Department of Urban and Regional Planning

UNIVERSITY of HAWAI'I
MĀNOA

July 22, 2008

MEMORANDUM

TO: Orlando Davidson
Executive Officer
Land Use Commission

FROM: Karl Kim

SUBJECT: Important Agricultural Lands Pilot Study Final Report

Enclosed please find a copy of our final report for the Important Agricultural Lands Pilot Study. I have also included a cd-rom of the documents.

Also enclosed is our final invoice for this project.

Please feel free to contact me should you have any questions or comments.

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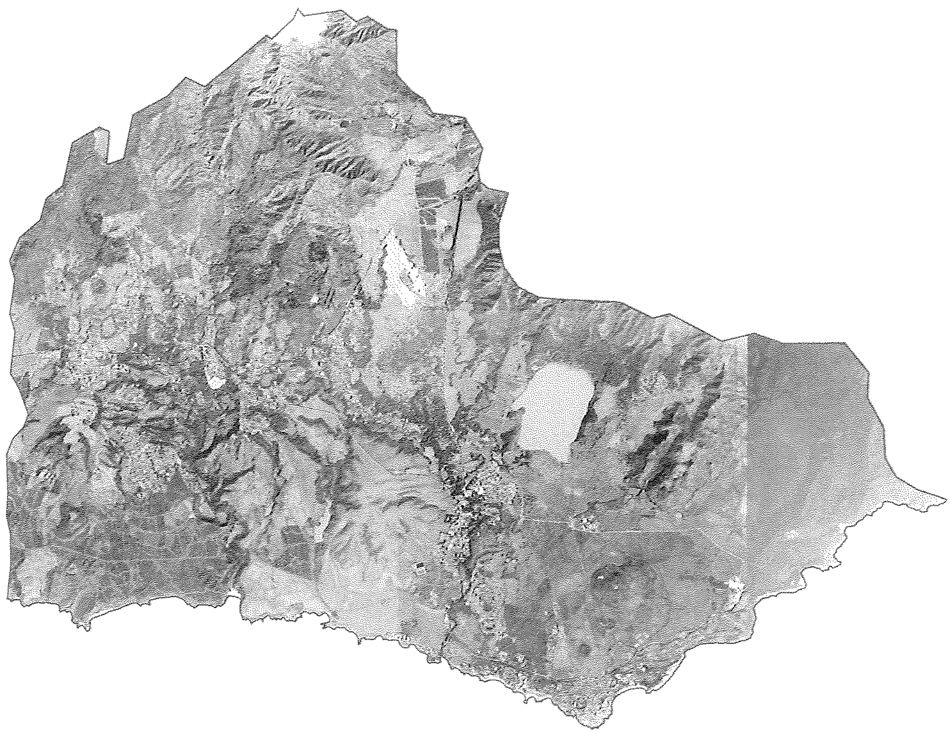
Koloa-Poipu
Important Agricultural Lands
Pilot Study



Prepared for
Land Use Commission
State of Hawaii

July 22, 2008

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The purpose of this report is to examine the conditions and terms of Act 183, SLH 2005 which requires the counties to identify and map potential important agricultural lands and to review the criteria for determining important agricultural lands. In this study, we focus on the Koloa-Poipu district on Kauai. We examine the enabling legislation, review the procedures and data requirements necessary for the identification of important agricultural lands, develop a set of basemaps and a database for the Koloa-Poipu district, conduct a pilot study on the Koloa-Poipu district and investigate the feasibility of using the approach and methods described in this report for other areas in the state.

Background

A. Literature Review

Hawaii is not alone in its attempt to preserve agricultural lands. Over the past half century, the increased conversion of farm land to developed uses has generated concern at the federal, state, and local levels. Increased demand for urbanization is likely to generate concerns into the future (Alig, Kline and Lichtenstein, 2004). Farm land plays an important economic, environmental and social roles (Coughlin, et. al., 1977). The preservation of farm land is part of food policy, energy programs, environmental remediation, as well as part of efforts to increase open space, improve aesthetics, and promote other community values (Hallerstein, et. al., 2002).

Four strategies for protecting farm land have been used: 1) agricultural zoning; 2) preferential treatment of farm land for tax purposes; 3) transfer development rights (TDR); and 4) purchase of development rights (PDR). See Paster (2004) for an extended discussion.

There are other related strategies for protecting farm land including right-to-farm laws, urban growth boundaries (which serve to contain urban expansion), and the creation of agricultural districts or areas where farming is the preferred use and landowners and farmers receive an assortment of benefits which vary from state to state. These benefits include exemption from sewer and water assessments, protection against eminent domain and other incentives. In return, landowners agree not to develop their land for a certain number of years. Currently, 20 states have some type of voluntary agricultural district program. Another strategy for protecting farm land involves the implementation of agricultural land evaluation systems such as the LESA (Land Evaluation Site Assessment) system developed by the U.S. Soil Conservation Service in 1981 (U.S. Department of Agriculture, 1983).

A combination of strategies and programs may be necessary to ensure protection of farm land over the long term. Farm land protection programs should also be an integral part of an overall system of land use control and comprehensive planning.

Hawaii was the first state to institute statewide land use planning in 1961. The State Land Use Law (Chapter 205, HRS) establishes 4 land use districts - urban, rural, agricultural, and conservation – as well as permitted uses within each district. Oregon remains the only other state to implement land use planning statewide.

Zoning is the most straightforward and tested method of protecting agricultural land. Zoning is used not only to protect the health and welfare of a community, but also to implement various plans and policies. To achieve this, there must be consistency between the general or comprehensive plans of a community and zoning. In addition to regulating the use of land for agricultural purposes, zoning can also be used to set limits on the minimum size of the parcel, as a way of ensuring lower densities and preserving agricultural or rural land uses. Large lot zoning, however, may still be subject to subdivision of land which may lead to increased development and higher densities.

There may be other relevant strategies such as clustering development or the use of buffers or other forms of green or open space as a means of preserving rural or agricultural character. The notion of designing and planning for appropriate land uses, given topography, soil conditions, rainfall, and other conditions, is one of the central tenets of planning (McHarg 1969).

The issues regarding the development of agricultural land, especially in proximity to urban areas in Hawaii have been studied (Ferguson and Khan, 1992). The economics of land preservation are similar to other areas (Gardner, 1977) and Hawaii faces similar challenges in terms of local growth management (GAO, 2000) or managing growth for efficient use of public infrastructure (Knapp, Ding, Hopkins, 2001). As rural areas become more urbanized, citizens typically demand more municipal services, and the resulting investment in public infrastructure and services serves to increase the value of land, making it more difficult to maintain agricultural activities (Runge, et. al., 2000). There are linkages between farm land preservation programs and encouraging coordination between the timing and location of appropriate urban infrastructure, referred to as "Smart Growth" (Sokolow, 2005).

Different analytical techniques and models have been developed to characterize the pattern of growth, development, and densification of urban regions (Loibl and Toetzer, 2003). These models are relevant to Hawaii. One long-standing concern, beyond the management of land, involves the viability of farming (Lapping, 1982). The economics of farming, however, may be affected by the extent to which the market for ethanol or other biofuels becomes established. This issue has been explored in Hawaii in terms of available lands, types of biomass, and production techniques (Keffer, Evans, Turn, and Kinoshita, 2006). With commercial agriculture, there is an issue of scale. Whether or not there is sufficient contiguous land mass to support production is a concern, particularly with the fragmentation of the landscape in urbanizing areas (Monroe, Croissant, and York, 2005).

The search for an appropriate rural development strategy is a problem faced by many communities in the U.S. (Lapping, Daniels, and Keller, 1989). The issue is complicated by the fact that while there may be "good intentions" to implement appropriate land management strategies (Libby, 1997), it is also evident that agricultural lands are largely privately owned (Lehman, 1995). It may be useful to distinguish between "use" values which may pertain to uses and public values such as growing food and preserving open space and views and "exchange" values which relate more to the economic value of land (Pfeffer and Lapping, 1994). It is for this reason that various programs to purchase conservation easements (Wang and Libby and Diehl and Barrett, 1988) and strategies for transferring (Daniels, 1991) or purchasing development rights (Buckland, 1987) have been proposed or implemented in many places. While there is some issue as to whether or not some land use actions constitute a taking, see Cordes (1997 and 1999), it is evident that as long as farming or other agricultural activities occur, there is economic value and return being generated. A compromise approach involves the formation of voluntary agricultural districts, an idea which has been around for some time (Conklin, and Bryant, 1974), but has gained more use in New York (Bill and Cosgrove, 1998) and many other states (American Farmland Trust, 2001).

There is value to Hawaii in examining the successes and failures in farm land preservation programs in other states such as Vermont (Daniels and Lapping, 1984), Oregon (Daniels and Nelson, 1986), New York (Robb and Bills), and other states (American Farmland Trust, 1997).

In reviewing the literature, several themes emerge. First, Hawaii is not alone in its attempts to preserve farm land. There are lessons to be learned from other places. Second, a range of different strategies ranging from zoning to economic incentives have been employed with varying degrees of success. Third, while zoning is the most straightforward, for zoning to work, there must be a clear connection to general and comprehensive plans which mean the articulation of widely held community goals and a rationale showing how plans and zoning protect the health and well being of the community. Fourth, the protection of farm land can not be seen in a vacuum. It is related to urbanization and the pattern, pace, intensity, and nature of residential development in a community. Protection of farm land is closely related to the prevention of urban sprawl, managing rural growth and development, and issues related to the densification of metropolitan regions. Fifth, there is a battery of different strategies, programs, and incentives associated with making farming a viable economic activity. One the real challenges involves finding the appropriate mix of government programs, tax policies, infrastructure support, and other incentives needed to support agriculture. Voluntary agricultural districts might also be an approach worth pursuing more vigorously in Hawaii.

B. Legislative Framework

In 1978, voters approved Article IX, Section 3, of the Constitution of the State of Hawaii, which sets out the framework for promoting agriculture and protecting agricultural lands in Hawaii. This section reads:

> The State shall conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency, and assure the availability of agriculturally suitable lands. The legislature shall provide standards and criteria to accomplish the foregoing.
>
> Lands identified by the State as important agricultural lands needed to fulfill the purposes above shall not be reclassified by the State or rezoned by its political subdivisions without meeting the standards and criteria established by the legislature and approved by a two-thirds vote of the body responsible for the reclassification or rezoning action.

In 2005, Act 183 was enacted by the Legislature. Act 183 states that:

> The Legislature finds that there is a compelling need to provide standards, criteria, and mechanisms to fulfill the intent and purpose of Article XI, Section 3 of the State Constitution and enable implementation of the constitutional mandate.

The intent of the act, moreover, "is not only to set policies for important agricultural lands and to identify important agricultural lands but also to provide for the development of incentives for agricultural enterprises that farm important agricultural lands and for landowners of important agricultural lands."

Act 183 defines agricultural lands as:

> (1) Are capable of producing sustained high agricultural yields when treated and managed according to accepted farming methods and technology;
>
> (2) Contribute to the State's economic base and produce agricultural commodities for export, or local consumption; or,
>
> (3) Are needed to promote the expansion of agricultural activities and income for the future, even if not in current production.

According to Act 183, the State will:

> (1) Promote agricultural development and land use planning that delineates blocks of productive agricultural lands and areas of agricultural activity for protection from the encroachment of nonagricultural uses; and,
>
> (2) Establish incentives that promote:
> (A) Agricultural viability;
> (B) Sustained growth of the agricultural industry; and
> (C) The long-term agricultural use and protection of these productive agricultural lands.

Act 183 also specifies the standards and criteria for the identification of important agricultural lands. It sets forth eight standards and criteria for the identification of IALs. Such lands "need not meet every standard and criteria," but, rather the standards and criteria should be weighed against each other in order "to meet the constitutionally mandated purposes in Article XI, Section 3." The standards and criteria include:

(1) Land currently used for agricultural production;

(2) Land with soil qualities and growing conditions that support agricultural production of food, fiber, or fuel- and energy-producing crops;

(3) Land identified under agricultural productivity rating systems, such as the agricultural lands of importance to the State of Hawaii (ALISH) system adopted by the board of agriculture on January 28, 1977;

(4) Land types associated with traditional native Hawaiian agricultural uses, such as taro cultivation, or unique agricultural crops and uses, such as coffee, vineyards, aquaculture, and energy production;

(5) Land with sufficient quantities of water to support viable agricultural production;

(6) Land whose designation as important agricultural lands is consistent with general, development, and community plans of the county;

(7) Land that contributes to maintaining a critical land mass important to agricultural operating productivity; and

(8) Land with or near support infrastructure conducive to agricultural productivity, such as transportation to markets, water, or power.

Act 183 also required the Legislature to produce legislation to establish incentives to support and enhance the polices set forth in Act 183. In 2008, the Legislature passed SB 2646 which provides "incentives and protections to establish and sustain viable agricultural operations on important agricultural lands, and provides for the designation of important agricultural lands on public lands." SB 2646 contains proposals for IAL incentives as well as revisions to the criteria and process for determining important agricultural lands.

The incentives established in SB 2646 include excluding agricultural lease income from income and general excise taxes; a tax credit for 50% of qualified agricultural costs over 3 years; residential dwellings for farmers, employees and their families; agricultural loan guarantees; and, priority permit processing for agricultural processing facilities.

SB 2646 would also require the Department of Agriculture and Department of Land and Natural Resources to identify and map *public* lands that should be designated as IAL.

Management of such lands would be transferred to the Department of Agriculture after the Land Use Commission has designated them as IAL.

SB 2646 provides for a landowner or farmer to file petitions with the LUC to request an IAL designation and district boundary amendment simultaneously. The request for reclassification to urban, rural, or conservation must be for lands in the same county and may not exceed 15% of the total acreage.

This bill also modifies the criteria for IAL designation *if* the petition is made together with a petition for reclassification. Presently, under Act 183, there are eight criteria which are to be considered although "lands need not meet every standard and criteria listed." SB 2646 states that "lands *shall* [emphasis added] be deemed qualified for designation as important agricultural land if the commission reasonably finds that the lands meet at least" the following:

- Land with sufficient quantities of water; and

- Land that contributes to a critical land mass important to agricultural operating productivity.

SB 2646 also provides for a "credit" if a request for reclassification is not made at the same time the landowner or farmer submits a petition to the LUC for IAL designation.

> *A petitioner granted a declaratory order that designates important agricultural land and, whether or not combined with the reclassification of land to the rural, urban, or conservation district, shall earn credits if the amount of land reclassified to the rural, urban or conservation district is less than fifteen percent of the total acreage of land subject to the order.*

When requests for IAL designation and reclassification are made together, if either is not approved, SB 2646 states that "the commission shall deny the petition in its entirety." However, in the case where a credit is given, a separate petition for "any of the petitioner's other land in the same county from the agricultural district to the rural, urban, or conservation district" must be filed. Such credits expire ten years after the IAL designation and may not be transferred.

The LUC may issue declaratory orders based on petitions by the landowner or farmer prior to receiving any maps from the counties. Any request to reclassify important agricultural lands designated through the dual process must be approved through the adoption of a concurrent resolution approved by a two-thirds majority of both the House and the Senate.

II. Data and Methods

A. Approach

The approach taken in this study was to examine Act 183 and to the extent possible collect relevant data to be mapped and used in the determination of important agricultural lands.

A literature review was conducted in order to examine how other states manage agricultural lands. Plans and studies relevant to Kauai and the designation of important agricultural lands were reviewed including the Kauai 2000 General Plan, Water Plan 2020, Koloa-Poipu – Kukuiula Area Circulation Plan, and "Measuring What Matters for Kauai," Community Indicators Report 2006.

Working with the staffs of the Land Use Commission and the Kauai Planning Department, a series of base maps describing existing conditions were developed. A uniform grid-based map structure was created with each grid cell equal to approximately 0.1 square mile or approximately 64 acres. The various data regarding land use, zoning, population, and other attributes were geo-referenced to the grid-based structure.

There are three reasons why a uniform grid-based structure was created. First, it provides a more consistent manner for considering a range of different attributes derived from other spatial units such as census block groups, zoning districts, or individual land parcels. Second, a uniform grid based structure creates a more conducive environment for projecting and modeling changes in population and land use. Finally, by using a uniform grid based structure instead of individual parcels, issues regarding ownership of land are not included in the rating system. The grid based structure is a more flexible approach for evaluating and rating lands.

An urban growth model was developed for projecting population and land use changes over the long term. The model uses forecasts of population to drive land use changes under alternative scenarios associated with the designation of important agricultural lands.

The purpose of this exercise was to develop a flexible planning tool for determining the impacts of various proposals for the designation of important agricultural lands and visualizing the consequences of alternative approaches and policy choices.

The initial results were reviewed by the County planning department and presented for feedback and reaction from other groups.

B. Data Sources and Criteria

Data from the following sources were reviewed: 1) State land use districts; 2) ALISH classifications; 3) land evaluation site assessment (LESA); 4) tax map key; and 5) major land users. (See Appendix A, Maps 1 – 6).

The data from these maps were transformed into the grid based structure described earlier. (See Appendix B, Maps 1- 8). Eight maps corresponding to the criteria were then developed. A ranking system was developed based on the eight criteria identified in Act 183 in order to determine which lands would be most suitable as important agricultural lands. Each of the specific criteria are discussed below.

1. Current Agricultural Production

Data for lands that are currently used for agricultural production was not found to be available in digital format. The USDA Farm Service Agency of Kauai County was able to assist in the study by visually identifying both small- and large-parcels and their related crops/products. (See Appendix A, Map 7). In the Koloa-Poipu District, it was found that much of the agricultural land is used for cattle pasture. A growing amount of land is also being used for the production of Albizia as a prospective alternative fuel/energy source. Other current agricultural land uses include production of coffee, corn, vegetables, lychee, taro, other mixed use, and land for goat pasture.

2. Soil Qualities and Growing Conditions

Soil quality and slope data were obtained from the county. Data was based on National Resource Conservation Service (NRCS) information and included soil types and slope measurements. Any polygons that were above 25% slope were assigned a value of "0" and eliminated from IAL candidacy despite whether or not the other criteria pertained to the cell.

3. Land Identified as ALISH

Data for Agricultural Lands of Importance to the State of Hawaii (ALISH) were obtained from the Hawaii Statewide GIS Program. This data represents land that was identified by the State as agriculturally important lands as part of an inventory by the Soil Conservation Service in a national inventory of agricultural lands. "Prime agricultural land" is land that is specifically suitable for crops such as food, feed, forage and fiber. This land is capable of sustaining high yields of crops economically when treated and managed according to modern farming methods. "Unique agricultural land" is also economically efficient in production of crops. Specifically, these lands are strong in production of high-value food crops such as: coffee, taro, rice, watercress, and non-irrigated pineapple. "Other important agricultural land" is land other than prime or unique agricultural lands that are capable of producing food, feed, fiber, and forage crops that are of local or state importance. These lands may be limited by factors that exclude them from "prime" or "unique" land, such as seasonal wetness, erodibility, and other related factors. Grid cells were assigned a "1" if they included any of the three categories of ALISH: Prime, Unique or Other.

