaries, or distance from the land trust to individual sites.

Using information from both my literature review and data analysis, I constructed both a comprehensive model and an abbreviated model to assist NCDENR Stewardship in predicting future site costs. Here, I leveraged existing templates from land trust organizations and modified them based on NCDENR Stewardship's institutional characteristics. The comprehensive model contains assumptions, variables, and formulas in order to identify expenses for all aspects of NCDENR Stewardship's activities. The abbreviated model attempts to simplify aspects of the comprehensive model by increasing the number of assumptions. For example, while the comprehensive model attempts to calculate the yearly cost of violations, the abbreviated model assumes that this cost is approximately $20. However, the abbreviated model keeps several key variables, including the site's perimeter length, number of landowners, and reserved rights per site. Adjustments to these inputs results in large changes to costs per site, making it necessary to include them. These variables are easily modified, allowing one to calculate site costs for a large number of sites relatively quickly.

Finally, I evaluated different funding models based on a variety of considerations including economic factors, administrative needs, and flexibility. I considered the current

endowment model, a periodic fees model, and a hybrid model that contained elements of both these models. For each model, my analysis includes a broad description of the benefits and drawbacks and then outlines these points in bulleted format for quick reference. With each model, I provide my own conclusions as to its appropriateness for NCDENR Stewardship.

RESULTS

As described in the Methods section, the statistical analysis conducted in R assessed the explanatory power of different variables in influencing costs for the 64 NCDENR Stewardship sites. Here, site area, perimeter, land trust, and distance from land trust to site were analyzed alone or in different combinations through the use of a general linear model, to identify their predictive ability in determining costs. It was assumed that perimeter and distance to site and, to a lesser extent, area would explain a large amount of the variation in cost, given that NCDENR Stewardship seeks to negotiate with land trusts based on site characteristics (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). Monitoring agents walk the perimeter of the site, and thus costs should correlate with the amount of time needed to drive to a site and walk its boundary. Explanatory power of the models is summarized in terms of deviance (D^2), a measurement of variance appropriate to the maximum likelihood estimate of generalized linear models. D^2 values are analogous to R^2 values and can be found by the difference between the model's null and residual deviance, divided by the null deviance. D^2 values for different combinations of site characteristics can be found in Table 1 below.

Table 1 Explanatory Power of Variables Without Contractor Included

Model	Variance Explained (D^2)
Area, Perimeter, Distance to Site, LT	0.72
Area, Perimeter, Distance to Site	0.27
Area, Perimeter	0.26
Area	0.25
Perimeter	0.18
Distance to Site	0.01
LT	0.59
Area, LT	0.71
Perimeter, LT	0.71

Table 2 Explanatory Power of Variables With Contractor Included	
Model	**Variance Explained (D^2)**
Area, Perimeter, Distance to Site, LT	0.56
Area, Perimeter, Distance to Site	0.28
Area, Perimeter	0.28
Area	0.24
Perimeter	0.27
Distance to Site	0.01
LT	0.23
Area, LT	0.44
Perimeter, LT	0.52

Land trusts, grouped alphabetically as categorical variables, had the greatest predictive power on stewardship costs. Here, 59% of the variability in stewardship costs could be explained by which land trust organizations conducted monitoring (D^2 of 0.59). When a general linear model was constructed using all variables (area, perimeter, distance to site, land trust), the D^2 value was 0.72. Removing land trust from this equation produced a corresponding D^2 of 0.27. Area was second to (but far behind) land trust in explanatory power, producing a D^2 of 0.25. Perimeter alone had a D^2 of 0.18. Distance to site had almost no explanatory power.

Lump sum negotiations with land trusts can explain the high predictive power of land trusts. A boxplot was constructed to illustrate costs for each participating land trust, which is shown in Figure 1 below. This graph illustrates the median cost (represented by the bold line in the middle of the box), as well as the upper and lower quartiles of the data (represented by the "box" itself). The lines above and below the box show the data's range and are represented with the lines showing the largest and smallest cost. Several land trusts have a single cost charged for all sites, which can be explained due to either the lump sum payments or the fact that some land trusts only monitor one site. As such,

this analysis may have limited explanatory power in terms of determining drivers of stewardship costs.

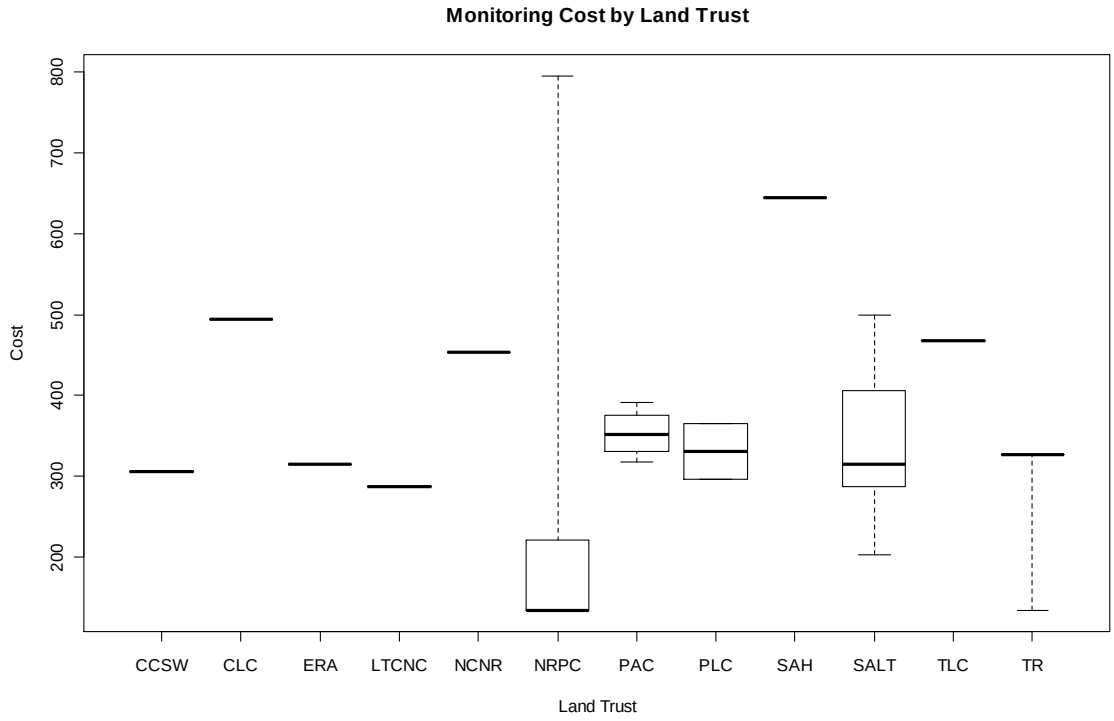

Figure 1: Boxplot Evaluating Monitoring Cost by Land Trust

Key to Monitoring Agents
CCSW: Chowan County Soil and Water District
CLC: Catawba Land Conservancy
ERA: Eno River Association
LTCNC: Land Trust for Central North Carolina
NCNR: National Committee for New River
NRPC: Private Contractor
PAC: Pacolet Area Conservancy
PLC: Piedmont Land Conservancy
SAH: Southern Appalachian Highlands
SALT: Sandhills Area Land Trust
TLC: Triangle Land Conservancy
TR: Tar River Land Conservancy

