USING SOCIAL VALUATION TO ASSESS THE PUBLIC ATTITUDES AND PREFERENCES OF THE MISSION-ARANSAS NATIONAL ESTUARINE RESEARCH RESERVE, TEXAS

By

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ACRONYMS

ANWR: Aransas National Wildlife Refuge

CV: Contingent Valuation

DTR: Distance to Rods

DTW: Distance to Water

EBM: Ecosystem-based Management

ES: Ecosystem Services

HD: Human Dimensions Program

HML: Hollings Marine Laboratory

IRB: Institutional Review Board

LULC: Land Use / Land Cover

MA-NERR: Mission-Aransas National Estuarine Research Reserve

NERR: National Estuarine Research Reserve

SV: Social Values

USGS: United States Geologic Survey

VI: Value Index

Abstract

Ecosystem services are the benefits provided by nature which enhance human well-being. These services can include food, storm protection, and clean water. Unfortunately, it is often difficult to value ecosystem services in a manner that conveys their importance to local resource managers and stakeholders. To inform the management practices undertaken by natural resource managers and policy-makers of the Mission Aransas National Estuarine Research Reserve (MA-NERR), TX, we utilized social valuation; a method of valuing ecosystem services which uses survey responses from local stakeholders to rank area ecosystem services.

Surveys were conducted between June and July of 2014 at twelve sampling sites within and around the reserve. The survey instrument was designed by researchers at the National Centers for Coastal Ocean Science (NCCOS) Hollings Marine Laboratory (HML) in Charleston, S.C., for the purpose of assessing stakeholder perceptions of ecosystem services. Respondents were asked about observed bio-physical changes to the environment over time, their opinion of specific management goals, and the adequacy of public access. The survey also included an interactive map, shown in Appendix B, where respondents could pinpoint locations of highly valued services.

Summer surveys were combined with surveys conducted in November, December, and January of 2013 by HML in collaboration with MA-NERR volunteers. To determine differences, respondents were categorized into four groups: Summer, winter, local and non-local. Data were analyzed using ArcGIS and SolVES (Social Values for Ecosystem Services). SolVES is a US Geological Survey application for the assessment, mapping, modeling, and quantification of ecosystem services. This methodology, in combination with non-spatial survey questions, allowed for the spatial identification and ranking of socially valued ecosystem services within

the MA-NERR to attain a robust assessment of the public attitudes and perceptions of the reserve.

Heat maps created through SolVES identified the location of highly valued ecosystem services within the MA-NERR and found a positive relationship to the underlying environmental characteristics. In addition, SolVES identified relationships between the location of valued services and the distance to water, distance to roads, and land use / land cover. A categorical analysis of survey responses identified a significant difference between visitor groups. The social valuation of ecosystem services provides useful information for resource managers and policy-makers in terms of making ecosystem-based resource management decisions, as well as encouraging public participation to provide a sense of democracy and legitimacy to the decision-making process.

Background

Ecosystem services (ES) can be defined as the benefits that humans derive from nature, which are necessary to live a full and healthy life (Yoskowitz 2010). These goods and services include, but are not limited to, food, storm protection, spiritual values, and recreation. Traditionally ES are categorized into four functional groups; provisioning (goods, such as timber provided by ecosystems), regulating (regulation of environmental conditions, such as water quality, that allows for optimized living conditions), cultural (intangible and non-market benefits, such as education, that enhance human lives), and supporting (natural processes, such as nutrient cycling, that are fundamental in maintaining all other ES) (MA 2005).

Natural ecosystems have been widely understood to be essential to human well-being. Yet, ecosystems continue to be degraded through unsustainable practices and often in exchange of short-term economic benefits (MA 2005). For example, oyster reefs fisheries in the Gulf of Mexico are valued at around $70M and provide several vital ES, including water purification and shoreline protection, but are some of the most overharvested marine ecosystems in the world (Peyre et al. 2012). As ecosystems degrade, their capacity to provide goods and services is also reduced (MA 2005). Major threats to ES include climate change, pollution, increasing populations, and urban sprawl (Gibbs 2009). The Millennium Ecosystem Assessment (2005) estimated that nearly 40% of the world population resides within 100 kilometers of the coast, and about 71% live within 50 kilometers of estuaries. In addition to these threats, human perception, resource use practices, and resource management decisions can have profound effects on ES. For example, a publication by Hughes et al. (2007) places the blame of resource losses on poor management models, which tend to overharvest ES, and fail to address damaging pressures.

Furthermore, resource policies can have significant effects on ES, as tradeoffs are weighed to maintain a desired set of ES by a particular community (Biggs et al. 2012; Scyphers et al. 2014). These tradeoffs often involve the prioritization of economically significant ES with the goal of attaining socio-economic benefits (Granek 2010). Given that some of ES provided by ecosystems lack monetary values, such as spiritual, aesthetic, and educational benefits, they can be perceived by policymakers as having a lesser importance and are usually not taken into account in resource management (Adger et al. 2005).

Ecosystem-based Management (EBM) has gained importance in the past decades as an environmental management approach to coastal and ocean environments (Granek 2010). This management perspective builds from a holistic and interdisciplinary methodological approach to resource management that takes into consideration human well-being, ecosystem function, and ES (Sherrouse et al. 2014). This form of management allows for the sustainable use of ecosystem goods and services that is both economically and ecologically sound. Today, it plays an essential role in responding to stressors and preventing further damage to ES (Adger et al. 2005). This is due to our understanding that fundamental links exist between human actions and environmental health (Scyphers et al. 2015; MA 2005). Figure 1 depicts these connections and how human well-being and ecological systems systematically affect one another, with ES identified as the shared befits.

In order to respond to environmental and human stressors to ecosystems, Berkes and Jolly (2001) indicate the need for place-based monitoring and analysis. This particular approach to resource management relies on the input of ecologic function information and the perceived societal values to determine specific management needs and goals (Granek 2010). Social values, or preferences, can be described as the priority placed on ecosystem goods and services that are based on the perceptions and attitudes of affected individuals of the public, henceforth called stakeholders (van Riper et al. 2012; Granek 2010). These are often non-monetary values that are perceived by stakeholders and correspond to ES (Sherrouse and Semmens 2012).

It is essential to include social values in resource management because the attitudes and perceptions of stakeholders dictate how goods and services are used (Sherrouse et al. 2011). For example, a study conducted by Orenstein and Groner (2014) on the political border between Jordan and Israel found that urban residents engaged in swimming and vehicle off-roading, while rural residents of the area engaged in biking and hiking. The study determined that cultural backgrounds and affluence had an effect on the use patterns of ES by the residents in the study area (Orenstein and Groner 2014). Even with this evidence, environmental management decisions are often made without taking into account the perceived social values of stakeholders, as they are often difficult to assess and incorporate non-monetary social values, especially when having to take into account various interest groups (Granek 2010).

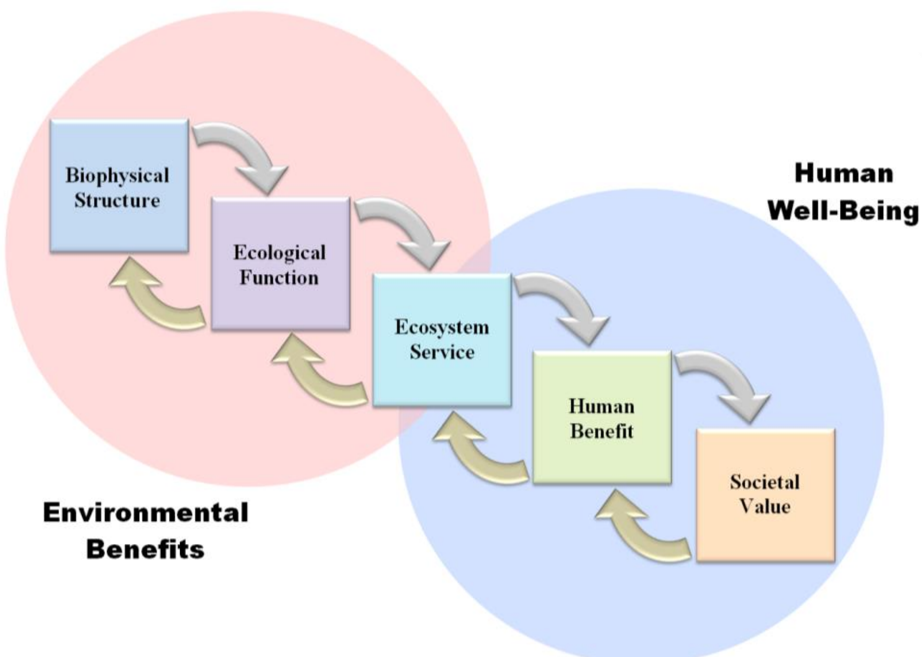


Figure 1. Socio-ecological connections of ecosystem services. (Modified from Potschin and Haines-Young, 2011)

It is often difficult to value ES in a manner that conveys their importance to stakeholders and policymakers. The valuation of non-market ES can be especially challenging due to the absence of well-connected links between environmental processes, ecological functions, ecosystem services, and social values (Sherrouse et al. 2011). There are currently over 20 methods for quantifying and valuing ES, each taking into account a diverse set of variables (Gibbs 2009). One method, social valuation, uses survey responses to assess and capture the human perception of ES (NOAA 2010). For example, a coastal community that values commercial fishing (provisioning service) over marsh land for storm protection (regulating service) might put more time and resources into the enhancement of fish stocks. A different community might value marsh highly for its water purification properties (regulating) over commercial fishing along their shorelines, thus putting their resource management efforts into enhancing the marsh. By using stakeholder survey responses to assess public perception at a micro scale, our understanding of the interrelationships between humans and natural systems is enhanced (Jordan et al. 2010; NOAA 2010). The contingent valuation (CV) method, also known as a “stated preference” method, is a form of social valuation that prompts survey respondents to allocate monetary values to ES using a hypothetical scenario (Mitchel and Carson 1989). Scientists have quickly realized its’ importance as a valuation tool to assess a wide variety of non-use, but inherently important, services (Mitchel and Carson 1989; Milcu et al. 2013).

Many spatial and temporal studies assessing socio-ecological connections that use stakeholder values have been conducted or are currently underway throughout the U.S. (Bagstad et al. 2015). These studies are important because the benefits and uses of ES usually span local, regional, and at global scales (Granek 2010). These studies are also significant because they identify the locations of ES that may have previously been unknown to resource managers.

Temporal analyses are also important because the benefits of ES require tradeoffs between short and long term use of those benefits (Granek, 2010; Scyphers et al. 2015).

Introduction

This study is part of a larger project being conducted in the Mission-Aransas National Estuarine Research Reserve (MA-NERR), Texas (Fig. 3) in collaboration with the Social Science Research Team at the National Centers for Coastal Ocean Science (NCCOS) Hollings Marine Laboratory (HML), Charleston, S.C., and MA-NERR resource managers. MA-NERR managers expressed interest in incorporating perceived social values of ES in the development of their new management plan, so to reflect those perceptions in the management of the reserve. The current plan, created in 2006, does not take into account these values. The main purpose of the larger project was to conduct surveys on stakeholder to assess their attitudes and preferences of the reserve and its ES.

To assist the MA-NERR, this thesis analyzed several relationships between ES, public perceptions of management issues, current environmental conditions, and bio-physical changes of the MA-NERR. The first objective was to identify the three highest ranking ES by visitor type (summer, winter, local, and non-local). The second objective was to determine the specific locations of the most valued ES and assess the relationship of underlying environmental characteristics. The third objective was to determine differences in survey question responses (bio-physical changes over time, adequacy of public access, and management goals) between summer versus winter visitors and local versus non-local visitors. To address these objectives, we administered a survey and analyzed responses through a social valuation tool called SolVES and applied statistical tests of association.

Social Values for Ecosystem Services (SolVES) is an application for ArcGIS used to "assess, map, and quantify the perceived social values of ES" (Sherrouse and Semmens 2012). SolVES was created by the United States Geologic Survey (USGS) in collaboration with Dr.

Jessica Clement at the University of Wyoming (Sherrouse and Semmens 2012). The general process flow of SolVES, used in this study to conduct the SolVES analysis, can be seen in Figure 2. A combination of public attitude and preference survey responses, area-specific environmental characteristics, and survey gathered spatial data points, were used to (a) identify highly valued ES, (b) show possible relationships between ES and underlying environmental characteristics, and (c) depict the geographic location of highly valued ES in heat maps (Fig. 2) (Sherrouse and Semmens 2015). Heat maps generated by SolVES depict hotspots of highly valued ES, thereby providing managers with a visual representation of ES, allowing for the prioritized assessment of those services (Loerzel 2013).

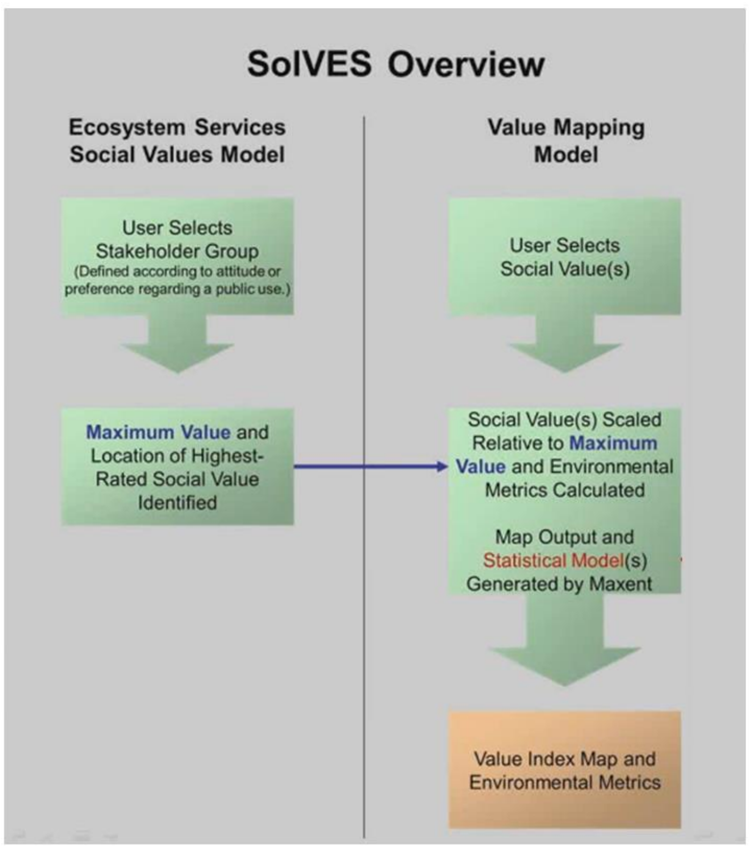


Figure 2. SolVES process flow model. (Modified from Sherrouse et al. 2012)

There are fewer than ten studies and reports worldwide that employ the SolVES program. The studies followed similar survey intercept methodologies and analysis, but the survey questions varied in an effort to incorporate the local bio-physical characteristics and address the management needs of each site.

Findings from this study will allow resource managers to prioritize effective and sustainable resource management decisions with the added benefit of encouraging public participation in the reserves decision making process (Biggs et al. 2012). Having limited funds and resources, MA-NERR managers are faced with making difficult decisions including managing the tradeoffs between different ES. The primary goal of this study is to aid decision-makers by using stakeholder perceptions in identifying valued ES and to identify possible relationships between perceived social values and specific visitor types. Including these results in the management plan will also encourage the implementation of EBM principles, public participation in the decision-making process, and enhance public advocacy for environmental health.

Methodology

Study Area

The MA-NERR is one of twenty-eight designated research reserves created through the Coastal Zone Management Act of 1972 and overseen by the National Oceanic and Atmospheric Administration. The National Estuarine Research Reserve (NERR) system was created to support long-term research of natural habitats and encourage resource stewardship through the protection of natural areas. The NERR system consists of 28 protected areas over 21 states. The MA-NERR was established in 2006 and is currently the only NERR site in Texas. It is the third largest research reserve and is comprised of 186,000 acres of diverse habitats, including marsh, mangroves, and oyster reefs (Fig. 3) (Evans et al. 2012). It is a shallow estuarine system that spans approximately 752 km^2 and has an average depth of about 2 meters (Evans et al. 2012; Mooney and McClelland 2012). It should also be noted that the purpose of the study area boundary, shown in Figure 3, is to manage the activities within the reserve and is not used as the extent of data collection or analysis.

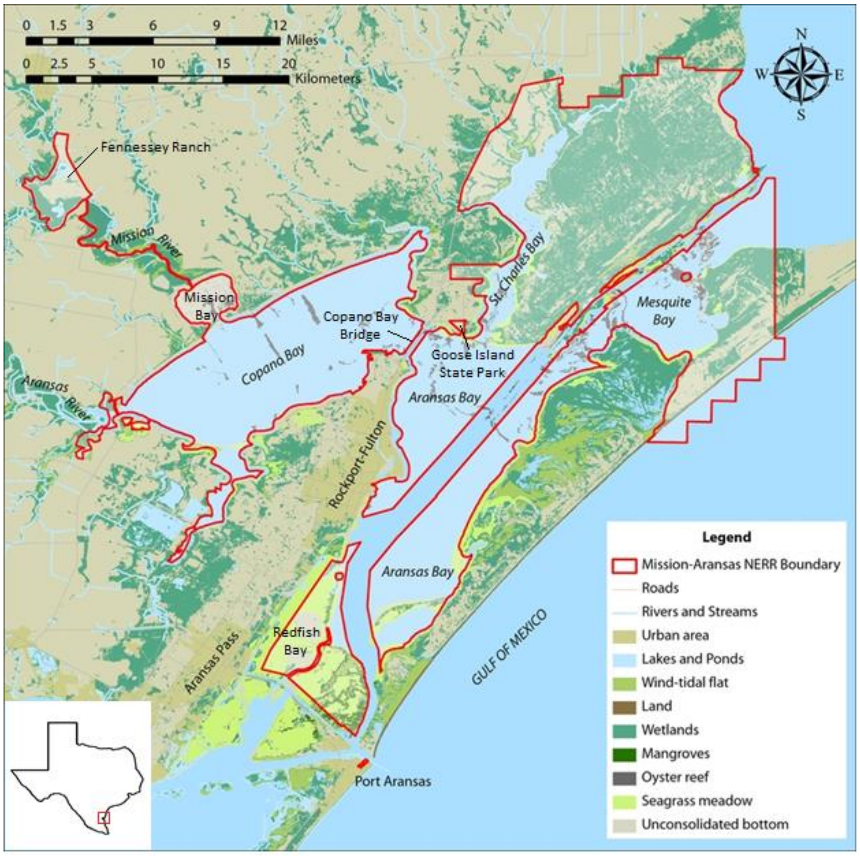


Figure 3. Mission-Aransas National Estuarine Research Reserve habitats and boundary. (Modified from Evans et al. 2012)

The Mission and Aransas Rivers are the two largest river systems that feed into the reserve. Their short river basins extend less than 100 miles from the shoreline to the Gulf of Mexico (Montagna et al. 2011). The rivers feed into several shallow bay systems that are located within the reserve; Copano, Mesquite, Aransas, St. Charles, Redfish, Port, and Mission (Evans et al. 2012). The Aransas, Calhoun, Nueces, Refugio, and San Patricio counties comprise the MA-NERR and its' neighboring areas. Several cities and towns surround the reserve including Rockport/Fulton, Portland, Aransas Pass, Port Aransas, Bayside, and Refugio.

Survey

The survey instrument, designed by NCCOS Social Science researchers, was originally used to capture the public attitudes and preferences of the Ashepoo-Combahee-Edisto Basin NERR, but was also developed with the intent of being transferrable to other coastal NERR locations (Loerzel 2013). The purpose of the survey was to aid researchers in understanding connections between environmental health and human well-being and was designed to elicit the respondents' opinions of current and long term management concerns. Overall, survey question responses provide managers with a better understanding of the public perceptions of reserve conditions by users, as well as their attitudes toward management issues and activities.

Surveys were administered to the users of the MA-NERR during the winter of 2013 and the summer of 2014. Initially, surveys were administered by paper methods. To reduce environmental impacts (e.g. reduce paper waste), decrease costs (e.g. printing, paper, stamps, envelops, labor), increase responses (e.g. convenience, improved user interface), and reduce transcription errors, surveys conducted through this study were administered online.

Each survey, shown in Appendix M, took about 20 minutes to complete and was comprised of nine sections:

1) Residency: Zip code and residency information for the respondent.
2) Bio-physical Changes: Observed changes over time by the respondent.
3) Statements: Respondents asked to express their views on the role of the MA-NERR in their lives and that of the surrounding community.
4) Value Allocation: Scenario where respondents were asked to rank ES by allocating monetary values to the services they value most. In this exercise, respondents were given 100 imaginary "pennies" to distribute amongst ES (Fig. 4).

5) Interactive Map: Survey takers asked to place markers in the areas within and near the MA-NERR they valued. Once a location was chosen, respondents identified the ES they valued at that specific location (Appendix B). Respondents were able to mark as many locations on the map as they choose, with a minimum of one.
6) Management Goals: Respondents asked for their opinion on the priority of current and future management goals of the MA-NERR.
7) Knowledge: Asked respondents to rank their level of understanding of general management subjects.
8) Public Access: Respondents asked about the adequacy of current public access and the need to acquire more lands for public use.
9) Demographics: Asked respondents for general demographic information.

To include a wide range of ES rather than focusing on specific services, ES were categorized into 13 groups called Social Values (SV). The survey included a description for each SV that is open to interpretation by the survey taker, shown in Figure 4. SolVES requires several inputs from the survey to function: map markers, management goal responses, and the value allocation (Sherrouse and Semmens 2015). The value allocation survey section, required in previous versions of SolVES, is now optional in the analysis of most recent version of the program, SolVES 3.0, which was employed in this study.

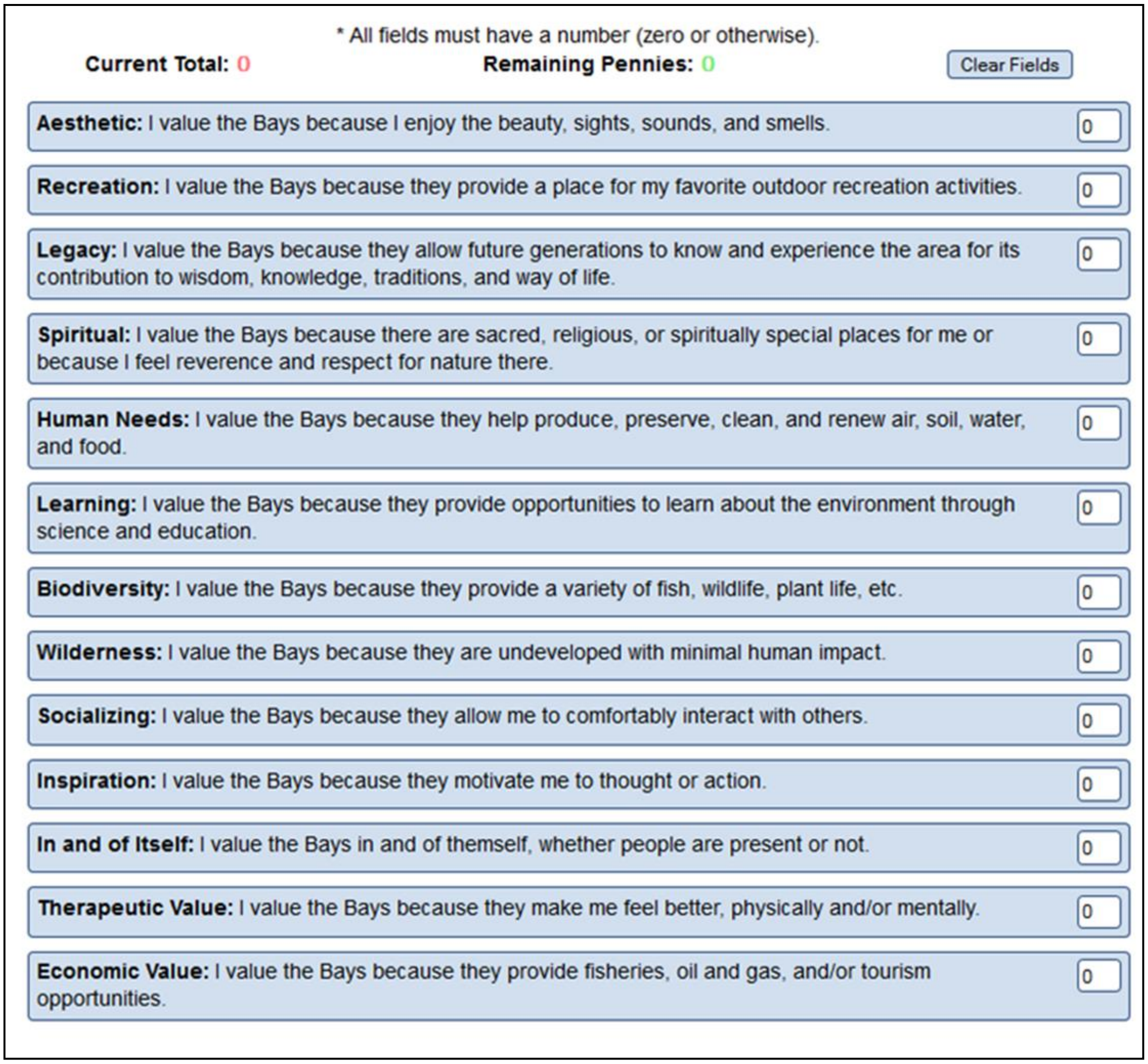


Figure 4. Screenshot of Social Value descriptions.