4. Land Associated with Traditional Hawaiian Agricultural Use

The legislation identifies traditional Hawaiian agricultural use with those lands that are associated with taro cultivation, or unique agricultural crops and uses, such as coffee, vineyards, aquaculture, and energy production. In the Koloa District, there are three crops that fall under this category: taro, coffee, and potential energy production through tree farming and other biofuels. Areas producing these specific crops were identified by the

Kauai Farm Service Agency. Cells containing the production of such crops were assigned a "1". Cells not containing such resources were assigned a "0."

5. Land with Sufficient Water

Data for water resources were obtained from the Hawaii Statewide GIS Program. Using the hydrographic features, grid cells were assigned a "1" if they contained water resources such as a reservoir, flume, penstock, or siphon. Cells not containing such resources were assigned a "0". A flume is an open artificial water channel, that leads water from a diversion dam or weir completely aside a natural flow, often an elevated box structure (typically wood) that follows the natural contours of the land. These have been extensively used in hydraulic mining, for the transportation of logs in the logging industry, electric power generation and to power various mill operations by the use of a waterwheel. A flume can be used to measure the rate of flow. A penstock is a sluice or gate or intake structure that controls water flow, or an enclosed pipe that delivers water to hydraulic turbines and sewerage systems. It is a term that has been inherited from the technology of wooden watermills. A siphon (also spelled syphon) is a continuous tube that allows liquid to drain from a reservoir through an intermediate point that is higher than the reservoir, the up-slope flow being driven only by hydrostatic pressure without any need for pumping. It is necessary that the final end of the tube be lower than the liquid surface in the reservoir.

6. Land that is consistent with the General Development Plan & Community Plans

Kauai County provided GIS data layers and imagery for this analysis. Lands that were zoned residential or urban were eliminated from consideration. Lands zoned agriculture, open, or conservation were included. In order to maintain consistency with the Kauai County General Plan, maps were reviewed by the Kauai County Planning Office. The 2000 GIS layer was cross-referenced with a 2007 TMK zoning layer and with the 2003 aerial photos to determine the areas that are currently developed.

7. Land that Contributes to Maintaining Critical Land Mass

Critical land mass for the study area in this study was based on an assessment of the connectivity or continguity of four (4) contiguous grid cells in which agricultural activities or lands were present. A cell was given a value of "1" if it was adjoining a linear, block, or other contiguous shape including a "T"- or "L"-shape.

8. Land near support infrastructure

Using an impervious surface imagery layer provided by the County of Kauai, grids that were overlaid on areas with road infrastructure were considered in the analysis to have adequate access to road infrastructure to transport/receive goods. These cells received a score of "1." Other additional resources such as location of processing plants, transport, and other necessary infrastructure were not immediately available for the current analysis. A cell was given a value of "0" if the criteria was non-applicable or "1" if the criteria was applicable.

The resulting values of each grid cell were computed and ranked, with the highest possible score as "8" if the cell contained all criteria and the lowest score as "0".

Land not suitable for IAL was eliminated. These factors included: slope exceeding 25%, and land that was not zoned as agriculture, open or conservation consistent with the County General Plan. Those grid cells that contained these limiting properties were assigned a "0", thus eliminating that cell from consideration despite the possibility of the presence of other criteria.

The resulting evaluation created four (4) categories:

IAL Score	Rank
7-8	Highest
5-6	High
3-4	Middle
0-2	Low

There are 402 grid cells within the Koloa District, or approximately 40 square miles. Of those cells, 256 were scored with low potential (~25 square miles); 6 were scored with middle or "medium" potential (0.6 square miles); 70 were scored with high potential (7 square miles); and 70 were scored with highest potential (7 square miles).

The majority of lands are eliminated from IAL candidacy, however High and Highest scorings reflect potential IAL lands in an estimated 34% of the Koloa District. This estimate may change based on development priorities, actual agricultural potential for specific crops, and other factors.

A concentration of potential Important Agricultural Lands falls along the central northern portion of the site, partially along Koloa Road and the picturesque Tree Tunnel. Additional clusters occur in the southeast and southwest coastal areas of Koloa and along the western border of the district boundary.

C. Urban Growth Model

The study involved estimating future growth of the region and applying an urban growth model to predict patterns of development over a thirty year period. Over the past several decades, there has been increased urbanization of agricultural lands. Urban sprawl has occurred in two ways. First, fringe areas next to urban centers have been converted to urban uses. Second, outlying areas or pockets of growth have occurred in places where there were rural villages, plantation camps, resorts, or transportation nodes. In time, these areas have developed from being rural places into villages and suburban areas such that there is both a pattern of expansion as well as movement along roadway corridors as these areas grow in population.

Based on our literature review, several factors are associated with urban growth. The availability of developable land and infrastructure (roadways, electricity, water, etc.) are important variables. Proximity to job centers and supporting services such as schools and other amenities can also encourage growth. The connections between transport and land use have long recognized (Wilson, 1998) both in the U.S. (Wegener, 1994) and internationally (Webster and Pauley, 1991). Klosterman (1994) provides a succinct introduction to the topic of urban growth modeling. Various urban growth models were reviewed in order to construct the one used for this project. Early efforts are described in Harris (1985). Putman's work (1992, 1995) has been particularly influential as has the work of Landis and his colleagues at the University of California (1995, 1998a 1998b). Several authors (Johnson and de la Barra, 1998 and Lee, 1998) have shown how GIS (geographic information systems) technologies can be integrated with urban growth models to better illustrate the patterns of growth and development over time and space. Our approach includes consideration of land suitability (Hopkins, 1997) as well as the issues associated with urban development and sprawl (Audirac and Zifou, 1989). Other state-of-the-art urban growth models which we have examined include Klosterman's "What If?" package (1998).

The structure of the urban growth model is straight-forward. First, we create a baseline model which captures the current distribution of population and existing patterns of development. In the model, there are three classes of land: 1) urban; 2) rural/suburban; and 3) agricultural lands. The model involves allocating future growth to each of these three areas depending upon theoretical maximum allowable densities. The following estimates are used in the model: 1) urban land = 7.8 people per acre which equals approximately 500 people per 64 acre grid cell; 2) rural/suburban land = 3.9 people per acre which is set at 250 people per 64 acre grid cell; and 3) agricultural land = 0.43 people per acre, which is equivalent to 28 people per grid cell or approximately one dwelling unit (2.2 persons per household) for every five aces. These estimates were based on existing conditions on Kauai. New growth is allocated based on the proximity to developed cells and the availability of roadways and other infrastructure. Two different population growth scenarios were derived. We used population forecasts produced by UHERO (University of Hawaii Economic Research Organization). These are regarded as the best available and most current forecasts. The first is modest growth in which the current population of the Koloa-Poipu area increases from approximately 10,000 people to 20,000 people over the next 30 years. The second is a high growth scenario in which the region's population grows to 30,000 people. A number of different policy options were developed. They include the following:

1. Policy Option 1: Do Nothing. Under current policies, trends of urbanization and conversion of agricultural lands to urban and suburban uses will continue and growth will occur on the converted lands;

2. Policy Option 2: Strict Urban Containment. Under this policy option, all future growth occurs only within existing urban zoned lands. This involves increasing urban densities in order to prevent urban sprawl.

3. Policy Option 3: Designation of Important Agricultural Lands Coupled with Urban Containment. This policy option involves setting aside important agricultural lands and directing future growth into current urban districts and adjacent rural and agricultural districts.

The policy options are considered with the two different population growth forecasts.

III. RESULTS

The findings from this project can be organized into two different sections. The first involves the determination of important agricultural lands based on criteria. The second involves the results of the analysis involving two growth conditions (moderate and high growth) and three different policy alternatives (do nothing, urban containment and urban containment with important agricultural lands). These growth forecasts and policy options combine to form 6 scenarios: 1) moderate growth, no IAL, no urban containment; 2) moderate growth, strict urban containment; 3) moderate growth, IAL, urban containment; 4) high growth, no IAL, no urban containment; 5) high growth, strict urban containment; 6) high growth, IAL, urban containment

A. Criteria-based Determination of Important Agricultural Lands

In this section, the data and methods used to determine important agricultural lands for the prototype test area are described. A complete listing of the map and data sources for all of the basemaps is contained in Appendix A. Figure 1, shows a Quickbird image of the region being examined. Located in the southern part of the island of Kauai (see Map 1, Koloa-Poipu District, A-2), the area consists of a total of 25,728 acres of which an estimated 2368 is urban, 2816 is in rural/suburban uses, and 15808 is in agricultural uses with the remaining 4,736 acres in conservation. Map 2 Koloa-Poipu State Land Use Districts (p. A-2) shows that the majority of the area is still classified for agricultural uses by the Land Use Commission. Much of the area, as illustrated in Map 3, Koloa-Poipu: ALISH Classifications contains prime and unique agricultural lands. A large amount of the area is classified under the LESA system (See Map 4, p A-4) as important agricultural lands. There has been, already, quite a bit of land subdivision and as the tax map key shows (Map 5), there is an array of different types of properties, from small subdivision lots, to large agricultural holdings to resort and urbanized areas. As illustrated in Map 6, there are a number of landowners with large holdings, including Grove Farm, Alexander and Baldwin, E. A. Knudsen, the McBryde Trust and others.

This information, along with input from the County and from others, was used to derive and map the specific criteria on which important agricultural lands are to be determined. The specific criteria are mapped, according to the grid-based system. Eight criteria were used: 1) current agricultural production; 2) soil quality, 3) prime, unique and other lands, 4) traditional agriculture; 5) presence of irrigation systems; 6) consistency with County plans; 7) critical land mass; and 8) proximity to infrastructure. Each of these specific criteria have been mapped and scored and are contained in Appendix B.

Scoring was based on a maximum of 8 possible points, corresponding to each of the eight criteria. Each of the criteria are equally weighted. Each grid cell can have a maximum of eight possible points. The distribution is as follows:

0 – 2	256 grid cells
3 – 4	6 grid cells
5 – 6	70 grid cells
7 – 8	70 grid cells

The summary of the scoring procedure is contained in Figure 2. The results are similar to the LESA designations. It should be noted that 70 grid cells have a score of 7 or 8; this amounts to approximately 4,480 acres. If considering only those scoring 8, the amount of acreage drops to 25 grid cells, approximately 1,600 acres.

B. Scenario Analysis

In this section, the findings from six different scenarios are described. The first three involve moderate growth in the region. It is based on an assumption that over the next 30 years, the population in the Koloa-Poipu area increases by approximately 10,000 people. In other words, the population doubles. We examine the consequences of moderate growth with no urban containment, with strict urban containment, and with a combination of urban containment and designation of important agricultural lands. These three scenarios, are entitled:

Scenario 1: Moderate Growth + No IAL + No Urban Containment
Scenario 2: Moderate Growth + Strict Urban Containment
Scenario 3: Moderate Growth + IAL + Urban Containment

and are contained in Figures 1-3, Appendix C.

The next three scenarios are based on an assumption of high growth, that is, the population grows by 150% or by 20,000 people by 2030. The three scenarios include:

Scenario 4: High Growth + No IAL + No Urban Containment
Scenario 5: High Growth + Strict Urban Containment
Scenario 6: High Growth + IAL + Urban Containment

The maps showing these results are contained in Figures 4-6, Appendix C.

Scenario 1: Moderate Growth + No IAL + No Urban Containment.

With moderate growth, no designation of important agricultural lands and no urban containment, there is considerable sprawl and growth occurring throughout the Koloa-Poipu region. By 2030, much of the agricultural land is converted to rural and suburban uses. These are designed as pink and red cells. Notably, there are more green cells on the map indicating a higher potential for agriculture.

Scenario 2: Moderate Growth + Strict Urban Containment.

To compare the extent of sprawl, it is instructive to view what would happen if all the population were concentrated in only the urban designated areas. This is captured in Scenario 2 + Moderate Growth + Strict Urban Containment. This preserves the maximum amount of agricultural lands and results in much higher urban densities in key locations depicted in red and pink cells. This scenario involves balancing urban growth and agricultural preservation.

Scenario 3: Moderate Growth + IAL + Urban Containment.

If population is further restricted to urban areas and areas with important agricultural lands are preserved, then there are fewer pink and red cells and more green cells as indicated by Scenario 3, Moderate Growth + IAL + Urban Containment.

Scenario 4: High Growth + No IAL + No Urban Containment.

The amount of red indicates urban growth and development. Without urban containment and designation of important agricultural lands, much of the area currently used for farming will be urbanized. This presents the worst case scenario for the preservation of agriculture.

Scenario 5: High Growth + Strict Urban Containment.

In addition to the designation of important agricultural lands, there is also a need for strict urban containment, if sprawl is to be prevented. This will require significantly increasing densities in the urban areas, particularly if there is a high level of population growth.

Scenario 6: High Growth + IAL + Urban Containment.

This scenario slows the inpact of high growth combined with the designation of IAL and urban containment. An important finding from this study is that designation of important agricultural lands in and of itself is not sufficient to prevent the long-term conversion of agricultural lands to urban uses.

C. Urban Growth Scenario Impacts

Table 1, Summary of Urban Growth Scenarios – Baseline and 2030 Projections summarizes these results. It shows for the baseline model as well as for the moderate growth and high growth conditions, the amount of population and acreage in the urban, rural and agricultural areas.

Information derived from the Baseline Model (2000) and for the Moderate Growth and High Growth Forecasts for 2030 is included in Table 1. The baseline conditions show a total urban population of 9,438 persons in the Koloa-Poipu area with 1,085 in the rural areas and 31 persons living on agricultural zoned lands, for a total population of 10,554. The estimated land area for the region is 25,728, with most of it, 15,808 acres classified as agriculture, followed by 4,736 acres in conservation, with 2,368 acres in urban uses and 2,816 classified as rural or suburban areas.

With moderate growth, the total population increases to 20,000 persons in 2030. Under Scenario 1, which is the "do nothing" scenario, that is, no urban containment and no designation of important agricultural lands, the rural population expands from 1,085 (baseline) to 3,590 and the number of people living in agricultural areas grows from 31 to 6,972 people.

In Scenario 2 which involves strict urban containment, the increase in population occurs only in the urbanized areas and it grows by 100%, going from 9,438 in the baseline (2000) to 18,884 in 2030. The population figures for the other types of land use (rural and agriculture) remain fixed at their 2000 baseline levels. This scenario involves both strict urban containment and increased populations and population density in urban areas.

Scenario 3, which involves both designation of important agricultural lands and also some growth in rural areas adjacent to urban areas, shows a significant growth in the population living on agriculturally zoned lands. While the increase of those living on agricultural lands is much higher than the amount occurring with strict urban containment (Scenario 2), the actual number, 3,024, is still less than half of the "do nothing" scenario (6,972). In Scenario 3, with moderate population growth, the designation of important agricultural lands along with urban containment results in increased population in the rural and non-IAL agricultural lands.

Table 1 also contains information pertaining to the high growth forecasts in which the population in the region grows to 30,554, or an additional 20,000. Similar to the moderate growth forecasts, there are three policy options which result in three different scenarios. Scenario 4, is the "do nothing" scenario, in which there is increased significant growth in urban, rural, and agricultural areas. Compared to the baseline population in 2000, the urban population grows from 9,438 to 12,582, while the rural population grows to 11,000 and the agricultural population jumps to 6,972 people. Under this scenario, there is little land left for agricultural activities.

Scenario 5 maximizes urban containment and directs all new growth to the existing urban zoned areas of the region. The urban population grows to 29,438, with rural and agricultural populations remaining constant at the baseline (2000) levels. There would be a dramatic increase in urban densities, but also a maximum amount of land preserved for agriculture.

Scenario 6 entails designation of important agricultural lands and urban containment, though less than the amount achieved under the moderate growth scenario because the development pressures are greater with the increased population. While this scenario does involve the preservation of agricultural lands, there is also an increased population of 3,024 people living on agricultural lands in 2030. There is also growth in urban and rural populations as well.

The point of this exercise is, to borrow a phrase and concept from Klosterman (1997): "what if." That is, *what if* population grows by more than 10,000 people in the next 30 years? Or *what if* population grows by more than 20,000? *What if* this population growth was accommodated only on urban zoned lands? *What if* policies for urban containment were applied such that there was more limited sprawl and residential development? *What if* important agricultural lands were set aside and protected from development? Table 1 provides a summary of the numerical impacts in terms of population and acreage, while the maps show graphically the consequences of growth and various policy options.

There are three ways to use the information provided in this section. First, it provides a quantitative and visual impact assessment of the various policy choices under assumptions of moderate and high population growth. Second, it provides an illustration of how the potential determination of important agricultural lands might occur and the consequences of protecting (or failing to protect) agricultural lands from development. Finally, the information serves as a reminder that designation of important agricultural lands alone must be seen as part and parcel of an overall strategy of urban planning, growth management, and containment of urban sprawl.

While we have used the best available population forecasts for Kauai, it is important to note that there is uncertainty associated with estimating not only the future level of growth, but also the spatial distribution of that growth. Our urban growth model assumes that urban zoned areas will grow first, followed by suburban and adjacent rural areas. Then, agricultural areas in proximity to urbanized areas will, over time, if left unprotected, will eventually change to urban uses.

Table 1. Summary Comparisons of Urban Growth Scenarios - Baseline and 2030 Projections

	Baseline (2000)	Moderate Growth (2030)			High Growth (2030)		
		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
		No IAL; No Urban Containment	No IAL; Strict Urban Containment	IAL; Urban Containment	No IAL; No Urban Containment	No IAL; Strict Urban Containment	IAL; Urban Containment
Population in Urban	9,438	9,438	18,884	9,438	12,582	29,438	17,780
Population in Rural	1,085	3,590	1,085	7,538	11,000	1,085	9,750
Population in Agriculture	31	6,972	31	3,024	6,972	31	3,024
Total Population	10,554	20,000	20,000	20,000	30,554	30,554	30,554
Acres in Urban	2,368	2,368	2,368	2,304	2,368	2,368	2,304
Acres in Rural	2,816	2,816	2,816	2,496	2,816	2,816	2,496
Acres in Agriculture	15,936	15,936	15,936	6,912	15,936	15,936	6,912
Acres in IAL	0	0	0	9,408	0	0	9,408
Acres in Conservation	4,608	4,608	4,608	4,608	4,608	4,608	4,608
Total Acreage	25,728	25,728	25,728	25,728	25,728	25,728	25,728
Urban Density (persons/acre)	3.9856	3.9856	7.9747	4.0964	5.3133	12.4316	7.7170
Rural Density	0.3853	1.2749	0.3853	3.0156	3.9063	0.3853	3.9063
Agriculture Density (IAL)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Agriculture Density (All Ag)	0.0019	0.4375	0.0019	0.1853	0.4375	0.0019	0.1853
Percent Change from baseline							
Population in Urban		0%	100%	0%	33%	212%	88%
Population in Rural		231%	0%	595%	914%	0%	799%
Population in Agriculture		22390%	0%	9655%	22390%	0%	9655%

Maximum urban density = 4 dwelling units*/acre
Maximum rural density = 1 dwelling unit*/acre
Maximum agricultural density = 1 dwelling unit*/5 acres
*1 dwelling unit = 2.2 persons

IV. RECOMMENDATIONS

The purpose of this project was to develop a set of tools and methods for Koloa-Poipu as a prototype for other communities. The project enabled us to acquire data and to investigate various models and approaches for both determining important agricultural lands and evaluating the impacts of various policy options and population growth scenarios.