In an attempt to isolate explanatory variables, I ran individual regressions using Microsoft Excel with site costs that were not part of a lump sum payment. 19 sites had these characteristics. Comparing costs with perimeter produced an R^2 value of 0.18, but this number was not statistically significant. Comparing costs with area showed greater explanatory power, with an R^2 value of 0.23, which was statistically significant. This indicates that area can explain a portion of the variation in monitoring costs charged by land trusts. Comparing costs with area, perimeter, and distance to site in a multiple regression model produced an R^2 of 0.28 though no variables except the intercept were statistically significant. Overall, these results suggest that individual site characteristics could be more carefully considered when determining payment amounts to land trusts. However, the lump sum payments currently utilized makes analysis of this data somewhat challenging. Negotiating and/or recording payment rates on a site-by-site basis in the future could help NCDENR Stewardship bolster the impression that it applied a consistent payment model for outsourced monitoring. With that said, some land trusts located far from NCDENR Stewardship's offices that monitor multiple properties may demand a premium for monitoring activities that may be necessary to pay, as it could be impractical for NCDENR Stewardship personnel to travel to these sites.

Regarding general site characteristics, the 64 sites analyzed had an average distance from land trust to site of 28 miles, with an average driving time of 40 minutes. Considerable range existed in this data, however, with the furthest site being 91 miles away from the land trust, with a driving time of 1 hour and 49 minutes, and the closest site was only 4 miles away, with a driving time of 6 minutes. The average area and perimeter were 69 acres and 11,184 ft., respectively. Considerable variation also existed here, however. For example, the largest site had a total size of 915 acres, and the smallest site only housed three acres. The site with the greatest perimeter totaled 75,494 ft. for its boundary, and the site with the smallest perimeter had a boundary of only 1,382 ft. The average annual monitoring cost and associated expenses was $326, with a maximum annual cost of $645 and a minimum annual cost of $135.

DISCUSSION

ALTERNATIVE TEMPLATES FOR PREDICTING STEWARDSHIP COSTS

Comprehensive Model

The results above suggest that land trusts may be able to negotiate payment rates that do not correspond to individual site characteristics. Given that land trusts are paid on an hourly wage, characteristics such as area, perimeter, or distance to site should have a strong correlation with total hours worked, and therefore individual site characteristics should have better explanatory power for monitoring costs. Given that monitoring personnel walk the perimeter of the site, as opposed to the entire area, perimeter length and distance to site should be key determinants in hours worked and, thus, stewardship costs. Some sites may be more accessible than others for a variety of reasons including distance from roads or site hydrology. This is not directly addressed in my analysis though it could be easily incorporated by adjusting the speed that personnel walk when monitoring the particular site.

When seeking to predict future costs, a reasonable approach would be to construct a model encompassing both the fixed and variable costs of stewardship. Such a model would allow NCDENR Stewardship to comprehensively identify all costs related to stewardship, administration, violations response, etc. and could provide the Stewardship Director with greater leverage in negotiating payments with land trusts. Furthermore, such a model could also permit NCDENR Stewardship to identify whether or not monitoring could be done more cheaply in-house. Land trusts provide a valuable service in quickly moving to protect individual sites that can then transferred to NCDENR Stewardship, and the program's subsequent monitoring contracts may foster valuable relationships necessary for continued land protection in the future (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). Therefore, even if costs are higher for monitoring by land trust organizations (as opposed to being done by NCDENR Stewardship personnel), such monitoring activities may still

be warranted. Nevertheless, even if land trusts are awarded a premium for their services, site characteristics should still play a large role in determining monitoring costs.

Please see Appendix A for a spreadsheet constructed for the purpose of estimating costs in a comprehensive manner. Here, I have based the categories on NCDENR Stewardship's institutional characteristics. The inputs are based both on aspects of my literature review and information specific to NCDENR Stewardship. The model can be broken into Assumptions, Variables, Formulas, and Annual Expenses (J. Masten, Triangle Land Conservancy, unpublished data). As will be described below, the model also includes a risk premium to cover unexpected costs.

Assumptions, determined by conversations with NCDENR Stewardship personnel and a literature review, can be adjusted if desired in response to factors such as inflation or differences between sites (such as the existence of reserved rights). Some costs are fixed (such as overhead costs or hard costs for landowner communications) or are not significant and are treated as a fixed (Such as materials costs for sites). Regarding assumptions, salaries and overhead are separated for land trust staff and NCDENR Stewardship. For the purposes of this analysis, however, it is assumed that costs for land trust personnel and land trust overhead are equivalent to those of NCDENR Stewardship personnel. Salaries are estimated at $60,000/year, with overhead estimated at $10/hour. Together, these variables are used to estimate per hour costs for both land trust personnel and NCDENR Stewardship employees. Total salaries and total additional overhead for NCDENR Stewardship will be used together in the template to estimate the total administrative costs per site.

Regarding cost assumptions for materials assumption, this expense should likely be minimal and is estimated at $10 for signs and $15 for herbicides used for invasive species control. The IRS reimbursement rate may be used as a proxy cost for operation of a motor vehicle or for direct reimbursements if an individual uses his or her own vehicle (J. Masten, Triangle Land Conservancy, personal communication). The average speed of 45 mph assumes a mix of driving on both highways and backcountry roads, but this number

can be adjusted if desired. This speed is applied to both land trusts and NCDENR Stewardship personnel traveling to sites. Reimbursable expenses are included as an option but estimated at no cost. They are separated for land trust personnel and NCDENR Stewardship personnel, given potentially large differences in distances to a site. Regarding monitoring time, it is estimated that average pre-monitoring time will take 1 hour and post monitoring time will also take 1 hour. Data from NCDENR Stewardship indicates that monitoring personnel walk half a mile an hour in wetland areas (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). As stated previously, this amount could be adjusted to account for factors such as extremely difficult terrain.

Landowner relations are assumed to take approximately two hours per year for a given landowner. Communication may involve phone calls or mailings and is necessary to maintain contact and good relations in order to ensure landowner cooperation. Hard costs associated with landowner relations are estimated at $25. Reserved rights have been discussed previously. While no properties currently have reserved rights, some properties managed by other agencies have reserved rights, and thus it is important to include this in the model while currently leaving this variable at zero. It is further assumed that reserved rights may be exercised, on average, once every twenty years, giving a 5% likelihood of exercise on a given year (J. Masten, Triangle Land Conservancy, unpublished data). As previously described in this report, invasive species removal may be effective on a small-scale. As such, it is estimated that it will take approximately one hour to complete the process when required.

