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Conservation Planning and Decision Support in a Nonprofit Organization: A Summer Internship with NatureServe

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the degree of Master of Science in the Department of International Development,

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Jie Tian, Chief Instructor

ABSTRACT

NatureServe's 2015 Internship in the Conservation Planning and Decision Support Department

Projects involving the Department of Defense and
the National Oceanic and Atmospheric Administration

Samantha Coccia

This report is an account of my internship spent with NatureServe, a nonprofit Conservation organization that provides detailed scientific data used in conservation decisions made across the Americas. NatureServe works with a network for natural heritage programs and is made up of four regional offices with headquarters in Arlington, VA. I spent my summer in their Boulder, CO location in the Conservation Planning and Decision Support Department under the guidance of Dr. Patrick Crist. I was offered my choice of two projects to work on, and was also offered a continuation of my internship with additional responsibilities given. Throughout the summer I spent the majority of my time working with the Department of Defense on their Eglin, FL Vista project and the National Oceanic and Atmospheric Administration on their Northeast Corridor of Puerto Rico Summit to Sea project. This internship provided advanced GIS software practice as well as various networking opportunities with multiple conservation organizations. This internship has provided me with the additional professional skills training that I needed to feel confident in my conservation GIS analyst capabilities and I would highly recommend this internship to other GISDE students looking towards a similar career path.

ACADEMIC HISTORY

Name:	Date:
Samantha Janette Coccia	December 2015

Baccalaureate Degree:	Date:
B.S. Conservation Biology	May 2011

Received From:

State University of New York's College of Environmental Science and Forestry

Occupation and Academic Connection: (since date of Baccalaureate Degree)

Zookeeper, Rosamond Gifford Zoo, Syracuse, NY (2012-2014)

Intern, Turpentine Creek Wildlife Refuge, Eureka Spring Arkansas (2011-2012)

ACKNOWLEDGEMENTS

I would like to thank Dr. Patrick Crist for becoming my professional mentor and giving me many opportunities to learn at NatureServe. His guidance has shaped my future career path as I look to graduation, and his encouragement and effort spent to give me many unique opportunities at NatureServe has fueled my work ethic and inspired me to push myself academically in my final year of graduate school. His impact truly made NatureServe a wonderful place to work.

I would also like to thank Dr. John Rogan for his enthusiasm for working with graduate students and also pushing students to give their best performance. You have also served as a mentor to me, and I truly appreciate all of your advice and look forward to future research work ahead.

Many other professors and administrators have also positively influenced my Master's Program, including Dr. Florencia Sangermano, Dr. Yelena Ogneva-Himmelberger, Dr. Robert Pontius and Erika Paradis. Your personal attention to student needs, concerns and questions, and the many hours you spend day in and day out with students has a huge impact on this program, and has helped me to succeed in so many ways. Thank you.

Finally, I would like to thank my fellow GISDE and IDCE colleagues for their support throughout my Master's program, and for always being available with great advice, guidance and an understanding attitude during our many courses and professional experiences together.

DEDICATION

I would like to dedicate this to my parents, family and loving fiancé, without whom I would not have been able to attend this prestigious program. Thank you for your constant support and words of encouragement. I love you all.

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GLOSSARY

DoD - Department of Defense

CI - Conservation International

GISDE - Geographic Information Science for Development and the Environment

IDCE – International Development, Community and Environment Department

NGO - Non-Governmental Organizations

NOAA - National Oceanic and Atmospheric Administration

SLAMM – Sea Level Affecting Marshes Model

TNC - The Nature Conservancy

UN CLME + - The United Nations Caribbean Large Marine Ecosystem Plus Project

WWF – the World Wildlife Fund

Chapter 1 – Introduction

Conserving endangered species has been a lifelong dream of mine, and participating (and potentially one day leading) a conservation organization in progressive and long-term solutions to species extinction is my dream career. My journey began from an early age, when I first learned that my favorite animal, the tiger, was endangered. I chose to dedicate my life to bringing species back from the brink of extinction, which lead me to a Baccalaureate degree in Conservation Biology. From there, I gained hands on experience working around endangered and exotic animals, and I made the decision to return to school to continue on my conservation path. I had heard about Clark University's GISDE graduate program during my undergraduate Introduction to GIS course, and after speaking with current students in the program, I decided that this program would prepare me best for a future in conservation GIS.