It should be noted that the approach was developed with the input and feedback from the County of Kauai planning department, the Land Use Commission staff, and from the Office of Planning. We also received valuable comments and information from the U.S.D.A. Farm Service Agency on Kauai. The model and preliminary results were also presented at a meeting of the Kauai Developers Council. The following recommendations are based on the input received to date.

A. Refinements to the Model

There are several different refinements and improvements to be made. It should be noted that this prototype system was based on an analysis and interpretation of Act 183. There may be other ways of interpreting the criteria. Moreover, our approach was to treat each of the criteria as equal. It is possible that some of the criteria may be more important than others. A criteria like traditional agriculture or access to water could be weighted more heavily than others. This would change the scoring and potentially the determination of important agricultural lands.

B. Changes in the IAL Law

Act 183 itself could be changed. A number of proposals for changing the determination of important agricultural lands and the process by which they are designated have been suggested. To date, there have not been significant changes in the law itself. At present, there are two different ways in which important agricultural lands can be designated. Using a method such as proposed in this study, Counties are required to develop and adopt maps identifying potential important agricultural lands for submission to the Land Use Commission for review and designation. In addition, farmers and landowners with qualifying lands may petition the Land Use Commission directly for consideration. The methods used in this study can be utilized either by the County to identify potential lands or by the Land Use Commission in reviewing County proposals or direct petitions from farmers and landowners. This study provides a method for operationalizing the criteria and also evaluating the impacts of designating areas as important agricultural lands.

C. Improving Data Sources

It is evident that data sources can be improved. Some of the data are outdated. Some of the information is not in a format that is readily accessible. Some of the information was available in digital format while others had to be created by using paper maps or conducting interviews with knowledgeable people. The map data are in different scales, projections, and formats. Data elements are subject to interpretation, such as the availability of water, supporting infrastructure or critical land mass. While we have described as clearly as possible how we interpreted the eight criteria and the sources of data, it is evident that there is no single, comprehensive source of information for evaluating and determining important agricultural lands.

D. Build Comprehensive Computerized Database

While it is possible to conduct a similar analysis for the rest of Kauai as well as other counties, it is clear that there is need to build a comprehensive computerized database with both spatial information such as presented in this report and other attributes. For example, it would be useful to have more detailed information on population growth rates and other specific features of communities in order to better estimate the level, extent, and nature of population growth and development. Taking into account factors such as the demographic structure of the population as well as other key community attributes such as the age of the housing stock, the amount of rental housing, vacancy rates, the extent to which investment is in second home properties or in affordable housing would also help to create a more complete picture of the pattern of growth and development.

E. Develop More Advanced Urban Growth Modeling

A more sophisticated urban growth model would focus on not just housing development and the use of agricultural land but plans and actions of other stakeholders as well. Having a more complete picture of the labor market and the demand for housing would also reduce some of the uncertainties with respect to future growth and development. A complete picture would include interactions between jobs and travel behavior, industrial location and local economics including more information on wages and salaries, agricultural prices, fuel costs, demand for alternative energy, investment in housing, taxes and expenditures of state, local, and national governments and other features of the economic base. While there is opportunity to utilize economic input-output data as well as other other modeling techniques, such as CGE (computable general equilibrium) models, it should be noted that these approaches are data-intensive and may not be appropriate for subarea analyses such as a fraction of a county or state. There is potential to integrate our models with statewide or county economic forecasts.

F. Combine Scientific Information and Human Judgment

An essential feature of the model is the simplification and clarification of policy choices which translate into the spatial location of lands or areas designated for either agriculture or urban uses. In its most basic form, the policy question is formulated in terms of whether or not the grid cell is red (urban) or green (agriculture). Both scientific information and human judgment are needed in order to resolve the policy questions.

G. Customized Applications

Another feature of both the determination of criteria for consideration of important agricultural land designations and the modeling of urban change is that the assumptions regarding growth, level and nature of development, both overall and in specific land use categories (urban, rural, and agricultural) can be adjusted for specific locations. While on Kauai, we combined rural and suburban land use categories; on other islands it might be appropriate to distinguish between suburban and more rural places or to create other specialized land use categories. There may also be different values and thresholds for other islands or even different communities on Kauai. These can be related to development plans or other community-specific expressions of the preferences for growth and development.

H. Scalable Approach

The format and methods presented are scalable. The methods and approaches developed for Koloa-Poipu can be applied to other regions of Kauai or to other parts of the state. Models for individual communities can be combined or used to build an overall county model or one for the entire state. Similar information can be compiled and presented for other areas facing challenges and tradeoffs between preservation of agriculture and urban growth.

I. Other Recommendations

First, more review of the models and initial results by the County planning department and Land Use Commission as well as other planning experts would be useful. Second, incorporating public feedback and input into the determination of both criteria as well as the impacts of preserving agricultural lands or allowing development to occur would also be most useful. This model should be viewed as a dynamic policy tool, one in which the policy options are clarified, discussed, deliberated, and evaluated by a broad range of constituents. Finally, the process for mapping and designating important agricultural lands and estimating the impacts of various growth scenarios an policy options can be automated and computerized so that the maps and analyses may be produced more efficiently to be more widely disseminated.

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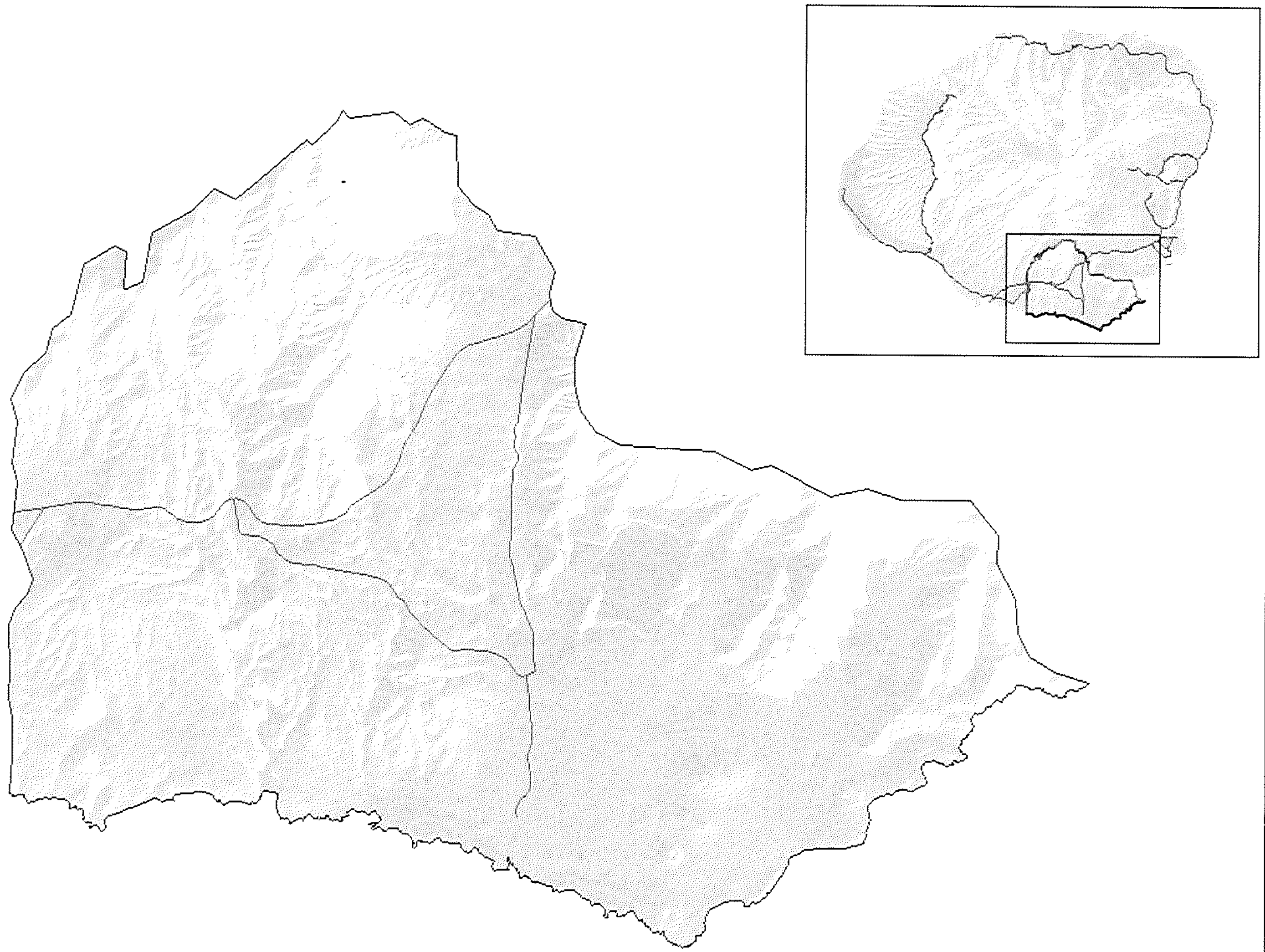
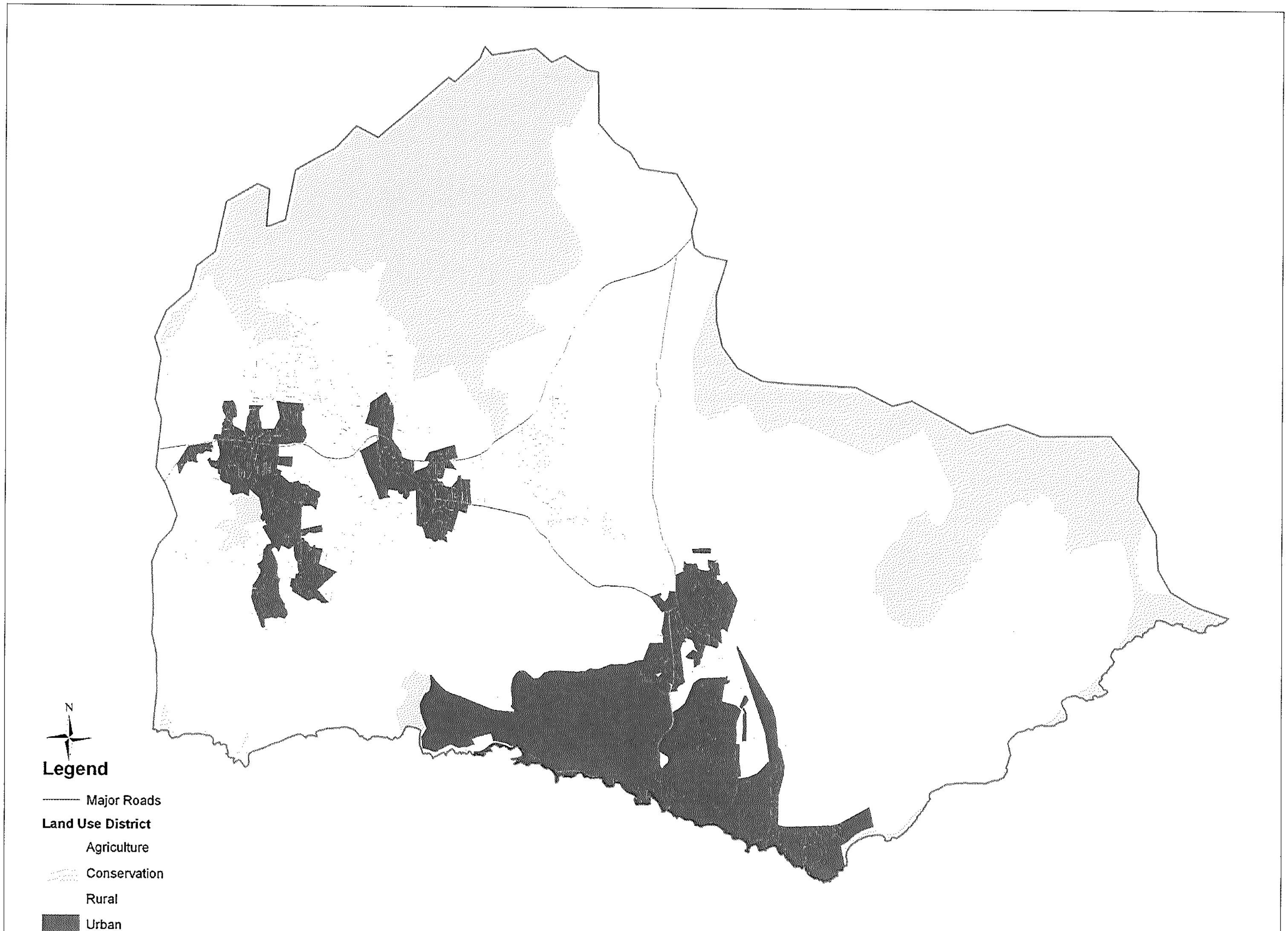
APPENDIX A: Baseline Maps

Map 1: Koloa-Poipu District
Map 2: State Land Use Districts
Map 3: ALISH Classifications
Map 4: Land Evaluation Site Assessment (LESA)
Map 5: Tax Map Key
Map 6: Major Landowners
Map 7: Current Agricultural Production



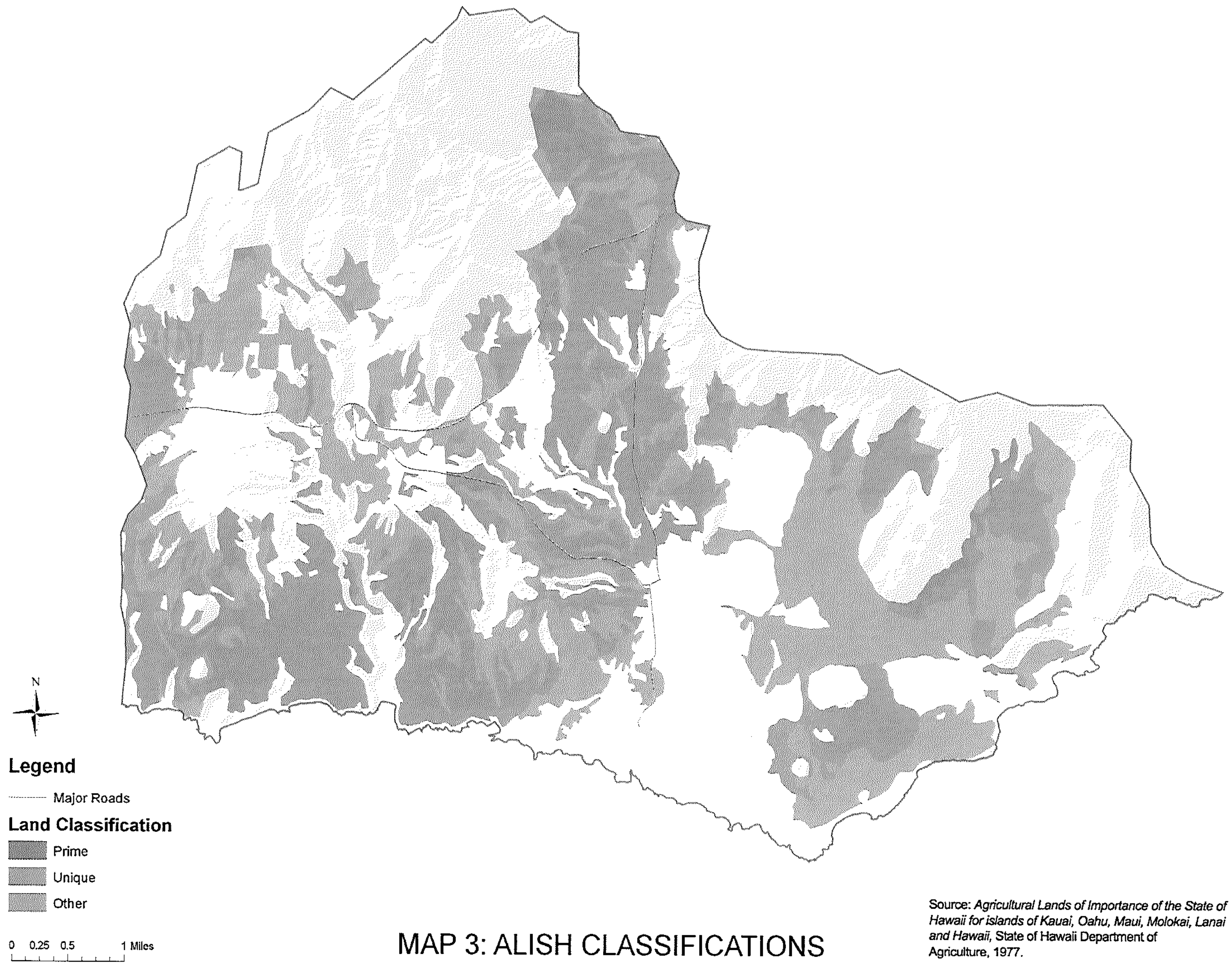
Map 1: Koloa-Poipu District

Source: *Georeferenced hillshade images*, State of Hawaii Office of Planning, 2003.



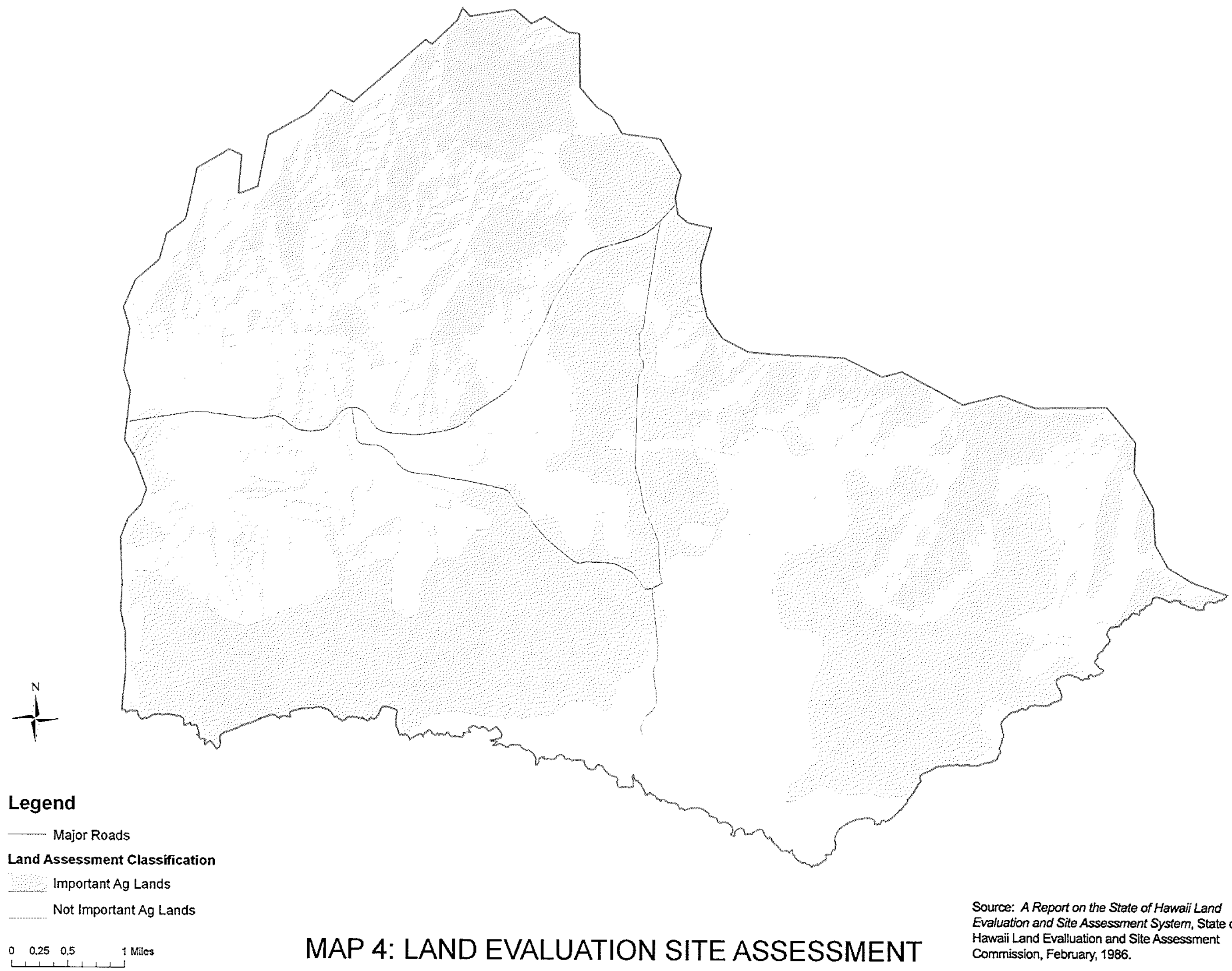
MAP 2: STATE LAND USE DISTRICTS

Source: State Land Use District Boundaries, State of Hawaii Land Use Commission, 2006.



