Hawaiian Islands Land Trust: North and South Kona Conservation Analysis

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Practicum

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Abstract

The Hawaiian Islands host unique environments and geographic zones that are home to a rich culture and history. The indigenous plants and animals in Hawaii make up the physical landscape and also express a connection to the history and culture of the Hawaiian people. Hawaiian Islands Land Trust (HILT) is an organization dedicated to the preservation of the physical and cultural landscape of Hawaii. The goal of HILT is the preservation and conservation of unique areas and their environmental and cultural importance. Integrating today's geographic information systems (GIS) technologies can improve the effectiveness and ease in which we preserve the world renowned beauty and identity of the Hawaiian Islands. This practicum created a GIS process for weighted and unweighted identification and classification of ideal conservation lands in the North and South Kona districts which contain features critical to meeting HILT's goals using existing data. Using a suitability analysis framework agricultural, cultural, environmental and ecological, publicly accessible, and scenic lands were evaluated to identify those areas of ideal conservation. Model builder served as the platform for the simultaneous

analysis of 22 contributing data layers. This process created 7 maps that can be used to assess the conservation significance of parcels using a basic geodatabase. The geodatabase developed for this practicum sets a baseline for past and present data across the 5 criteria in HILTS strategic plan.

Letter of Significant Contribution

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May 14, 2017

LETTER OF SIGNIFICANT CONTRIBUTION

Dr. Dawn Hawley, PhD, Professor
Department of Geography, Planning, and Recreation
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Dear Dr. Hawley:

My name is Janet Britt and I am the Acquisitions Specialist and Director for Hawaii Island for the Hawaiian Islands Land Trust (HILT), a non-profit 501 (c)(3) conservation organization protecting land throughout the State of Hawaii. One of our major problems as an organization has been to identify lands that contain conservation targets that fall into the main focal areas of agricultural areas; ecological areas; cultural/historical areas; marine and coastal lands; scenic and open space and public access opportunities. Those broad categories are defined as the conservation targets we look for when considering whether or not to undertake a project. Most of our efforts have been very subjective in that we talk to people living in the various districts on each island and they tell us about the places that are special to them and places where they <u>think</u> conservation targets exist. Obviously, this is not a scientific, objective manner in which to choose projects to pursue. For years, HILT has been trying to obtain a GIS based study of the lands on each island but have found that we could not afford the costs associated with that kind of project. Then, a little over a year ago, Alan Livingston and Dr. Richard Bennett, both on our Hawaii Island Advisory Council, mentioned that Alan's son, Trey was working on a Master Thesis in G.I.S. Trey and I visited and his proposed project for his Masters was <u>exactly</u> what HILT had envisioned for years. Trey proposed to do an in-depth analysis of land in the Districts of North and South Kona on the island of Hawaii by looking at the focal areas listed above and identifying those areas that overlapped as far as having one or more of the identified conservation targets present.

Trey showed me the results of his work last week and both Dr. Bennett and I were ecstatic with the work that Trey has done and the resultant product. We can ask questions about a particular parcel of land and find out exactly what conservation targets most likely occur on that land. If we are looking to protect a particular target, such as coffee farms, then his G.I.S. database shows where all the coffee farms are, how large they are, who owns the land, etc. If we are looking to protect a threatened or endangered species, we can also pinpoint where that species is most likely to occur. Trey's Master Thesis project will be vital to our conservation efforts on the island of Hawaii.

In particular, Trey was incredibly motivated and worked extremely hard to incorporate all the databases that we knew were available in his final product as well as finding additional databases that were also added such as water quality and impaired water bodies. The resultant database combines many other mapping products so that all are now in one place where it is easy to see the various layers.

I have the highest of praise for Trey's accomplishments as well as for Trey himself. He was such a pleasure to work with and was always enthusiastic, dependable, makes excellent decision that are well thought out, and has a wonderful attitude towards his work. He always kept me informed as to how the project was coming and was an excellent communicator. Trey certainly went above and beyond what I had expected that the final G.I.S. product would be. Trey Livingston has developed a G.I.S. database for a portion of Hawaii Island that will be invaluable to the Hawaiian Island Land Trust as we proactively work to protect lands that have a concentration of conservation targets. Trey has certainly excelled in his quest to complete the requirement for this practicum.

Please feel free to contact me with any questions.

Sincerely yours,

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Introduction

Conservation of the Hawaiian Islands is of high priority to the federal and state government, and the residents who rely upon island resources and beauty for livelihood and enjoyment. Volcano National Park, and Kealakekua Bay State Park represent premier examples of the public's dedication to preserving the environment and the culture indigenous to Hawaii. HILT is the only statewide nonprofit land trust and it distinguishes itself from the Trust for Public Land by holding conservation easements and fee simple lands, and performing stewardship of protected lands. Hawaiian Islands Land Trust aims to provide quality conservation of critically important areas across all islands. HILT's mission is "To protect the lands that sustain us for current and future generations" (HILT 1 2014). Properties that contain significant agricultural, cultural, ecological and environmental, public access (Private land adjacent to public land or known reserves), and scenic characteristics are defined as ideal conservation lands. These properties are central to HILTs' acquisition process because they represent five categories that are critical to preserving the physical and human geography of Hawaii.

Population growth can result in less land being available for conservation and greater pressure on the environment and the ecology that it supports. According to the Population and Economic Projections for the State of Hawaii to 2040, the majority of growth will occur on Oahu's neighbor islands and Honolulu's projected population will drop from 70.1 to 63.6 percent of the state's total population (SoH 1 2012). The neighbor islands have a significantly lower population density than the island of Oahu due to Honolulu's population foci but will sustain population growth and a density increase. The result of increasing the population density on neighbor islands means conservation needs to be implemented now, prior to the influx of people and division of lands. This practicum focuses on the Big Island of Hawaii because of this increased likelihood of development. Pristine Hawaiian lands will become rarer while also becoming more important. Geospatial analysis can show us lands targeted for optimal conservation and land use efficiency providing a balance between development and conservation.

The large conservation areas around Hawaii are some of the leading tour destinations and in a state where tourism is a key economic enabler these areas become very valuable. The Volcano National Park for example, sees an average of 1.6 million people every year. This park alone fuels the economy of the Big Island while also preserving a 333,000 acre wildlife refuge area (NPCA 1 2008). Importance of these areas goes beyond the economy and aesthetic value; the resources they protect are critical to life on the islands. For example, rainforest preservation is critical to maintaining effective watersheds and is a case in point of the finite resources Hawaii relies upon for survival. Hawaii obtains its drinking water from wells drilled deep below the island where the volcanic rock has purified and stored it. Isolation of the islands from any great land mass makes this one of the most cost effective ways to provide water. The aquifer ensures a future for the residents of Hawaii, its visitors, and ecology. Identifying and conserving Ideal conservation lands that represent characteristics critical to Hawaii is necessary to sustain and improve the environment, lifestyle, and brilliance unique to these islands.

Purpose

The purpose of this practicum is to analyze North and South Kona districts of Hawaii using GIS to identify and classify the density of land ideal for conservation. This is accomplished by establishing an objective process for selecting land based on criteria and data representative of the HILTs strategic plan. The data set used for this analysis will be sufficient to prove the benefit and utility of this process.

The objectives to be met are:

1) Establish a Geodatabase that will enable HILT to utilize and grow GIS operations
2) Provide a map of North and South Kona that identifies ideal land for conservation.
3) Prioritize ideal conservation lands and provide HILT a report in an effective and understandable format.

Scope

North and South Kona host a large array of habitats that range from barren lava flows to rainforests and cattle pastures. The practicum was limited to the analysis of these districts, producing a map of parcels of land that meet conservation criteria, and prioritizing those lands by their conservation potential. GIS provides the analysis of the parcels; an explanation of this analysis will be covered in the report. A brief to HILT was necessary to justify why certain criteria were used, the results of the analysis, and how this practicum could improve their ability to identify lands for conservation in the future. A geodatabase is provided to HILT as a byproduct of the GIS work that was done. The focus of this practicum is not to create an extensive database of these lands, but rather a concept trial, and will only contain data used and produced for the final analysis.

This practicum required coordination with the Hawaiian Island Land Trust to find ways to represent conservation value and priority. Available data determined the criteria that was included in the analysis since there was no opportunity or time to conduct necessary field work to collect new data. Using current and additional data to represent each criteria can create a more accurate and precise representation of ideal conservation lands, however this practicum focused on using enough data to validate and exercise the validity of this process. Maintaining communication with HILT to address problems with data among other things as early as possible was critical. Iterative processing of the data against the defined problem and goal was necessary to smooth out the issues regarding data availability.

Literature Review

GIS and Land Conservation

This literature review uses habitat GIS studies to explore different frameworks GIS analysts apply to protecting the environment, natural resources, and wildlife. Techniques and best practices identified by each of these studies creates a database of lessons learned that were vital to improving the value and accuracy of this practicum. Advantages gained by reviewing these studies include identifying frameworks for scoping the extent of data finding, relevant GIS tools, and the application and flow of advanced models. These studies also gave insight to challenges and limitations of using GIS to evaluate environment and habitat suitability.

The framework and tools used by the Land Trust of Napa County were critical to informing the process of this practicum. The goal of this practicum and the Land Trust of Napa County are centered on the premise of using GIS to identify land based on objective criteria. Napa County contains 480,000 acres and about 70 imperiled species and natural communities (ESRI 1 2006). Protecting an area of this size is difficult and requires efficient practices and dedication of personnel. The proximity of Napa County to San Francisco correlates to its recent boom in development that threatened some of the 70 imperiled species challenging the Land Trust of Napa County processes. GIS proved to be a critically important tool for the Land Trust of Napa County by focusing efforts of conservation on the highest risk areas to protect the species and their habitats. The Land Trust hired the Nature Conservancy and Nature Serve to accomplish the GIS analysis. “The Nature Conservancy and NatureServe used ArcView and ArcInfo to identify key landscape linkages that would maintain the composition, structure, and vitality of important ecological systems in the county" (ESRI 1 2006). These and other factors that other conservancy organizations identified were brought together in GIS to determine areas of high conservation priority. Analysis in GIS involved use of the Vista tool, and presentation of the information improved through use of the spatial analyst extension among other tools (ESRI 1 2006). The use of the Vista tool created a process that this land trust could use to analyze new areas without needing to reinvent the framework.

Hawaii faces a boom in population and an increasing risk to its habitat and ecosystem similar to what occurred in Napa County. The ability of this practicum to account for this increasing risk hinges on the relevance of the factors used to define Ideal conservation lands and conservation importance. The analysis performed by Napa County Land Trust highlighted the practice of narrowing the scope of analysis to a sample area in order to accurately capture threatened areas when the extent of land to cover is large. Defining objectives and finding correlating data that represents a sample of the overall desired area is applied to this practicum by analyzing the North and South Kona districts with the intent for the model to be scaled to include all islands.

Habitat Suitability Models

Habitat modeling and landscape modeling although common practices for GIS users are often used exclusively. The combination of these practices, however, is an effective technique for conservation planning. These disciplines were synthesized by Dr. Larson in Southern Missouri in

2004. Dr. Larson applied habitat suitability, landscape simulations and population viability models in southern Missouri for the ovenbird. “Using population viability, habitat suitability, and landscape simulation models in an integrated analysis for conservation planning is an important advancement because habitat quality is a critical link between human land use decisions and wildlife population viability” (Larson 4 2004). The planning we conduct for our communities is often influenced by the effect to the local ecosystems, an integrated approach ensures the opportunity to present balanced information to decision makers. Conservation planning should use a comprehensive approach when attempting to identify areas where an improvement in Hawaii’s wildlife population viability or habitat quality is the desired outcome. For example, watersheds and wetlands should be considered when assessing habitat quality because they are such an important factor for the plants and animals in Hawaii that support these ecosystems (PCJV 1 2009).

It is not possible to incorporate all of the factors that would produce an accurate model of an environment, attempting to do so would lead to decreased product quality. There are many direct and indirect factors that influence our environment and identifying each factor then quantifying them is an endless process. Accomplishing a practicum to model the environment requires the analyst to accept the imperfection of their model and proceed with generating a product. The best alternative is to choose a specific group of factors to accomplish a defined objective and noting the caveats to the product. Approaching a large problem in increments allows for higher quality through dedicated focus and also the opportunity to incorporate learned efficiencies as the process iterates. "It is important, therefore, that model users evaluate these uncertainties and make them explicit, and so model results can be interpreted appropriately" (Larson 4 2004). Li created a prioritization study of land in Missouri to determine areas of greatest biodiversity. The model used by Li to accomplish this study is shown below.

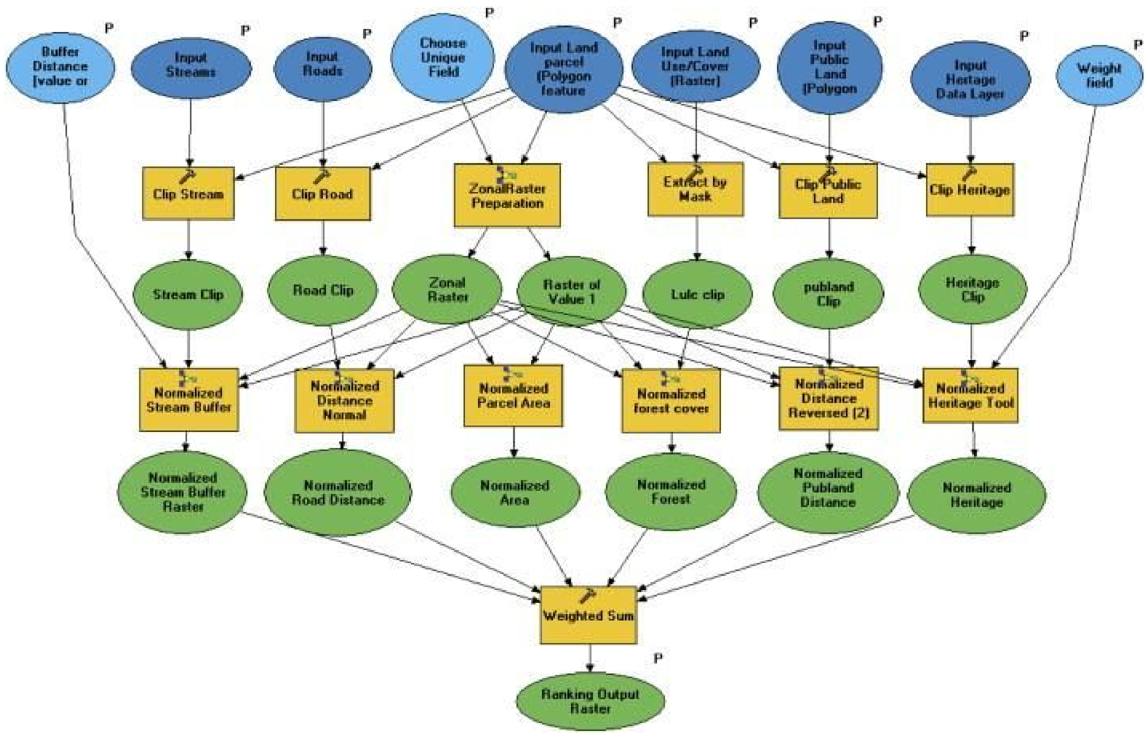

Figure 1: Biodiversity land prioritization model (Li 101 2011)

The great bustard, a bird species found primarily in Europe, is threatened by habitat fragmentation. Spain, home to the highest population of great bustards, is experiencing agricultural and infrastructure development which further increases the threat of habitat fragmentation (Osborne 103 2001). A large scale method of analyzing the great bustard habitat led a group from the University of Sterling to apply advanced very high resolution radiometer AVHRR data and GIS analysis. The group determined that roads, buildings, railways, and rivers were key features that fragmented the great bustard's habitat. These features were added to GIS along with AVHRR imagery of the Madrid province in Spain. The AVHRR satellite imagery incorporated as normalized differentiated vegetation index NDVI allowed for correlation to be applied for the vegetation the great bustards are observed in. The results of analyses showed the strongest trend between a lack of bustards and presence of roads and buildings (Osborne 112 2001). This is important because high weighting of these factors could be justified in a future analysis of the great bustard's habitat. Collecting data on locations that correlate to high bustard population and characteristics of those locations is valuable information for further improvements to this process. The group not only accomplished their goal to determine correlating factors between bustard population and habitat fragmentation, but also paved the way for future studies on the great bustard. Fragmentation is a significant factor when development is a primary threat to habitats. Preserving habitats is especially challenging on islands where highly desired areas are often subdivided creating large areas of fragmentation in some of the most fragile and critical habitats. Fragmentation was incorporated in this practicum to determine conservation importance by including lands adjacent to existing preserves and public lands. Since Hawaii contains many different ecosystems in a small area, slight subdivisions of these ecosystems can have dramatic effects on a species ability to survive. Accurately modeling the habitats of endangered species is important so that the threat of fragmentation to species population can be weighed against the desire to develop an area.

Agencies and Habitat Data

There is a significant amount of GIS data available for GIS users on the Hawaiian Islands as a result of the many academic, commercial, and government agencies that perform GIS analysis in Hawaii. Hawaii was one of the first states in the country to establish a statewide GIS program to consolidate available data and provide a data standard to enable efficient use and accessibility of spatial information. "One of the primary goals of the State GIS Program is to improve overall efficiency and effectiveness in government decision-making. In support of this goal, participating State agencies are developing, maintaining and sharing their respective databases and applications" (SoH Office of Planning 1 2012). The statewide database was the main source for data used in this analysis. Sources that contributed to the statewide database and the selected layers were the Department of Land and Natural Resources (DLNR), National Parks Conservation Association (NPCA), and Pacific Fish and Wildlife Office (PFW). The DLNR is a trusted source of data and reference for contributing spatial data for agricultural, ecological and environmental criteria. These organizations share some key objectives with HILT. For example, the DLNR highlights the need for preserving places of historic value; this is in line with HILT's definition of cultural lands. Preserving these places using GIS and establishing a reliable GIS inventory is one of three goals identified in the Hawaii State Historic Preservation Plan (DLNR 30 2012).

Evaluating ecological and environmental lands in Hawaii requires consideration of the ocean and land based habitats. The PFW Office maintains a robust database of the locations of sea life that is threatened or endangered (FWS 1 2012). This information is supplemented by the data on plants provided by the NPCA. The NCPA planted more than 10,000 individual native plants in 2006 (NPCA 1 2008). The Hawaii Conservation Reserve Enhancement Program (CREP) identified dryland forests as a key factor in improving wildlife and plant habitats (CREP 1 2013). Identifying habitats for both plants and animals is complex, dedicated data collection efforts over time will provide a higher fidelity assessment of the status of these habitats than what is captured in this practicum. This practicum provides an opportunity to capture feedback for these organizations that could focus data collection efforts to specific areas.

The problem and goal addressed by the practicum and the analysis in Napa County are similar despite differences in the physical or human geographical environment. The Island of Hawaii contains many unique ecosystems; combining numerous factors to identify conservation importance of ideal conservation lands will require an iterative approach and therefore a flexible model. Having a flexible model is critical because an effective model of this island may be reused to accomplish an analysis of the other islands. Once matured the analysis of other islands will advance HILT’s ability to establish itself as a statewide land trust (HILT 1 2014). An effective model built for this practicum could be applied to find solutions for the Land Trust of Napa County or other locations by tweaking the input data and analysis tolerances within the model.

Methodology

Defining Criteria and Locating Data

HILT highlighted six focus areas to assess conservation importance for ideal conservation lands (refer to Appendix B "Research Request". The six focus areas include:

1. Agricultural Lands

2. Lands with Cultural or Historical Value

3. Ecologically Important Lands

4. Public Access to Recreational lands

5. View Planes and Corridors

6. Coastal Lands/Adjacent Marine Habitat

HILT's Island of Hawaii Council created a framework to provide an objective articulation of the preferred land categories for conservation as stated in HILTs 2011 strategic plan (refer to Appendix C "Determining and Articulating Our Conservation Objectives: The Hawaiian islands Land Trust for the Hawaii island"). The six categories were reconfigured by aligning coastal/adjacent Marine Habitat under the criteria for ecological and environmental and defining Public Access to recreational lands with proximity to public lands. Proximity to public land accounts for the impact of fragmentation which is detrimental to ecology and large scale agriculture.

The following five criteria align with HILT objectives to determine conservation importance of Ideal conservation lands:

1. Agricultural
2. Ecological and environmental
3. Cultural
4. Public Access
5. Scenic

The numerous direct and indirect relations contribute to the factors that define these criteria. A part of the purpose of this practicum is to provide an objective approach to identifying land ideal for conservation. Using GIS these five criteria can be modeled with spatial data that represent each of the criteria.

The State of Hawaii Office of Planning provides GIS data online to the public for free. The data used in this practicum was gathered from this website and from a data set provided to HILT from the University of Hawaii. Although more data can always be used to define these criteria, the intent of this practicum is to provide a proof of concept and establish a process for applying objective criteria to land selection. The layers chosen were selected from readily available sources and applied as best as possible to meet the objectives of the practicum.

Data Preparation

The data was pre-processed to prepare it for use in the model, this processing is not standard for all files due to various sources.

Table 1: Listing of GIS data files and description grouped by the criteria they are aligned with.

Criteria	File Name	Description	Sources
Base Layers	Hawtmk.shp	Tax map key for the entire island of Hawaii. Map of all parcels in Hawaii (polygon)	County of Hawaii
	allocean	Ocean extent stops at the coastline (polygon)	USGS Digital Line Graphs
	Judicial|_n83.shp	Map of island of Hawaii districts judicial borders (polygon)	Hawaii State Statute (HRS Chapter 3, Section 4-1)

The first step to prepare the data for analysis was to standardize the projections for each layer. The majority of the data selected originated from the State of Hawaii Planning Office where each layer was projected to NAD 1983 UTM zone 4N. The data received from the University of Hawaii was in a variety of projections and required projection to NAD 1983 UTM zone 4N.

The next step for data preparation was to define the extent of the analysis. Districts were chosen as the smallest area of influence in order to focus analysis to an area small enough for detailed interpretation but also to reduce unnecessary processing time. The North and South Kona districts were selected in order to focus efforts on an area that is well represented by publicly available data and because of its familiarity to the analyst and customers. The Judicial Districts Boundaries Layer from the SoH Planning Office website was used to create a layer of North and South Kona. The select tool desired districts were selected via the select by attributes tool and a SQL query as shown in appendix D.

All data for the practicum was placed in a single folder (project_data) and clipped to the extent of the North and South Kona District boundary using the model in figure 3. This model's output delivered each data layer to the Kona Geodatabase using the inputs name and "_kona" to indicate that it had finished processing. Reference Appendix D for the full model report.

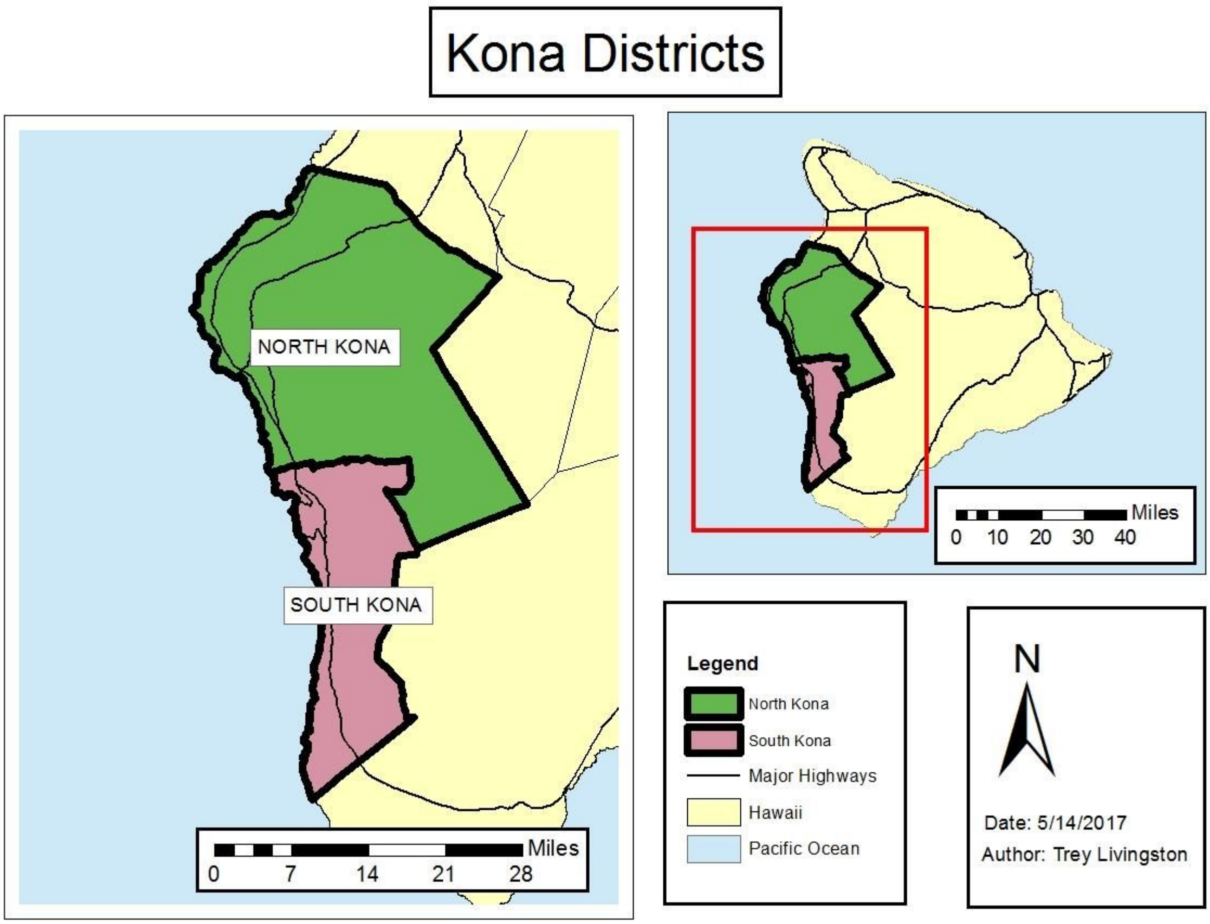

Figure 2: Map of North and South Kona District Boundaries

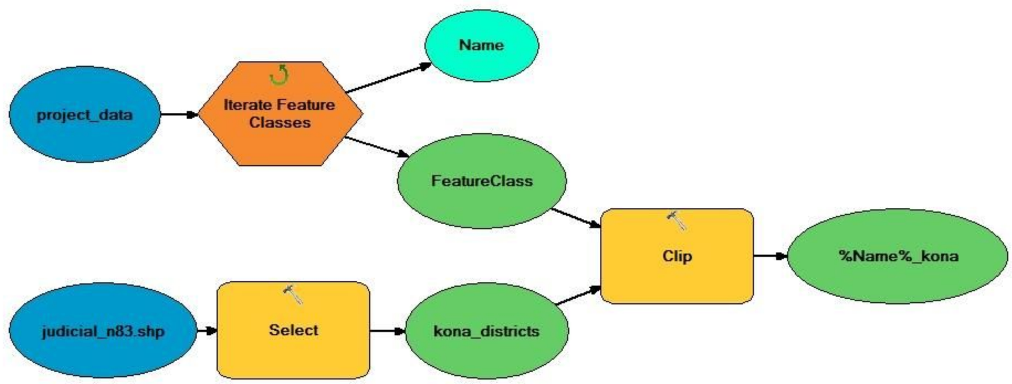

Figure 3: Data Preparation model

Database layers

The following section lists each of the five criteria for analysis and provides an overview of the layers that represent them. These criteria are the overall categories which data will be aligned under when performing analysis. The objectives provide detailed explanation of the intent of the criteria and enables the analyst to determine what spatial data best meets the intent of the criteria.

