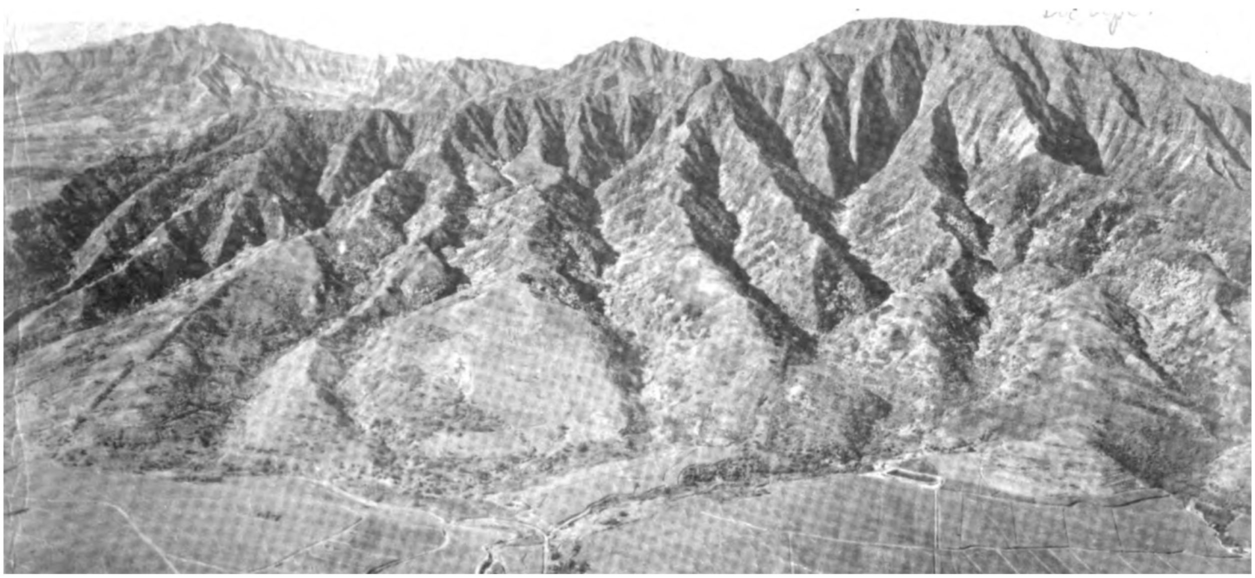
SOIL CLASSIFICATION SYSTEMS & USE IN REGULATING AGRICULTURAL LANDS STUDY

Interim Report

December 2023



Portion of the cover image from 'An Inventory of Available Information on Land Use in Hawai'i' report for the Territory of Hawai'i Economic Planning and Coordination Authority by Harland Bartholomew & Associates, 1957.

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SUPERSISTENCE

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ACRONYMS

ALISH - Agricultural Lands of Importance to the State of Hawaiʻi

ASR - Annual Soils Refresh

CTAHR - College of Tropical Agriculture and Human Resources

DBEDT - Department of Business, Economic Development and Tourism

DLNR - Department of Land and Natural Resources

FPPA - Farmland Protection Policy Act

GIS - Geographic Information System

HAR – Hawaiʻi Administrative Rules

HDOA – Hawaiʻi Department of Agriculture

HILT – Hawaiʻi Land Trust

HNRIS – Hawaiʻi Natural Resources Information System

HRS – Hawaiʻi Revised Statutes

IAL - Important Agricultural Lands

LESA - Land Evaluation and Site Assessment

LIM - Land Inventory and Monitoring

LSB - Land Study Bureau

LUC - Land Use Commission

LURF - Land Use Research Foundation

MSRI - Modified Storie Rating Index

NALS - National Agricultural Lands Study

NRCS - Natural Resources Conservation Service

OPSD - Office of Planning and Sustainable Development

RC&D - Resource Conservation and Development Council

SALUB - Statewide Agricultural Land Use Baseline

SC - Steering Committee

SI - Storie Index

SCS - Soil Conservation Service

SSURGO - USDA-NRCS Soil Survey Geographical Database

USDA - United States Department of Agriculture

I. EXECUTIVE SUMMARY

This interim report summarizes Phase I of a study commissioned by the State of Hawaiʻi to assess the suitability of soil classification systems used in agricultural land planning and regulation. Given that the soil classification systems most frequently used in Hawaiʻi's agricultural land regulation were developed decades ago, the study evaluates these systems and will formulate recommendations on the use of soil classification systems for agricultural land use regulation.

This report covers the study's origins, objectives, phased approach, and achievements to date (Section II); reviews four major existing soil classification systems (LSB, ALISH, LESA, SSURGO) used in Hawaiʻi, outlining the history, methods, mapping, and prior studies completed for each system and evaluating their strengths, limitations, and opportunities for improvement (Section III); summarizes initial work on best practices research (Section IV) and a compilation of regulations utilizing soil classification systems across Hawaiʻi State and its counties (Section V); and analyzes feedback gathered from focus groups, meetings, and a digital forum to understand stakeholder perspectives on current systems (Section VI).

Despite the merits of current systems, the findings highlight opportunities to update data, broaden scope, enhance user-friendliness, and better serve diverse agricultural needs. This report lays the groundwork for Phase II, which will focus on developing and refining recommendations to maintain, improve, or replace soil classification systems with consideration of their role in agricultural land use regulation.

In Phase II, the preliminary research, best practices from other jurisdictions, impacted statutes and rules, and stakeholder feedback presented in this report, along with a completed criteria-based system comparison, will be utilized to develop initial recommendations. These recommendations will be presented for stakeholder feedback in a second round of stakeholder outreach, leading to a refinement of draft recommendations and the development of final recommendations. The study will conclude with a Final Report to be completed by November 2024.

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II. INTRODUCTION

PROJECT ORIGINS AND OBJECTIVES

Hawaiʻi's agricultural lands are vital to the State's economy, food security, and cultural heritage. Soil classification systems have long been used in Hawaiʻi to identify productive agricultural lands and guide their regulation and protection. However, existing systems have limitations that constrain their effectiveness for modern agricultural land management.

To address this issue, Act 189 of the 2022 Hawaiʻi State Legislature directed the Office of Planning and Sustainable Development (OPSD) to undertake a study of the Land Study Bureau's Overall (Master) Productivity Rating system and other soil classification systems used to regulate agricultural lands across Hawaiʻi. The goal of the study is to evaluate these systems and develop recommendations with consideration of their role in protecting the State's agricultural land resources.

The study is being conducted by Supersistence LLC with support from a contractor team including G70, Plasch Econ Pacific, Stantec, and Dr. Adhann Iwashita, with guidance from OPSD and a Steering Committee comprised of representatives from the Department of Agriculture, the University of Hawaiʻi College of Tropical Agriculture and Human Resources, and the Land Use Commission.

The study has four key objectives:

1) To assess the strengths and weaknesses of the LSB and other soil classification systems, including how they are updated to reflect changing conditions.

2) To understand how decision-makers and stakeholders use the current classification system.

3) To identify and learn from best management practices in other jurisdictions that use soil classifications systems to guide their agricultural land regulation.

4) To develop recommendations on soil classification systems and their role in agricultural land use regulation.

The study objectives were achieved through the following activities:

- Conducting a thorough evaluation of the merits and limitations of the soil classification systems used in Hawaiʻi, including their ability to incorporate changes in conditions. This involved reviewing existing systems, overlaying relevant maps, developing assessment criteria, and analyzing system strengths and weaknesses.
- Investigating how stakeholders currently utilize the soil classification systems through engagement with the Steering Committee, stakeholder consultations, and outreach activities to gather input and feedback.
- Identifying and analyzing best management practices from other jurisdictions using soil classification systems for agricultural land regulation. This will be completed in Phase II and involves researching policies, evaluating regulatory schemes from at least three jurisdictions, and identifying effective approaches for enhancing agricultural land regulation in Hawaiʻi.
- Developing recommendations for maintaining, improving, or replacing soil classification systems with consideration of their role in agricultural land use regulation based on the assessment and analysis. This will include crafting initial recommendations, compiling stakeholder feedback, and developing final recommendations incorporating stakeholder input, all presented in a Recommendations Matrix.

The ultimate goal is to provide actionable guidance to strengthen the use of soil classification systems in regulating Hawaiʻi's agricultural lands. Findings aim to support a robust agricultural sector and judicious stewardship of the State's limited productive agricultural land resources.

PURPOSE AND SCOPE OF INTERIM REPORT

This Interim Report provides updates on Phase I activities of the Soil Systems Study (June-December 2023). The report includes preliminary findings from soil systems research and evaluations, a compilation of soil system references in State and county regulations, and a collection and preliminary analysis of stakeholder comments from initial consultations.

APPROACH TO STUDY

The overall strategy for the study leverages the contractor team's collective expertise in soil survey and classification systems, agricultural land use policy and regulation, agricultural economics, agronomy, soil science, and stakeholder outreach through a two-phase approach with a strong emphasis on stakeholder engagement.

Phase I focuses on research and initial outreach, consisting of a) soil classification systems research, soil classification systems criteria development and analysis, mapping, best practice research in other jurisdictions, and compilation of State and county regulations, and b) stakeholder outreach via focus groups, community meetings, and a digital forum to gather stakeholder comments and perspectives. Phase I concludes with this Interim Report to the legislature for the 2024 session.

Phase II will center on generating and refining recommendations, including 1) developing recommendations based on Phase I research and 2) stakeholder consultation to refine recommendations. Phase II will conclude with a Final Report to the Legislature for the 2025 session.

ACCOMPLISHMENTS

From July through November 2023, Supersistence and the contractor team, in consultation with OPSD, completed the following tasks and subtasks under Phase I of the Study Approach:

<u>Reviewed Existing Systems</u>

A review of key systems used to classify and regulate agricultural lands in Hawaiʻi was conducted. The goal of the review was to understand the origins, methods, and limitations of each system as a foundation for the broader study. Four primary systems were examined: Land Study Bureau (LSB), Agricultural Lands of Importance to the State of Hawaiʻi (ALISH), Land Evaluation and Site Assessment (LESA), and the USDA-NRCS Soil Survey Geographic (SSURGO) Database. For each of these four systems, the review provided background information and history of the system, explained the methodology and components, described the mapping approach and geographic extent, compiled prior relevant studies and reports, and evaluated strengths, limitations, and opportunities to enhance the system's effectiveness for agricultural land regulation. Section III of the report elaborates on this review.

<u>Developed Assessment Criteria and Compared Soil Classification Systems</u>

The criteria used to evaluate land classification systems were developed through analysis of expert presentations, project documents, and input from the project team, OPSD, and the Steering Committee. This process identified key factors that were refined into a final set of assessment criteria. The final list includes eight key factors: 1) Accuracy in identifying quality agricultural land, 2) Adaptability to changing conditions and crop production, 3) Transparency, understandability, and documentation, 4) Incorporation of non-soil factors, 5) Geographic coverage, 6) Productivity & Agricultural Value, 7) Irrigation Infrastructure, 8) Cultural & Indigenous Considerations.

Each system was evaluated based on the criteria to identify strengths and identify potential areas for enhancement. These criteria and system comparisons are summarized in Section III, Criteria, below. The full comparison criteria and comparison rubric tables are in Appendix A.

<u>Completed Overlay Mapping</u>

Utilizing available geographic information systems (GIS) data, a web map was created to present soil classifications LSB, ALISH, and LESA; Important Agricultural Lands (IAL) designations; and agricultural land use assessments crop distribution information from the Statewide Agricultural Land Use Baseline (SALUB) 2020 Update. The overlay map allows users to visually explore the categories within each classification system, along with crop production data. The objective of the overlay map was to enable stakeholder exploration of the differences and overlaps among these systems. A summary and screenshot of the overlay map can be found in Section III, Summary of Overlay Mapping. The interactive overlay map can be found on the project website, which can be found at https://storymaps.arcgis.com/stories/aceb7c1d500e4cfe9eaf57274c0db123.

Initiated Best Practices Research

Working in collaboration with the OPSD, the Steering Committee, and external groups such as the American Farmland Trust, Supersistence has begun an initial review across multiple jurisdictions, which will be followed by an in-depth analysis of three selected jurisdictions. The analysis will focus on these jurisdictions' best practices in soil classification systems for agricultural land regulation. The goal of the research on best practices aims to broaden the review scope, enhancing understanding of diverse soil classification efforts and associated challenges toward the ultimate goal of formulating robust and effective recommendations for the State of Hawaiʻi. A summary review of best practices will be completed in Phase II of the study. Section IV summarizes work to date and next steps of the research process.

Compiled Regulations

A list of State and county laws, ordinances, and administrative rules in Hawaiʻi that cite soil classification systems for regulating land use and development permitting was compiled. The compilation includes the regulations themselves and also pinpoints specific sections or subsections that reference or utilize these systems. The goal of this task was to provide an understanding of the broader impact of soil classification on community land use and development and regulatory changes that might be needed should changes be recommended. Regulations were also used to prompt discussion in county-based meetings. A summary of the methodology, findings, challenges and limitations, and outcomes can be found in Section VI, and a table of soil system references in State and county codes and regulations can be found in Appendix F.

Completed Community Outreach

A multi-level community engagement process to share information, gather input, and summarize recommendations was conducted. Details of the outreach meetings and stakeholder feedback, including results of the survey poll, can be found in Section V. The engagement process also included the preparation of a Community Outreach Strategy, compilation of a list of diverse stakeholders, development of project presentation and slides, and the following outreach activities:

- Creation of Project Website

  A dedicated project website has been developed to function as a central hub for project-related content, encompassing the project's scope, methodology, findings, polls, and other pertinent information. Presently, the website offers an overview of the project, a concise history of agriculture and land use planning in Hawaiʻi, summaries and maps outlining various soil classification systems (SSURGO, LSB, ALISH, and LESA), overlay maps of the soil classification systems integrated other agricultural land layers, and links to the interactive platform for website visitors to engage in the initial Polis poll conversation (see "Developed Survey Poll" below). It was designed as an ArcGIS StoryMap to allow for the presentation of mapping products and other project data. The website was shared with all meeting invitees, was highlighted during Focus Group and County Group meetings, was posted to the OPSD website, and was sent to all recipients of the OPSD newsletter.

- Development of Survey Poll

  A Polis Survey Poll was created to assess stakeholder views of soil classification systems in Hawaiʻi. The platform allows participants to submit short text comments which are then displayed for others to vote on. The system collects and examines data in real time, and enabled participants to view statements and areas of agreement and disagreement among all perspectives. A summary of preliminary findings from the Polis poll can be found in Section V, Overview of Stakeholder Feedback, and stakeholder statements can be found in Appendix D and E. Access to the Polis survey will remain open on the project website, and at the conclusion of the process, a summary of all survey results will be provided.

- Facilitation of Focus Group Meetings

  Three focus group meetings were held in virtual format in October. A total of 152 were invited, and 61 people attended the sessions (a 40% attendance rate). The purpose of these meetings was to understand how current soil systems are used and how they can be improved, solicit information on the strength and weaknesses of the various soil systems, and learn of potential different approaches to using soil systems in agricultural land use regulation. The focus group meetings were held with a) individuals with technical-legal expertise (e.g., LUC, Land Use Research Foundation [LURF], State/private planners, land use lawyers, etc.); b) agricultural and land use stakeholders (e.g., HDOA, Hawaiʻi Farm Bureau, Hawaiʻi Farmers Union, CTAHR, Hawaiʻi Land Trust [HILT], etc.); and c) other impacted groups and other stakeholders identified in earlier focus groups (energy, additional developers, large landowners, etc.).

  The same core information was presented at each meeting and was recorded; excerpts from the recorded presentation, along with slides, will be made available on the project website. Following the presentation and Question & Answer periods, participants were invited into breakout groups to engage participants in deeper and more focused conversations regarding soil classification systems and agricultural land use in Hawaiʻi.

- Facilitation of County Meetings

  Three county-focused meetings were also held in virtual format in October, with a total of 213 invited and 34 people attending the sessions (a 16% attendance rate). Along with elected officials, the county focus group meetings were held with county planners and other appropriate stakeholders including Soil and Water Conservation Districts, select farm and ranch entities, community groups, and farm organization leadership. The purpose and structure of these meetings were similar to the focus group meetings; however, a short list of county laws, ordinances, and administrative rules citing soil classification systems for regulating land use and development permitting was compiled and presented at these meetings.

- Summary and Analysis of Initial Stakeholder Comments

  A summary and analysis of key takeaways from the initial outreach meetings, including survey results, was produced for further evaluation by the project team, OPSD, and the Steering Committee. This summary is available in Section V of this report.

  The Steering Committee (SC) is a group composed of representatives from OPSD, State of Hawaiʻi Department of Agriculture (HDOA), College of Tropical Agriculture and Human Resources (CTAHR), and the State of Hawaiʻi Land Use Commission (LUC). During the initial SC meeting (August 2023), the Contractor team was introduced, project goals were articulated, the proposed Work Plan was reviewed, and SC perspectives on project direction were gathered. This meeting was followed up with in-depth discussions with individual SC members and others to gather further information on soil classification system use, history, mapping, and alternate jurisdiction areas to ensure alignment with stakeholder needs and study objectives. A second SC meeting (December 2023) allowed for initial comment on the Draft Interim Report prior to submission to the Legislature.

  Two progress meetings with OPSD (September and October, 2023) functioned as an opportunity for project updates, including concerted review of completed and pending Phase I sub-tasks and on stakeholder outreach activities conducted and to be conducted. Meetings also provided opportunities for discussion of insights garnered from stakeholder interactions and suggestions on directions forward.