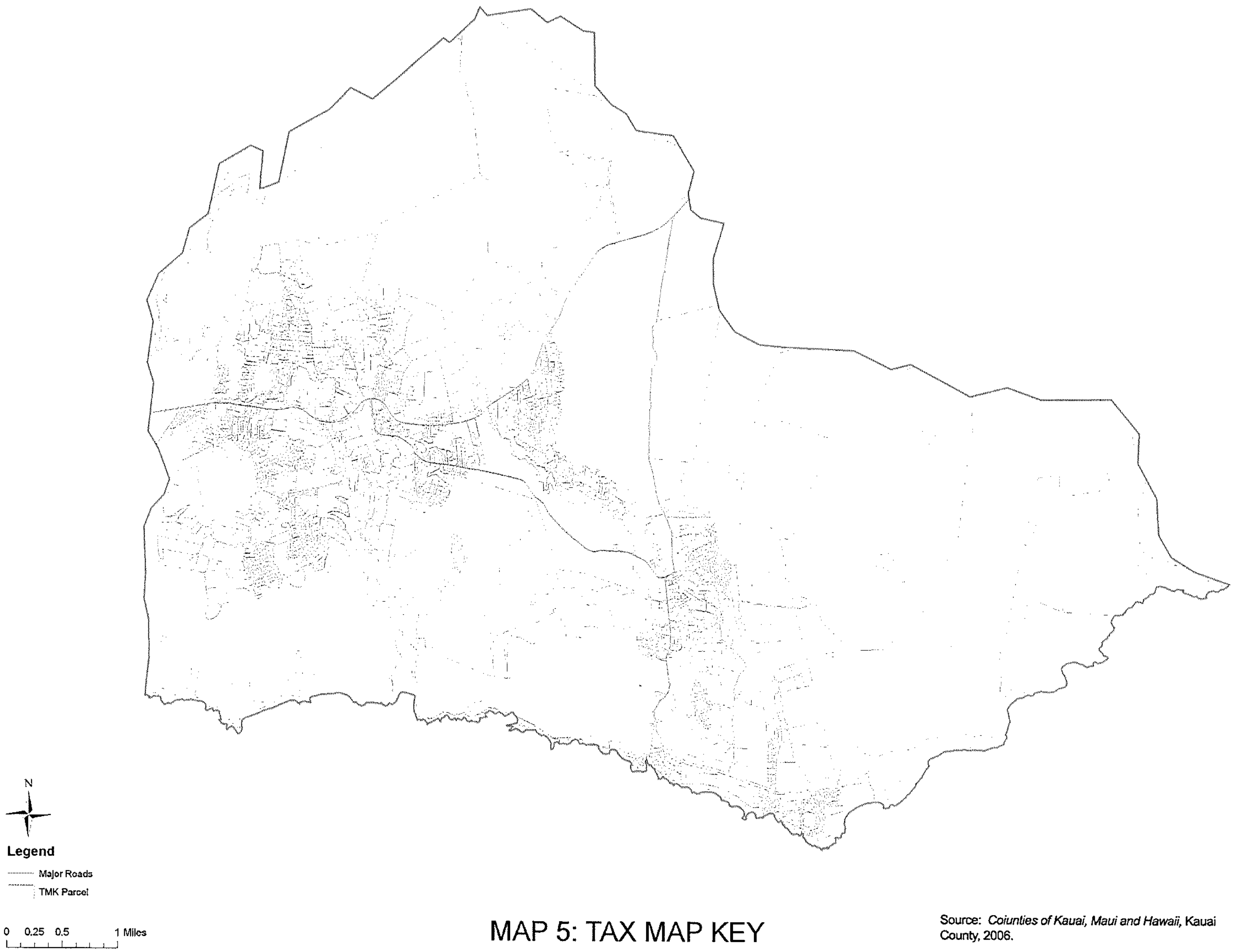
MAP 3: ALISH CLASSIFICATIONS

Source: *Agricultural Lands of Importance of the State of Hawaii for islands of Kauai, Oahu, Maui, Molokai, Lanai and Hawaii*, State of Hawaii Department of Agriculture, 1977.



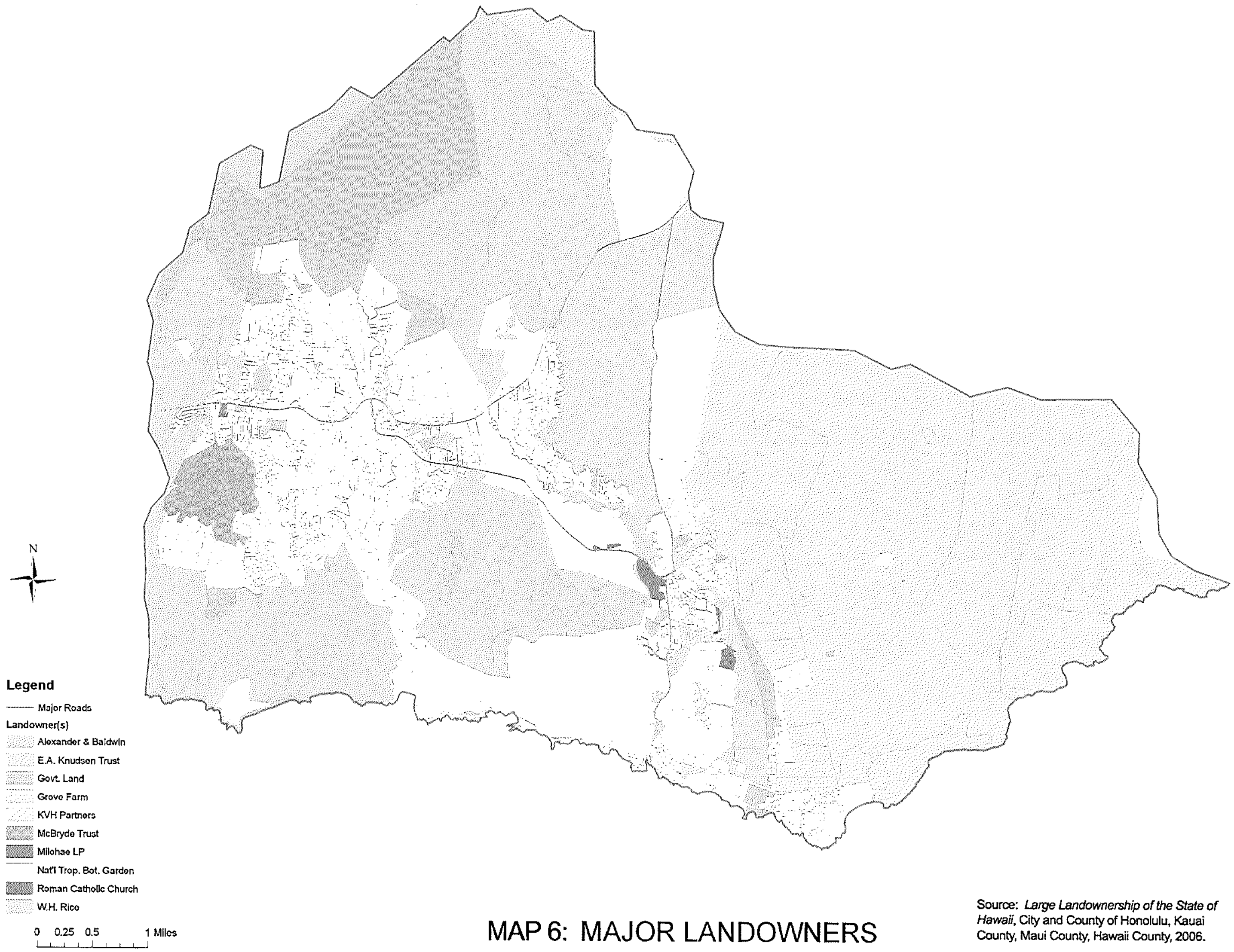
MAP 4: LAND EVALUATION SITE ASSESSMENT

Source: *A Report on the State of Hawaii Land Evaluation and Site Assessment System*, State of Hawaii Land Evalluation and Site Assessment Commission, February, 1986.



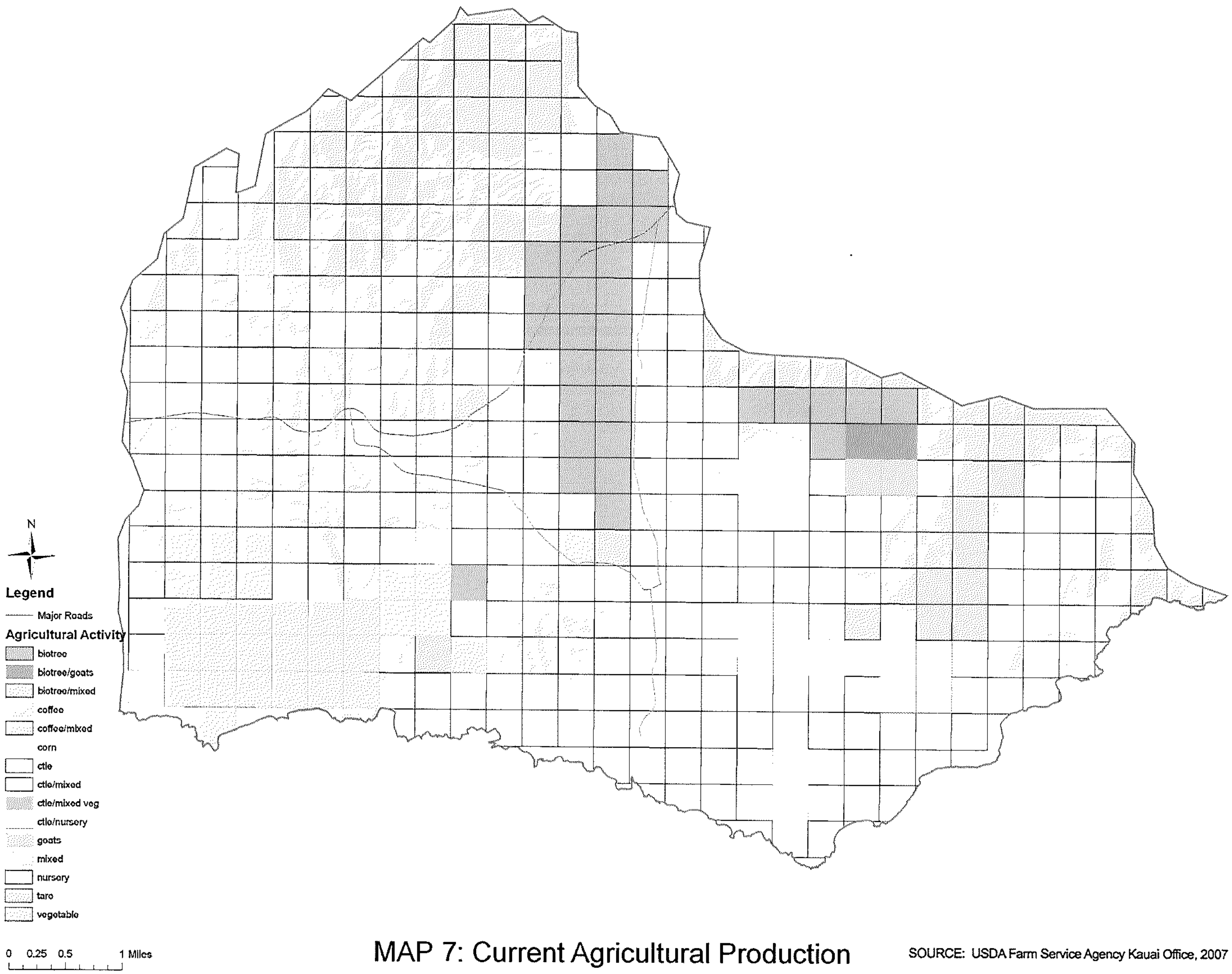
MAP 5: TAX MAP KEY

Source: *Coiunties of Kauai, Maui and Hawaii*, Kauai County, 2006.



MAP 6: MAJOR LANDOWNERS

Source: *Large Landownership of the State of Hawaii*, City and County of Honolulu, Kauai County, Maui County, Hawaii County, 2006.

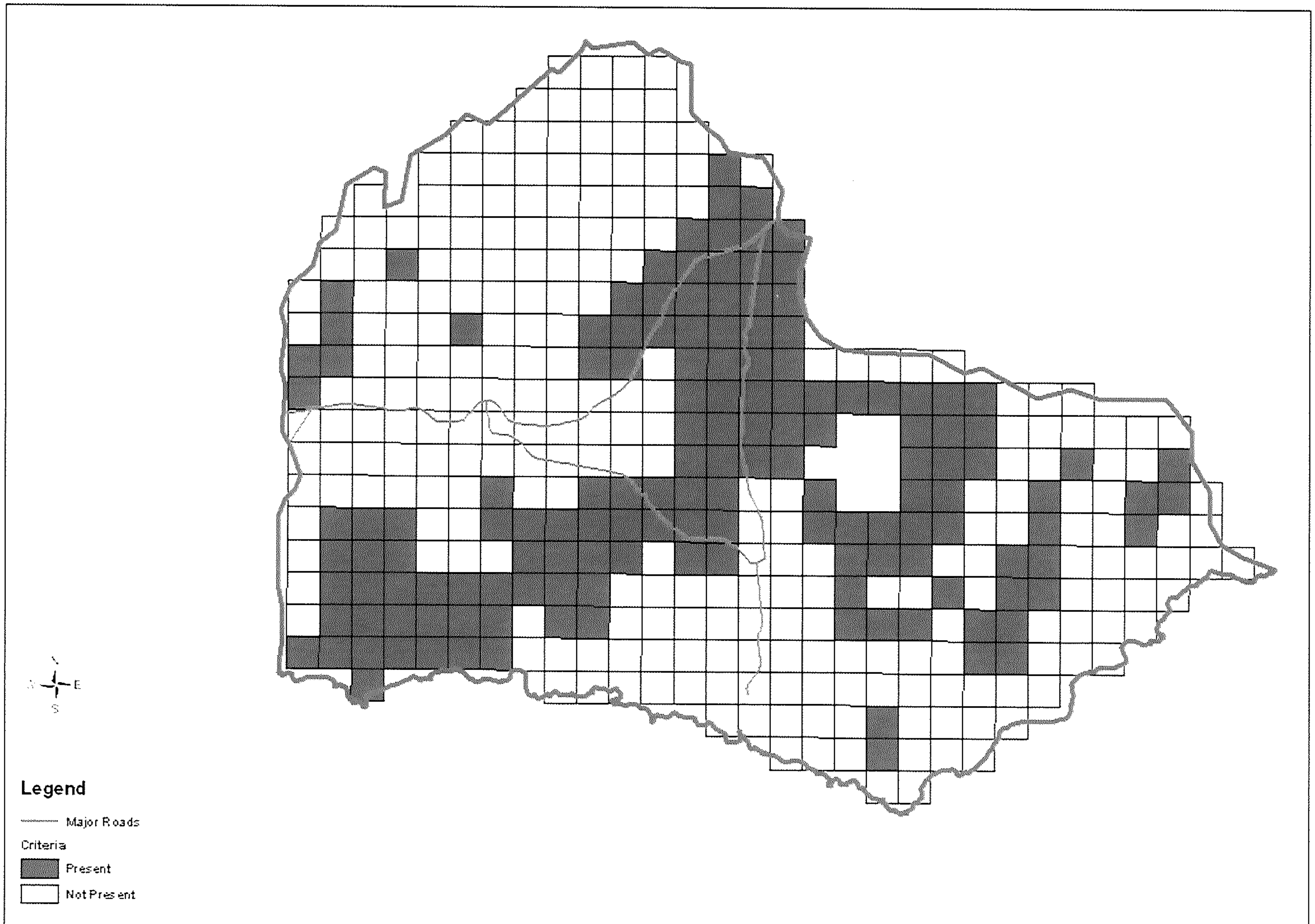


MAP 7: Current Agricultural Production

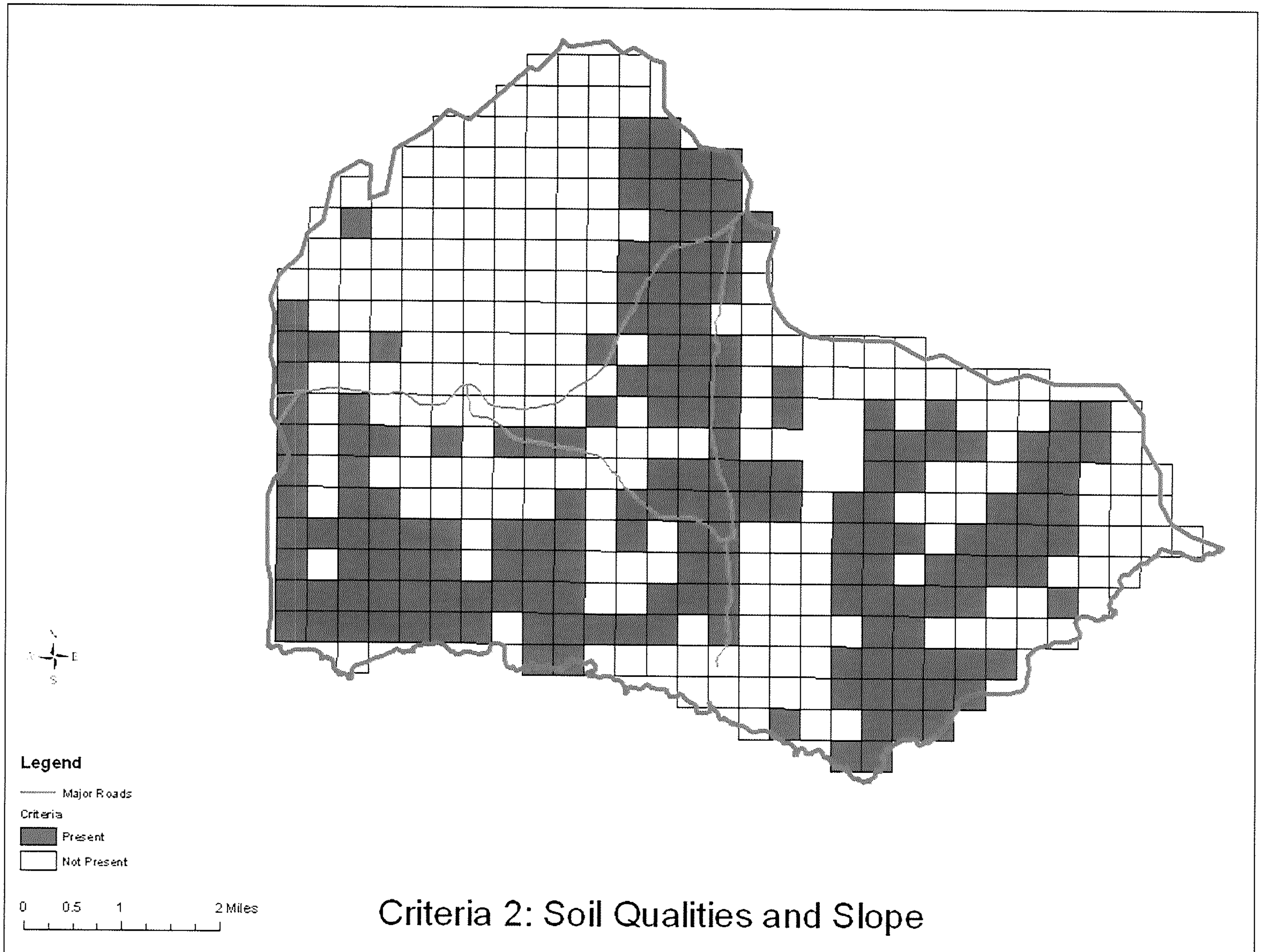
SOURCE: USDA Farm Service Agency Kauai Office, 2007