I originally wanted to work on a research project, but after much difficulty gathering data, I decided to switch to the practitioner's track. My first conversations with Conservation NGOs were with World Wildlife Fund, but navigating the network of such a large organization was difficult and time consuming. A fellow GISDE student pointed me to NatureServe, and it seemed like the perfect fit. As soon as I started looking at their website I immediately felt like this organization could be where I spend my future career, and I applied for the internship. I was accepted, and my internship began on May 18th 2015 and is still continuing today. I look forward to a potential future with this organization, but I also feel that my experience at NatureServe has prepared me well to work in a variety of Conservation NGOs.

This paper further highlights the multiple opportunities and projects I was given (and am continuing to work on) throughout this internship. The main body is broken down into three chapters, highlighting the organization of NatureServe, my internship assignments and my

assessment of the internship, respectively. I have also included some examples of the layout of the Vista tool which I describe in Chapter 3, as well as some of my current outputs from my work. I am thankful for the experiences I was given at NatureServe, and I hope that my journey in conservation continues to lead me towards the impressive and collaborate work that NatureServe has set as a standard in the conservation science community.

Chapter 2 – Description of NatureServe

2.1 History, Mission and Organization

Nonprofits in a complex term used to describe a variety of organizations, from those classified by the Internal Revenue Code as 501(c)(3) charitable tax-exempt to the 501(c)(4) civic organizations (Hall, 2004). Nonprofits have existed in their truest form in the United States since the 1970s, and they play an important role in conservation organizations in particular. One of these important nonprofit organizations for conservation in the U.S. is NatureServe. NatureServe began in The Nature Conservancy, when they helped to establish the first state natural heritage program in 1974. In the two decades that followed, The Nature Conservancy began to build a network of natural heritage programs in the US, with the goal of collecting and managing data about the "distribution of species and ecosystems of conservation concern" (www.natureserve.org). The network expanded to Canada and Latin America until it reached the public-private partnership that is NatureServe today, which includes more than 80 independent organizations. NatureServe was named in 1994, and became independent from The Nature Conservancy in 2001, and today has a headquarters in Arlington, Virginia, along with four regional offices.

NatureServe's mission is "to provide the scientific basis for effective conservation action", and their vision is to inform decision makers on the importance of biodiversity in everything that we do. NatureServe has done just that, and recently won the 2014 MacArthur Award for Creative and Effective Institutions for their ability to create this organized network of conservation information. NatureServe plans to use its award to "accelerate and implement a new, five-year strategic plan that includes expanded monitoring and evaluation to increase the effectiveness of conservation action"(www.macfound.org).

NatureServe carries out its mission across the world, with the main network of biodiversity centers existing in the Americas, and major NatureServe projects happening in Africa and eastern Asia. Its data is now recognized as a standard for conservation science and biodiversity assessment. Projects NatureServe recently completed include: capacity building for addressing climate change in the Andean conservation efforts; ecoregional assessment with NatureServe Vista for the Bureau of Land Management; and de-listing the shale barren rock cress (*Boechera serotine*) from the endangered species list. NatureServe works with many other conservation and land management organizations, such as The Nature Conservancy, Conservation International, Department of Defense, Bureau of Land Management, World Wildlife Fund, NOAA, etc. to provide detailed data and conservation plans for a variety of projects. Along with their five main offices, NatureServe has three regional section councils to accommodate the unique social, political and economic conditions that exist across their broad span of conservation work. These three councils are; the Canadian Board of Directions, the Latin America Section Council and the U.S. Section Council.

2.2 Mapping and GIS

The goal of NatureServe is to provide high-quality and up-to-date scientific knowledge, and to build effective tools and databases for collecting this knowledge. One of these effective tools developed by NatureServe is called Vista: a conservation planning decision support tool offered as an extension to ArcGIS, and free for public use. The tool combines scenario-based planning, species, land use and infrastructure layers, and expert knowledge to produce information on whether particular elements of interest are supported or threatened in the landscape. The tool can also develop site mitigations and produce alternatives to achieve the

planning objectives. Vista also integrates well with other conservation GIS software, such as Marxan, to provide a more in-depth conservation planning analysis. Although all of this can be done by the user, NatureServe does work with clients to perform this level of analysis for their specific conservation management projects. It was in this focus of NatureServe where I interned, in their Conservation Planning Department.

2.3 Strengths and Effectiveness

The breadth of NatureServe's network spanning over continents certainly serves as a strength as well as an area of attention. Organizing projects across different parts of the world requires patience and good communication, which is an area that will always need constant attention. Also, I feel that NatureServe could invest in more GIS specialists to use their Vista tool with new clients to increase awareness of this toolset. There are many unique GIS tools for ecosystem management and conservation planning used across the United States today. However, NatureServe's history and their devotion to the development of Vista are two strengths that make this tool stand out amongst others used today. NatureServe needs more staff not only dedicated to marketing this powerful tool, but also more staff to use this tool with clients to show its strengths compared to what they may (or may not) be already using. This leads to another strength of NatureServe, which is its ability to collaborate with other conservation organizations around the world today. They do this not only in their Conservation Services department and Ecology department, but they also collaborate with partners on conferences and workshops dedicated to bringing these scientists together face-to-face to discuss how they approach management in their areas of expertise and what projects they have worked on. It is in this collaboration, along with its network of natural heritage programs, that NatureServe is able to be effect in accomplishing its mission.