It is important to define the objectives for each criteria in order to select data that represents the intent of the criteria. The objectives communicate the intent of the criteria which provides reasoning and justification for aligning data layers under certain criteria and using them in specific ways. The data used to represent each shapefile and the source it was collected from is listed in table 1 below. These layers were selected based on their extent, availability and correlation to the objectives for each criteria. This practicum was not an exercise to collect primary data but rather to use available data to provide a proof of concept and identify a list of ideal conservation lands organized by conservation importance. It is imperative to know what data was used to enable future iterations to add and remove data necessary to refine the analysis or model.

Agricultural Lands

Agriculture is a key factor for defining life on the Hawaiian Islands. The islands are isolated from any significant land mass by more than 2000 miles in any direction. This isolation leads to dependence on local agricultural crops. Hawaii's agriculture is also unique due to its climate. It is one of the few places on earth where nearly anything can be grown due to the variety of ecosystems and climates. These variations in ecosystem and climate are in close proximity to one another lending to the diversity of the agricultural industry and culture.

Objective 1: To protect productive agricultural lands that are important to Hawaii's agricultural diversity and may be threatened by alternative land uses or land values, which would impact the economic feasibility of their continued use.

Objective 2: To protect and preserve lands that have superior biophysical characteristics that allow for highly productive and sustainable agricultural practices.

Objective 3: To preserve large or contiguous agricultural lands to sustain a regional resource of agricultural productivity.

Objective 4: Preserve agricultural lands of high capacity, special or highly unique importance for food sustainability to the state or region.

Objective 5: Protect agricultural lands on each island that are determined to be critical to Hawai‘i’s energy and food independence.

Objective 6: Protect family farms to maintain a farming tradition in Hawai‘i.

Each spatial data layer used to define agricultural lands represented either current or historic agricultural land uses. The spatial data used to represent the agricultural criteria are data sets derived from previous studies and analyses. Each of these layers is a product of in depth analysis that also meets the criteria objectives for agriculture identified by HILT. These layers were overlayed on top of each other to determine the extent of ideal agricultural lands. Reference Appendix E for Agricultural Land Meta-data, Model Report, and Parameters.

Table 2: Agricultural Land Data

Criteria	File Name	Description	Source
Agricultural Lands	ALUM	Agricultural Land Use Maps (Polygon). Agricultural Land and its commodities produced.	State Department of Agriculture
	ALISH	Agricultural Lands of Importance State of Hawaii (Polygon). Classification of agricultural land as either “Prime” “Unique” or “other”	State Department of Agriculture
	LESA	Land Evaluation and Site Assessment (Polygon). Important Agricultural Lands defined by the LESA commission per the LESA study regulations	State of Hawaii Land Evaluation and Site Assessment Commission

	LSB	Land Study Bureau (Polygon). Agricultural land classified by Productivity percentage ratings	State of Hawaii Office of Planning

Agricultural Land Use Maps (ALUM)

The ALUM display areas that supported an array of agricultural commodities based on data prior to 1980 (see figure 4). The original layer was dominated by the animal husbandry commodities. These commodities were excluded from the analysis after consulting with HILT because these types of agriculture do not sufficiently meet any of the objectives listed above for preserving agricultural lands.

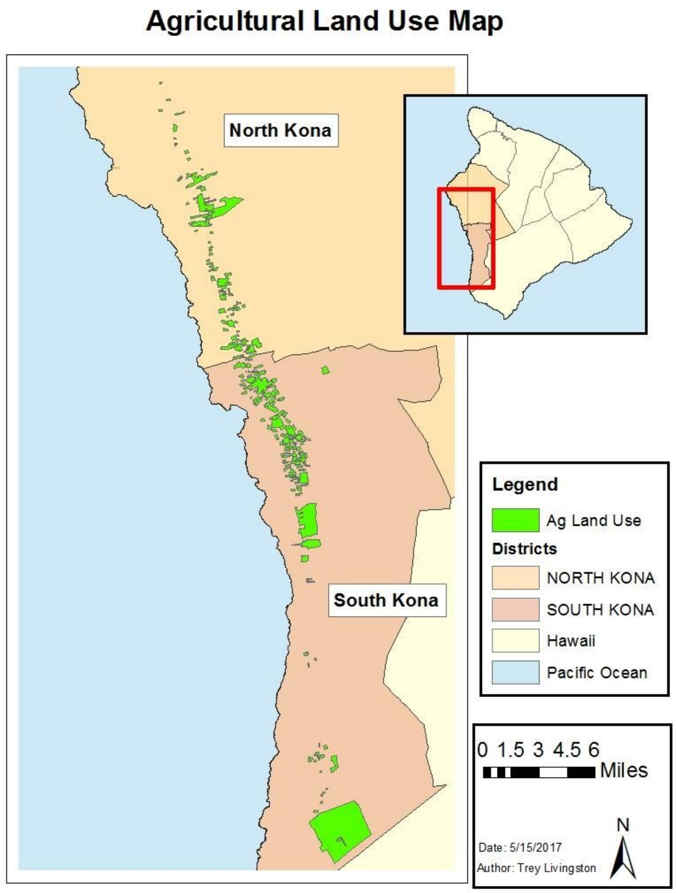

Figure 4: Agricultural land use map displaying the extent of land classified as Agricultural.

Agricultural Lands of Importance to the State of Hawaii (ALISH)

The ALISH defines agricultural land based on three classifications, Prime Agriculture, Unique Lands, and Other Lands from data prior to 1977 . Each polygon in figure 5 represents an area that contains ideal agricultural land per the definition of each of the three classifications shown in Table 3. The extent of this layer is solely agricultural and required no additional analysis.

Table 3: ALISH Classifications

Code	Name	Definition
0	Unclassified	N/A
1	Prime Lands	Land best suited for the production of food, feed, forage and fiber crops.
2	Unique Lands	Land other than PRIME AGRICULTURAL LAND and is used for the production of specific high-value food crops.
3	Other Lands	Land other than PRIME or UNIQUE AGRICULTURAL LAND that is of state-wide or local importance for the production of food, feed, fiber and forage crops.

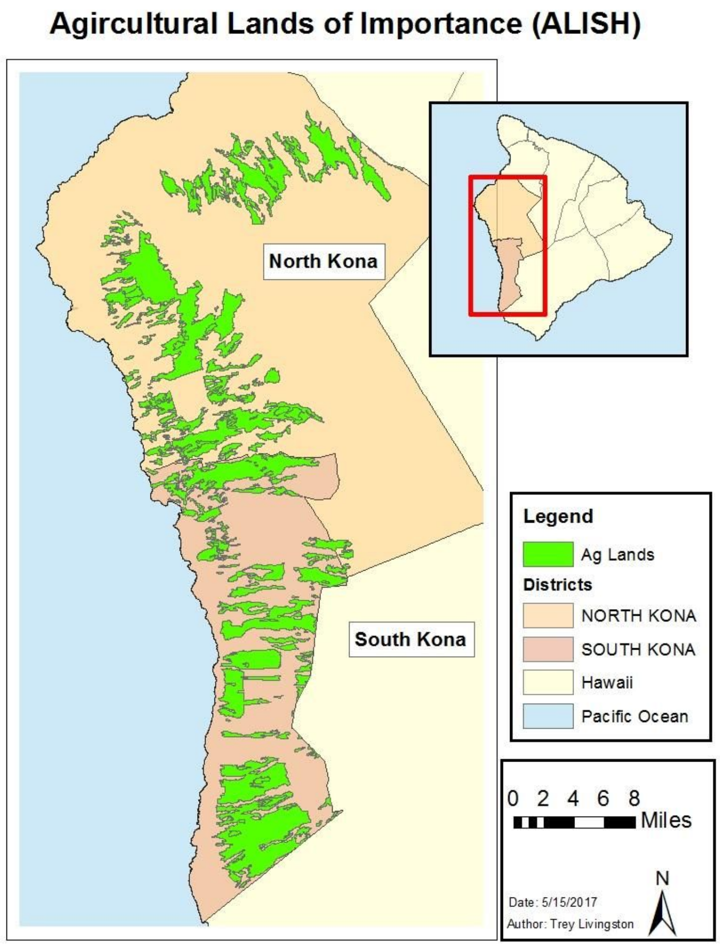

Figure 5: Map of land classifications (ALISH)

Land Study Bureau (LSB)

The LSB Detailed Land Classification layer ranks agricultural lands based on agricultural productivity. "The Land Study Bureau of the University of Hawaii prepared an inventory and evaluation of the State's land resources during the 1960s and 1970s. The Bureau grouped all lands in the State, into homogeneous units of land types; described their condition and environment; rated the land on its over-all quality in terms of agricultural productivity; appraised its performance for selected alternative crops; and delineated the various land types and groupings based on soil properties and productive capabilities" (SoH Planning Office 1 2017). This layer was analyzed by selecting the lands that contained Agricultural Productivity Ratings of A-C. These ratings correlate to a productivity percentage which can be found in Table 4.

Table 4: Land Study Bureau Productivity Percentage scale

Rating	Productivity Percentage
A	100 - 85
B	84 - 70
C	69 - 55
D	54 - 30
E	30 - 0

Ratings of E and D were excluded because they correlated to a productivity between 0-54%. Lands rated as "E"and "D" were determined to be too poor of quality to be included in this analysis. HILT agreed with limiting the inclusion to values between 55-100% this criteria may be modified in the agriculture model by adjusting the query in the select attribute tool. The select attribute tool was used as shown in figure 6 below to select all lands other than those rated as E or D.

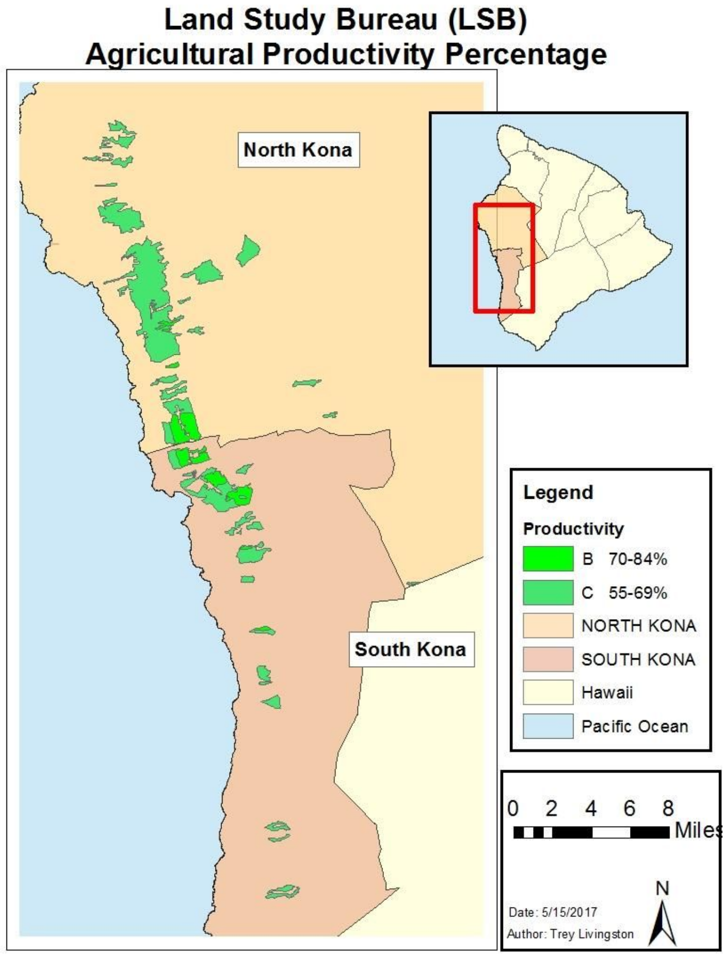

Figure 6: Land Study Bureau Map (North and South Kona)

Land Evaluation and Site Assessment (LESA)

The LESA commission uses a system for evaluating agricultural lands using two parts, the Land Evaluation and the Site Assessment. The "Land Evaluation" portion of the study primarily considers soils to determine ratings. “Soils of a given area are rated and placed into groups ranging from the best to the worst suited for a stated agricultural use, i.e., cropland, forest land, or rangeland. A relative value is determined for each group: the best group is assigned a value of 100 and all other groups are assigned lower values" (LESA 5 2011). The land evaluation is based on data from the National Cooperative Soil Survey. "Site assessment identifies important factors other than soils that contribute to the quality of a site for agricultural use. Each factor selected is stratified into a range of possible values in accordance with local needs and objectives. This process provides a rational, consistent, sound basis for making land use decisions" (LESA 5 2011). The site assessment uses the following data to determine ratings.

A. A comprehensive plan for the community;
B. Maps showing topography, population distribution, natural resource conditions, etc. of existing conditions and trends;
C. Current land use data;
D. Land use regulations;
E. Farmland protection and other pertinent policies applicable to the planning area;
F. Sewerage, water, and transportation facilities, existing and proposed;
G. Case files involving local agricultural land protection decisions; and
H. Other pertinent data.

(LESA 33 2011)

The extent of lands that were evaluated and determined to be important Agricultural lands based on the 1986 State of Hawaii LESA commission are shown in figure 7.

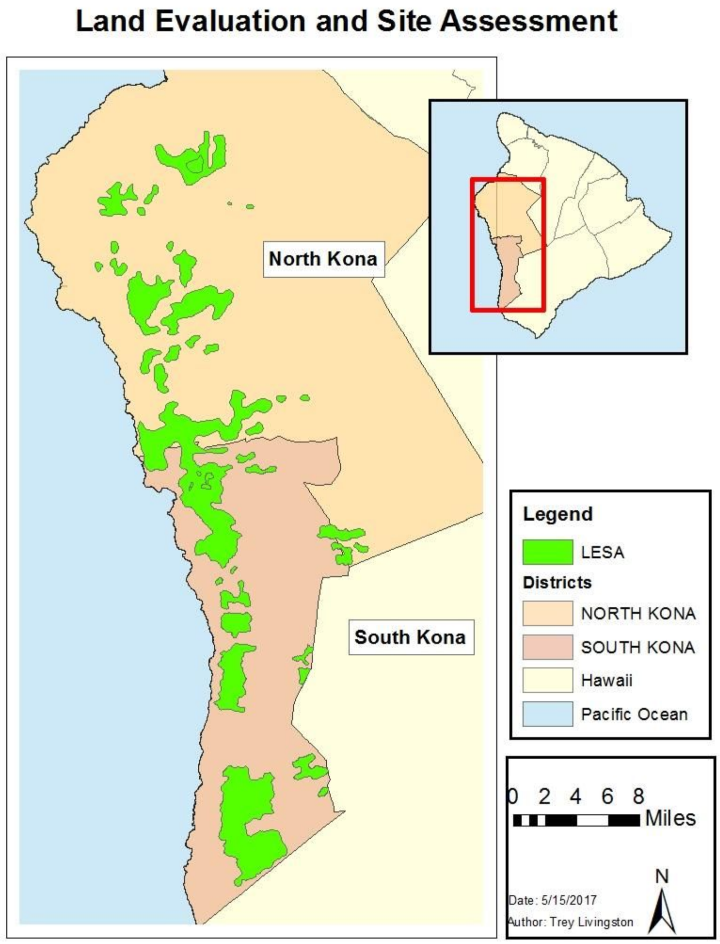

Figure 7: Important Agricultural Lands defined by the LESA 1986

Agricultural Union

Each layer representing the agricultural land criteria was combined using the “union” tool. This created a polygon encompassing the extent of the layers combined. The output represents areas that contained at least 1 of the 4 layers used to define agricultural lands.

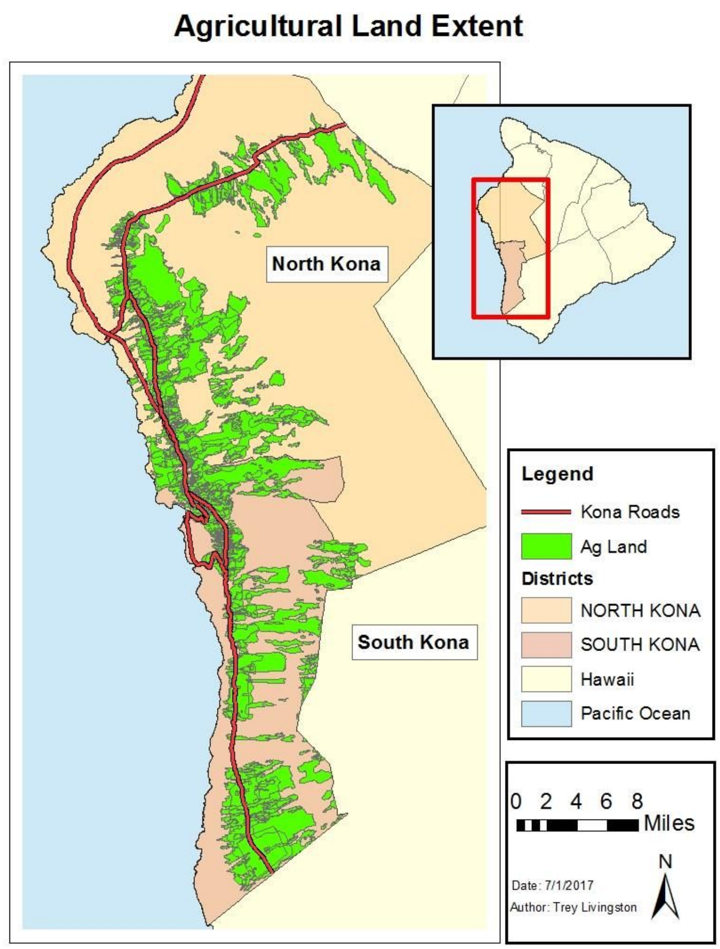

Figure 8: Agricultural Union

This polygon layer was converted to a raster using the “polygon to raster” tool using the “OBJECTID” as the “Value field”. This layer was reclassified changing the “value” field to 1. Each cell that contained at least 1 of the 4 contributing agricultural datasets is classified as 1. Agricultural land identified in more than 1 of these layers is represented the same as land that contains only 1 of the 4 datasets. The datasets contributing to the agricultural map are not weighted against each other because they do not have mutually exclusive purposes and there is no quality comparison between the datasets. The LESA layer for example was created using data from the ALISH, LSB, and US Soil Conservation Service. Combining the layers and scoring lands the same despite overlap between the four layers prevents over weighting certain areas. The resulting raster map contained cells that contained any one of the previously defined relations to Hawaii agriculture with a value of 1.

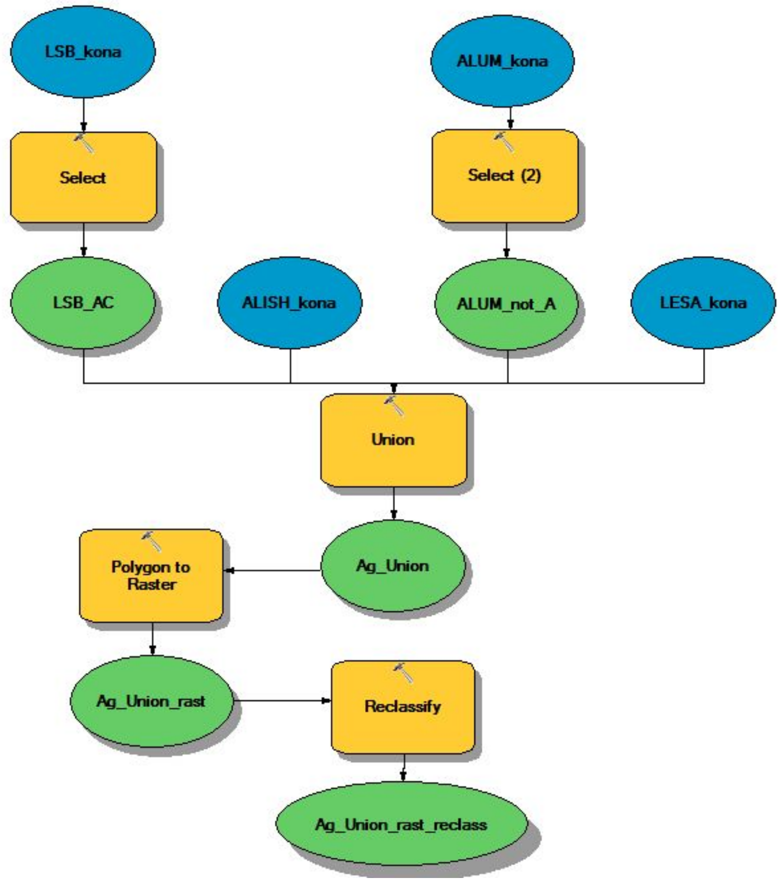

Figure 9: Agricultural Lands Model

<u>Cultural Lands</u>

Objective 1: To protect sites and/or structures that have significant historical and/or cultural value to native Hawaiians and all the people of Hawaii.

Objective 2: To protect those lands that are part of the traditional stories or legends of the region.

Objective 3: Protect lands that will contribute to key aspects of the overall historical narrative of the Hawaiian Islands.

Objective 4: Protect the most threatened Native Hawaiian archeological sites statewide.

Table 5: Cultural Land Data

Criteria	File Name	Description	Source
Cultural Lands	Huntingareas	Extent of publicly owned hunting areas (Polygon)	University of Hawaii Manoa Dept. of Urban and Regional Planning
	Fishponds	Fresh alkaline water ponds, used by ancient Hawaiians for bathing, fishing, etc. (Polygons	University of Hawaii Manoa Dept. of Urban and Regional Planning
	HistoricPlaces	Historic landmarks determined by UH Manoa to be of cultural signficance	University of Hawaii Manoa Dept. of Urban and Regional Planning
	NaAlaHeleTrails	Public trails within the Na Ala Hele Trail and Access system. (Polyline)	State Department of Land and Natural Resources
	Boating_Facilities	Locations of boating facilities located on the main Hawaiian Islands	NOAA Raster Nautical Charts, DLNR/DOBAR, etc.

Land is a finite resource in Hawaii and therefore locations and their unique attributes often drive specific cultural purposes for people in Hawaii. This is important to recognize and protect; poor planning and over emphasis on the economy when creating land use plans may result in an improper balance between development and land conservation. The intangible benefit to local culture of these areas can be easily overlooked; by identifying these critical cultural parcels

HILT can ensure that the desires of economic development are balanced against the value of maintaining culture through protecting the geography that it derives from.

Fish Ponds

This polygon layer displays the location and extent of fish pond boundaries in the main Hawaiian Islands. Fish ponds continue to be a significant contributor to Hawaii's culture. They originally served as critical infrastructure to provide food, and they now represent educational and gathering areas for the people of Hawaii and their children. Parcels that intersect the fish pond polygons were selected using the "select by location" tool.

Fish Ponds

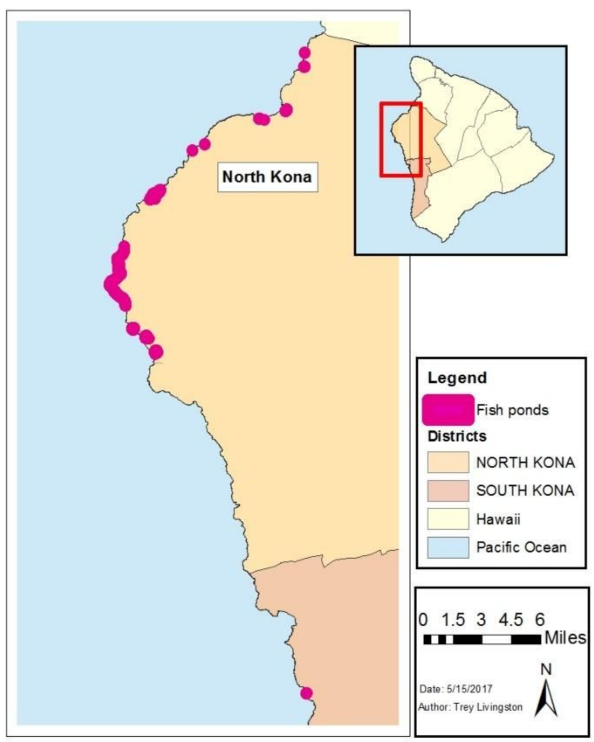

Figure 10: Fish Ponds

Boating Facilities

This layer includes points for each of the boating facilities located on the main Hawaiian Islands. The ocean and the resources it provides to Hawaii are priceless however the significance of this geographic feature goes beyond economic and is a part of the Hawaiian lifestyle. Canoeing, surfing, diving, and fishing are all activities enabled by access to the ocean. It is important to preserve this access to preserve the traditions of the ancient Hawaiians and their culture. A 0.5 mile buffer was placed around these boating facilities and any parcel that intersected this buffer was selected for its proximity to the facilities. The 0.5 mile buffer was selected to capture lands that influence the access, availability, storage, and recreation that is typically found around these locations. These locations often include significant historical and archaeological areas due to ancient Hawaiian dependence on the ocean; modern day boating facilities are located in the same areas as the ancient ocean. These locations serve as access points to the ocean due to the physical geographic advantages of these areas. These physical geographic advantages include protection from high surf, natural inlets, and proximity and ease of access to and from inland areas and villages.