Respondent Selection

The target population of this study was the visitors and users of the MA-NERR, while the sample frame consisted of all the adults present at the sampling location during the time of sampling. Two trained interviewers walked each sampling location and approached adults to inquire about completing the survey. The survey intercept method was employed to ensure a mixed sample of MA-NERR stakeholders were intercepted. When few individuals were present at a sample site, then all adults were intercepted. However, if several groups of people were present with little difference between groups, then one person from each group was intercepted.

Once a potential respondent was identified, the surveyor provided the person a summary of the survey and its purpose and asked if a) if they were 18 or older, b) if they had previously visited the MA-NERR, and c) if they were willing to participate in the survey. Survey respondents were then selected if they answered “yes” to all three questions.

Sampling Locations

Sampling sites were selected based on the number of amenities available to users (e.g. fish cleaning stations, seating areas, water fountains, restrooms). These sites included marinas, piers, public and state parks, beaches and boat ramps. A complete list site names and locations, represented numerically in Figure 5, can be seen in Appendix A.

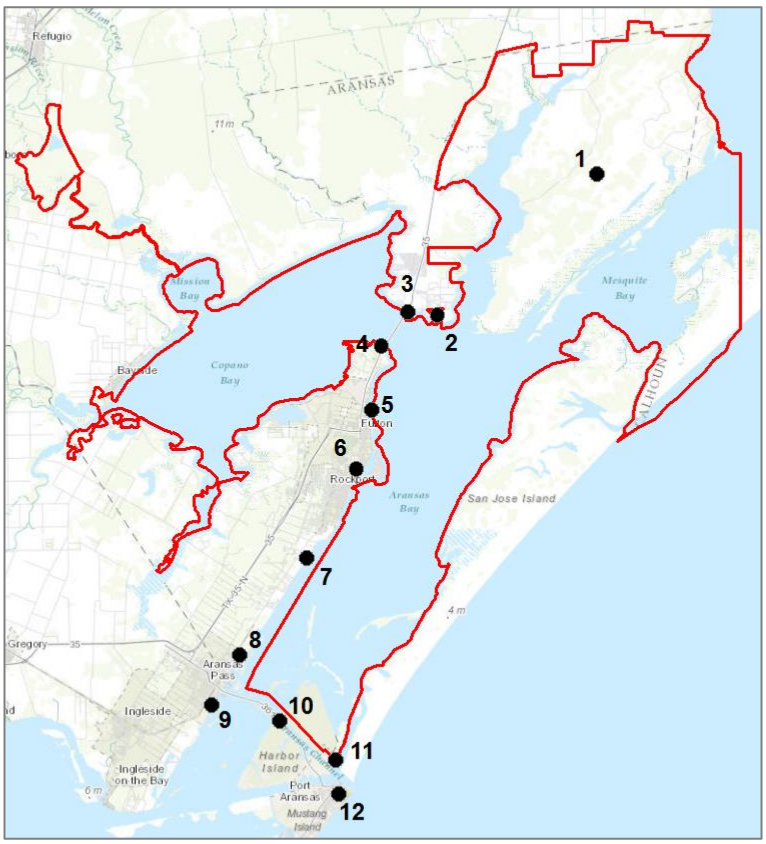


Figure 5. Sampling locations.

Survey Administration

In preparation for the survey administration in this study, an Institutional Review Board (IRB) protocol application was completed to ensure the study complied with institutional and governmental research guidelines. In addition, all surveyors completed the Responsible Conduct of Research course administered by the Collaborative Institutional Training Initiative, which was required by the Texas A&M University - Corpus Christi IRBs policy on ethical human research. Prior to its use, the survey instrument was also approved by the United States Office of Management and Budget (OMB control number: 0648-0687), as required by the Paperwork Reduction Act.

Winter 2013

Surveys were conducted in the MA-NERR during the winter of 2013 (November, December, January). The effort was led by Principle Investigators Jarrod Loerzel and Dr. Susan Lovelace, NCCOS social scientists at the HML, along with researchers at the MA-NERR, and with the aid of seventeen MA-NERR volunteers. In-person surveys were conducted at each of the sampling locations for 3-4 hours between 6am and noon, and in the evening, and for 3-4 hours between the hours of noon and 6pm. Surveys were administered by paper to in-person respondents, while respondents unable to take the survey in-person were given a business card with the URL to the survey online and the researchers' contact information. A total of 58 surveys were completed during the winter sampling period.

Summer 2014

Summer in-person surveys were conducted for a total of fourteen days between June and July of 2014. The same twelve locations sampled during the winter were surveyed during the summer. A canopy, table, sign, and water cooler where set up in a high visibility area at each survey site on the sampling days. Again, to ensure a mixed sample of reserve users, each location was sampled two times on two separate days; in the morning, for 3-4 hour intervals between 6am and noon, and in the evening, for 3-4 hour intervals between the hours of noon and 6pm. The in-person surveys were conducted through the use of two Samsung tablets and a MiFi portable wireless device. A business card with the URL to the survey website and researchers' contact information was given to respondents unable to take the survey in-situ, allowing them to complete the survey online at their convenience. Respondents who successfully completed the survey in person received a pen and a bottle of water as appreciation for their participation. A total of 86 surveys were completed during the summer sampling efforts.

Survey Data Treatment and Classification of Responses

Responses from the survey were classified according to two characteristics from respondents. First, respondents were categorized as summer or winter visitors depending on the season in which they completed the survey. Then, respondents were characterized according to their residence. To categorize respondents as either local or non-local, respondent zip codes gathered from the survey were mapped in ArcGIS 10.1.1. A buffer area of 20 miles was created from the center of the MA-NERR boundary. Those respondents whose zip codes fell outside the buffer area were categorized as non-local. The 20 mile buffer was chosen to exclude the population of Corpus Christi, TX, a city south of the reserve boundary. This was done because

Corpus Christi residents were unlikely to be familiar with the ecology, biology, and management issues of the MA-NERR. As a result of this classification, four stakeholder groups were analyzed in this study: Summer, winter, local, and non-local. The objective for the group classifications was to determine if a difference existed in attitudes and perceptions of visitors concerning to ES and the reserve. This could inform reserve managers of the benefits of ecosystems valued by different stakeholder groups, leading to improved prioritization of resource management.

Spatial Data

Three 30 meter resolution spatial layers were chosen as SolVES inputs which represented the underlying characteristics of the study area: Distance to Water (DTW), Distance to Roads (DTR), and Land Use / Land Cover (LULC). The Euclidian Distance tool (shortest horizontal straight line from each cell to a variable in meters) in ArcGIS was used on a 2010 Texas hydrology geodatabase (USGS 2010) and a 2014 Texas roadways geodatabase (TNRIS 2014) to create DTW and DTR layers. The LULC layer was derived from a 2010-era Land Use / Land Cover dataset (NOAA 2011). Other spatial layers used in the analysis were county boundaries, state boundaries, and a study area boundary, which were used as spatial references (Jarrod Loerzel, Personal Communication).

The landscape characterizing layers were chosen based on previous SolVES studies and SolVES 2.0 and 3.0 manual (Sherrouse et al. 2011; Sherrouse and Semmens 2012; van Riper et al. 2012; Sherrouse and Semmens 2014; Sherrouse et al. 2014; Bagstad et al. 2015; Sherrouse and Semmens 2015). The DTR and DTW layers were used in this study to explore how the accessibility impacts the valuation of ES by users of the reserve. Examining the LULC layer also allowed us to assess the underlying land types and uses associated with highly valued ES.

Data Analysis

SolVES Analysis

To address the first two objectives of this study, survey gathered map markers, value allocation responses, management goal survey responses, and the spatial layers were input into the SolVES program through a geodatabase. The SolVES analysis was repeated once for each of the visitor types (summer, winter, local, non-local). To create a weighted density surface SolVES used the “pennies” allocated to each SV and combined that data with the number of markers placed for that SV. Higher density values are a result of having a greater amount of combined points, which are generated as kernel densities for the study area. The SV containing the cell with the highest overall weighted density is used to normalize the density surfaces of all the SV, thus defining the most valued area per SV. The SV are then ranked using a Value Index (VI), which assigns value between 1 and 10, with 1 being the lowest ranked and 10 being the highest. (Sherrouse et al. 2011; Sherrouse and Semmens 2015)

The following criteria were assigned in SolVES using the Analyze Survey Data Tool, shown in Figure 6: DTR and DTW were categorized as continuous data, while the LULC layer was identified as categorical data. The analysis was conducted “By Survey Subgroup Across Social Value Types.” “Public Use” and “Attitude or Preference” options were left blank to analyze all SV. The scale of the map used in the survey mapping exercise was 1:250,000. To generate the most accurate heat maps, the SolVES 3.0 Manual suggest making the output cell size 1:1000 of the map scale, so a cell size of 250 meters was chosen (Sherrouse and Semmens 2015). The search radius, used to determine the extent of data used for statistical calculations within SolVES, is automatically set to 100 times the output cell size, to include data from the areas surrounding the study area boundary in the analysis. A buffer area of 1000 meters around the study area was chosen to ensure the majority of map markers were included in the analysis. The "Threshold Features" option was chosen to reduce the visibility of high profile structures in heat maps. Survey points were also weighted. The same options were selected for each analysis by visitor type.

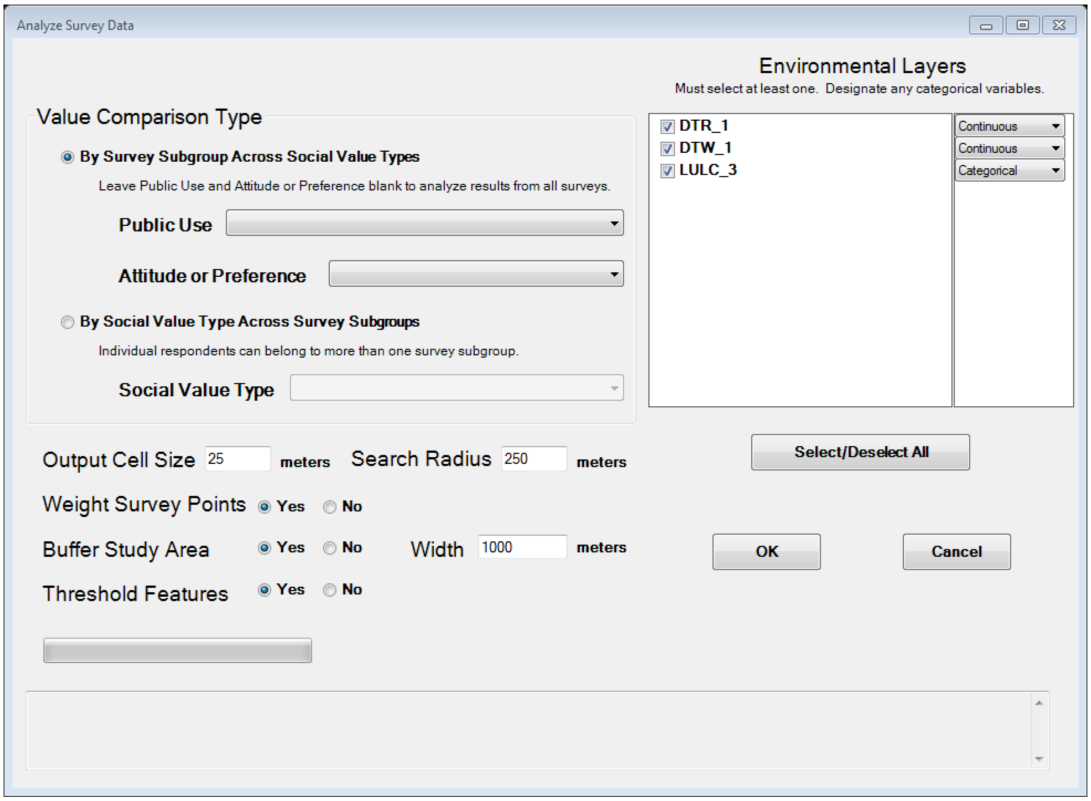


Figure 6. Screenshot of the Analyze Survey Data Tool found in SolVES. (Modified from Sherrouse and Semmens 2015)

Statistical Analysis

Summary statistics were computed to assess demographic characteristics and attributes of survey respondents (Means and Standard Deviations). To address the third objective, categorical association tests (Chi Square) were used to explore the Management Goals, Public Access, and Bio-physical Change responses between the summer and winter visitors, and also the local and non-local visitors. The association tests explored whether significant differences existed between how participants responded to these sections. Level of significance was established at an α below or equal to 0.05. An in depth analysis was then conducted on the survey criteria where significant differences were observed.

Results

Summary Statistics

A total of 144 surveys were completed with 58 conducted during the winter sampling period and 86 during the summer. Non-local respondents characterized 108 of the responses, with only 36 local respondents. Summer respondents were typically Caucasian males with an average age of 54 years (SD= 14.4 yr), who had attained at least a college degree, were retired, and earned between $40,000 and $69,999 a year. Winter respondents were also typically Caucasian men with an average age of 58 years (SD= 15 yr), who attained at least a college degree, were retired, and earned at least $70,000 annually. Local visitors had an average age of 58 years (SD= 16.6 yr), were mostly Caucasian men who had attained a college degree and were retired with an average income between $40,000 and $69,000. Non-local respondents were for the most part Caucasian males with an average age of 55 years (SD= 13.7 yr) who were retired and earned an income of $70,000 or more. Detailed demographic data for all visitor types can be viewed in Appendix C. An analysis of respondent zip codes, shown in Appendix D, indicated the reserve had visitors from as far as Mountain View, HI, while the majority of non-local respondents were residents of San Antonio, Texas.

Survey Responses for all Visitor Types

An analysis of all bio-physical change responses, detailed by visitor type in Appendix G, showed that participants were mostly ‘unsure’ or did not see any changes in these items. In Table 1 for example, over 50% of respondents were ‘unsure’ of the abundance of oysters, while almost 20% of responses indicated ‘no change’ in the conditions of oysters and less than 1% indicated a large increase in oyster abundance. ‘No change’ was observed in public access to land and water resources by about 40% of respondents, with zero indicating a ‘large decrease’. Increases (over 29%) were reported for the occurrence of red tides and shoreline erosion. Finally, respondents observed a ‘decrease’ in the abundance of fish (29.86%).

Table 1. Bio-physical change responses for all survey respondents (percent).

Bio-physical Changes							
Criteria	Large Increase	Increase	No Change	Decrease	Large Decrease	Unsure	No Response
Abundance of oysters	0.69	11.81	19.44	11.11	2.78	51.39	2.78
Abundance of fish	2.08	11.11	31.94	29.86	5.56	18.06	1.39
Abundance of blue crabs	1.39	6.25	22.22	21.53	6.25	40.97	1.39
Abundance of seagrass	4.86	20.14	34.72	13.19	1.39	25.00	0.69
Shoreline erosion	2.08	29.17	41.67	4.86	0.00	21.53	0.69
Abundance of birds	2.08	28.47	40.28	9.72	2.78	15.97	0.69
Abundance of wildlife	1.39	22.22	47.92	16.67	2.08	9.03	0.69
Public access to land and water resources	1.39	11.11	39.58	7.64	0.00	38.19	2.08
Red tide occurrences	9.72	29.86	31.25	15.28	1.39	11.81	0.69
Abundance of jellyfish	4.17	22.22	43.75	17.36	2.08	9.72	0.69

In the management goals section, shown in detail by visitor type in Appendix E, respondents agreed for the most part that all items showed some level of importance that should be addressed in future management efforts. For example, in Table 2, about 60% of respondents said that improving the water quality of the MA-NERR was a ‘high priority’, and zero respondents indicated that it was not a ‘priority’. Restoring and sustaining fish stocks and other marine resources was considered a ‘priority’ or a ‘high priority’ by almost 90% of respondents. Interestingly, responses shift from a ‘high priority’ when looking at purely ecological criteria, to ‘priority’ when looking at items that include social and cultural concerns, such as increasing awareness and inclusion of heritage.

Table 2. Management goal responses for all survey respondents (percent).

Management Goals							
Criteria	**High Priority**	**Priority**	**Neutral**	**Low Priority**	**Not a Priority**	**Unsure**	**No Response**
Improve water quality in the local bays	59.72	27.78	5.56	2.08	0.00	2.08	2.78
Improve freshwater inflows into the bays	42.36	26.39	12.50	2.78	0.69	11.11	4.17
Manage the quantity and improve the quality of storm water runoff into the bays	45.83	32.64	10.42	2.08	1.39	4.86	2.78
Restore shoreline and wetland habitats	47.22	34.03	9.72	3.47	1.39	0.69	3.47
Eliminate further loss of shoreline, seagrass and wetland habitats	51.39	37.50	4.17	2.78	0.69	0.69	2.78
Restore and sustain fish stocks and other living marine resources in the bays	57.64	31.94	2.78	2.78	0.69	1.39	2.78
Provide increased levels of public access to the bays and its resources	22.22	24.31	25.69	14.58	9.03	0.69	3.47
Increase the resilience of coastal communities in the face of natural and human-induced disasters (i.e. hurricanes, rising seas)	27.08	38.19	13.19	8.33	6.94	2.78	3.47
Incorporate local social and cultural heritage into management of the Bay's resources	15.28	38.19	20.83	14.58	4.86	2.78	3.47
Increase awareness of human-use patterns that influence resources sustainability	28.47	48.61	13.89	4.17	0.00	1.39	3.47
Integrate understanding of human uses with knowledge of natural processes	24.31	39.58	22.92	4.17	1.39	2.08	5.56
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the bays	19.44	31.25	20.83	9.72	10.42	3.47	4.86

In General, respondents indicated in the public access options that they had ‘adequate’ access to the criteria listed. These responses may be seen by visitor type in Appendix F. In Table 3, for example, 44% of respondents stated that they had ‘adequate’ access to rod and reel fishing sites, with none indicating ‘little or no’ access. In addition, participants indicated that they had ‘adequate’ access to kayaking sites as well as scenic viewpoints and beaches. However, almost 42% of respondents mentioned they were ‘unsure’ about the adequacy of public oyster sites, with less than 3% saying there was ‘more than adequate’ access.

Table 3. Public access change responses for all survey respondents (percent).

Public Access							
Criteria	More than adequate	Adequate	Neutral	Inadequate	Little/No Access	Unsure	No Response
Boat Ramps	11.81	49.31	12.50	7.64	0.69	13.89	4.17
Beaches	21.53	47.22	9.03	12.50	2.08	4.17	3.47
Boat Slips	11.81	34.72	13.89	5.56	0.69	27.08	6.25
Restaurants and Restaurant Dockage	15.97	46.53	13.19	9.72	2.08	6.25	6.25
Scenic View Points	21.53	44.44	13.19	10.42	4.17	2.08	4.17
Waterway Nature Trails (e.g. Kayak Trail)	8.33	34.03	11.81	15.97	2.08	21.53	6.25
Nature Trails Adjacent to Water	4.86	27.78	19.44	22.92	4.17	13.89	6.94
Natural Swimming Areas	11.81	38.19	11.11	19.44	2.08	12.50	4.86
Boardwalks	6.25	39.86	22.22	14.58	6.94	5.56	4.86
Dune Walkovers	6.94	25.69	20.14	13.89	4.86	22.22	6.25
Camping	15.97	40.28	13.19	11.11	2.78	10.42	6.25
Wind/Kite Surfing	8.33	34.03	23.61	2.78	1.39	22.92	6.94
Kayaking Sites	10.42	45.83	12.50	6.25	0.69	16.67	7.64
Rod and Reel Fishing Sites	25.00	43.75	6.94	11.81	0.00	7.64	4.86
Fly Fishing Sites	8.33	22.22	22.92	6.94	4.86	29.86	4.86
Public Oyster Sites	2.78	13.89	14.58	9.72	9.03	41.67	8.33

Chi Square Analysis

Summer v. Winter

The bio-physical change responses between the summer and winter, shown in Figure 4, revealed a total of five significant differences: Abundance of blue crabs ($p = 0.035$), abundance of birds ($p = 0.004$), abundance of wildlife ($p = 0.014$), public access to land and water resources ($p = 0.037$), and red tide occurrences ($p = 0.008$).

Table 4. Chi square results of summer versus winter responses for bio-physical changes.

Bio-physical Changes: Summer vs Winter		
Criteria	**Chi Square**	**P-value**
Abundance of oysters	9.55	0.145
Abundance of fish	9.86	0.131
Abundance of blue crabs	13.59	0.035
Abundance of seagrass	9.96	0.126
Shoreline erosion	3.46	0.630
Abundance of birds	19.25	0.004
Abundance of wildlife	15.90	0.014
Public access to land and water resources	11.86	0.037
Red tide occurrences	17.37	0.008
Abundance of jellyfish	11.29	0.080

Table 5 shows a more detailed comparison of the summer versus winter responses that allows for the identification of important differences in the bio-physical change section of the survey. For example, the majority of winter respondents (56.9%) indicated they were unsure of the abundance of blue crabs, while summer respondents indicated either ‘no change’ (27.9%) or ‘unsure’ (30.2%). The majority of summer respondents indicated ‘increase’ (37.2%) or ‘no change’ (40.7%) in the abundance of birds, as compared to winter visitors who indicated ‘no change’ (39.7%) or ‘unsure’ (29.3%). A clear majority of summer responses indicated the abundance of wildlife as ‘no change’ (54.7%), where winter respondents indicated either ‘increase’ (29.3%) or ‘no change’ (37.9%). A majority of summer visitors (50%) indicated ‘no change’ in public access to land and water resources over time and just under 30% indicated they were ‘unsure’, while a majority of winter respondents indicated they were ‘unsure’ (51.7%) of changes in public access in the reserve. Both the majority of summer and winter responses showed either an ‘increase’ or ‘no change’ pertaining to red tide occurrences, however, summer respondents had a slightly higher majority who indicated ‘no change’ (33.7%), as compared to winter respondents who had a majority responses were equally divided between 'increase' (27.6%) and 'no change' (27.6%).

Table 5. Comparison of bio-physical change responses between summer and winter visitors (percent).

Bio-Physical Changes: Summer vs Winter								
Criteria	**Visitor Type**	**Large Increase**	**Increase**	**No Change**	**Decrease**	**Large Decrease**	**Unsure**	**No Response**
Abundance of blue crabs	**Summer**	1.2%	9.3%	27.9%	23.3%	7.0%	30.2%	1.2%
	Winter	1.7%	1.7%	13.8%	19.0%	5.2%	56.9%	1.7%
Abundance of birds	**Summer**	1.2%	37.2%	40.7%	9.3%	3.5%	7.0%	1.2%
	Winter	3.5%	15.5%	39.7%	10.3%	1.7%	29.3%	0.0%
Abundance of wildlife	**Summer**	1.2%	17.4%	54.7%	20.9%	1.2%	3.5%	1.2%
	Winter	1.7%	29.3%	37.9%	10.3%	3.5%	17.2%	0.0%
Public access to land and water resources	**Summer**	1.2%	10.5%	50.0%	8.1%	0.0%	29.7%	1.2%
	Winter	1.7%	12.1%	24.1%	6.9%	0.0%	51.7%	3.5%
Red tide occurrences	**Summer**	11.6%	31.4%	33.7%	16.3%	2.3%	3.5%	1.2%
	Winter	6.9%	27.6%	27.6%	13.8%	0.0%	24.1%	0.0%

Five significant differences were found between summer and winter management goal responses, seen in Table 6. These were: Improving water quality (p = 0.027), restoring shoreline and wetland habitats (p = <0.0001), eliminating further loss of shoreline, seagrass and wetland habitats (p = 0.011), increase awareness of human-use patterns that influence resource sustainability (p = 0.004), and purchasing additional non-wetland areas to add to publically owned lands within or adjacent to the bays (p = 0.003).

Table 6. Chi square results of summer versus winter responses for management goals.

Management Goals: Summer vs Winter		
Criteria	**Chi Square**	**P-value**
Improve water quality in the local bays	12.65	0.027
Improve freshwater inflows into the bays	7.60	0.269
Manage the quantity and improve the quality of storm water runoff into the bays	11.16	0.084
Restore shoreline and wetland habitats	33.75	<0.0001
Eliminate further loss of shoreline, seagrass and wetland habitats	16.48	0.011
Restore and sustain fish stocks and other living marine resources in the bays	11.01	0.088
Provide increased levels of public access to the bays and its resources	5.07	0.535
Increase the resilience of coastal communities in the face of natural and human-induced disasters (i.e. hurricanes, rising seas)	4.09	0.665
Incorporate local social and cultural heritage into management of the Bay's resources	6.79	0.341
Increase awareness of human-use patterns that influence resource sustainability	17.11	0.004
Integrate understanding of human uses with knowledge of natural processes	11.47	0.075
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the bays	20.18	0.003

The majority of responses for summer and winter tended to be either a 'high priority' or a 'priority' for the management goals section, as seen in Table 7. Summer and winter respondents both indicated that improving the quality in the reserve was a 'high priority' (65.1% and 51.7% respectively), however, 32.8% of winter visitors indicated improving the water quality to be a priority, as compared to 24.4% of summer visitors. A large majority of summer visitors indicated that restoring shoreline and wetland habitats was a 'high priority' (65.1%), as compared to a majority of winter visitors who indicated habitat restoration as a 'priority' (50%). Summer respondents (60.5%) indicated that eliminating further loss of shoreline, seagrass, and wetland habitats was a ‘high priority’, in contrast, 48.3% of winter visitors indicated this management goal was a ‘priority’. The majority of summer responses were divided between ‘high priority’ (25.6%) and ‘priority’ (25.6%) on the issue of purchasing additional non-wetland areas to add to the publicly owned lands within and adjacent to the reserve, however, winter respondents indicated this goal as a ‘priority’ (39.7%).

Table 7. Comparison of management goal responses between summer and winter visitors (percent).