Chapter 3 – Description of Internship Responsibilities

3.1 Project Assignment

Internship responsibilities at NatureServe involved work in the Conservation Planning and Decision Support Department, under the guidance of Dr. Patrick Crist, the Director of Conservation Planning. NatureServe works with a variety of clients who use their Vista Planning software, and interning in this department allowed for a choice of organizations to work with. I chose two projects, one with the Department of Defense in their Eglin, FL base, and the other with NOAA (National Oceanic and Atmospheric Administration) in a land-sea integration project in the Northeast Corridor of Puerto Rico. The motivation for working with the DoD (Department of Defense) was that it offered networking with an organization that I had never envisioned working with before. I had also never thought this group involved conservation into their land ownership across the country, so I was interested to see what this project entailed. The work with NOAA came with a stipend, and also offered great networking opportunities and a much larger project involving multiple organizations. I found both projects to be enjoyable, and continued with both past the length of my summer internship.

3.2 Department of Defense – Eglin, FL

In the DoD Eglin Project, I was building onto an existing assignment and finishing NatureServe's involvement in this particular analysis. The majority of this project was completed by other NatureServe staff, however, the client (DoD) was looking to add an additional Future Scenario analysis with SLAMM sea-level rise data, as well as split an existing land-cover category into two categories (Secure Managed Tree Plantations and Unsecure Managed Tree Plantations). NatureServe was also looking to use this project as

an example of Vista's ability to work with other programs, such as SLAMM and Marxan. I felt that this project was a good way for me begin my internship and to get acquainted with the software.

The project began by first loading in SLAMM data for the year 2050 and 0.5 m sea-level rise for the Eglin study area (see Figure 1). My next step was to copy over the Future Scenario that existed for this Vista project, and incorporate the SLAMM Data in this Scenario. This Vista project involved assessing the distributions of five plant and animal species: Gopher Tortoise, Florida Bog Frog, Panhandle Meadowbeauty, Panhandle Lily and Small-flowered Meadowbeauty. These species had been previously chosen by the client as key species for analysis. For each species, a unique value was given for their minimum habitat size for viability, their condition threshold, their compatibility with the various land cover types (levels of urban, agriculture, commercial, etc.), and how intensely that species is impacted by the land use types. An example of this layout is shown in Figure 2.

In Figure 2, the labels 'Site Intensity' and 'Distance (m)' correspond to how intensely that land use type impacts the species' ability to survive (for example, an intensity value of 0.01 would mean that there was a 99% chance that that species would be eradicated from that area), and how far (in meters) from that land use type that it would impact the species, respectively.

The SLAMM data was built into the analysis as a 'Sea-Level Inundation' land-use type, and it was also built in as a Translator, which highlights different land cover types that would be especially impacted by sea-level inundation. This project also involved some preprocessing with the classified land cover data to split a category into two categories

based on the client's request (the secure and unsecure managed tree plantations) as this category could impact species very differently depending on where these managed tree plantations existed. Once all of these steps had been completed, the new SLAMM 2050 layer was ready to be run. Figure 3 shows a screenshot of the window used to create the Scenario.

The Scenario first created different land use layers for the inputs that went into the model. I did not look at these in detail, and as I will discuss later, they are a part of this program that I look forward to learning more about. My next step was to evaluate the Scenario using the weights, filters and goals set by the previous NatureServe staff. This next step gives the outputs that the clients are most interested in: detailed layers showing the element condition models, element condition by site, full condition models and compatibility conflict.

In the evaluation, the Scenario takes into account the elements used and whether or not any of those elements are weighted more than another for protection, and what goals are set for each element to be conserved. As the Vista help document states: "To judge the conservation compatibility of areas within a planning region, biodiversity value must be integrated with socioeconomic factors, such as current land use, current conservation status, and ownership. One of the most powerful features of Vista is its ability to compare various scenarios representing land use and conservation in the planning region - in other words, alternate plans that identify which places to conserve, areas where there are gaps in protection, and which places to designate for housing, roads, or other development (Vista Help 2014-12-4)." For this project, the client was most interested in the Element Condition

Models (specific maps made for each element that show the condition of that element in its current distribution based on our inputs for the Scenario). Figure 4 shows an example of a map I made (based on the NatureServe template) for the Future Scenario of the Gopher Tortoise.