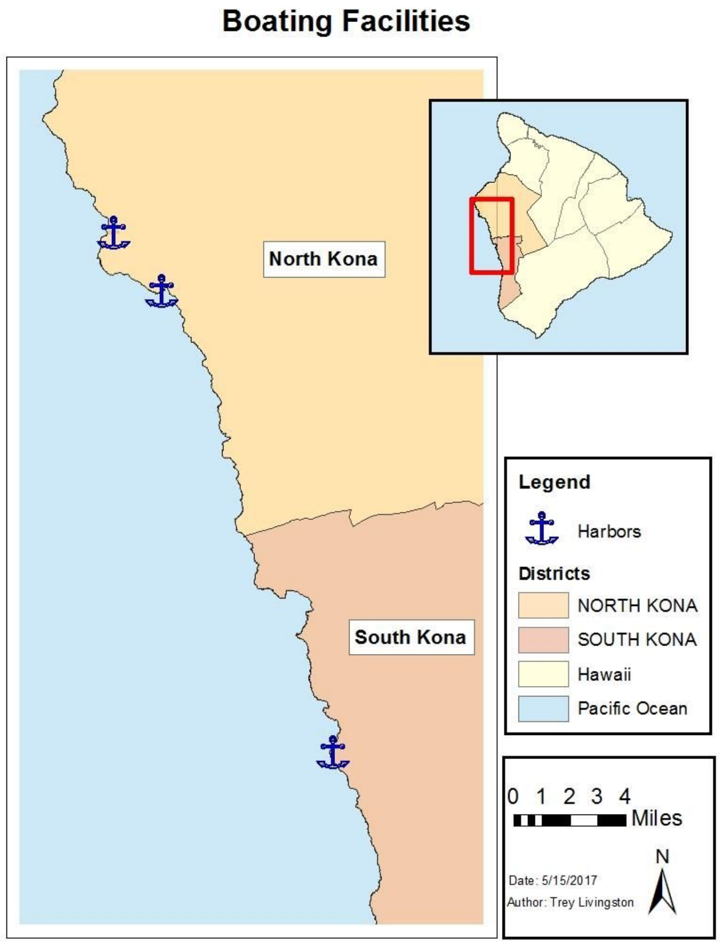

Figure 11: Boating Facilities

Historic Places

Historic Places are defined in this data set as points with significant cultural historical relevance. This includes the birthplace of King Kamehameha, ancient habitation sites, burial locations, and Hawaiian religious or spiritual locations. Parcels that contain culturally sensitive areas were selected to preserve the sites and the surrounding land. These areas are some of the most pristine preservations of ancient Hawaiian culture and many have significant connections to the religion and spiritual culture of the people.

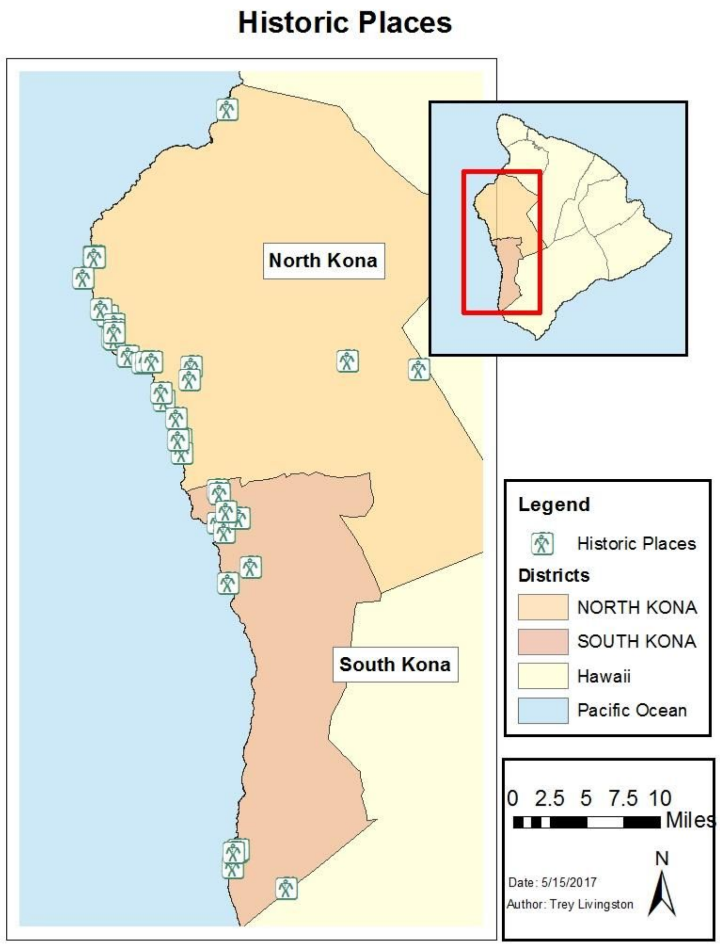

Figure 12: Historic Places

Hunting Areas

Hunting in Hawaii is deeply embedded in the culture, it was a necessary food source for the ancient Hawaiians to maintain a balanced diet. Today it is hobby, sport, and social event; many families hunt together and share the meat with friends and families during local parties. The food is often prepared using recipes that reflect the melting pot culture of the islands which preserves the culinary culture of Hawaii. The hunting layer itself does not capture all of these factors however, it is important to preserve areas that enable this activity and therefore the other spin off cultural essentials. This data is a polygon layer that displays the extent of the public hunting areas that should be preserved as open space to enable the continuity of this culture, the health of the wildlife, and the safety of the hunters and public.

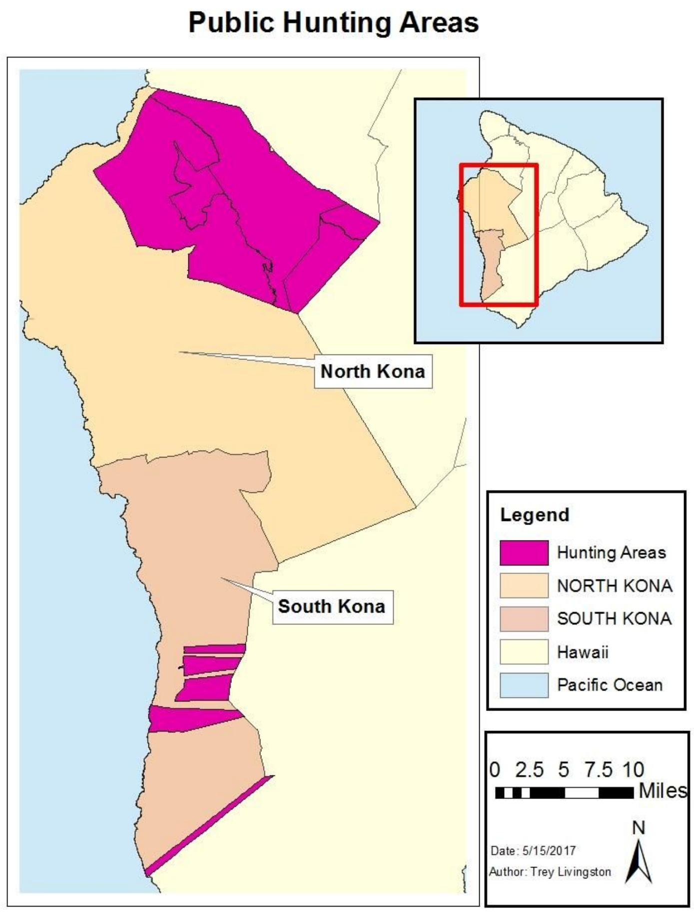

Figure 13: Hunting Areas

NaAlaHele Trails

This trail system established by the ancient Hawaiians linked the many kingdoms throughout the islands. The trails were used by runners to convey messages and information across different kingdoms or districts. Preserving these trails protects the routes that were traveled by the first settlers of Hawaii. Many of the trails are lined with beach rocks for sure footing and easy movement. Any polygon parcel from the TMK data layer that intersected the trails is identified as culturally significant.

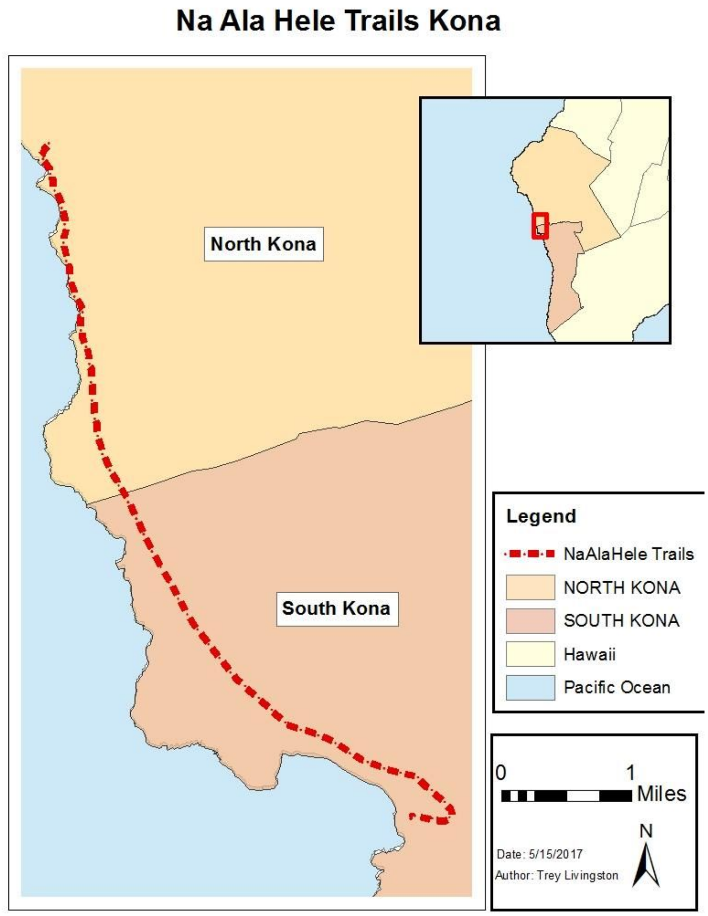

Figure 14: Na Ala Hele Trails

Culturally Significant Lands

Each of the layers were combined using the union tool to create the Cul_union layer. This layer was converted to raster then each cell representing at least one of the five layers was reclassified. Each of the layers was overlayed to display the extent of the culturally significant areas in North and South Kona. The areas where multiple cultural factors overlapped is displayed in the map in figure 15. The majority of the areas displayed in the map only contain one of the culturally significant data layers although there are some areas where two or three layers overlapped as shown in pink and blue. These areas with several layers of overlap are the most culturally significant areas in this analysis.

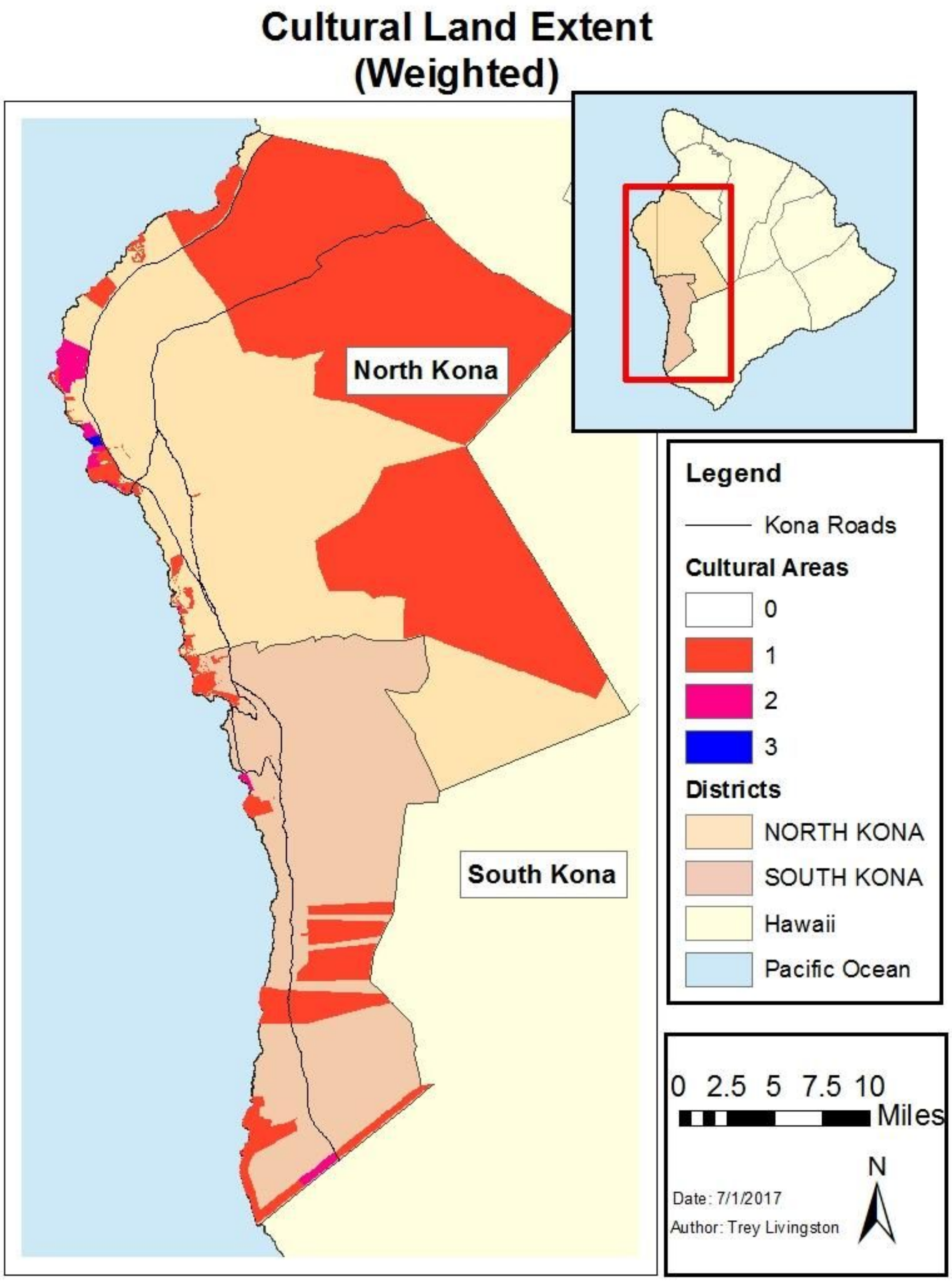

Figure 15: Cultural Lands

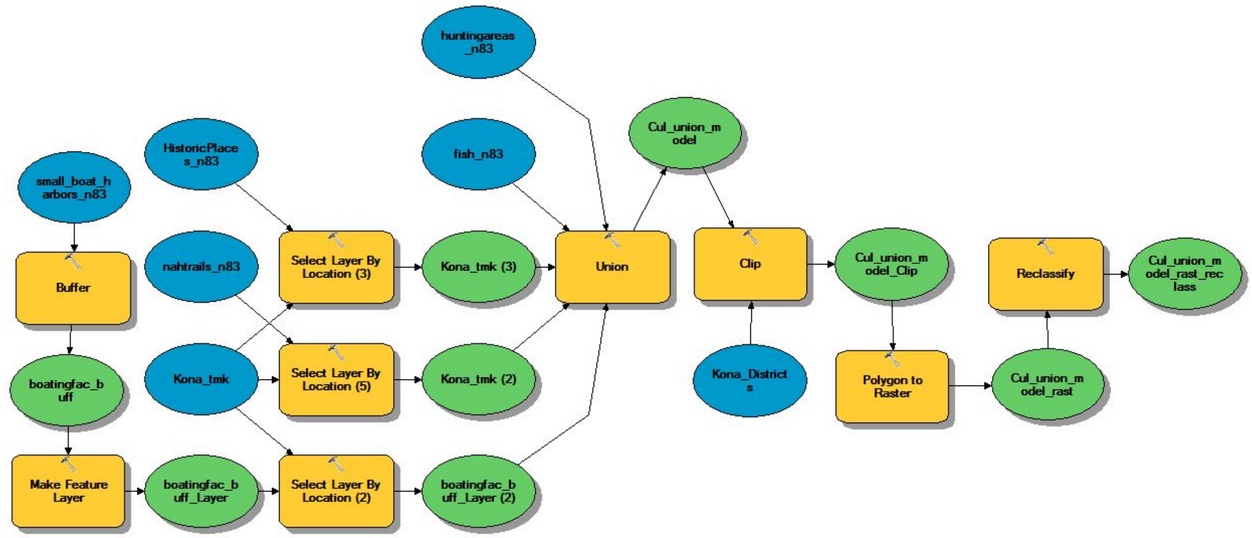

Figure 16: Cultural Lands Model

Ecological and Environmental Lands

Objective 1. To protect lands or their surroundings which are deemed ecologically significant for their unique habitat and/or botanic features.

Objective 2. Protect land that is or will be important habitat for individual or a complex of native species.

Objective 3. Protect lands important to mitigating the effects of climate change on native plant and animal species.

Objective 4. Protect lands that are a critical part of a landscape and the beneficial uses of fresh and ocean water in the watershed.

These lands are necessary to support the habitats of Hawaii's unique plants and animals. The islands are extremely isolated and as a result many indigenous species have adapted to the unique environment and rely on the small ecosystems that exist throughout the island chain. As these ecosystems are small and self-contained, the plants and animals that inhabit them are vulnerable to extinction. Some of these species only exist in one location on one island. These ecosystems are threatened by climate change, human development, and the introduction of alien species to the islands. It is important to identify these areas and protect them; many of these areas play a key niche role in maintaining the Hawaii that we know and depend on. Properties encompassing these characteristics were identified by aggregating areas that contained threatened indigenous and unique ecosystems, habitats, and endangered flora and fauna.

Table 6: Ecological and environmental data

Criteria	File Name	Description	Source
Ecological and environmental Lands	crhb_kokdry	Critical habitat for Kokia drynarioides (Polygon)	U.S. Fish and Wildlife Service, Pacific Islands Office
	crhb_moth	Critical habitat for the Blackburn's sphinx moth (Polygon)	U.S. Fish and Wildlife Service, Pacific Islands Office
	crhb_picturewing	Critical habitat for the picture-wing fly (Polygon)	U.S. Fish and Wildlife Service, Pacific Islands Office
	crhb_plant	Critical habitat for 41 of 58 plant species (Polygon)	U.S. Fish and Wildlife Service, Pacific Islands Office
	strmrip	Streams Identified with significant Riparian resources (Polyline)	A cooperative project between the State of Hawaii and the National Park Service

	teplant	Each island is divided into distinct zones of T&E species concentration, ranging from 'low' concentration to 'very high' concentration of T&E plant species (Polygon)	The Nature Conservancy's Rare & Endangered Species maps
	marine_mgt_areas	Areas designated to protect marine, estuarine, or anchialine resources and their use. (Polygon)	DLNR, Department of Aquatic Resources
	HI_wetlands_Poly	Areas designated as wetlands by the National Wetlands Inventory (Polygon)	National Wetlands Inventory
	allved	Map of tree canopy cover, tree height, and dominant species composition of the tree and understory vegetation layers (Polygon)	Vegetation Maps of the Upland Plant Communities on the Islands of Hawai'i, Maui, Moloka'i, and Lana'i

Critical Habitats

Critical Habitat (crhb) “is the term used in the Endangered Species Act to define those areas of habitat that are known to be essential for an endangered or threatened species to recover and that require special management or protection” (U.S. Fish and Wildlife Service 1 2017). These polygon layers include a general location of the habitat for several endangered species. Specifically the species in North and South Kona that critical habitat data exists for are: Kokia drynarioides, (kokdry), Blackburn's sphinx moth (moth), picture-wing fly (picturewing), and 41 of 58 listed endangered plant species known historically from the Island of Hawaii (plant). These polygon layers are combined along with the other ecological and environmental layers.

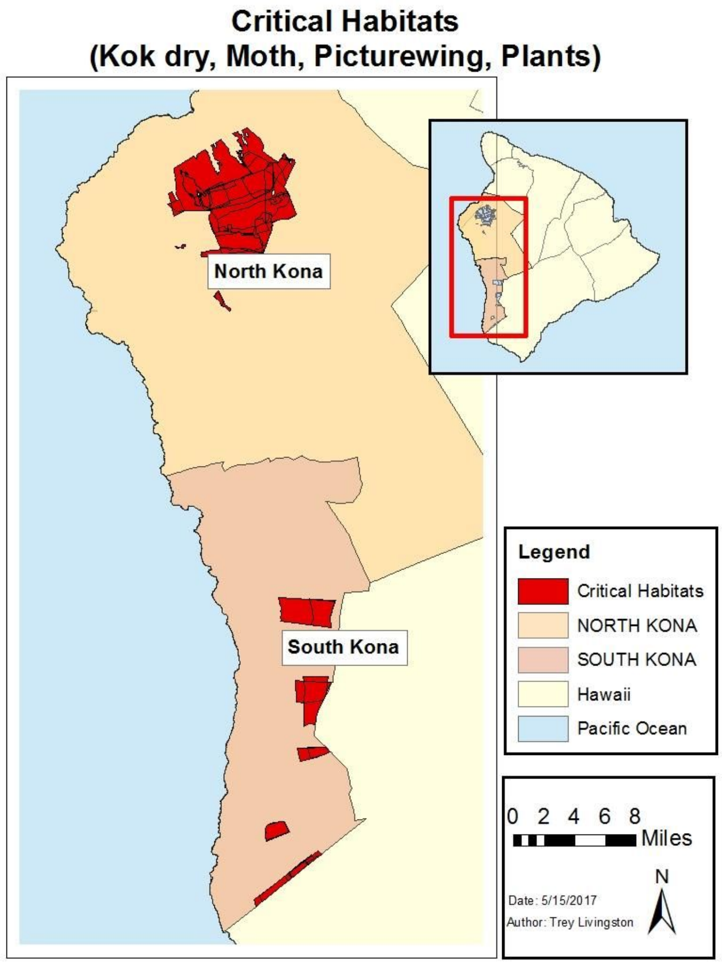

Figure 17: Critical Habitats

Riparian Habitats

Streams identified by the Hawaii Stream assessment as having significant riparian resources. The North and South Kona districts are located on the leeward side of the Island of Hawaii and experience minimal rainfall throughout the year. This drier climate results in few areas that qualify as riparian increasing the necessity to protect these habitats. These areas support niche habitats that create a diverse landscape and ecosystem of the western side of the Island of Hawaii. Any parcels that intersect these streams are selected and included in the ecological and environmental layer.

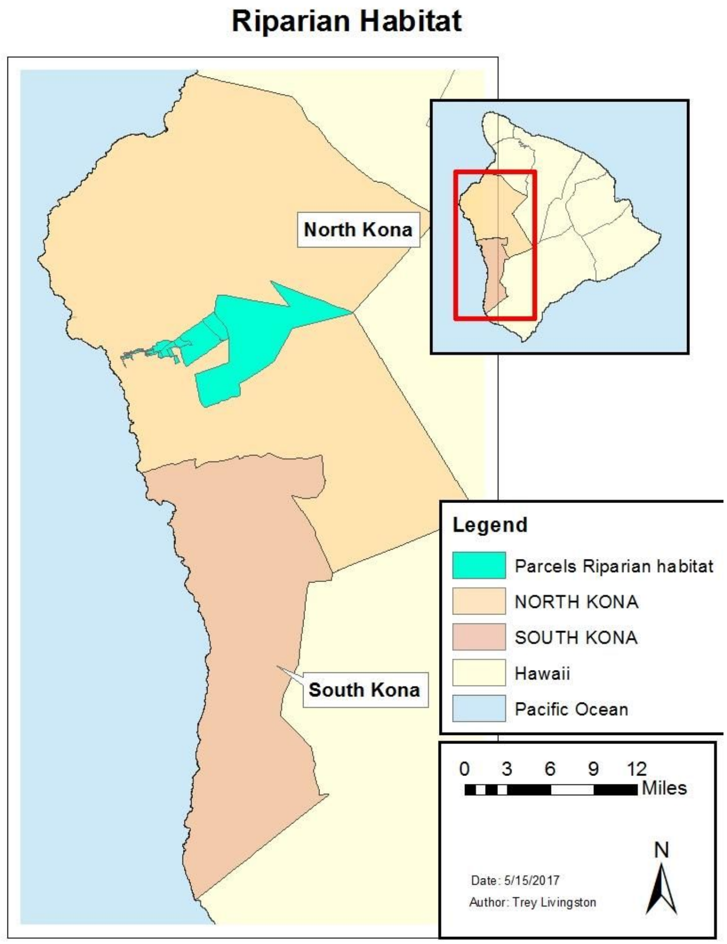

Figure 18: Riparian Habitat

Threatened Endangered Plant Density

Threatened and endangered plant species densities are plotted using this dataset. The densities range from low to very-high. This layer maps the densities for the entire island, for the purposes of this practicum only very-high densities were chosen. This limited the extent to only those areas that need preserved and not those that would require significant resources to increase the density levels.