III. Evaluation of Existing Soil Classification Systems

Overview

In the mid-20th century and onwards, land and soil classification systems were developed to classify and map the productive potential of agricultural lands across the islands, evaluating factors like soil properties, slope, drainage, climate and crop suitability to categorize lands for agricultural productivity. The resulting maps and data have served as important inputs for land use regulation and policymaking aimed at preserving productive agricultural lands and guiding development.

However, in the context of contemporary land use needs and modern soil science, concerns have been raised about the limitations of these systems. Some feel the frameworks are outdated, with data reflecting conditions from decades past that may no longer be accurate. A focus on inherent soil properties is seen by some as neglecting factors impacting productivity such as soil health and management related ecosystem service outcomes. Others felt the classifications were oriented towards large-scale plantation agriculture which differs from most of today's smaller diversified operations. Questions remain about how suitable these systems are for current agricultural land planning and regulation.

What follows provides a focused review of the four major existing soil and agricultural land classification systems used in Hawaiʻi: Land Study Bureau (LSB), Agricultural Lands of Importance to the State of Hawaiʻi (ALISH), Land Evaluation and Site Assessment (LESA), and USDA-NRCS Soil Survey Geographical Database (SSURGO). This review thus aims to clearly outline the capabilities and constraints of current soil data and frameworks to inform forthcoming evaluation of alternative approaches. For each system, history, methodology, mapping approach, prior studies, strengths, limitations, and opportunities for improvement are outlined. Information about each system was gathered via a literature review of documents related to United States and Hawaiʻi-based soil studies and soil classification work from a combination of sources, including archival documents, official government reports, books, peer-reviewed academic articles, and system datasets. A listing of Selected References is provided at the end of this report. The Strengths and Limitations and Opportunities for Improvement sections for each soil system draw largely from past studies and reports, however may also include interpretations based on the review of those documents. To the extent possible, these sections include reviews of comparable benchmarks for each system; however, they are not meant to perform a standardized comparative analysis. Precisely because these sections rely on published documents, they include the strengths, weaknesses, and opportunities most salient in the texts, as well as those that emerge from analysis of the specific historical context, methodology, and mapping approach of that system.

Ultimately, the goal is to identify the optimal approaches for classification and agricultural land use regulation in a way that combines flexibility and foresight. This approach is essential in creating robust land use policies that fulfill current needs while also preparing for and mitigating future uncertainties.

Land Study Bureau (LSB)

Background and History

In the mid-20th century, Hawaiʻi's economy was heavily dependent on agriculture. Sugar and pineapple were major industries, and with the diversifying economy and increasing urbanization, there was a need to ensure the continued productivity of sugar and pineapple lands and the preservation of agricultural lands for the future. The legislature recognized the need for a dedicated agency to gather, analyze, and publish information about agricultural land in the State.

In 1957, the Territorial Legislature (Act 35) created the Land Study Bureau (LSB) to provide detailed agricultural land classification data.

The mission of the LSB was twofold: to provide immediate information through generalized land classifications, and to conduct long-range, detailed land classifications, including economic and crop capability ratings. These classifications would form the basis for the General Plan for the State of Hawaiʻi and the State zoning law, which reflected the need to allocate land for various purposes, including agriculture.

At the heart of the LSB's work was the assessment of agricultural land capabilities. LSB's Overall (Master) Productivity Rating system classified soils into five levels (A, B, C, D, and E) based on their overall productivity for agricultural purposes. This system aimed to identify and categorize lands suitable for farming and distinguish between lands with high and low agricultural potential.

LSB's early work informed the establishment of the State Land Use Districts (Harland Bartholomew & Associates, 1963). The Land Use Commission used the agricultural productivity ratings developed by the LSB to guide their decisions regarding land use and district boundary amendments. This reflected the recognition of the importance of preserving and promoting agriculture in the State's economy and culture.

After major classifications were complete, funding for LSB was cut and LSB was discontinued in 1974.

Methodology and Components

The LSB land classification system rates the productivity potential of lands using a methodology that combines measurements and ratings of multiple factors. Lands were first classified into Land Types based on similarities in soil properties, climate, topography, and other characteristics affecting agricultural use.

Each Land Type was then given an Overall (Master) Productivity Rating to delineate general productive capacity for agricultural use (A-E). To create and vet the Overall (Master) Productivity Rating, two independent methods were utilized: the Selected Crop Productivity Ratings and application of a Modified Storie Rating Index (MSRI). This system aimed to ensure that the Overall (Master) Productivity Rating assessed the productivity capacity of the land and not the skill of management.

The Selected Crop Productivity Ratings rated lands (on a scale of lowercase a-e) for potential productivity of seven major crops and uses: pineapple, sugarcane, vegetables, orchard fruits, forage, grazing, and forestry. The initial yield specifications for the Selected Crop Productivity Ratings were developed using input from specialists at the University of Hawaiʻi's Cooperative Extension Service and Hawaiʻi Agricultural Experiment Station, as well as knowledgeable individuals from plantations, ranches, and farms across the state. Their expertise and experience with crop yields under Hawaiʻi's growing conditions were critical in establishing reasonable yield estimates for the rating system's crop productivity criteria. These ratings were based on estimated yields using prevailing cultural practices. Using the Selected Crop Productivity Rating method, every Land Type was assessed based on the seven different uses and the results of these ratings were then averaged to determine an Overall Productivity Rating (on a scale of A-E) of the land's productive potential.

The MSRI built upon the original Storie Index (SI), developed by Berkeley researcher R. Earl Storie in 1933. The SI evaluated soil potential by considering factors like soil profile, surface texture, slope, and site conditions. Storie's method multiplied percentage values assigned to four factors: A (soil profile), B (texture of the surface soil), C (slope of the land), and X (other soil conditions). The percentage values for the most favorable or ideal conditions with respect to each factor are rated at 100 percent. The ratings for each factor are then multiplied to obtain the SI rating of the soil.

This pioneering effort was iterated on by Storie for decades, and the 1937 version was modified by the LSB to add an additional factor ("Y") for rainfall, with irrigated plots assigned a rating of 100%, signifying their moisture needs are fully met. This alteration, termed the MSRI, is represented by the equation: MSRI = A x B x C x X x Y, where:

A = % rating for the soil profile

B = % rating for soil surface texture

C = % rating for the slope of the land

X = % rating for site conditions (salinity, winds, erosion, etc.)

Y = % rating for rainfall (or irrigation)

While outputs were made for both irrigated and non-irrigated conditions, in the final index irrigated plots received a rainfall factor rating of 100% as the moisture requirements were adequately met (Land Study Bureau, 1972). The percentage outcome of the MSRI was then translated into an Overall Productivity Rating on a scale of A-E.

The Land Suitability Bureau's Overall (Master) Productivity Rating evaluates each Land Type's general capacity for agricultural use. The LSB used the two independent methods, Selected Crop Productivity Rating and the Modified Storie Rating Index (MSRI) to establish and validate this overall rating. This allows comparison between Land Types for agricultural use. Together, these ratings established a very robust system to evaluate land resources.

This final Overall (Master) Productivity Rating, used in regulation and available in a statewide geographic information system (GIS) layer, represents the land's overall potential for agricultural production based on considering its soil, climate, topographic limitations, and productive potential. The LSB's Overall Productivity Rating is occasionally also termed the LSB "detailed land classification," "productivity rating," "master productivity rating," or "classification."

Mapping Approach and Extent

LSB conducted detailed land classification mapping for agricultural productivity across the main Hawaiian islands in the 1960s and early 1970s. Mapping was done for Hawaiʻi (1965), Maui (1967), Kauaʻi (1967), Lānaʻi (1967), Molokaʻi (1968), and Oʻahu (1972). The mapping covered the entire State at a scale of 1:24,000 using USGS topographic quadrangles.

The basic mapping units delineated were Land Types - homogeneous units defined by similarities in soil properties, topography, climate and other factors affecting agricultural use. The classification and delineation of Land Types was done through field surveys, aerial photo analysis, consultation with experts, and incorporation of soil surveys, climate data and other relevant information.

Urban areas were excluded from the land classification maps. The focus was evaluating and rating the islands' agricultural land resources. Lands were rated for overall productivity potential as well as specific major crops grown in Hawaiʻi.

The original land classification maps were produced manually. In 1998, the maps were digitized by the Office of Planning to create digital spatial data. The current geospatial layer maintained by the State represents a high-resolution inventory of agricultural lands across Hawaiʻi based on a multilayered analysis of productivity factors. The State GIS did not digitize any LSB areas rated 'U' for urban, additionally all lands categorized within the State Land Use Urban District were removed from the layer using the 1995 Land Use District Boundary data. The LSB was disbanded in 1974 and no update has been made to the original 1960s-1970s rating efforts.

Strengths and Limitations

Strengths

The LSB system has several notable strengths, including its detailed methodology, significant data collection, and regulatory system integration. The evaluation approach used by LSB incorporated measurements of various soil properties, topography, drainage, climate, and other factors to assess land productivity potential. This level of detail allowed for objective, multifaceted analysis of land resources, answering an important need at a time when agricultural productivity was an economic priority in Hawaiʻi. Additionally, LSB demonstrated flexibility by customizing the SI method to suit island conditions by adding water availability (Factor "Y" for rainfall or irrigation) as a factor. The estimated crop yields for pineapple, sugarcane, vegetables, forage, grazing, orchard crops, and forestry (timber) are only found in the LSB. Despite being outdated with respect to crop land use and modern irrigation management (i.e., drip vs furrow irrigation), LSB's detailed data tables are used by agricultural planners and regulators to determine potential productivity for the LSB's Land Type.

Limitations

A major weakness in the LSB system is that none of the input (factors) or output (Overall) data has been updated since it was originally produced in the 1960s and 1970s. Unlike SSURGO's robust digital database related to spatial map units, the multiple inputs for the Overall (Master) Productivity Rating, such as the Selected Crop Productivity Rating for seven crops and uses and the multiple MSRI factors, have not been digitized and related to a geospatial layer of LSB Land Types. As noted above, these MSRI and yield data, while outdated, are still utilized by agricultural specialists. Static, hardcopy maps lack responsiveness to evolving conditions that could be provided by a digital model of the LSB's Overall (Master) Productivity Rating and underlying calculations. Furthermore, it is unclear who would resource and oversee such updates.

Multiplicative productivity rating systems, such as SI and MSRI, have distinct limitations compared to additive systems, as highlighted by Huddleston (1984). One significant drawback is that only a limited number of factors can be effectively incorporated. To illustrate, multiplying five factors each with a 95% rating gives a rating of 77%. This further reduces to 60% when ten factors are incorporated, each at a 95% rating. Thus the capacity of multiplicative systems is generally capped at around four or five factors; any more and the ratings dip so low that differentiating slight productivity variations becomes untenable.

Moreover, one factor in a multiplicative system can exert undue influence on the final rating. The MSRI's addition of a rainfall factor, where land with irrigation received a 100% rating, demonstrates how a single factor can significantly impact the overall score. For example, areas in West Molokaʻi (Land Type 38), have an Overall (Master) Productivity Rating of D. These lands were used for non-irrigated pineapple production by Libby McNeill Libby and later by Dole's Hawaiian Pineapple Company. The same soils irrigated, say for sugarcane production which often relied on irrigation, would have received an A rating. In this way the LSB's Overall (Master) Productivity Rating is shaped by historical irrigation extent and previous crop selection. This results in some current user confusion, where drastically different soil ratings occurred on either side of a fence line or even within a modern parcel boundary with no visible reason for the difference. Without consulting the LSB's printed reports' data tables, or having a deep knowledge of previous land uses and irrigation extents, a high rated field (say used for irrigated sugarcane) may abut a low rated one (say used for non-irrigated pineapple). Furthermore, the extent of irrigation has changed significantly since the LSB developed its ratings, which means that ratings may significantly under and/or overestimate potential productive capacity. As few users, and none of the regulations, consult the LSB' printed tables books for deeper insights, the Overall (Master) Productivity Rating leads to not just confusion by current users seeking to understand their fields, but also means that historical crop selection and irrigation extents are shaping current agricultural productivity assessments and land use regulatory decisions.

Opportunities for Improvement

The utility of LSB ratings can be greatly enhanced with the integration of information on the current irrigation extent of lands, updating information on irrigation from the 1960s and 1970s when studies were conducted. This could include details like average water volumes with enough data to determine potential gallons per acre per day, as well as the quality of irrigation water sources–for instance, surface, groundwater, salinity, reclaimed water, Hawaiʻi Department of Health (HDOH) rating, and mixed water information.

As the MRSI rainfall factor considers both precipitation and irrigation extent, changes in climate and irrigation infrastructure underscores the need for periodic reassessment and adjustments in such rating systems to ensure they remain relevant and accurate.

As with many soil and land classification systems, resurveying lands, incorporating contemporary climate data, and harnessing the latest technological progress in mapping and data analysis can optimize the system. Regular updates would ensure that the system remains pertinent to land-use needs, and support decision-making in land-use planning and regulatory systems.

In 2005, the University of California (UC) introduced an advanced version of the 1978 SI, leveraging the National Soil Information System (NASIS) to curtail the subjectivity and inconsistencies inherent to the traditional hand-generated Storie ratings. NASIS, the NRCS's database for generating SSURGO data products, was used to digitally model the SI criteria. By relating soil properties embedded in the SSURGO data with a modification of the 1978 SI to reduce subjectivity, the UC's revision enables rapid generation of SI outputs that correlate well with hand-generated Storie ratings. The digitization and elimination of subjective scoring would reduce variability and time required for resampling and updating of ratings.

Prior Reports and Studies

The LSB's primary agricultural land rating reports are the Detailed Land Classifications by island:

- Detailed land classification: Island of Hawaiʻi. Honolulu: Land Study Bureau, University of Hawaiʻi, Nov. 1965.

- Detailed land classification - Island of Kauaʻi. Honolulu: University of Hawaiʻi, Land Study Bureau, Dec. 1967.
- Detailed land classification - Island of Lānaʻi. Honolulu: University of Hawaiʻi, Land Study Bureau, May 1967.
- Detailed land classification: Island of Maui. Honolulu: Land Study Bureau, University of Hawaiʻi, May 1967.
- Detailed land classification: Island of Molokaʻi. Honolulu: Land Study Bureau, University of Hawaiʻi, June 1968.
- Detailed land classification: Island of Oʻahu. Honolulu: Land Study Bureau, University of Hawaiʻi, Jan. 1963 and Dec. 1972.

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

Background and History

The Rural Development Act of 1972 directed the United States Secretary of Agriculture to carry out a program to study soil erosion, land use change, and related natural resource concern issues, and report on findings every five years (Schnepf, 2008). In 1975, the Soil Conservation Service (SCS) issued Land Inventory and Monitoring (LIM) Memorandum-3 which defined prime and unique farmland criteria and established other categories of important farmlands that could be defined by state and local governments (Berg, 1979). The LIM criteria drew upon physical and chemical soil characteristics and land use to classify lands based on their suitability for agricultural production. The memorandum and SCS's related Important Farmland mapping project initiated a program of county and state mapping efforts.

After the SCS adoption of the prime and unique criteria around 100 counties nationwide, including Honolulu and Maui, were selected to be classified using the system. Hawaiʻi became an early participant to ensure the inventory's relevance to the State's unique agricultural landscape and needs, and pursued statewide mapping through a contract with a planning firm that was producing an agricultural master plan for the State.

An ad hoc committee, with members from diverse entities like the Soil Conservation Service, the University of Hawaiʻi College of Tropical Agriculture and Human Resources, and various State of Hawaiʻi Departments, was formed. Led by the Hawaiʻi Department of Agriculture, the committee collaborated to develop the classification system specifically tailored to Hawaiʻi's agricultural conditions.

This Agricultural Lands of Importance to the State of Hawaiʻi (ALISH) system was designed to classify agricultural lands in Hawaiʻi based on their potential suitability for various types of crop production, taking into account factors such as soil quality, growing season, temperature, humidity, sunlight, and other criteria relevant to Hawaiʻi's agricultural landscape.

In early 1977, the State Board of Agriculture formally adopted the ALISH system, which classified lands of agricultural importance into three categories: Prime Agricultural Land, Unique Agricultural Land, and Other Important Agricultural Lands.

Prime Agricultural Lands offer optimal conditions for sustained high crop yields with minimal energy and financial input; Unique Agricultural Lands are non-Prime lands dedicated to the production of specific high-value food crops due to its unique conditions; and Other Important Agricultural Lands either support the State's agricultural economy or hold potential for future agricultural endeavors. Lands not considered for classification in the ALISH system were developed urban lands, public use lands, forest reserves, steep slopes, and most military lands.

The ALISH report notes that the classifications should "provide decision makers with an awareness of the long-term implications of various land use options for agricultural production" (Baker, 1979). A few years later, the 1982 State Agricultural Plan underscored the continued need for cohesive strategies in land-use decisions. The plan stressed the need to preserve Prime agricultural lands, as land use redistricting was shrinking their availability for agriculture, jeopardizing future self-sufficiency and export potential. In light of this, the plan included a recommendation to replace the LSB's "A" and "B" classifications with the ALISH classes (Duncan, 1987). While this recommendation was not adopted, in 2005 ALISH was included as a criterion for identifying Important Agricultural Lands (IAL), and references to ALISH and LSB can be found in Hawaiʻi's State and County land use regulations and rules.