Management Goals: Summer vs Winter								
Criteria	**Visitor Type**	**High Priority**	**Priority**	**Neutral**	**Low priority**	**Not a priority**	**No Response**	**Unsure**
Improve water quality	**Summer**	65.1%	24.4%	4.7%	1.2%	0.0%	4.7%	0.0%
	Winter	51.7%	32.8%	6.9%	3.5%	0.0%	0.0%	5.2%
Restore shoreline and wetland habitats	**Summer**	62.8%	23.3%	5.8%	2.3%	0.0%	5.8%	0.0%
	Winter	24.1%	50.0%	15.5%	5.2%	3.5%	0.0%	1.7%
Eliminate further loss of shoreline, seagrass and wetland habitats	**Summer**	60.5%	30.2%	3.5%	1.2%	0.0%	4.7%	0.0%
	Winter	37.9%	48.3%	5.2%	5.2%	1.7%	0.0%	1.7%
Increase awareness of human-use patterns that influence resource sustainability	**Summer**	37.2%	44.2%	8.1%	4.7%	0.0%	5.8%	0.0%
	Winter	15.5%	53.5%	22.4%	3.5%	0.0%	1.7%	3.5%
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the Bays	**Summer**	25.6%	25.6%	23.3%	9.3%	7.0%	8.1%	1.2%
	Winter	10.3%	39.7%	17.2%	10.3%	15.5%	0.0%	6.9%

The chi square results for public access, seen in Table 8, had six responses with significant differences between summer and winter visitors: Boat ramps ($p = 0.001$), nature trails adjacent to water ($p = 0.034$), natural swimming areas ($p = 0.005$), dune walkovers ($p = 0.006$), camping ($p = 0.023$), and public oyster sites ($p = 0.006$).

Table 8. Chi square results of summer versus winter responses for public access.

Public Access: Summer vs Winter		
Criteria	**Chi Square**	**P-value**
Boat Ramps	21.67	0.001
Beaches	7.27	0.296
Boat Slips	7.97	0.240
Restaurants and Restaurant Dockage	10.57	0.103
Scenic View Points	8.56	0.200
Waterway Nature Trails (e.g. Kayak Trails)	6.92	0.328
Nature Trails Adjacent to Water	13.66	0.034
Natural Swimming Areas	18.47	0.005
Boardwalks	7.58	0.270
Dune Walkovers	18.08	0.006
Camping	14.72	0.023
Wind/Kite Surfing	6.66	0.353
Kayaking Sites	10.99	0.089
Rod and Reel Fishing Sites	7.05	0.217
Fly Fishing Sites	10.97	0.089
Public Oyster Sites	18.26	0.006

The summer versus winter comparison of the public access survey had many more ‘unsure’ responses than in the other sections, as seen in Table 9. Both summer (46.5%) and winter respondents (53.5%) indicated the access to boat ramps as ‘adequate’, however, 25.9% of winter also responded ‘unsure’ to their access adequacy. The majority of summer responses were equally distributed between ‘adequate’ (27.9%) and ‘inadequate’ (27.9%) for the access of nature trails adjacent to the water, while winter responses indicated nature trail access as adequate (27.6%) and neutral (25.9%). A majority of summer respondents (44.2%) considered natural swimming areas to be ‘adequate’. Winter responses indicated access to swimming areas to be ‘adequate’ (29.3%) but also had 24.1% of respondents indicating they were ‘unsure’. A simple majority of summer visitors indicated dune walkover access to be ‘adequate’ (30.2%), however, 37.9% winter respondent indicted they were ‘unsure’. A majority of summer and winter responses indicated camping access to be ‘adequate’ (41.9% and 37.9% respectively), however, 23.3% of summer respondents also indicated camping to be ‘more than adequate’, compared to just 5.2% of winter respondents. A large majority of winter respondents (58.6%) said they were unsure of the access to public oyster sites, similar to a majority of winter responses (30.2%), however, 19.8% of winter respondents indicated access to public oyster sites as ‘neutral’ and 18.6% to be ‘adequate’.

Table 9. Comparison of public access responses between summer and winter visitors (percent).

Public Access: Summer vs Winter								
Criteria	**Visitor Type**	**More Than Adequate**	**Adequate**	**Neutral**	**Inadequate**	**Little or No Access**	**Unsure**	**No Response**
Boat ramps	**Summer**	12.8%	46.5%	18.6%	10.5%	1.2%	5.8%	4.7%
	Winter	10.3%	53.5%	3.5%	3.5%	0.0%	25.9%	3.5%
Nature trails adjacent to water	**Summer**	3.5%	27.9%	15.1%	27.9%	7.0%	10.5%	8.1%
	Winter	6.9%	27.6%	25.9%	15.5%	0.0%	19.0%	5.2%
Natural swimming areas	**Summer**	14.0%	44.2%	8.1%	20.9%	3.5%	4.7%	4.7%
	Winter	8.6%	29.3%	15.5%	17.2%	0.0%	24.1%	5.2%
Dune walkovers	**Summer**	9.3%	30.2%	19.8%	18.6%	4.7%	11.6%	5.8%
	Winter	3.5%	19.0%	20.7%	6.9%	5.2%	37.9%	6.9%
Camping	**Summer**	23.3%	41.9%	9.3%	11.6%	1.2%	8.1%	4.7%
	Winter	5.2%	37.9%	19.0%	10.3%	5.2%	13.8%	8.6%
Public oyster sites	**Summer**	2.3%	18.6%	19.8%	12.8%	7.0%	30.2%	9.3%
	Winter	3.5%	6.9%	6.9%	5.2%	12.1%	58.6%	6.9%

Local v. Non-local

A comparison of the bio-physical responses showed no significant differences between local and non-local respondents, shown in Table 10.

Table 10. Chi square results of local versus non-local responses of bio-physical changes.

Bio-physical Changes: Local vs Non-local		
Criteria	**Chi Square**	**P-value**
Abundance of oysters	12.09	0.060
Abundance of fish	11.17	0.083
Abundance of blue crabs	5.89	0.436
Abundance of seagrass	10.59	0.102
Shoreline erosion	5.55	0.353
Abundance of birds	11.50	0.074
Abundance of wildlife	11.40	0.077
Public access to land and water resources	9.41	0.094
Red tide occurrences	5.15	0.524
Abundance of jellyfish	9.29	0.158

Three differences were observed between management goals in the local versus non-local comparison in Table 11: Improving freshwater inflows into the bays ($p = 0.037$), managing the quantity and improving the quality of storm water runoff ($p = 0.005$), and providing increased levels of public access to the reserve and its resources ($p = 0.017$).

Table 11. Chi square results of local versus non-local responses of management goals.

Management Goals: Local vs Non-local		
Criteria	**Chi Square**	**P-value**
Improve water quality in the local bays	4.95	0.422
Improve freshwater inflows into the bays	13.42	0.037
Manage the quantity and improve the quality of storm water runoff into the bays	18.49	0.005
Restore shoreline and wetland habitats	8.20	0.224
Eliminate further loss of shoreline, seagrass and wetland habitats	5.73	0.454
Restore and sustain fish stocks and other living marine resources in the bays	8.41	0.210
Provide increased levels of public access to the bays and its resources	15.43	0.017
Increase the resilience of coastal communities in the face of natural and human-induced disasters (i.e. hurricanes, rising seas)	9.08	0.169
Incorporate local social and cultural heritage into management of the bay's resources	11.24	0.081
Increase awareness of human-use patterns that influence resource sustainability	4.33	0.503
Integrate understanding of human uses with knowledge of natural processes	10.56	0.103
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the bays	6.35	0.386

Table 12 shows the comparison of responses between local and non-local visitors for the management goal survey section. A large majority of local respondents (63.9%) indicated that improving freshwater inflows into the reserve was a 'high priority', while winter respondents said this management goal was a 'high priority' (35.2%) and a 'priority' (31.5%). A large majority of local respondents (66.7%) also indicated that managing the quantity and improving the quality of storm water runoff into the reserve was a 'high priority', as compared to non-local responses showing 38.9% as 'high priority' and 36.1% as 'priority'. When asked about increasing the public access to the reserve, the majority of responses for local visitors were divided between 'high priority' (27.8%) and 'not a priority' (22.7%), compared to local respondents who indicated this to be a 'priority' (25.9%) or 'neutral' (29.6%).

Table 12. Comparison of management goal responses between local and non-local respondents (percent).

Management Goals: Local vs Non-local								
Criteria	**Visitor Type**	**High Priority**	**Priority**	**Neutral**	**Low Priority**	**Not a Priority**	**Unsure**	**No Response**
Improve freshwater inflows	**Local**	63.9%	11.1%	13.9%	0.0%	0.0%	8.3%	2.8%
	Non-local	35.2%	31.5%	12.0%	3.7%	0.9%	12.0%	4.6%
Manage the quantity and improve the quality of storm water runoff	**Local**	66.7%	22.2%	0.0%	0.0%	0.0%	8.3%	2.8%
	Non-local	38.9%	36.1%	13.9%	2.8%	1.9%	3.7%	2.8%
Provide increased levels of public access to the bays and its resources	**Local**	27.8%	16.7%	13.9%	13.9%	22.2%	2.8%	3%
	Non-local	20.4%	25.9%	29.6%	14.8%	4.6%	0.0%	4.6%

Public access responses of local versus non-local visitors had several significant differences, shown in Table 13: Boat ramps (p = 0.003), boat slips (p = <0.0001), restaurants and restaurant dockage (p = 0.021), waterway nature trails (p = 0.022), wind and kite surfing (p = 0.007), rod and reel fishing sites (p = 0.040), fly fishing sites (p = 0.046), and public oyster sites (p = 0.015).

Table 13. Chi square results of local versus non-local responses of public access.

Public Access: Local vs Non-local		
Criteria	**Chi Square**	**P-value**
Boat Ramps	20.07	0.003
Beaches	9.91	0.129
Boat Slips	28.60	<0.0001
Restaurants and Restaurant Dockage	14.91	0.021
Scenic View Points	10.89	0.092
Waterway Nature Trails (e.g. Kayak Trails)	14.76	0.022
Nature Trails Adjacent to Water	9.33	0.156
Natural Swimming Areas	9.97	0.126
Boardwalks	5.88	0.436
Dune Walkovers	9.17	0.164
Camping	10.87	0.093
Wind/Kite Surfing	17.82	0.007
Kayaking Sites	12.00	0.062
Rod and Reel Fishing Sites	11.63	0.040
Fly Fishing Sites	12.82	0.046
Public Oyster Sites	15.70	0.015

An analysis of local and non-local responses for the public access section can be seen in Table 14. A majority of non-local respondents believe the access to boat ramps was 'adequate' (55.6%), compared to 27.8% local respondents who though access was 'more than adequate' and 30.6% who believed access was 'adequate'. Non-local respondents indicated the access to boat slips to be 'more than adequate' (25%) and "adequate' (30.6%). Non-local respondents indicated access to boat slips to be 'adequate' (36.1%), while 34.3% indicated they were 'unsure'. When asked about restaurants and their amenities, a majority of non-local respondents (51.9%) indicated access to be 'adequate', however, the majority of local respondents indicated access as 'more than adequate' (25%) or 'adequate' (30.6%). Local respondents believed that access to waterway nature trails (e.g. kayak trails), is 'adequate' (55.6%), while non-local responses were largely divided between 'adequate' (26.9%) and 'unsure' (25.9%). The majority of local respondents believed the access of rod and reel fishing sites to be 'more than adequate' (41.7) and 'adequate' (41.7%), while only 43.4% of non-local respondents believed access was 'adequate'. Responses for the adequacy of access of fly fishing sites and public oyster sites were more evenly distributed amongst the response options. A simple majority of local responses indicated access to fly fishing as 'adequate' (27.8%), while a majority of non-locals indicated they were 'unsure' (32.4%). A simple majority of local respondent indicated access to public oyster sites as 'adequate' (22.2%) and 50% of non-local respondents indicated they were 'unsure'.

Table 14. Comparison of public access responses between local and non-local respondents (percent).

Public Access: Local vs Non-local								
Criteria	**Visitor Type**	**More Than Adequate**	**Adequate**	**Neutral**	**Inadequate**	**Little or No Access**	**Unsure**	**No Response**
Boat ramps	**Local**	27.8%	30.6%	19.4%	13.9%	0.0%	5.6%	2.8%
	Non-local	6.5%	55.6%	10.2%	5.6%	0.9%	16.7%	4.6%
Boat slips	**Local**	25.0%	30.6%	11.1%	16.7%	0.0%	5.6%	11.1%
	Non-local	7.4%	36.1%	14.8%	1.9%	0.9%	34.3%	4.6%
Restaurants and restaurant dockage	**Local**	25.0%	30.6%	11.1%	22.2%	0.0%	2.8%	8.3%
	Non-local	13.0%	51.9%	13.9%	5.6%	2.8%	7.4%	5.6%
Waterway nature trails (e.g. kayak trails	**Local**	11.1%	55.6%	5.6%	13.9%	0.0%	8.3%	5.6%
	Non-local	7.4%	26.9%	13.9%	16.7%	2.8%	25.9%	6.5%
Wind/kite surfing	**Local**	19.4%	47.2%	16.7%	0.0%	2.8%	8.3%	5.6%
	Non-local	4.6%	29.6%	25.9%	3.7%	0.9%	27.8%	7.4%
Rod and reel fishing sites	**Local**	41.7%	41.7%	8.3%	2.8%	0.0%	2.8%	2.8%
	Non-local	19.4%	43.4%	6.5%	14.8%	0.9%	9.3%	5.6%
Fly fishing sites	**Local**	22.2%	27.8%	16.7%	5.6%	2.8%	22.2%	2.8%
	Non-local	3.7%	20.4%	25.0%	7.4%	5.6%	32.4%	5.6%
Public oyster sites	**Local**	5.6%	22.2%	13.9%	16.7%	13.9%	16.7%	11.1%
	Non-local	1.9%	11.1%	14.8%	7.4%	7.4%	50.0%	7.4%

Top Ranked Social Values

Based on the VI generated by SolVES, shown in the environmental models of the heat maps in Appendix I, the three highest ranked SV for the winter respondents were Aesthetic (9.7 VI), Recreation (7.1 VI), and Economic (7 VI). The three highest ranked SV for the summer visitors were Biodiversity (10 VI), Aesthetic, and Wilderness (5.5 VI), shown in Appendix J. Local respondents had Biodiversity (9.5), Aesthetic (8 VI), and Economic (7.2) as their top three SV, which are shown in Appendix K. Top SV for non-local respondents were Biodiversity (9.4 VI), Aesthetic (8.9 VI), and Recreation (6.9 VI), shown in Appendix L.

Heat Maps

Heat maps generated by SolVES depicted hotspots of SV in the MA-NERR and modeled the relationships to DTW, DTR, and LULC. Figure 7 depicts the hotspots for the Aesthetic SV and within the study area boundary, including the buffer area, and the environmental models. Heat maps were created for all the SV, with the exception of Socializing, due to having a small sample size (Appendices I-L).

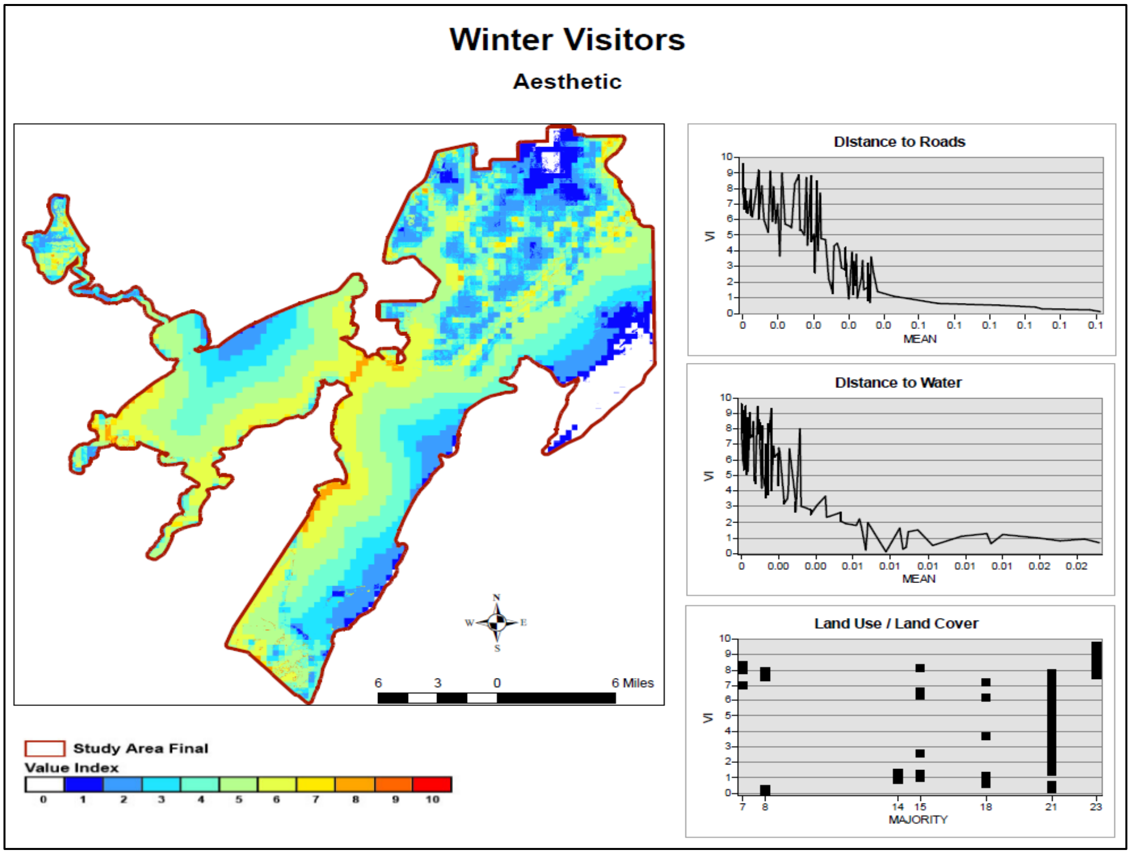


Figure 7. SolVES heat map and DTR, DTW, and LULC environmental models for the Aesthetic SV of winter visitors.

Winter

Hotspots for the winter SV were generally found in Fennessey Ranch, along the South and West portion of the Copano Bay, along the Copano Bay Bridge in Rockport, within and around the Aransas National Wildlife Refuge (ANWR), on the North-East side of the Aransas-Bay and in Redfish Bay (Appendix G). Hotspots for the highest ranked SV, Aesthetic, can be found in South Copano Bay, along the Copano Bay Bridge, at Goose Island State Park, and on the coast of Rockport/Fulton adjacent to Aransas Bay. In and of Itself, and Inspiration SV lack hotspots in the study area.

Summer

Hotspots for the summer SV were found along the South and West part of the Copano Bay, the city of Rockport, including the Copano Bay Bridge, the North-West portion of the Aransas and Redfish Bays, and in the ANWR (Appendix H). Biodiversity, which was the most highly ranked SV for the summer, had hotspots located along the Southern border of the Copano Bay, in the South Bay, within the ANWR, and in Fennessey Ranch. The Economic, Human Needs, Inspiration, Learning, Socializing, and Therapeutic SV did not show hotspots within the MA-NERR.

Local

The majority of hotspots for SV chosen by local respondents were located around the middle of the MA-NERR along the Copano Bay Bridge in the city of Rockport, surrounding the Copano Bay, and on the North-West face of Aransas and Redfish Bays (Appendix I). The areas in the ANWR had the most area with the least information, visualized by white areas. The exception was with the Biodiversity SV, which had hotspots near the Goose Island State Park, the Aransas Wildlife Refuge, and Fennessey Ranch. The Inspiration and Education SV showed no hotspots within or around the reserve.

Non-Local

The SV for non-local respondents were located within Fennessey Ranch, the South-Eastern edges of the Copano Bay, the North-Western Redfish and Aransas Bays, in Rockport, and along the boundaries of the ANWR (Appendix J). The highest ranked SV, Biodiversity, only showed hotspots within the ANWR and Fennessey Ranch. The Economic, Human Needs, In and of Itself, Inspiration, Learning, Therapeutic, and Wilderness SV showed no hotspots in the study area.

Physical Characteristics

For every heat map created, SolVES was used to determine if a relationship existed between the SV (excluding Socializing) and the DTR, DTW, and LULC spatial layers, the results of which can be seen in Table 15 for the three most valued ES by visitor type. The top three SV for the summer season had a slight to positive trend where the VI of the SV increased with a shorter distance to roads and bodies of water. The majority of SV for the winter showed a positive trend where the VI increased with a shorter distance to roads or water. Top SV of local visitors demonstrated little to no connection to the DTR, however, the SV depicted a VI that increased with a shorter distance to water. Top SV for non-local visitors showed the VI increased the shorter the distance to roads or water.

Table 15. Three highest ranked social values (SV) by visitor type and their relationship to the distance to water (DTW), distance to roads (DTR), and land use/land (LULC) cover environmental layers.

Visitor Type	SV	VI	DTR	DTW	LULC Code
Winter	Aesthetic	9.7	VI higher w/shorter distance	VI higher w/shorter distance	23
Winter	Recreation	7.1	VI higher w/shorter distance	No trend	7
Winter	Economic	7	VI higher w/shorter distance	VI higher w/shorter distance	9
Summer	Biodiversity	10	VI higher w/shorter distance	VI higher w/shorter distance	9
Summer	Aesthetic	7.8	VI higher w/shorter distance	VI higher w/shorter distance	23
Summer	Wilderness	5.5	Slight trend	VI higher w/shorter distance	9
Local	Biodiversity	9.5	VI higher w/shorter distance	No trend	3
Local	Aesthetic	8	Slight trend	VI higher w/shorter distance	7
Local	Economic	7.2	No trend	VI higher w/shorter distance	21
Non-local	Biodiversity	9.4	VI higher w/shorter distance	VI higher w/shorter distance	23
Non-local	Aesthetic	8.9	VI higher w/shorter distance	VI higher w/shorter distance	23
Non-local	Recreation	6.9	VI higher w/shorter distance	VI higher w/shorter distance	12

Land use types associate to the top SV by visitor type were determined by the SolVES analysis. The top SV were associated with six LULC classifications, detailed in Appendix H: Medium intensity developed (class 3), pasture/hay (class 7), deciduous forest (class 9), scrub/shrub (class 12), open water (class 21), and estuarine aquatic bed (class 23) (NOAA 2011).

Discussion

The goal of this study was to assess stakeholder perception and preferences toward MA-NERR ES. Through the use of SolVES we were able to determine the most valued ES by visitor type, spatially demonstrate the location of valued ES though heat maps, and to derive connections between the underlying bio-physical characteristics of the reserve with the highly valued services. We determined that respondents, regardless of visitor type, had similar demographic backgrounds. Respondents tended to be older Caucasian males in their mid to late 50s who were well educated and were retired with an income of about $50,000. To characterize and discuss main findings from the study, we will divide this section into the two following parts: 1) SolVES findings, significance and recommendations, and 2) Survey findings and recommendations.

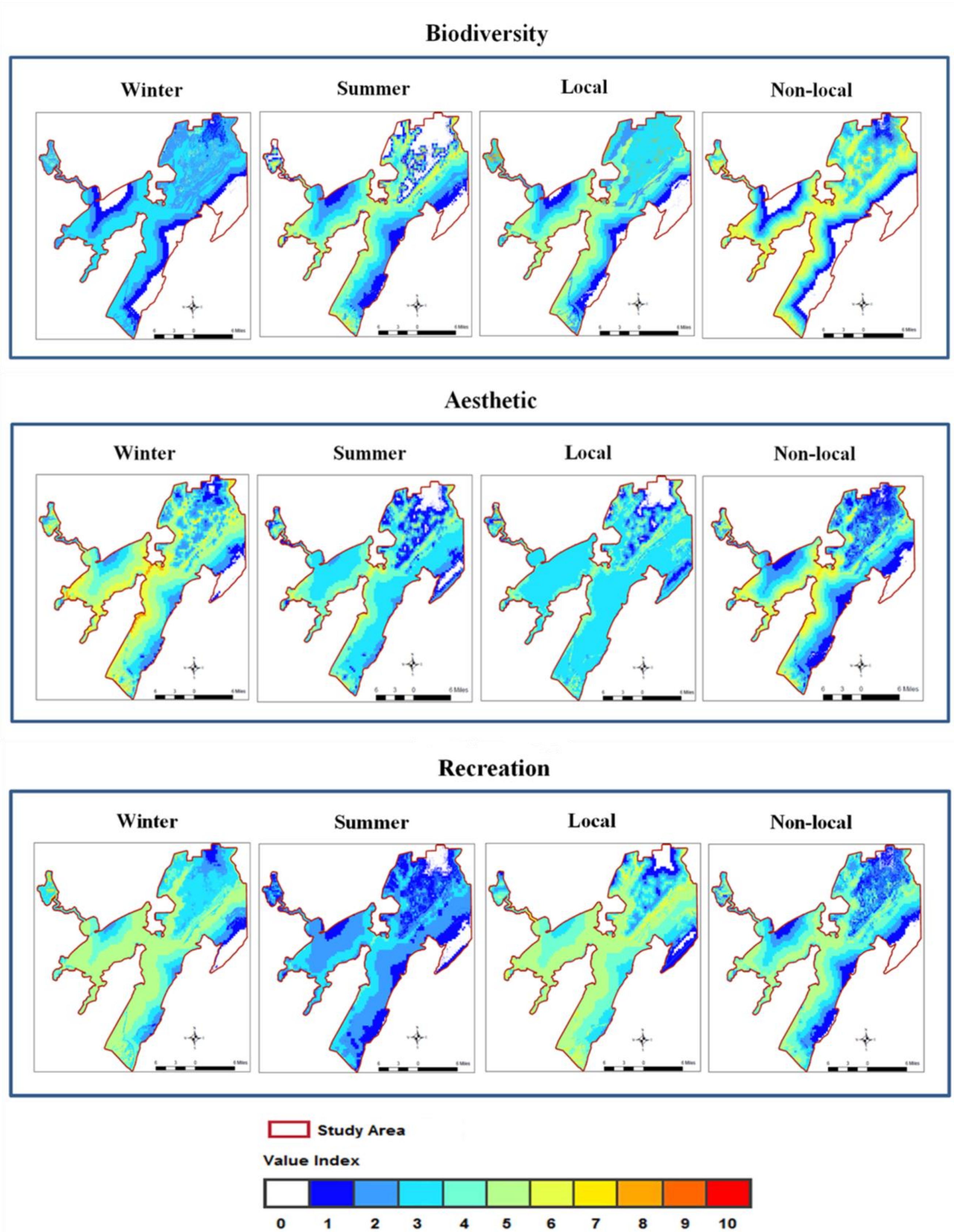
1. SolVES Findings

When exploring the results from the SolVES analysis regarding top ES or Social Values, we discovered that the four visitor types had slight variations in the ES they valued most. All four indicated that they valued the MA-NERR for its Aesthetic qualities, suggesting they visit the reserve to enjoy its natural beauty. Winter respondents also valued Recreation and Economic ES. The winter months are considered the “off season”, however, plenty of recreational activities are still available to users of the reserve, attracting “winter Texans” who visit during the winter months. This “off season” is also likely important in terms of Economic ES because there are likely fewer tourists than during the summer months, making economic stability a priority to stakeholders.