Future analysis should consider analyzing areas where threatened and endangered plant species densities are low. Additional assessment could be performed to focus on specific species and the level of effort that would be required to increase the population of those species in those areas. It is possible that a species may only be located in that location and it is nearly extinct resulting in a low density. A higher potential for extinction may drive a greater need for conservation and allocation of resources compared to an area where a threatened species is already found in high densities.

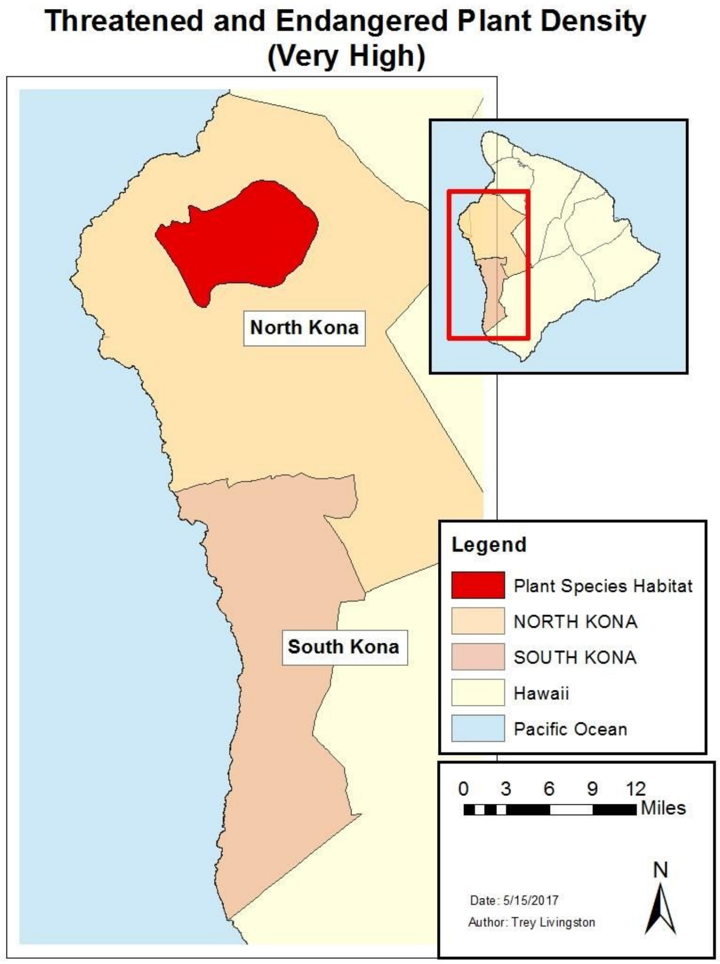

Figure 19: Threatened and Endangered Density

Marine Management Areas

"Marine Managed Areas (MMAs) are specific geographic areas designated by statute or administrative rule for the purpose of managing a variety of marine, estuarine, or anchialine resources and their use" (Hawaii.gov 1 2017). Protecting the ocean resources that Hawaii residents interact with either by fishing, diving, or other activities is done partially by protecting the land adjacent to those resources. The presence of development near the shore can result in runoff that damages the ocean's ecosystem in some circumstances the runoff could also include harmful chemicals or toxins that further aggravate the situation. This is a polygon data layer current as of 2003 that encompasses the extent of these areas in the ocean, these polygons touch the coastline but do not extend inland. These marine managed areas can benefit by preserving the natural environment adjacent to and inland of these locations. Protecting and regulating land use along the coast is as important to preserving the water quality and aquaculture as attempting to regulate the usage and activities occurring on the water in those areas. Parcels adjacent to the marine managed areas were selected to represent important ecological and environmental lands using the following query.

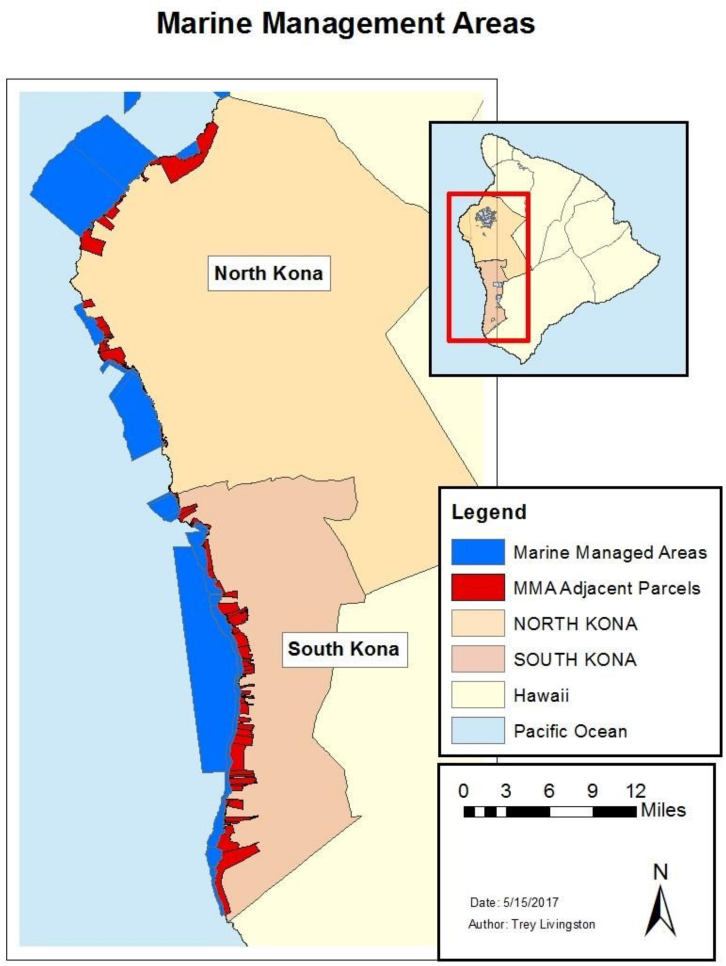

Figure 20: Marine Management Areas

Wetland Habitats

Hawaii hosts a variety of ecosystems although the expanse of any one ecosystem is limited due to the amount of land and the dramatic changes in elevation and microclimates. Wetlands are an example of an ecosystem in Hawaii that is critical to plant and bird life, however it does not occur in many locations. The trade winds blowing east across the Pacific run into Mauna Loa and Mauna Kea where orographic lift occurs and precipitates moisture on the eastern (windward) side of the island. Relatively little moisture is dropped on the leeward side which encompasses North and South Kona. There are few wetlands located in North and South Kona for this reason and the need to protect those increases accordingly.

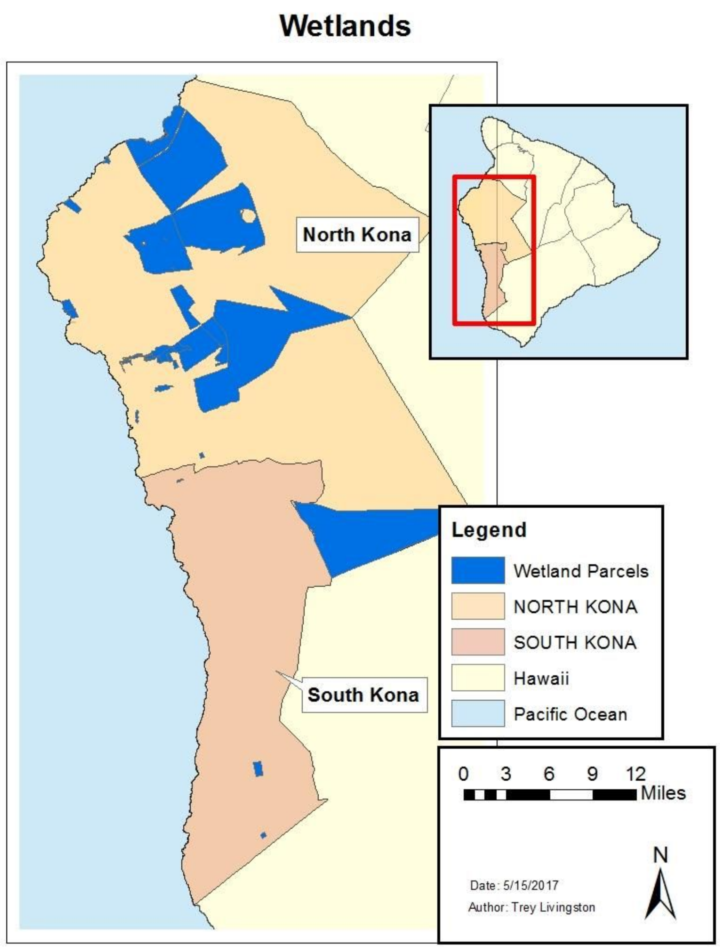

Figure 21: Wetland Parcels

Non Invasive Vegetation

This layer maps vegetation throughout the islands and assigns a code to each polygon representing the dominant species in the various levels of canopy and vegetation. Using the "select by attributes" tool introduced overstory and understory vegetation were deselected along with areas with a high degree of disturbance. Specifically the following criteria were excluded from creating a new layer using the data from this layer:

Overstory:

All but: (xt) Introduced trees

Understory:

All but:

(xg) Introduced grasses, sedges, or rushes

(xh) Introduced herbaceous species

(xs) Introduced shrubs

(xx) Bare ground (at least 25% of the area without vegetation)

Degree of Disturbance:

All but:

(XX) Communities that are totally dominated by introduced plants; virtually no native species remaining.

Future studies should consider identifying lands that contain invasive species in otherwise desirable land. HILT would have with the option to pursue properties with the intent of reducing invasive species populations. This analysis could include a relation between invasive species and endangered plants. Identifying a correlation between a high invasive species population and low density of threatened plants could feed other initiatives. For example if the previous condition is met and the location and habitat is ideal for higher densities of endangered plants HILT may desire to emphasize land stewardship in these areas.

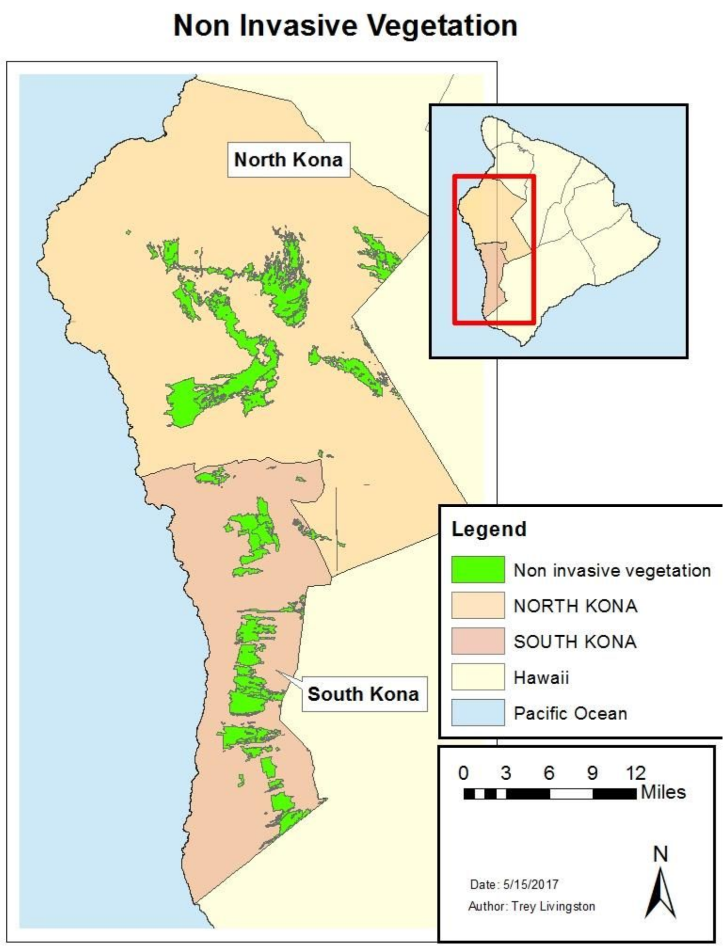

Figure 22: Non Invasive Vegetation

Ecological and Environmental Land Union

Each of the layers were combined using the union tool and converted to a raster map. The ecological and environmental raster "value" field was reclassified to two different layers, one with a value of 1 for the weighted analysis and the other with a value of 100 for the unweighted analysis.

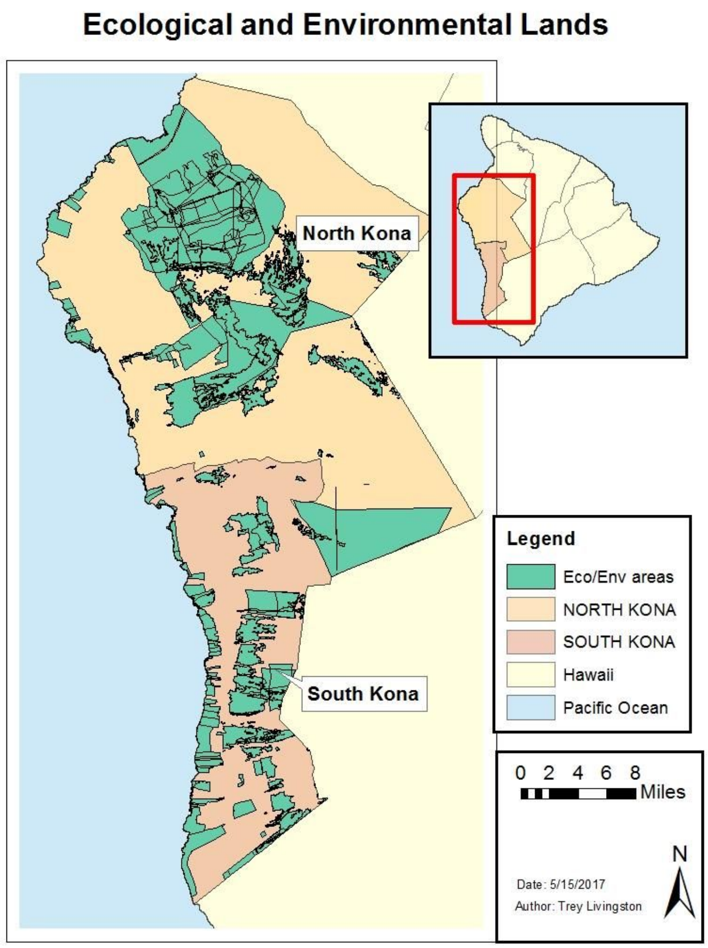

Figure 23: Ecological and Environmental Lands

Additionally each contributing layer was converted to a raster and the value of each populated cell reclassified to a value of 1. The six layers were added together using the raster calculator and the output displayed a map showing Areas where the contributing data layers overlapped (Figure 24).

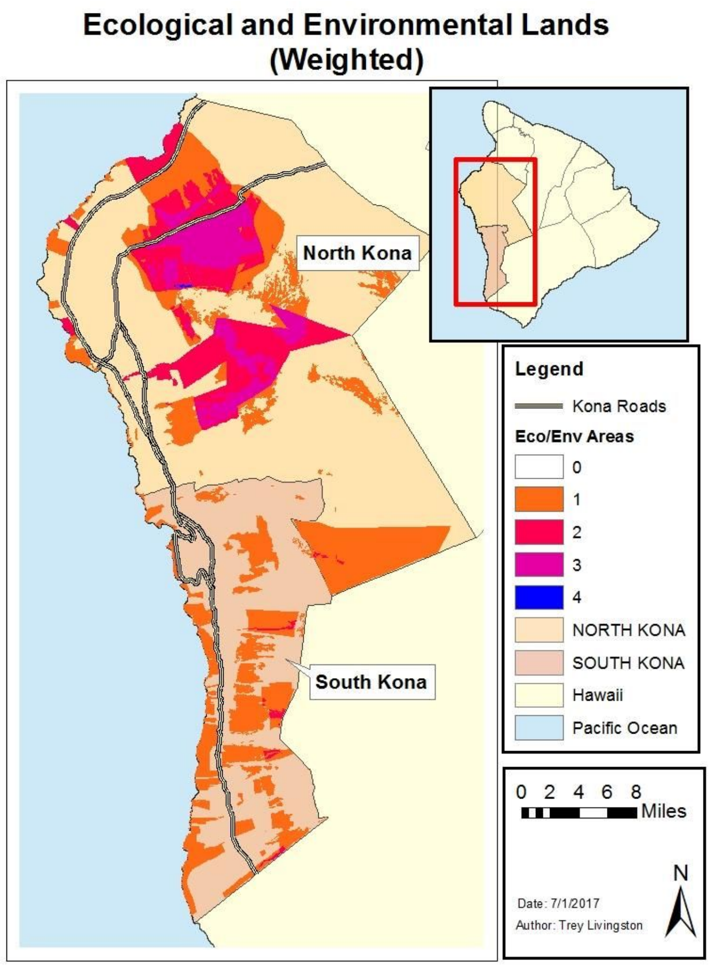

Figure 24: Ecological and Environmental Areas (Weighted)

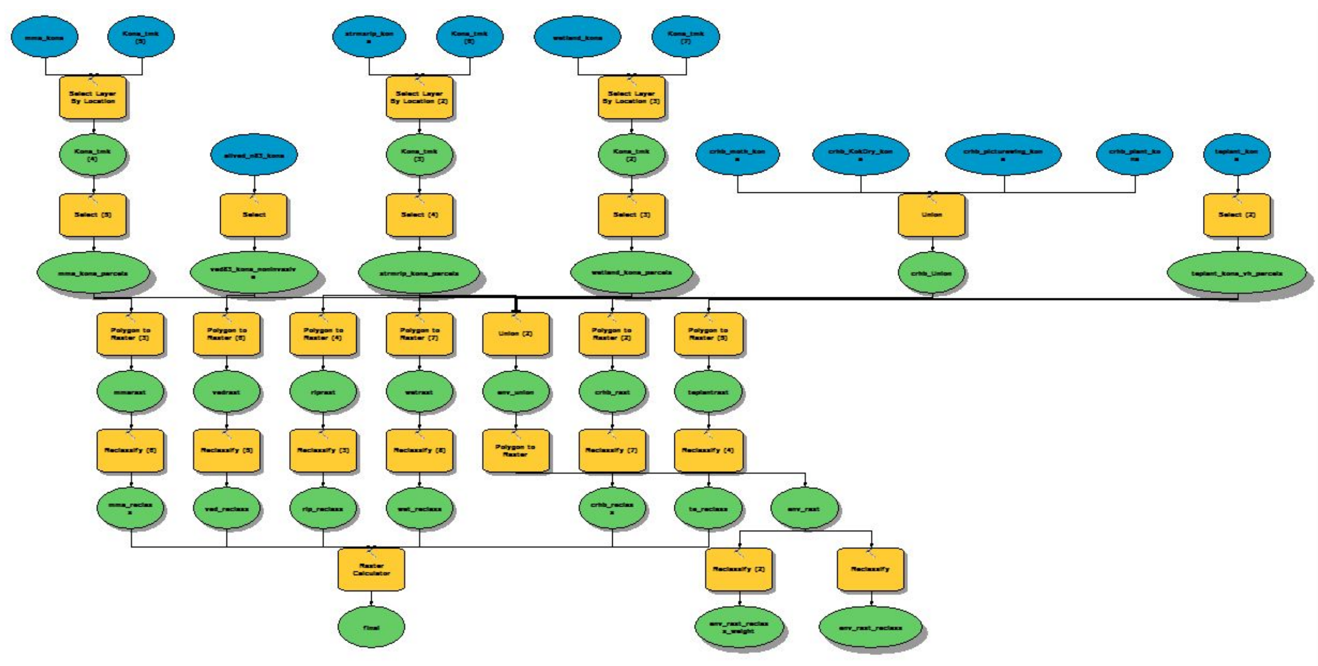

Figure 25: Ecological and Environmental Model

Public Access Lands

Objective 1. To protect or create access right-of-ways to public recreational areas, particularly beaches, shorelines, mountain trails and other features of significant public interest.

Objective 2. Protect lands that provide the public with access to recreation, cultural lands, and native plants and animals.

Examples include: Pathways open to the public over private lands to both ocean and mountain recreation areas.

Table 7: Public Access Lands data

Criteria	File Name	Description	Sources

Public Access Lands	Reserves	Layer containing land parcels currently designated by the County of Hawaii as a Reserve	State of Hawaii Dept of Land and Natural Resources
	gov_own	Layer containing land parcels currently owned by the government, County, State, Federal	State of Hawaii Office of Planning, U.S. Census Bureau

Public access is a treasure in Hawaii where the economic barriers to owning property would otherwise limit individuals' ability to enjoy some of the finer aspects of the islands. Through public access laws the citizens retain a certain level of access rights to areas such as coastlines, archeological and religious sites. These areas can be identified in advance of development and land can be acquired to adjoin public access with pristine areas. Additionally HILT enables any property owner to set aside all or part of their land for conservation or public access. Landowners can increase the amount of preserved shoreline for example which maintains access for residents but also decreases the impact on coastal ecosystems and preserves the view corridor. This concept is especially beneficial when property adjoins public land that may or may not already be in conservation. Continuous areas of uninterrupted conservation set the stage for ecosystems to fully develop. Parcels that are adjacent to reserves and government land are selected and used to create the Public Access Union. This polygon layer represents each parcel that adjoins but does not contain government owned lands and reserves. The layer is converted to a raster and reclassified with a value of 1,000.

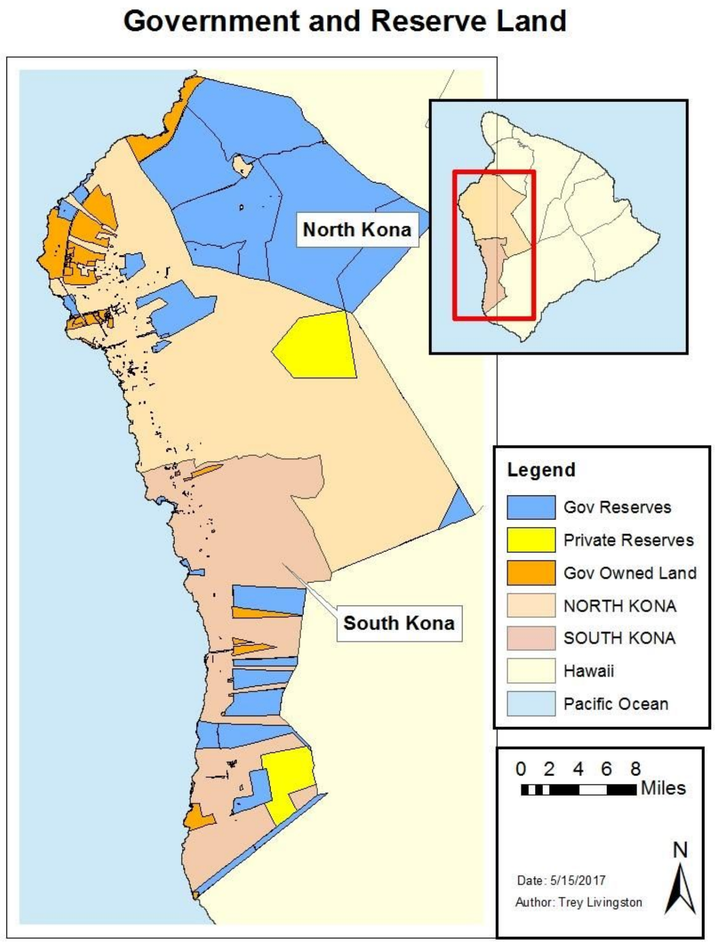

Figure 26: Government and Reserve Lands

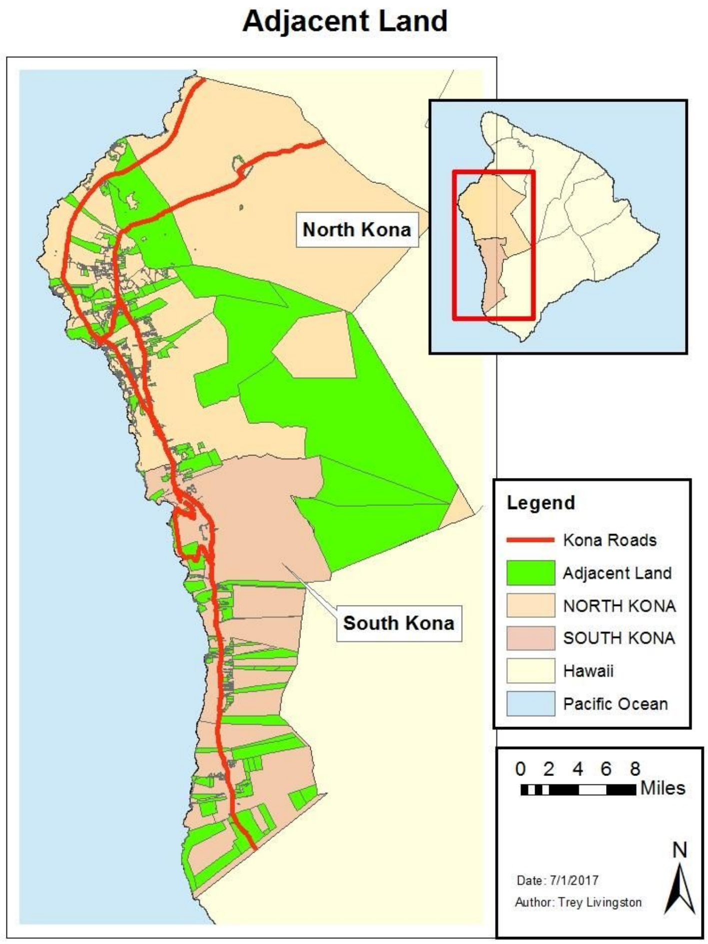

Figure 27: Adjacent Lands

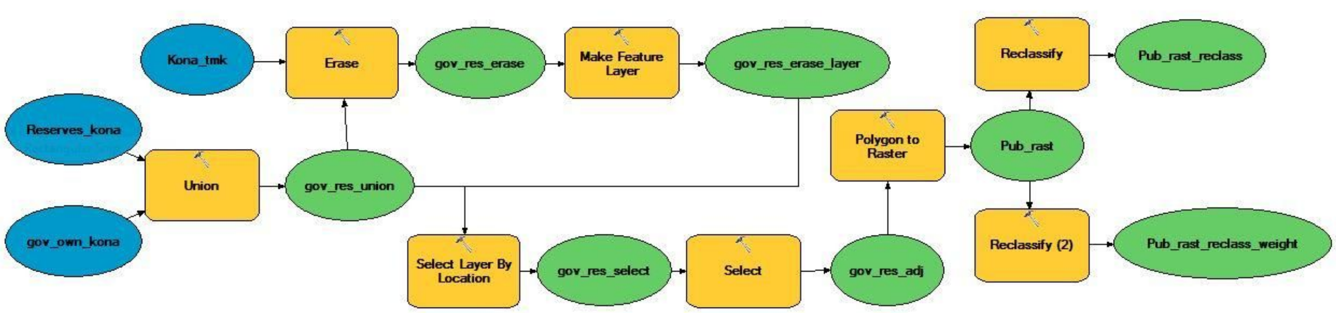

Figure 28: Public Model

Scenic or View Planes and Corridors

Objective 1: To protect and enhance views of significant scenic value for the enjoyment of all of Hawaii's people.