Assumptions for easement violations are based on data described above and potentially entail ten hours of staff time to head off the violation, with one site visit. This estimate is lower than the estimate in the literature review described previously. However, as the majority of large, expensive violations generally occur during the restoration process, most of the properties managed by NCDENR Stewardship have not been subject to large violations requiring significant expenditures or staff time (S. Horton, North Carolina Department of Environment and Natural Resources, personal communication).

Furthermore, violators must assume responsibility for reimbursing NCDENR Stewardship for damages to the site, limiting potential repair costs, and the only instance in which NCDENR Stewardship would be required to pay for repairs would occur if the violator could not be found (S. Horton, North Carolina Department of Environment and Natural Resources, personal communication). Protocol for dealing with landowners involves discussing the violation with the landowner at the same time the inspection is conducted, with a letter sent to the landowner detailing the violation. [54] If the landowner is not present during the inspection, contact may be made by telephone, certified mail, or an in-person meeting.[55] Given the fact that large violations have not generally occurred on these sites, it is further estimated that average costs to repair a given site will be approximately $1000, a conservative estimate based on the literature review.

Finally, given the large uncertainties associated with legal expenses for major violations, and the enormous potential risk associated with potential lawsuits, the yearly amount designated to be set aside for major violations is $50,000. This amount will be set aside every year until a sufficient fund is established. A reasonable goal would be $500,000 to $1,000,000, which would be achieved in a 10-year or 20-year timeframe, respectively. While this amount will result in significantly increased cost per site, it is also a temporary charge that will eventually be discontinued. Furthermore, this cost will be reduced on a per-site basis when additional sites are added to the program. Given that staff hours required for minor violations may involve an overestimation, and that major violations are very infrequent, no additional staff hours are assumed to be required for major violations.

Variables include site idiosyncrasies and must be entered for each site. This includes factors such as perimeter, area, land trust distance to site, NCDENR Stewardship distance to site, number of landowners per site, number of reserved rights on a site, and whether the site requires treatment for invasive species. Perimeter, inputted with average length for the 64 sites analyzed, is converted to miles to assist with calculations. Average land trust distance to site for sites analyzed in my analysis is 28 miles. It is assumed that this number is the same for NCDENR Stewardship as well, but this can be changed if

necessary. By far, the majority of the sites analyzed in this report have only one landowner, so that number is included. However, given that the majority of these sites were preservation projects, and restoration sites may have more than 10 landowners (J. Stanfill, North Carolina Department of Environment and Natural Resources, personal communication), this variable can be changed as needed. Some EEP personnel suggest that perimeter/area ratio may play a factor in the number of violations occurring on a given site, with greater violations occurring on sites with a high perimeter/area ratio (J. Horton, North Carolina Department of Environment and Natural Resources, personal communication). Furthermore, they suggest a cut-off point for perimeter/area ratios of 200 between lower and higher violation sites (J. Horton, North Carolina Department of Environment and Natural Resources, personal communication). As NCDENR Stewardship personnel previously estimated that, on average, 5-10% of sites have violations per year (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication) a higher percentage of 10% is given sites with a P/A ratio above 200 and a lower percentage of 5% is given sites with a P/A under 200. The P/A ratio for average site characteristics is under 200, thus leading to the lower average estimate. The option is granted for users to input whether or not the site could benefit from small-scale invasive species removal. Finally, included in this section is the total number of sites under NCDENR Stewardship, as this will affect how overhead, salaries, and legal fees are charged per site.

The Formulas section of the template calculates hourly staff rate for land trust personnel and NCDENR Stewardship and combines assumptions related to travel costs with actual miles driven to produce estimated round trip costs. The formulas also calculate total overhead costs per site and legal fees per site. These formulas simplify the model by preventing the need of performing multiple calculations in the Annual Expenses section.

Annual Expenses combine the model's assumptions with applicable variables. They are divided between likely expenses for land trust personnel and NCDENR Stewardship and summed to generate an estimated annual funding cost. Costs are differentiated by annual monitoring expenses, annual invasive species treatment, annual landowner relations

expenses, per year cost of exercise of reserved rights, and violations. Total costs for NCDENR Stewardship are estimated previously by dividing the total overhead and staffing costs by the number of sites. However, to provide additional information, specific costs are estimated from this model and can be seen as an estimate of how the resources of personnel would be expended. Expenses above and beyond annual landowner relations expenses, annual cost of reserved rights, and annual violations expenses are assumed to entail costs related to administrative oversight by the Stewardship Director and associated staff. Potential site repairs are separated from administrative costs and estimated on an annual basis. Finally, legal expenses per site are also estimated. As described previously, such costs are extremely difficult to estimate, as a protracted legal fight can theoretically cost millions of dollars. Nevertheless, it is assumed that $50,000, divided by the total sites, may be set aside over a number of years to provide the necessary cushion. Finally, to account for potentially unforeseen circumstances, an additional 10% risk premium should also be charged (J.Stanfill, North Carolina Department of Environment and Natural Resources, personal communication).

This comprehensive analysis of stewardship costs attempts to both account for all reasonable costs related to NCDENR Stewardship. Using assumptions from my literature review, as well as average site characteristics from the 64 sites previously analyzed produces a total average cost of $1,843.10. Currently, NCDENR Stewardship endowments are insufficient to fund costs related to staff salaries, overhead, or legal enforcement. This analysis indicates that the majority of costs arising from NCDENR Stewardship are related to administrative costs, followed by legal expenses, and monitoring costs.

Given that DENR is currently looking to revise NCDENR Stewardship's fee structure, a concrete analysis of total costs arising from the program's needs becomes highly important for predicting future expenditures. Site by site analysis using a template such as this would be necessary both for gauging future costs as well as total costs for current properties. An average value produced by analyzing current sites could be applied to future sites, as opposed to using this template to predict costs for each new site. However,

these future sites would need similar attributes to current sites to ensure reasonable accuracy. Accepting a large amount of sites with, for example, greater perimeters or numerous reserved rights should be reflected in higher estimated costs per site. A thorough analysis using this template could help avoid funding shortfalls in the future.

Abbreviated Model

A second approach to constructing a model for NCDENR Stewardship could entail an abbreviated model (Appendix B) that would be used to quickly estimate costs for a potential property. In this analysis, I have leveraged information previously calculated from the comprehensive model. The structure is the same, where the model is broken up into assumptions, variables, annual expenses, with a risk premium added to total annual expenses. Assumptions include factors such as hourly staff rate, round trip travel costs, and walking speed per hour. Variables include perimeter size, number of landowners, and reserved rights per site. From the combination of assumptions and variables, annual expenses are calculated and produce a very similar result to the comprehensive model. For the purposes of simplicity, some of the previous expenses have been built into assumptions and can be easily changed based on totally new assumptions or modifications to the comprehensive model. For example, rather than calculating yearly costs for site repairs in the comprehensive model based on factors such as staff costs and time, yearly costs for repairs are simply assumed to be $50. While the abbreviated model strives for simplicity, the abbreviated model and comprehensive models may be used jointly for purposes of calculation, where the comprehensive model could be used to calculate various expenses that can then be used as assumptions for multiple properties.