Summer visitors indicated they valued the reserve for its Biodiversity, Aesthetic, and Wilderness ES. Stakeholders value the vast areas of undeveloped lands that encompass various ecosystems and species. This is also seen in the responses to access items in the public access section of the survey, as it will be discussed below. When considering resident types, local visitors of the reserve valued Economic and Biodiversity among their top services. This might a response to the fact that they have an intrinsic investment in the local economy. On the other hand, Biodiversity and Recreation ES were valued by non-local visitors of the reserve, indicating they visit the MA-NERR to enjoy recreational activities and appreciate the variety of flora and fauna available.

A visual analysis of the heat maps for the most highly valued ES by visitor type indicated a concentration of hotspots around the middle of the reserve, along the inner edges of the shoreline to adjacent bays. No other trends were found in of the location or intensity of hotspots. For example, Figure 8 shows a higher VI was achieved in the summer heat map than the winter heat map for Biodiversity, however, the winter heat maps for the Aesthetic and Recreation ES depicted a higher VI that spread across larger areas than the summer heat maps. A trend was also absent in the comparison of local and non-local heat maps (Fig. 8).

Figure 8. Biodiversity, Aesthetic, and Recreation ES heat maps by visitor type.



An assessment of the DTR and DTW models associated with hotspots indicate that ES which are closer to roads and water are more valued by the users of the reserve. This is likely because the roads and water lead to other forms of accessibility to ES, such as boat ramps and fishing sites. The two LULC classifications most frequently associate with top ES were estuarine aquatic bed and deciduous forest. Estuarine aquatic bed is described as tidal wetlands with brackish salinity levels and with an 80% vegetation cover, while deciduous forest is characterized as forested land containing trees larger than 5 meters in height that span over 20% of the vegetation growth cover (NOAA 2011). Additionally, estuarine aquatic bed, representing seagrass beds within the MA-NERR, was closely correlated to the Aesthetic ES for the winter, summer, and non-local visitor types (Evans et al. 2012). This recurring association may suggest importance in terms of management priority for this land class type. Interestingly, the medium intensity developed LULC class was associated with the Biodiversity ES. Similar to the DTR and DTW models, this correlation may be explained by the access and amenities (e.g. food and fuel) provided through developed areas as a means to accessing natural areas for the public enjoyment of ES.

Significance of SolVES analysis

This study is only one of few instances where geographic locations of ES have been correlated to bio-physical models and compared to corresponding stakeholder perceptions (Bagstad et al. 2015; Loerzel, 2015). The process allows researchers to attain a more robust assessment of stakeholder attitudes and preferences of ES in the MA-NERR. Currently, only six published applications of SolVES exist. While two applications were focused in coastal areas (Loerzel 2013; van Riper 2012), the rest are focused on forested mountain areas (Sherrouse et al.

2011 and 2014; Sherrouse and Semmens 2015; Bastad et al. 2015). The majority of these studies were conducted to develop the SolVES program and to identify limitations in the extent of its use. They also assessed the heat maps and statistically linked the bio-physical models to them. However, they did not go the extra step to combine these two analyses to specific survey responses. In this study, SolVES looked at specific visitor types rather than by subgroup (i.e. fishermen, hunters) or by ES, as done in previous studies. By doing so, this study allowed researchers to understand the range of uses and limitations of using the program. The cumulative results of this study can be integrated in resource planning, monitoring, and management.

SolVES Limitations and Recommendations

The SolVES application has proven to be a useful and adaptable tool in ES and social value assessments (citations). Nevertheless, improvements can be made to potentially improve the overall analysis and quality of results. First, the manner in which results are presented for the Value Index are difficult to interpret, which could potentially lead to misinterpretation of VI data. Within the current version of SolVES, VI are embedded within the environmental models generated from the data analysis (Fig. 7). To reduce on potential discrepancies of VI interpretation, we suggest presenting results through a table listing the VI for each social value analyzed, as reported in Sherrouse et al. 2011.

Second, the scale of the mapping exercise could lead to potential errors in the hotpot analysis and the bio-physical models. Respondents had the option of zooming in and out of the digital map in the mapping exercise to place markers. Many respondents however, chose not to use the zoom tool and instead placed markers in the general vicinity of locations they valued. SolVES uses the data cells corresponding with the map markers across the environmental layers to create the heat maps and the environmental models. Due to this, markers placed at a smaller map scale may not accurately reflect valued locations. This issue could also cause inaccuracy in the LULC classifications associated with top ES. A similar concern was encountered by Bagstad and colleagues (2015). The authors concluded that the collective analysis of the data markers might still provide a “reasonable estimate of valued locations”.

Finally, and as previously stated, the latest version of SolVES no longer requires the value allocation survey section for analysis. The SolVES 3.0 user manual states this was done in an effort to reduce core requirements and facilitate analysis (Sherrouse and Semmens 2015), however, it remains unclear as to how the absence of the value allocation data impacts the results of the analysis. Despite the value allocation data no longer being a requirement, we collected and utilized the data in this study to conduct an analysis similar to past studies, all which employed SolVES 2.0 (Sherrouse et al. 2011; Sherrouse et al. 2014; Bagstad et al. 2012; van Riper et al. 2012). Based on our results, our recommendations for future work is to continue using the value allocation data, as it gives an additional dimension in creating a robust assessment of ES and social values, and their relationship to bio-physical attributes.

2. Survey Findings

Based on the chi square analysis of all the survey responses, an in depth analysis of survey questions identified as having significantly different responses were conducted. The majority of significant differences were identified between summer and winter survey responses. The responses of the bio-physical changes section generally indicated ‘no change’ by both summer and winter visitors. Similar to the bio-physical changes responses, the analysis of the public access section identified the majority of summer and winter responses as ‘adequate’.

Summer respondents were more likely to rate the public access criteria as ‘adequate’, while winter responses were distributed mostly between the ‘adequate’ and ‘unsure’ options. Significant differences were determined as summer visitors having a higher percentage of “no change” responses, compared to winter respondents indicated high percentages of ‘unsure’ responses. The management goal survey responses between summer and winter visitors were almost evenly distributed between the ‘high priority’ and ‘priority’ options. Summer visitors tended to have higher percentages of responses indicating management goals as a ‘high priority’, as compared to winter respondents who were more likely to rate the same management goals as a ‘priority’.

Several significant differences were also observed in the results of chi squares tests in the public access responses between local and non-local visitors, although fewer differences were observed than the summer and winter response comparison. An examination of all the responses for public access showed adequate access overall. Local visitors also tended consider public access criteria as ‘more than adequate’. In contrast, winter participants allocated their responses mostly between the ‘adequate’ and ‘unsure’ response options. The majority of management goal responses fell under the ‘high priority’ option. However, higher summer visitors chose ‘high priority’, in comparison to winter respondents, who shared responses between the ‘high priority’ and ‘priority’ choices. Surprisingly, there were no significant differences observed in the bio-physical changes section observed by local and non-local visitors.

Overall, significant differences elicited between the summer and winter responses are likely due to the length of stay by visitors. Winter visitors, known as “winter Texas”, spend the winter months living in the south Texas region and continuously visit throughout the years, thus are more likely to understand the ecological and managerial issues of the reserve. In contrast, summer visitors tend to stay in the area for short periods of time, usually a few days, and are unlikely to recognize the management concerns of the reserve. Differences between local and non-local responses may stem partly from the fact that non-local visitors are less invested in the long term well-being of the reserve and place less emphasis on those management goals that directly impact them during their visit. These differences between local and non-local responses could also be due to a lack of information available to non-local visitors. Whereas locals might know more about the reserve because of the length of their residence in the area (Avg = 18 yr), non-locals probably only know of features that are popular or commonly advertised. In all, responses indicated a need for more public education dealing with the biology, ecology, visitor amenities of the reserve. For example, over 50% of winter respondents and 30% of summer respondents indicated they did not know about the abundance of oysters, which are critical to the health of the bays in the reserve (Table 1), and 50% of non-local respondents indicated they were 'unsure' of the access to public oyster sites within the reserve.

Survey Recommendations

As previously mentioned, place-specific monitoring is important in achieving EBM. We recommend tailoring the survey instrument to address very specific management concerns. Conducting focus groups on stakeholders prior to the development of a survey instrument could aid researchers in prioritizing survey questions. This study found major differences between local and non-local respondents: future surveys should focus less on attempting to capture seasonal differences, more on local and non-local visitor types

An issue encountered by surveyors was potential respondents declining to take the survey due to the length of time required to complete it. In some instances, respondents stopped the survey while in progress. Records from the online survey also showed over 20 instances where a survey taker had started a survey but failed to finish (Jarrod Loerzel, Personal Communication). To increase the likelihood of potential respondents completing the survey, we suggest reducing the survey length to a maximum of 5-10 minutes. Another reason for this is to reduce respondent fatigue; the loss of interest in the survey due to extended length of time and excessive questions, leading to loss of quality in responses (Freeman 2013; Kanninen 2007). It should be noted, however, that it is understood that much more data can be derived from longer surveys, thus producing a superior assessment overall. An alternative to reducing the quantity of survey questions is to separate the survey into two surveys; one survey which includes only the sections necessary as inputs for the SolVES program, and another survey which asks managerially relevant questions.

We also suggest more variation in sampling locations and conducting surveys over longer periods of time. For example, administering the survey in high traffic areas (e.g. shopping centers), and during special events (e.g. Fourth of July). We suggest attempting to survey a larger range of stakeholders, including policymakers, local businesses (especially those dependent on reserve resources to thrive), land managers with decision making responsibilities to the reserve, and individual households that depend on the reserve for its ES benefits.

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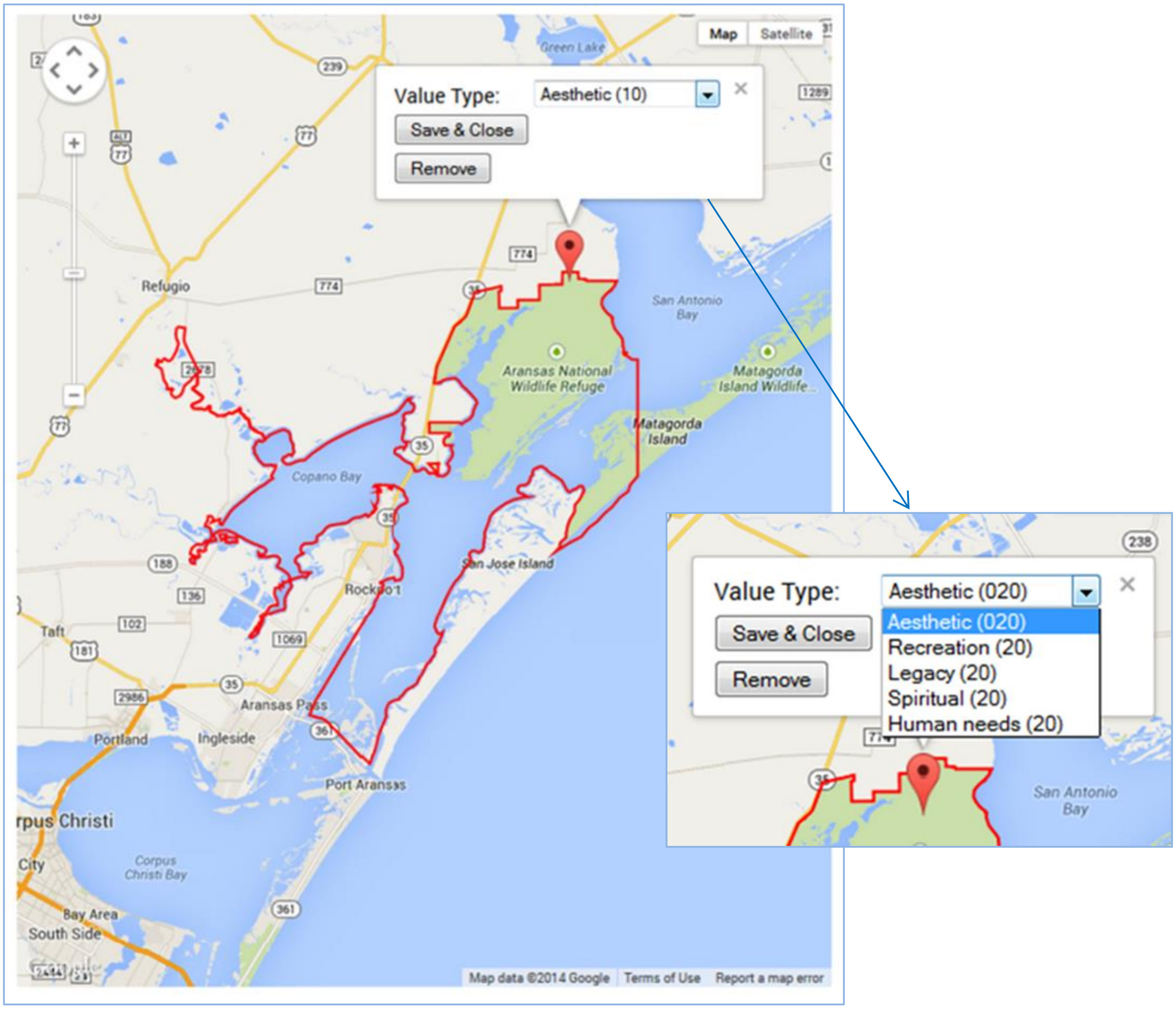
APPENDIX

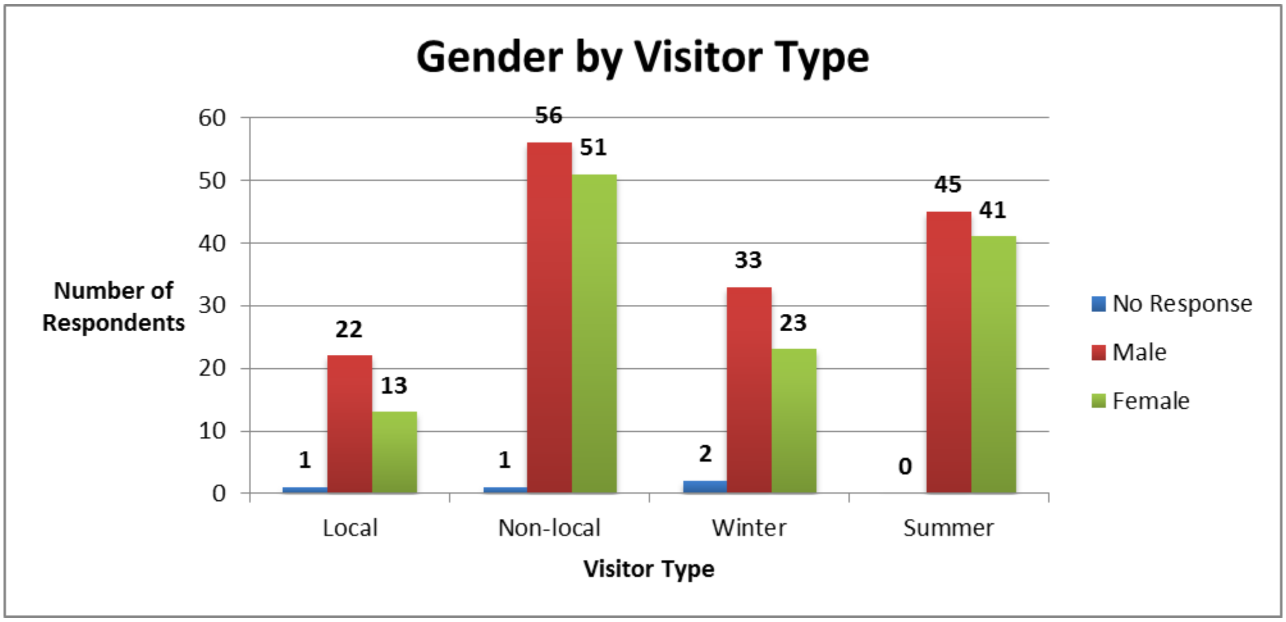
Appendix A. Sampling locations and map reference numbers.

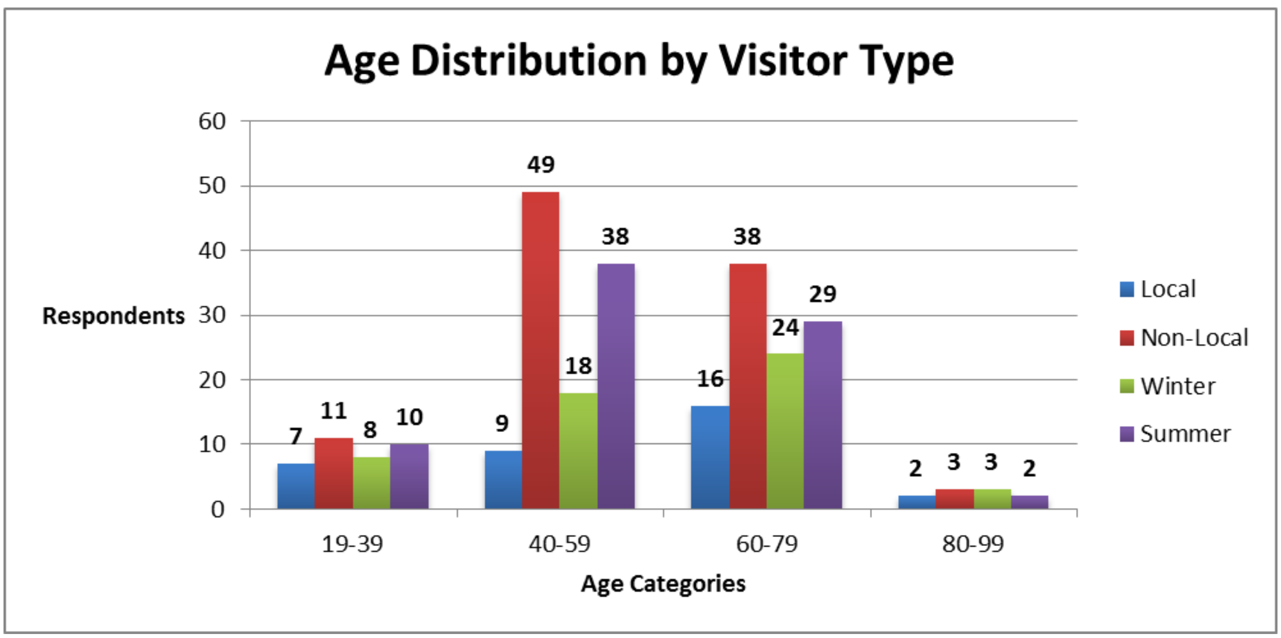
Location on Map	Name and Location
1	Aransas National Wildlife Refuge- Austwell, TX
2	Goose Island State Park- Rockport, TX
3	Sea Gun Bait and Marina- Rockport, TX
4	Copano Bay Bridge- Rockport, TX
5	Fulton Harbor Park Pier- Fulton, TX
6	Rockport Beach Park- Rockport, TX
7	Palm Harbor Marina- Rockport, TX
8	Conn-Brown Harbor Park- Aransas Pass, TX
9	Ransom Road Park- Aransas Pass, TX
10	Tarpon Shores Marina- Aransas Pass, TX
11	Roberts Point Park- Port Aransas, TX
12	IB Magee Park- Port Aransas, TX

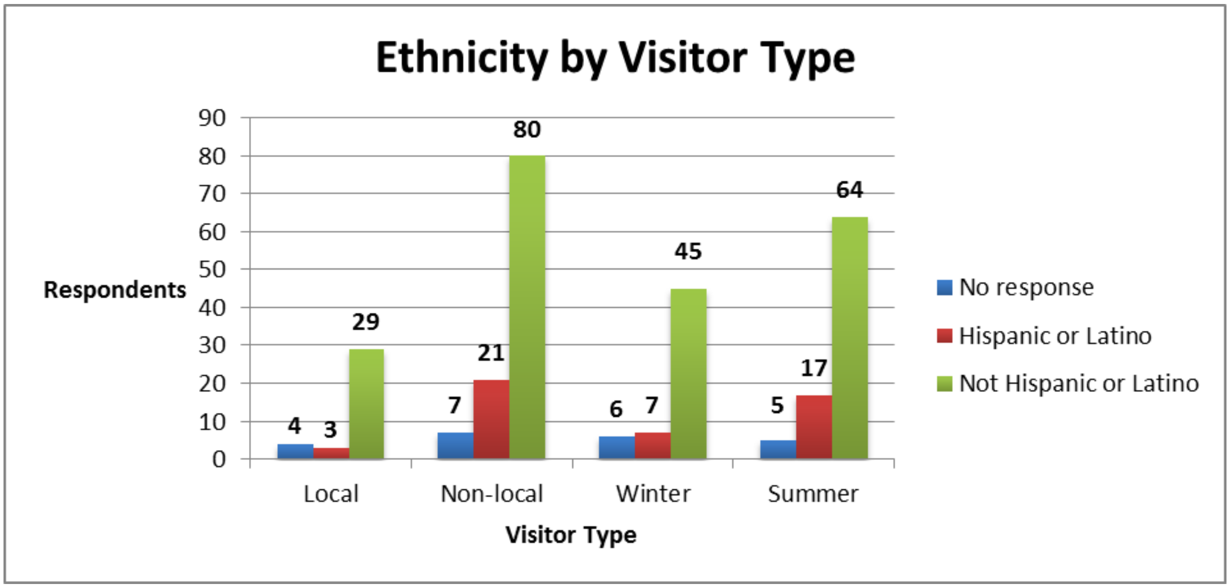
Appendix B. Interactive map found in the survey instrument.



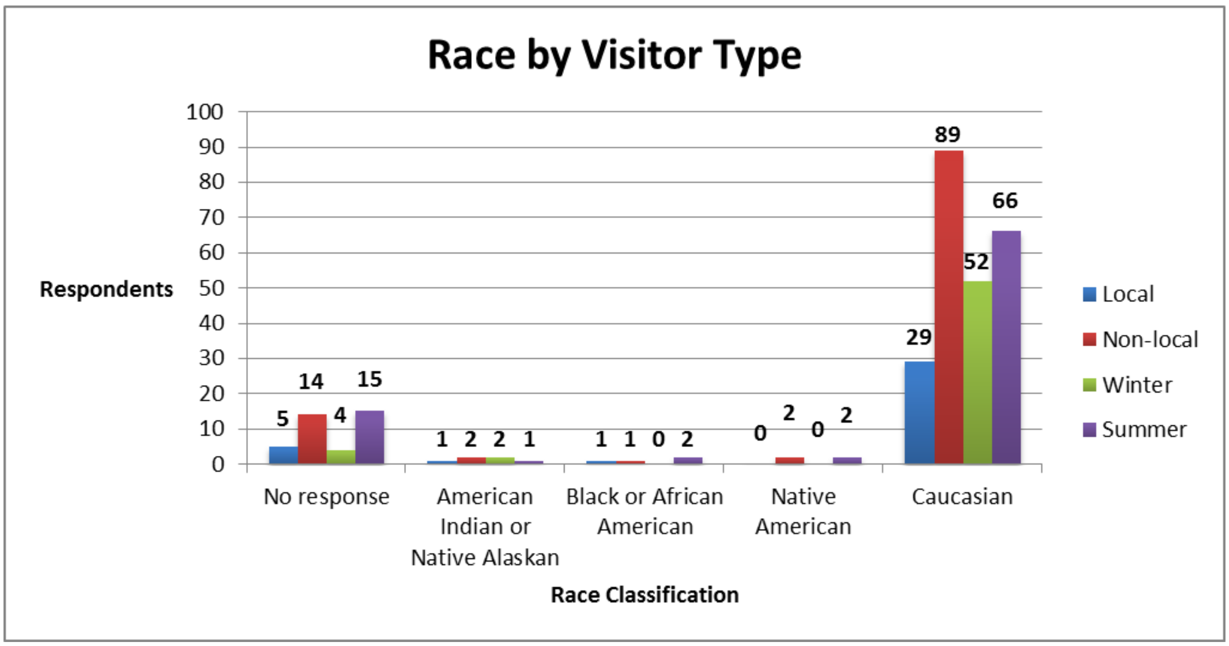
Appendix C. Distribution of demographics by visitor type for gender, age, ethnicity, race, and education.