The last step of this project was to generate a Conservation Solution to highlight locations that would be best suited for conservation (either as protected areas or locations for further analysis, etc.). The program that I used to generate these areas was Marxan, as the first steps of the Marxan inputs have been built into the Vista Toolbar under 'Generate a Conservation Solution.' After Marxan runs, the outputs are captured back into Vista and can then be used to run another Scenario evaluation. This last step is still on the list of things to complete during the continuation of my internship. Figure 5 shows an output of one of my many Marxan runs.

3.3 NOAA – Northeast Corridor of Puerto Rico

My next task was to begin working on the Land-Sea Integration Project for the Northeast Corridor of Puerto Rico with NOAA. This project consisted of three steps: (1) Use OpenNPSECT to model 'Summit to Sea' stressors using the best available data, (2) Use the outputs from that model along with existing data being currently gathered by NOAA together into Vista to provide an integrated land-sea planning decision support system, and (3) to then demonstrate these features and capabilities of Vista applied to a land-sea integration scenario.

However, as is the reality of Conservation work, the data was slow to arrive. This did allow for this portion of my internship to continue into the Fall of 2015 and Spring of

2016. I have recently obtained the data for Step 1, and will be looking to complete this project in 2016, with the possibility of presenting this research as a conference next summer.

3.4 Offer of Internship Continuation – Planning the Caribbean Based Tools Workshop

As mentioned above, an opportunity to continue my internship remotely was offered to me at the end of the summer. I was also offered the opportunity to help plan an upcoming Tools Workshop in Puerto Rico, scheduled for April of 2016. Although this did not offer 'hands on' GIS work, it did offer me many networking opportunities with the multiple partners involved in this workshop. Every year, NatureServe hosts a conference called 'Biodiversity without Boundaries' with the location for 2016 scheduled for San Juan, Puerto Rico. Part of their funding from the MacArthur Foundation was set aside to teach the science community about the tools that they use (such as Vista), and this led Patrick Crist to propose a Tools Workshop that would follow the conference in Puerto Rico. The idea was to bring the GIS analysts and other professionals together to discuss the tools they use in their respective Conservation organizations, and to train in new tools. The theme of the event is set to be Caribbean focused, with special attention towards Marine Protected Areas, Land-Sea Integration and Climate Change.

My role in this internship was to assist Patrick Crist and Sarah Carr with creating surveys to send out to potential partners and participants, to help with contacting sponsors and partners, and to organize phone calls, PowerPoints and other data into Excel spreadsheets and documents. Depending upon funding in 2016, I may also have the opportunity to travel to Puerto Rico to assist with the conference and tools workshop in April.

Chapter 4 – Internship Assessment

4.1 Skills learned at NatureServe

NatureServe provided me with rigorous, thought provoking work with excellent guidance and opportunities for networking. I was very familiar with the ArcGIS software package, but working with this software every day at NatureServe solidified my confidence to navigate GIS data in Arc. I was also given the opportunity to learn the Vista extension of ArcGIS created by NatureServe, as well as run two new software tools: Marxan and OpenNSPECT. Throughout this internship, I gained an understanding of the many conservation toolkits in existence that different Conservation NGOs use. I was not aware of all of the different ways that The Nature Conservancy, Conservation International, World Wildlife Fund, etc. were analyzing the data they collect in the field. This became a motivation for me to get involved in the Tools Workshop planning to help bring these organizations together and encourage sharing and collaboration of tools.

My supervisor, Patrick Crist along with the full-time GIS Analyst and Vista Developer Cameron Scott, were both wonderful teachers who were able to get me acquainted with the Vista software quickly and effectively. There are still many features of this software that I have yet to learn, however, my extended internship has allowed me to become more familiar with the many components of Vista. My goals this summer were to become familiar with how a Conservation NGO operates daily and works to get out the reports and articles that help to drive conservation policies in the U.S. I feel that this opportunity at NatureServe is allowing me to understand the networks that are formed amongst NGOs and how they communicate with each other. I had only seen NatureServe's name appear occasionally on data used in TerrSet tutorials and on other data downloaded for class research projects, but I was not familiar with who they were as an

organization. NatureServe is the exact type of Conservation NGO that I would want to work for. They are the perfect size (not too small or too large), they work internationally and their projects are constantly changing as they sign onto new proposals with other NGOs.