Methodology and Components

The State of Hawaiʻi's three agricultural land classes were originally created to support the national prime farmland inventory by the Soil Conservation Service. The ALISH classification was adapted to local agricultural practices with these categories:

TABLE 1. ALISH & SCS CLASSIFICATION SYSTEM TERMINOLOGY

ALISH Classification 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 goal was establishing a localized classification aligned with national standards for prime agricultural lands. The classification system and criteria were developed by an ad hoc committee with representatives from multiple State and federal agencies, led by the State Department of Agriculture. The criteria for Prime Agricultural Land align with the national soil-focused criteria used by the Soil Conservation Service (now NRCS) and focus on soil properties like moisture supply, drainage, texture, and organic matter content (see below for exact criteria). The criteria for Unique and Other Important Agricultural Lands consider additional factors like specific high-value crops, seasonal wetness, erodibility, flooding risk, and more. The cooperative development of tailored criteria, involving soil experts, economists, foresters, and planners, allowed the system to meet both State and federal objectives.

The SCS has published methodology for classifying prime farmland soils based on soil taxonomy units, soil properties, growing season length, and other factors. With respect to the SCS approach adopted by the ALISH committee, Prime Agricultural Land met the following criteria:

1. The soils have a dependable and adequate moisture supply and good water storage capacity.
2. The soils have a mean annual temperature and growing season suitable for growing the prevailing crops.
3. The soils are neither too acid nor too alkaline for vigorous plant growth.
4. The water table is either lacking or so deep that it does not adversely affect plant growth.
5. The soils are not salty or otherwise limiting in the root zone.
6. The soils are not flooded frequently during the growing season.
7. The soils do not have a serious erosion hazard.
8. The soils transmit water readily and without drainage problems.
9. The soils are not so stony in the surface layer as to cause difficulty in cultivating with large equipment.
10. The soils have stability characteristics which permit the use of large equipment.

Unique Agricultural Land refers to lands distinct from Prime Agricultural Land, specifically cultivated for certain high-value food crops due to its unique combination of factors like soil quality, climate, sunlight, elevation, proximity to markets, and other conditions. Such crops included coffee, taro, rice, watercress, and non-irrigated pineapple. However, if lands used to cultivate a unique high-value crop met the criteria for Prime Agricultural Land, those lands were classified as Prime.

Other Important Agricultural Land is land crucial for the production of various crops but doesn't fit into Prime or Unique categories. This classification often involves lands with challenges like seasonal wetness, erosion, limited rooting zones, and others that don't meet the Prime or Unique criteria. However, with additional efforts like fertilization, drainage improvements, and erosion control, these lands could produce reasonable crop yields. The lands qualified as Other Important Agricultural Land are based on specific criteria, such as having slopes less than 20% suitable for crops or slopes less than 35% suitable for grazing. Another qualifying factor is the presence of thin soils atop lava with favorable growing conditions.

In general, criteria used for classification in the ALISH system include soil quality, moisture supply, temperature suitability, pH levels, water table depth, salinity, erosion hazards, drainage properties, stoniness, and stability. Suitability of a soil for a particular category is determined by meeting specific criteria for that category. Factors and criteria were not explicitly weighted in the ALISH system.

Mapping Approach and Extent

The ALISH system considered lands across all islands and included land that may or may not have been in agricultural use. However, the criteria applied resulted in an output focused mostly on lands where production was already present. The three primary classifications of ALISH lands were plotted on standard United States Geological Survey quadrangle maps. These maps, with a 1:24,000 scale, encompassed the whole of Hawaiʻi (Baker, 1979). The ALISH study was a one-off effort that delineated important agricultural lands and has not been updated or reproduced subsequently.

Certain categories of land are excluded from consideration for classification under ALISH. These exclusions include urban areas greater than 10 acres; enclosed bodies of water, both natural and man-made, of more than 10 acres; forest reserves; parks, historic sites, and other public use lands; and lands with slopes exceeding 35% grade. In addition, military installations are generally excluded from classification, aside from undeveloped areas on military installations over 10 acres (Baker, 1979).

Strengths and Limitations

Strengths

ALISH provides a consistent, objective methodology for evaluating agricultural land quality that establishes a framework for prioritizing the protection of the best agricultural lands, including for specialty crops that have unique value to Hawaiʻi. By integrating detailed soil data with climate and crop suitability factors, the system is able to help identify lands that are often excluded or poorly rated by other systems. For example, portions of the lands in the South Kona coffee belt, categorized as class D in the LSB Overall (Master) Productivity Rating system, fall within the ALISH Other Important Agricultural Lands class. Permissible uses within LSB class D agricultural lands are not governed by HRS §205-4.5. ALISH however is included as a standard and criteria for the identification of important agricultural lands in HRS §205-44, meaning these lands could be included in an IAL petition. This demonstrates how disparity between classification system outcomes and regulatory application can lead to vastly different use and protection of a singular land parcel.

Limitations

The ALISH system's data has not been updated since the original classification over 40 years ago in the late 1970s, potentially making it outdated and unreflective of current conditions. Two criteria for the Prime classification consider limitations framed by the use of large cultivation equipment, a practice that contrasts with the small-scale, diversified nature of most farms in the State. Criteria also do not account for new crops, technologies, farming methods, or the actual agricultural productivity of the lands; and, because the classifications were based predominantly on soil surveys, they may not encompass the full suitability range for different crops. The system is mainly centered on biophysical attributes of land, neglecting essential socioeconomic and infrastructure factors.

Additionally, its focus is on inherent soil characteristics for crop production rather than dynamic qualities of soil health. Factors like soil biodiversity, structure, and nutrient cycling were not considered. The data relies on standard soil surveys, which provide limited information on key indicators like organic matter levels, microbial biomass, and biology. ALISH emphasizes soils for commodity crop production and does not address biological function beyond basic fertility and drainage. As a result, ALISH is a static classification system not designed to assess changes in quality over time.

Opportunities for Improvement

The ALISH report (Baker, 1979) states that "classification of agriculturally important lands does not in itself constitute a designation of any area to a specific land use." Subsequently, however, the Important Agricultural Lands Act 183 of 2005 incorporated ALISH into what is now Hawaiʻi Revised Statutes §205-44 *Standards and criteria for the identification of important agricultural lands*.

Furthermore, the ALISH report noted that new "knowledge and changes in land use will necessitate the periodic review and revision of the classification system and lands identified in the various classes." Despite this, no revision or updates have been made. Thus updating the ALISH system has direct value to ongoing efforts to protect agricultural lands. Several areas present potential for improvement.

It is essential to ensure that the maps are reflective of present realities. The ALISH maps need to be revised to reflect urbanization and to illustrate the present and potential conditions of crops, as highlighted by Yamamoto (1999). The Statewide Agricultural Land Use Baseline (SALUB) (2015) and Update (2020) Project, SALUB, produced for the Hawaiʻi Department of Agriculture by the University of Hawaiʻi at Hilo's Spatial Data Analysis and Visualization Lab, used a combination of satellite imagery, geospatial datasets, and statewide farm interviews to produce a GIS layer that identified and mapped commercially grown agricultural crops across the State. SALUB and Update's use of satellite imagery and ground truthing offers a method to update agricultural land use mapping and identify currently cultivated areas. Revised mapping with the incorporation of new crops would ideally also trigger a review of the extent of 'Unique' and 'Other' classification areas. These categories, however, also require revision.

The classification process warrants refining. The 'Unique' category in ALISH doesn't have a clear, standardized criterion, which Yamamoto (1999) noted makes it challenging for consistent replication. This category, alongside the 'Other' classification, introduces variability, detracting from the system's consistency. Addressing these issues would bring about increased clarity, precision and reproducibility.

Finally, the inclusion of quantitative productivity data can strengthen the ALISH system's robustness. By incorporating quantitative productivity measures and yield data, the rating system can be made more effective and precise. The consideration of socioeconomic factors also warrants attention. For example, expanding the system to include criteria that assess essential elements like water supply, labor trends, and market accessibility would provide a more complete understanding of the agricultural landscape.

Prior Reports and Studies

The primary ALISH reports are:

- Agricultural Lands of Importance to the State of Hawaiʻi (Revised). (1977).
- Baker, H. L. (1979). Agricultural Lands of Importance to the State of Hawaiʻi. Circular – Hawaiʻi University Cooperative Extension Service (USA), 496. https://scholarspace.manoa.hawaii.edu/server/api/core/bitstreams/dc06a8a4-af6f-410a-837d-d6c5393b693d/content
- ALISH GIS Layer Metadata. (n.d.). Retrieved September 2, 2023, from https://gis.hawaiicounty.gov/public/downloads/plhyperlinks/MetadataFiles/ALISH%20(Statewide).pdf

Selected Other Reports referencing ALISH:

- Mark, S. M., & Lucas, R. L. (1982). Development of the Agricultural Sector in Hawaiʻi (p. 40).
- Plasch Econ Pacific, LLC. (2011). Oʻahu Agriculture: Situation, Outlook and Issues. The Department of Planning and Permitting, City and County of Honolulu.

Suryanata, K., & Lowry, K. (2016). Tangled Roots: The Paradox of Important Agricultural Lands in Hawaiʻi. In Food and Power in Hawaiʻi: Visions of Food Democracy (pp. 17–35). University of Hawaiʻi Press. https://doi.org/10.1515/9780824858612-003

LAND EVALUATION AND SITE ASSESSMENT (LESA)

Background and History

The Land Evaluation and Site Assessment (LESA) system was initially developed in response to national concerns about urban sprawl and farmland loss.

A 1975 Potential Cropland Study focused concerns about protecting agricultural lands, creating momentum for nationwide study of agricultural land loss (Schnepf, 2008). In 1978, the United States Secretary of Agriculture commissioned the National Agricultural Lands Study (NALS) to investigate concerns about the conversion of agricultural land to non-agricultural uses. Findings from the study prompted Congress to enact the Farmland Protection Policy Act (FPPA) of 1981, which aimed to reduce unnecessary agricultural land conversion by federal programs. Multiple state and local governments also initiated their own farmland protection efforts, creating a demand for a land and site evaluation tool.

In response, the federal Soil Conservation Service (now NRCS) expanded and revised a land classification system developed in Orange County, New York. Site assessment criteria were added based on information from NALS and the Compact Cities report, reflecting urban sprawl impacts. A pilot project to test the draft Land Evaluation (LE) and Site Assessment (SA) system was conducted in 12 counties across six states. The model LESA system was presented to NRCS staff in 1982, and the first National Agricultural Land Evaluation and Site Assessment Handbook was produced in 1983. LESA gained visibility when it was included in the proposed rule for the FPPA in 1984, requiring federal agencies to use LESA to review the impact of their programs on agricultural land.

Hawaiʻi's rapid economic development meant that similar urbanization and development pressures, and similar concerns about the use and loss of agricultural lands, faced the State. Rapid development had illustrated the ineffectiveness of statewide zoning to protect agriculture. In 1978, Hawaiʻi's State constitution was amended (Article IX, Sec 3) to emphasize the heightened commitment of the State to conserve and protect agricultural lands, promote agricultural self-sufficiency, and ensure the availability of agriculturally suitable lands. The amendment, alongside the new constitutional mandate to identify and protect important agricultural lands, called for a system to objectively rate agricultural land.

Hawaiʻi was the first to adopt LESA for statewide assessment. The LESA Commission, formed in 1983 by Act 273, was charged with developing standards, criteria, and procedures to identify important agricultural lands (IAL), to establish the initial IAL inventory, and develop standards, criteria, and procedures for the redesignation of IAL parcels to urban or to other uses. Following input from public hearings, the Commission also worked to determine standards, criteria, and procedures for the reclassification of other or conservation parcels as IAL. In short, mechanisms to move lands out of a protected status or from one protected status to another.

Act 273 included criteria to frame the identification of important agricultural lands, directing the LESA Commission to consider and build upon existing systems including LSB (1965-1972) and ALISH (1977). Hawaiʻi's LESA system also pulled data from the Soil Conservation Service's (SCS) Soil Potential Index and LSB's Modified Storie Rating Index (MSRI) to gather soil productivity and physical and chemical land characteristic information. As well, it integrated Site Assessment scoring with the Hawaiʻi Natural Resource Information System (HNRIS-GIS), an existing GIS at the University of Hawaiʻi that had been developed for water resources and later expanded to include land use, soils, and vegetation (Chapman, 1996). Hawaiʻi's integration of LESA with GIS was later used as a prototype for other areas who looked to automate their LESA scoring process (Ferguson & Bowen, 1991).

The LESA system developed by the Commission is comprised of two parts. The first part consists of standards, criteria, and procedures to identify "important agricultural lands," and to establish the initial IAL inventory. The second part consists of (a) standards, criteria, and proce-dures to redesignate parcels which had been classified as

"Important Agricultural Lands" to "Urban" or to "Other Uses;" and (b) standards, criteria, and procedures to designate "Other" or "Conservation" lands to "Important Agricultural Lands."

Following its study, the LESA Commission recommended the creation of a new State Land Use Agricultural District, excluding poor agricultural land and placing poor agricultural lands under county control. Unique Lands were also suggested to be included in the new district, with a greater role for the Hawaiʻi Department of Agriculture (HDOA) and the Land Use Commission (LUC) in administration. Legislation was introduced based on these recommendations, but never passed.

Legislative attempts to implement LESA in Hawaiʻi were revisited in the 2000 legislative session but faced challenges from competing interests; a compromise bill was proposed but was never signed into law, leaving the issue unresolved. The stalemate reflects the economic, social, and political tensions that emerged from myriad and sometimes conflicting beliefs about land and land use, including use for tourism, conservation, and/or affordable housing, with agriculture.

Methodology and Components

The Hawaiʻi LESA system contains two main components:

Land Evaluation (LE) - 5 factors related to the physical productivity of agricultural lands based on soil properties:

- Land Capability Classification (LCC via SCS)
- Agricultural Lands of Importance to the State of Hawaiʻi (ALISH)
- Soil Potential Index (via SCS)
- Modified Storie Rating Index (MSRI via LSB)
- Overall (Master) Productivity Rating (via LSB)

Site Assessment (SA) - 10 factors covering the economic, social, policy aspects:

- County plan conformity
- Irrigation availability
- Proximity to urban infrastructure
- On-site farm facilities
- Conformance with State agricultural programs
- Access to agricultural services
- Farm parcel size and layout
- Compatible agricultural land uses
- Adequacy of drainage
- Impacts of non-agricultural nearby land uses

To determine final values, the LE rating and SA scores were calculated individually, and then combined into a final LESA rating.

LE factors were normalized to a 0-100 scale, weighted, and then averaged to produce the LE rating. The Soil Potential Index and MSRI were already in 0-100 format, but the LCC, ALISH, and LSB Overall (Master) Productivity Rating required conversion. For example, LCC was adjusted so that Class I equaled 100; Class II, 87.5; Class III, 75; Class IV, 62.5; Class V, 50; Class VI, 37.5; Class VII, 25; and Class VIII, 12.5. ALISH was adjusted so that Prime equaled 100; Unique, 75; Other Im-portant Lands, 50; and the remaining residual group, 25. For LSB Overall Ratings, a numerical rating of 100 was assigned to "A"; 80 to "B"; 60 to "C"; 40 to "D"; and 20 to land types in the "E" category.

Viewed as more direct measures of productivity, LSB's Overall (Master) Productivity Rating and the Soil Potential Index were each weighted at one and one-half as they were. LCC, ALISH and MSRI were each weighted as one.

The SA score was determined by rating, weighting, and summing the SA factors. A given parcel or area would receive a 1-10 (low to high) rating for each SA factor based on how well it met the factor criteria. Overall each SA factor was assigned a weighting, from 1-15 (low to high), based on their relative importance. The SA factor listing above is in order of that weighting, with County plan conformity weighted at 15 and Impacts of non-agricultural nearby land uses weighted at 1. The SA factors weighted ratings would be summed to produce an SA score.

The 0-100 scale LE rating and SA score are then combined at a 1:1 ratio into an overall LESA rating.

(LE rating + SA score) divided by 2 = LESA rating

This aimed to complement the physical productivity measures of LE with the SA factors capturing other important determinants of agricultural viability.

Mapping Approach and Extent

The LESA identification method is divided into three distinct phases, each led by the LESA Commission:

First, the LESA commission gathered and integrated Land Evaluation (LE) data from five distinct land classification and rating systems, subsequently integrating this data producing LE ratings for each island, except for Niʻihau and Kahoʻolawe. LESA's LE facets, in using inputs from both the SCS and LSB, therefore drew upon both the Territorial soil survey released in 1955 and the later soil surveys released in 1972 and 1973. Second, the Site Assessment (SA) phase collected map information on the ten SA factors from county planning departments, the Land Use Commission, HDOA, SCS, the Federal Emergency Management Agency, and internal GIS work. Finally, LE ratings with the SA scores were then merged, based on the approaches of mainland governmental entities modified for local application . The Commission experimented with several combinations of LE ratings and SA scores and settled on one that best represents agricultural and farming activities in Hawaiʻi: (LE rating + SA score) divided by 2 = LESA rating.

LESA scores were mapped statewide for the major Hawaiian islands. The maps delineated LESA scores, subsequently the polygons were drafted onto 1:24,000 USGS quadrangle maps, then digitized by State Office of Planning staff.

Strengths and Limitations

Strengths

LESA provides a standardized system for numerically rating the agricultural suitability of lands, allowing for consistent evaluation. The system can be applied for various purposes, including assessing the impact of proposed projects on agricultural land, property tax assessment, delineating agricultural districts, zoning decisions, and ranking applications for agricultural conservation programs. LESA is a flexible tool that can be adapted to address local conditions and concerns, making it versatile for different regions and communities.