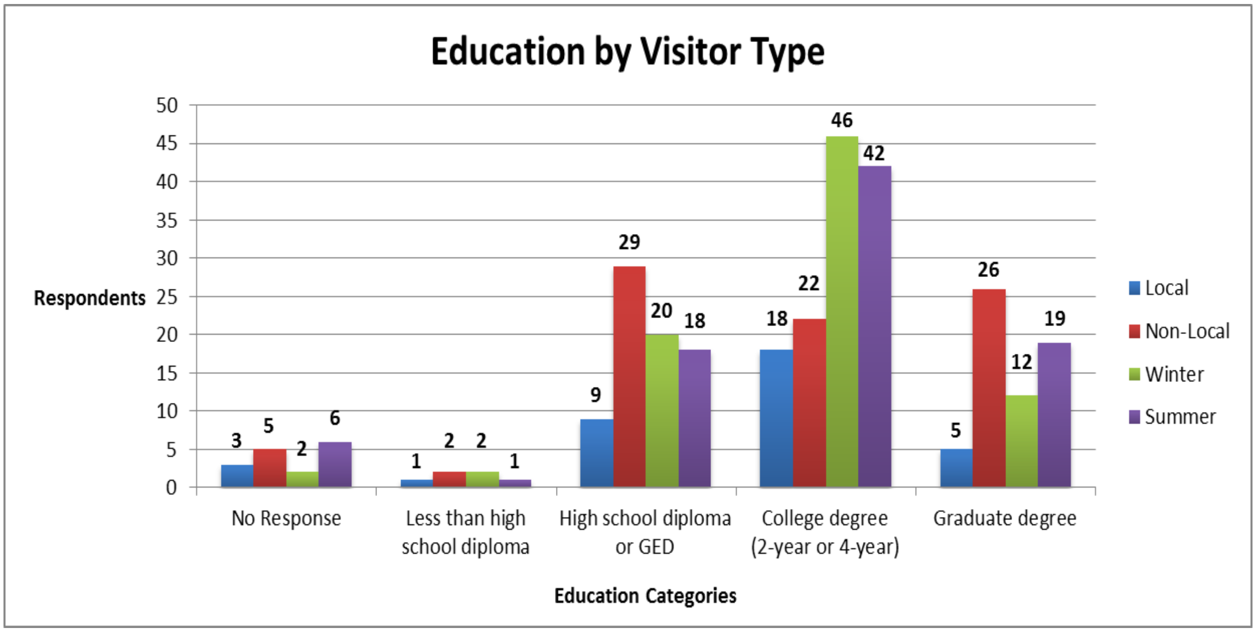




Ethnicity by Visitor Type
Respondents
90
80
70
60
50
40
30
20
10
0
4
3
29
7
21
80
6
7
45
5
17
64
Local
Non-local
Winter
Summer
Visitor Type
No response
Hispanic or Latino
Not Hispanic or Latino



Race by Visitor Type
Respondents
100
90
80
70
60
50
40
30
20
10
0
5
14
4
15
1
2
2
1
1
1
0
2
0
2
0
2
29
89
52
66
No response
American Indian or Native Alaskan
Black or African American
Native American
Caucasian
Race Classification
Local
Non-local
Winter
Summer



Education by Visitor Type
Respondents
50
45
40
35
30
25
20
15
10
5
0
3
5
2
6
1
2
2
1
9
29
20
18
18
22
46
42
5
26
12
19
No Response
Less than high school diploma
High school diploma or GED
College degree (2-year or 4-year)
Graduate degree
Education Categories
Local
Non-Local
Winter
Summer

Appendix D. Respondent residency information by local and non-local classification.

Local Visitors		
Zip Code	**City**	**State**
78382	ROCKPORT	Texas
78358	FULTON	Texas
78382	ROCKPORT	Texas
78382	ROCKPORT	Texas
78336	ARANSAS PASS	Texas
78358	FULTON	Texas
78374	PORTLAND	Texas
78382	ROCKPORT	Texas
78382	ROCKPORT	Texas
78377	REFUGIO	Texas
78382	ROCKPORT	Texas
78373	PORT ARANSAS	Texas
78382	ROCKPORT	Texas
78362	INGLESIDE	Texas
78336	ARANSAS PASS	Texas
78362	INGLESIDE	Texas
78373	PORT ARANSAS	Texas
78382	ROCKPORT	Texas
78382	ROCKPORT	Texas
78382	ROCKPORT	Texas
78373	PORT ARANSAS	Texas
78373	PORT ARANSAS	Texas
78373	PORT ARANSAS	Texas
78373	PORT ARANSAS	Texas
78373	PORT ARANSAS	Texas
78373	PORT ARANSAS	Texas
78373	PORT ARANSAS	Texas
78382	ROCKPORT	Texas
78382	ROCKPORT	Texas
78382	ROCKPORT	Texas
78358	FULTON	Texas
78382	ROCKPORT	Texas
78382	ROCKPORT	Texas
78373	PORT ARANSAS	Texas
78382	ROCKPORT	Texas
78373	PORT ARANSAS	Texas

Non-Local Visitors		
Zip Code	City	State
78101	ADKINS	Texas
78332	ALICE	Texas
79830	ALPINE	Texas
55303	ANOKA	Minnesota
54911	APPLETON	Wisconsin
55126	ARDEN HILLS	Minnesota
78002	ATASCOSA	Texas
78702	AUSTIN	Texas
78734	AUSTIN	Texas
78739	AUSTIN	Texas
78727	AUSTIN	Texas
78727	AUSTIN	Texas
78757	AUSTIN	Texas
78759	AUSTIN	Texas
78003	BANDERA	Texas
49615	BELLAIRE	Michigan
76513	BELTON	Texas
78601	BLANCO	Texas
78606	BLANCO	Texas
78606	BLANCO	Texas
78015	BOERNE	Texas
78521	BROWNSVILLE	Texas
76028	BURLESON	Texas
78613	CEDAR PARK	Texas
78418	CORPUS CHRISTI	Texas
78414	CORPUS CHRISTI	Texas
78412	CORPUS CHRISTI	Texas
78427	CORPUS CHRISTI	Texas
78415	CORPUS CHRISTI	Texas
78418	CORPUS CHRISTI	Texas
78412	CORPUS CHRISTI	Texas
78411	CORPUS CHRISTI	Texas
78420	CORPUS CHRISTI	Texas
78412	CORPUS CHRISTI	Texas
78412	CORPUS CHRISTI	Texas
78412	CORPUS CHRISTI	Texas
78404	CORPUS CHRISTI	Texas

78411	CORPUS CHRISTI	Texas
77532	CROSBY	Texas
80214	DENVER	Colorado
78852	EAGLE PASS	Texas
49633	FIFE LAKE	Michigan
76179	FORT WORTH	Texas
75035	FRISCO	Texas
66032	GARNETT	Kansas
76528	GATESVILLE	Texas
77963	GOLIAD	Texas
88242	HOBBS	New Mexico
77063	HOUSTON	Texas
55751	IRON	Minnesota
77449	KATY	Texas
99338	KENNEWICK	Washington
78639	KINGSLAND	Texas
78121	LAVERNIA	Texas
78121	LAVERNIA	Texas
78641	LEANDER	Texas
55045	LINDSTROM	Minnesota
79423	LUBBOCK	Texas
79423	LUBBOCK	Texas
78052	LYTLE	Texas
77355	MAGNOLIA	Texas
78654	MARBLE FALLS	Texas
77459	MISSOURI CITY	Texas
96771	MOUNTAIN VIEW	Hawaii
54960	NESHKORO	Wisconsin
78130	NEW BRAUNFELS	Texas
74857	NEWALLA	Oklahoma
73026	NORMAN	Oklahoma
79765	ODESSA	Texas
56359	ONAMIA	Minnesota
50219	PELLA	Iowa
56164	PIPESTONE	Minnesota
78064	PLEASANTON	Texas
83202	POCATELLO	Idaho
83202	POCATELLO	Idaho
53820	POTOSI	Wisconsin
77406	RICHMOND	Texas
77406	RICHMOND	Texas

79358	ROPESVILLE	Texas
78665	ROUND ROCK	Texas
55075	SAINT PAUL	Minnesota
63376	SAINT PETERS	Missouri
78253	SAN ANTONIO	Texas
78209	SAN ANTONIO	Texas
78247	SAN ANTONIO	Texas
78244	SAN ANTONIO	Texas
78263	SAN ANTONIO	Texas
78203	SAN ANTONIO	Texas
78216	SAN ANTONIO	Texas
78238	SAN ANTONIO	Texas
78251	SAN ANTONIO	Texas
78254	SAN ANTONIO	Texas
78209	SAN ANTONIO	Texas
78250	SAN ANTONIO	Texas
78227	SAN ANTONIO	Texas
78245	SAN ANTONIO	Texas
78213	SAN ANTONIO	Texas
78212	SAN ANTONIO	Texas
78217	SAN ANTONIO	Texas
78213	SAN ANTONIO	Texas
78666	SAN MARCOS	Texas
78383	SANDIA	Texas
K0H-2N0	SEELYS BAY	Ontario, Canada
77372	SPLENDORA	Texas
77380	SPRING	Texas
77388	SPRING	Texas
65802	SPRINGFIELD	Missouri
76502	TEMPLE	Texas
77377	TOMBALL	Texas

Appendix E. Management goal responses by visitor type.

Management Goals: Winter 2013							
Goals	High Priority	Priority	Neutral	Low Priority	Not a Priority	Unsure	No Response
Improve water quality in the local Bays	30	19	4	2	0	3	0
Improve freshwater inflows into the bays	20	18	9	1	0	9	1
Manage the quantity and improve the quality of storm water runoff into the bays	20	23	8	2	1	4	0
Restore shoreline and wetland habitats	14	29	9	3	2	1	0
Eliminate further loss of shoreline, seagrass and wetland habitats	22	28	3	3	1	1	0
Restore and sustan fish stocks and other living maring resources in the bays	29	23	2	3	0	1	0
Provide increased levels of public access to the bays and its resources	10	16	17	8	6	0	1
Increase the resilience of coastal communitiesin the face of natural and human-induced disasters (i.e. hurricanes, rising seas)	12	26	8	5	4	2	1
Incorporate local social and cutural heritage into management of the Bay's resources	6	22	15	8	3	3	1
Increase awareness of human-use patterns that influence resouce sustainability	9	31	13	2	0	2	1
Integrate understanding of human uses with knowledge of natural processes	11	27	14	1	2	2	1
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the Bays	6	23	10	6	9	4	0

Management Goals: Summer 2014							
Goals	High Priority	Priority	Neutral	Low Priority	Not a Priority	Unsure	No Response
Improve water quality in the local Bays	56	21	4	1	0	0	4
Improve freshwater inflows into the bays	41	19	9	3	1	7	5
Manage the quantity and improve the quality of storm water runoff into the bays	46	24	7	1	1	3	4
Restore shoreline and wetland habitats	54	20	5	2	0	0	5
Eliminate further loss of shoreline, seagrass and wetland habitats	52	26	3	1	0	0	4
Restore and sustan fish stocks and other living maring resources in the bays	54	23	2	1	1	1	4
Provide increased levels of public access to the bays and its resources	22	19	20	13	7	1	4
Increase the resilience of coastal communitiesin the face of natural and human-induced disasters (i.e. hurricanes, rising seas)	27	29	11	7	6	2	4
Incorporate local social and cutural heritage into management of the Bay's resources	16	33	15	13	4	1	4
Increase awareness of human-use patterns that influence resouce sustainability	32	39	7	4	0	0	4
Integrate understanding of human uses with knowledge of natural processes	24	30	19	5	0	1	7
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the Bays	22	22	20	8	6	1	7

Management Goals: Local							
Goals	High Priority	Priority	Neutral	Low Priority	Not a Priority	Unsure	No Response
Improve water quality in the local Bays	23	10	0	1	0	1	1
Improve freshwater inflows into the bays	23	4	5	0	0	3	1
Manage the quantity and improve the quality of storm water runoff into the bays	24	8	0	0	0	3	1
Restore shoreline and wetland habitats	20	8	5	0	1	0	2
Eliminate further loss of shoreline, seagrass and wetland habitats	22	10	1	1	1	0	1
Restore and sustan fish stocks and other living maring resources in the bays	27	6	1	1	0	0	1
Provide increased levels of public access to the bays and its resources	10	6	5	5	8	1	1
Increase the resilience of coastal communitiesin the face of natural and human-induced disasters (i.e. hurricanes, rising seas)	14	9	3	3	5	1	1
Incorporate local social and cutural heritage into management of the Bay's resources	10	15	4	2	3	1	1
Increase awareness of human-use patterns that influence resouce sustainability	14	15	3	2	0	1	1
Integrate understanding of human uses with knowledge of natural processes	12	15	5	0	1	2	1
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the Bays	7	13	7	2	6	0	1

Management Goals: Non-Local							
Goals	High Priority	Priority	Neutral	Low Priority	Not a Priority	Unsure	No Response
Improve water quality in the local Bays	63	30	8	2	0	2	3
Improve freshwater inflows into the bays	38	34	13	4	1	13	5
Manage the quantity and improve the quality of storm water runoff into the bays	42	39	15	3	2	4	3
Restore shoreline and wetland habitats	48	41	9	5	1	1	3
Eliminate further loss of shoreline, seagrass and wetland habitats	52	44	5	3	0	1	3
Restore and sustan fish stocks and other living maring resources in the bays	56	40	3	3	1	2	3
Provide increased levels of public access to the bays and its resources	22	29	32	16	5	0	4
Increase the resilience of coastal communitiesin the face of natural and human-induced disasters (i.e. hurricanes, rising seas)	25	46	16	9	5	3	4
Incorporate local social and cutural heritage into management of the Bay's resources	12	40	26	19	4	3	4
Increase awareness of human-use patterns that influence resouce sustainability	27	55	17	4	0	1	4
Integrate understanding of human uses with knowledge of natural processes	23	42	28	6	1	1	7
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the Bays	21	32	23	12	9	5	6

Appendix F. Public access responses visitor by type.

Public Access: Winter 2013							
Criteria	More than adequate	Adequate	Neutral	Inadequate	Little or No Access	Unsure	No Response
Boat Ramps	6	31	2	2	0	15	2
Beaches	14	27	5	5	1	5	1
Boat Slips	4	19	6	3	1	21	4
Restaurants and Restaurant Dockage	5	27	7	7	3	5	4
Scenic View Points	9	25	12	7	1	2	2
Waterway Nature Trails (e.g. Kayak Trails)	8	20	4	7	1	14	4
Nature Trails Adjacent to Water	4	16	15	9	0	11	3
Natural Swimming Areas	5	17	9	10	0	14	3
Boardwalks	3	22	16	6	3	6	2
Dune Walkovers	2	11	12	4	3	22	4
Camping	3	22	11	6	3	8	5
Wind/Kite Surfing	4	20	13	0	1	17	3
Kayaking Sites	8	23	6	2	1	15	3
Rod and Reel Fishing Sites	15	24	4	4	0	8	3
Fly Fishing Sites	4	9	11	3	2	26	3
Public Oyster Sites	2	4	4	3	7	34	4

Public Access: Summer 2014							
Criteria	More than adequate	Adequate	Neutral	Inadequate	Little or No Access	Unsure	No Response
Boat Ramps	11	40	16	9	1	5	4
Beaches	17	41	8	13	2	1	4
Boat Slips	13	31	14	5	0	18	5
Restaurants and Restaurant Dockage	18	40	12	7	0	4	5
Scenic View Points	22	39	7	8	5	1	4
Waterway Nature Trails (e.g. Kayak Trails)	4	29	13	16	2	17	5
Nature Trails Adjacent to Water	3	24	13	24	6	9	7
Natural Swimming Areas	12	38	7	18	3	4	4
Boardwalks	6	35	16	15	7	2	5
Dune Walkovers	8	26	17	16	4	10	5
Camping	20	36	8	10	1	7	4
Wind/Kite Surfing	8	29	21	4	1	16	7
Kayaking Sites	7	43	12	7	0	9	8
Rod and Reel Fishing Sites	21	39	6	13	0	3	4
Fly Fishing Sites	8	23	22	7	5	17	4
Public Oyster Sites	2	16	17	11	6	26	8

Public Access: Local							
Criteria	More than adequate	Adequate	Neutral	Inadequate	Little or No Access	Unsure	No Response
Boat Ramps	10	11	7	5	0	2	1
Beaches	13	15	3	4	0	0	1
Boat Slips	9	11	4	6	0	2	4
Restaurants and Restaurant Dockage	9	11	4	8	0	1	3
Scenic View Points	12	17	2	4	0	0	1
Waterway Nature Trails (e.g. Kayak Trails)	4	20	2	5	0	3	2
Nature Trails Adjacent to Water	3	13	8	6	3	2	1
Natural Swimming Areas	8	17	2	5	1	2	1
Boardwalks	4	9	10	5	3	3	2
Dune Walkovers	3	13	4	5	4	5	2
Camping	9	18	2	2	2	2	1
Wind/Kite Surfing	7	17	6	0	1	3	2
Kayaking Sites	8	18	3	3	0	2	2
Rod and Reel Fishing Sites	15	15	3	1	0	1	1
Fly Fishing Sites	8	10	6	2	1	8	1
Public Oyster Sites	2	8	5	6	5	6	4

Public Access: Non-Local							
Criteria	More than adequate	Adequate	Neutral	Inadequate	Little or No Access	Unsure	No Response
Boat Ramps	7	60	11	6	1	18	5
Beaches	18	53	10	14	3	6	4
Boat Slips	8	39	16	2	1	37	5
Restaurants and Restaurant Dockage	14	56	15	6	3	8	6
Scenic View Points	19	47	17	11	6	3	5
Waterway Nature Trails (e.g. Kayak Trails)	8	29	15	18	3	28	7
Nature Trails Adjacent to Water	4	27	20	27	3	18	9
Natural Swimming Areas	9	38	14	23	2	16	6
Boardwalks	5	48	22	16	7	5	5
Dune Walkovers	7	24	25	15	3	27	7
Camping	14	40	17	14	2	13	8
Wind/Kite Surfing	5	32	28	4	1	30	8
Kayaking Sites	7	48	15	6	1	22	9
Rod and Reel Fishing Sites	21	48	7	16	0	10	6
Fly Fishing Sites	4	22	27	8	6	35	6
Public Oyster Sites	2	12	16	8	8	54	8

Appendix G. Bio-physical change responses visitor type.

Bio-physical Changes: Winter 2013							
Criteria	**Large Increase**	**Increase**	**No Change**	**Decrease**	**Large Decrease**	**Unsure**	**No Response**
Abundance of oysters	1	9	9	3	1	32	3
Abundance of fish	1	5	13	20	2	16	1
Abundance of blue crabs	1	1	8	11	3	33	1
Abundance of seagrass	4	8	20	6	0	20	0
Shoreline erosion	1	17	22	2	0	16	0
Abundance of birds	2	9	23	6	1	17	0
Abundance of wildlife	1	17	22	6	2	10	0
Public acess to land and water resources	1	7	14	4	0	30	2
Red tide occurances	4	16	16	8	0	14	0
Abundance of jellyfish	4	14	19	10	1	10	0

Bio-physical Changes: Summer 2014							
Criteria	**Large Increase**	**Increase**	**No Change**	**Decrease**	**Large Decrease**	**Unsure**	**No Response**
Abundance of oysters	0	8	19	13	3	42	1
Abundance of fish	2	11	33	23	6	10	1
Abundance of blue crabs	1	8	24	20	6	26	1
Abundance of seagrass	3	21	30	13	2	16	1
Shoreline erosion	2	25	38	5	0	15	1
Abundance of birds	1	32	35	8	3	6	1
Abundance of wildlife	1	15	47	18	1	3	1
Public acess to land and water resources	1	9	43	7	0	25	1
Red tide occurances	10	27	29	14	2	3	1
Abundance of jellyfish	2	18	44	15	2	4	1

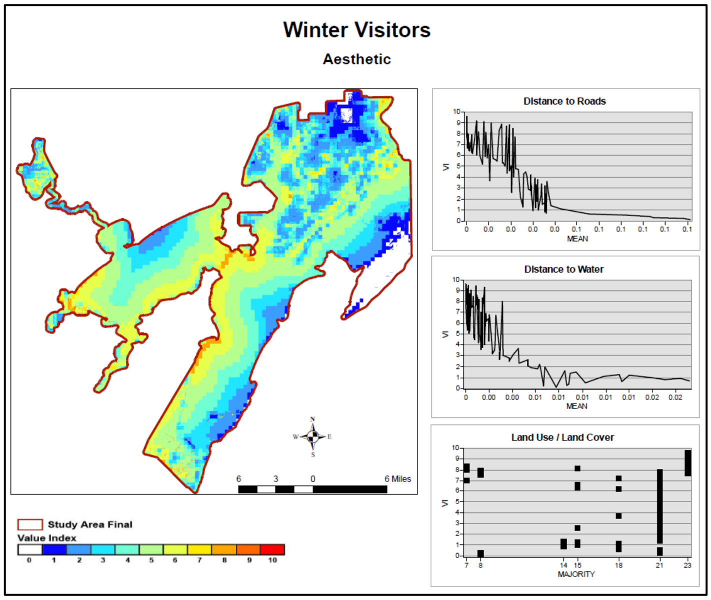
Bio-physical Changes: Non-Local							
Criteria	Large Increase	Increase	No Change	Decrease	Large Decrease	Unsure	No Response
Abundance of oysters	1	8	22	10	2	62	3
Abundance of fish	1	12	39	31	3	21	1
Abundance of blue crabs	1	7	25	23	4	47	1
Abundance of seagrass	3	25	35	12	2	30	1
Shoreline erosion	1	29	45	6	0	26	1
Abundance of birds	1	30	44	10	1	21	1
Abundance of wildlife	0	20	55	19	3	10	1
Public acess to land and water resources	1	9	41	7	0	48	2
Red tide occurances	8	31	34	18	2	14	1
Abundance of jellyfish	2	23	50	19	1	12	1

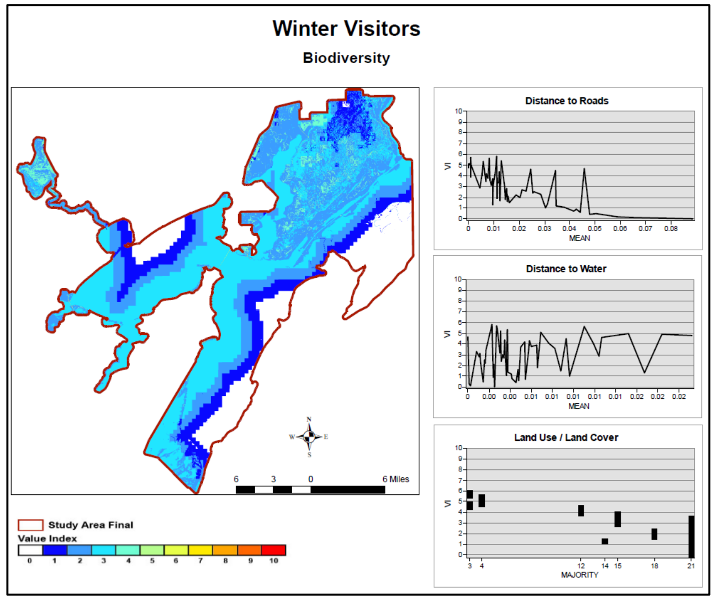
Bio-physical Changes: Local							
Criteria	Large Increase	Increase	No Change	Decrease	Large Decrease	Unsure	No Response
Abundance of oysters	0	9	6	6	2	12	1
Abundance of fish	2	4	7	12	5	5	1
Abundance of blue crabs	1	2	7	8	5	12	1
Abundance of seagrass	4	4	15	7	0	6	0
Shoreline erosion	2	13	15	1	0	5	0
Abundance of birds	2	11	14	4	3	2	0
Abundance of wildlife	2	12	14	5	0	3	0
Public acess to land and water resources	1	7	16	4	0	7	1
Red tide occurances	6	12	11	4	0	3	0
Abundance of jellyfish	4	9	13	6	2	2	0

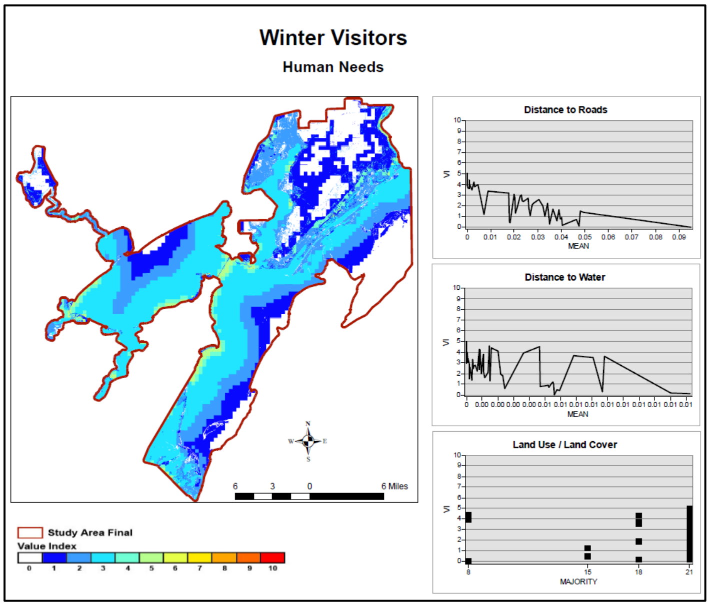
Appendix H. Land use and land cover codes (NOAA 2011).