APPENDIX B: Mapping of IAL Criteria

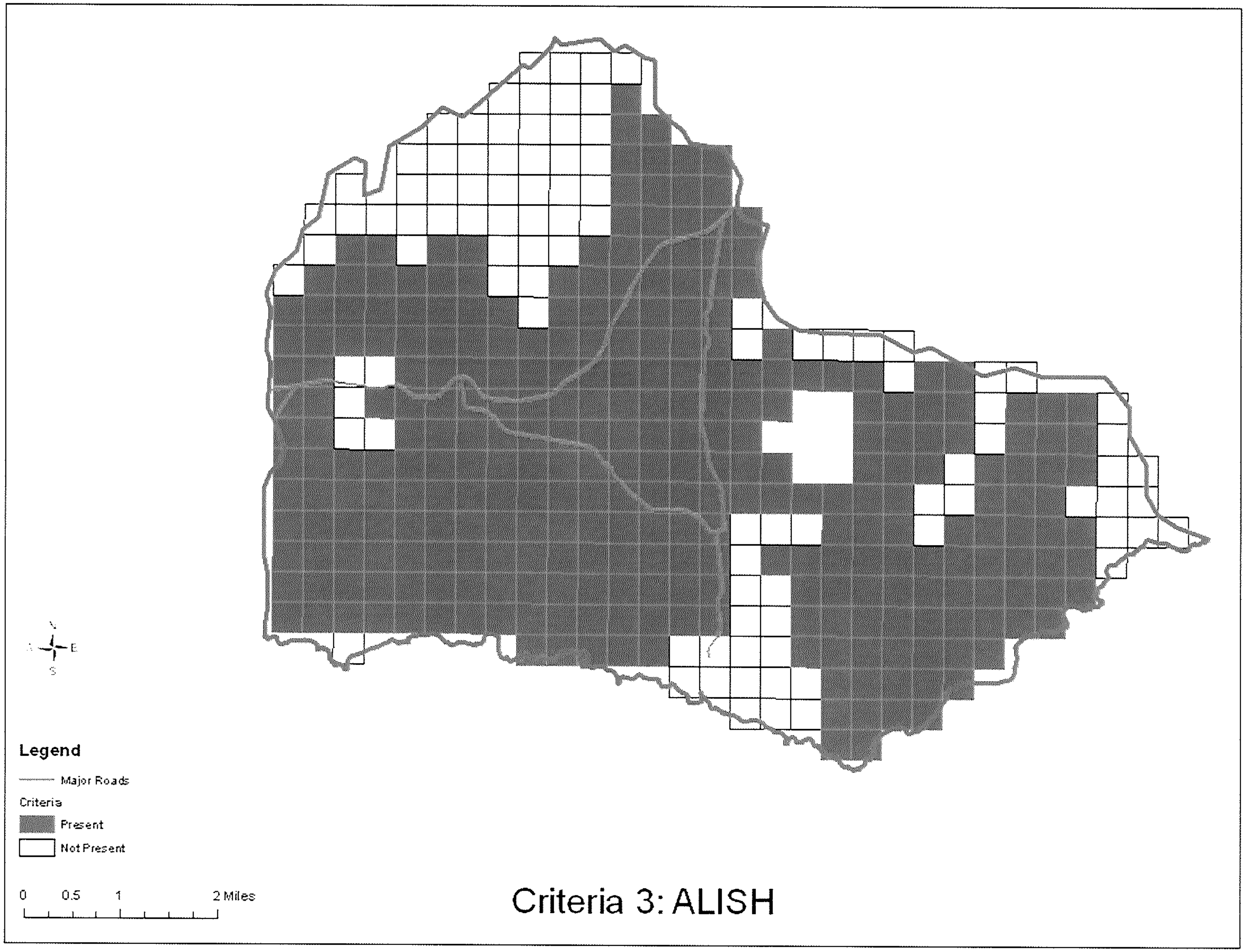
Criteria 1: Current Agricultural Production
Criteria 2: Soil Qualities and Slope
Criteria 3: ALISH
Criteria 4: Traditional Agriculture
Criteria 5: Irrigation
Criteria 6: Non-Urban Designated Lands
Criteria 7: Critical Land Mass
Criteria 8: Proximity to Infrastructure
Cumulative IAL Score



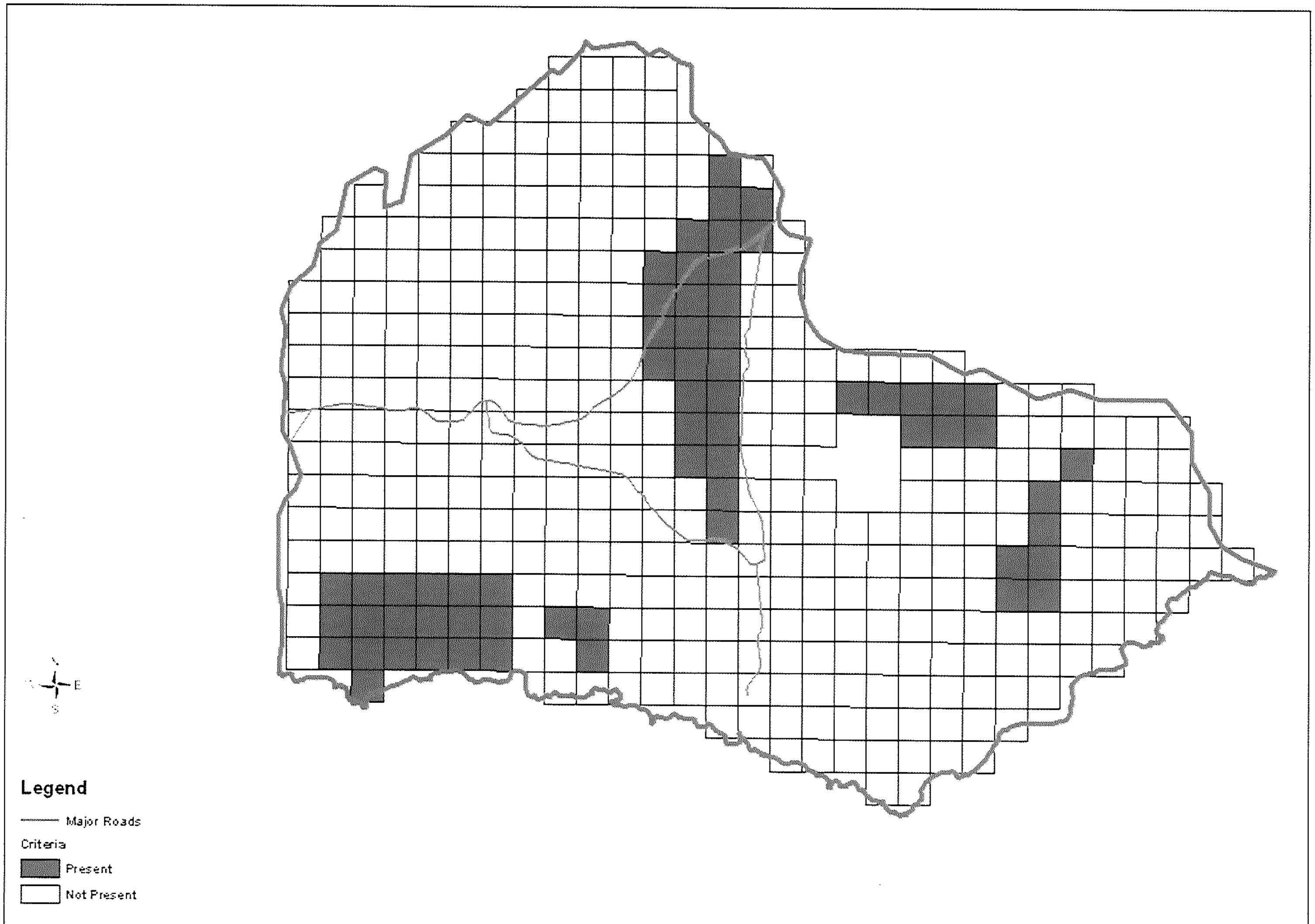
Criteria 1: Current Agricultural Production