LESA promotion materials tout that developing a LESA system encourages community members to engage in discussions and planning for multiple use-cases, and can thus aid in planning, helping communities manage growth, ensure food security, achieve agricultural sustainability, and direct farmland preservation programs.

Limitations

Analyses by CTAHR in 1990 and 1991 identified several technical and practical limitations of the LESA system. Vague definitions for some Site Assessment factors made consistent statewide mapping difficult, requiring substitute proxy measures that altered the original intent. The high cost of mapping all Site Assessment factors was problematic given data constraints. Additionally, the system lacked provisions for periodic review and updating to maintain relevance as conditions changed over time. Most critically, core premises around the importance of sugar and pineapple became outdated as those industries declined. These studies highlighted deficiencies that would constrain real-world application and ongoing utility of the LESA framework in Hawaiʻi.

Since its initial development in the 1980s, support and usage of Hawaiʻi's LESA system has steadily declined. Despite early enthusiasm, various legislative proposals in the decades since have failed to implement reforms integrating LESA into land use policy and regulation. LESA does not appear to play a major role guiding land use and development decisions in Hawaiʻi at present. Overall, the current usage and application of Hawaiʻi's LESA system seems limited, only referenced twice in administrative rules (see Appendix F), likely due to the combination of technical deficiencies, outdated premises, and lack of political will to adopt the LESA-based land use evaluation system.

Opportunities for Improvement

While pioneering for its time, various analyses revealed areas needing refinement in the Hawaiʻi LESA system from both a technical and policy perspective. Considering the limitations above, potential ways to improve Hawaiʻi's LESA system include clarifying and simplifying the Site Assessment factors, focusing on the most important/mappable ones; designating a government agency or process for periodic review and updating of the system; incorporating improved spatial data as available (e.g. Census TIGER system); automating parts of the LESA analysis through use of the GIS system; and drawing lessons from more recent agricultural land classification systems and evaluation tools. The suggested improvements could support an enhanced system better aligned with current agricultural conditions and land use information needs.

The LESA Ratings have not been actively used for the past 30 years or so. However, many of the criteria considered through LESA were incorporated into the HRS 205-44 standards, as demonstrated in the following table.

Table 2. IAL and LESA Criteria Comparison

IAL HRS 205-44 Standard	LESA Factor
(1) Land currently used for agricultural production;	ALISH (LE)
(2) Land with soil qualities and growing conditions that support agricultural production of food, fiber, or fuel- and energy-producing crops;	Land Capability Classification (LE); Modified Storie Rating Index (LE); Overall productivity rating (LE)
(3) Land identified under agricultural productivity rating systems, such as the agricultural lands of importance to the State of Hawaiʻi (ALISH) system adopted by the board of agriculture on January 28, 1977;	ALISH (LE)
(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;	ALISH (LE; Unique lands category)
(5) Land with sufficient quantities of water to support viable agricultural production;	Irrigation (SA)
(6) Land whose designation as important agricultural lands is consistent with general, development, and community plans of the county;	County Plan (SA)

(7) Land that contributes to maintaining a critical land mass important to agricultural operating productivity; and	Farm Layout (SA)
(8) Land with or near support infrastructure conducive to agricultural productivity, such as transportation to markets, water, or power.	Farm Facilities (SA); Urban Facilities (SA)

Prior Reports and Studies

Primary reports on Hawaiʻi's LESA system

- Land Evaluation and Site Assessment Commission. (1985). Progress report of the State of Hawaiʻi Land Evaluation and Site Assessment System to the Thirteenth Legislature, State of Hawaiʻi. Legislative Reference Bureau. https://library.lrb.hawaii.gov/cgi-bin/koha/opac-retrieve-file.pl?id=9068b6dd8eb1ac2f6bbd1ae5e3e29ae5
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USDA-NRCS Soil Survey Geographic Database (SSURGO)

Background and History

The development of the soil survey system, including the USDA-NRCS Soil Survey Geographic Database (SSURGO), can be traced back to the early 20th century when the United States government began conducting soil surveys. Soil surveying involved the collaborative efforts of various organizations and individuals, primarily under the oversight of the United States Department of Agriculture (USDA) and via the leadership of the Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), an agency within the USDA.

Surveys were initially done on a county-by-county basis, to acquire knowledge about the distribution and characteristics of soils in various regions. This knowledge was crucial for understanding the suitability of soils for agriculture and other land uses, and to support land-use and natural resource planning and management, especially in the context of agriculture. It also helped farmers and land planners make informed decisions about crop selection, irrigation, and soil management, critical to attempts to maximize agricultural productivity at a time when agriculture functioned as a pillar of the United States economy.

Over the decades, as soil surveys were conducted across the country, the information was compiled and digitized, leading to the creation of the SSURGO database. The database contains both spatial and tabular data, with the spatial data representing the geographic distribution of soil types and the tabular data providing detailed information about each soil type's properties and characteristics. SSURGO represents the most detailed level of soil geographic data available in the United States today. The database contains information that can be used in land-use planning, agricultural management, environmental research, and other applications.

The first comprehensive soil survey of Hawaiʻi was a cooperative effort between the USDA and the University of Hawaiʻi Agricultural Experiment Station. This initial soil survey field work covered the six major islands of the Territory of Hawaiʻi–Oʻahu, Hawaiʻi Island, Kauaʻi, Lānaʻi, Maui, and Molokaʻi–and was completed in 1939. However, due to circumstances related to World War II, the results of this soil survey were written up in 1947-48 and published in 1955 (United States Soil Conservation Service, 1955).

With its unique geology and climate, Hawaiʻi presented specific challenges for soil mapping. The islands' volcanic origins and the State's diverse microclimates meant a wide range of soil types. Areas were sampled and mapped at different intervals, depending on their importance. Detailed surveys were completed using data from traverses at ⅛ - ½ mile intervals; semi-detailed surveys at ¼ to 1 mile intervals; and reconnaissance surveys from 1-10 mile intervals. In areas of less concern, data was compiled from maps, reports, and oral accounts of foresters, ranchers, and other sources not trained as soil surveyors. This survey served as the foundation for understanding the soils of Hawaiʻi at that time.

The second major soil survey for the Hawaiian islands was conducted cooperatively by the Soil Conservation Service and the University of Hawaiʻi Agricultural Experiment Station in the mid-1960s, and released in the early 1970s. Soil scientists studied the landscape, dug soil pits to examine profiles, classified and named the soils, and delineated soil boundaries on aerial photos to create the soil maps. The main units of mapping are soil series (soils with similar profiles) and soil phases (specific varieties within a series). Complexes and associations are used where areas contain intermingled or complex patterns of soils. Laboratory data was collected on soil properties and crop yield data was also reviewed. This was used along with field experience to group the soils into classes for interpretive purposes. The goal was to organize the detailed soil data to make it most useful for various applications like agriculture, forestry, and engineering. In summary, this second survey, released in 1972 for the islands of Kauaʻi, Oʻahu, Maui, Molokaʻi, and Lānaʻi (United States Soil Conservation Service et al., 1972), and in 1973 for Hawaiʻi Island (United States Soil Conservation Service, 1973), involved field study, laboratory analysis, and data organization to characterize, map, and classify the soils for practical land use purposes.

With the evolution of soil science, soil classification systems have changed over time. The system used in the 1955 survey was based on soil genesis, while the 1972-73 surveys adopted the new Soil Taxonomy System, which focuses on quantifiable soil and provides a more uniform classification by a group of scientists. It considers properties like soil depth, moisture, temperature, texture, structure, cation exchange capacity, base saturation, clay mineralogy, organic matter content, and the presence of oxides of iron, aluminum, and salts for soil classification (McCall, 1975).

The statewide surveys and later updates incorporated into SSURGO remain the most extensive resources for soil properties in Hawaiʻi to date.

Methodology and Components

Soil samples from various locations within survey areas are collected and analyzed to determine key soil properties, including soil texture (proportions of sand, silt, and clay), organic matter content, pH, drainage characteristics, cation exchange capacity, and more. Results are used to delineate soil map units, where each map unit represents an area with similar soil characteristics. The boundaries of these units are drawn based on observed changes in soil properties, and are stored in a geographic information system (GIS) for management and further analysis. Aerial and satellite imagery supplement soil survey data, as the images can provide valuable information about land cover, topography, and other factors that influence soil classification. SSURGO soil data are based on the Soil Taxonomy System developed by the USDA, and rely on specific soil properties and their measured values to classify and categorize soils.

SSURGO includes data that rates soils for various land uses, including agriculture, urban and infrastructure planning, conservation and environmental management, and forestry. Within agriculture, assessments can be made regarding the suitability of soils for various crops with consideration of soil drainage, texture, and erosion risk. These tools can help farmers make decisions about crop selection and soil management practices.

A commonly used SSURGO data facet are the Land Capability Classification (LCC) system ratings. The capability classes (I to VIII) are determined based on the severity and number of limitations. Class I soils have the least limitations and are suitable for a wide range of crops, while Class VIII soils have severe limitations that make them unsuitable for commercial production.

The subclasses (e, w, s, and c) are determined based on the primary limitation for agricultural use. Subclass e represents soils with limitations due to the risk of erosion, subclass w represents soils with water-related limitations, subclass s represents soils with limitations due to shallow, droughty, or stony conditions, and subclass c represents soils with limitations due to climatic conditions.

Land capability classes and subclasses for both irrigated and non-irrigated lands are generated based on an assessment of the soil's physical and chemical characteristics, climate, and landscape features. These factors determine the limitations of the soil for agricultural use.

For irrigated lands, the assessment includes factors such as the soil's water-holding capacity, permeability, depth, texture, structure, salinity, and alkalinity. The availability and quality of irrigation water, as well as the effectiveness of the irrigation system, are also considered.

For non-irrigated lands, the assessment focuses on the soil's natural moisture availability, which is influenced by factors such as rainfall, evaporation rate, and the soil's ability to store and transmit water. Other factors such as the soil's fertility, erosion risk, and limitations for mechanization are also considered.

For a given soil map unit (concept described below), the classification may differ between irrigated or non-irrigated land capability classifications. For example, the 3,500 acres of Makaweli silty clay loam at 0 to 6 percent slopes (map unit MgB), has a non-irrigated land capability classification of IVc (severe limitations with climatic constraints) but an irrigated classification of IIe (minor limitations with erosion risk).

Mapping Approach and Extent

SSURGO provides detailed soil mapping coverage for most of the United States, including 48 contiguous states, Alaska, Hawaiʻi, and the Territories, Commonwealths, and Affiliated Pacific Islands served by USDA-NRCS. The mapping scales range from more detailed, large-scale maps at 1:12,000 scale to smaller-scale maps at 1:63,360. Areas with 1:12,000 scale maps have more precise delineation of soil types and variation compared to the general overview provided by 1:63,360 scale maps (Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture, 2015).

Soil map units are the foundational components of SSURGO maps and represent areas dominated by a particular soil type or set of characteristic soil components. Map units are defined and delineated based on exhaustive fieldwork and sampling by experienced soil scientists who traverse the landscape observing variations in topography, vegetation, drainage, parent material, and land use. After digging soil pits and analyzing soil profiles, scientists determine the soil series, phases, and components present to delineate the extent of map units with similar composition (United States Department of Agriculture, 2017).

Each distinct soil type has a particular combination of physical, chemical, and biological characteristics. These inherent soil properties have significant implications for engineering constraints, agricultural productivity, natural hazard risk, hydrologic functioning, and the distribution of native plant and animal communities. The integration of soil types with climate and terrain can serve as a general indicator of land suitability for various purposes including engineering, agriculture, and wildlife habitat.

Each soil map unit is assigned a unique symbol or color on the soil map and is accompanied by a correlated set of tabular data describing the key physical, chemical, and biological properties of the soils within that delineated geographic area. Map unit names reflect the major soil components along with slopes, textures, frequency, or other features. This provides valuable localized information on the diversity and distribution of soils for land use planning and management.

SSURGO data is updated on an annual basis through the Annual Soils Refresh (ASR) process carried out by the USDA-NRCS and released on October 1st of each year. Both tabular attribute data and spatial map data are updated through the ASR. For tabular SSURGO data, the entire database is refreshed annually to publish new data, update existing data, and add required standard interpretations. For spatial SSURGO data, only areas with new maps or updates to existing maps are refreshed through the ASR process, which equates to approximately 10% of total SSURGO maps each year (Natural Resources Conservation Service, United States Department of Agriculture, n.d.). Updates depend on various factors such as significant changes in the landscape, advancements in soil science methodologies, and/or increased available resources to support detailed mapping.

Hawaiʻi participates in the ASR process to ensure regular annual updates to SSURGO datasets. However, more extensive spatial revision projects in Hawaiʻi require additional prioritization and support. In 2012, there was a major revision of SSURGO data for the entire island of Hawaiʻi that updated both spatial mapping data as well as tabular attributes. Since then, SSURGO updates in Hawaiʻi have focused more on correlation of map units across islands and taxonomic changes rather than large-scale spatial revisions. For example, in 2018 SSURGO spatial and tabular data was updated and added following new lava flows in Puna, Hawaiʻi. Many older “miscellaneous land types” still exist in Hawaiʻi SSURGO which warrant an update with more detailed spatial data (A. Koch, personal communication, September 29, 2023). While regular ASR updates continue, Hawaiʻi NRCS is engaging partners to identify needs and advocate for support to enable more extensive spatial revision projects in the future. Accelerated update work would help SSURGO data to provide current, high-quality standardized soil data that meets modern user needs.

Strengths and Limitations

Strengths

SSURGO remains the most extensive available statewide resource for soil properties, second only to small-scale testing done in various parcels or regions for the purpose of research or agricultural development.

SSURGO data is also georeferenced, which allows SSURGO data to be organized in multiple layers in a GIS to understand soil properties, land capability, erosion risk, and other relevant information of an area, enabling analysis of soil characteristics in relation to land use and management. SSURGO data integrated in a GIS enhances the utility of soil data by enabling spatial analysis, mapping, visualization, and informed decision-making across various sectors. This integration helps land managers, researchers, policymakers, and other stakeholders better understand and manage soils in a geospatial context.

The USDA Web Soil Survey is an online tool that provides access to the largest natural resource information system in the world, the SSURGO database. The USDA Web Soil Survey provides a wealth of data and interpretations that can be used for a wide range of applications, from construction and land management to disaster planning and soil health assessment.

Attributes from SSURGO data valuable for assessing soil health encompass:

- Water Permeability: Reflects the soil's drainage ability.
- pH (Acidity): Influences numerous biological, physical, and chemical soil processes.
- Organic Matter: Represents the non-mineral content of soil, derived from living organisms, however SSURGO estimates are not regarded as an accurate source of values.
- Soil Carbon: Provides values for total carbon. It's important to note these values do not specify the carbon's condition (whether stable or labile).
- Soil Structure: Pertains to the organization of soil aggregates.
- Nutrient Holding Capacity: Details how much and how well the soil can retain nutrients.
- Taxonomy: Classifies soils based on quantifiable soil properties.
- Soil Order: The broadest category, distinguishing soils by factors like parent material and age.
- Soil Series: A highly detailed category that takes into account a wide range of soil properties.

The Web Soil Survey also includes data on a variety of other soil health aspects like soil response to biochar application, soil fragility, limitations for aerobic soil organisms, organic matter depletion, compaction, and salt concentration.

Limitations

Limitations include the reliability and lack of dynamic soil qualities available in the SSURGO dataset. For example, while SSURGO essentially has all common intrinsic (such as physical and chemical) properties available in its database, these properties have been found to be inaccurate in many locations, particularly regarding soil carbon content. Furthermore, the SSURGO values for soil carbon are a measure of total carbon and are not indicators of the state of the carbon (stable or labile). Dynamic soil qualities and biological soil data values in SSURGO are often missing and/or outdated. Thus, while soil health can be approximated by using a combination of values provided within SSURGO, the margins of error throughout parameters limit the ability for this information to be extrapolated with high confidence.

While SSURGO contains ratings specifically designed for sugarcane, pineapple, pasture, and commercial timber, most commercial crops in Hawaiʻi are not included. NRCS provides access to SSURGO in a database format with a related GIS spatial layer, as well as through a Web Soil Survey online portal. The Hawaiʻi Open Data portal provides the SSURGO spatial map unit layer but requires potential users to download tabular soils data separately, county by county, from the NRCS Web Soil Survey. The spatial and tabular data would then need to be joined by a user. Thus while SSURGO has the most detailed information on soil ratings with and without irrigation, slope, depth of soil, permeability, available water capacity, pH, shrink-swell potential, and chemical components, the readability of the information by those who are not proficient in database or GIS systems may limit its use.

The manual cartographic process described in the soil survey manual has three notable limitations. First, soil delineations are heavily dependent on features visible in the aerial photographs used as base maps; second, there is a limit to the minimum mappable size of soil areas; and third, soil boundaries are depicted as sharp breaks rather than gradual transitions (Brevik et al., 2016).

Last, the national Annual Soil Refresh currently allows regular incremental updates. However, large-scale remapping requires dedicated funding and staff time. Remapping projects are resource intensive, involving new fieldwork, lab analysis, digital map production, and data processing. Significant landscape changes, advances in science, and evolving user needs also create demand for remapping that exceeds current resources. Accelerating update cycles would require increased budget allocation, personnel, and institutional prioritization. With appropriate resourcing, SSURGO mapping updates could be performed at state and regional levels to modernize foundational soil data on a 10-20 year cycle rather than relying solely on incremental annual updates.