Objective 2: To protect those scenic areas that are the recognized visual character of the region.

Table 8 Scenic Land data

Criteria	File Name	Description	Sources
Scenic Land	North_Kona_Natural_Beauty_Sites and South_Kona_Natural_Beauty_Sites	Areas that contain or have views of distinctive landmarks and/or attractive natural/native vegetation (Polygon)	University of Hawaii Manoa Dept. of Urban and Regional Planning

Tourism is the primary industry in Hawaii, the beauty of the islands is known around the world and revered by many. This beauty is worth preserving, and in order to do so those postcard areas must be protected and preserved for the enjoyment of generations to come. Preserving the natural beauty is challenging because it often requires attempting to control vast areas of land and many other factors well out of a single entity's sphere of influence. These beautiful regions are also prime lands for development, or agriculture. When competing interests meet there is often a resulting conflict. By maintaining objective criteria to determine which of these areas should be preserved we can enable a fruitful conversation to preserve the best interest of the islands.

North and South Kona Beauty Sites

These two layers are of TMK parcels that contain sites known for their aesthetic characteristics. Aesthetic characteristics in this context relates to view corridors and extended open space, mountain summits, iconic landmarks, formally identified scenic points, coastlines. These two layers were combined to form the scenic union layer and converted to raster and reclassified to 10,000 for distinction.

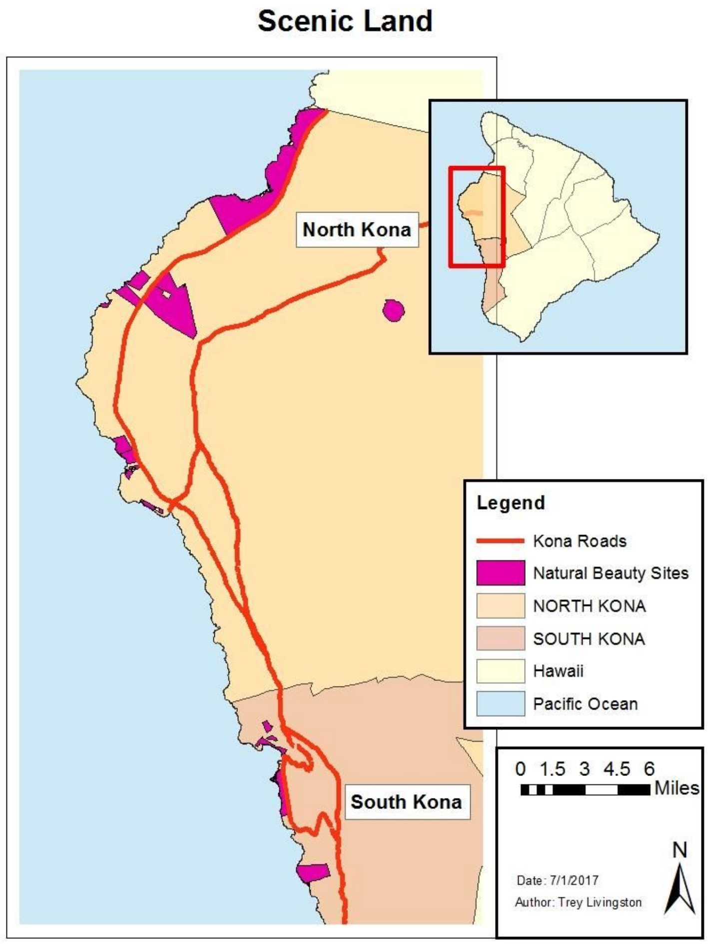

Figure 29: Scenic Lands

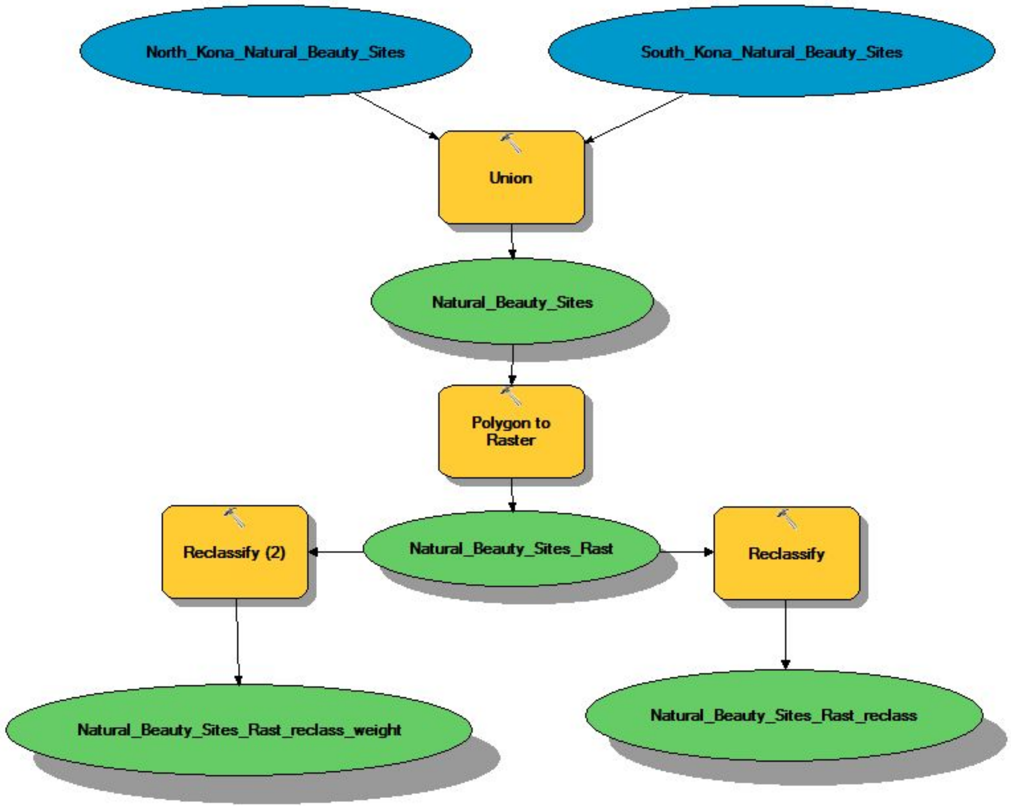

Figure 30: Scenic Model

Final map

The product of the previously mentioned analysis is five raster maps displaying the location of land parcels that meet their respective criteria. Each of the five rasters were reclassified according to the following key in order to provide distinction between one another. The sum of any layers together produces a unique value which will be useful for determining which criteria were met for any given parcel if desired.

Table 9: Layer classifications

Ag	Culture	Ecological and Environmental	Public Access	Scenic
1	10	100	1,000	10,000

Using the raster calculator each layer was added together using the following syntax

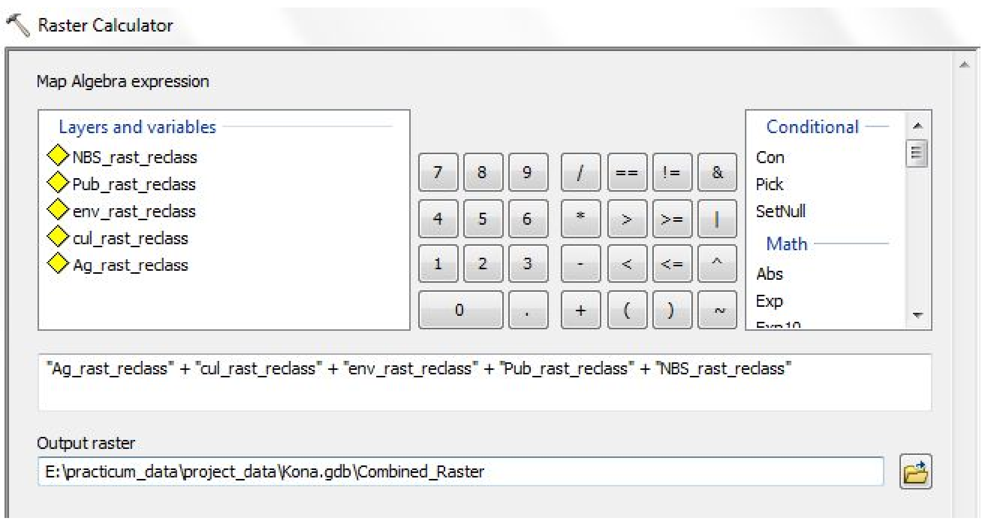

Figure 31: Raster Calculator

The result was a basic raster map showing all of the TMK parcels and their associated values. This map contained a value for each cell between 1 and 11,111 or NoData. This map is valuable for further analysis to determine which lands meet certain criteria. However, this practicum does not weigh any one criteria over the other. Therefore this raster was reclassified with values 1-5 depending on how many criteria were met within any one raster cell. This was done using the following associations as an example.

Table 10: Final map reclassification key

Original score	Representation	Scaled
1	Agricultural	1
10	Cultural	1
11	Agricultural and Cultural	2
100	Ecological	1
101	Ecological and Agricultural	2
110	Ecological and Cultural	2
111	Ecological, Cultural, and Agricultural	3
1000	Public Access	1
1001	Public Access and Agricultural	2
1010	Public Access and Cultural	2
1011	Public Access, Cultural, and Agricultural	3
1101	Public Access, Ecological, and Agricultural	3
1111	Public Access, Ecological, Cultural, and Agricultural	4
1100	Public Access and Ecological	2
1110	Public Access, Ecological, and Cultural	3
10000	Scenic	1
10001	Scenic and Agricultural	2
10010	Scenic and Cultural	2
10011	Scenic, Cultural, and Agricultural	3
10100	Scenic and Ecological	2
10101	Scenic, Ecological, and Agricultural	3
10110	Scenic, Ecological, and Cultural	3
10111	Scenic, Ecological, Cultural, and Agricultural	4
11000	Scenic and Public Access	2
11001	Scenic, Public Access, and Agricultural	3
11010	Scenic, Public Access, and Cultural	3
11011	Scenic, Public Access, Cultural, and Agricultural	4
11100	Scenic, Public Access, and Ecological	3
11101	Scenic, Public Access, Ecological, and Agricultural	4
11110	Scenic, Public Access, Ecological, and Cultural	4
11111	Scenic, Public Access, Ecological, Cultural, and Agricultural	5

Once reclassified the raster map was then converted back into a polygon and joined with a TMK map. This associated the values 1-5 for each parcel with the TMK number as well as information specific to each parcel such as number of acres, owner (government or private), and land value. This information is valuable for additional understanding of the land identified as ideal for conservation and further enables informed decision making.

Ideal Conservation Land Map
(Unweighted Inputs)

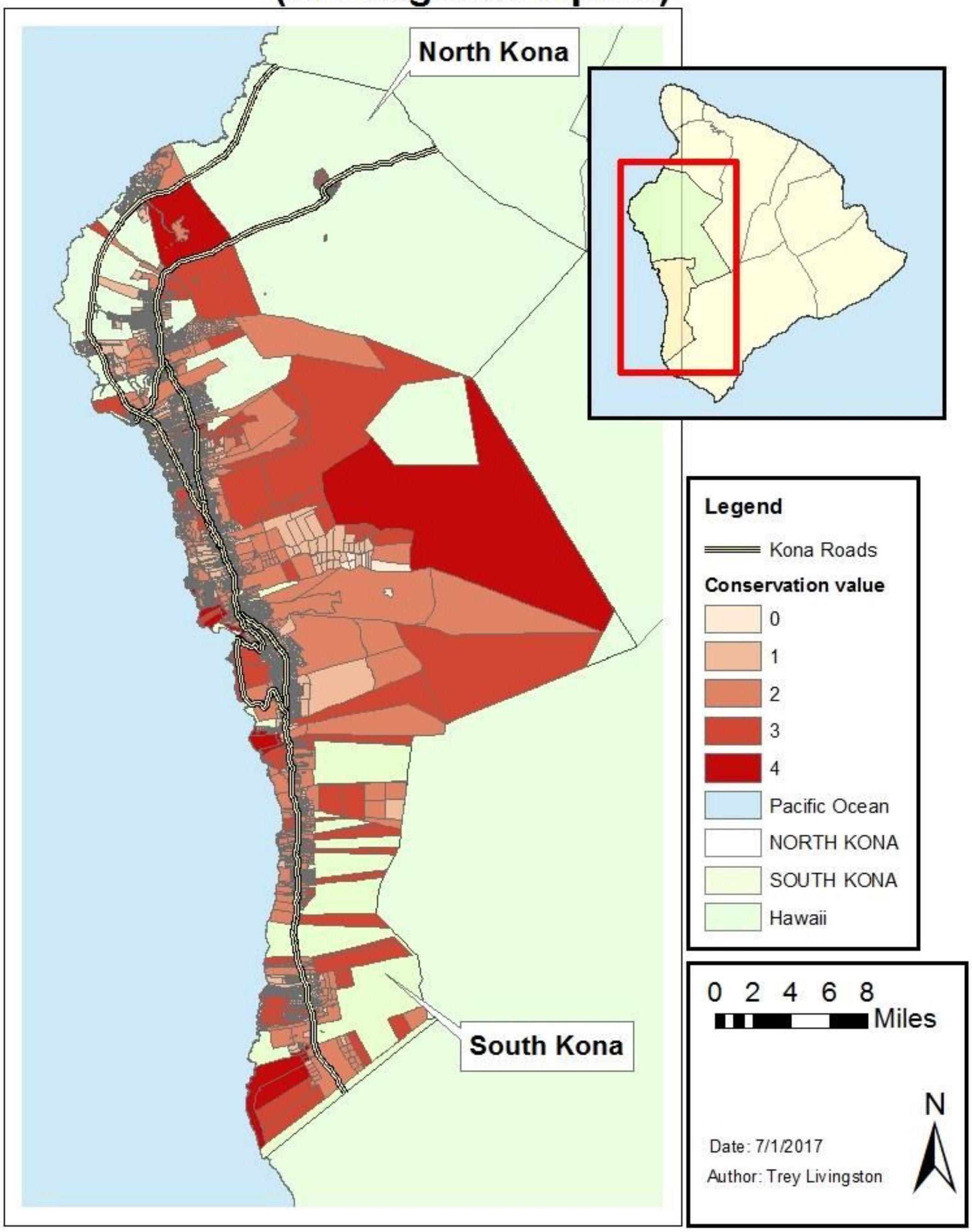

Figure 32: Ideal conservation lands map

Each criteria was also reclassified to a value of 1 with the exception of the weighted maps (Cultural and Ecological and Environmental). Each of these layers was added together to provide HILT with a more detailed view of how weighting individual criteria within the overall model provides a higher fidelity map. The weights indicate overlap of layers and do not sugest that certain layers are valued higher than others. This is important to consider because weighting maps early in the process can result in unintentional favoring of a certain criteria. The cultural and Ecological and Environmental criteria are represented much more prevalently than the other three criteria in Figure 33.

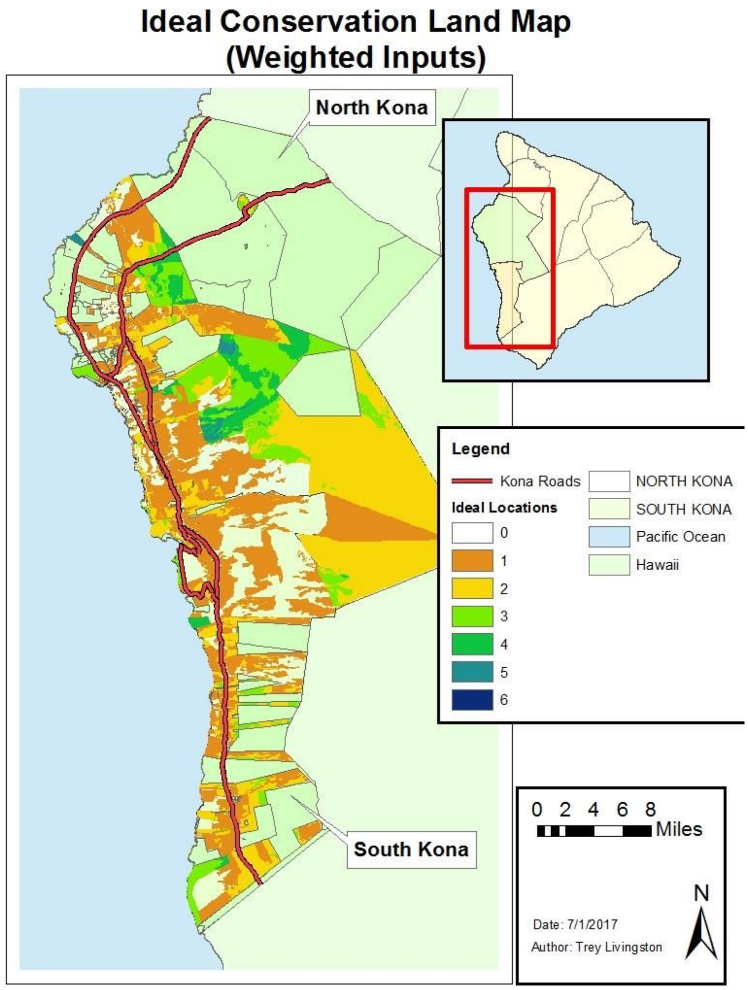

Figure 33: Ideal conservation lands map (weighted inputs)

Results and Discussion

The ideal conservation lands map ranks parcels and areas within them that HILT can focus their attention on to meet their objectives. Figure 32 includes a snapshot of the parcels in North and South Kona listed by descending Max C score (Maximum conservation score). This report displays the top ideal conservation lands listed by affordability. Additional information included in this report are the major landowner, the number of acres, and the parcels corresponding TMK numbers. The map and report allow HILT to review the properties based on spatial location and non-spatial data. This information can be used to identify ideal conservation lands of interest and queue further investigation for acquisition potential. This can be done by correlating the TMK number and using a MLS or other service to further study specific properties.

Final Unweighted Conservation Parcels

tmk #	Max C score	Mean C score	Major Owner	Tax Acres	Land Value
378001003	4	2.408377	Kamehameha Schools	62700	1092400
372003003	4	0.457627	Kamehameha Schools	7486	2443400
389006003	4	1.75	Showe Family	2389.556	3980900
389006019	4	2	South Kona	1702.496	47700
385005001	4	1.9	Kamehameha Schools	619.0002	1140900
381007054	4	1.941176	Pacific Star	251	1029600
381007045	4	1.727273	other	242.7	90300
386011012	4	1.315789	E.M. Stack	239.08	20500
389002001	4	1.75	other	112.976	31400
381004003	4	1.888889	1250 Oceanside	105.994	3179800
381010004	4	1.533333	other	88.742	84300
381007001	4	2.266667	Pacific Star	80.5	771100

Figure 34: Final Report Example

Future analysis can include the tax value of the property as a weighted factor for determining ideal lands to acquire. The intent of this practicum was to establish an objective process to identify lands that met criteria defined for ideal conservation lands. Additionally a model was built to enable

HILT to continue to refine their use of GIS to provide objective justification to board members for land acquisition. Refined analysis on each criteria should be accomplished using current data and additional factors. It would be beneficial to HILT to approach this with a refined objective focused on one of the criteria at a time. This practicum treated each criteria equivalently however, depending on the balance of lands currently in conservation, HILT may prefer to focus their efforts and resources to acquire lands with criteria that have not been adequately represented in the current day conservation picture. Analysis to include water quality around the coastlines should be conducted using available water turbidity data. This information is critical in modeling the environment and ecology in areas where pristine waters exist. The coastline adjacent to high quality waters should be weighted highly so that future degradation of these waters is limited. Coastline adjacent to low quality water should be identified and maps made publicly available so that the public and corresponding land owners can take action to reduce activities related to the increase in turbidity.

Conclusion

Defining land based on criteria that represents agricultural, cultural, ecological and environmental, public adjacency, and scenic significance is a dynamic challenge. Each of these criteria may be defined differently from person to person, establishing objectives and refining them as understanding of this process increase is critical to developing a justifiable approach to ideal conservation land prioritization. Selecting the data that represents each objective is an incredibly challenging task. These five criteria and the objectives currently established create requirements for data that captures land status over a significant time period. Cultural significance is an example of how the data for this practicum spans multiple generations. This criteria is defined based on what was once important to the Hawaiian people and also what is still or now important. Capturing that data involves a heightened knowledge of the history and geography of the Hawaiian people and the locations they inhabited.

GIS proved useful for creating a repeatable process that is ready for refinement and development with additional data sources and weighing/prioritization of criteria and objectives. Using this tool HILT can appeal to landowners and the public with justified and scientific fortified reasoning. Preserving the sensitive environment and culture of Hawaii is critical to the future and becoming more and more challenging as land is developed. Objective assessment of ideal conservation lands will provide HILT with avenues for political inertia and community buy in. Along with the right resources this assessment method can grow to become a highly accurate and repeatable process across all islands and around the world.

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Appendices

Appendix A Timeline

December 2014 – Initial committee teleconference

December 2014 – Meeting with HILT to establish objectives and refine criteria for analysis

January 2015 – Received University of Hawaii data from HILT

November 2015 – Progress check with HILT

December 2015 – Initial agricultural data and workflow complete

March 2016 – Update to HILT on progress. Agricultural model builder complete. Workflow for other criteria updated.

20 February 2017 – Final report submitted to advisor for corrections

4 March 2017 - Received feedback on report

26 March 2017 – Made corrections to report and resubmitted for review

4 April 2017 – Received feedback on report

6 April 2017 – Returned report with corrections

10 April 2017 – Received feedback from HILT on products (Maps, data report)

2 May 2017 – Presented results to HILT

20 May 2017 – Report Defense copy sent to committee members

30 May 2017 – Defense to Committee

Appendix B Research Request

HAWAIIAN ISLANDS LAND TRUST

Island Offices

Maui – Main Office
808.244.5263

Hawai'i Island
808.769.4343

Kaua'i
808.755.5707

O'ahu
808.498.8385

April 21, 2014

Trey Livingston

Dear Trey:

The Hawaiian Islands Land Trust (HILT) is very excited to be working with you on your Master's in Geospatial Science at Northern Arizona University and the resulting thesis and practicum that is required for your degree. Your work will be instrumental in helping the Land Trust identify and protect those lands that are the most important for Hawaii to conserve because of their unique features.

I have described below the information the Land Trust is hoping to obtain from your research.

The student will provide an analyses of parcels of land that have been determine to be "iconic" by the Hawaiian Islands Land Staff and Board of Directors. The analysis will include determining the conservation importance of each of the identified parcels by looking at the vegetative habitat, the animals that are present, if endangered or threatened species are present on the parcel, the relation of the parcel to surrounding ownership patterns and the applicability of the parcel to furthering the mission of the Hawaiian Islands Land Trust.

The general land categories which are a focus for the Land Trust include:

1. Agricultural Lands
2. Lands with Cultural or Historical Value
3. Ecologically Important Lands
4. Public Access to recreational lands
5. View Planes and corridors
6. Coastal Lands/Adjacent Marine Habitat

The criteria that was used to prioritize lands on each island are:

1. Willing Landowner where 1 is willing and 3 is unwilling
2. Threat of Development where 1 is high and 3 is low
3. Conservation Values where high values contains three or more conservation values (1); medium contains two (2) and low (3) contains no known.
4. Cost Feasibility which was looked at by acquisition and stewardship. Costs of less than $1,000,000 were deemed 1; $1,000,000-$3,000,000 (2); 3 was over $3,000,000. If a property would be fee owned or protected by a conservation easement were as follows: easements would be deemed a 1or 2; fee owned would be 2 or 3 because of the greater costs associated with owning land.

P.O. Box 965 | Wailuku, HI 96793 | www.hilt.org

5. Due Diligence: Low problems (1); medium (2) and high problems (3). This would be in reference to title clouds, hazardous issues, etc.

I have attached a paper written by Rick Bennett titled: Determining and Articulating Our Conservation Objectives: The Hawaiian Islands Land Trust for the Hawaii Island. This paper is an elaboration of the Iconic Lands Study referenced above. I am also attaching the results of the iconic land study that lists what the island council and the Board of Directors of HILT determined were the iconic lands on each island. This information is confidential as to the ownership of the parcels that were listed, since this report looks at properties holistically and not in terms of if they are available for purchase or conservation easement placement. For each parcel listed, there is a write up describing why that parcel was chosen for inclusion in the iconic list.

HILT can also provide you with information on the North Kohala area that has been mapped for GIS. The County of Hawaii also has several GIS products available with county information, as does the Park Service for the King's Trail. Another very good source to look at is The Nature Conservancy's website for Hawaii that lists their conservation areas and has several good overlays of biological information for the State.