My current internship opportunities with NatureServe have connected me to managers and directors across a diverse expanse of Conservation organizations, including the UN CLME+, CI, WWF, TNC and Invemar to name a few. This has led me to great networking connections and opened doors to potential job opportunities that I don't think I could have received in such numbers at any other organizations. I have learned how to organize surveys directed at conservation professionals and about the ways that these organizations network with each other, which were skills that I was hoping to learn, but not expecting to learn during this internship. Overall, I have grown as a Conservation GIS professional immensely because of my experiences with NatureServe.

4.2 Preparation from Clark University

Clark University's GISDE program, housed in the IDCE and Geography Departments, helped to prepare me for an excellent internship experience. The faculty in this program put together highly developed and cutting-edge coursework that translate well into the GIS job market. The program also has flexibility to pursue specific interests, as I was able to take international development and environmentally related GIS courses. The connection with Clark Labs provided me with great training in their Terrset (formerly called IDRISI) software. However, in my experience throughout my internship, I rarely came across this software in the field. The Clark GISDE program name is recognized in part because of this connection, so I still feel that I am part of an innovative program. The advanced level coursework that I took throughout my first year, including Advanced Vector GIS, Advanced Raster GIS and Advanced

Remote Sensing prepared me for the high level of work I took on during my summer internship. I felt that these courses also helped me to be competitive when applying for internships, and eventually receiving the internship that I accepted.

4.3 Recommendation and Final Remarks

This internship fit perfectly with what I expected to learn during the summer, and is the exact type of organization where I want to spend my career. I would absolutely recommend this internship to fellow GISDE students who also want to work in a mid-sized Nonprofit Conservation organizations. Their network with other nonprofit organizations, and with smaller natural heritage programs allows for great conservation conversation across many levels. Their interaction with clients and the ability to choose from a broad range of projects was another highlight of my experience, and unique among other GIS internship experiences at competitive organizations. I came away with not only new GIS analysis experience, but great connections in a variety of organizations, and I feel confident in my upcoming job search for my next career step post-graduation.

Chapter 5 – Conclusion

NatureServe's mission 'to provide the scientific basis for effective conservation action' rings true to the goals for my conservation career path. I hope to be able to blend together my conservation biology experience from my undergraduate program together with my newly gained GIS analysis skills learned in my graduate program to find a way to protect endangered species across the world. GIS is a powerful tool for creating new conservation policies through research and analysis, and the outputs of many of the software and tools can be used to influence global decisions related to conservation and development. NatureServe provided me with an opportunity to be a part of current conservation projects and to add additional GIS 'tools to my tool belt' that I otherwise would not have learned. Together, with my experience in the GISDE program at Clark, I feel that I am a competitive applicant for a variety of GIS positions. I look forward to a challenging and rewarding career path ahead.