Opportunities for Improvement

In addition to physical and chemical properties, soils harbor an immense diversity of microorganisms and organic matter that interact and transform the soil over time. Shifts in climate, vegetation, soil amendments, management practices, and other environmental factors can alter biological activity and processes within soils. Soil scientists indicate that more frequent remapping and updates could capture changes in soil biology and processes missed by widely spaced mapping intervals, and that dense, high-resolution temporal data on soil biota and soil organic carbon would greatly advance understanding of soil change trajectories. Overall, increased resourcing for regular mapping updates using the latest science and technology would yield benefits for monitoring and managing dynamic soil resources.

Prior Reports and Studies

- Major Surveys
    - United States Soil Conservation Service. (1955). Soil Survey, Territory of Hawaiʻi: Islands of Hawaiʻi, Kauaʻi, Lānaʻi, Maui, Molokaʻi, and Oʻahu (1955). http://archive.org/details/usda-hawaii_territory1955
    - United States Soil Conservation Service. (1972). Soil Survey of the Islands of Kauaʻi, Oʻahu, Maui, Molokaʻi, and Lānaʻi, State of Hawaiʻi. United States Government Printing Office. http://archive.org/details/usda-islandsHI1972

  - United States Soil Conservation Service. (1973). Soil Survey of Island of Hawaiʻi, State of Hawaiʻi. United States Government Printing Office. http://archive.org/details/usda-hawaii_state1973

- Selected Other Reports
  - McCall, W. W. (1975). Soil classification in Hawaiʻi (Circular 476). Cooperative Extension Service, University of Hawaiʻi. http://hdl.handle.net/10125/53628
  - Uehara, G., & Ikawa, H. (2000). Use of Information from Soil Surveys and Classification. Plant Nutrient Management in Hawaiʻi's Soils, Approaches for Tropical and Subtropical Agriculture. Honolulu: College of Tropical Agriculture and Human Resources, University of Hawaiʻi at Mānoa, 67–77.

Criteria Developed for System Comparison

Multiple sources of information were reviewed to develop assessment criteria for the soil classification systems. Initial factors were identified in the project scope, amended with additional input from Plasch Econ Pacific and Stantec, and further refined through consultations with the Contractor Team, OPSD, and the Steering Committee.

A draft rubric was developed through a process of reviewing relevant presentations, project documents, subject matter expert input, and public comments. To start, three presentations by local planners on the topic (Yamamoto, 1999; Chillingworth, 2009; and Souki, 2013) were analyzed to identify common assessment criteria and topics covered regarding soil classification systems. Criteria and requirements outlined in the project scope and Work Plan were also incorporated to ensure alignment with intended project outcomes.

Additional considerations for rubric criteria were developed based on contractor team discussions, interviews with Steering Committee Members, and legal and technical subject matter expert input during early outreach activities. These public perspectives were also considered by categorizing and evaluating the assessment criteria-related comments submitted through the Polis engagement platform. Duplicates and statements outside of the project scope were removed to focus on relevant evaluation factors.

A draft rubric was generated, including criteria name, criteria description, method or scale of criteria measurement, criterion approach source(s), and difficulty of completing criteria evaluation. Review of the draft rubric by OPSD and HDOA refined the criteria to this final list for assessment:

1. **Accuracy in identifying quality agricultural lands**: How well the system classifies and delineates the most productive agricultural lands based on soil properties, soil health, topography, climate, etc.

2. **Adaptability to changing conditions and crop production**: The ease and feasibility of updating the system to account for new crops, technologies, soil data, etc.

3. **Transparency, understandability, and documentation**: How clear and accessible the methodology and rationale of the system are.

4. **Incorporation of non-soil factors**: Extent to which non-soil factors (e.g., access to markets, land use plan alignment) are considered.

5. **Geographic coverage**: Completeness of geographic coverage across the State and areas excluded from analysis.

6. **Productivity & Agricultural Value**: The extent to which the system accounts for the economic value of agricultural lands based on productivity.

7. **Irrigation Infrastructure**: The degree to which the system considers the presence, access, and need for irrigation infrastructure and water systems.

8. **Cultural & Indigenous Considerations**: The incorporation of Hawaiian indigenous knowledge, land classifications, and cultural factors into the methodology.

The resulting assessment criteria thus draws from various relevant sources into a framework for evaluating soil classification systems. Project documents, expert input, public comments, and contractor team knowledge were synthesized to develop aligned criteria measuring system qualities like accuracy, adaptability, transparency, soil health measurement, and overall utility. This rubric provides a robust structure for the next stage of populating ratings and comparisons for the existing systems. The development process helped ensure a rubric responsive to project requirements and grounded in varied disciplinary expertise and community perspectives. The list can be found in Appendix A's Comparison Criteria Table.

System Comparison

As demonstrated in the reviews above, each system takes a different approach to evaluating and rating agricultural lands based on factors like soil properties, topography, climate, crop suitability, and more. LSB and ALISH focus on rating inherent soil productivity potential, while SSURGO provides detailed soil survey data. LESA incorporates additional economic and social factors beyond land capacity.

In reviewing the systems, limitations and opportunities were revealed. LSB and ALISH have static data that may be outdated and methodologies somewhat aligned to past agricultural practices. LESA is more adaptable but lacks implementation. SSURGO offers robust statewide soil data and receives partial frequent updates.

While all the systems have merits, updating to current conditions and agricultural needs, improving documentation of system methods beyond those provided in the State's GIS metadata, and integrating evolving best practices in soil science and land evaluation could enhance the utility of these or a similar tool. More responsive systems could provide data-driven guidance on land use suitability under changing conditions.

Criteria Based Comparison of Soil Classification Systems in Hawaiʻi

The following analysis highlights selected strengths and weaknesses of each system based on the set of assessment criteria. This allows comparison across critical dimensions relevant to supporting agricultural planning and policymaking. See Appendix A's Comparison Rubric Table for additional review information.

Accuracy in Identifying Quality Agricultural Lands

- SSURGO provides detailed soil data and interpretations to identify lands suitable for cultivation, but lacks key indicators of overall quality like soil biology.
- LSB is based primarily on soil properties so has limitations in identifying all productive lands.
- ALISH relies mainly on soil properties but tries to expand beyond just prime lands.
- LESA incorporates multiple factors but has outdated data quality issues.

Adaptability to Changing Conditions and Crop Production

- SSURGO has an annual update process that allows incremental improvements over time. However, extensive remapping requires significant resources and has not occurred comprehensively since initial mapping efforts in the 1970s.
- LSB, ALISH, and LESA have not been updated since their initial development, limiting their accuracy and relevance under modern conditions.

Transparency, Understandability, and Documentation

- SSURGO has robust documentation available online detailing methodology and rationale, however database and GIS skills are required to fully access some of the data.
- LSB's methodology is published in hardcopy but lacks easily accessible documentation.

- ALISH has published reports that provide an overview but details are lacking.
- LESA details are available in government reports but not consolidated/online.

Incorporation of Non-Soil Factors

- SSURGO emphasizes soil factors directly related to productivity.
- LSB focuses narrowly on inherent soil productivity.
- ALISH mainly examines inherent soil characteristics.
- LESA specifically includes socioeconomic, policy, and other non-soil criteria.

Geographic Coverage

- SSURGO provides detailed statewide coverage.
- LSB mapped all major islands except Niʻihau and Kahoʻolawe, and excluded urban areas.
- ALISH and LESA were criteria based and thus have the most limited spatial coverage.

Productivity and Agricultural Value

- SSURGO contains crop yield data to estimate productivity potential.
- LSB provides general productivity ratings but lacks economic valuation.
- ALISH has no economic analysis, just broad productivity classes.
- LESA has no monetary valuation, just qualitative productivity factors.

Irrigation Infrastructure

- SSURGO indicates generalized irrigation needs but does not include infrastructure data.
- LSB accounts for presence/absence of irrigation but data is outdated.
- ALISH notes irrigation availability but information not updated.
- LESA includes a basic but outdated assessment of irrigation potential.

Cultural and Indigenous Considerations

- LSB does not incorporate traditional Hawaiian knowledge or cultural factors.
- ALISH considers the traditional Hawaiian crop taro in identifying unique lands.
- LESA has no documentation of cultural considerations beyond the incorporation of ALISH unique lands category.
- SSURGO does not address traditional Hawaiian systems or crops

Additional Comparison of Soil Classification Systems in Hawaiʻi

Comments provided by OPSD and SC members identified additional areas of consideration for comparing the four major soil classification systems. Using additional criteria identified, strengths and weaknesses of each system were analyzed with respect to:

Robustness to Changing Conditions

- SSURGO has an annual update process that allows incremental improvements over time. However, extensive remapping requires significant resources and has not occurred since the 1970s.
- LSB, ALISH, and LESA have not been updated since their initial development, limiting their accuracy and relevance under modern conditions.

Flexibility for Transitions Between Crops

- SSURGO provides generalized crop suitability ratings but lacks specificity for most of Hawaiʻi's current diverse crops.
- LSB and ALISH have fixed crop assumptions that may not match current cultivation.
- LESA could likely be adapted for new crops more readily.

Focus on Plantation vs Diversified Agriculture

- LSB reflects aspects of large-scale plantation agriculture systems as those operations were a major source of yield data.
- ALISH reflects aspects of large-scale plantation and diversified agriculture systems.
- LESA offers flexibility to incorporate diversified agriculture factors.
- SSURGO provides only limited diversified crop suitability data in its yield estimates.

Consideration of Land Access and Tenure

- None of the systems directly address land ownership patterns or tenure arrangements.

Accounting for Management Practice Impacts

- Management practices are not explicitly incorporated in LSB, ALISH or SSURGO.
- LESA includes management-related factors like farm facilities, farm parcel size, and services.

Incorporating Cultural Factors

- No systems comprehensively address cultural aspects related to traditional cultivation.
- ALISH briefly mentions traditional crops.

Legal Frameworks Enabling Regulation

- LSB and ALISH are embedded in Hawaiʻi statutes governing agricultural lands.
- SSURGO and LESA currently lack regulatory standing but can inform policymaking.

In summary, while all systems have limitations, the more recent systems appear more robust. This is due in part to later systems inputs being composed of outputs of earlier systems. LESA demonstrates greater capacity for flexibility, evolution, and integration of diverse factors relevant to contemporary agriculture. However, lack of implementation in Hawaiʻi policy restricts its impact. SSURGO provides a robust spatial soil dataset but requires updates and expansion to fully meet emerging needs. Overall, the development of next-generation systems maximizing strengths while overcoming weaknesses merits exploration.

Summary of Overlay Mapping

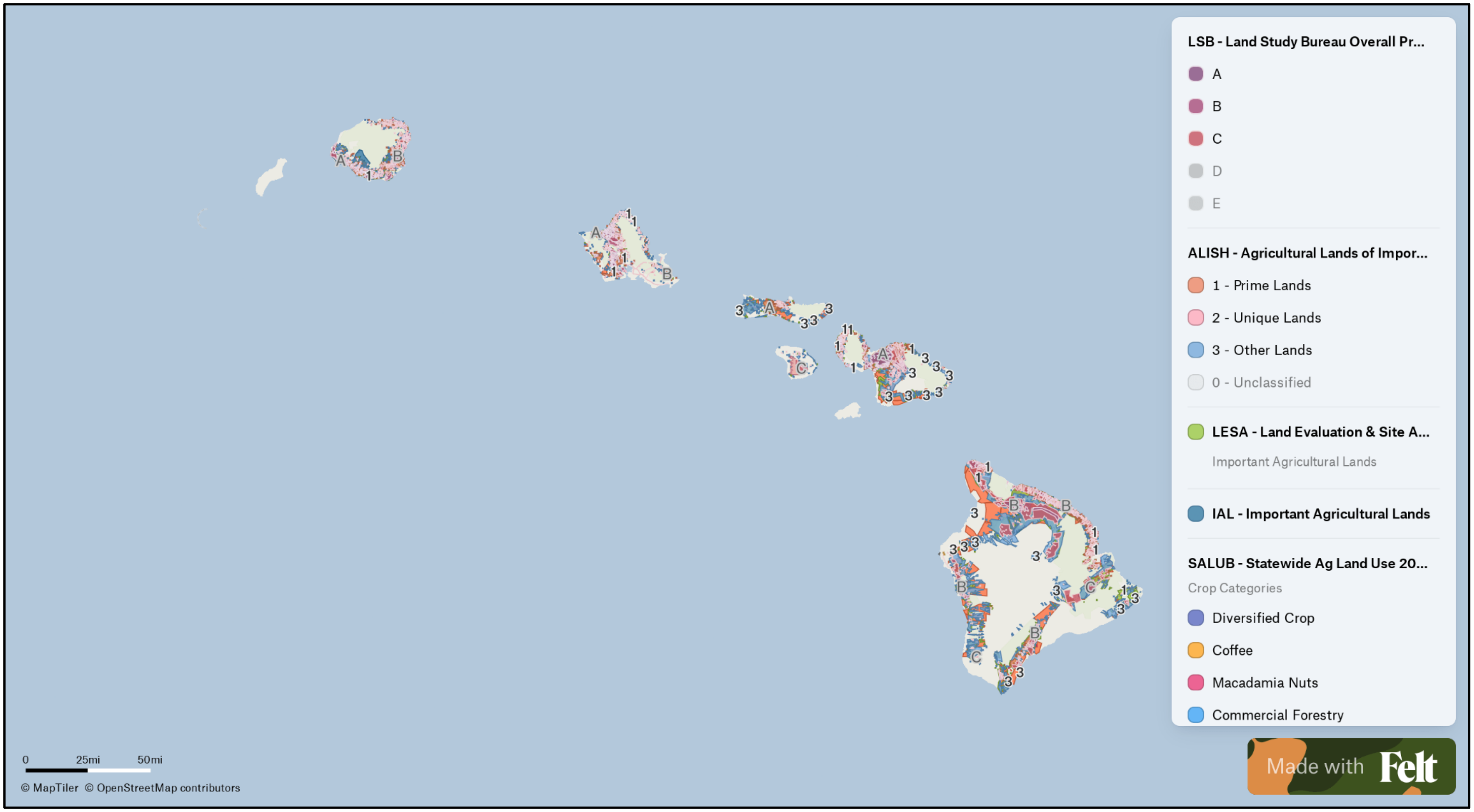
A web mapping tool was used to create an overlay map (see Figure 1). Overlay Map Screenshot on the next page) embedded into the project website for easy access and interaction. The map displays various soil classifications, agricultural land use assessments, and agricultural land designations commonly used in Hawaiʻi.

Overlay mapping is a technique that involves placing one map on top of another to create a composite map. First developed by pioneering planner Ian McHarg in his book Design with Nature (1969), he demonstrated mapping different environmental aspects on transparent overlays. By stacking these layers, planners could identify suitable areas for development or areas to be preserved. Each map, or layer, contains different types of data. For example, one layer might show the physical geography of an area, while another might show the distribution of a certain population or the location of various services. When these layers are overlaid, they can show how different factors interact. This can be useful in a wide range of fields, from urban planning and environmental management to marketing and logistics, and the method was a precursor to today's GIS. In the context of digital mapping, these layers can often be toggled on and off, allowing users to customize the information they see.

The project website uses the ArcGIS StoryMap tool to display numerous land and soil layers. However, as StoryMaps do not allow users to toggle between multiple layers on a single map a web mapping tool called Felt was used for the overlay map.

The Overlay Map includes the LSB's Overall (Master) Productivity Ratings, the Agricultural Lands of Importance to the State of Hawaiʻi (ALISH), the Land Evaluation and Site Assessment (LESA) Commission's Important Agricultural Lands, the Important Agricultural Lands (IAL) designated by State Land Use Commission as of October 2020, and the Statewide Agricultural Land Use Baseline (SALUB) 2020 update commissioned by the Hawaiʻi Department of Agriculture.

Figure 1. Overlay Map Screenshot



These data were sourced from the Hawai'i Statewide GIS Program Geospatial Data Portal (https://geoportal.hawaii.gov/). Additional information about the soil classification systems layers is provided in Section III. Evaluation of Existing Soil Classification Systems.

While not elaborated on in that section, the IAL and SALUB layers included in the Overlay Map provide additional land use context.

The purpose of this task was to provide a flexible visualization and increased understanding of map coverage of these systems and how their findings differ. Thus the overlay map was approached as an exploratory data analysis tool enabling stakeholders to explore the layers across the State. This map effort, while enabling visual spatial analysis, did not include production of summary spatial statistics to compare the systems' findings or their relationship with recent land use (i.e., IAL and SALUB).

Overall, the Overlay Mapping supports a cursory visual review of existing systems, intended to facilitate discussions on the use of existing systems by stakeholders, and provide a foundation for study recommendations.

IV. Review of Best Practices

Best Practices in Soil Classification Systems for Agricultural Land Regulation research is currently underway. The first step involved an initial broad review across multiple jurisdictions to identify prominent examples with agricultural land regulations utilizing soil classification. An initial list of 10-15 relevant jurisdictions has been compiled through consultation with sources including the project team, OPSD, the Steering Committee, and external groups such as the American Farmland Trust and National Healthy Soils Policy Network to identify regions with robust approaches.

The next step, to be completed in Phase II, will be an in-depth analysis of at least three jurisdictions selected in consultation with OPSD. Publicly available documents will be reviewed to identify effective, balanced approaches. Methodologies, outcomes, and use cases are to be documented for each jurisdiction. Finally, the findings will be consolidated into a memo detailing the best practices research. The memo will highlight robust models and formulated recommendations based on findings for potential adoption in Hawaiʻi.

In summary, the process encompasses background research to identify jurisdictions for further investigation, coupled with analysis of select cases to uncover best practices that could enhance local approaches in Hawaiʻi.