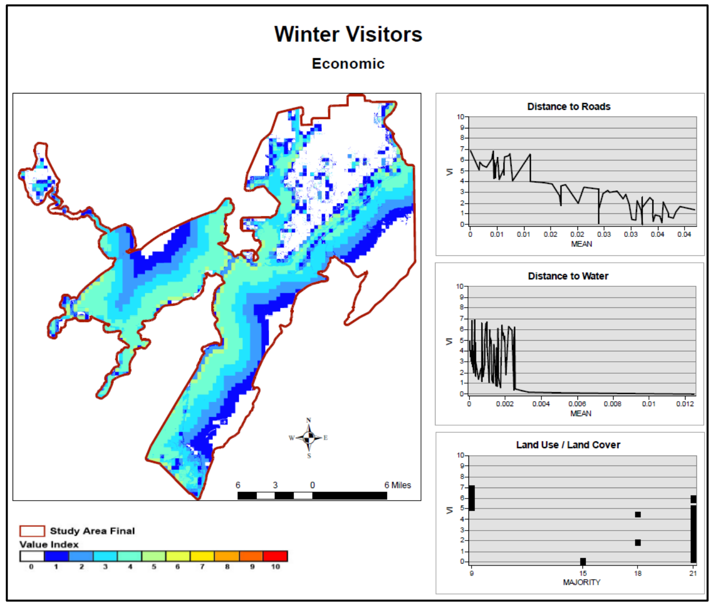
Code	Class Name
1	Background
2	Developed, High Intensity
3	Developed, Medium Intensity
4	Developed, Low Intensity
5	Developed, Open Space
6	Cultivated Crops
7	Pasture/Hay
8	Grassland/Herbaceous
9	Deciduous Forest
10	Evergreen Forest
11	Mixed Forest
12	Scrub/Shrub
13	Palustrine Forested Wetland
14	Palustrine Scrub/Shrub Wetland
15	Palustrine Emergent Wetland
16	Estuarine Forested Wetland
17	Estuarine Scrub/Shrub Wetland
18	Estuarine Emergent Wetland
19	Unconsolidated Shore
20	Bare Land
21	Open Water
22	Palustrine Aquatic Bed
23	Estuarine Aquatic Bed

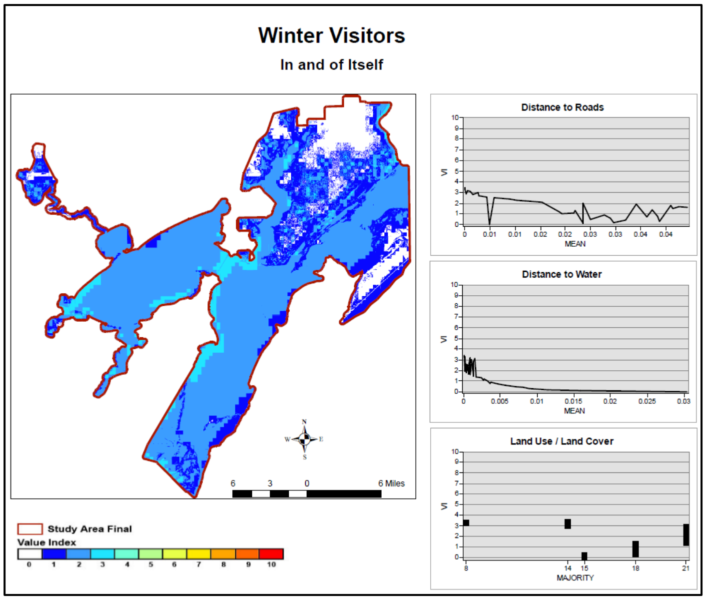
Appendix I. SolVES heat maps and environmental models for winter visitors.

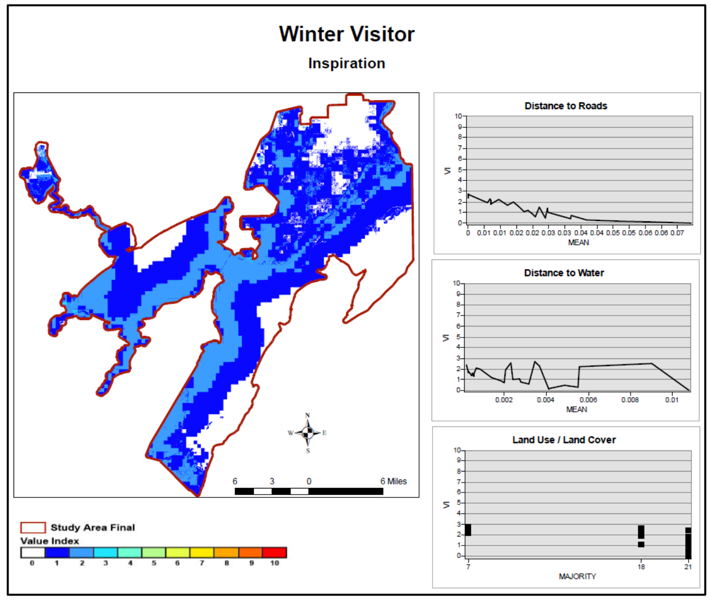


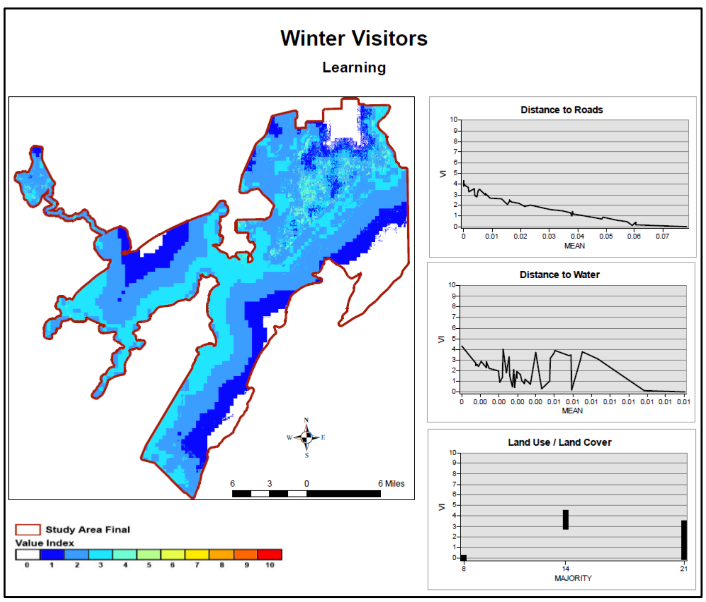


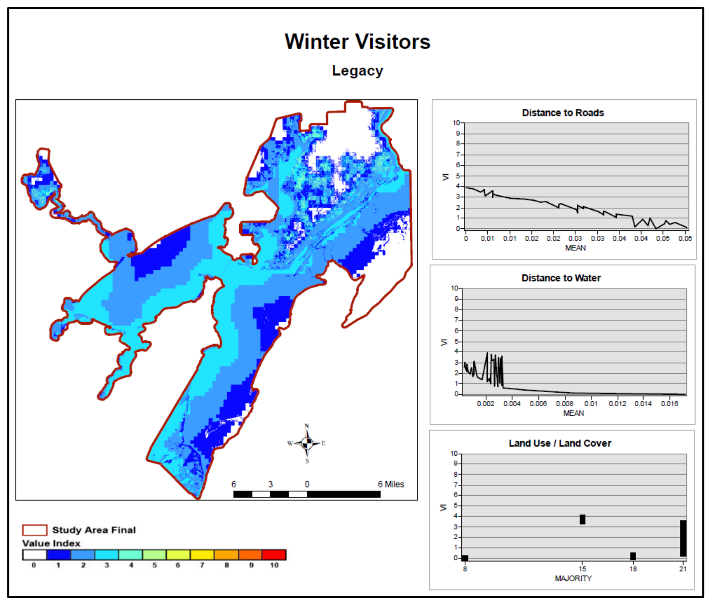


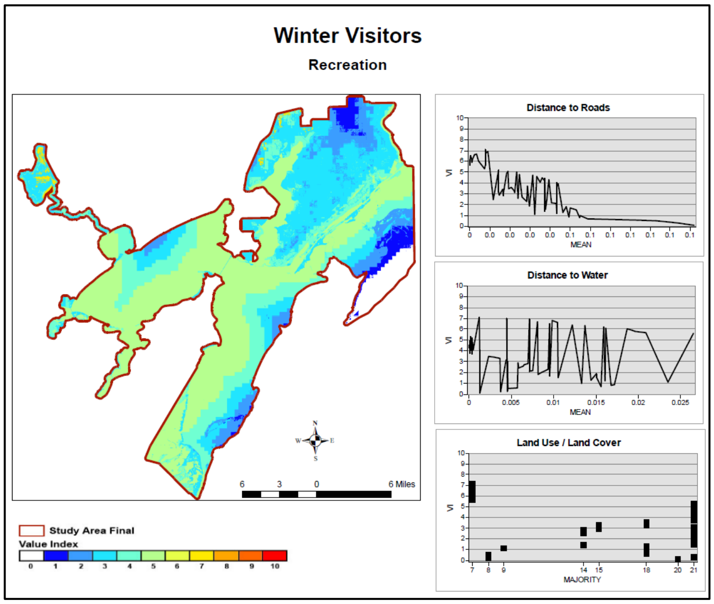


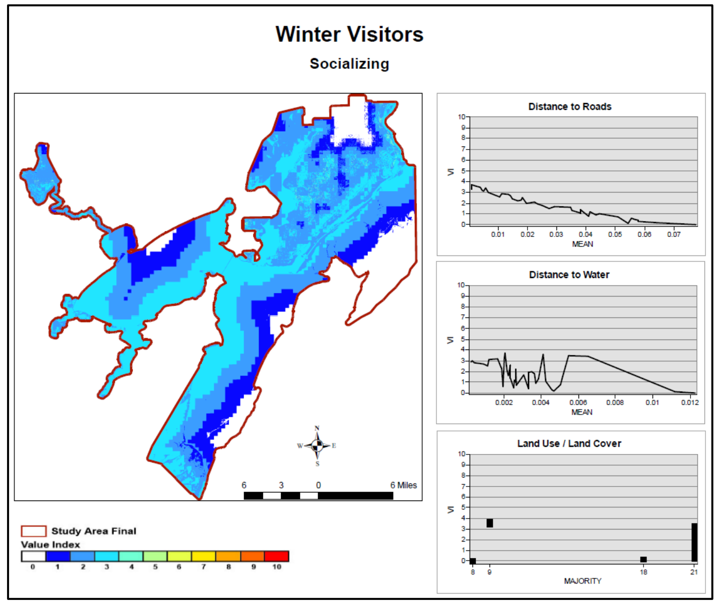

Winter Visitors
In and of Itself
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

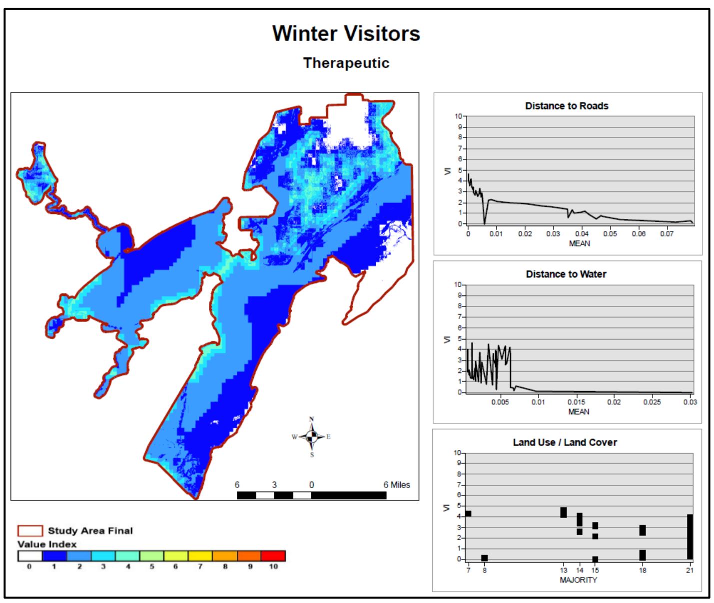

Winter Visitor
Inspiration
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

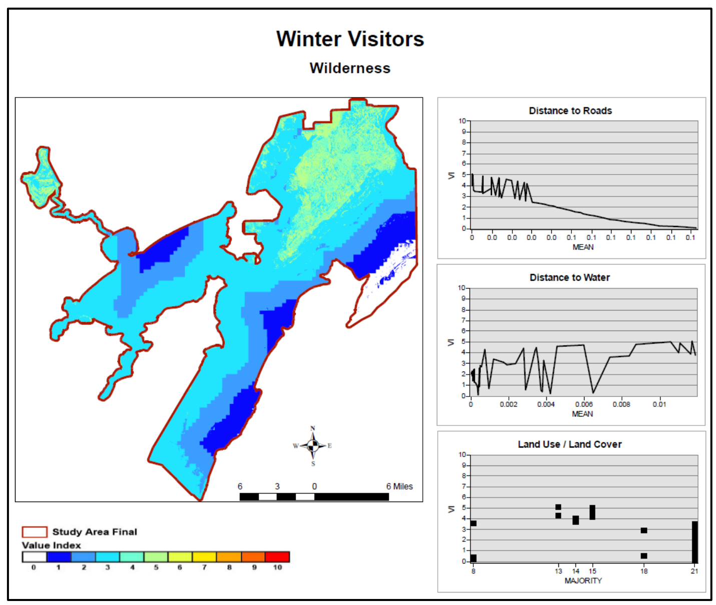

Winter Visitors
Learning
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10


Winter Visitors
Legacy
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

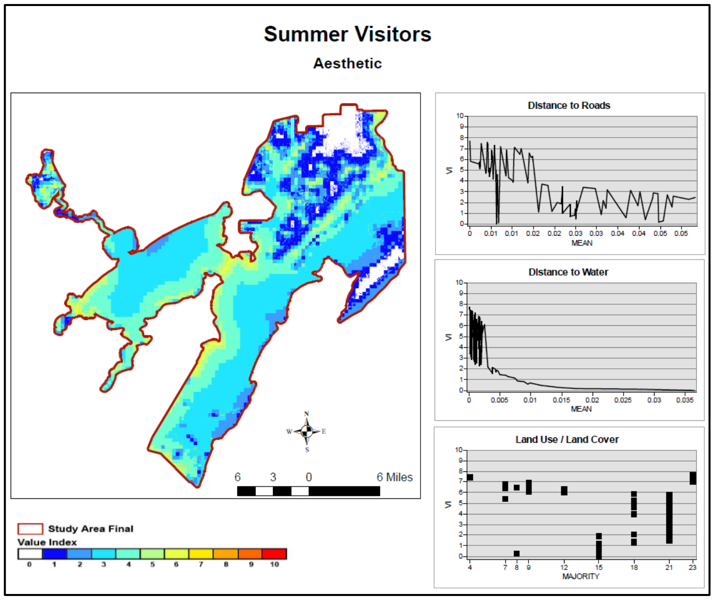

Winter Visitors
Recreation
Distance to Roads
Distance to Water
Land Use / Land Cover
VI
MEAN
MAJORITY
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

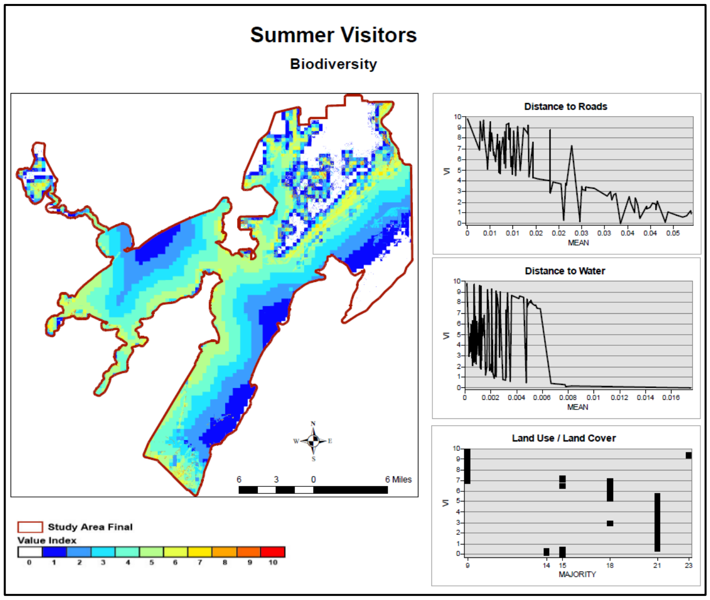

Winter Visitors
Socializing
Distance to Roads
Distance to Water
Land Use / Land Cover
VI
MEAN
MAJORITY
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

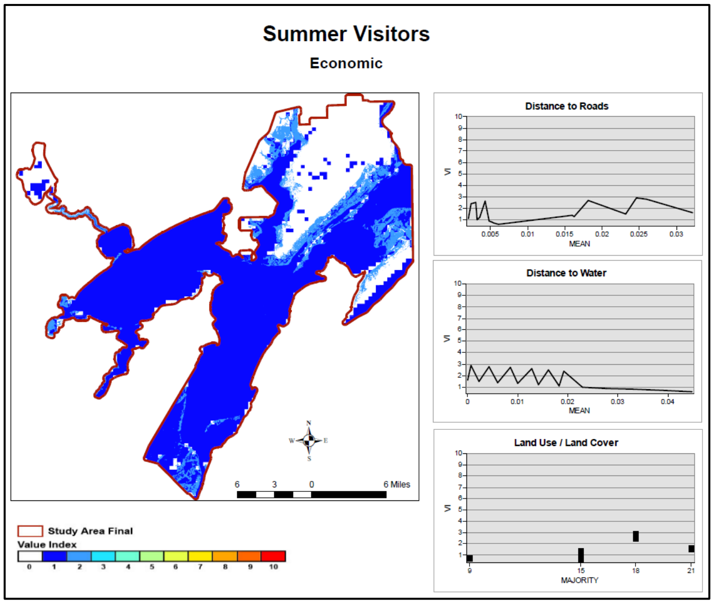

Winter Visitors
Therapeutic
Distance to Roads
Distance to Water
Land Use / Land Cover
VI
MEAN
MAJORITY
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

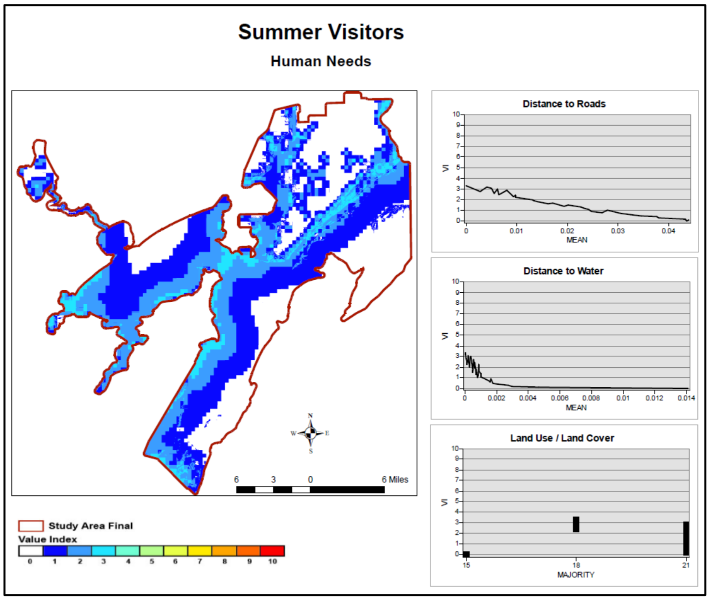

Winter Visitors
Wilderness
Distance to Roads
Distance to Water
Land Use / Land Cover
VI
MEAN
MAJORITY
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

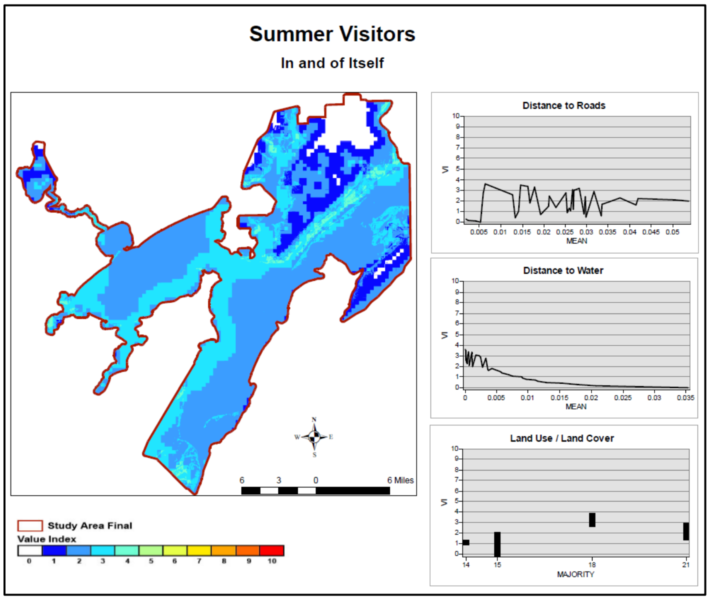
Appendix J. SolVES heat maps and environmental models for summer visitors.

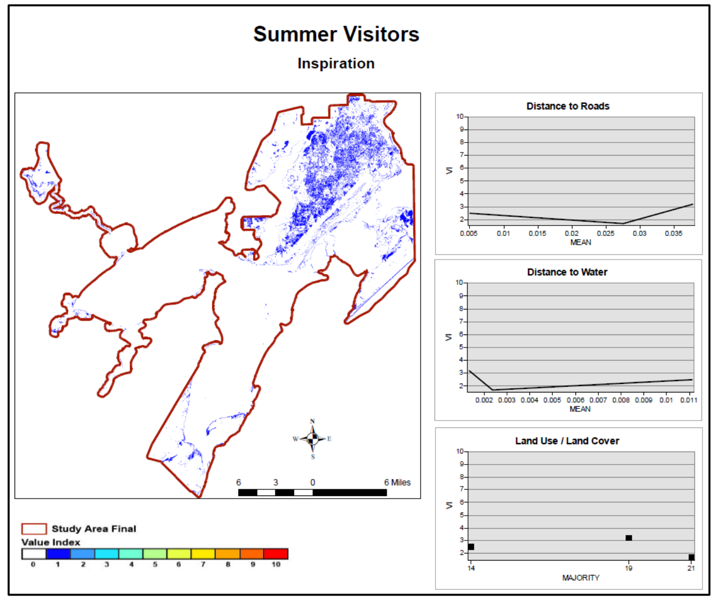


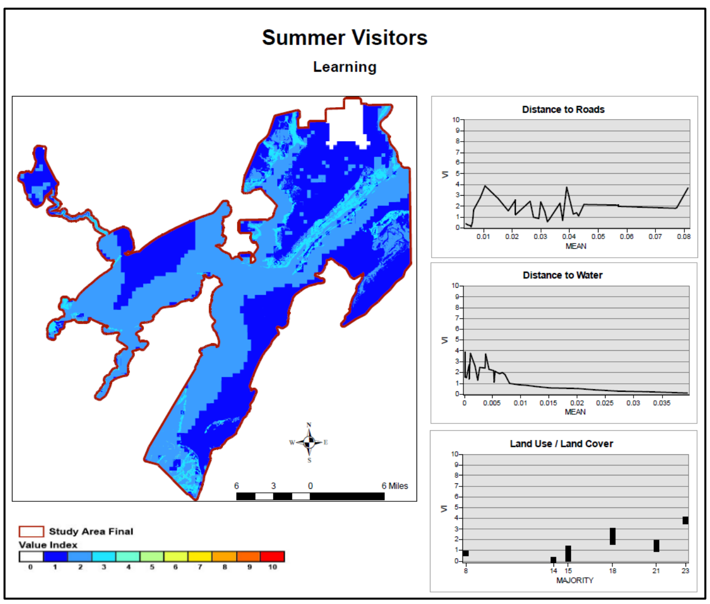


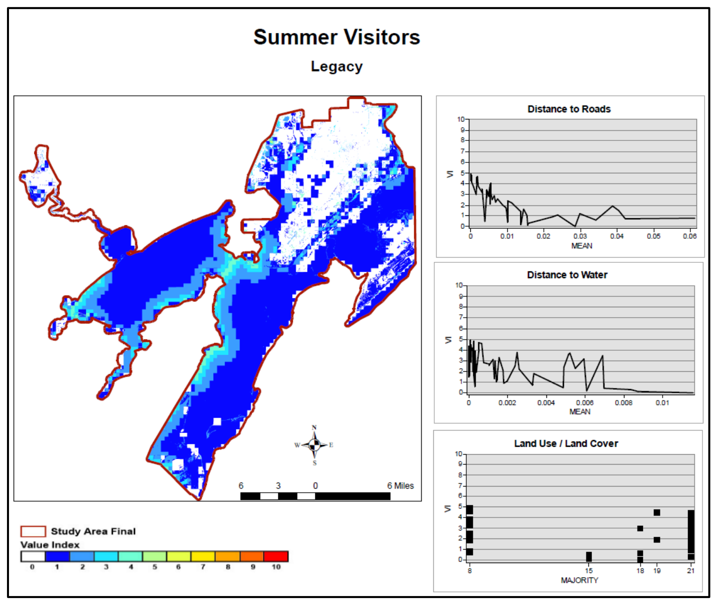


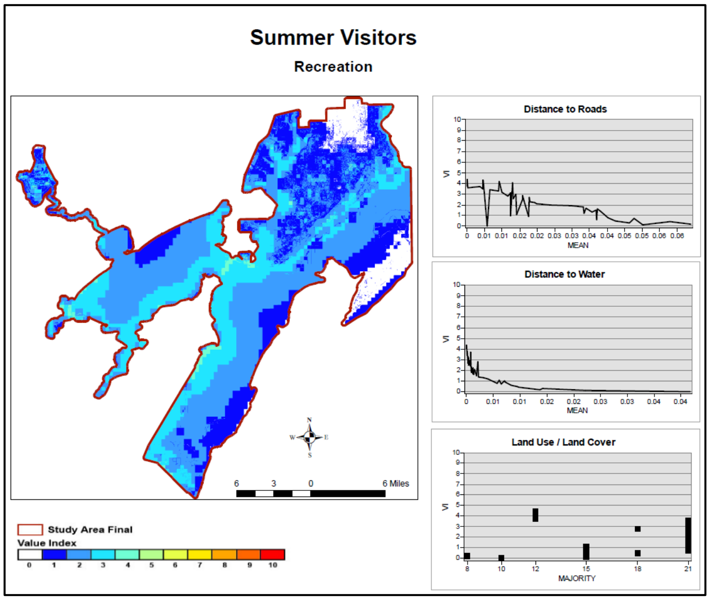


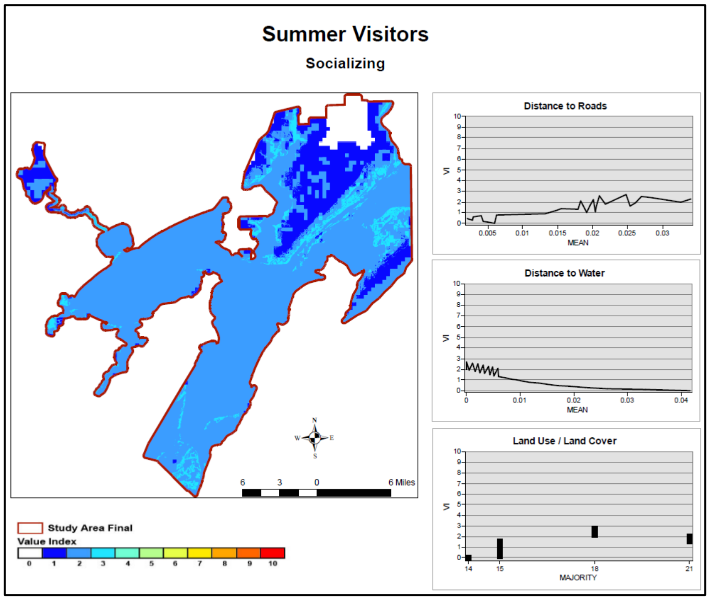

Summer Visitors
In and of Itself
Distance to Roads
MEAN
Distance to Water
MEAN
Land Use / Land Cover
MAJORITY
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