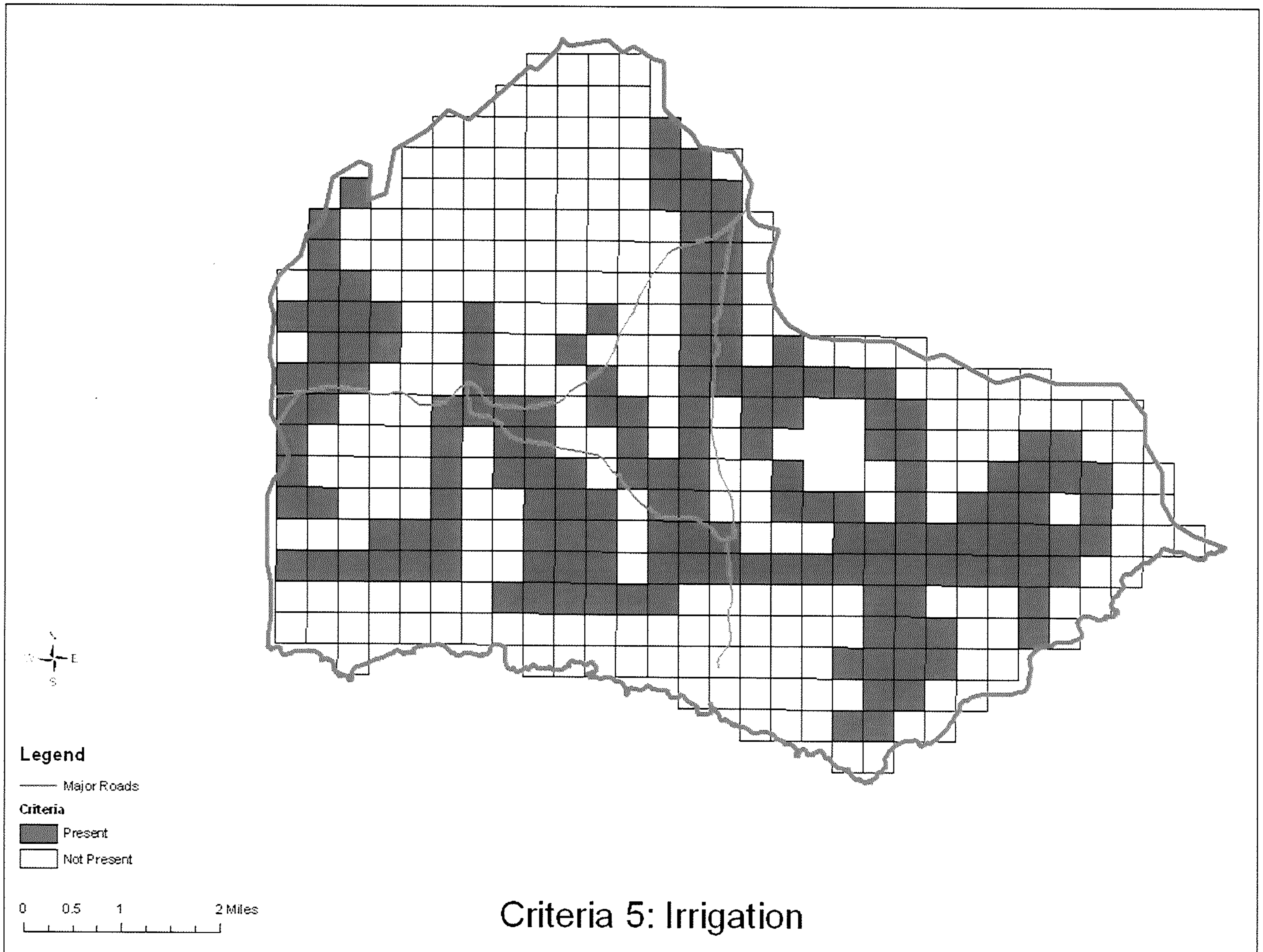
Criteria 2: Soil Qualities and Slope



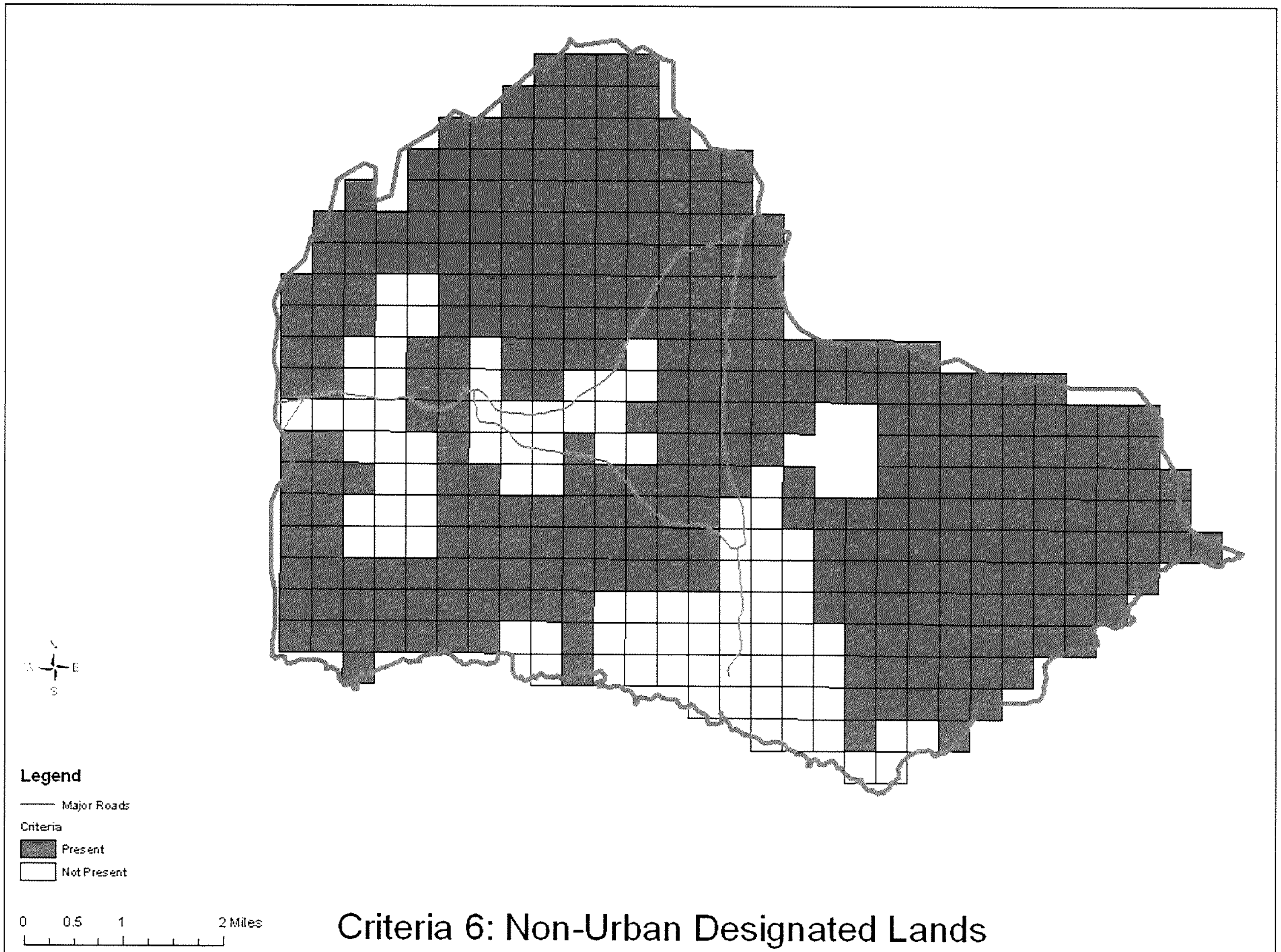
Criteria 3: ALISH



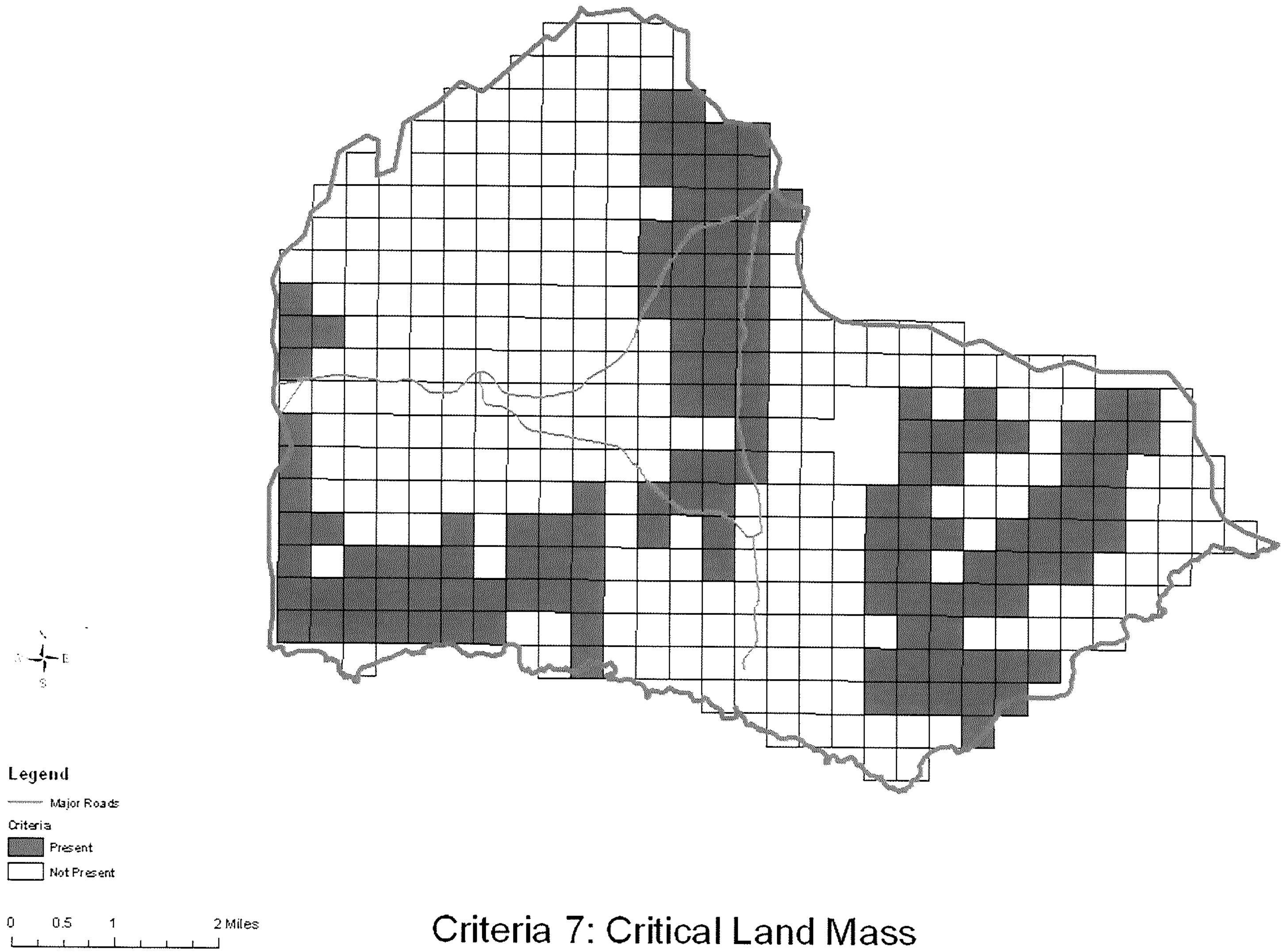
Criteria 4: Traditional Agriculture



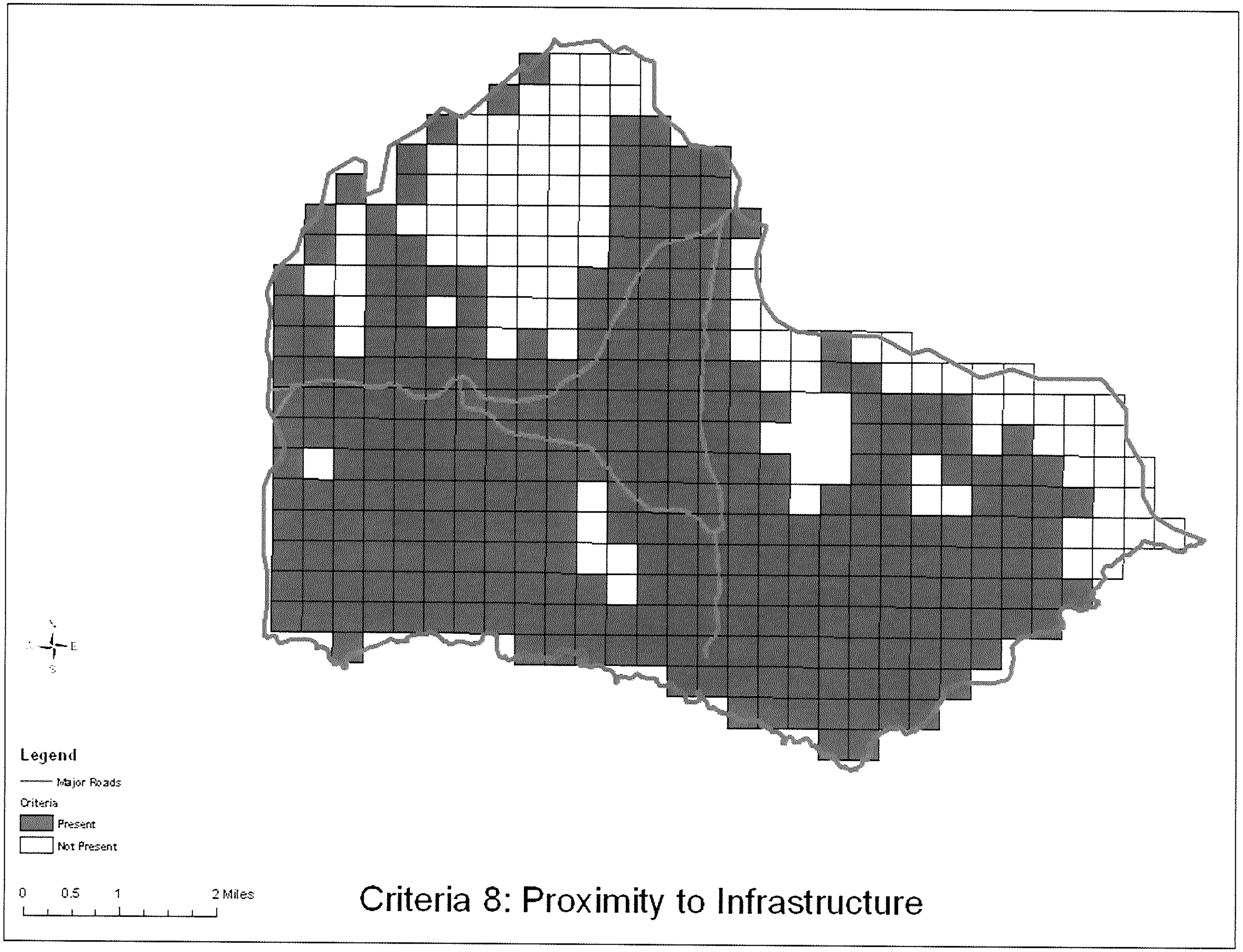
Criteria 5: Irrigation



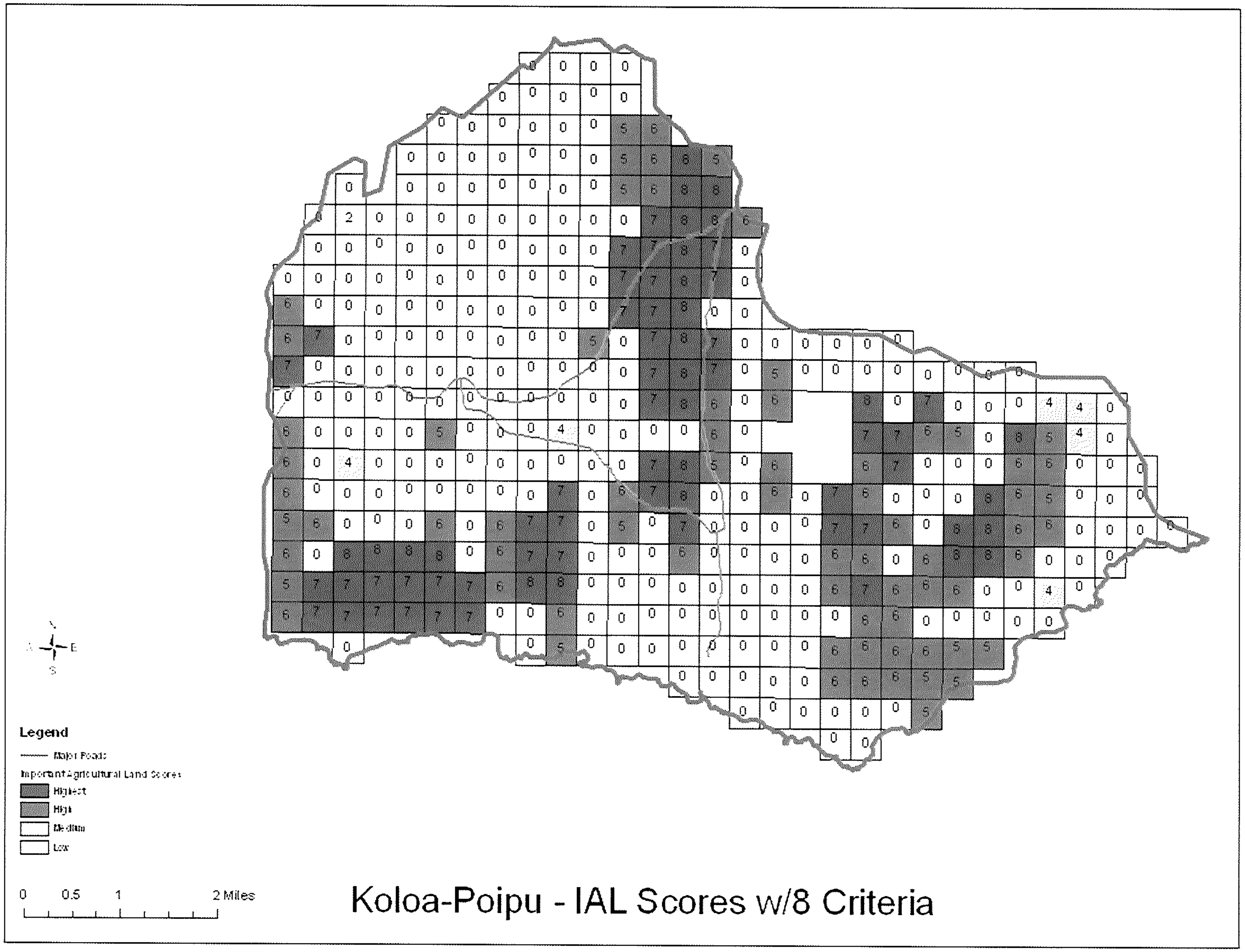
Criteria 6: Non-Urban Designated Lands



Criteria 7: Critical Land Mass

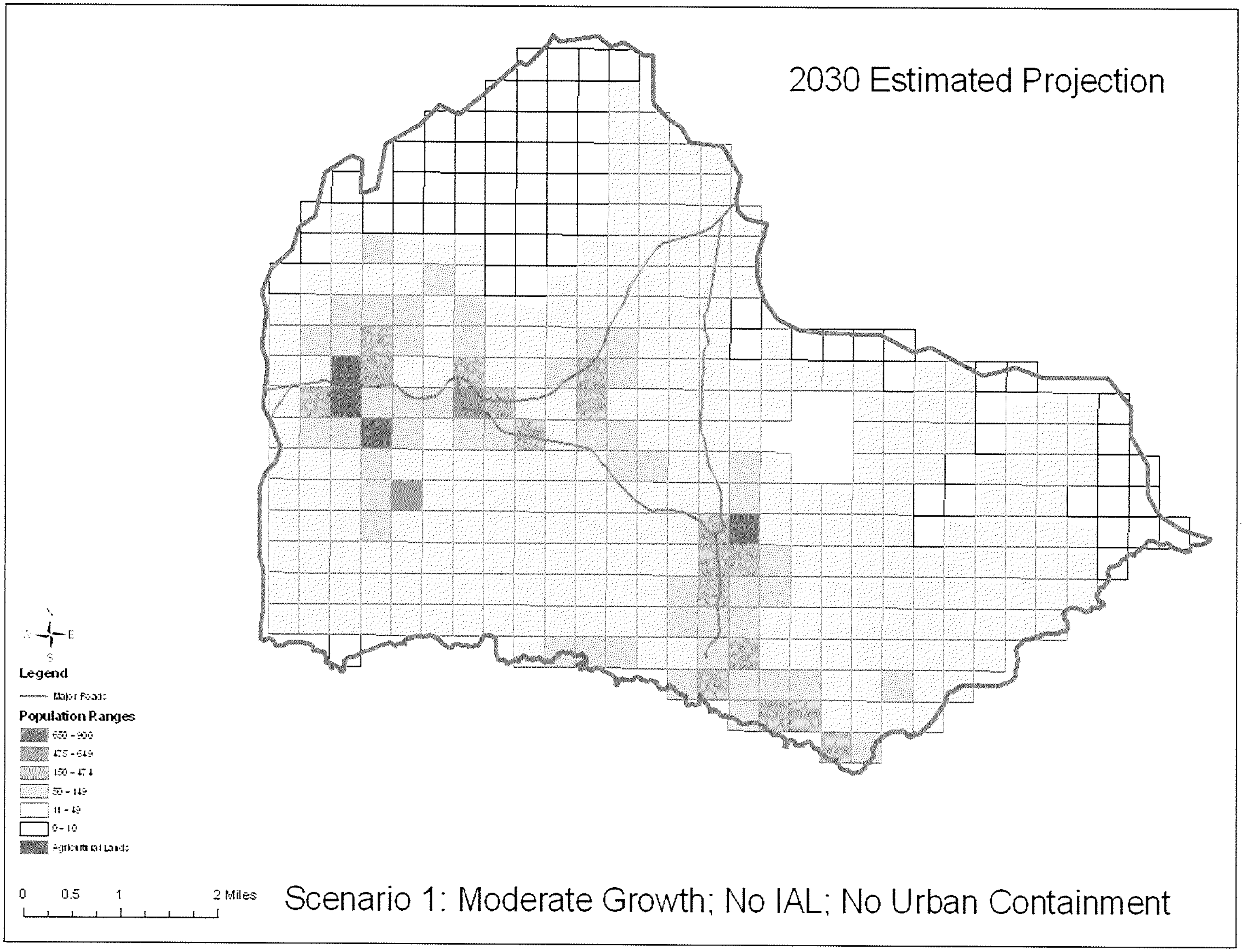


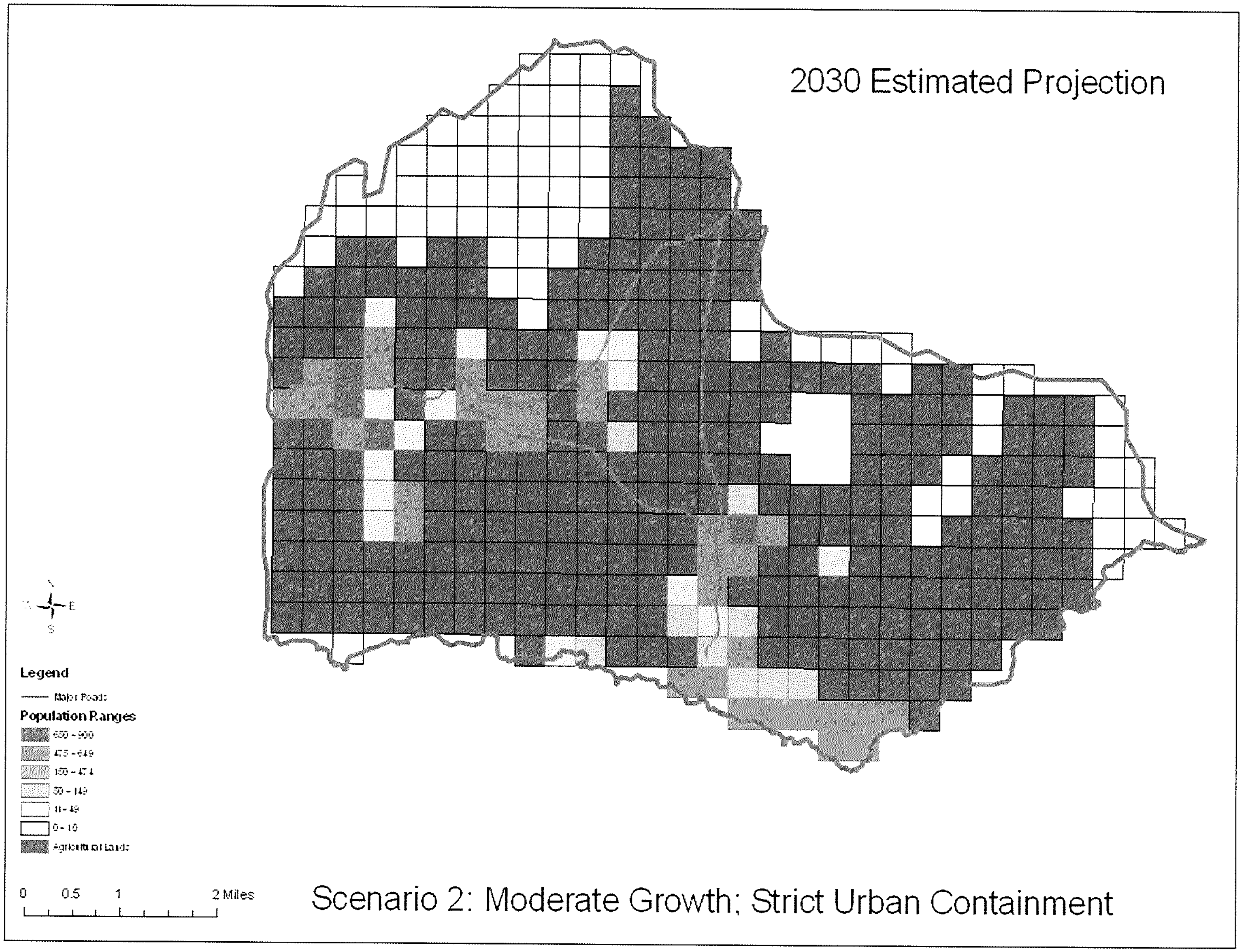
Criteria 8: Proximity to Infrastructure

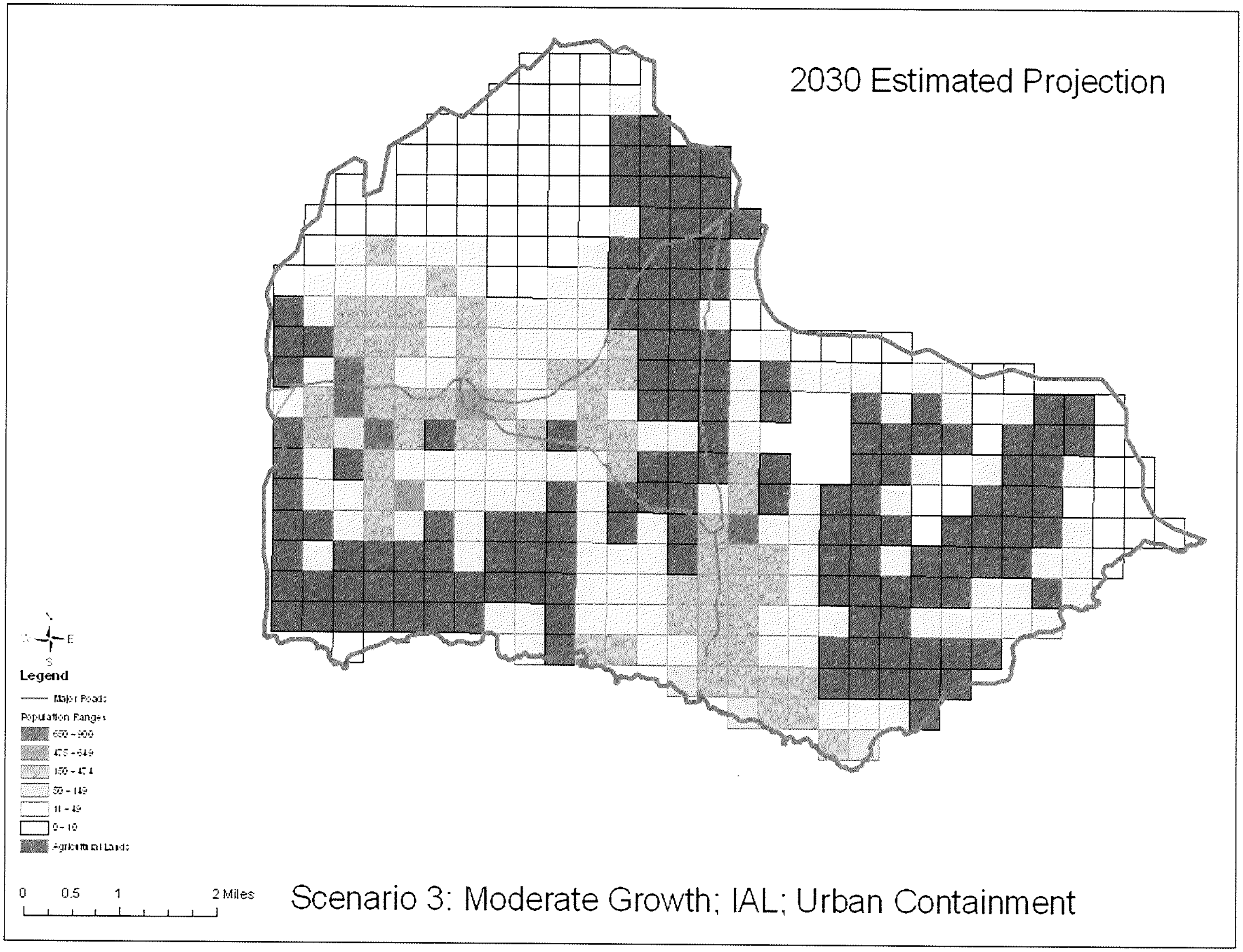

Legend
Major Roads
Important Agricultural Land Scores
Highest
High
Medium
Low
0 0.5 1 2 Miles
Koloa-Poipu - IAL Scores w/8 Criteria