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V. Stakeholder Perspectives

Summary of Outreach Activities

A stakeholder engagement process was undertaken to understand the current usage of soil classification systems and to collect recommendations for enhancing their role in agricultural land regulation. This process involved engaging stakeholders through interactions with the Steering Committee, consultations, meetings, and outreach activities aimed at gathering input and feedback. Stakeholder comments and perspectives were gathered through focus groups, meetings held at the county level, and a digital forum, ensuring understanding of insights and suggestions.

Stakeholders were identified in Act 189 (2022), through recommendations from the Project's Steering Committee, and from the Project Team's previous experience. The diverse group of stakeholders included individuals from private, non-profit, State, and county organizations, representing varied backgrounds in technical-legal matters, agriculture, land use, energy, development, and large land ownership. They offered valuable insights into the utilization of systems across Kauaʻi, Oʻahu, Maui, Hawaiʻi, and Statewide. This list of stakeholders included the Hawaiʻi Farm Bureau, Hawaiʻi Farmers Union United, Hawaiʻi's Thousand Friends, Ulupono Initiative, Hawaiʻi State Energy Office, county planning departments, elected State and county officials, Soil and Water Conservation Districts, county resource conservation and development councils (RC&Ds), Hawaiʻi Agriculture Research Center, associated non-profit organizations, extension agents, farmers, landowners, local community members, and additional relevant parties identified during the course of the project. Stakeholder representation was meant to ensure that diverse perspectives and expertise are considered, leading to well-informed and inclusive outcomes.

To gain a preliminary understanding of stakeholder perspectives and recommendations, four one-on-one or small group meetings were held with individuals who have substantial exposure to soil and land classification systems and/or with related procedural, legal, social, cultural, and community issues. These included representatives from CTAHR, HDOA, LUC, and OPSD. Through these meetings, deeper understanding of the systems, as well as the positions, sentiments, perspectives, and attitudes regarding soil classifications, was obtained.

Two types of formal stakeholder meetings were held: Focus Group and County Group meetings. A total of three Focus Group meetings were held, inviting a) individuals with technical-legal expertise (e.g., LUC, LURF, State/private planners, land use lawyers, etc.); b) agricultural and land use stakeholders (e.g., HDOA, Hawaiʻi Farm Bureau, Hawaiʻi Farmers Union, CTAHR, HILT, etc.); and c) other impacted groups and other stakeholders identified in earlier focus groups (energy, additional developers, large landowners, etc.) to participate. Three County Group meetings were also held, and included county planners, elected officials, and other appropriate stakeholders including Soil and Water Conservation Districts, select farm and ranch entities, community groups, and farm organization leadership. The goal of these meetings was to understand how soil classification systems are being used, to gather input on systems' strengths, limitations, and potential improvements, and to learn of different approaches to utilizing soil systems in agricultural land use regulation. County Group meetings were similar to Focus Group meetings, but included additional information and solicited additional feedback about regulation utilizing soil classification systems at the county level.

Due to some concern about the extent of shared knowledge of the intricacies of soil classification systems and their intersection with land use policy across all public and stakeholder sectors, outreach was grounded in information sharing about the systems and their regulatory use. Meeting invitations included a link to the project website, which provided an overview of agriculture and land use planning in Hawaiʻi, soil classification systems, and overlay maps of the systems. Further insights into each system were elaborated upon during the meetings (refer to Appendix B), and ample time was allotted for questions and clarifications.

In order to gather stakeholder feedback in a way that would both encourage participation over Zoom and facilitate analysis, the Polis survey tool was used. Polis is an open-source, online platform that facilitates understanding of group opinion and enables collective decision-making. Participants can submit short text opinion or position statements, which enter the system and are queued for moderation. From the administrative interface of the Polis system, a moderator can accept, reject, or leave the statement unmoderated. Accepted statements are added to a statement deck which participants can flip through and agree, disagree, or pass on the statements. The platform aggregates votes in real time and illuminates areas of agreement and disagreement among all participants.

For the study, “Accepted” statements (Appendix D) reflected original, meaningful, and relevant statements that expressed opinions of or thoughts about soil classification systems and their use in land use planning and agricultural land regulation.

“Rejected” statements (Appendix E) included spam comments (e.g., ‘lol whatever’ or ‘dfs34f43sdf’); non-specific statements (‘You should do better’) or statements not directly relevant to the topic of the study (e.g. ‘the most beautiful lands are near the sea’); questions (e.g., ‘Is it possible to appeal classification of land under a current system?’), statements that contained more than one idea (e.g., ‘LSB is excellent for determining land quality and vertical farming is the future’), which make it difficult to determine which idea is being agreed or disagreed with; and duplicative statements. For duplicative statements, the clearest version of the statement was moderated into the conversation whenever possible. For instance, if two statements referred to ecosystem services, where Statement 1 read, ‘The system should prioritize ecosystem services in land use planning,’ and Statement 2 read, ‘Ecosystem services need to be prioritized,’ Statement 1 would be moderated into the conversation on the basis of its clear reference to prioritization in the soil classification systems. Statement 2 would be moderated out, in order to maximize the voting efforts of participants. When statements were akin to each other and yet nuanced in distinct ways, both statements were kept. For instance, if Statement 1 read, ‘Class A land should be allowed for agrivoltaics,’ and Statement 2 read, ‘Agrivoltaics stimulate agriculture on Class A lands that have not recently been used,’ both statements would be kept.

The original punctuation and spelling of all comments were kept; the Polis system does not allow copy or other edits of participants’ statements. Initial Polis voting was meant to a) enable stakeholders to examine statements made by previous participants and b) evoke conversation among participants based on their response to these statements and/or adjacent thoughts. Participants were asked to join breakout rooms, where questions on current use, perceived strengths and weaknesses, recommendations for improvement, roles in regulation, and future-orientation of systems were used to prompt discussion and the formulation of new statements by participants.

The following questions were used to guide discussion:

Current Use - How are current soil classification systems integrated into your organization's work? Please share specific examples of how you actively utilize and rely on existing frameworks like LSB in your operations, analysis, or decision-making.

Strengths & Weaknesses - In your experience, what are the biggest strengths of current soil classification systems in Hawaiʻi? What works well that should be maintained or leveraged? On the flip side, what are the major pain points, limitations, or weaknesses that need to be addressed?

Recommendations for Improvement - If you could change or improve soil classification systems in Hawaiʻi in any way, what specific updates or modifications would you make? How could existing frameworks be adapted or alternatives developed to better meet your needs and modern context?

Roles in Regulation - In what ways have you seen soil classifications applied or overlooked in agricultural land use regulations and policy? How effectively do existing systems guide permitting and land use decisions right now? How could soil data be better incorporated?

21st Century System - Envisioning an ideal soil classification system tailored to present-day Hawaiʻi, what would it look like? What methodology, technologies, data, expertise, and stakeholder input should be leveraged to build an effective and forward-looking framework?

Throughout the process, Polis statements were being voted on and created by active meeting participants. To close the meeting, results of the Polis survey and patterns in activity were shared and explained. Participants were shown data visualizations of majority support items, trends of consensus and division, opinion groups, and uncertainty.

Participants were encouraged to check the website periodically, where a direct link to the Polis poll would enable them to continue voting on subsequent statement entries.

The stakeholder engagement process provided information about the extent of understanding and use of soil classification systems in Hawaiʻi, as well as opinions about land regulation and use, both historically and in the present day. The input received from stakeholders issues a solid foundation for the subsequent phases of the study. A summary of Stakeholder feedback is below.

Overview of Stakeholder Feedback

This overview of Stakeholder feedback includes feedback received from the Steering Committee, a summary of six total Focus Group and County Group meetings, and an enumeration opinion and position statements expressed through the Polis survey.

Steering Committee

The Steering Committee as a group and in one-on-one discussions provided valuable suggestions in gaining stakeholder perspectives. To better grasp the historical context of soil classification systems, the Steering Committee recommended investigating whether original intentions behind systems like LSB and ALISH were geared towards large-scale plantation agriculture, and how the shift from plantation systems to diversified agriculture impacted aspects like land access and tenure. The Committee also emphasized the importance of documenting legal and procedural developments that facilitated the regulatory use of productivity ratings, understanding how systems like LESA and LSB are utilized in land use regulations and decision-making, and when and how linkages to land valuation and taxation policy were established. Moreover, they recommended investigating if there were early intentions to incorporate Hawaiian cropping systems and cultural connections to land, which might have been overlooked.

With regard to obtaining stakeholder feedback, the Steering Committee recommended compiling a diverse community from whom to draw feedback, including agricultural, Hawaiian, environmental, and other groups. They were interested in assessing participant opinions on ease of understanding and use by different users, the balance of rigor and simplicity for regulatory purposes, and pressures and rationales for updating or replacing systems to meet emerging needs. They also commented that it would be helpful to analyze perspectives on how well systems aligned with actual agricultural viability and land use over time.

Focus and County Groups

Stakeholder comments received during the general discussion and breakout rooms from the three Focus Groups and three County Group meetings tended to generally fall under the following categories: Productivity as a Factor in Agricultural Land Regulation, Solar Farms and other Non-agricultural uses on Agricultural Land, Observations and Recommendations for Current Soil Classification Systems, Soil Classifications in Regulation, and Important Agricultural Lands (IAL). Individual meeting summaries can be found in Appendix C.

As expected, diverse views were shared during the meetings. Oftentimes, views and their converse were expressed. For example, some participants felt that soil classification systems have protected agricultural land and have helped with regulating land uses, while others felt that these systems have not been and may not be the best tool for determining agricultural land use, given systems' biases toward large plantation systems, their lack of particular data (e.g., soil biology), and errors in the data they contain, especially relating to soil health (carbon). Likewise, many agreed that soil classification systems should be updated, while others were wary of updates, voicing concern that changes to the system would provide an opportunity for lawmakers to do away with existing safeguards and/or introduce new and harmful regulations, ultimately eliminating agricultural land protections under the current system. Or, the affirmation by some agricultural producers of their use of land classification systems to determine productive potential, counterpointed by the belief that the farmer's ability to cultivate or remediate soil, and not the inherent nature of soil or conditions of land, determine land's agricultural productivity.

A few opinions shared more agreement, but showed variation in participants' considerations around the statement. For example, participants tended to agree that updates to soil classifications should consider factors other than productivity, and suggested a variety of facets to examine: geology, land use, land position (mauka/makai), distance to services, previous and potential uses, and economic considerations. Participants remarked that updates should also take into account soil changes, identifying these changes as a result of a variety of factors: erosion and deposition of soils, availability of water/irrigation infrastructure, sea level rise and other climatic changes, and invasive species impacts. Relatedly, there were concerns by participants around the accuracy of soil systems' measurement of productivity, given the potentials of land from the perspective of ecosystem services, and the potentials that are produced by utilizing (bio)remediation or other measures to increase the health of soils.

A need to determine criteria for allowing non-agricultural uses (especially solar power generation) on agricultural land also emerged.

Although not a soil classification system nor part of this study, the current Important Agricultural Lands (IAL) law was suggested for review multiple times, especially regarding how IAL relates to regulation. Some felt IAL was a better indicator than current soil classification systems of important and productive lands; others felt that IAL allowed landowners to claim agricultural lands that are not productive, upzone up to 15% of their lands as urban, and ultimately urbanize some of Hawaiʻi's most productive lands.

POLIS SURVEY

This section enumerates results of the Polis survey from the period that Focus and County Group meetings began (October 2023) until voting was closed (December 4, 2023). Participants voted only on statements that were moderated into the conversation ("Accepted" statements). Statements were moderated in real time during the meetings, and reviewed following each meeting; moreover, the Polis platform remained open for voting and statement input throughout this period. For these reasons, some of the accepted statements, such as those that were input near or on the date of survey closure, have received fewer votes. In other cases, statements that were initially accepted during the meetings may have been moderated out of the conversation after closer review, and thus may have some votes. Accepted statements are presented in Appendix D. Rejected statements can be found in Appendix E. Participation was anonymous throughout.

Presented below is a compilation of survey results, intended solely as a summary of Polis statements collected over the initial outreach period. The Final Report for this study will include analysis of survey results and clarify their relationship to initial and final recommendations.

Number of participants voting: 116

Votes cast: 6,575

Average votes per participant: 57

Statements submitted: 170 (103 statements accepted)

Average statements per author: 3

PARTICIPANT STATEMENTS SHARED IN POLIS

Participants voted on 103 accepted statements (Appendix D). An initial set of 10 statements generated by the Contractor team seeded the voting and discussion. The remaining opinion and position statements were generated by participants. An initial categorization of statements, based on the discussion prompt categories used during the outreach sessions (see Summary of Outreach Activities), provides groupings of participant perspectives. The most statements focused on Recommendations for Improvement, 21st Century Systems, and Strengths and Weaknesses. Fewer statements addressed Current Use or Roles in Regulation.

At least half the respondents (58) agreed in majority (60% or more) with categories of statements:

<u>Recommendations for Improvement:</u>

- Any system incorporating soils for land use decisions should be updatable, dynamic, and easily incorporated into land use decisions. Data should be updated to reflect how lands are currently being used, and periodic re-evaluation and stakeholder input would help keep existing systems relevant. Classification maps and indexes must be modernized to optimize for those factors of value in Hawaiʻi today, i.e., not just productivity.

- Soil systems should be easy to use and understand.

21st Century Systems:

- There is need for a robust modern system that supports agricultural productivity, and protecting prime productive lands should remain a priority in agricultural land regulation.
- Protecting prime productive lands should remain a factor in agricultural land regulation.
- Distance to services and history of use are important considerations. Soil classifications should take into account ahupuaʻa and indigenous perspectives, justice, land access, and water access. Water infrastructure is needed to ensure IAL and similar lands are able to be utilized.

Strengths & Weaknesses:

- The LSB soil classification system feels outdated, as systems were designed to protect sugar and pineapple, and do not reflect current use, diversified use, agriculture on marginal lands or taro farming.
- A major limitation of current systems is the lack of regular updates to reflect changing conditions. Existing systems don't account for climate change or traditional Hawaiian land management.
- It's challenging to reconcile differences between multiple classification systems on the same land.

Statements were also categorized by content (Table 3). 42% of the statements were related to the soil classification systems: Systems, LSB, SSURGO. 17% were related to Regulation. Factors not currently considered by the current soil classification system such as native Hawaiian perspectives and other factors, made up 24% of the statements. There were also statements regarding renewable energy—mainly photovoltaic solar and agrivoltaics. Most of these renewable-energy related statements considered approaching the need for renewable energy and food production simultaneously, and in some instances, together.

TABLE 3. ACCEPTED STATEMENTS CATEGORIZED BY CONTENT

Content	Count	Percent
Systems	27	26%
Other factors	20	19%
Regulation	18	17%
LSB	11	11%
Energy	9	9%
Data	8	8%
native Hawaiian perspectives	5	5%
SSURGO	5	5%
Total	103	100%

At least half the respondents agreed in majority with these statements categorized as Soil Classification Systems (Systems, LSB, SSURGO) that were not already mentioned above:

- Soil classifications are one tool in the toolbox, but may not be the best way to determine land use priorities.
- LSB classes C and lower are used to discount land quality and upzone, despite agricultural potential.

There were no additional statements categorized as Other factors, native Hawaiian perspectives or Regulation that were not already mentioned above where at least half the respondents agreed in majority.

In all, a total of 170 statements were submitted by participants. In order to streamline voting, spam, duplications, or multi-idea comments were excluded by a moderator on the contractor team prior to voting. 68 statements were rejected by the moderator (Appendix E).

CONSENSUS AND DIVISION

Statements underwent a voting process where participants could express their agreement, disagreement, or uncertainty. The Polis system would then compile results, find groupings of voters, and prepare statistics and visualizations of each group's stance on a statement, as well as an overall statistic for each statement.

Consensus statements were voted on the same way - either everyone agreed or disagreed (but some were unsure). Divisive statements were split between agreement and disagreement. The statements with the most consensus were considered to have at least 75% of the participants (87 or more) voting with 75% either disagreeing ("No" column) or agreeing ("Yes" column). These consensus statements were related to recommendations to improve the systems or described a 21st Century System, with one statement describing a weakness (Table 4). These may be helpful to consider for developing recommendations.

TABLE 4. CONSENSUS STATEMENTS

Statement	Discussion Prompt Category	Content	Number of Participants	Yes	No	Pass
Protecting prime productive lands should remain a factor in agricultural land regulation.	21st Century System	Regulation	87	86%	2%	11%
Protecting prime productive lands should remain a priority in agricultural land regulation.	21st Century System	Regulation	91	84%	7%	7%
Water infrastructure is needed to ensure IAL and similar lands are able to be utilized.	21st Century System	Other factors	91	81%	5%	13%
Soil systems should be easy to use and understand.	Recommendations for improvement	Systems	91	80%	5%	14%
Periodic re-evaluation and stakeholder input would help keep existing systems relevant.	Recommendations for improvement	Systems	94	79%	6%	13%
Data should be updated to reflect how lands are currently being used.	Recommendations for improvement	Data	88	78%	10%	11%

Systems were designed to protect sugar and pine do not reflect current use, diversified use, agriculture on marginal lands or taro farming.	Weakness	Systems	89	76%	4%	19%

Divisive statements may indicate areas of conflict. The statements most divided in opinion were categorized as either Recommendations for Improvement or under 21st Century system (Table 5). There was also some overlap in content, with two related to energy.