Overall, either the abbreviated model or comprehensive model may represent a more viable method for calculating future costs for NCDENR Stewardship. While the format of the abbreviated model is simpler, the number of variables that need be inputted are not greatly reduced, and many of the assumptions come from the comprehensive model. As such, these assumptions could be held constant when using the comprehensive model. With that said, even limited reductions in time needed to compute costs may be beneficial, and it is unclear whether or not the comprehensive model will actually

produce a better cost estimate. The benefits of reduced time spent estimating costs would be particularly apparent if large numbers of sites were simultaneously transferred. Finally, the abbreviated model may also present a simpler format to follow when inputting costs that may be desirable.

ALTERNATIVE FUNDING MODELS FOR STEWARDSHIP

Funding Model 1: The Endowment Model

In evaluating different funding models, it is appropriate to first consider the endowment model, which is the current source of funding for NCDENR Stewardship monitoring activities. In general, an endowment can be defined as a fund that has been transferred or donated to an institution. The goal of an endowment normally involves the protection of the fund's principal in both nominal and inflation-adjusted terms. The fund's principal is generally invested to either generate income or capital gains that are then used to fund an institution's programs. Additional proceeds from income may be reinvested, or capital gains (such as from stocks) may be left untouched, to ensure the endowment does not decline on an inflation-adjusted basis. Overall, the fund should be invested such that it grows sufficiently to both address spending needs and prevent any losses in purchasing power due to inflation.

In general, it is recognized by those in the land trust community that endowment amounts should be determined by analyzing spending needs, investment return assumptions, and a rate of inflation. The difference between the investment return and the inflation rate is calculated, and then the spending rate is divided by this difference. This final amount, in theory, represents an appropriate endowment level, the investments from which will be sufficient to support spending needs and prevent loss of purchasing power due to inflation.

An example may be helpful in demonstrating this concept. Let us assume that a particular property requires $400/year in spending to meet the needs of NCDENR Stewardship. Let us further assume an inflation rate of 3%, and an investment yield of 5%. The investment return rate is subtracted by the inflation rate, leaving a 2% return over inflation. The

assumption thus becomes that 2% of the endowment could be spent every year while maintaining the endowment's purchasing power through reinvesting the excess yield. The original spending rate, $400, is then divided by 2%, resulting in the amount of $20,000. Therefore, the assumption is that for an endowment of $20,000, we can support spending needs of $400/year and maintain the endowment's purchasing power.

When constructed and operating properly under the above assumptions, an endowment can confer numerous benefits to institutional stakeholders. Endowments can be convenient for both the grantor of funds as well as the institution's administrators. Endowments can be funded once, which limits the overhead needed to administer funding sources (To be fair, additional funds may of course be added to an endowment, thus requiring additional oversight. However, in the case of NCDENR Stewardship, the assumption would be that this would not occur). In the specific case of NCDENR Stewardship, an endowment model provides benefits of convenience for both NCDENR Stewardship and its clients such as EEP. For example, EEP can transfer a lump sum payment in the form of an endowment, which then requires limited oversight by EEP or NCDENR Stewardship. Given that these funds are currently managed by the North Carolina State Treasurer's office, NCDENR Stewardship and the client both face limited burdens from fund administration or investment activities.

Endowments can also offer revenue stream diversification for an institution and can allow for generous spending rates. Examples of revenue diversification include endowments for colleges and universities, which require yearly funding in the way of grants and tuition but can also benefit from a steady stream of income as a result of their endowments. As such, the endowment's income stream can provide protection from volatility from other funding sources, such as a drop in tuition or reduction in available grants.[56] Furthermore, when a skillful management team has responsibility for the endowment's investments, the endowment can allow for generous spending. From 1996 to 2006, the return for small endowments, with assets equal to or less than $25 million, was a highly respectable 7.4%. This compares favorably to the inflation rate over the same period, which averaged 2.5%,[57] equating to a potential spending rate of almost 5%.

Endowment returns may also be a function of size. In a study evaluating endowment characteristics, return, growth, and spending, the author found that the average return for endowments with assets greater than $1 billion was 2.4% higher than the median return for endowments between the years of 1996 to 2006.[58] Larger endowments can invest in private, illiquid investments such as venture capital or private equity, whose risk and high requirements for capital can preclude smaller institutions from investment. Such investments may generate a higher rate of return than traditional investments such as stocks or bonds, conferring a sizable advantage to larger institutions able to afford larger capital infusions and diversify the number of illiquid investments they hold. For example, investment managers of private equity or venture capital funds may require initial investments of $1 million to $5 million. This may limit the ability of smaller institutions to make investments in such funds for fear of exposing an unacceptably large portion of their endowment to risky, illiquid holdings.

However, the endowment model also contains numerous risks and potential disadvantages that must also be considered. These risks represent risks endemic to investing in general, namely the possibility of either temporary or permanent loss of capital. Changes in interest rates, inflation, national or global economic conditions all carry the possibility of negatively impacting the principal of NCDENR Stewardship's endowment account. For example, interest rate fluctuations can negatively impact the market value of a bond, leading to permanent losses if the bond is sold prior to maturity. Losses of principal will in turn negatively impact income amounts from the endowment, now that there are fewer assets from which to generate income. Increased inflation can reduce the purchasing power of an endowment. Furthermore, reduced interest rates, due to factors such as an economic downturn, may prevent adequate funding sources for NCDENR Stewardship, as is occurring in the current low-interest rate environment.

In weighing the benefits and drawbacks of the endowment model, it is worth examining the investment options available. As stated above, North Carolina's State Treasurer is responsible for fund management for NCDENR Stewardship. Currently, regulations

permit NCDENR Stewardship to invest its assets in one of two funds, the Short-Term Investment Fund (STIF), and the Long-Term Investment Fund (LTIF). Assets invested in the LTIF can never be moved to the STIF (E. Galamb, North Carolina Department of Environment and Natural Resources, personal communication). The STIF comprises the majority of the Treasurer's Cash Management Program and is managed to provide the maximum amount of income while preserving the fund's principal and liquidity.[59] In other words, these investments are largely designed to be safe investments, with limited risk of permanent loss and highly liquid characteristics, allowing them to be bought and sold with ease. The fund is generally invested in money market funds and short to intermediate term U.S. Treasuries and other Agencies.[60] As of June 30, 2010, the STIF had the following allocation: U.S. Agencies 48.7%, U.S. Treasuries 35.7%, Repurchase Agreements 11.7%, FDIC 3.4%, Certificates of Deposit 0.4%, and Corporates 0.1%.[61] U.S. Agencies includes loans from U.S. government agencies or also government sponsored enterprises such as the Federal National Mortgage Association (also known as Fannie Mae), U.S. Treasuries include debt issued by the United States, repurchase agreements are short-term loans backed by collateral, FDIC are FDIC-insured loans, Certificates of Deposit are short term loans offered by banks, thrift institutions, and credit unions, and Corporates include company loans.[62]

While this portfolio may indeed be safer than other bond portfolios managed by the State Treasurer's office, the investments do contain some risk, which may impact either the investment's principal or inflation-adjusted value of the income. Risks to U.S. treasuries include rising interest rates, which may impact the market value of the security, resulting in loss of principal if the bond is sold prior to maturity. Longer term bonds are more subject to this risk (also known as duration risk) than short-term bonds, so the risk to the endowment is somewhat minimized. Duration risk is also mitigated by the fact that holders of the debt may hold the bond until maturity, thus receiving full principal repayment. Investments in even short to medium term treasury bonds also carry the risk that inflation will increase prior to the bond's maturation and subsequent principal repayment, leading to losses in purchasing power for the endowment. This risk may be mitigated by the fact that increases in inflation are generally (but not always)

accompanied by increases in interest rates, allowing the bond holder to "roll over" his debt every few years into higher yielding securities. The short-term nature of the U.S. Treasuries in the STIF help to mitigate this risk.