FIGURES

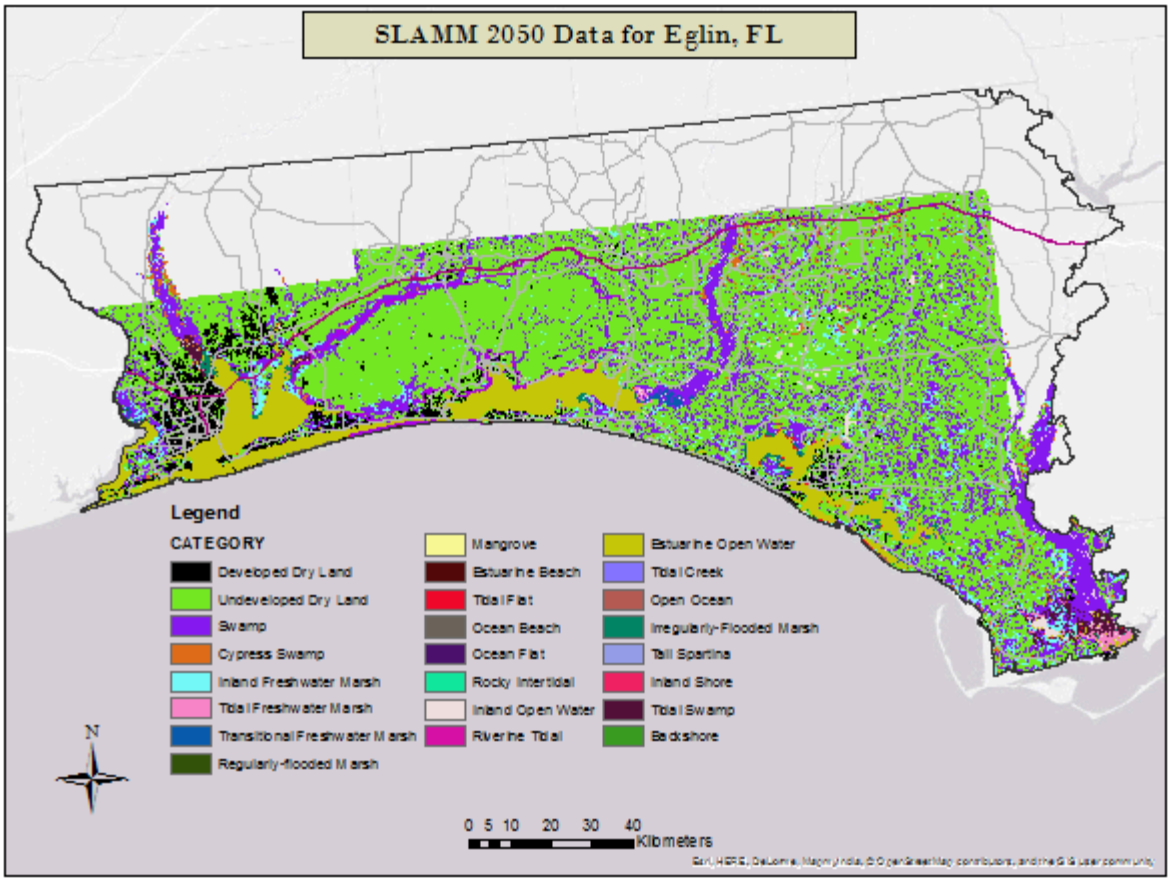

Figure 1: Study area boundary with SLAMM data depicted for the year 2050 and 0.5m sea-level rise.

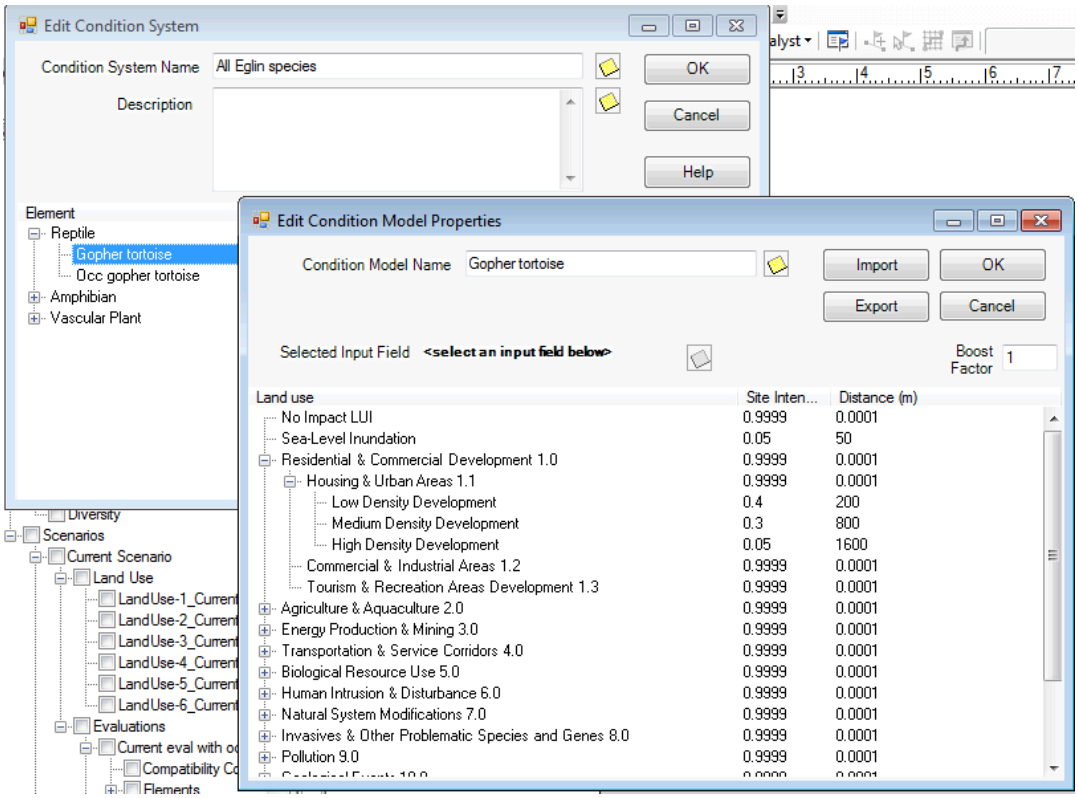

Figure 2: An example of some of the toolbars and inputs used to build the Vista Scenarios.