TABLE 5. TOP DIVISIVE STATEMENTS

Statement	Discussion Prompt Category	Content	Number of Participants	Yes	No	Pass
Class A land should also be allowed for renewable energy use if there is an appropriate and approved agriculture plan for the land	Recommendations for improvement	Energy	67	47%	37%	14%
Indigenous values and water rights should be centered in the development of a classification system that may be used for land use regulation	21st Century system	native Hawaiian perspectives	78	47%	28%	24%
The State should hold managers and owners accountable for fallow ag lands or crops that have little use in our lives (i.e., pineapple)	Recommendations for improvement	Regulation	81	37%	32%	30%
climate change effects on endangered species movement needs to be also addressed	Recommendations for improvement	Other factors	59	33%	33%	32%
We need to release ag land for energy use	21st Century system	Energy	79	26%	48%	25%

MAJORITY

Majority statements are those that 60% or more of all participants voted one way or the other, regardless of whether large amounts of certain minority opinion groups voted the other way. Protecting prime productive lands in agricultural regulation, the necessity of water infrastructure for using IAL and similar lands, and the ease of using soil systems, including in land use decisions, are all statements that the majority of participants agreed to (Table 6). 68% of participants also disagreed that the LSB system is fine because soils change over time. These statements may also indicate areas to develop recommendations.

TABLE 6. MAJORITY STATEMENTS

Statement	Discussion Prompt Category	Content	Number of Participants	Yes	No	Pass
Protecting prime productive lands should remain a priority in agricultural land regulation	21st Century system	Regulation	91	84%	7%	7%
Water infrastructure is needed to ensure IAL and similar lands are able to be utilized	21st Century system	Other factors	91	81%	5%	13%
Soil systems should be easy to use and understand	Recommendations for improvement	Systems	91	80%	5%	14%
Protecting prime productive lands should remain a factor in agricultural land regulation	21st Century system	Regulation	87	86%	2%	11%
Any system incorporating soils for land use decisions should be updatable, dynamic, and easily incorporated into land use decisions	Recommendations for improvement	Systems	86	81%	4%	13%
The LSB system is fine because soils don't change over time	Strength	LSB	56	10%	69%	19%

Opinion Groups

Across 105 total participants, Polis identified two opinion groups. There are two factors that define an opinion group. First, each opinion group is made up of a number of participants who tended to vote similarly on multiple statements. Second, each group of participants who voted similarly will have also voted distinctly differently from other groups. Opinion Group A is composed of 35 participants and Opinion Group B is composed of 70 participants.

Opinion Group A

Participants in Opinion Group A acknowledge the need for some system updates, though they believe these systems should not be constantly updated. They are cautious about considering new factors and uses to current systems, as outlined in Table 7.

TABLE 7. STATEMENTS THAT DEFINE OPINION GROUP A

Statement	Discussion Prompt Category	Content	Opinion Group A (35 total participants)	Opinion Group B (70 total participants)
We should be cautious about major changes to systems that still work reasonably well	Recommendations for improvement	Systems	78% agree (out of 33 participants)	36% agree (out of 61 participants)
We need to release ag land for energy use.	21st Century System	Energy	11% agree (out of 27 participants)	34% agree (out of 52 participants)
Systems need updating, but we need to have a system that isn't constantly being updated too	Recommendations for improvement	Systems	64% agree (out of 25 participants)	39% agree (out of 46 participants)
climate change effects on endangered species movement needs to be also addressed	Recommendations for improvement	Other factors	0% agree (out of 20 participants)	51% agree (out of 39 participants)
Important ag lands need good soil types, relatively flat, have gravity-flow non-potable water.	Recommendations for improvement	Systems	0% agree (out of 7 participants)	57% agree (out of 7 participants)

Opinion Group B

Participants in Opinion Group B are interested in considering other factors in soil classification systems (Table 8). Most participants in Opinion Group B also believe that data should be updated to reflect how lands are currently being used. The views of Opinion Group B differ from Opinion Group A, as they support including new factors into the soil classification systems.

TABLE 8. STATEMENTS THAT DEFINE OPINION GROUP B

Statement	Discussion Prompt Category	Content	Opinion Group A (35 total participants)	Opinion Group B (70 total participants)
Soil classifications should take into account ahupuaʻa and indigenous perspectives, justice, land access, and water access	21st Century system	native Hawaiian perspectives	21% agree (out of 33 participants)	80% agree (out of 60 participants)
Data should be updated to reflect how lands are currently being used	Recommendations for improvement	Data	56% agree (out of 32 participants)	91% agree (out of 56 participants)
Dynamic soil properties, like soil health, should be part of a new classification system	21st Century system	Other factors	30% agree (out of 26 participants)	80% agree (out of 47 participants)
A land's potential for soil carbon sequestration should be considered in any new integrated framework	21st Century system	Other factors	33% agree (out of 24 participants)	84% agree (out of 46 participants)
Systems should consider land cover change as a result of sea level rise.	Recommendations for improvement	Other factors	25% agree (out of 16 participants)	88% agree (out of 25 participants)

AREAS OF UNCERTAINTY

Areas of uncertainty were identified as those statements in which greater than 30% of participants who saw these statements 'passed'. Most of these areas of uncertainty are related to unfamiliarity with the use of a soil classification system or the information contained within these systems. However, some statements had an objectively correct answer that a substantial number of participants failed to identify, indicating potential knowledge gaps (Table 9).

TABLE 9. AREAS OF UNCERTAINTY

Statement	Discussion Prompt Category	Content	Number of Participants	Yes	No	Pass
SSURGO is useful for waterflow and erosion analysis for housing developments	Current use	SSURGO	68	29%	5%	64%

Only LSB contains crop/animal yield estimates that are useful to farmers	Current use	LSB	73	15%	21%	63%
LSB is the primary system used in solar scoping due to use in land regulation	Current use	LSB	54	35%	5%	59%
SSURGO is useful for identify inputs to see if lands are economically feasible	Strength	SSURGO	70	31%	10%	58%
Site specific soil studies determine that the existing classifications are inaccurate	Weakness	Systems	53	32%	9%	58%

SUMMARY OF POLIS SURVEY

Most participants want to protect prime agricultural lands. There also seems to be a general consensus for updating the current soil classification system. There is a desire for these systems to be easier to understand and use, and easily incorporated into land use decisions. However, the opinions for changing these systems vary, including how often these updates should occur. Opinion Group B seems to be more willing to incorporate other factors into the soil classification system. Group A appears more cautious about changes to current systems, though they acknowledge the need for some system updates.. Group A also believes that system updates do not need to occur frequently.

KEY THEMES AND CONCERNS RAISED TO DATE

Both the stakeholder meetings and the Polis survey indicate that there is interest by participants in updating the current soil classification systems. It is generally understood that the LSB system is outdated, having not been updated since it was originally produced in the 1960s and 1970s. There is a perception that LSB was developed with a focus on plantation agriculture and is outdated. Updates should make the systems easier to understand and use, and should take advantage of current data and soil technologies, including GIS mapping capabilities. However, there is disagreement as to the degree of the updates and how often the updates should occur. Some want updates to occur periodically with stakeholder input; others believe that constant updates are not necessary. Some believe that soil classification updates should incorporate indigenous values and perspectives. Others are more cautious about major updates and believe LSB should remain the foundation for any update.

Participants voiced a wide variety of factors to incorporate into soil classification systems and agricultural land use regulation. However, the line between soil classification system and agricultural land use regulation appears to be blurred for many participants. The areas of uncertainty from the Polis survey indicate unfamiliarity with the LSB and SSURGO soil classification systems. Additionally, participant recommendations for the changes to be made often conflate soil classifications and agricultural land regulation. It will be important to identify where updates are most appropriate to ensure soil classification systems are separate from agricultural land use regulation. Of note, this initial stakeholder outreach occurred two months after the Maui wildfires. This may have caused other factors (e.g. climate change, water, other factors) to be at the forefront of participants' minds.

Overall, there is a desire to protect prime agricultural lands. However, there is also a concern that updates to the soil classification systems could hurt agricultural land protections. This concern needs to be balanced against modern-day agricultural land uses.

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VI. Soil Classification Systems References in State and County Codes and Regulations

Overview

As part of the review, a detailed list of State and county laws, ordinances, and administrative rules in Hawai'i that cite soil classification systems for regulating land use and development permitting was compiled. This compilation includes not only the regulations themselves but also specific sections or subsections that reference or utilize the system. The aim of this task was to provide an understanding of the extent to which current systems are integrated into State and county regulation, the policy change impact of soil classification system recommendations from this project, and the implications of such changes to land use and development regulation. To wit, given the extent to which the various soil classification systems are integrated into State and county rules and regulations it may be practically quite difficult to implement changes without substantial effort and state level legislation.

Methodology

The process of compiling this list involved extended research and a systematic approach. We began by identifying relevant databases and resources, including the Hawai'i Revised Statutes (HRS), Hawai'i Administrative Rules (HAR), and county ordinances and rules for each of the counties in Hawai'i. We also reviewed administrative rules for various departments at both the state and county levels.

To ensure a thorough search, a list of search terms based on the soil classification systems was created. These terms were used in a Boolean search string to locate any mentions of soil classification systems or related terminology in the identified databases and resources.

Relevant sections or subsections were recorded in a structured manner, noting the specific policy provision, full statute or rule language, a web link to the resource, the soil classification system(s) cited, notes about the finding when statute or rules language was unclear, and basic coding of the type of regulation. This information was consolidated into a searchable and filterable Airtable database, which can be viewed at https://airtable.com/appJYu3xHuTDuK6P6/shrRThXRCjpFWwiWi.

A truncated table of the data, can be found in Appendix F.

Findings

The regulations identified span a diverse range of policy areas beyond just agriculture. The research identified citations related to zoning, land use districting, subdivision, development permitting, agricultural parks, solar facilities, environmental review, and other facets of land use planning and regulation at both the State and county levels. While many of the regulations specify particular soil classification systems by name, some are unclear and only generally reference soil classification without noting an exact system.

The most frequently referenced systems across the regulations is LSB's Overall (Master) Productivity Rating, followed by ALISH and policies that didn't specify which system should be employed. The LESA system is only referenced in administrative rules.

The breadth of entities involved runs the gamut from State agencies like the Department of Land and Natural Resources (DLNR), Department of Business, Economic Development and Tourism (DBEDT), and the LUC to the individual counties and their departments.

The findings reveal a diverse range of regulations that cite soil classification systems. These regulations span various aspects of land use and development permitting, and real property tax, reflecting the roles that soil classification systems play in shaping Hawai'i's land use policies and practices.

Challenges and Limitations

Even with the systematic approach, there were some challenges and limitations. For one, the different approaches between the State and counties in their compiling, digitizing, and hosting of statutes and administrative rules on the web.

At the State level, the Hawaiʻi Revised Statutes (HRS) are listed on the capitol website across thousands of individual pages, whereas the Hawaiʻi Administrative Rules (HAR) are linked from the Lieutenant Governor's webpage, but are stored and listed differently at each State department. These issues with State level data access were overcome by the use of the Westlaw Edge program, an online proprietary database, to enable searching across the entirety of HRS and HAR.

At the county level, there were significant differences in how code of ordinances and administrative rules and regulations are provided online. Honolulu, Maui, and Kauaʻi counties each, unlike the State HRS, provide an online full text database of ordinances. Hawaiʻi County provides multiple PDF format documents, including an unofficial 2016 document of all ordinances that was able to be searched using a PDF reader. For county administrative rules and regulations, no cross-department compilation of rules was found for any county. Instead, many counties provided digital access for some of their departments' administrative rules. Numerous county administrative rules, when findable, were also not provided in a searchable format.

Due to these issues, while there is confidence in the State level data and county ordinance data, it is possible that some county administrative rules and regulations may have been overlooked due both the sheer volume of files and the lack of digitally shared administrative rules data for many county departments.

Despite these challenges, the compilation provides an overview of the regulations that cite soil classification systems in Hawaiʻi. This serves as a valuable resource for understanding the application of soil classification systems on land use and development in the State.

Outcomes & Utility

The compilation of regulations that cite soil classification systems is a critical step in our research. It provides a solid foundation for our subsequent analysis and helps inform the development of recommendations for improving land use and development practices in Hawaiʻi. Moving forward, we plan to analyze these regulations in greater detail to understand their implications for land use and development. This will involve a closer examination of the specific provisions and requirements, as well as the broader context in which they are applied. Based on recommendations developed in Phase II, a summary of State and county statutes, ordinances, and rules that would need to be amended or revised will be included in the Final Report.

VII. NEXT STEPS

Prior to finalization, this report was sent for review by OPSD staff, the Steering Committee, and county planning departments. During this review, interest emerged to illustrate the ways systems utilized knowledge and/or data from preceding systems in attempts to develop a system to identify and regulate the most productive agricultural lands. Means to formulate an effective way to depict this laddering and the relationships between classification systems are being explored.

OVERVIEW OF REMAINING PHASE I TASKS

Complete Review of Best Practices Review in Other Jurisdictions.

As stated in Section IV, an initial list of 10-15 relevant jurisdictions is being compiled that will be narrowed to at least three for deeper review. The findings will be consolidated to highlight robust models and aid in the development of recommendations in Phase II.

OVERVIEW OF PHASE II TASKS

As mentioned in Section II, this study is taking a two-phase approach with Phase II focusing on generating and refining recommendations with consideration of the role of soil classification systems in agricultural land use regulation. This phase will begin in January 2024 with the initial development of recommendations. It will continue through the calendar year with additional stakeholder outreach activities to gather feedback on draft recommendations and will conclude in late 2024 with the delivery of a final report summarizing findings and recommendations.

The key tasks involved in Phase II are:

Develop Initial Recommendations (Jan-Mar 2024)

Drawing on findings from preliminary research and further analysis of initial stakeholder engagement findings in Phase I, the Contractor Team will develop a set of initial recommendations for maintaining, improving, or replacing current soil classification systems. This will begin with content analysis of Polis statements and meeting notes collected during initial outreach in Phase I, and will consider best practices from other jurisdictions, stakeholder feedback, operational requirements, potentially impacted statutes and rules, and other relevant criteria established by OPSD and the Steering Committee. The Contractor Team will compile the initial recommendations into a Recommendations Matrix intended to provide actionable guidance aligned with the study's findings.

Community Outreach on Initial Recommendations (Mar-Jun 2024)

The Contractor Team will conduct a second round of outreach centered on gathering stakeholder feedback on the initial recommendations. Outreach activities will include presenting the recommendations via virtual meetings and distributing an updated survey tool to allow stakeholders to evaluate and refine the initial findings. The Contractor Team will summarize the feedback received by June 2024.

Final Report (Oct-Nov 2024)

Finally, the Contractor Team will compile all the information gathered into a final report to be delivered to OPSD. The report will provide a summary of the study's research, findings, and conclusive recommendations. It will weave together the analysis of current systems, review of best practices, stakeholder feedback, and details on any recommended regulatory amendments. The goal is to illuminate potential ways to improve the soil classification frameworks that serve as a cornerstone of agricultural land use regulation.

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VIII. References & Appendices

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APPENDIX A: COMPARISON CRITERIA AND RUBRIC TABLES

Comparison Criteria Table

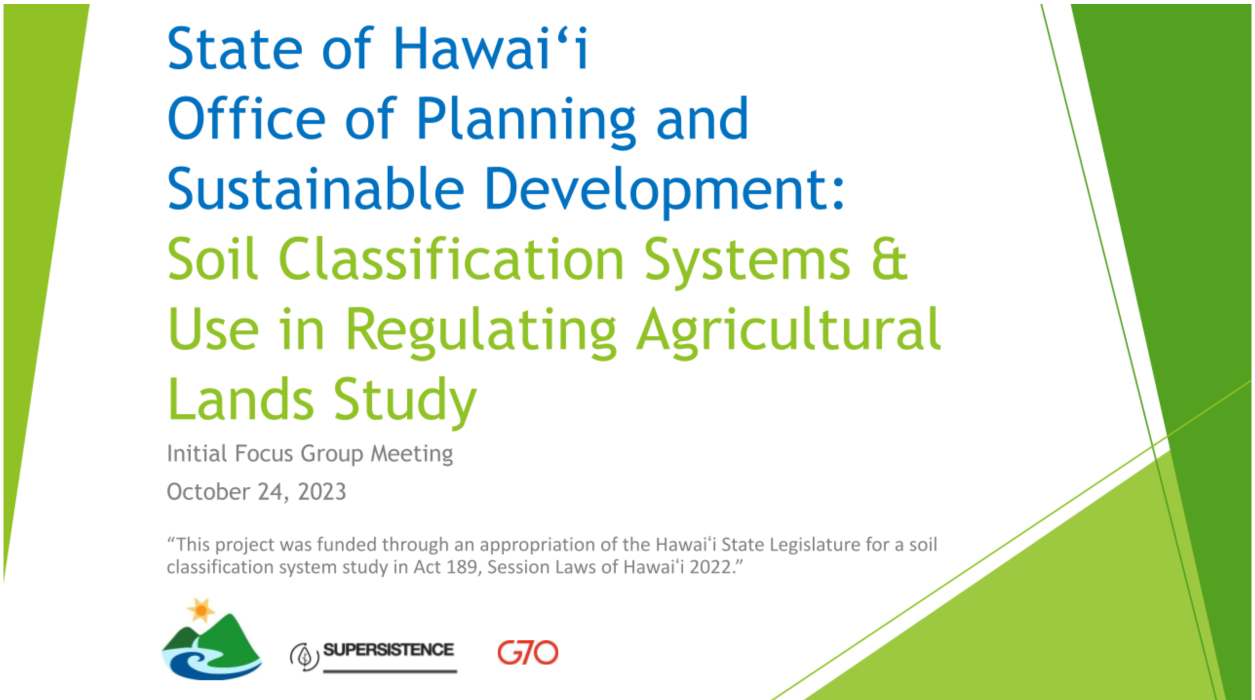
Criteria	Description	Measurement	Source	Difficulty
Accuracy in identifying quality agricultural lands	How well the system classifies and delineates the most productive agricultural lands based on soil properties, soil health, topography, climate, etc.	Qualitative (High, Moderate, Low)	Yamamoto, Chillingworth, RFP/Work Plan	Moderate - Requires analysis of system methodology and comparison to actual agricultural productivity
Adaptability to changing conditions and crop production	The ease and feasibility of updating the system to account for new crops, technologies, soil data, etc.	Qualitative (High, Moderate, Low)	Yamamoto, Chillingworth, RFP/Work Plan	Easy - Can assess based on system methodology
Transparency, understandability, and documentation	How clear and accessible the methodology and rationale of the system are.	Qualitative (High, Moderate, Low)	Yamamoto, RFP/Work Plan, 10/3 Outreach Comments	Easy - Assess based on available documentation
Incorporation of non-soil factors	Extent to which non-soil factors (e.g., access to markets, land use plan alignment) are considered	Qualitative (High, Moderate, Low)	Yamamoto, Chillingworth	Easy - Review methodology for inclusion of non-soil factors
Geographic coverage	Completeness of geographic coverage across the State	Qualitative (High, Moderate, Low)	Yamamoto	Moderate - Requires GIS analysis to quantify coverage
Productivity & Agricultural Value	The extent to which the system accounts for the economic value of agricultural lands based on productivity.	Qualitative (High, Moderate, Low)	10/3 Outreach Comments	Moderate - Requires understanding methodology and data sources
Irrigation Infrastructure	The degree to which the system considers the presence, access, and need for irrigation infrastructure and water systems.	Qualitative (High, Moderate, Low)	10/3 Outreach Comments	Easy - Assess based on methodology
Cultural & Indigenous Considerations	The incorporation of Hawaiian indigenous knowledge, land classifications, and cultural factors into the methodology.	Qualitative (High, Moderate, Low)	10/3 Outreach Comments	Easy - Review methodology