U.S. agency debt and that of government sponsored enterprises also contain limited risk. U.S. Agency debt includes the risk of default of the underlying instrument, including instruments such as mortgage bonds, farm loans, and student loans.[63] Government agency debt (while subject to some of the risks highlighted above) is nevertheless backed by the U.S. government[64] and thus carries almost zero risk to principal. Government sponsored enterprises, on the other hand, have implicit guarantees from the U.S. government.[65] Both agency and government sponsored enterprises have loans with slightly higher yields than comparable U.S. treasuries due to the fact that shifting political forces may result in the failure of the U.S. government to fully guarantee the loans were defaults to occur.[66]

In repurchase agreements, one party sells a security to another at an agreed upon price, simultaneously agreeing to repurchase the security at a later date with a fixed price.[67] Given that the agreed upon repurchase price is greater than that for which the security is sold, repurchase agreements effectively have a yield, making them therefore similar in structure to other fixed income instruments such as U.S. Treasuries. Repurchase agreements are subject to counterparty risk, whereby the original issuer may either fail to repurchase the agreement, thereby defaulting on his obligation, or default outright.[68] When this occurs, the original purchaser becomes the owner of the collateral and may be forced to sell these assets at a reduced price, leading to losses on the original investment.[69]

The LTIF contains greater risk but also the potential for greater rewards. As of June 30, 2010, the allocation of the LTIF included the following: Corporates 37.4%, Government (U.S. Treasuries and Agencies) 36.2%, Mortgage-Backed 25.5%, and Cash 0.9%.[70] With the exception of Corporates, descriptions of these investments can be found above, and many of the risks faced by investments in these categories have been previously detailed. However, this fund holds greater risks than the STIF for several reasons. First, the bonds

held by the LTIF are longer term than those of the STIF,[71] making them more susceptible to duration risk. Furthermore, the large allocation to corporate debt faces the risk of company default, which would negatively impact the repayment of principal. Here, large-scale bankruptcies by U.S. companies due to an economic downturn could cause permanent loss of capital.

Unfortunately, both the LTIF and STIF currently carry low interest rates, making it difficult for these endowments to preserve purchasing power or support current spending needs. As of 9/30/2011, the yield on the LTIF and STIF was 2.9% and 0.8%, respectively (B. Lewis, North Carolina Department of State Treasurer, personal communication). This compares with the current, yearly inflation rate in the United States of 3.5%.[72] As such, even if spending were reduced to 0% of NCDENR Stewardship's endowment, the endowment's purchasing power would erode on an inflation-adjusted basis. Furthermore, the low interest rate does not allow the endowment to generate enough funds to support the program's activities (S. Horton, North Carolina Department of Environment and Natural Resources, personal communication). The original endowment amounts given to support NCDENR Stewardship were $14,000, which applied to the current yield of the STIF yields a paltry $112/year, well below the amount needed to support annual monitoring needs, let alone total funding needs for monitoring. As such, economic factors such as interest and inflation rates would need to change dramatically to justify a continuation of the current endowment model for Stewardship's funding needs.

The benefits of the endowment model are as follows:

- **Administrative Ease** - The endowment model offers convenience for both clients and NCDENR Stewardship in that it requires a one-time payment as well as limited oversight either from an administrative or investment standpoint.
- **Potential for Large Returns** - In general, endowments have the potential to produce sizable gains that can allow for increased spending rates and protection from inflation.

- **Strong Fit with Current DENR Model** - The current EEP model of one-time fees paid by applicants for mitigation would fit well with this model, where a portion of those fees could be transferred to NCDENR Stewardship as an endowment.

The drawbacks of the endowment model are as follows:

- **Current Economic Factors** - Low interest rates and high inflation rates will result in automatic loss of purchasing power for funds invested in either the LTIF or STIF, even without any spending. Interest rates alone, regardless of inflation, are too low to currently support the mandate of NCDENR Stewardship. These rates may continue to shift in the future, making effective budgeting difficult to accomplish.
- **Investment Risks** - As detailed above, risks to endowment principal do exist even in the STIF. This could reduce potential income in the future.
- **Lack of Flexibility** - As endowments for NCDENR Stewardship would likely continue to be funded as a one-time, lump sum payment, there will be limited options for addressing funding shortfalls other than increasing amounts for future endowments from future properties.

Summary

The current economic environment does not justify additional funding in current investment funds available. Interest rates are too low to support program activities, and inflation rates will erode purchasing power. Unfortunately, the possibility of inflation rates outstripping interest rates is not generally considered in endowment calculations. Should economic factors change such that the endowment model becomes favorable again, additional safeguards in the way of increased funding should occur to protect NCDENR Stewardship for future periods of low interest rates and high inflation. Seeking additional yield through investment in the LTIF is not justified due to the enhanced risk to endowment principle. While endowments offer convenience and fit well with EEP's

current funding model, my analysis does not support their use in the near future with the current options available to NCDENR Stewardship.

One item of note could be the possibility of investing in other assets as a way of generating an increased return for NCDENR Stewardship funds. While it may be convenient for DENR to outsource the management of its account to the North Carolina State Treasurer, the investment options available are limited. Other assets classes may offer the possibility of higher returns or diversification. Many university endowments now have a significant portion of their assets invested in stocks, hedge funds, real estate, private equity, venture capital, and natural resources. [73] However, while these investments may offer the potential for higher return, they may also have the potential to exhibit greater volatility in market value and a greater possibility of permanent loss of capital. With this warning in mind, NCDENR Stewardship could nevertheless examine the possibility of investing in other asset classes held by the North Carolina State Treasurer. Alternatively, outside management, such as a private firm, might also be an option if the endowment model is continued.

Funding Model II: Periodic Fee Model

A second approach could entail periodically charging clients, such as EEP, for costs related to stewardship activities. Here, if the client wanted NCDENR Stewardship to assume stewardship responsibility for a completed property, the client would pay an agreed-upon sum, and NCDENR Stewardship would be responsible for the site for an agreed-upon time period (J. Stanfill, North Carolina Department of Environment and Natural Resources, personal communication). If after the designated period the client no longer desired that NCDENR Stewardship have site responsibility, the property could then be transferred back to the client, who would then be required to find another steward (J. Stanfill, North Carolina Department of Environment and Natural Resources, personal communication). In this model, fees could be structured such that they could be paid either at the beginning or end of the designated period, or a portion of the fees could be paid over the course of period, such as on a quarterly basis. Partial fees could be charged upfront, with the remainder charged at the end of the period. This remainder amount

could be adjusted to account for one-time costs or other increases in funding needs over the period. Costs could also be paid upfront entirely.