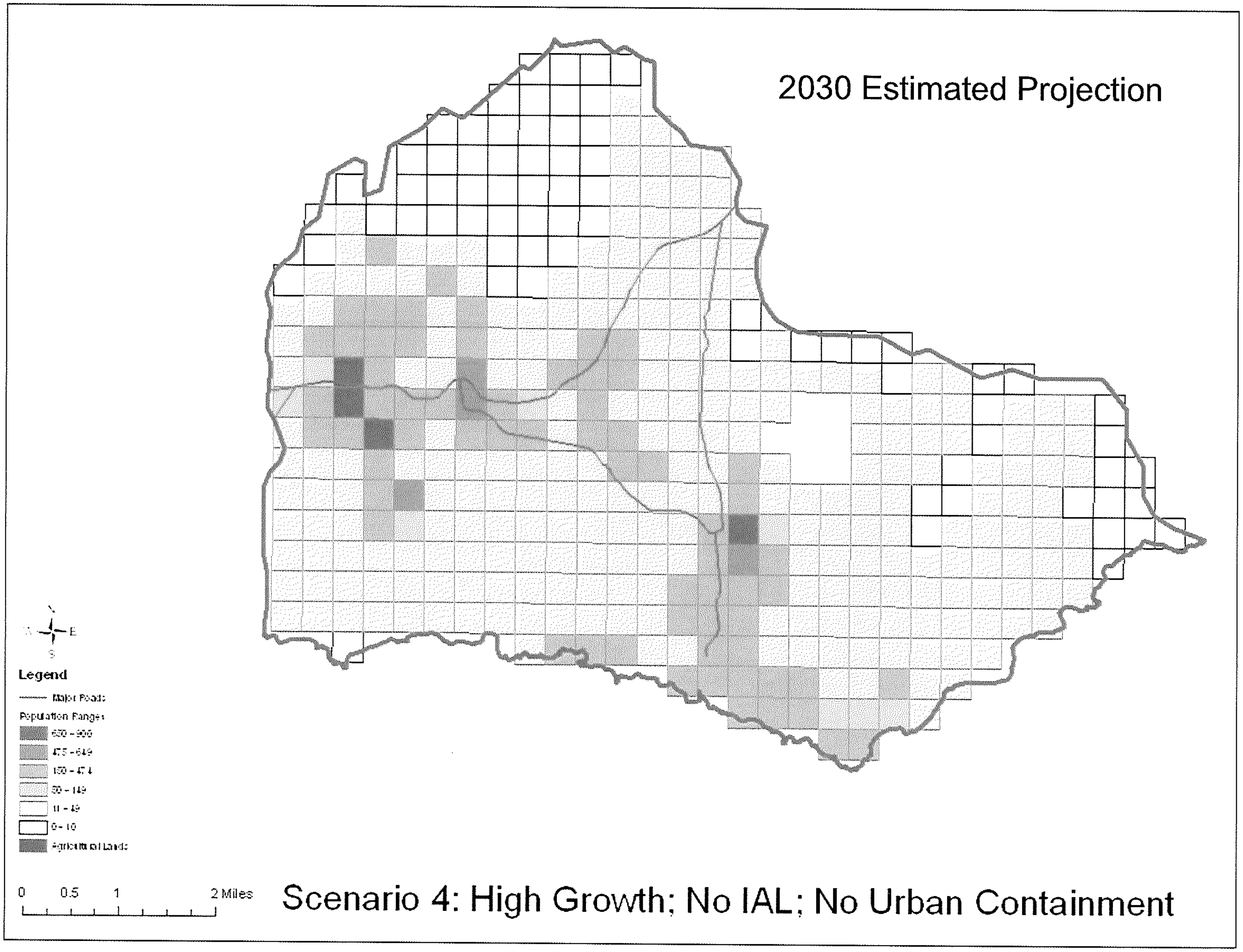
APPENDIX C: Urban Growth Scenarios

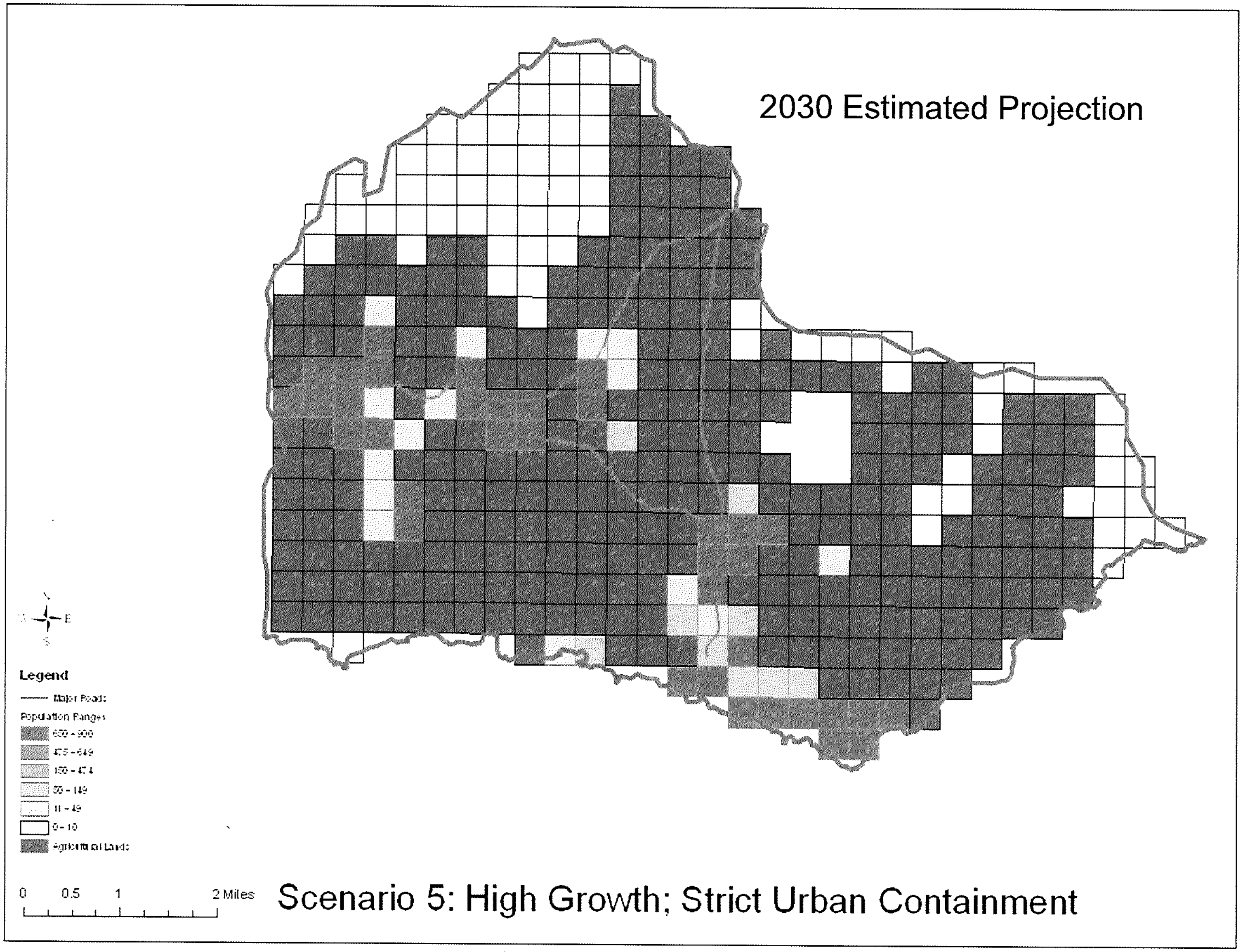
Scenario 1: Moderate Growth, No IAL, No Urban Containment
Scenario 2: Moderate Growth, Strict Urban Containment
Scenario 3: Moderate Growth, IAL, Urban Containment
Scenario 4: High Growth, No IAL, No Urban Containment
Scenario 5: High Growth, Strict Urban Containment
Scenario 6: High Growth, IAL, Urban Containment

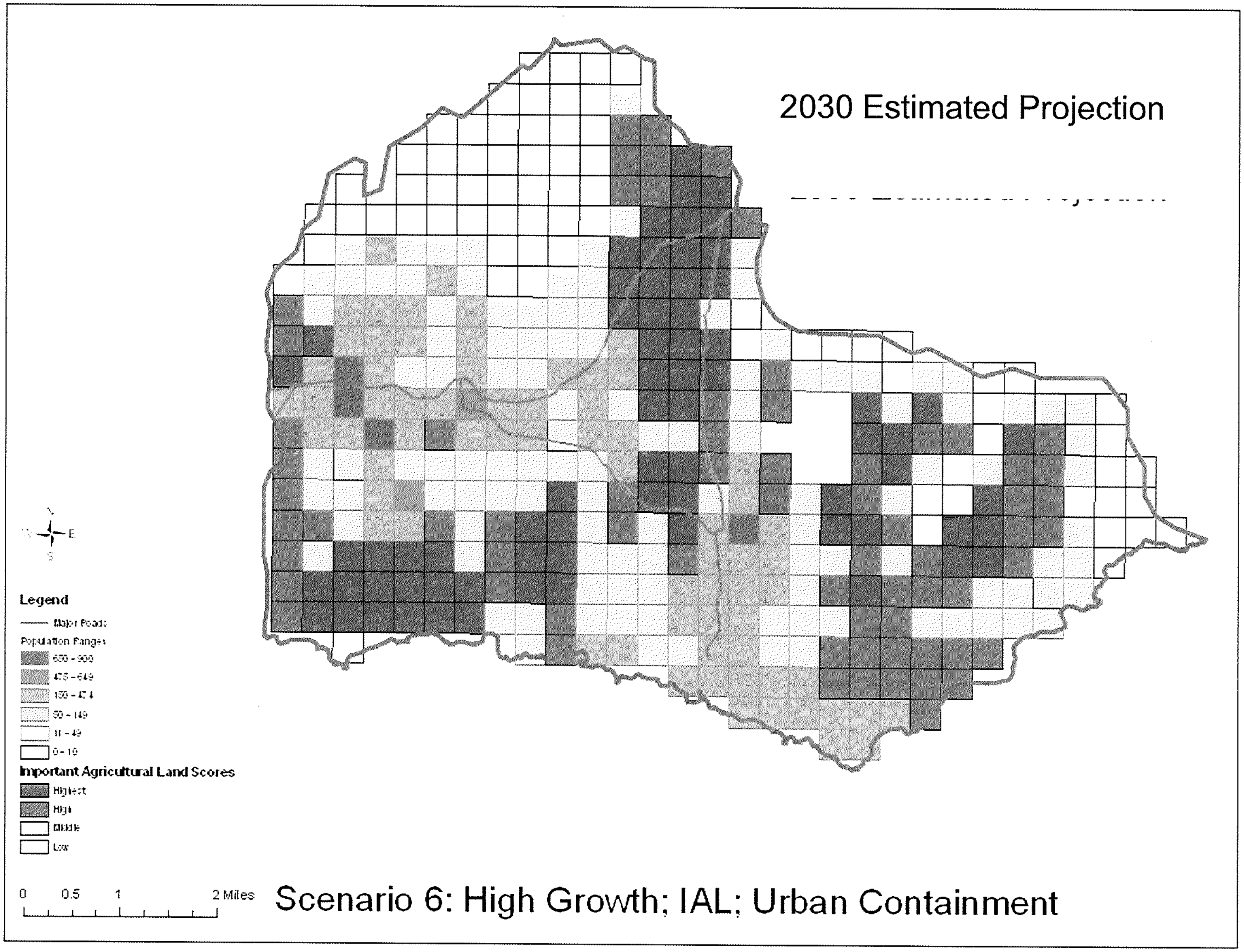

2030 Estimated Projection
N
W
E
S
Legend
Major Roads
Population Ranges
650 - 900
475 - 649
150 - 474
50 - 149
11 - 49
0 - 10
Agricultural Lands
0
0.5
1
2 Miles
Scenario 1: Moderate Growth; No IAL; No Urban Containment


2030 Estimated Projection
E
S
Legend
Population Ranges
475 - 649
11 - 49
0 - 10
0
0.5
1
2 Miles
Scenario 2: Moderate Growth; Strict Urban Containment


2030 Estimated Projection
N
E
S
Legend
Major Roads
Population Ranges
650 - 900
475 - 649
150 - 474
50 - 149
11 - 49
0 - 10
Agricultural Lands
0
0.5
1
2 Miles
Scenario 3: Moderate Growth; IAL; Urban Containment


2030 Estimated Projection
Legend
Major Roads
Population Ranges
650 - 900
475 - 649
150 - 474
50 - 149
11 - 49
0 - 10
Agricultural Lands
0
0.5
1
2 Miles
Scenario 4: High Growth; No IAL; No Urban Containment


2030 Estimated Projection
E
S
Legend
Major Roads
Population Ranges
650 - 900
475 - 649
150 - 474
50 - 149
11 - 49
0 - 10
Agricultural Lands
0 0.5 1 2 Miles
Scenario 5: High Growth; Strict Urban Containment


2030 Estimated Projection
E
S
Legend
Major Roads
Population Ranges
650 - 900
475 - 649
150 - 474
50 - 149
11 - 49
0 - 10
Important Agricultural Land Scores
Highest
High
Middle
Low
0
0.5
1
2 Miles
Scenario 6: High Growth; IAL; Urban Containment

APPENDIX D: Metadata Sources for Spatial Analysis

State Land Use Districts
ALISH
LESA
Major roads
TMK
Major landowners

Layer Name: State Land Use District Boundaries

Coverage Name: SLUD

Layer Type: Polygon

Status: Complete

Geog. Extent: Main Hawaiian Islands

Projection: Universal Trans Mercator, Zone 4 (Meters)

Datum: NAD 83

Description: State Land Use District Boundaries for the 8 main Hawaiian Island. Version Date: April 20, 2006.

Source: State Land Use Commission 1:24,000 mylar maps. State Land Use District Boundaries were compiled by the State Land Use Commission using the State of Hawaii's Geographic Information System (GIS). The State Land Use Districts depicted in these files are not official and are merely representations for presentation purposes only. A determination of the official State Land Use District Boundaries should be obtained through the State Land Use Commission. Duplication of these files or the information therein is prohibited unless authorized by the State Land Use Commission.

History: Initially digitized in Arc/Info versions 4, 5, and 6 using ArcEdit by the Office of Planning (OP) from State Land Use Commission's (LUC) 1:24,000 mylar maps. Updated by LUC staff, April 2006. Converted to personal geodatabase to obtain Shape Length and Shape Area by OP.

Attributes: Polygons:

LUDCODE	Land Use District Boundary Code

A	Agricultural Land Use District
C	Conservation Land Use District
R	Rural Land Use District
U	Urban Land Use District

ISLAND	Island
shape_Length	Perimeter (meters)
Shape_Area	Area (square meters)

Contact: Joan Delos Santos, Office of Planning, State of Hawaii,
PO Box 2359, Honolulu, Hi. 96804; (808) 587-2895.
email: JDelos_Santos@dbedt.hawaii.gov

Layer Name: Agricultural Lands of Importance to the State of Hawaii

Coverage Name: ALISH

Layer Type: Polygon

Status: Complete

Geog. Extent: Main Hawaiian Islands

Projection: Universal Trans Mercator, Zone 4

Datum: NAD 83

Description: Agricultural Lands of Importance to the State of Hawaii for islands of Kauai, Oahu, Maui, Molokai, Lanai & Hawaii.

Source: State Department of Agriculture 1:24,000 hand drafted blueline maps; compiled and drafted in 1977. Prepared with the assistance of the Soil Conservation Service, U.S. Department of Agriculture, and the College of Tropical Agriculture, University of Hawaii. See text below for information about the classification system, including criteria for classification.

History: Digitized in Arc/Info version 6 using ArcEdit by the Office of State Planning (OSP) from State Department of Agriculture's 1:24,000 blueline maps.

Attributes: Polygons:

AREA	area of polygon (sq. meters)
PERIMETER	perimeter of polygon (meters)
ALISH#	Polygon internal number (for Arc/Info use)
ALISH-ID	Polygon ID (for Arc/Info use)
AGTYPE	Agricultural Type

AGTYPE	Definition
0	Unclassified
1	Prime Lands
2	Unique Lands
3	Other Lands

Arcs:

FNODE#	From Node Number (for Arc/Info use)
TNODE#	To Node Number (for Arc/Info use)
LPOLY#	Left Polygon Number (for Arc/Info use)
RPOLY#	Right Polygon Number (for Arc/Info use)
LENGTH	Length (meters)
ALISH#	Arc Internal Number (for Arc/Info use)
ALISH-ID	Arc ID (for Arc/Info use)
FLAG	Source of Arc

FLAG	Definition
0	Digitized arc
1	Extracted arc (from 1:24,000 DLGs)
2	Closure arc
3	Coastline arc
9	Other

Note:(from "Agricultural Lands of Importance to the State of Hawaii Revised," State Department of Agriculture, November, 1977).