All of the staff at the Land Trust are available to help you gather information for the project. Specifically, the island staff include: Ted Clement, Executive Director, ted@hilt.org; Director of Conservation and Maui Island Director, Scott Fisher, scott@hilt.org; James Crowe, Director of Stewardship and also does GIS work for the Land Trust, james@hilt.org; Jen Luck, Kauai Island Director, jennifer@hilt.org; Tina Aiu, Oahu Island Director, christina@hilt.org; and me, Janet Britt, Acquisitions Specialist and Hawaii Island Director, janet@hilt.org (808-769-4343). The main number for Maui is 808-244-5263 and the address is PO Box 965, Wailuku, HI 96793. Please contact any of us with questions or requests for information. We are all thrilled about this project as it will help each of us to better understand our currently listed priority areas for conservation and will help guide our work in the future.

Thank you again, Trey.

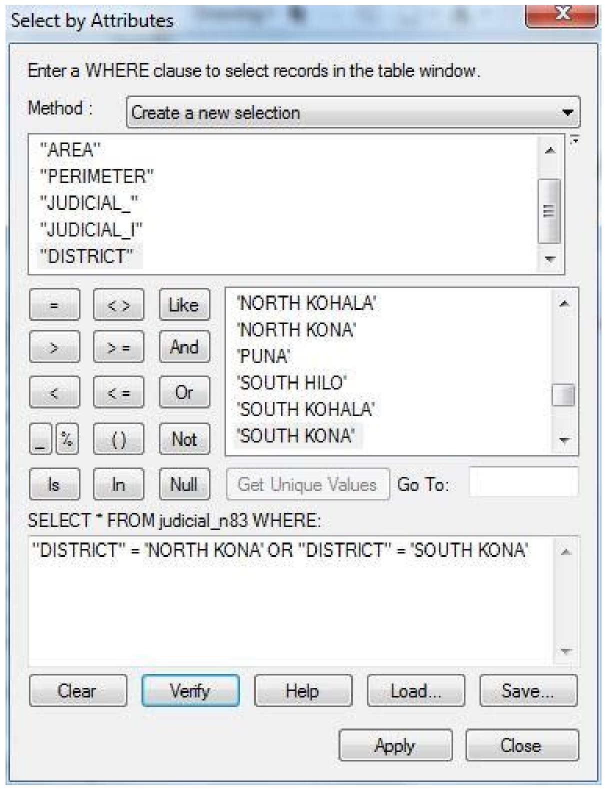
Sincerely yours,

Janet

Janet R. Britt
Acquisitions Specialist/Hawaii Island Director
Hawaiian Islands Land Trust

Encl.

Appendix C Data Preparation Model Report and Parameters



Select by Attributes tool and North and South Kona query logic

Appendix D Agricultural Land Meta-data, Model Report, and Parameters

Model Report

Expand/Collapse All

Generated on: Thu May 11 00:51:53 2017

Variables

LSB_kona

Data Type:Feature Layer
Value:LSB_kona

LSB_AC

Data Type:Feature Class
Value:E:\practicum_data\project_data\Ag.gdb\LSB_AC

ALISH_kona

Data Type:Feature Layer
Value:ALISH_kona

LESA_kona

Data Type:Feature Layer
Value:LESA_kona

ALUM_kona

Data Type:Feature Layer
Value:ALUM_kona

ALUM_not_A

Data Type:Feature Class
Value:E:\practicum_data\project_data\Ag.gdb\ALUM_not_A

Ag_Union

Data Type:Feature Class
Value:E:\practicum_data\project_data\Ag.gdb\Ag_Union

Ag_Union_rast

Data Type:Raster Dataset or Raster Catalog
Value:E:\practicum_data\project_data\Ag.gdb\Ag_Union_rast

Ag_Union_rast_reclass

Data Type:Raster Dataset
Value:E:\practicum_data\project_data\Ag.gdb\Ag_Union_rast_reclass

Processes

Select

Tool Name:Select
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Extract\Select

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	LSB_kona
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Ag.gdb\LSB_AC
Expression	Input	Optional	SQL Expression	type NOT LIKE 'E' OR type NOT LIKE 'D'

Messages:

Select (2)

Tool Name: Select
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Extract\Select

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	ALUM_kona
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Ag.gdb\ALUM_not_A
Expression	Input	Optional	SQL Expression	COMMODITY NOT LIKE 'A%'

Messages:

Union

Tool Name: Union
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Overlay\Union

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Value Table	E:\practicum_data\project_data\Ag.gdb\LSB_AC #;ALISH_kona #;LESA_kona #;E:\practicum_data\project_data\Ag.gdb\ALUM_not_A #
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Ag.gdb\Ag_Union
JoinAttributes	Input	Optional	String	ALL
XY Tolerance	Input	Optional	Linear unit	
Gaps Allowed	Input	Optional	Boolean	true

Messages:

Polygon to Raster

Tool Name: Polygon to Raster
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Conversion Tools.tbx\To Raster\PolygonToRaster

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Ag.gdb\Ag_Union
Value field	Input	Required	Field	OBJECTID
Output Raster Dataset	Output	Required	Raster Dataset or Raster Catalog	E:\practicum_data\project_data\Ag.gdb\Ag_Union_rast
Cell assignment type	Input	Optional	String	CELL_CENTER
Priority field	Input	Optional	Field	NONE

Cellsize	Input	Optional	Analysis Cell Size	50

Messages:

Reclassify

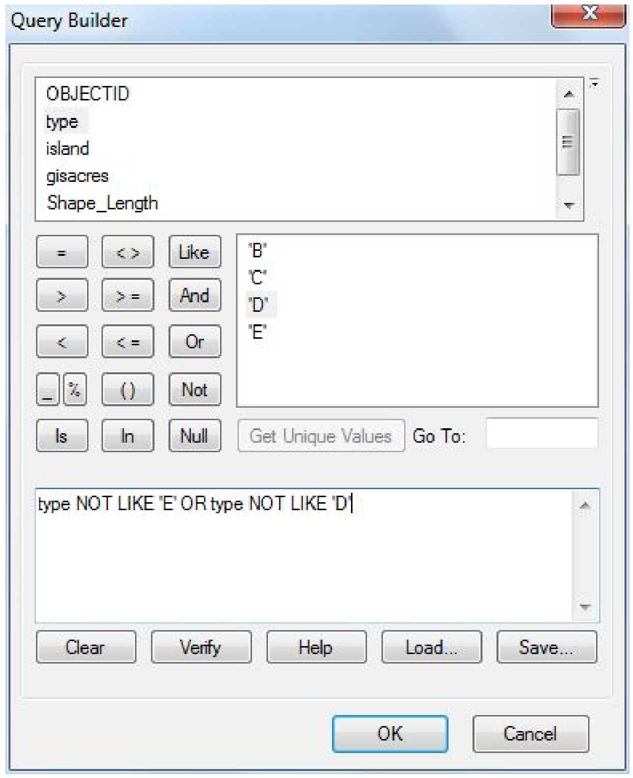
Tool Name: Reclassify
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Ag.gdb\Ag_Union_rast
Reclass field	Input	Required	Field	Value
Reclassification	Input	Required	Remap	1 11495 1;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Ag.gdb\Ag_Union_rast_reclass
Change missing values to NoData	Input	Optional	Boolean	false

Messages:

Commodities code	Definition
A	Animal Husbandry
A-1	Grazing
A-2	Dairy
A-3	Hog
A-4	Poultry
F	Field Crops
F-1	Vegetables/Melons
F-2	Flowers
F-3	Foliage and Nursery
F-4	Forage and Grain
O	Orchards
O-1	Banana
O-2	Papaya
O-3	Macadamia Nuts
O-5	Coffee
O-6	Guava
O-7	Other
P	Pineapple
Q	Aquaculture
S	Sugarcane
W	Wetlands



Select by attribute tool; query used to ignore Rating "E" and "D"

Appendix E Cultural Land Meta-data, Model Report, and Parameters

Model Report

Expand/Collapse All

Generated on: Thu May 11 00:52:18 2017

Variables

Kona_tmk

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*Kona_tmk

HistoricPlaces_n83_kona

*Data Type:*Feature Layer
*Value:*HistoricPlaces_n83_kona

Kona_tmk (4)

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*Kona_tmk

NaAlaHeleTrails_kona

*Data Type:*Feature Layer
*Value:*NaAlaHeleTrails_kona

Kona_tmk (3)

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*Kona_tmk

huntingareas_kona

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Kona.gdb\Cul\huntingareas_kona

fishponds_kona

*Data Type:*Feature Layer
*Value:*fishponds_kona

Kona_tmk (5)

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*Kona_tmk

BoatingFacilities_kona

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*BoatingFacilities_kona

Kona_tmk (2)

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*Kona_tmk

Cul_union

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Cul.gdb\Cul_union

Cul_union_rast

*Data Type:*Raster Dataset or Raster Catalog
*Value:*E:\practicum_data\project_data\Cul.gdb\Cul_union_rast

Cul_union_rast_reclass

*Data Type:*Raster Dataset
*Value:*E:\practicum_data\project_data\Cul.gdb\Cul_union_rast_reclass

Cul_union_rast_reclass_weight

*Data Type:*Raster Dataset
*Value:*E:\practicum_data\project_data\Cul.gdb\Cul_union_rast_reclass_weight

Processes

⌃Select Layer By Location (3)

Tool Name: Select Layer By Location
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\SelectLayerByLocation

⌃Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Feature Layer	Input	Required	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Relationship	Input	Optional	String	CONTAINS
Selecting Features	Input	Optional	Feature Layer	HistoricPlaces_n83_kona
Search Distance	Input	Optional	Linear unit	
Selection type	Input	Optional	String	ADD_TO_SELECTION
Output Layer Name	Output	Derived	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Invert Spatial Relationship	Input	Optional	Boolean	false

⌄Messages:

⌃Select Layer By Location (2)

Tool Name: Select Layer By Location
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\SelectLayerByLocation

⌃Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Feature Layer	Input	Required	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Relationship	Input	Optional	String	INTERSECT
Selecting Features	Input	Optional	Feature Layer	NaAlaHeleTrails_kona
Search Distance	Input	Optional	Linear unit	
Selection type	Input	Optional	String	ADD_TO_SELECTION
Output Layer Name	Output	Derived	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Invert Spatial Relationship	Input	Optional	Boolean	false

⌄Messages:

⌃Select Layer By Location (4)

Tool Name: Select Layer By Location
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\SelectLayerByLocation

⌃Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Feature Layer	Input	Required	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Relationship	Input	Optional	String	INTERSECT
Selecting Features	Input	Optional	Feature Layer	fishponds_kona

Search Distance	Input	Optional	Linear unit	
Selection type	Input	Optional	String	NEW_SELECTION
Output Layer Name	Output	Derived	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Invert Spatial Relationship	Input	Optional	Boolean	false

Messages:

Select Layer By Location

*Tool Name:*Select Layer By Location
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\SelectLayerByLocation

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Feature Layer	Input	Required	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Relationship	Input	Optional	String	WITHIN_A_DISTANCE
Selecting Features	Input	Optional	Feature Layer	BoatingFacilities_kona
Search Distance	Input	Optional	Linear unit	0.5 Miles
Selection type	Input	Optional	String	NEW_SELECTION
Output Layer Name	Output	Derived	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Invert Spatial Relationship	Input	Optional	Boolean	false

Messages:

Union

*Tool Name:*Union
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Overlay\Union

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Value Table	Kona_tmk #;Kona_tmk #;E:\practicum_data\project_data\Kona.gdb\Cul\huntingareas_kona #;Kona_tmk #;Kona_tmk #
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Cul.gdb\Cul_union
JoinAttributes	Input	Optional	String	ALL
XY Tolerance	Input	Optional	Linear unit	
Gaps Allowed	Input	Optional	Boolean	true

Messages:

Polygon to Raster

*Tool Name:*Polygon to Raster
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Conversion Tools.tbx\To Raster\PolygonToRaster

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Cul.gdb\Cul_union

Value field	Input	Required	Field	OBJECTID
Output Raster Dataset	Output	Required	Raster Dataset or Raster Catalog	E:\practicum_data\project_data\Cul.gdb\Cul_union_rast
Cell assignment type	Input	Optional	String	CELL_CENTER
Priority field	Input	Optional	Field	NONE
Cellsize	Input	Optional	Analysis Cell Size	50

Messages:

Reclassify

Tool Name:Reclassify
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Cul.gdb\Cul_union_rast
Reclass field	Input	Required	Field	Value
Reclassification	Input	Required	Remap	1 1658 10;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Cul.gdb\Cul_union_rast_reclass
Change missing values to NoData	Input	Optional	Boolean	false

Messages:

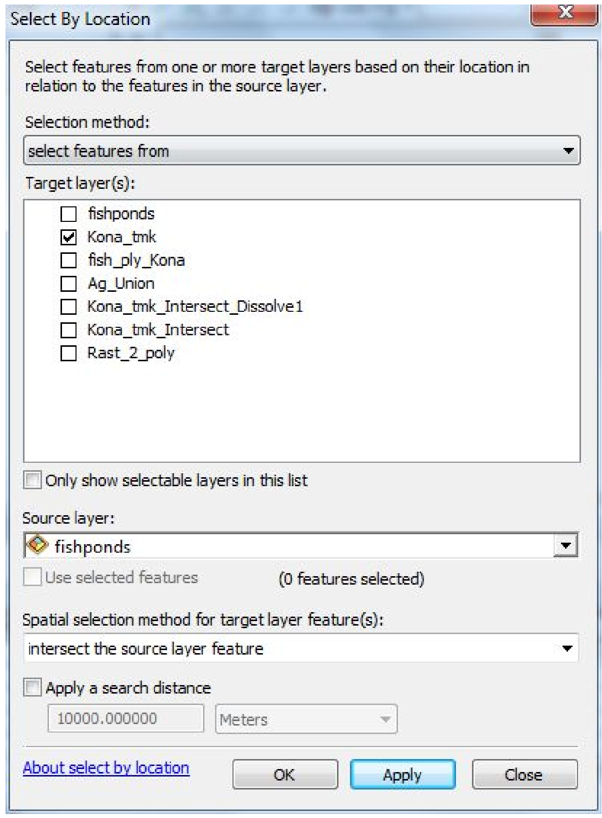
Reclassify (2)

Tool Name:Reclassify
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

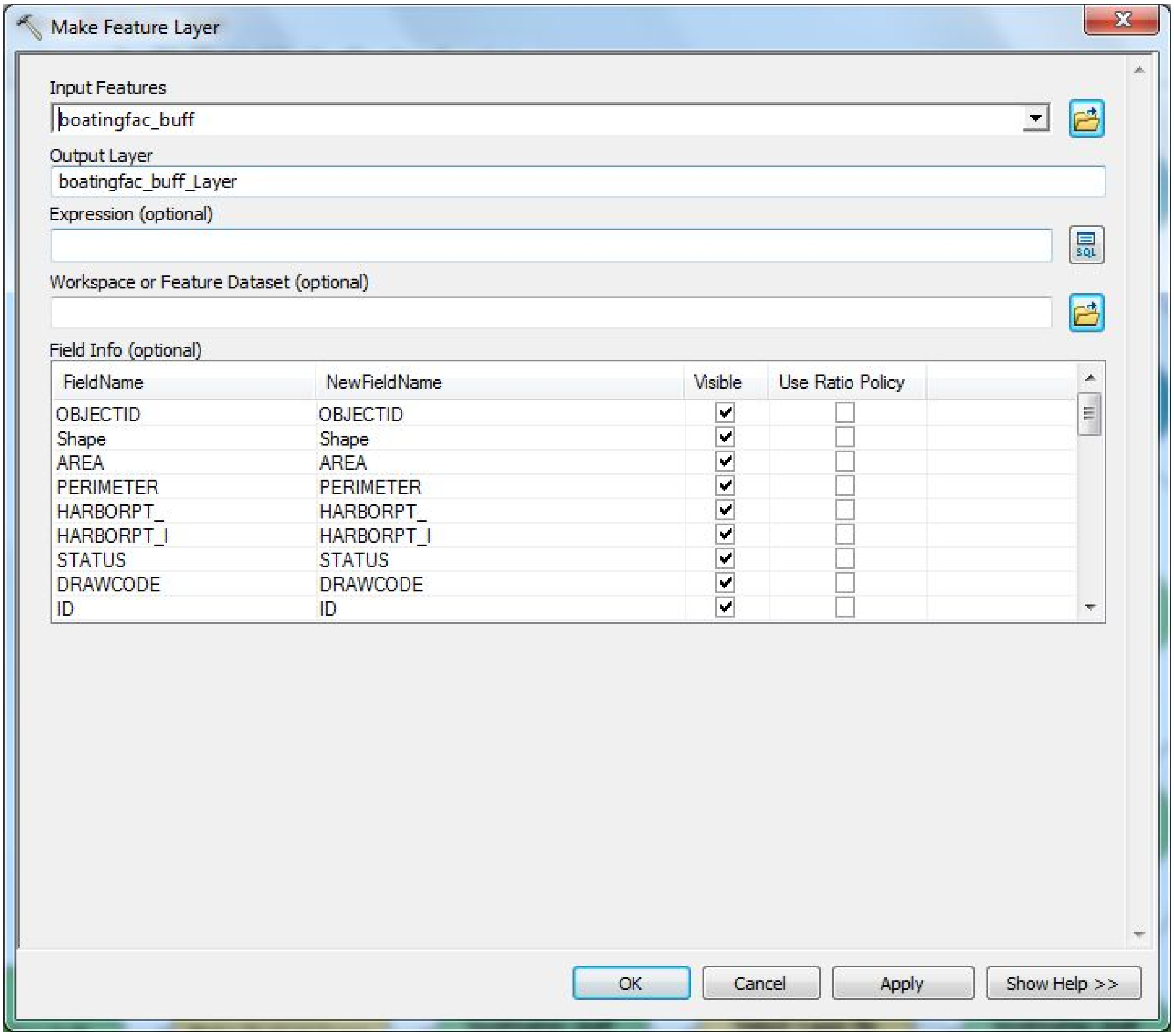
Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Cul.gdb\Cul_union_rast
Reclass field	Input	Required	Field	Value
Reclassification	Input	Required	Remap	1 1658 1;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Cul.gdb\Cul_union_rast_reclass_weight
Change missing values to NoData	Input	Optional	Boolean	false

Messages:



Fish pond intersection


Make Feature Layer
Input Features
boatingfac_buff
Output Layer
boatingfac_buff_Layer
Expression (optional)
Workspace or Feature Dataset (optional)
Field Info (optional)
FieldName
NewFieldName
Visible
Use Ratio Policy
OBJECTID
OBJECTID
Shape
Shape
AREA
AREA
PERIMETER
PERIMETER
HARBORPT_
HARBORPT_
HARBORPT_I
HARBORPT_I
STATUS
STATUS
DRAWCODE
DRAWCODE
ID
ID
OK
Cancel
Apply
Show Help >>