There are several benefits with regards to the periodic fees model. This model provides flexibility to adjust pricing to reflect true programmatic costs. Periodic adjustments in pricing could also reflect changes in costs due to varying rates of inflation. Spending rates are not held hostage to current yields on investments but can reflect the program's actual needs and be adjusted on an annual basis (or sooner). Along the same vein, funding does not rely on an outside source such as the North Carolina State Treasurer's Office to properly manage funds. Furthermore, given that no money is "wasting away" due to the combination of low interest rates and high inflation, this fee structure may also possess greater legitimacy from an institutional standpoint. Annual fees charged to clients such as EEP could also be elevated on a temporary basis, to make up for shortfalls in interest earned for other sites currently funded by endowments. In turn, these costs would need to be passed on to future participants in EEP's in-lieu fee program, such as developers. While this would result in increased charges, this program would be voluntary, thus minimizing potential disagreements. Finally, increasing the periodicity to shorter periods would also prevent potential cash shortfalls for NCDENR Stewardship.

As with the endowment model, there are also potential drawbacks to the periodic fees model. Changing the payment amounts periodically throughout the period could be burdensome for clients. On the other hand, charging the entire amount upfront could result in funding shortfalls for NCDENR Stewardship if unforeseen events and expenses occur, or if funding amounts are improperly estimated. Furthermore, if numerous clients agree to transfer their properties to NCDENR Stewardship, it is logical to assume that this might be matched by increased personnel. Future mass withdrawals of clients from the program could potentially jeopardize NCDENR Stewardship due to now higher fixed costs of personnel and administration. With that said, continuing to outsource the majority of monitoring needs to land trusts will continue to reduce these fixed costs, lessening these potential impacts of reduced funding. Furthermore, close partnerships

with EEP make this an unlikely possibility. Fees charged to new clients could also be used to make up for such potential cash shortfalls.

It is indeed possible that NCDENR Stewardship could run out of funds during the designated period. However, this fact could be mitigated through diversifying the designated time period from which a contract begins for different sites. If this period began at different times, fees could be increased from other sites to make up potential shortfalls. A periodic fees model would likely entail greater administrative needs in the form of closely tracking fees charged to clients. Given that the program currently only employs one person, this could indeed become burdensome. Finally, these periodic fees transfer risk from NCDENR Stewardship to clients, who must now estimate stewardship costs for a given period. If these clients use an endowment, they may face the same economic risks NCDENR Stewardship faces in its current model. Clients may need to shift to an actual cost method of accounting, whereby costs for all sites previously transferred to NCDENR Stewardship are now charged to applicants. This introduces challenges for clients such as EEP, who must now determine how to distribute costs to an unknown number of future applicants. For example, if a client estimates that the costs of stewarding 100 sites previously transferred to NCDENR Stewardship will be $50,000 for a given year, it must charge applicants in an appropriate manner to cover these costs. However, clients do not necessarily know how many permittees they will have in a given year, making such estimation difficult.

The benefits of the program can be summarized below:

- **Flexibility** – A periodic fees model would better allow fees to reflect true costs and could easily be modified when needed.
- **Independence and Investment Security** – Funding is no longer reliant on investment success from outside sources such as the North Carolina State Treasurer's Office and, along the same vein, does not depend on economic factors such as interest rates and inflation.

- **Addressing Current Shortfalls** – Fees charged to permittees could compensate for cash shortfalls on existing properties.

The drawbacks of this program can be summarized below:

- **Funding Security** – Client withdrawal from the program could result in funding shortfalls in regards to the fixed costs of NCDENR Stewardship. Furthermore, unexpected expenses arising before the next payment period could result in funding shortfalls.
- **Funding Security** - Clients now face increased risks and complexity, given that they must now determine how best to charge applicants for costs to steward their sites.
- **Administration** – There may be additional administrative burdens required of NCDENR Stewardship to closely track expenses and payment receipts.

Summary

A periodic fees model represents the most appropriate model given current economic conditions. Periodic fees allow for adjustments in fees charged to clients and are not reliant on economic factors to produce sufficient funding. Temporarily increasing periodic fees could also partially pay for sites funded by endowments, which now face funding shortfalls due to low interest rates. Risks to this model include funding shortfalls in the interim between payments though an increased periodicity could mitigate this risk. There is some risk to NCDENR Stewardship if mass withdrawal of clients occurred. However, diversifying the client base and continuing to outsource monitoring needs to local land trusts should mitigate this potential problem by reducing potential client loss and fixed costs, respectively. A significant drawback would be the increased administrative burdens placed on the Stewardship Director, who must now oversee a more complex payment process. Clients such as EEP who desire stewardship of their sites also face the burden of needing to estimate stewardship costs and incorporate this added expense into their budgets. Clients face the risk that they will underestimate annual costs, thereby preventing site stewardship for a given year.

Funding Model III: Hybrid Model with Initial Periodic Fees and the Development of an Endowment

A third potential model could entail a periodic fees model, with additional charges in excess of actual costs levied in order to gradually create an endowment over time (J. Stanfill, North Carolina Department of Environment and Natural Resources, personal communication). Here, periodic fees could be charged in the manner described in the periodic fees model above. However, the fee would include a premium above actual costs, which would be set aside. Over a specific period of time, an endowment would be constructed with this premium with an amount sufficient to support NCDENR Stewardship's activities. The premium could be set aside and invested in the North Carolina State Treasurer's account. When the endowment had reached a sufficient level, periodic fees would no longer be charged to clients, and NCDENR Stewardship's activities would be funded entirely by the endowment. The invested monies from the premium amount charged to clients would also generate interest that could be used to construct the endowment and reduce either the time period needed to fund the endowment or the premium paid by the clients. As with the other models, this hybrid model has benefits and drawbacks.

The benefits of this model would include elements of both models discussed above. The periodic fees component of the model would allow NCDENR Stewardship to adjust rates based on actual costs. Adjustments could also occur in the premium paid and set aside as an endowment, to account for changing economic factors such as inflation and interest rates. The periodic fees could also help to mitigate current shortfalls in funding for other sites due to low interest rates generated by current endowments. If a client decided to withdraw from the program during the period of time in which an endowment were being built for that particular site, it is possible that the endowment amount would remain the property of NCDENR Stewardship, allowing for funding of other activities even though the reference property had been transferred back to the client. It is also possible that several years in the future, economic factors will revert to more normal

circumstances, where interest rates are greater than inflation rates. This would allow for the proper functioning of an endowment.