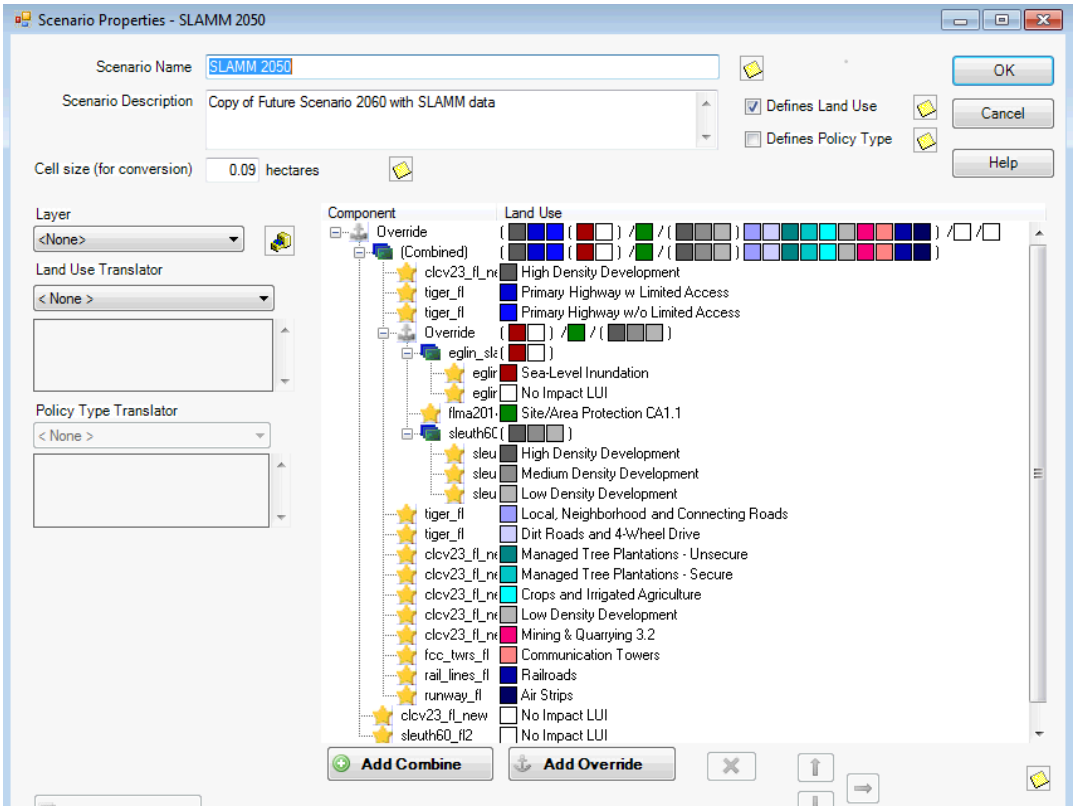

Figure 3: The Scenario window, where the layer, Land Use Translator, and Components all come together.