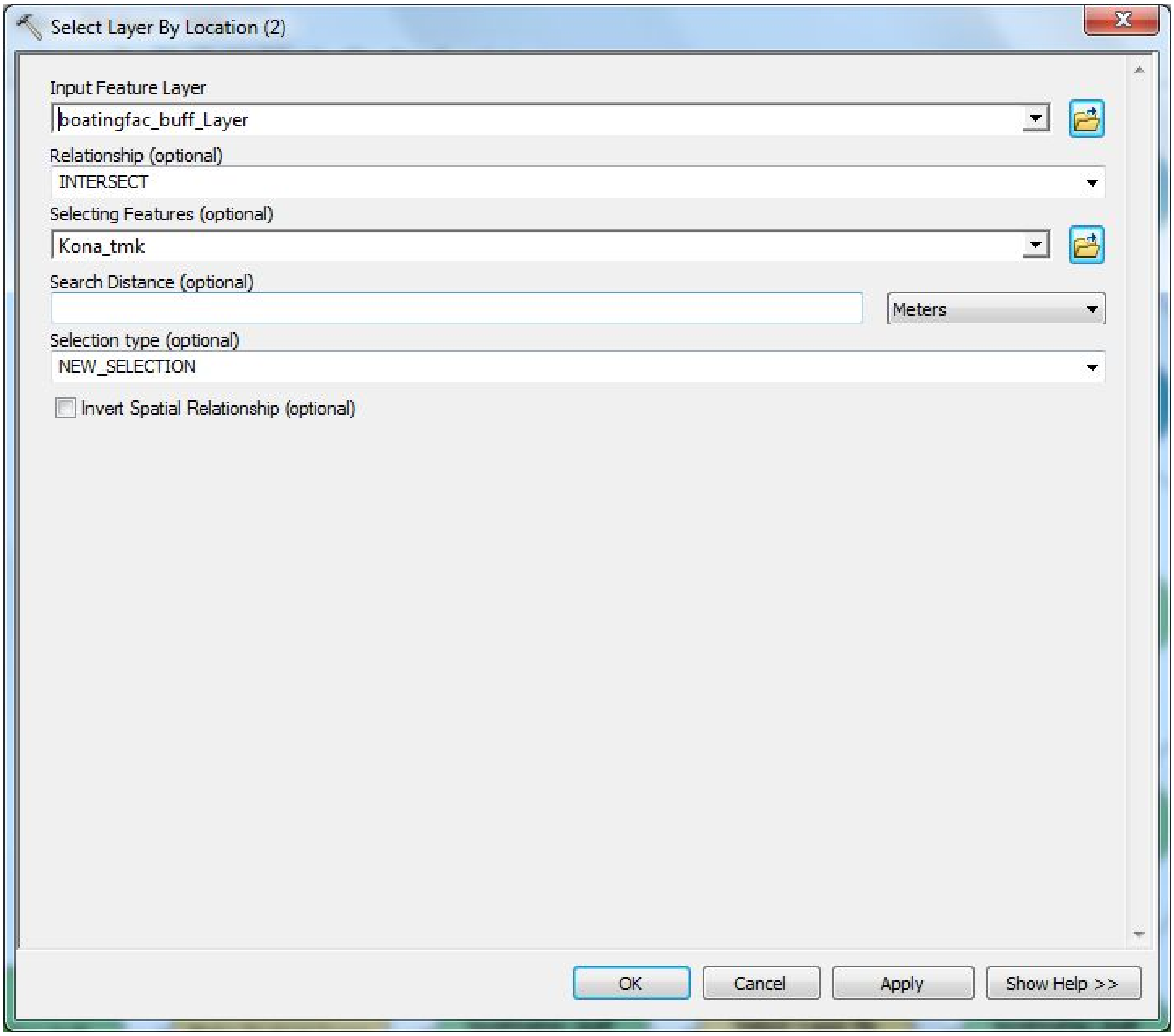
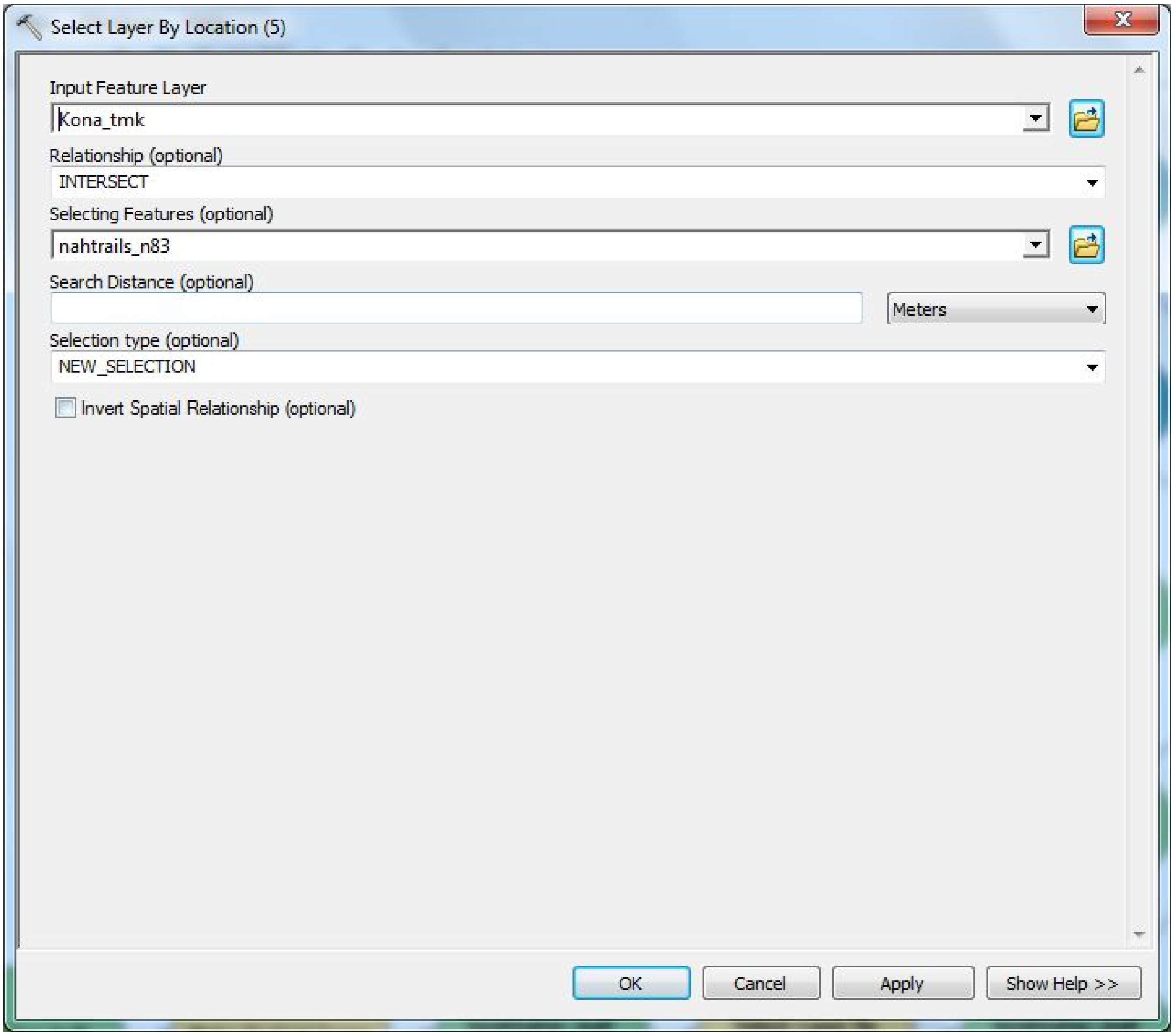
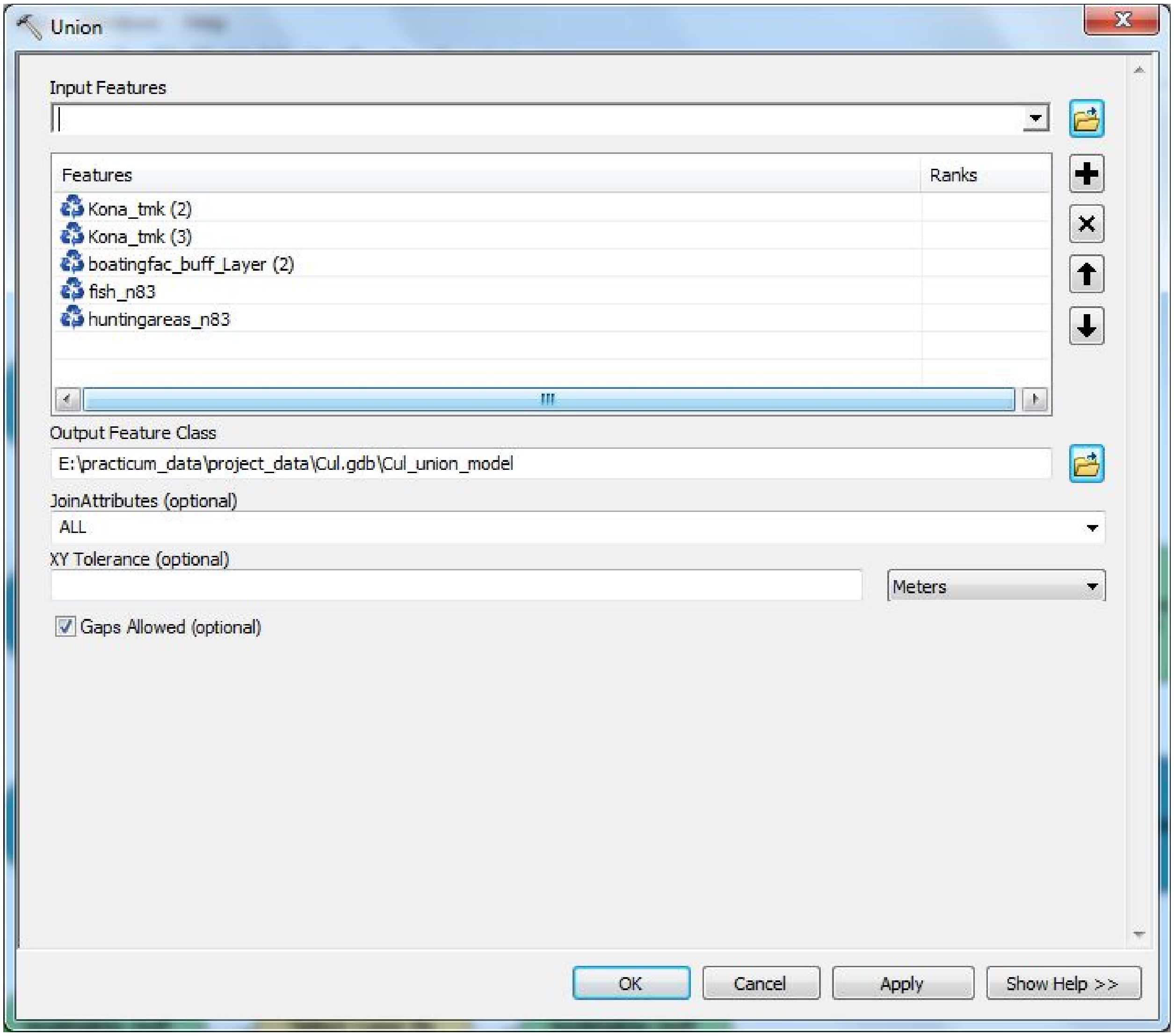
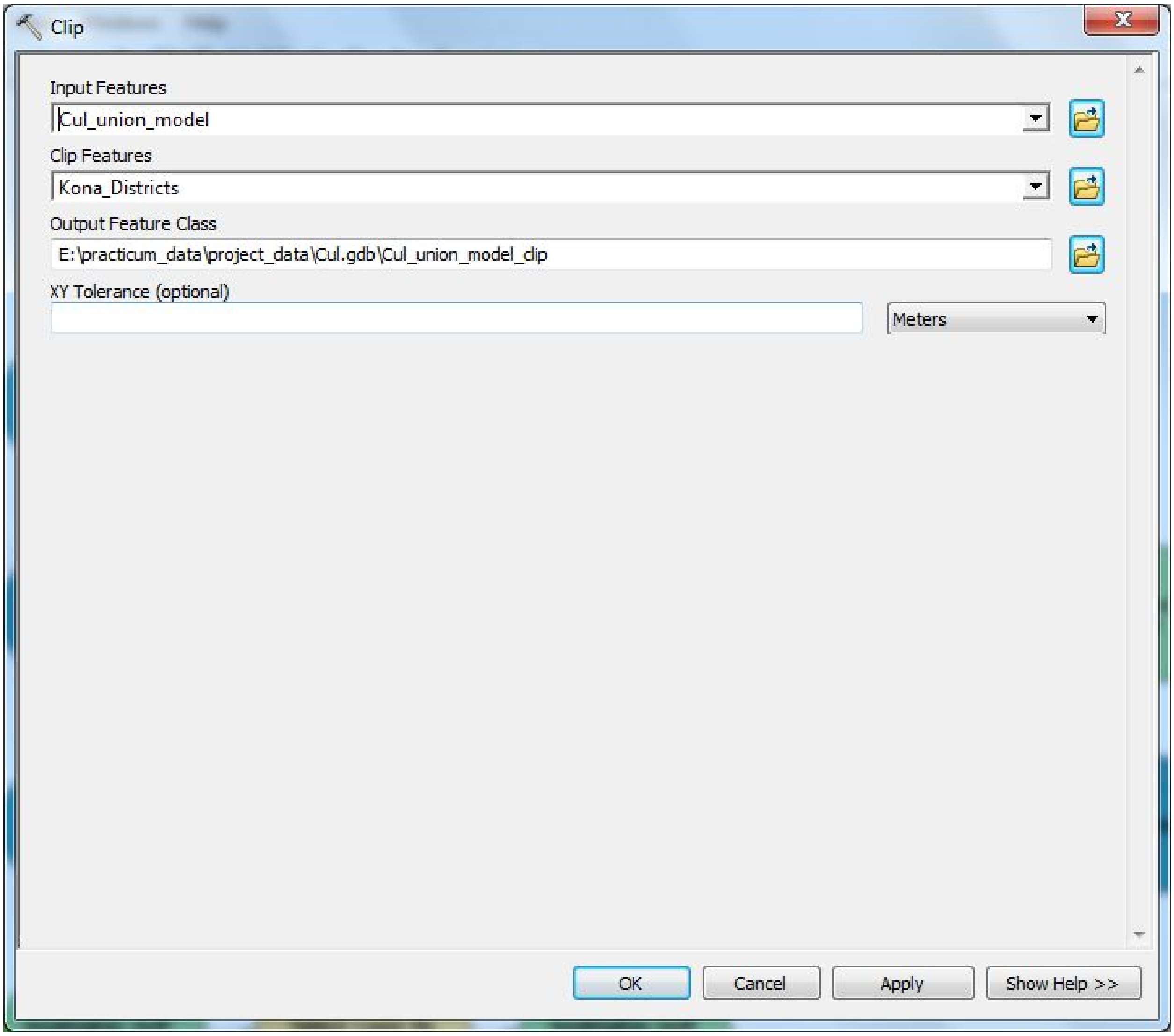
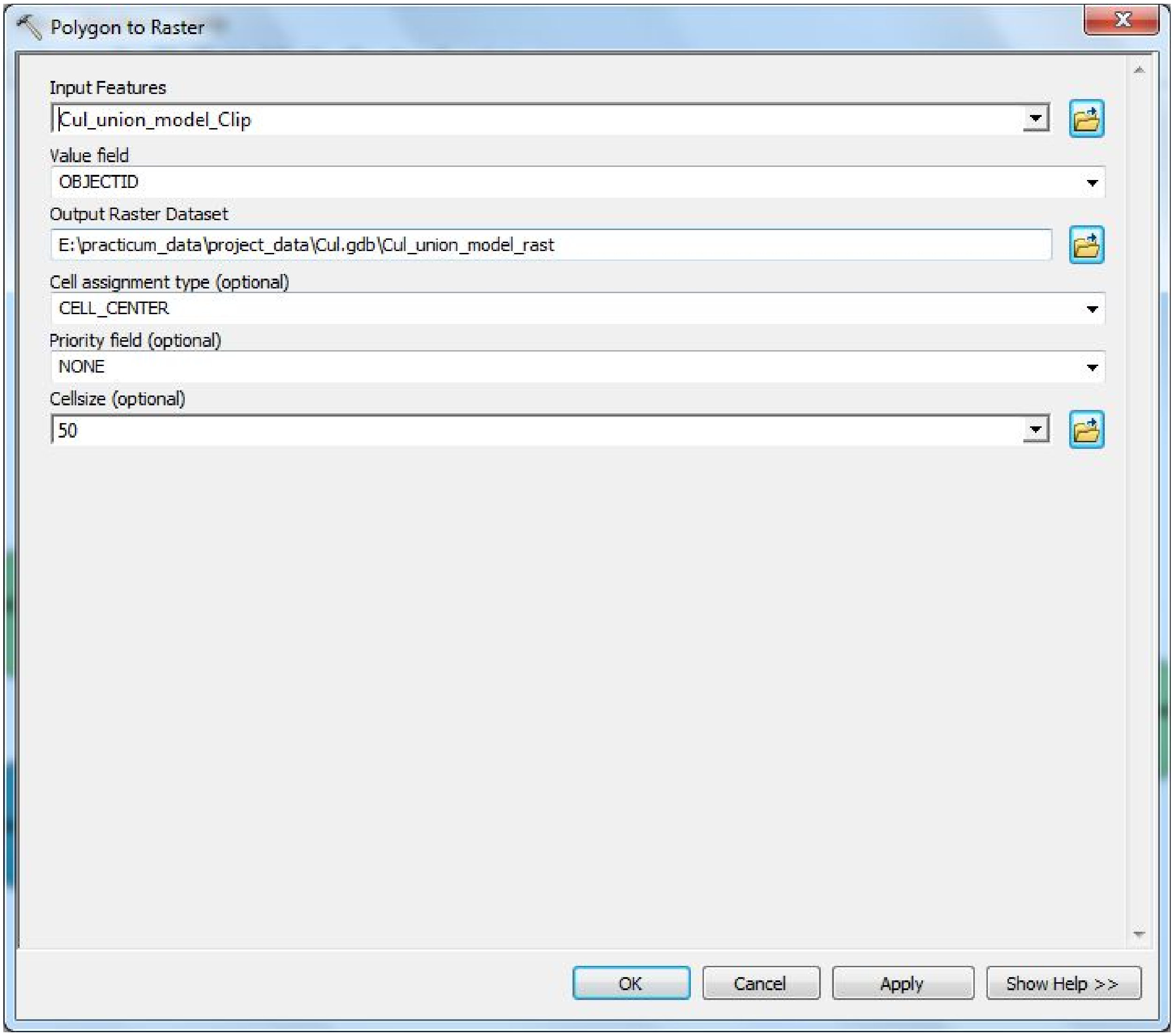


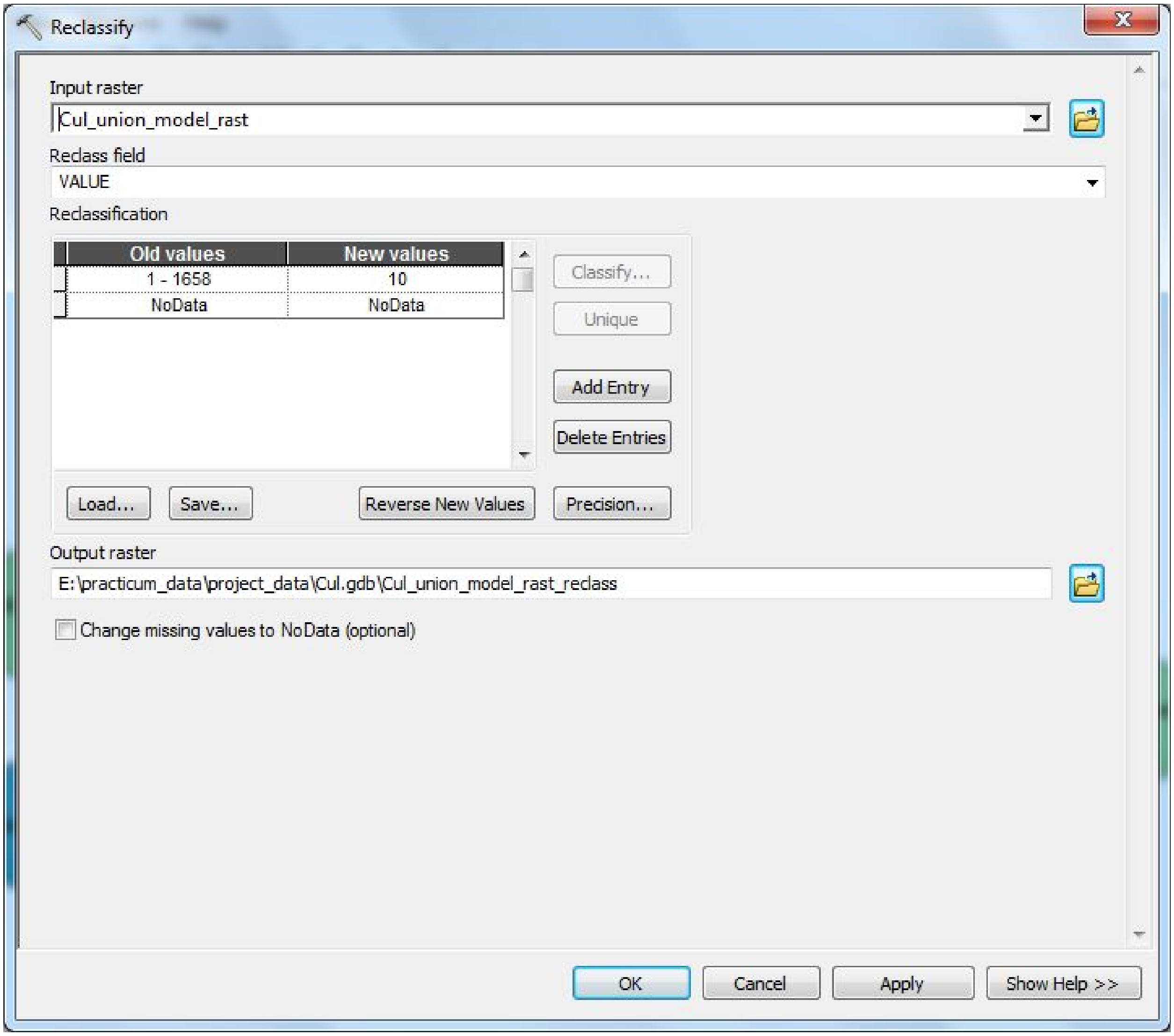
Figure 35: Boating Facilities buffer intersection


Select Layer By Location (5)
Input Feature Layer
Kona_tmk
Relationship (optional)
INTERSECT
Selecting Features (optional)
nahtrails_n83
Search Distance (optional)
Meters
Selection type (optional)
NEW_SELECTION
Invert Spatial Relationship (optional)
OK
Cancel
Apply
Show Help >>


Union
Input Features
Features
Ranks
Kona_tmk (2)
Kona_tmk (3)
boatingfac_buff_Layer (2)
fish_n83
huntingareas_n83
Output Feature Class
E:\practicum_data\project_data\Cul.gdb\Cul_union_model
JoinAttributes (optional)
ALL
XY Tolerance (optional)
Meters
Gaps Allowed (optional)
OK
Cancel
Apply
Show Help >>


Clip
Input Features
Cul_union_model
Clip Features
Kona_Districts
Output Feature Class
E:\practicum_data\project_data\Cul.gdb\Cul_union_model_clip
XY Tolerance (optional)
Meters
OK
Cancel
Apply
Show Help >>


Polygon to Raster
Input Features
Cul_union_model_Clip
Value field
OBJECTID
Output Raster Dataset
E:\practicum_data\project_data\Cul.gdb\Cul_union_model_rast
Cell assignment type (optional)
CELL_CENTER
Priority field (optional)
NONE
Cellsize (optional)
50
OK
Cancel
Apply
Show Help >>


Reclassify
Input raster
Cul_union_model_rast
Reclass field
VALUE
Reclassification
Old values
New values
1 - 1658
10
NoData
NoData
Classify...
Unique
Add Entry
Delete Entries
Load...
Save...
Reverse New Values
Precision...
Output raster
E:\practicum_data\project_data\Cul.gdb\Cul_union_model_rast_reclass
Change missing values to NoData (optional)
OK
Cancel
Apply
Show Help >>

Appendix F Ecological & Environmental Land Meta-data, Model Report, and Parameters

Model Report

Expand/Collapse All

Generated on: Thu May 11 00:52:38 2017

Variables

crhb_moth_kona

*Data Type:*Feature Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\crhb_moth_kona

crhb_KokDry_kona

*Data Type:*Feature Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\crhb_KokDry_kona

crhb_picturewing_kona

*Data Type:*Feature Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\crhb_picturewing_kona

crhb_plant_kona

*Data Type:*Feature Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\crhb_plant_kona

crhb_Union

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Env.gdb\crhb_union

teplant_kona

*Data Type:*Table View or Raster Layer or Mosaic Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\teplant_kona

teplant_kona_vh_parcels

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Env.gdb\teplant_kona_vh_parcels

Kona_tmk

*Data Type:*Feature Layer
*Value:*Kona_tmk

wetland_kona

*Data Type:*Feature Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\wetland_kona

Kona_tmk (2)

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*Kona_tmk

wetland_kona_parcels

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Env.gdb\wetland_kona_parcels

strmsrip_kona

*Data Type:*Feature Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\strmsrip_kona

Kona_tmk (3)

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*Kona_tmk

strmrip_kona_parcels

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Env.gdb\strmrip_kona_parcels

mma_kona

*Data Type:*Feature Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\mma_kona

Kona_tmk (4)

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*Kona_tmk

mma_kona_parcels

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Env.gdb\mma_kona_parcels

allved_n83_kona

*Data Type:*Table View or Raster Layer or Mosaic Layer
*Value:*E:\practicum_data\project_data\Kona.gdb\Env\allved_n83_kona

ved83_kona_noninvasive

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Env.gdb\ved83_kona_noninvasive

env_union

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Env.gdb\env_union

env_rast

*Data Type:*Raster Dataset or Raster Catalog
*Value:*E:\practicum_data\project_data\Env.gdb\env_rast

env_rast_reclass

*Data Type:*Raster Dataset
*Value:*E:\practicum_data\project_data\Env.gdb\env_rast_reclass

env_rast_reclass_weight

*Data Type:*Raster Dataset
*Value:*E:\practicum_data\project_data\Env.gdb\env_rast_reclass_weight

Processes

Union

*Tool Name:*Union
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Overlay\Union

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Value Table	E:\practicum_data\project_data\Kona.gdb\Env\crhb_moth_kona #;E:\practicum_data\project_data\Kona.gdb\Env\crhb_KokDry_kona #;E:\practicum_data\project_data\Kona.gdb\Env\crhb_picturewing_kona #;E:\practicum_data\project_data\Kona.gdb\Env\crhb_plant_kona #
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Env.gdb\crhb_union
JoinAttributes	Input	Optional	String	ALL
XY Tolerance	Input	Optional	Linear unit	
Gaps Allowed	Input	Optional	Boolean	true

Messages:

Select (2)

Tool Name: Select
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Extract\Select

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Kona.gdb\Env\teplant_kona
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Env.gdb\teplant_kona_vh_parcels
Expression	Input	Optional	SQL Expression	DENSITY = 'VH'

Messages:

Select Layer By Location (3)

Tool Name: Select Layer By Location
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\SelectLayerByLocation

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Feature Layer	Input	Required	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Relationship	Input	Optional	String	CONTAINS
Selecting Features	Input	Optional	Feature Layer	E:\practicum_data\project_data\Kona.gdb\Env\wetland_kona
Search Distance	Input	Optional	Linear unit	
Selection type	Input	Optional	String	ADD_TO_SELECTION
Output Layer Name	Output	Derived	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Invert Spatial Relationship	Input	Optional	Boolean	false

Messages:

Select (3)

Tool Name: Select
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Extract\Select

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	Kona_tmk
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Env.gdb\wetland_kona_parcels
Expression	Input	Optional	SQL Expression	

Messages:

Select Layer By Location (2)

*Tool Name:*Select Layer By Location
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\SelectLayerByLocation

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Feature Layer	Input	Required	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Relationship	Input	Optional	String	INTERSECT
Selecting Features	Input	Optional	Feature Layer	E:\practicum_data\project_data\Kona.gdb\Env\strmsrip_kona
Search Distance	Input	Optional	Linear unit	
Selection type	Input	Optional	String	NEW_SELECTION
Output Layer Name	Output	Derived	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Invert Spatial Relationship	Input	Optional	Boolean	false

Messages:

Select (4)

*Tool Name:*Select
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Extract\Select

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	Kona_tmk
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Env.gdb\strmrip_kona_parcels
Expression	Input	Optional	SQL Expression	

Messages:

Select Layer By Location

*Tool Name:*Select Layer By Location
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\SelectLayerByLocation

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Feature Layer	Input	Required	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Relationship	Input	Optional	String	INTERSECT
Selecting Features	Input	Optional	Feature Layer	E:\practicum_data\project_data\Kona.gdb\Env\mma_kona

Search Distance	Input	Optional	Linear unit	
Selection type	Input	Optional	String	NEW_SELECTION
Output Layer Name	Output	Derived	Feature Layer or Raster Catalog Layer or Mosaic Layer	Kona_tmk
Invert Spatial Relationship	Input	Optional	Boolean	false

Messages:

Select (5)

Tool Name:Select
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Extract\Select

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	Kona_tmk
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Env.gdb\mma_kona_parcels
Expression	Input	Optional	SQL Expression	

Messages:

Select

Tool Name:Select
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Extract\Select

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Kona.gdb\Env\allved_n83_kona
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Env.gdb\ved83_kona_noninvasive
Expression	Input	Optional	SQL Expression	OVERSTORY NOT LIKE '%x%' AND UNDERSTORY NOT LIKE '%x%' AND DEGREE_OF_ NOT LIKE '%XX%'

Messages:

Union (2)

Tool Name:Union
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Overlay\Union

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Value Table	E:\practicum_data\project_data\Env.gdb\crhb_union #;E:\practicum_data\project_data\Env.gdb\teplant_kona_vh_parcels #;E:\practicum_data\project_data\Env.gdb\wetland_kona_parcels #;E:\practicum_data\project_data\Env.gdb\strmrip_kona_parcels #;E:\practicum_data\project_data\Env.gdb\mma_kona_parcels #;E:\practicum_data\project_data\Env.gdb\ved83_kona_noninvasive #
	Output	Required		E:\practicum_data\project_data\Env.gdb\env_union

Output Feature Class			Feature Class	
JoinAttributes	Input	Optional	String	ALL
XY Tolerance	Input	Optional	Linear unit	
Gaps Allowed	Input	Optional	Boolean	true

Messages:

Polygon to Raster

Tool Name:Polygon to Raster
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Conversion Tools.tbx\To Raster\PolygonToRaster

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Env.gdb\env_union
Value field	Input	Required	Field	OBJECTID
Output Raster Dataset	Output	Required	Raster Dataset or Raster Catalog	E:\practicum_data\project_data\Env.gdb\env_rast
Cell assignment type	Input	Optional	String	CELL_CENTER
Priority field	Input	Optional	Field	NONE
Cellsize	Input	Optional	Analysis Cell Size	50

Messages:

Reclassify

Tool Name:Reclassify
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Env.gdb\env_rast
Reclass field	Input	Required	Field	Value
Reclassification	Input	Required	Remap	1 1143 100;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Env.gdb\env_rast_reclass
Change missing values to NoData	Input	Optional	Boolean	false

Messages:

Reclassify (2)

Tool Name:Reclassify
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Env.gdb\env_rast
Reclass field	Input	Required	Field	Value

Reclassification	Input	Required	Remap	1 1143 1;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Env.gdb\env_rast_reclass_weight
Change missing values to NoData	Input	Optional	Boolean	false

Messages:

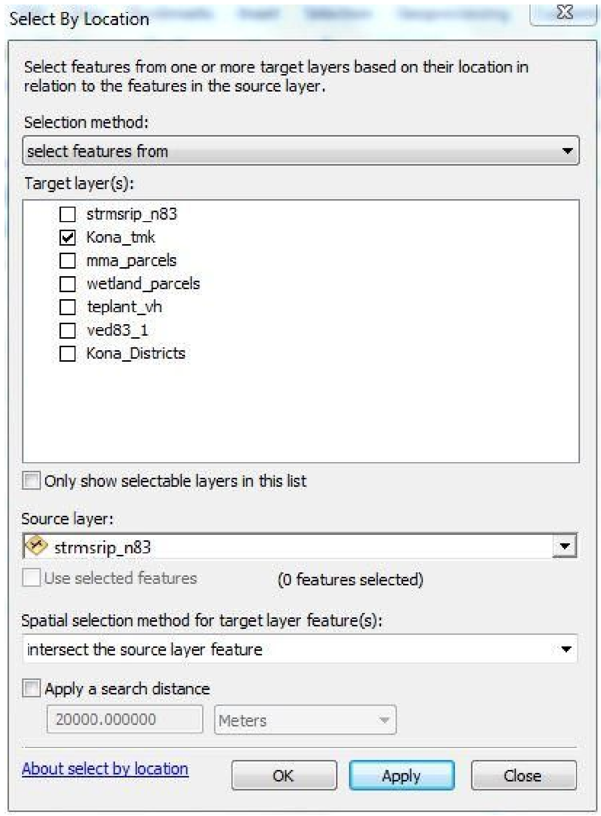


Figure 36: Stream and parcel intersection

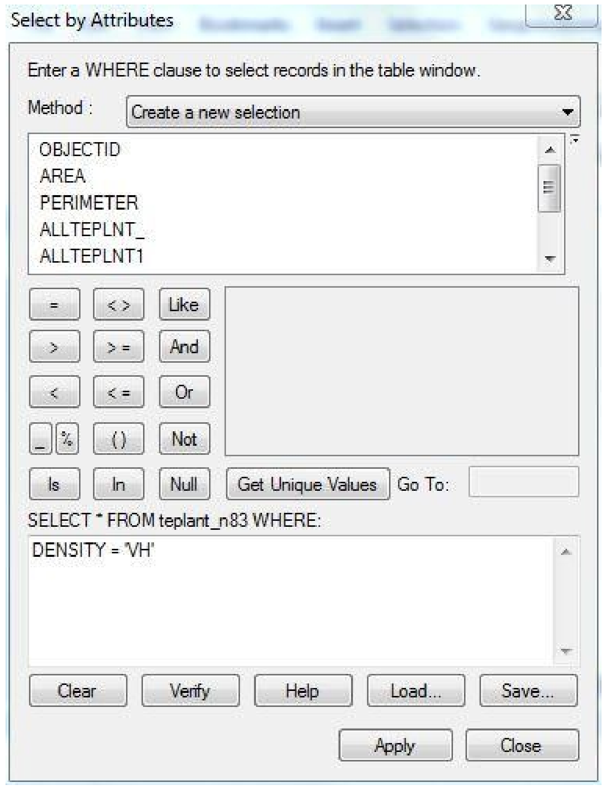


Figure 37: Threatened and Endangered plant density selection

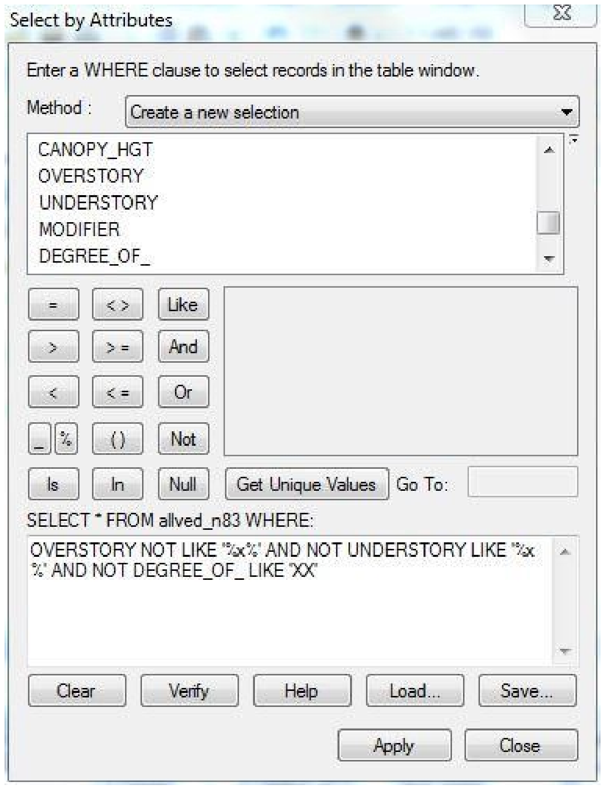


Figure 38: Vegetation selection

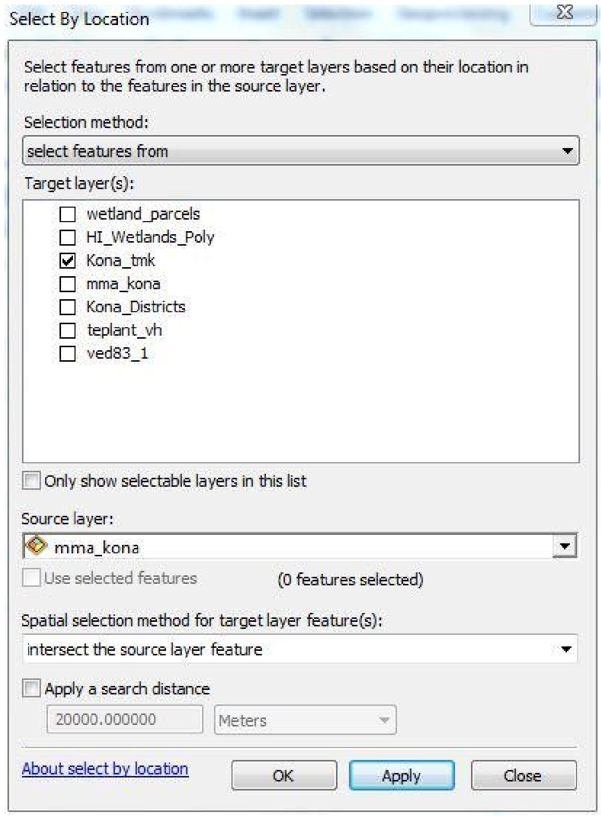


Figure 39: Marine Management area intersection

Appendix G Public Access Land Meta-data, Model Report, and Parameters

Model Report

Expand/Collapse All

Generated on: Mon May 15 22:49:58 2017

Variables

Kona_tmk

*Data Type:*Feature Layer
*Value:*Kona_tmk

gov_own_kona

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Kona.gdb\Public\gov_own_kona

Reserves_kona

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Kona.gdb\Public\Reserves_kona

gov_res_union

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Public.gdb\gov_res_union

gov_res_erase

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Public.gdb\gov_res_erase

gov_res_erase_layer

*Data Type:*Feature Layer
*Value:*gov_res_erase_Layer

gov_res_select

*Data Type:*Feature Layer or Raster Catalog Layer or Mosaic Layer
*Value:*gov_res_erase_Layer

gov_res_adj

*Data Type:*Feature Class
*Value:*E:\practicum_data\project_data\Public.gdb\gov_res_adj

Pub_rast

*Data Type:*Raster Dataset or Raster Catalog
*Value:*E:\practicum_data\project_data\Public.gdb\Pub_rast

Pub_rast_reclass

*Data Type:*Raster Dataset
*Value:*E:\practicum_data\project_data\Public.gdb\Pub_rast_reclass

Pub_rast_reclass_weight

*Data Type:*Raster Dataset
*Value:*E:\practicum_data\project_data\Public.gdb\Pub_rast_reclass_weight

Processes

Union

*Tool Name:*Union
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Overlay\Union

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*

Input Features	Input	Required	Value Table	E:\practicum_data\project_data\Kona.gdb\Public\gov_own_kona #;E:\practicum_data\project_data\Kona.gdb\Public\Reserves_kona #
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Public.gdb\gov_res_union
JoinAttributes	Input	Optional	String	ALL
XY Tolerance	Input	Optional	Linear unit	
Gaps Allowed	Input	Optional	Boolean	true

Messages:

Erase

Tool Name:Erase
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Overlay\Erase

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	Kona_tmk
Erase Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Public.gdb\gov_res_union
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Public.gdb\gov_res_erase
XY Tolerance	Input	Optional	Linear unit	

Messages:

Make Feature Layer

Tool Name:Make Feature Layer
Tool Source:c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\MakeFeatureLayer

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Public.gdb\gov_res_erase
Output Layer	Output	Required	Feature Layer	gov_res_erase_Layer
Expression	Input	Optional	SQL Expression	
Workspace or Feature Dataset	Input	Optional	Workspace or Feature Dataset	
Field Info	Input	Optional	Field Info	OBJECTID OBJECTID VISIBLE NONE;Shape Shape VISIBLE NONE;tmk tmk VISIBLE NONE;majorowner majorowner VISIBLE NONE;bigstowner bigstowner VISIBLE NONE;taxacres taxacres VISIBLE NONE;landvalue landvalue VISIBLE NONE;landexempt landexempt VISIBLE NONE;bldgvalue bldgvalue VISIBLE NONE;bldgexempt bldgexempt VISIBLE NONE;pittcode pittcode VISIBLE NONE;homeowner homeowner VISIBLE NONE;gisacres gisacres VISIBLE NONE;nhoodcode nhoodcode VISIBLE NONE;publishdat publishdat VISIBLE NONE;comments comments VISIBLE NONE;shape_Leng shape_Leng VISIBLE NONE;Shape_Length Shape_Length VISIBLE NONE;Shape_Area Shape_Area VISIBLE NONE;Shape_length Shape_length VISIBLE

				NONE;Shape_area Shape_area VISIBLE NONE

Messages:

Select Layer By Location

*Tool Name:*Select Layer By Location
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\Layers and Table Views\SelectLayerByLocation

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Feature Layer	Input	Required	Feature Layer or Raster Catalog Layer or Mosaic Layer	gov_res_erase_Layer
Relationship	Input	Optional	String	SHARE_A_LINE_SEGMENT_WITH
Selecting Features	Input	Optional	Feature Layer	E:\practicum_data\project_data\Public.gdb\gov_res_union
Search Distance	Input	Optional	Linear unit	
Selection type	Input	Optional	String	NEW_SELECTION
Output Layer Name	Output	Derived	Feature Layer or Raster Catalog Layer or Mosaic Layer	gov_res_erase_Layer
Invert Spatial Relationship	Input	Optional	Boolean	false

Messages:

Select

*Tool Name:*Select
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Extract\Select

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	gov_res_erase_Layer
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Public.gdb\gov_res_adj
Expression	Input	Optional	SQL Expression	

Messages:

Polygon to Raster

*Tool Name:*Polygon to Raster
*Tool Source:*c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Conversion Tools.tbx\To Raster\PolygonToRaster

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Public.gdb\gov_res_adj
Value field	Input	Required	Field	OBJECTID

Output Raster Dataset	Output	Required	Raster Dataset or Raster Catalog	E:\practicum_data\project_data\Public.gdb\Pub_rast
Cell assignment type	Input	Optional	String	CELL_CENTER
Priority field	Input	Optional	Field	NONE
Cellsize	Input	Optional	Analysis Cell Size	50

Messages:

Reclassify

Tool Name: Reclassify
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Public.gdb\Pub_rast
Reclass field	Input	Required	Field	VALUE
Reclassification	Input	Required	Remap	1 2348 1000;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Public.gdb\Pub_rast_reclass
Change missing values to NoData	Input	Optional	Boolean	false

Messages:

Reclassify (2)

Tool Name: Reclassify
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Public.gdb\Pub_rast
Reclass field	Input	Required	Field	VALUE
Reclassification	Input	Required	Remap	1 2348 1;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Public.gdb\Pub_rast_reclass_weight
Change missing values to NoData	Input	Optional	Boolean	false

Messages:

Appendix H Scenic Land Meta-data, Model Report, and Parameters

Model Report

Expand/Collapse All

Generated on: Thu May 11 00:53:25 2017

Variables

North_Kona_Natural_Beauty_Sites

Data Type: Feature Layer
Value: E:\practicum_data\project_data\Kona.gdb\Scenic\North_Kona_Natural_Beauty_Sites

South_Kona_Natural_Beauty_Sites

Data Type: Feature Layer
Value: E:\practicum_data\project_data\Kona.gdb\Scenic\South_Kona_Natural_Beauty_Sites

Natural_Beauty_Sites

Data Type: Feature Class
Value: E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites

Natural_Beauty_Sites_Rast

Data Type: Raster Dataset or Raster Catalog
Value: E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites_Rast

Natural_Beauty_Sites_Rast_reclass

Data Type: Raster Dataset
Value: E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites_Rast_reclass

Natural_Beauty_Sites_Rast_reclass_weight

Data Type: Raster Dataset
Value: E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites_Rast_reclass_weight

Processes

Union

Tool Name: Union
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Analysis Tools.tbx\Overlay\Union

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Value Table	E:\practicum_data\project_data\Kona.gdb\Scenic\North_Kona_Natural_Beauty_Sites #;E:\practicum_data\project_data\Kona.gdb\Scenic\South_Kona_Natural_Beauty_Sites #
Output Feature Class	Output	Required	Feature Class	E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites
JoinAttributes	Input	Optional	String	ALL
XY Tolerance	Input	Optional	Linear unit	
Gaps Allowed	Input	Optional	Boolean	true

Messages:

Polygon to Raster

Tool Name: Polygon to Raster
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Conversion Tools.tbx\To Raster\PolygonToRaster

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input Features	Input	Required	Feature Layer	E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites
Value field	Input	Required	Field	OBJECTID_1
Output Raster Dataset	Output	Required	Raster Dataset or Raster Catalog	E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites_Rast
Cell assignment type	Input	Optional	String	CELL_CENTER

Priority field	Input	Optional	Field	NONE
Cellsize	Input	Optional	Analysis Cell Size	50

Messages:

Reclassify

Tool Name: Reclassify
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

Parameters:

Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites_Rast
Reclass field	Input	Required	Field	VALUE
Reclassification	Input	Required	Remap	1 18 10000;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites_Rast_reclass
Change missing values to NoData	Input	Optional	Boolean	false

Messages:

Reclassify (2)

Tool Name: Reclassify
Tool Source: c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Spatial Analyst Tools.tbx\Reclass\Reclassify

Parameters:

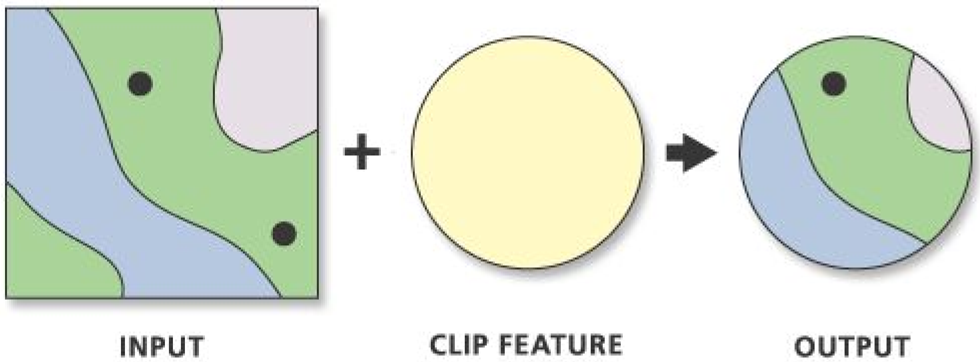
Name	*Direction*	*Type*	*Data Type*	*Value*
Input raster	Input	Required	Composite Geodataset	E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites_Rast
Reclass field	Input	Required	Field	VALUE
Reclassification	Input	Required	Remap	1 18 1;NODATA 0
Output raster	Output	Required	Raster Dataset	E:\practicum_data\project_data\Scenic.gdb\Natural_Beauty_Sites_Rast_reclass_weight
Change missing values to NoData	Input	Optional	Boolean	false

Messages:

Appendix I ArcGIS tool description

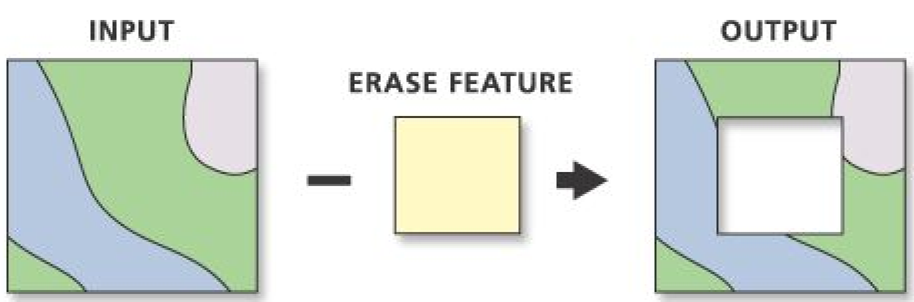
Clip:

Extracts input features that overlay the clip features. Use this tool to cut out a piece of one feature class using one or more of the features in another feature class as a cookie cutter.



Erase:

Creates a feature class by overlaying the Input Features with the polygons of the Erase Features. Only those portions of the input features falling outside the erase features outside boundaries are copied to the output feature class.



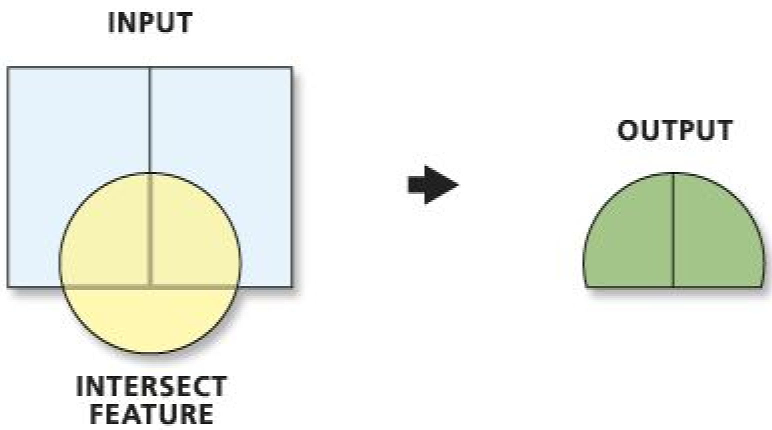
Select:

Extracts features from an input feature class or input feature layer, typically using a select or

Structured Query Language (SQL) expression and stores them in an output feature class.

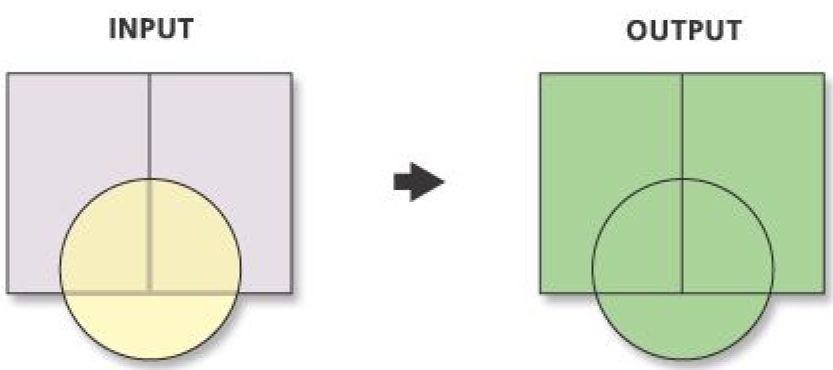
Intersect:

Computes a geometric intersection of the input features. Features or portions of features which overlap in all layers and/or feature classes will be written to the output feature class.



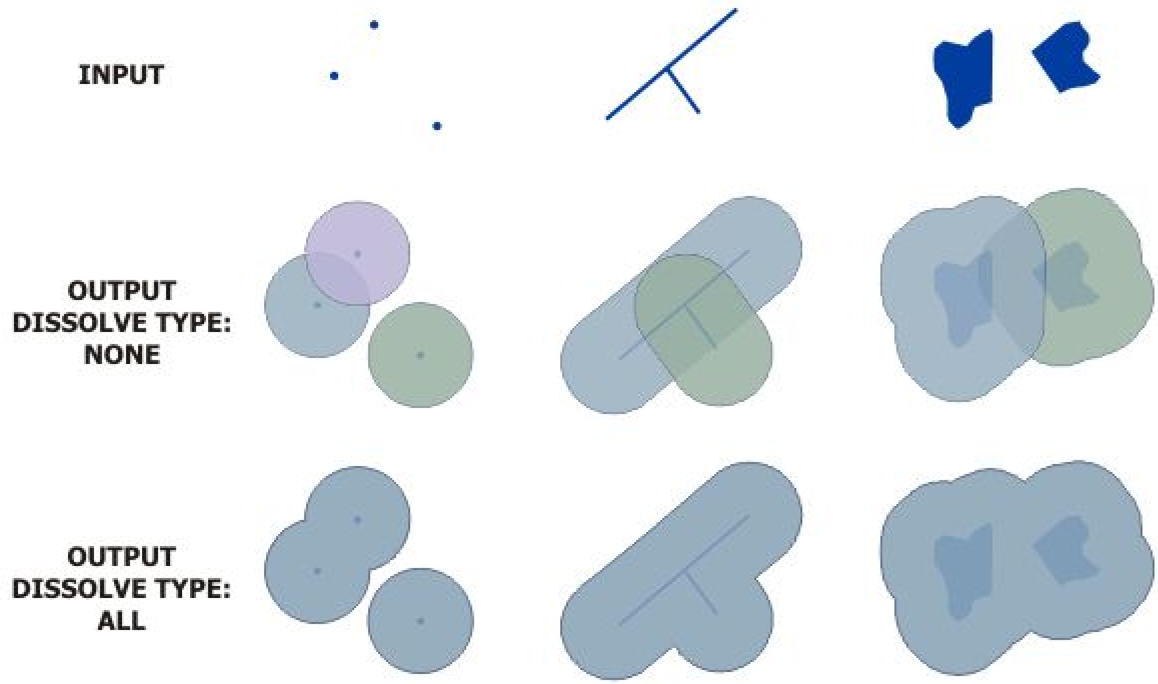
Union:

Computes a geometric union of the input features. All features and their attributes will be written to the output feature class.



Buffer:

Creates buffer polygons around input features to a specified distance.

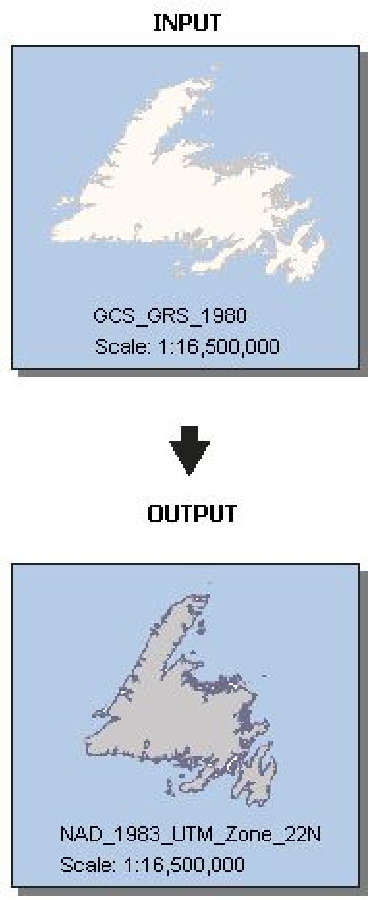


Polygon to Raster:

Converts polygon features to a raster dataset. A polygon layer is divided into a raster grid using the following logic. The cell center falls within only one feature, then the attribute of that feature is assigned to the cell. The cell center falls within more than one feature, then the feature with the smallest FID is selected.

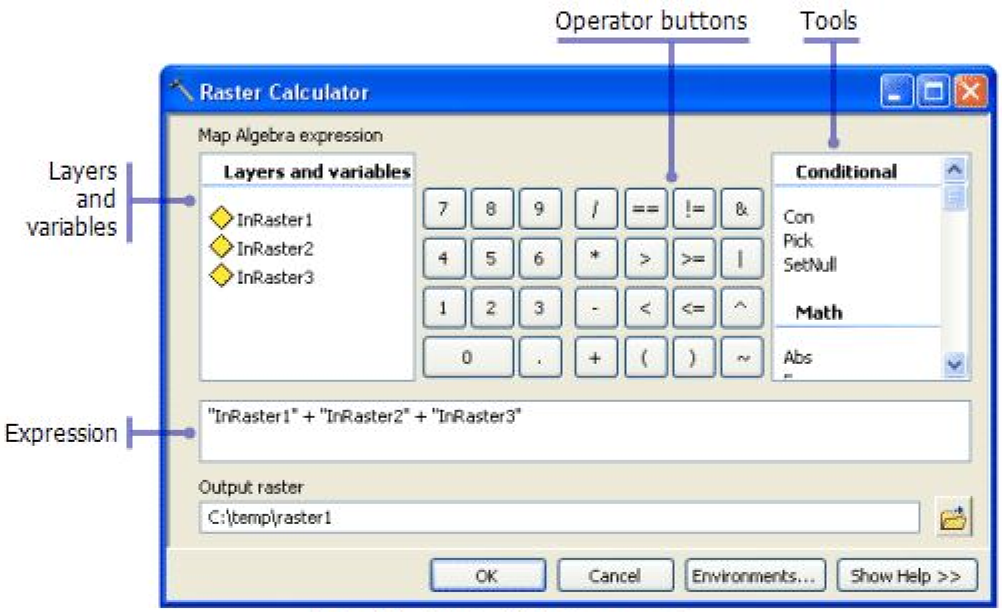
Project:

Projects spatial data from one coordinate system to another.



Raster Calculator:

Builds and executes a single Map Algebra expression using Python syntax in a calculator-like interface.



Raster Calculator tool dialog box example

Reclassify:

The reclassification tools reclassify or change cell values to alternative values using a variety of methods. You can reclass one value at a time or groups of values at once using alternative fields; based on a criteria, such as specified intervals (for example, group the values into 10 intervals);

or by area (for example, group the values into 10 groups containing the same number of cells). The tools are designed to allow you to easily change many values on an input raster to desired, specified, or alternative values.

Model Builder:

ModelBuilder is an application you use to create, edit, and manage models. Models are workflows that string together sequences of geoprocessing tools, feeding the output of one tool into another tool as input. ModelBuilder can also be thought of as a visual programming language for building workflows.