The drawbacks of this model include current economic factors and investment options available to NCDENR Stewardship. Current interest rates are currently below inflation rates, resulting in an automatic erosion of purchasing power. This would effectively reduce endowment levels set aside from premiums paid. As such, any money set aside for endowment construction would see an automatic erosion in value in either the STIF or LTIF. This could require the premium amounts charged not only to build up an endowment but also to compensate for losses in purchasing power in monies already set aside. This model also assumes that, at the end of the designated time period (after which the endowment were completely constructed), interest rates would become greater than inflation rates and would also be large enough to support spending needs. While this situation is indeed possible, it may also represent a flawed assumption, given that the Federal Reserve is willing to keep interest rates below inflation rates for extended periods of time. Given the limited investment options available to NCDENR Stewardship, even if endowments were sufficiently constructed, economic factors could revert to a situation in which inflation outstrips interest rates, eroding the purchasing power of the program's endowments. Finally, this model would also require increases in administrative support needed to track the various expenses and receipts, and potentially adjust rates as needed.

The benefits of the hybrid model are as follows:

Flexibility - This model allows for adjustments in rates to reflect true costs and can also be adjusted for economic factors.

Convenience - After the requisite period in which the endowment were constructed, periodic fees would no longer need be charged, reducing the administrative burdens of this model.

Increased Funding - If clients withdrew from the program, it is possible that the endowment could be kept by NCDENR Stewardship, resulting in increased funding for other properties.

The drawbacks of the hybrid model are as follows:

Economic Factors - Currently, low interest rates and high inflation rates would result in erosion of purchasing power for monies set aside for the endowment.

Economic Assumptions - There is no guarantee that economic factors will support the endowment model in the future.

Complexity - This model would require additional oversight by way of overseeing proper endowment construction and overseeing any changes in rates that had to be changed.

Summary

While this model has some benefits, current economic factors do not support its adoption by NCDENR Stewardship. Monies set aside face erosion of purchasing power that may prevent their use as a viable funding sourcing in the future. In other words, an endowment that reached its funding goal might have lost the ability to actually support a site due to the effects of inflation. Appropriate economic factors may exist in the future, allowing for an endowment model to function properly. However, it is impossible to determine when economic factors will return to previous conditions in which interest rates are sufficient to support stewardship activities and are sufficiently greater than the inflation rate to prevent erosion of purchasing power. Furthermore, even if such economic conditions returned, there is no guarantee that they will not again revert back to our present rates, where interest rates are low and inflation is greater than interest rates. With that said, aspects of this model could potentially be adopted for a periodic fees model. Charging a small premium above actual costs for sites could help to provide funding security if clients withdrew from the program. While this money would face erosion of purchasing power, it could still serve as a form of insurance, even in reduced form.

RECOMMENDATIONS

1.) Identify Likely Costs on a Site-by-Site Basis

The lump sum payment model currently used by NCDENR Stewardship makes analysis of cost drivers challenging. Payments were often negotiated on a lump sum basis, making it impossible to evaluate cost drivers of individual sites. In order to better improve transparency for negotiated rates, monitoring costs could be calculated and recorded on a site-by-site basis based on either the comprehensive or abbreviated model and then aggregated into lump sum charge. Such information could then be made readily available.

2.) Maintain Land Trust Partnerships

Land trusts provide valuable services to NCDENR Stewardship that should be maintained if possible. The adoption and use of the models in this report may provide greater leverage in terms of negotiating payments (and thus allow the Stewardship Director to guide rates in a more predictable manner), but land trust relationships as monitoring agents should be maintained if possible. The use of land trusts reduces fixed costs (which may prove valuable in a periodic fees model, as described previously in this report). Furthermore, land trusts oftentimes have existing relationships with landowners and are located closer to sites that NCDENR Stewardship, reducing travel time for the program.

3.) Place Greater Emphasis on Site Characteristics When Negotiating Costs

Greater emphasis should be placed on site characteristics when negotiating payments. Use of either the comprehensive or abbreviated model should be helpful in estimating these costs.

4.) Implement Either the Comprehensive or Abbreviated Model for True Cost Estimation

Determining future costs should rely on the use of either some form of the comprehensive or abbreviated model detailed in this report. Use of these templates should hopefully provide sound estimates of total costs for future sites.

5.) Adopt Periodic Fees Model and Consider Other Investment Funds

The periodic fees model provides good flexibility for rate changes and is not dependent on economic factors or outside management. This funding model should be adopted by NCDENR Stewardship, and the possibility of other investment funds should also be considered.

6.) Charge Additional Risk Premium

If possible, an additional risk premium should be considered as an additional charge to safeguard funding sources for NCDENR Stewardship should properties be transferred away from NCDENR Stewardship. This risk premium will help to cover factors such as unforeseen risks to sites.

7.) Maintain Assets in the STIF

A problem revolves around where to invest excess program funds. An example of this would be funds set aside for legal expenses or site repairs that may not be used every year. Invested in either the STIF or LTIF, they will face erosion of purchasing power. However, given the risks of loss of funding, it probably still makes sense to set aside funds as insurance for these possibilities. All funds should remain in the STIF to safeguard against losses.

8.) Choose Clients Carefully

Eventually, costs are dependent on the client: If the client is unwilling to pay higher costs, then NCDENR Stewardship may need to reduce fees. To prevent mass withdrawals from the program, clients (particularly those with large numbers of sites to be monitored) should be chosen carefully, and client diversification should be encouraged to safeguard funding sources.

FUTURE STUDIES

1. Evaluate Stewardship Costs of North Carolina Land Trusts

Future studies could examine stewardship costs specifically for North Carolina land trusts. Such an analysis could potentially provide more precise cost estimates for NCDENR Stewardship, given that the data would have more local precision. This data could provide valuable information that could be used to modify either the comprehensive or abbreviated model developed as part of this report. Such a study could also assist NCDENR Stewardship when negotiating payments for outsourced land trusts in their monitoring activities, given that it would provide objective data that could be referenced during the negotiations.

2. Evaluate Different Investment Options for Endowments

A full evaluation of investment options available to NCDENR Stewardship or other DENR programs is beyond the scope of this report. Nevertheless, such an analysis could prove valuable when considering potential funding models. It would first be necessary to evaluate if other options were legally available to DENR programs and if DENR could be allowed to invest in other funds of the North Carolina Department of State Treasurer. Alternatively, the possibility of hiring a private investment consultant could also be considered. The end goal would be to identify other asset classes that could improve the investment prospects of these programs. Diversifying into conventional asset classes such as equities, which may offer the potential of greater returns and inflation hedging characteristics, could be a reasonable first step.

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APPENDIX

Appendix A: Comprehensive model calculating the costs of stewardship, administration, and defense of a given property.