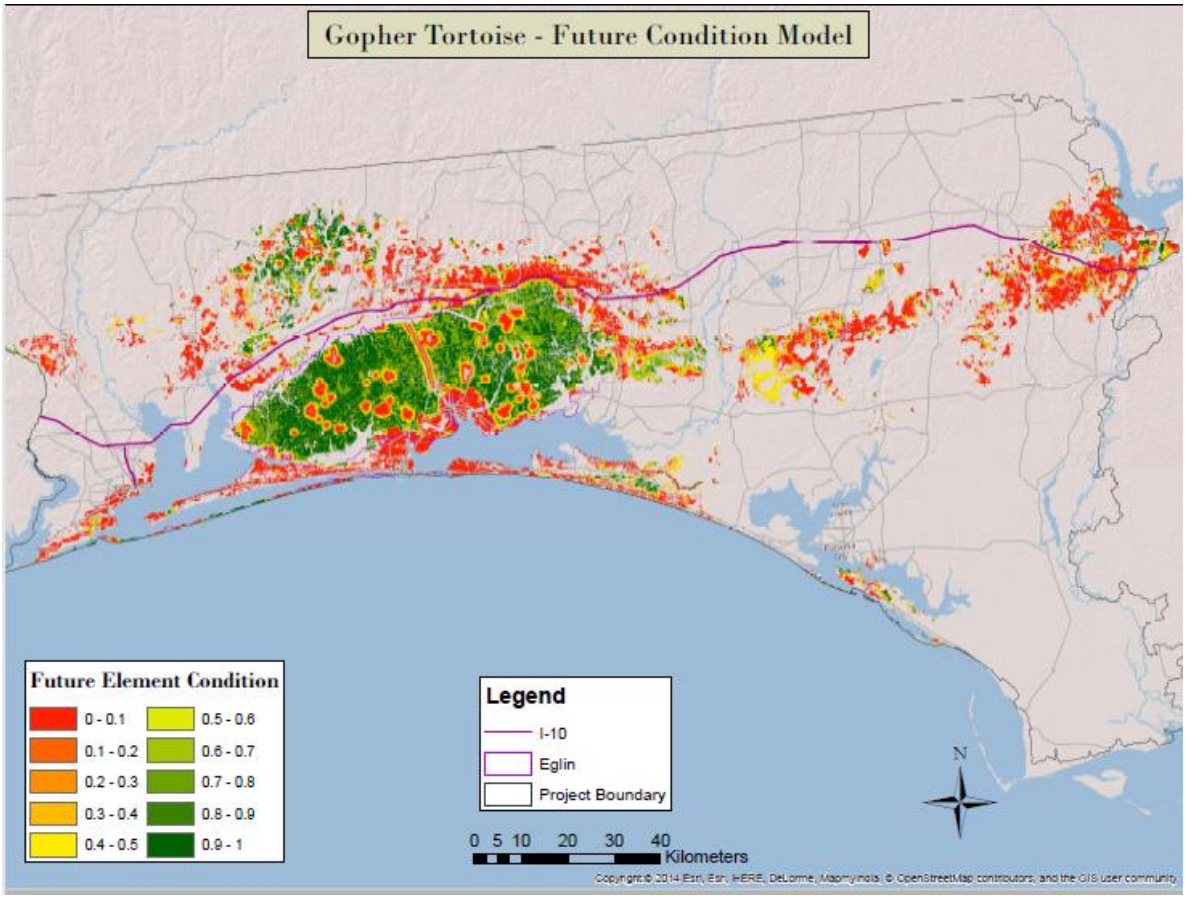

Figure 4: Future Condition Model of the Gopher Tortoise, with red depicting low condition and green depicting high condition.

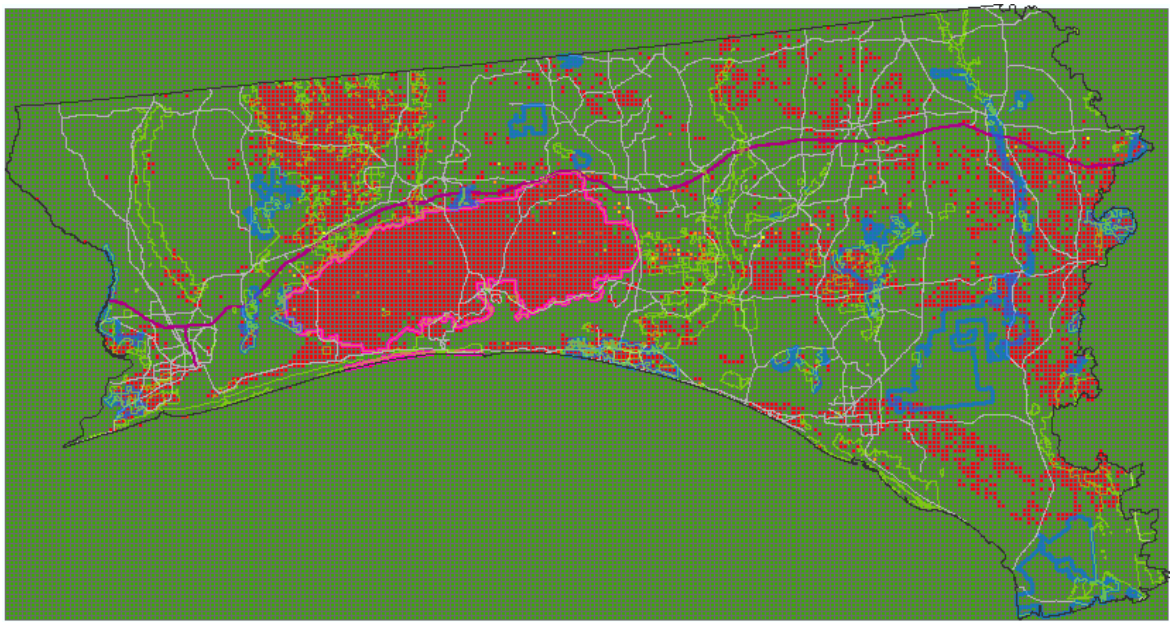

Figure 5: One Marxan output showing areas in red that are recommended as high levels of conservation. The blue, green, and pink outlines show currently protected areas in the study area. Many of these match up nicely to the Marxan outputs, particularly the Eglin base (outlined in pink).

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