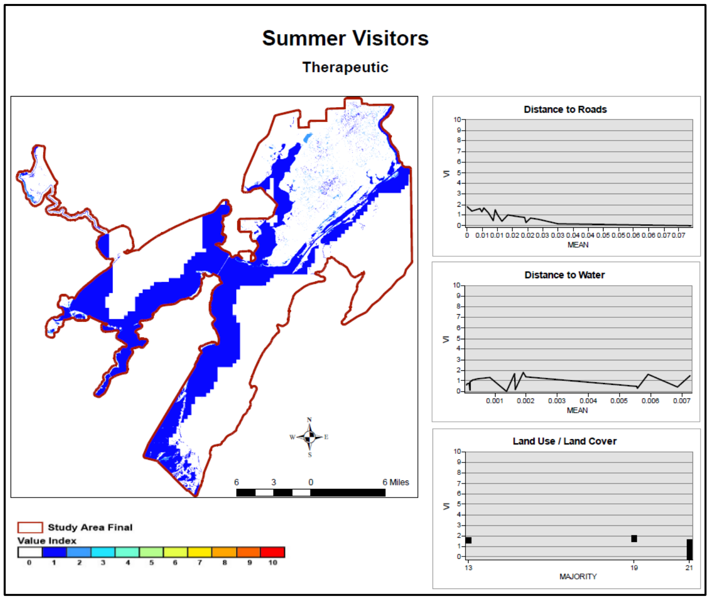

Summer Visitors
Inspiration
Distance to Roads
MEAN
Distance to Water
MEAN
Land Use / Land Cover
MAJORITY
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

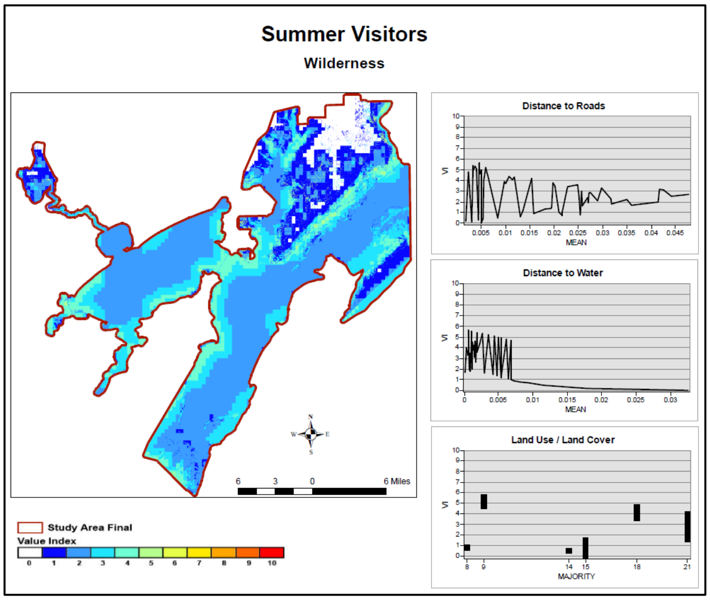

Summer Visitors
Learning
Distance to Roads
MEAN
Distance to Water
MEAN
Land Use / Land Cover
MAJORITY
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10


Summer Visitors
Legacy
Distance to Roads
MEAN
Distance to Water
MEAN
Land Use / Land Cover
MAJORITY
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

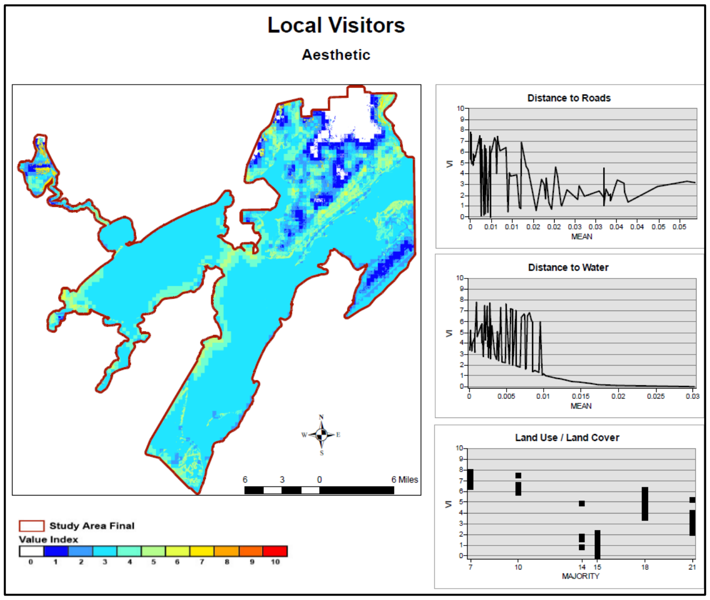

Summer Visitors
Recreation
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

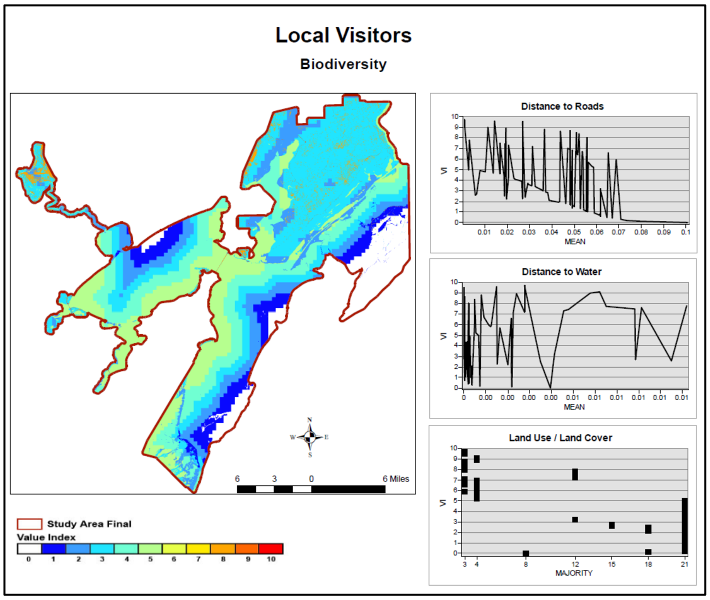

Summer Visitors
Socializing
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

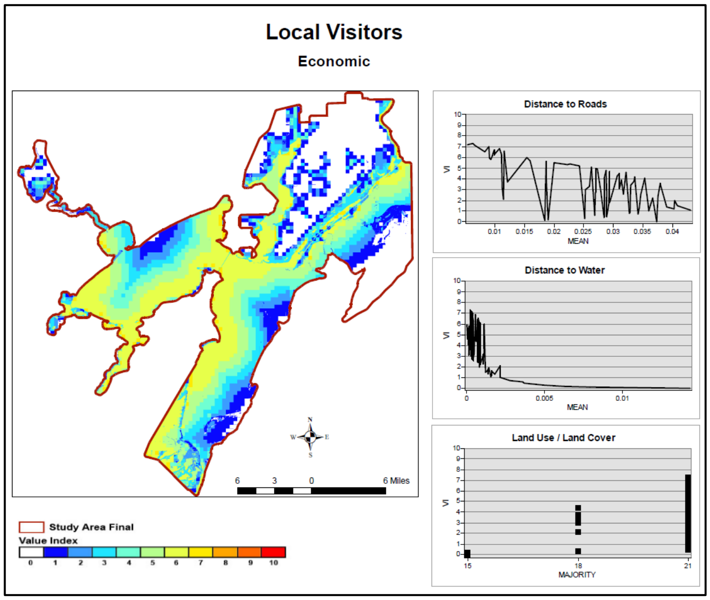

Summer Visitors
Therapeutic
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

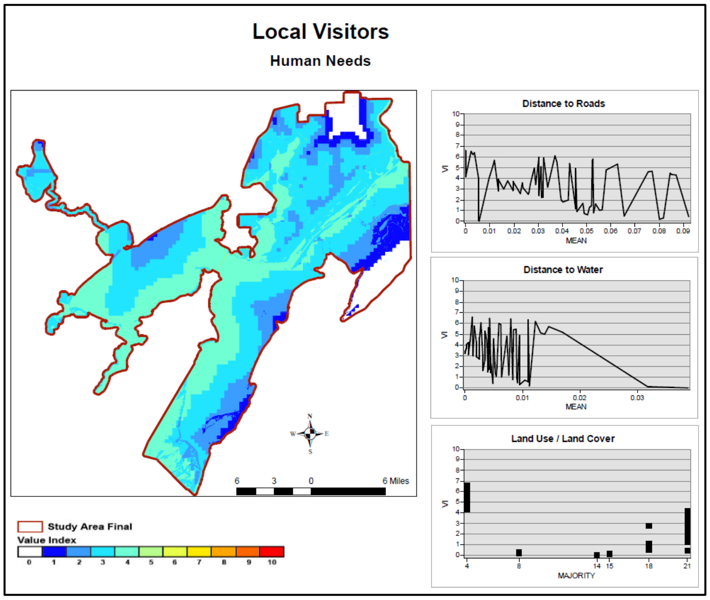

Summer Visitors
Wilderness
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

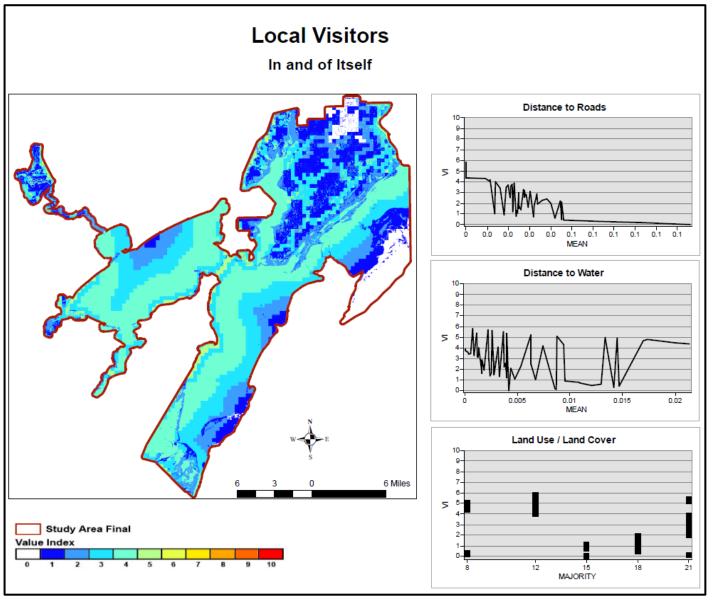
Appendix K. SolVES heat maps and environmental models for local visitors.

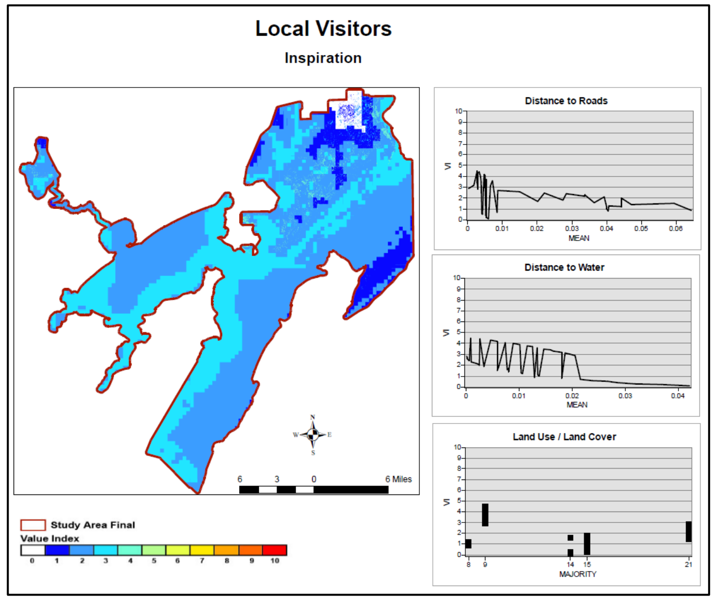


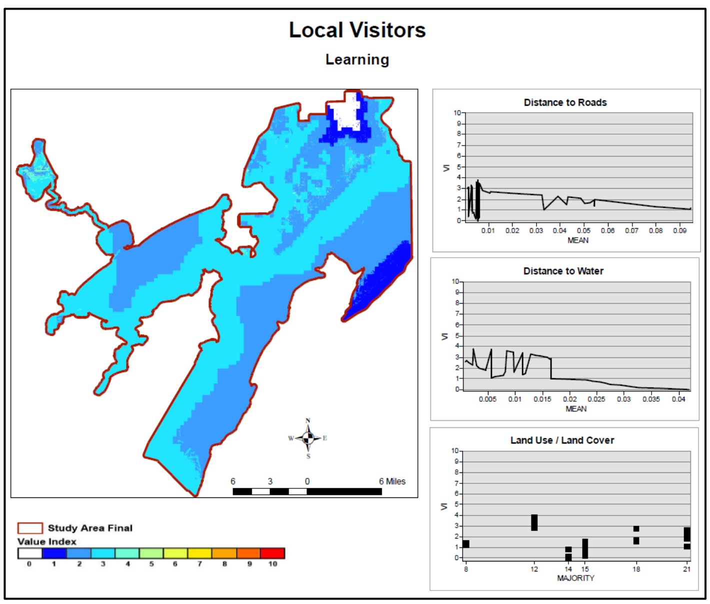


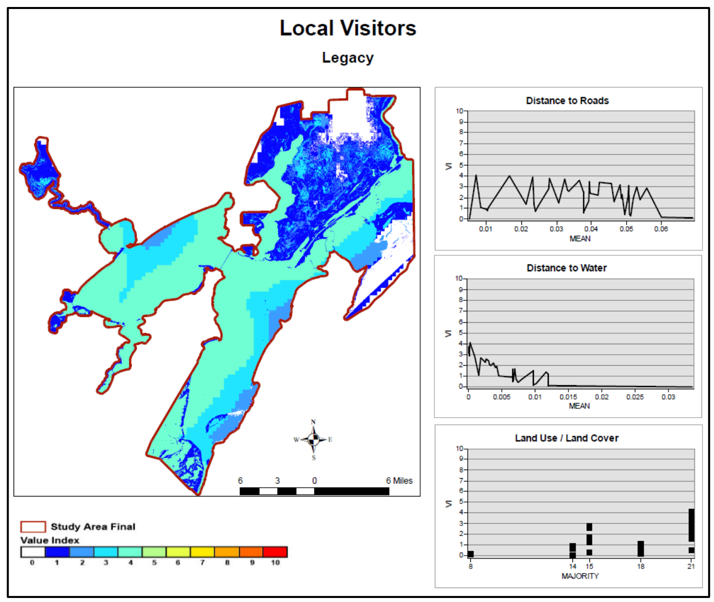


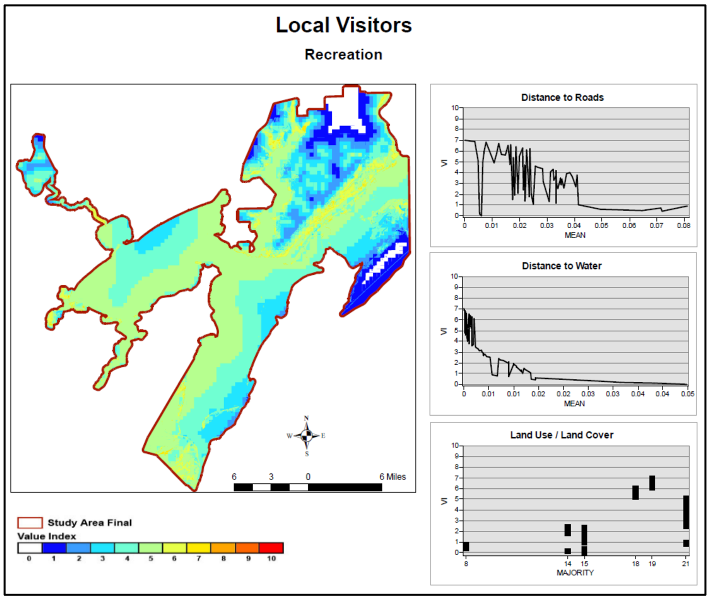


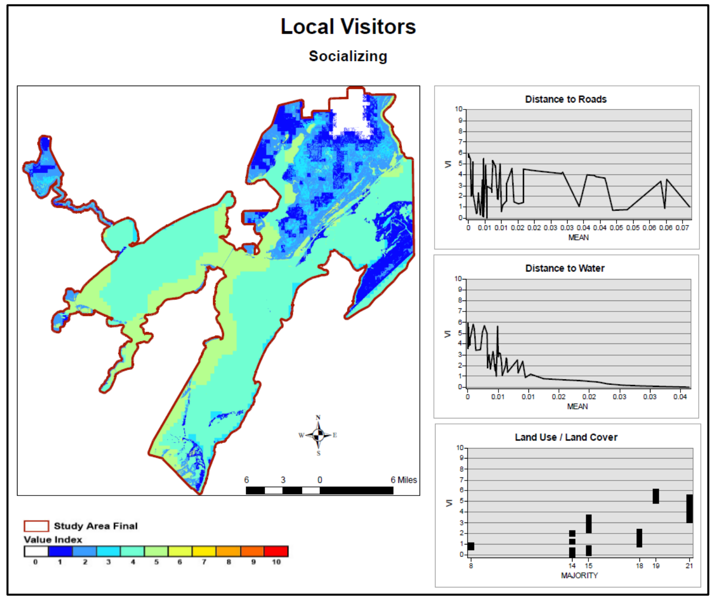

Local Visitors
In and of Itself
Distance to Roads
Distance to Water
Land Use / Land Cover
VI
MEAN
MAJORITY
6 Miles
Study Area Final
Value Index

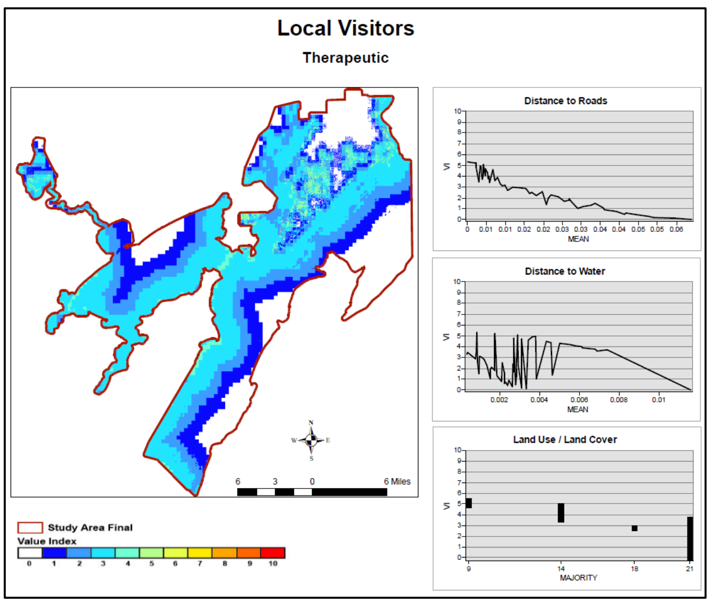

Local Visitors
Inspiration
Distance to Roads
Distance to Water
Land Use / Land Cover
VI
MEAN
MAJORITY
6 Miles
Study Area Final
Value Index

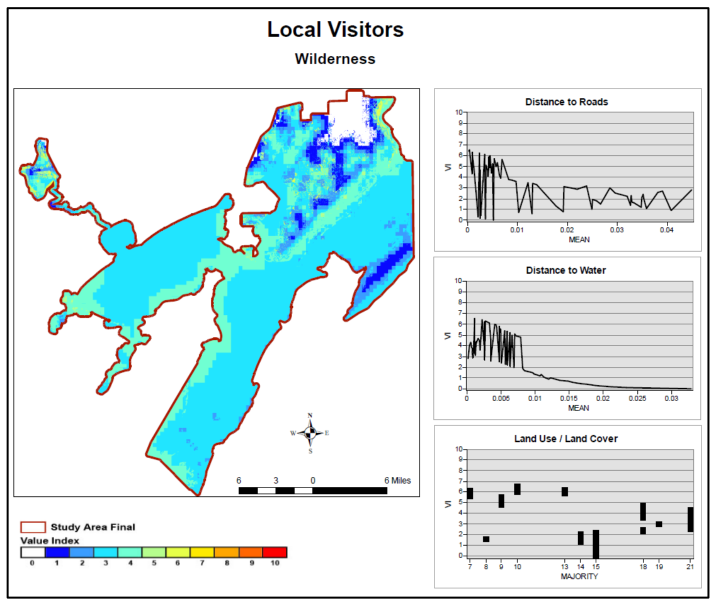

Local Visitors
Learning
Distance to Roads
Distance to Water
Land Use / Land Cover
VI
MEAN
MAJORITY
6 Miles
Study Area Final
Value Index


Local Visitors
Legacy
Distance to Roads
Distance to Water
Land Use / Land Cover
VI
MEAN
MAJORITY
6 Miles
Study Area Final
Value Index