A. Assumptions

1. Land Trust Staff Salaries and Overhead Costs	
Total annual salary for monitoring personnel	$60,000.00
Hours worked per year (50 wks x 40 hrs/wk less 7 holidays x 8 hrs/day)	1,944
Salary per hour (annual salary / hours worked per year)	$30.86
Overhead / staff member / hour (benefits, rent, typing, phone, computer)	$10.00
2. DENR Stewardship Salaries and Overhead Costs	
Total annual salaries	$60,000.00
Hours worked per year (50 wks x 40 hrs/wk less 7 holidays x 8 hrs/day)	1,944
Salary per hour (annual salary / hours worked per year)	$30.86
Overhead / staff member / hour (benefits, rent, typing, phone, computer)	$10.00
Total additional overhead (benefits, rent, typing, phone, computer)	$19,440.00
3. Materials Costs	
Individual material costs (signs posted, etc.)	$10.00
Invasive species costs (herbicides)	$15.00
4. Travel Costs to Sites	
Reimbursement per mile (Current IRS Regulation)	$0.51
Average vehicular speed for entire trip	45
Land Trust Reimbursable travel expenses	$0.00
DENR Stewardship Reimbursable travel expenses	$0.00
5. Monitoring Time	
Staff time for monitoring	
Average pre-monitoring time (hours)	1
Hours needed to walk one mile on sites	0.5
Average post-monitoring time (hours)	1
6. Landowner Costs	
Staff time needed for annual landowner relations (hours)	2
Likely hard costs per landowner per year (e.g. newsletter, postage, etc.)	$25.00
7. Frequency of Exercise of Reserved Rights, Management Plan updates etc.	
How often will reserved rights etc. be exercised in a 20 year period?	0

Therefore the likelihood of exercise of reserved right etc. in any one year is:	0%
Average staff hours needed for exercise of reserved rights etc. per time	20
Number of site visits required to review change per time	1

8. Invasive Species Removal

Average staff hours needed for light invasives removal	1

9. Easement Violations and Response

Staff hours required to head off violation	10
Potential site visits required to head off violation	1
Estimated site repair	$1,000.00

10. Yearly Amount Set Aside for Major Violations (Legal Fees)	$50,000.00

B. Variables

1. Site Characteristics

Perimeter (Ft.)	11,184
Perimeter (Miles)	2.1
Land trust distance to site	28
DENR Stewardship distance to site	28

2. Annual Landowner Relations

Number of landowners per site	1

3. Number of Reserved Rights/Site	0
4. Site Needs Light Invasive Species Removal (1 for yes, 0 for no)	0

5. Easement Violations and Response

Perimeter (Ft.)	11,184
Area (Acres)	69
P/A	
Ratio	162
Likely percentage of violations/year	5%

6. Total Number of Sites Under DENR Stewardship	101

C. Formulas

1. Land Trust Hourly staff rate (including overhead)

Salary costs per hour	$30.86
Overhead costs per staff member per hour	$10.00
Total: Hourly staff rate	$40.86

2. DENR Stewardship Hourly staff rate (including overhead)

Salary costs per hour	$30.86
Overhead costs per staff member per hour	$10.00
Total: Hourly staff rate	$40.86

3. Land Trust Travel Costs

Mileage reimbursement: mileage x reimbursement rate	$14.28
hourly staff rate x (mileage divided by average vehicular speed)	$25.43
Reimbursable travel expenses	$0.00
Travel Costs for Each Site Visit	$39.71
Total: Round Trip Travel Costs	$79.41

4. DENR Stewardship Travel Costs

Mileage reimbursement: mileage x reimbursement rate	$14.28
hourly staff rate x (mileage divided by average vehicular speed)	$25.43
Reimbursable travel expenses	$0.00
Travel Costs for Each Site Visit	$39.71
Total: Round Trip Travel Costs	$79.41

5. Total DENR Overhead Costs Per Site

Total annual salaries	$60,000.00
Total additional overhead	$19,440.00
Total sites monitored	101
Total: Overhead costs per site (total costs/number of sites)	$786.53

6. Total Major Violations Expenses Per Site (Legal Fees)

Yearly amount set aside for major violations	$50,000.00
Total sites monitored	101
Total: Major violations costs per site (total costs/number of sites)	$495.05

C. Annual Expenses

Monitoring and Related Expenses for Land Trust Personnel

1. Annual Monitoring Expenses

Pre-monitoring staff costs: hourly staff rate x staff time needed	$40.86
Monitoring staff costs: hourly staff rate x total perimeter/perimeter walk rate	$172.82
Monitoring hard costs	$10.00
Post-monitoring costs: hourly staff rate x staff time needed	$40.86
Travel Costs	$79.41
Total Annual Monitoring Expenses	$343.96

2. Annual Invasive Species Removal Expense	
Materials cost	$0.00
Staff costs: hourly staff rate x hours needed	$0.00
Total: Total cost of invasive species removal	$0.00
Total Monitoring and Related Expenses	**$343.96**

DENR Overhead and Staffing Expenses	
3. Annual Landowner Relations Expense	
Costs of staff time: hourly staff rate x hours needed x number of landowners	$81.73
Costs of supplies x number of landowners	$25.00
Total Annual Landowner Relations Costs	$106.73
4. Annual Exercise of Reserved Rights Expense	
Staff costs: hourly staff rate x hours needed	$0.00
Travel costs for each site visit	$0.00
Costs of exercise of reserved right every 20 years	$0.00
x percentage likelihood of right being exercised within 20 years)	0%
Total: Per year cost of exercise of reserved right	$0.00
6. Annual Violations Expense	
Staff costs: hourly staff rate x hours needed	$408.64
Travel costs	$79.41
Costs of violations	$488.06
Percentage likelihood of occurring in one year	5%
Total: Per year cost for violations	$24.40
7. Additional Annual Overhead Expenses	
Total overhead expenses per site	$786.53
Total overhead expenses already accounted for	$131.13
Total: Remaining overhead expenses per site	$655.40
Total Overhead and Staffing Expenses	**$786.53**

Other Site Costs	
8. Potential Site Repair Costs	
Estimated repair costs	$1,000.00
Percentage likelihood of occurring in one year	5%
Total: Per year cost for violations	**$50.00**

Annual Legal Expenses for Major Violations	
9. Annual Major Violations Expenses	**$495.05**

Total Annual Expenses	**$1,675.55**

Total Annual Expenses with 10% Risk Premium	**$1,843.10**

Appendix B: Abbreviated model calculating the costs of stewardship, administration, and defense of a given property.

Assumptions

Hourly staff rate (including overhead)	$40.00
Round trip travel costs	$80.00
Other monitoring expenses	$90.00
Miles walked per hour	0.5
Light invasive species removal	$60.00
Site repair costs	$50.00
Annual legal fees	$50,000.00
Total staffing and overhead fees	$80,000.00

Variables

Perimeter size in miles (ft/5289 ft/mile)	2.1
Number of landowners	1
Light invasive species removal required (1 for yes, 0 for no)	0
Total numbers of sites under DENR Stewardship	101

Annual Expenses

On site monitoring costs	$170.13
Travel costs	$80.00
Other monitoring costs	$90.00
Light invasive species removal costs	$0.00
Site Repair Costs	$50.00
Annual legal fees	$495.05
Staffing and overhead fees	$792.08
Total Annual Expenses	**$1,677.26**
Total Annual Expenses with 10% Risk Premium	**$1,844.99**

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