The Classification System:

The classification system for identification of agriculturally important lands in the State of Hawaii provides for the:

1. Establishment of classes of agricultural lands primarily, but not exclusively, on the basis of soil characteristics;

2. Establishment of criteria for classification of lands; and

3. Identification of lands which meet the criteria for the respective classes.

Three classes of agriculturally important lands were established for the State of Hawaii with the intent of facilitating the SCS effort to inventory prime farmlands nationally and adapting the classification to the types of agricultural activity in Hawaii. These classes and their corresponding SCS (national) equivalents are:

Hawaii Classificiation System	SCS Classification System
Prime Agricultural Land	Prime Farmland
Unique Agricultural Land	Unique Farmland
Other Important Agricultural Land	Additional Farmland of Statewide and Local Importance

The criteria for classification of PRIME AGRICULTURAL LAND are identical to the criteria established by SCS for national application. The criteria for UNIQUE AGRICULTURAL LAND and OTHER IMPORTANT AGRICULTURAL LAND were established cooperatively by the Soil Conservation Service in Hawaii, the College of Tropical Agriculture, and the State Department of Agriculture.

Land considered for classification may or may not currently be in agricultural use, or may be in an agricultural use other than that which its classification may indicate as its agricultural capability. An example of the latter situation is land currently being used for grazing but which meets the criteria for Prime Agricultural Land. Lands not considered for classificiation as agricultural lands of importance to the State of Hawaii are:

1. Developed urban land over 10 acres;

2. Natural or artificial enclosed bodies of water over 10 acres;

3. Forest reserves;

4. Public use (parks and historic sites) lands;

5. Lands with slopes in excess of 35%; and

6. Military installations, except undeveloped areas over 10 acres.

The classification of agriculturally important lands does not in itself constitute a designation of any area to a specific land use. The classification should, however, provide decision makers with an awareness of the long-term implications of various land use options for production of food, feed, forage, and fiber crops in Hawaii.

Over time new areas may be developed for agricultural uses, other areas may be converted to irreversible non-agricultural uses, and new knowledge may be gained regarding soil interpretations. These and other developments will necessitate the periodic review and revision of the classification system and lands identified for the various classes.

The Criteria for Classification:

PRIME AGRICULTURAL LAND

PRIME AGRICULTURAL LAND is land best suited for the production of food, feed, forage and fiber crops. The land has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed, including water management, according to modern farming methods.

PRIME AGRICULTURAL LAND meets the following criteria:

1. The soils have an adequate moisture supply. Included are:

   a. Soils having aquic or udic moisture regimes. (For definitions of moisture regimes see Soil Taxonomy, Agricultural Handbook 436, December 1975). These soils commonly are in humid or subhumid climates that have well distributed rainfall or have enough rain in the summer that the amount of stored moisture plus rainfall is approximately equal to or exceeds the amount of potential evapotranspiration. Water moves through the soils at some time in most years.

   b. Soils having xeric or ustic moisture regimes and in which the available water capacity is great enough to provide adequate moisture for the commonly grown crops in 7 or more years out of 10.

   c. Soils having aridic or torric moisture regimes and the area has a developed irrigation water supply that is dependable and of adequate quality. Also included are soils having xeric or ustic moisture regimes in which the available water capacity is limited but the area has a developed irrigation water supply that is dependable and of adequate quality.

   d. Soils having sufficient available water capacity within a depth of 40 inches (1 meter), or in the root zone if the root zone is less than 40 inches deep, to produce the commonly grown crops in 7 or more out of 10 years.

   A dependable water supply is one in which enough water is available for irrigation in 8 out of 10 years for the crops commonly grown.

2. The soils have a soil temperature regime that is isomesic, isothermic, or isohyperthermic. These are soils that, at a depth of 20 inches (50 cm), have a mean annual temperature higher than 47 degrees F (8 degrees C), and the difference between the mean summer and mean winter temperature differ by less than 9.0 degrees F (5 degrees C).

3. The soils have a pH between 4.5 and 8.4 in all horizons within a depth of 40 inches (1 meter) or in the root zone if the root zone is less than 40 inches deep. (Soils which have a pH of less than 4.5

in surface soil because of use of fertilizers are excluded). This range of pH is favorable for growing a wide variety of crops without adding large amounts of amendments.

4. The soils have no water table or a water table that is maintained at a sufficient depth during the cropping season to allow crops common to the area to be grown.

5. The soils can be managed so that in all horizons within a depth of 40 inches (1 meter) or in the root zone if the root zone is less than 40 inches deep, during part of each year the conductivity of saturation extract is less than 4 mmhos/cm and the exchangeable sodium percentage (ESP) is less than 15.

6. The soils are not flooded frequently during the growing season (less often than once in 2 years).

7. The soils have a product of K (erodability factor) x percent slope of less than 2.0. That is, soils having a serious erosion hazard are not included.

8. The soils have a permeability rate of at least 0.06 inches (0.15 cm) per hour in the upper 20 inches (50 cm) and the mean annual soil temperature at a depth of 20 inches is less than 57 degrees F (14 degrees C). Permeability rate is not a limiting factor if the mean annual soil temperature is 57 degrees F (14 degrees C) or higher.

9. Less than 10 percent of the surface layer in these soils consists of rock fragments coarser than 3 inches (7.6 cm). These soils present no particular difficulty in cultivating with large equipment.

10. Must not be thixotropic and have isomesic temperature regime.

UNIQUE AGRICULTURAL LAND

UNIQUE AGRICULTURAL LAND is land other than PRIME AGRICULTURAL LAND and is used for the production of specific high-value food crops. The land has the special combination of soil quality, growing season, temperature, humidity, sunlight, air drainage, elevation, aspect, moisture supply, or other conditions, such as nearness to market, that favor the production of a specific crop of high quality and/or high yield when the land is treated and managed according to modern farming methods. In Hawaii, some examples of such crops are coffee, taro, rice, watercress and non-irrigated pineapple.

Land that qualifies as PRIME AGRICULTURAL LAND and is used for a specific high-value crop is classified as PRIME AGRICULTURAL LAND rather than as UNIQUE AGRICULTURAL LAND.

OTHER IMPORTANT AGRICULTURAL LAND

OTHER IMPORTANT AGRICULTURAL LAND is 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. The lands in this classification are important to agriculture in Hawaii yet they exhibit properties, such as seasonal wetness, erodibility, limited rooting zone, slope, flooding, or droughtiness, that exclude them from the PRIME or UNIQUE AGRICULTURAL LAND classifications. Two examples are lands which do not have an adequate moisture supply to qualify as PRIME AGRICULTURAL LAND and lands which have similar characterisitics and properties as UNIQUE AGRICULTURAL LAND except that the land is not currently in use for the production of a "unique" crop. These lands can be farmed satisfactorily by applying greater inputs of fertilizer and other soil amendments, drainage improvement, erosion control practices, flood protection and produce fair to good crop yields when managed properly.

Other criteria which may qualify lands as OTHER IMPORTANT AGRICULTURAL LAND are:

1. The land has slopes less than 20%, is presently in crop or has cropping potential, and is not classified as PRIME or UNIQUE AGRICULTURAL LAND. The soils have a moisture supply which is adequate for the commonly grown crop.

2. The land has slopes less than 35%, is presently used for grazing or has grazing potential, and is not classified as PRIME or UNIQUE AGRICULTURAL LAND. The soils have:

    a. An aquic, udic, xeric, or ustic moisture regime in which the available water capacity is sufficient to produce fair to good yields of adapted forage.

    b. Less than 10% rock outcrops and coarse fragments coarser than 3 inches (7.6 cm) in the surface layer.

3. The soils are thin organic soils underlain by aa lava (typic tropofolists) having aquic, udic, xeric, or ustic moisture regimes and isohyperthemic (greater than 72 degrees F) or isothermic (59 - 72 degrees F) soil temperature regimes.

Contact: Joan Delos Santos, Office of Planning, State of Hawaii,
PO Box 2359, Honolulu, Hi. 96804; (808) 587-2895.
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Layer Name: Land Evaluation and Site Assessment

Coverage Name: LESA

Layer Type: Polygon

Status: Complete

Geog. Extent: Islands of Hawaii, Kauai, Lanai, Maui, Molokai and Oahu

Projection: Universal Trans Mercator, Zone 4, Meters

Datum: NAD 83

Description: Important Agricultural Lands (IAL) as determined/delineated by the LESA Commission. ALISH, LSB and the U.S. Soil Conservation Service LESA studies were all used and considered when evaluating land for inclusion in the IAL inventory.

The "Land Evaluation" portion of the study primarily considered soils to determine rankings. In the "Site Assessment" portion of the study, consideration was given to significant factors other than

soils that contribute to the viability of a given site for agricultural use. See the report listed below for more specific information as to criteria and exact methodology used.

Source: "A Report on the State of Hawaii Land Evaluation and Site Assessment System" by The State of Hawaii Land Evaluation and Site Assessment Commission, February, 1986.

History: Polygons were drafted onto 1:24000 USGS quadrangle maps, then digitized in Arc/Info version 7.x by Office of Planning staff.

NOTE: "Doughnut" / "Island" polygons on the island of Kauai and part of the island of Hawaii have been differentiated and given distinct codes/values.

Attributes: Polygons

AREA area of polygon in square meters
PERIMETER perimeter of polygon in meters
LESA_N83# polygon internal number (for Arc/Info use)
LESA_N83-ID polygon ID (for Arc/Info use)

LESA 1 = Important Ag Lands
0 = Not Important Ag Lands

Contact: Joan Delos Santos, Office of Planning, State of Hawaii,
P.O. Box 2359, Honolulu, Hi. 96804; (808) 587-2895.
e-mail: JDelos_Santos@dbedt.hawaii.gov
=

Layer Name: DLG Major Roads

Coverage Name: DLGMAJRDS

Layer Type: Line

Status: Complete

Geog. Extent: Islands of Kauai, Oahu, Molokai, Lanai, Maui and Hawaii

Projection: Universal Trans Mercator, Zone 4 (Meters)

Datum: NAD 83

Description: "Major roads" extracted from the USGS 1983 DLGs for the main hawaiian islands.

Source: USGS Digital Line Graphs, 1983 version.

History: Subset of the roads layer of the 1983 DLGs, obtained by reselecting arcs using USGS major and minor codes. H-3 was added to the layer by the Office of Planning.

Attributes: Arcs:

FNODE#	From Node # (for Arc/Info use)
TNODE#	To Node # (for Arc/Info use)
LPOLY#	Left Polygon # (for Arc/Info use)
RPOLY#	Right Polygon # (for Arc/Info use)
LENGTH	Length (Length of arc in meters)
<ISL>MAJRD#	Arc Internal Number (for Arc/Info use)
<ISL>MAJRD-ID	Arc ID (for Arc/Info use)
MAJOR1	Major Code 1
MINOR1	Minor Code 1
MAJOR2	Major Code 2
MINOR2	Minor Code 2
MAJOR3	Major Code 3
MINOR3	Minor Code 3
MAJOR4	Major Code 4
MINOR4	Minor Code 4
MAJOR5	Major Code 5
MINOR5	Minor Code 5
MAJOR6	Major Code 6
MINOR6	Minor Code 6

Major Codes (1-6):

170 DLG Roads and Trails layer
171 (with minor code xxxx) # of lanes
172 (with minor code xxxx) Interstate Route Number
173 (with minor code xxxx) U.S. Route Number
174 (with minor code xxxx) State Route Number
175 (with minor code xxxx) Reservation, park or military route number
176 (with minor code xxxx) County Route Number
177 (with minor code XXYY) Alphabetic Portion of Route # - Sub. numeric equiv. of alpha. for XX and for YY as follows:
00=blank, 01=A, 02=B, 03=C, 04=D, 05=E, 06=F, 07=G, 08=H, 09=I, 10=J, 11=K, 12=L, 13=M, 14=N, 15=O, 16=P, 17=Q, 18=R, 19=S, 20=T, 21=U, 22=V, 23=W, 24=X, 25=Y, 26=Z.
178 (with minor code = 0000) best estimate of position or classification
179 (with minor code 00xx) Coincident feature

Minor Codes (1-6):

0001 Bridge abutment
0002 Tunnel portal
0004 Gate
0005 Cul-de-sac
0006 Dead end
0007 Drawbridge

0100 Void Area

0201 Primary route, class 1, symbol undivided
0202 Primary route, class 1, symbol divided by centerline
0203 Primary route, class 1, divided, lanes separated
0204 Primary route, class 1, one way, other than divided highway
0205 Secondary route, class 2, symbol undivided
0206 Secondary route, class 2, symbol divided by centerline
0207 Secondary route, class 2, symbol divided, lanes separated
0208 Secondary route, class 2, one way, other than divided highway
0209 Road or street, class 3
0210 Road or street, class 4
0211 Trail, class 5, other than four-wheel-drive vehicle
0212 Trail, class 5, four-wheel-drive vehicle
0213 Footbridge
0214 Road ferry crossing

0215 Perimeter of parking area
0216 Arbitrary extension of line (join or closure)
0217 Road or street, class 3, symbol divided by centerline
0218 Road or street, class 3, divided lanes separated
0219 Road or street, class 4, one way
0220 Closure line
0221 Road or street, class 3, one way
0222 Road in transition
0299 Processing line

0401 Traffic circle
0402 Cloverleaf or interchange
0403 Toll gate, toll plaza or perimeter of toll plaza
0404 Weigh station
0405 Nonstandard section of road

0601 In tunnel
0602 Overpassing, on bridge
0603 Under construction, classification known
0604 Under construction, classification unknown
0605 Labeled "old railroad grade"
0606 Submerged or in ford
0607 Underpassing
0608 Limited access
0609 Toll road
0610 Privately operated or controlled public access
0611 Proposed
0612 Double-decked
0613 In service facility or rest area
0614 Elevated
0615 Bypass route
0616 Alternate route
0617 Business route
0618 On drawbridge
0619 Spur
0620 Loop
0621 Connector
0622 Truck route
0650 Road width 46-55 feet, 0.025 inches at 1:24,000
0651 Road width 56-65 feet, 0.030 inches at 1:24,000
0652 Road width 66-75 feet, 0.035 inches at 1:24,000
0653 Road width 76-85 feet, 0.040 inches at 1:24,000
0654 Road width 86-95 feet, 0.045 inches at 1:24,000
0655 Road width 96-105 feet, 0.050 inches at 1:24,000
0656 Road width 106-115 feet, 0.055 inches at 1:24,000
0657 Road width 116-125 feet, 0.060 inches at 1:24,000
0658 Road width 126-135 feet, 0.065 inches at 1:24,000
0659 Road width 126-145 feet, 0.070 inches at 1:24,000

0000 Photo revised feature

Note: For more complete layer information, please refer to majroads.met

Contact: Joan Delos Santos, Office of Planning, State of Hawaii,
PO Box 2359, Honolulu, Hi. 96804; (808) 587-2895.
email: JDelos_Santos@dbedt.hawaii.gov

Layer Name: Neighbor Island Parcels

Coverage Name: <isl>tmk

Layer Type: Polygon

Directory: K:\Data\Landuse_Ownership\Parcels

Status: Complete

Geog. Extent: Main Hawaiian Islands, except Oahu

Projection: Universal Trans Mercator, Zone 4 (Meters)

Datum: NAD 83

Description: Parcel/TMK maps for Neighbor Islands

Source: Counties of Kauai, Maui and Hawaii

History: Originally created by Geographic Decision Systems International (GDSI).

Maintenance assumed by counties in 2004 and 2005.

Currentness/Latest Updates:

Hawaii County - May, 2006
Kauai County - September, 2006
Maui County - May, 2006

Attributes: Polygons:

FID Feature ID
SHAPE Feature Geometry
TMK 9 Digit Tax Map Key Number
MAJOROWNER Major Owner, rest set to "other" (see definition, below)
BIGSTOWNER Biggest Owner, rest set to "other" (see definition, below)
TAXACRES Tax assessor parcel acreage
LANDVALUE Tax assessor parcel land value
LANDEXEMPT Tax assessor parcel land exemption
BLDGVALUE Tax assessor parcel building value
BLDGEXEMPT Tax assessor parcel building exemption
PITTCODE PITT Code - used to identify the tax rate applied to the property
HOMEOWNER Homeowner - Yes, No, or Unknown
GISACRES Parcel Acreage calculated by the GIS

TMK:

1st Digit Division/County

1 = Oahu
2 = Maui
3 = Hawaii
4 = Kauai

2nd Digit Zone

Oahu
1,2,3 = Honolulu
4 = Koolaupoko
5 = Koolauloa
6 = Waialua
7 = Wahiawa
8 = Waianae
9 = Ewa

Maui
1 = Hana
2 = Makawao
3 = Wailuku
4 = Lahaina
Zone 4, Section 9 = Lanai
5 = Molokai
6 = County of Kalawao

Hawaii
1 = Puna
2 = South Hilo
3 = North Hilo
4 = Hamakua
5 = North Kohala
6 = South Kohala
7 = North Kona
8 = South Kona
9 = Kau

Kauai
1 = Waimea
2 = Koloa
3 = Lihue
4 = Kawaihau
5 = Hanalei

3rd Digit Section

4th-6th Digits Plat

7th-9th Digits Parcel

Notes:

Major Owner: This value is filled in for the largest composite land owners on any given island - for example, it may be owners of more than 50 acres on one island, or owners of over 500 acres on another island. For Federal, State and Local government land owners, the value denotes which agency owns the parcel - for example, State of Hawaii, DLNR vs. State of Hawaii, DOH.

BigstOwner: This value is filled in for those landowners that are "well-known" in Hawaii - for example, AMFAC, Alexander & Baldwin, C. Brewer, etc. In addition, State ownership is broken down only for State and State DHHL - for example, DOE, DLNR, etc. are all grouped together as "State."

At the request of the Counties, the "Owner" field has been deleted for posting of this layer to the website in light of privacy and security concerns. Small or individual land owner information can be cross-referenced to other publicly available databases, or by contacting the respective county.

Oahu data - the Office of Planning periodically receives updates of the Oahu parcel data from the City and County of Honolulu Land Information System (HoLIS) and provides it on our website as a public service. For the latest Oahu parcel data, be sure to check the City's GIS data download site at gis.hicentral.com

Contact: Joan Delos Santos, Office of Planning, State of Hawaii,
PO Box 2359, Honolulu, Hi. 96804; (808) 587-2895.
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Layer Name: Large Landowners

Coverage Name: large_landowners

Layer Type: Polygon

Library: State

Status: Complete

Geog. Extent: Main Hawaiian Islands

Projection: Universal Trans Mercator, Zone 4 (Meters)

Datum: NAD83

Description: Large Landownership of the State of Hawaii

Source: C&C of Honolulu, Kauai County, Maui County, Hawaii County (2006).

History: This dataset was created using the TMK Parcel shapefiles from the counties of Honolulu, Kauai, Maui and Hawaii. For Kauai, Maui and Hawaii Counties, the "MajorOwner" field was queried to include all public lands along with private landowners with a cummulative of at least 1000 acres per island. All land owners with "MajorOwner" = "other" were excluded.

For Oahu, since there was no "MajorOwner" field, the "Owner" field was queried to select the Public Lands and Private owners of at least 1000 acres.

Attributes: Polygons:

MajorOwner Name of Major Landowner
Island Island
Type "Private" or "Public" Ownership
Tax_Acres Tax Acreage
GIS_Acres Acreage calculated by GIS

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