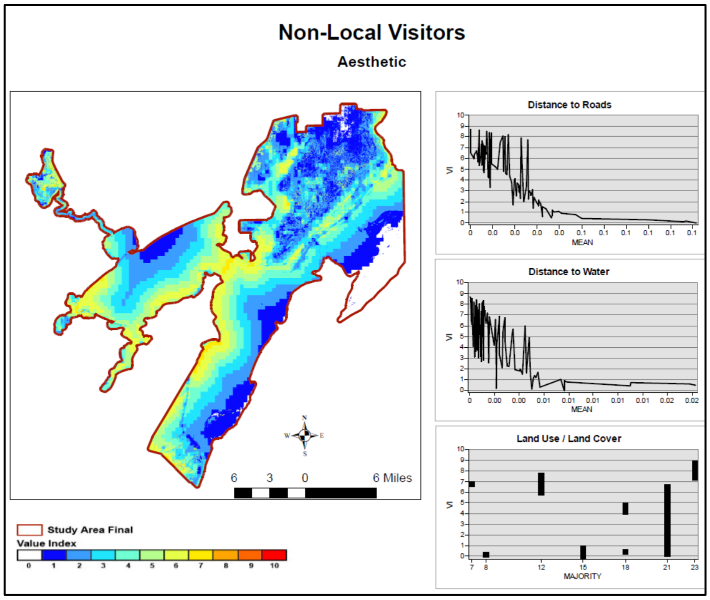

Local Visitors
Recreation
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

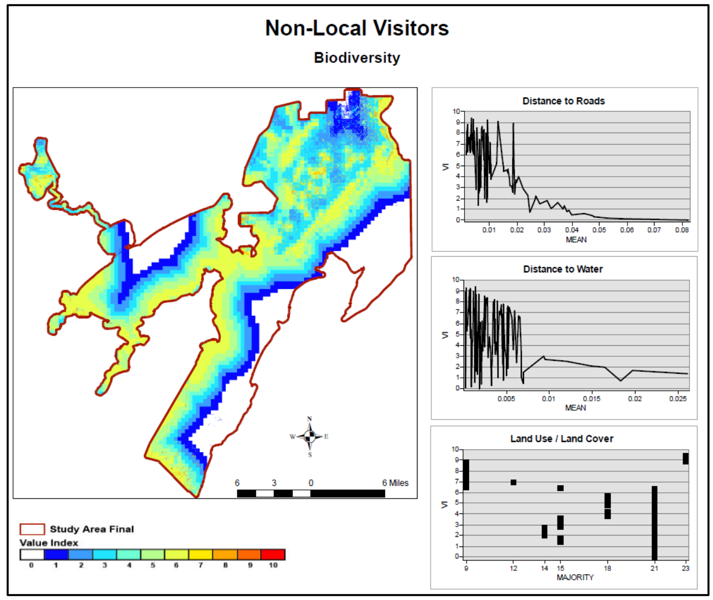

Local Visitors
Socializing
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

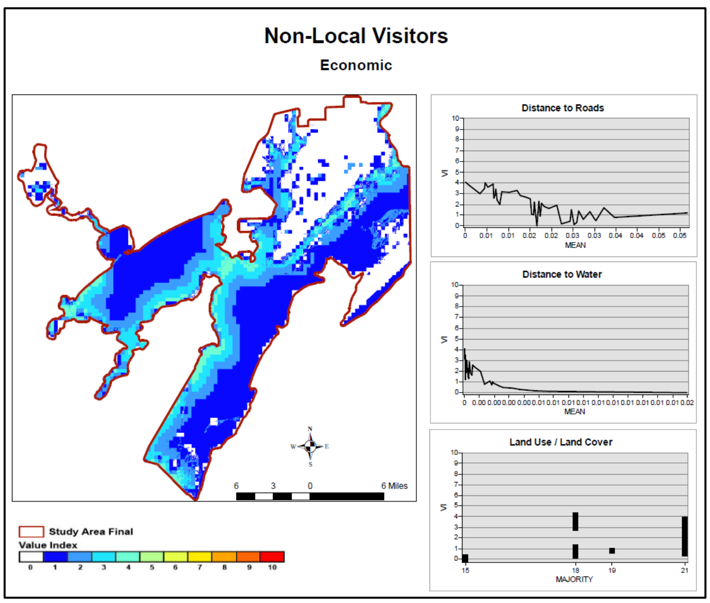

Local Visitors
Therapeutic
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

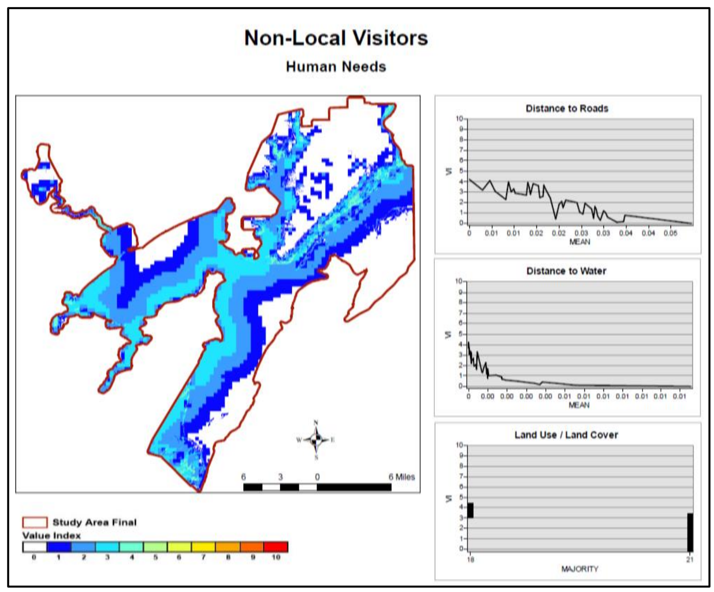

Local Visitors
Wilderness
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

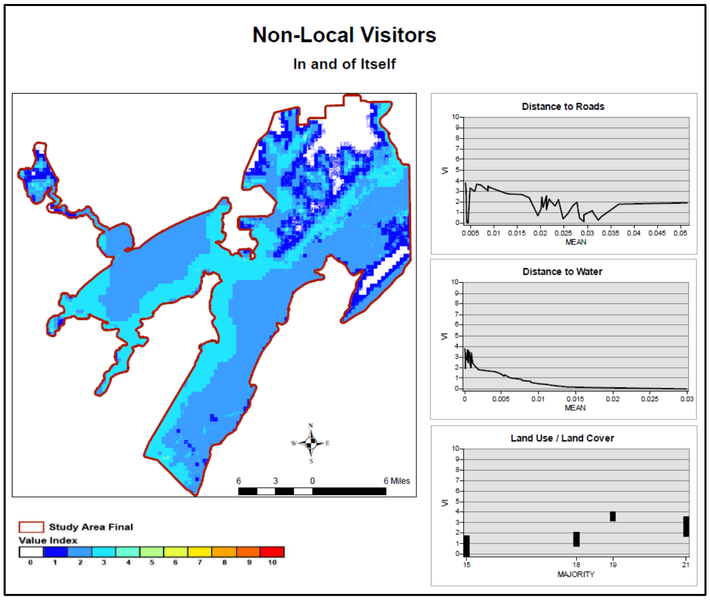
Appendix L. SolVES heat maps and environmental models for non-local visitors.

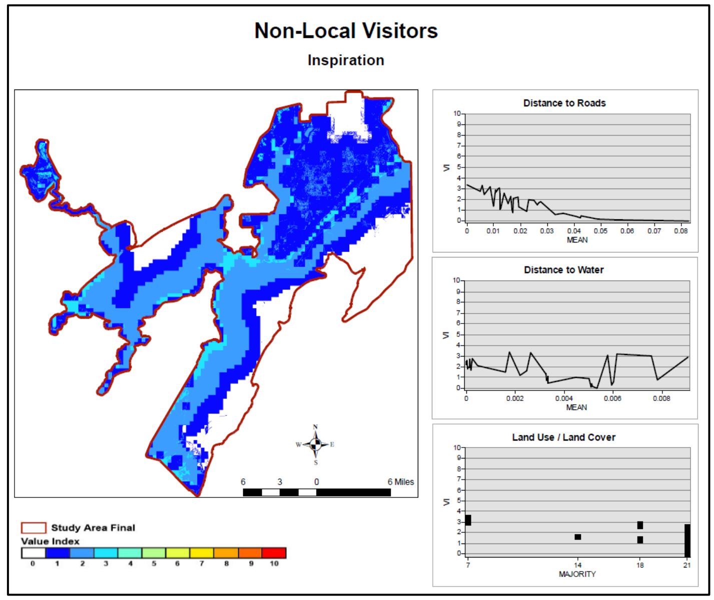


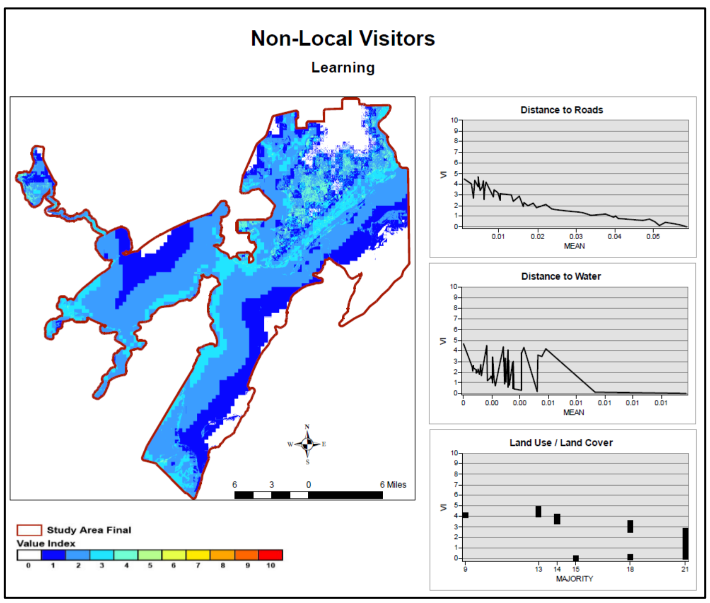


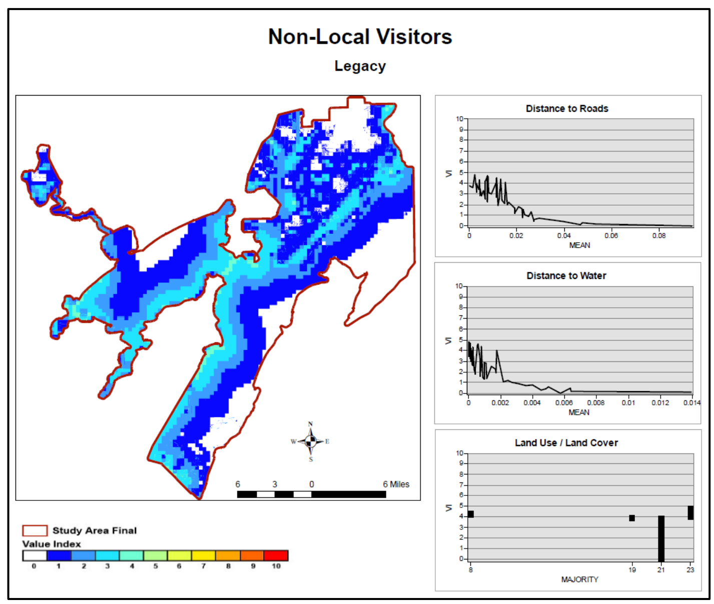


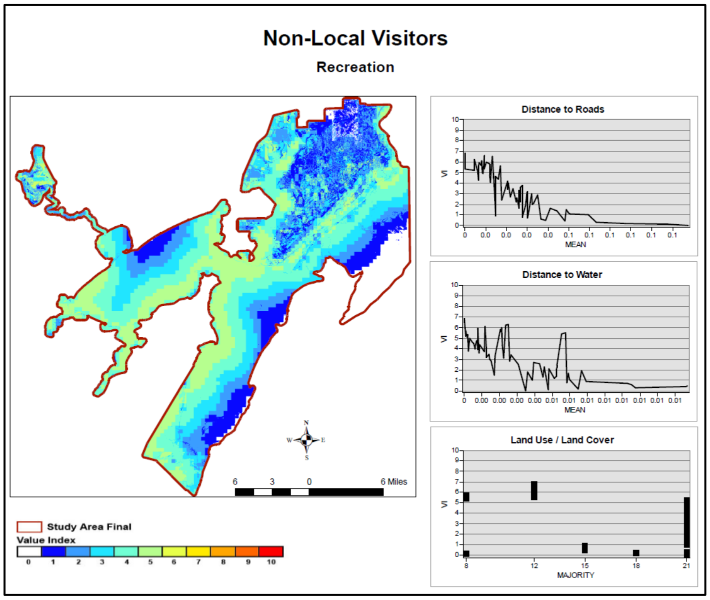


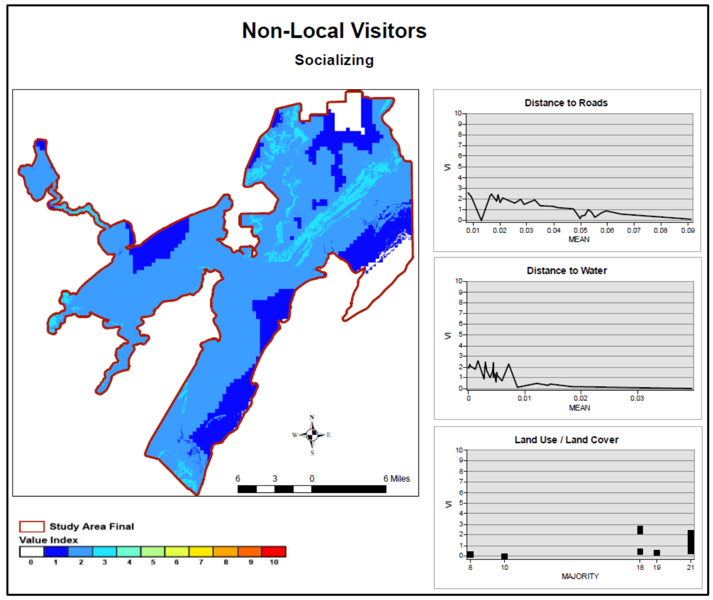

Non-Local Visitors
In and of Itself
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

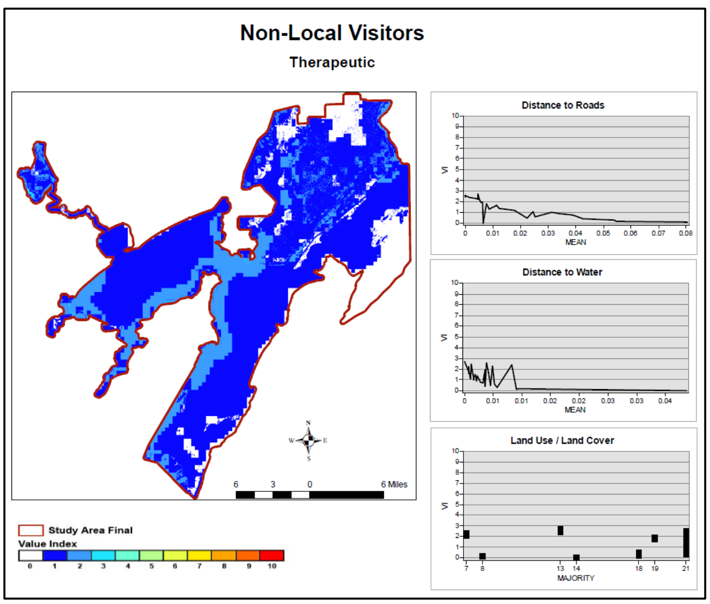

Non-Local Visitors
Inspiration
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10

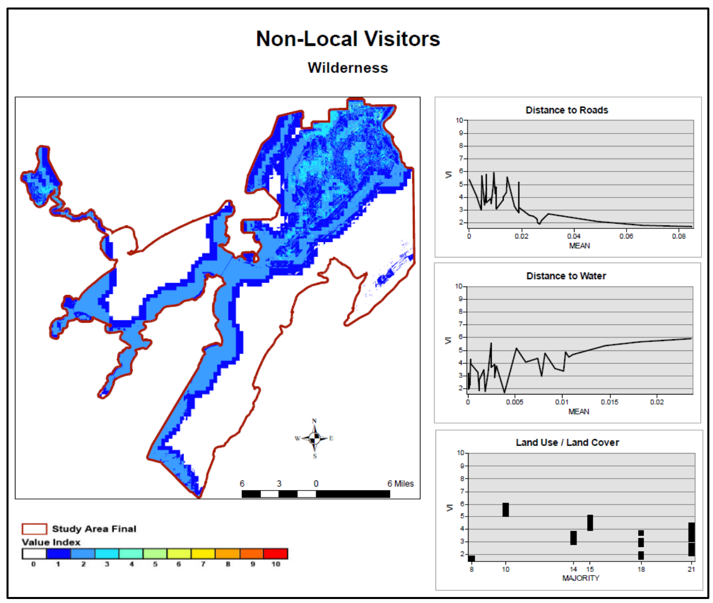

Non-Local Visitors
Learning
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10


Non-Local Visitors
Legacy
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
VI
6 3 0 6 Miles
Study Area Final
Value Index
0 1 2 3 4 5 6 7 8 9 10


Non-Local Visitors
Recreation
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
6 Miles
Study Area Final
Value Index


Non-Local Visitors
Socializing
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
6 Miles
Study Area Final
Value Index


Non-Local Visitors
Therapeutic
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
6 Miles
Study Area Final
Value Index


Non-Local Visitors
Wilderness
Distance to Roads
Distance to Water
Land Use / Land Cover
MEAN
MAJORITY
6 Miles
Study Area Final
Value Index

Appendix M. Mission-Aransas Reserve survey instrument.

Script for Introduction

Good afternoon! On behalf of the Mission-Aransas Reserve I am asking people about how they value the Bays in the area. If you are willing, the survey will take about 20 minutes. This survey will provide managers with information about why Bays are important to visitors and residents of the area. I will not ask any personal identification information, your responses are confidential and you can stop at any time.

Can I ask you some questions?

- <If No, then> If you would rather take the survey later I can give you a link to the Internet site.
  <Share card #1 if requested>
- <If Yes then> Great! <If needed> I do need to verify that you are 18 or older <If no, discontinue interview>. I also need to tell you a few things. This research study has been approved by the United States Office of Management and Budget and by a College Review Board for the Protection of Participants. If you would like more information, have comments, suggestions, or questions about this study I can provide more information.
  <If asked, read big card >

1. First, can you please tell us the ZIP code for the area that you live in? __________

2. How many years have you lived in or nearby this location? ___________

3. Do you consider yourself a:

_____ seasonal resident
_____ permanent resident, or a
_____ visitor

4. Have you ever visited the Bays or areas nearby?

_____Yes _____No _____ Unsure/don't know

5. If you answered yes or unsure to question 4, about how often?

_____every day
_____several times to once a week
_____several times to once a month
_____several times a year to once a year
_____less than once a year

Next, I would like to ask for your opinion of the changes you have seen in the Bays while you have lived in or visited the area. The answer choices are “Large Increase”, “Increase”, “No Change”, “Decrease “, “Large Decrease”, or “Unsure or Don’t Know.”

	Large Increase	Increase	No Change	Decrease	Large Decrease	Unsure or Don’t Know
Abundance of oysters						
Abundance of fish						
Abundance of blue crabs						
Abundance of seagrass						
Shoreline erosion						
Abundance of birds						
Abundance of wildlife						
Public access to land and water resources						
Red tide occurrences						
Abundance of jellyfish						

Next, I have several statements about use of the Bays and the role they play in the lives of families and communities. You can answer “Strongly Agree”, “Agree”, “Neutral”, “Disagree”, “Strongly Disagree”, or “Unsure or Don’t Know”.

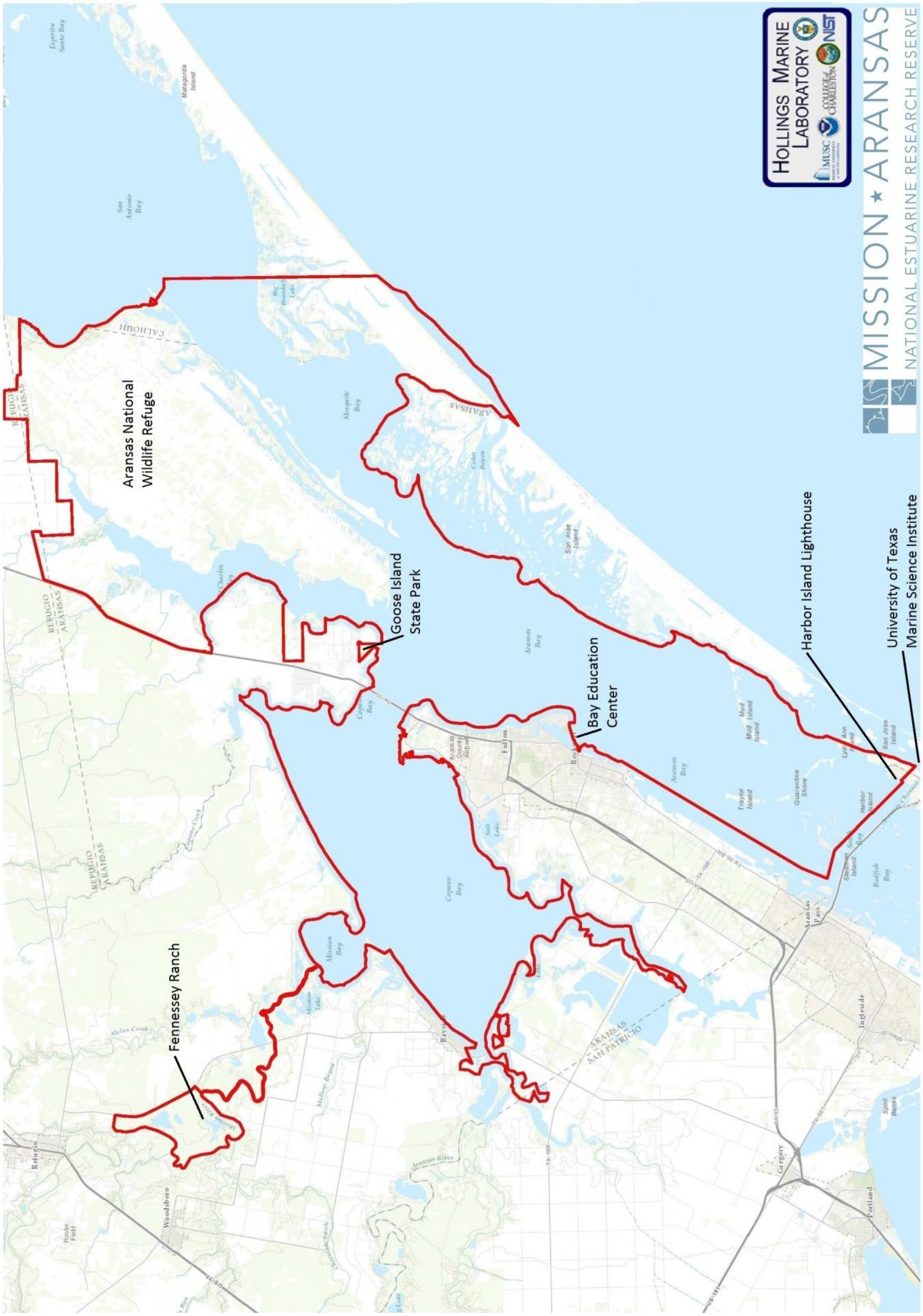
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unsure or Don't Know
The Bays are the best place to satisfy my outdoor recreation needs						
The Bays represent a way of life in my community						
The Bays are important for providing habitat for fish and other wildlife						
I am very attached to the Bays						
I get more satisfaction out of visiting the Bays than any other place						
My community's economy depends on the natural resources of the Bays						
The Bays contribute to the character of my community						

Now I would like to ask you about how you value the Bays. We are interested in 13 values. I can give you a definition or examples for any of them.
<Let them fill this out if it's easier>

1. Aesthetic ______
2. Biodiversity ______
3. Economic ______
4. Legacy ______
5. In and of itself ______
6. Learning ______
7. Human Needs ______
8. Recreation ______
9. Spiritual ______
10. Therapeutic ______
11. Wilderness ______
12. Inspiration ______
13. Socializing ______

First, We would like to know how important each of the following value types are to you when you think about the Bays. Later, we will ask you to mark places that you value on the map.

To do this imagine that you could "spend" 100 pennies to ensure that the Bays are able to preserve or develop the characteristics that you most value. You may allocate or "spend" the 100 pennies in any way you like, but your total spending may not exceed 100. You might "spend" all 100 pennies on one value (and 0 on all others), or you might "spend" 50 pennies on one value, 25 on another value, and 25 on yet another value. Remember, the total pennies you "spend" should equal 100 (this is not money… just an easy way for the researcher to compare).


Aransas National Wildlife Refuge
Goose Island State Park
Bay Education Center
Harbor Island Lighthouse
University of Texas Marine Science Institute
Fennessey Ranch
Hollings Marine Laboratory
MISSION ★ ARANSAS
NATIONAL ESTUARINE RESEARCH RESERVE

Next, I would like to discuss management goals. Local communities have identified goals to guide decisions that affect the Bays and its watersheds. Please indicate whether you consider each of these a “High Priority”, “Priority”, “Neutral”, “Low Priority”, “Not a Priority”, or “Unsure or Don’t Know”.

	High Priority	Priority	Neutral	Low Priority	Not a Priority	Unsure or Don’t know
Improve water quality in the local Bays						
Improve freshwater inflows to the Bays						
Manage the quantity and improve the quality of storm water runoff to the Bays						
Restore shoreline and wetland habitats						
Eliminate further loss of shoreline, seagrass and wetland habitats						
Restore and sustain fish stocks and other living marine resources in the Bays						
Provide increased levels of public access to the Bays and its resources						
Increase the resilience of coastal communities in the face of natural and human-induced disasters (such as hurricanes and rising seas)						
Incorporate local social and cultural heritage into management of the Bays resources (such as public input and community advisory boards)						
Increase awareness of human-use patterns that influence resource sustainability						
Integrate understanding of human uses with knowledge of natural processes						
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the Bays						

To help us better understand what residents know about the characteristics of the Bays, please rate your level of understanding of the following management dimensions. Please select “Excellent,” “Good,” “Fair,” “Poor,” or “Not sure” for each of the dimensions.

	Excellent	Good	Fair	Poor	Not sure
Policy					
Ecology					
History					
Recreational Aspects					
Public Involvement Opportunities					
Educational Opportunities					

Public access to coastal waters and waterways has been identified as an Adequate Access management issue. From your perspective, how adequate is existing public access to the Bays? For each access type please select the response that best represents your opinion. Your choices are “More than Adequate Access”, “Adequate Access”, “Neutral”, “Inadequate Access”, “Little or No Access”, or “Don’t Know”.

	More than Adequate Access	Adequate Access	Neutral	Inadequate Access	Little or No Access	Don't Know
Boat Ramps						
Beaches						
Boat Slips						
Restaurants and restaurant dockage						
Scenic view points						
Waterway nature trails (e.g. kayak trails)						
Nature trails adjacent to water						
Natural swimming areas						
Boardwalks						
Dune walkovers						
Camping						
Wind/Kite surfing						
Kayaking sites						
Rod-and-reel fishing sites						
Fly fishing sites						
Public oyster sites						

Finally, I would like to ask just a few more questions to help us understand your needs.
The answers you provide here will in no way be linked to you.
Does your household income depend on products or services related to the Bay's resources?
_____Yes _____No _____Unsure

If yes, please describe the source of the income:
_____Commercial Fishing _____Commercial Oystering _____Tourism _____Oil and gas _____Other

In what year were you born? __________

Are you ______male ______female?

What is your highest level of education? <don't read, just check one>
_____Less than high school diploma
_____High school diploma or GED
_____College degree (2-year or 4-year)
_____Graduate degree

In which of these categories does your income fall into? READ
______ $39,000 or below______$40,000-$69,999, ______$70,000 or more

What is your occupation? _______________________

What is your ethnicity?
_____ Hispanic or Latino
_____ Not Hispanic or Latino

With which racial group(s) do you most identify? (Don't read, just check one or more)
_____American Indian or Alaska Native
_____Asian
_____Black or African American
_____Native American
_____Native Hawaiian or Other Pacific Islander
_____Caucasian