Comparison Rubric Table

Criteria	LSB	ALISH	LESA	SSURGO
Accuracy in identifying quality agricultural lands	Moderate. LSB provides useful yield and soil information, but may not be as detailed as soil-specific systems.	High. ALISH provides comprehensive land use data, including soil properties.	High. LESA uses a variety of factors to evaluate agricultural land quality.	High. SSURGO provides detailed soil data, including properties and characteristics, which are crucial for identifying quality agricultural lands.
Adaptability to changing conditions and crop production	High. LSB is adaptable and can be updated with new data relatively easily.	Moderate. ALISH's adaptability may depend on the availability and integration of new data.	High. LESA is designed to be adaptable to changing conditions.	Moderate. While the database is comprehensive, updating it with new data can be a complex process.
Transparency, understandability, and documentation	High. LSB's methodology is clear and well-documented.	High. ALISH's methodology is clear and well-documented.	High. LESA's methodology is clear and well-documented.	High. The methodology and rationale behind SSURGO are well-documented and accessible.
Incorporation of non-soil factors	High. LSB considers a variety of factors beyond soil properties.	High. ALISH considers a variety of factors, including land use and accessibility.	High. LESA considers a variety of factors, including land use, accessibility, and proximity to markets.	Low. SSURGO primarily focuses on soil data.
Geographic coverage	Moderate. LSB excluded urban areas, Niʻihau, and Kahoʻolawe from analysis. Subsequent maps removed areas with urban districts boundaries.	Moderate. ALISH is criteria based and thus has limited geographic coverage.	Moderate. LESA is criteria based and limited by the spatial extents of multiple input layers.	High. SSURGO provides the most detailed level of soil geographic data available in the United States.
Productivity & Agricultural Value	Moderate. LSB used the most robust yield data, but these data are out of date.	Moderate. ALISH’s unique category considers special high yield or value crops.	High. LESA considers the economic value (via LSB and SPI) of agricultural lands.	Moderate. The database contains yield information on a few crops that can be used in agricultural management and land-use planning.

Criteria	LSB	ALISH	LESA	SSURGO
Irrigation Infrastructure	Moderate. LSB considered irrigation access, but this has not been updated since the system was created.	Moderate. ALISH considers soil moisture and irrigation need.	High. LESA considers the presence of irrigation infrastructure.	Low. SSURGO does not specifically consider irrigation infrastructure.
Cultural & Indigenous Considerations	Low. LSB does not specifically incorporate indigenous knowledge or cultural factors.	Moderate. ALISH incorporates some indigenous crops.	Low. LESA does not specifically incorporate indigenous knowledge or cultural factors.	Low. SSURGO does not specifically incorporate indigenous knowledge or cultural factors.

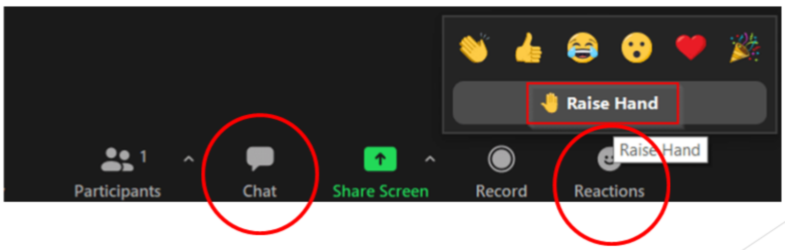
APPENDIX B: OUTREACH PRESENTATION SLIDES



How to share your input

Questions will be taken after the Overview of Soil Classifications:

- Type into the "Chat" box
- Use "Raise Hand" to ask a question or share knowledge



Project Background

Act 189 (2022)

- "The Office of Planning and Sustainable Development (OPSD) shall conduct a study of the suitability of soil classification systems."
- Assistance from (the Steering Committee):
  - State of Hawai'i, Department of Agriculture
  - University of Hawaii at Mānoa, College of Tropical Agriculture and Human Resources
  - State of Hawai'i, Land Use Commission
- Final report to the legislature

Project Overview

- **Contractor team**
  - Supersistence, lead
  - G70
  - Stantec
  - Plasch Econ Pacific
  - Dr. Adhann Iwashita
- **Work Plan**
  - Phase I: Soil Classification Systems and Best Practices Research (Jul-Dec 2023)
    - Task 1: Preliminary Research
    - Task 2: Initial Outreach - Community Outreach Plan
    - Task 3: Interim Report to Legislature
  - Phase II: Recommended Alternatives (Jan-Nov 2024)
    - Task 4: Develop Initial Recommendations
    - Task 5: Additional Outreach - Community Outreach Plan
    - Task 6: Final Report to Legislature
- Phases will conclude with a draft and final report


Community Engagement
Initial Focus Group Meetings
3 Focus Group meetings
participants will include those with expertise in technical, legal, energy, regulatory, agricultural, and other aspects of classification systems
4 County Group meetings
Second Round of Stakeholder Engagement
2 Focus Group meetings
4 County Group meetings
Website
Overlay maps of classification systems
Pol.is discussion tool
Meeting summaries & recordings
Findings & recommendations

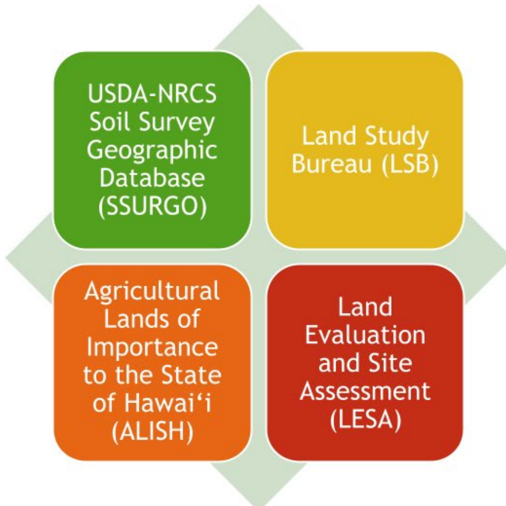

Project Timeline
Phase I
Phase II
July 2023
Project Kick-off
July-Aug 2023
Preliminary Research
October 2023
Initial Focus & County Group Meetings
Nov-Dec 2023
Interim Report
Jan-March 2024
Initial Recommendations
March-April 2024
Additional Focus & County Group Meetings
May 2024
Meeting Summary Memorandum
May-June 2024
Follow-up Recommendations
Oct-Nov 2024
Final Report

Meeting Purpose

- **To understand:**
  - How current soil systems are used and how they can be improved
  - Solicit information on the strength and weaknesses of the various soil systems
  - Learn of potential different approaches to using soil systems in agricultural land use regulation

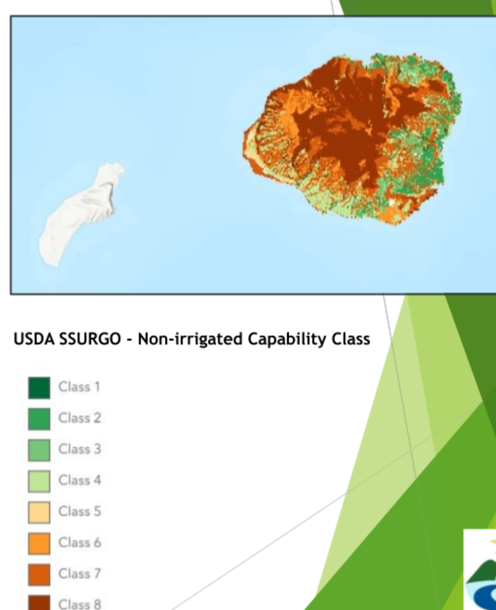
Soil Classifications Overview

Soil Classifications in Hawaiʻi



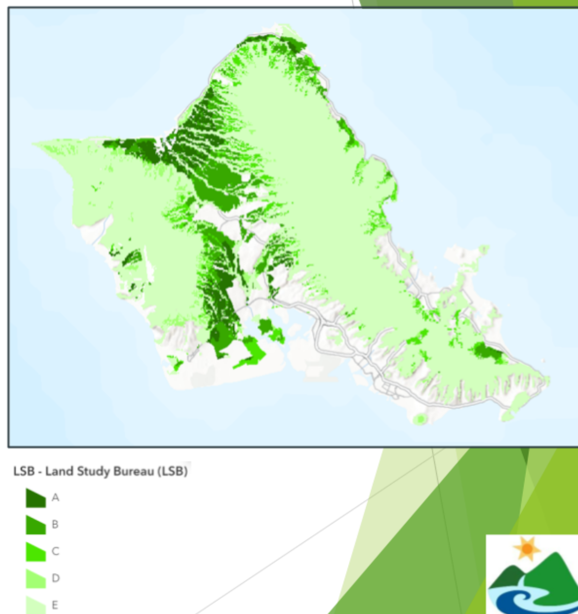
USDA-NRCS Soil Survey Geographic Database (SSURGO)

- High-res soil data for land use & natural resource management, and engineering
- Developed over a century by USDA-based soil surveys, including:
  - 1955 release of 1939 field work by USDA Soil Conservation Service & UH that involved traversing landscapes, sampling soils, and oral accounts
  - 1972-3 release of 1965 field work also used aerial photos and topographic maps
- Spatial and tabular database of:
  - soil properties (physical and chemical)
  - Land Capability Classes (1-8) developed
  - engineering and planning uses
  - limitations for various activities
- Used in CTAHR's Hawaiʻi Soil Atlas and crop suitability modeling



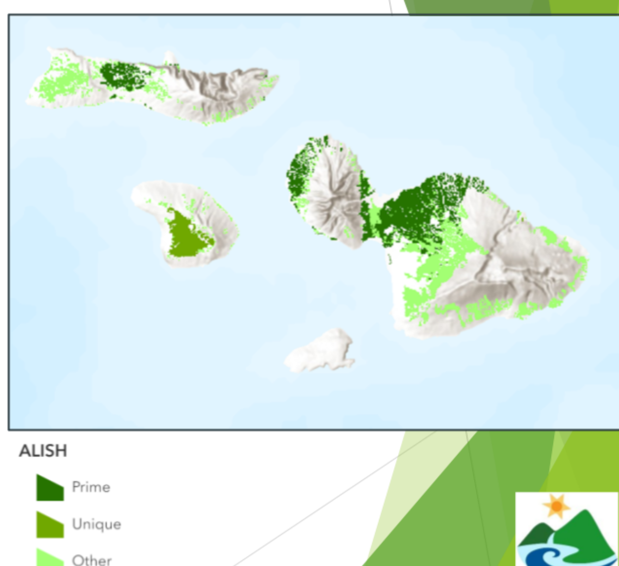
Land Study Bureau (LSB)

- Initiated by Act 35,
  1957 Territorial Legislature (1957-1974)
- Intended to develop, assemble, coordinate, and interpret data on characteristics and use of land
- Determined Overall (Master) Productivity Ratings A (highest) to E (lowest) to rate soil productivity based on productivity and soil and landform characteristics
- Classified A & B Lands as "most productive" agricultural lands
- Used in HRS §205-4.5 to protect the most productive lands by limiting the uses allowed on them. Lower rated lands (C-E) can have somewhat more flexible uses



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

- Developed by HDOA with SCS (NRCS) and UH-CTAHR following a federal Potential Cropland Study in 1975
- Intent to facilitate inventory of prime farmlands nationally, adapted to Hawaiʻi
- Considered soil quality for mechanized field crops as well as within specific needs of high-value food crops
- Established three land classifications:
  - Prime (soils with best physical, chemical, and climatic properties for field crops)
  - Unique (land other than prime for traditional or unique high-value crops such as taro or coffee)
  - Other (non-prime, non-unique, but important lands requiring irrigation or commercial production management)
- Used as a factor in considering the designation of Important Agricultural Lands (Act 183, SLH 2005)



Land Evaluation and Site Assessment (LESA)

- Adapted from USDA-NRCS LESA methodology by LESA Commission (Act 273, 1983 State Legislature)
- Intended to identify important agricultural lands and develop and propose legislation toward land reform
- Combined Land Evaluation (soils, topography, and climate) and Site Assessment (location, land use) in weighted numerical assessment
- All lands with scores above a threshold were identified as important agricultural land

Land Evaluation & Site Assessment

Important Ag Lands

Soil Classification Q & A

SSURGO | LSB | ALISH | LESA

Soil Classification Related Policy Overview

Soil Classification Related Policy

Related to Permissible Uses Within Agriculture Districts

- HRS §205-4.5(a)(b)(c)
  - Permissible uses within the agricultural districts
- HRS §205-6(f)
  - Special Permit

- Restricts the types of agricultural uses on LSB Class A or B
- Subdivision of land with LSB Class A or B cannot be approved by the county unless certain restrictions are met
- Accessory agricultural uses and services may be further defined by the county for LSB Class C, D, E, or U
- Uses not identified as permissible but allowed in a habitat conservation plan or safe harbor agreement may be permitted in LSB Class C,D,E, or U

Soil Classification Related Policy

<u>Related to Solar Energy Facility Development</u>

- HRS §205-4.5(20)(21)
  - Permissible uses within the agricultural districts
- Kaua'i County §8-2.4(q)(20)
  - Uses in Districts
- Maui County §19.30A.050
  - Permitted uses

Generally, these policies have restrictions on Solar Energy Facilities placed within land with soil classified by LSB:

- A: not permitted
- B or C: various restrictions
- D or E: minimal to no restrictions

<u>Related to Golf Course Development</u>

- Honolulu County §24-1.14
  - Golf course development

Applications for golf courses are evaluated but not precluded on whether they are located on prime agricultural lands rated "A" or "B" by the LSB classification, although the approval of golf courses on such lands is discouraged

Soil Classification Related Policy

<u>Related to Agricultural Districts</u>

- Honolulu County §21-3.50
  - Agricultural district - purpose and intent

The intent of the AG-1 restricted agricultural district is to conserve and protect important agricultural lands for the performance of agricultural functions by permitting only those uses that perpetuate the retention of these lands in the production of food, feed, forage, fiber crops, and horticultural plants. Identification of AG-1 lands include those that are predominantly classified as prime or unique under ALISH

<u>Related to Country Districts</u>

- Honolulu County §21-3.60
  - Country district - purpose and intent

One of the guidelines used to identify lands that may be considered for this district includes lands that are <u>not</u> predominately classified as prime, unique, or other under the agricultural lands of importance to the State system

Soil Classification Related Policy

<u>Related to Family Agricultural (FA) Districts</u>

- Hawai'i County §25-5-60
  - Purpose and applicability

This district provides for a blend of small-scale agricultural operations associated with residential activities, and is intended to be primarily comprised of agricultural lands less than five acres in area, which are <u>not</u> classified as A or B lands under the LSB's master productivity rating, or classified as prime, unique, or other important agricultural lands

<u>Related to Intensive Agricultural (IA) Districts</u>

- Hawai'i County §25-5-80
  - Purpose and applicability

The IA district provides for the preservation of important agricultural lands as provided for in the general plan and characterized by a mix of small and large scale commercial farms and other agricultural operations which may include residential use in the form of farm dwellings closely tied to intensive agricultural use

Soil Classification Related Policy

<u>Related to Agricultural Project Districts (APD)</u>

- Hawai'i County §25-6-50
  - Purpose and applicability

The APD district is intended to provide a flexible and creative planning approach for developments within the agricultural zoning districts, and provide a vehicle to satisfy the demand for a rural lifestyle on marginal agricultural land, while decreasing the pressure to develop important agricultural land for this purpose

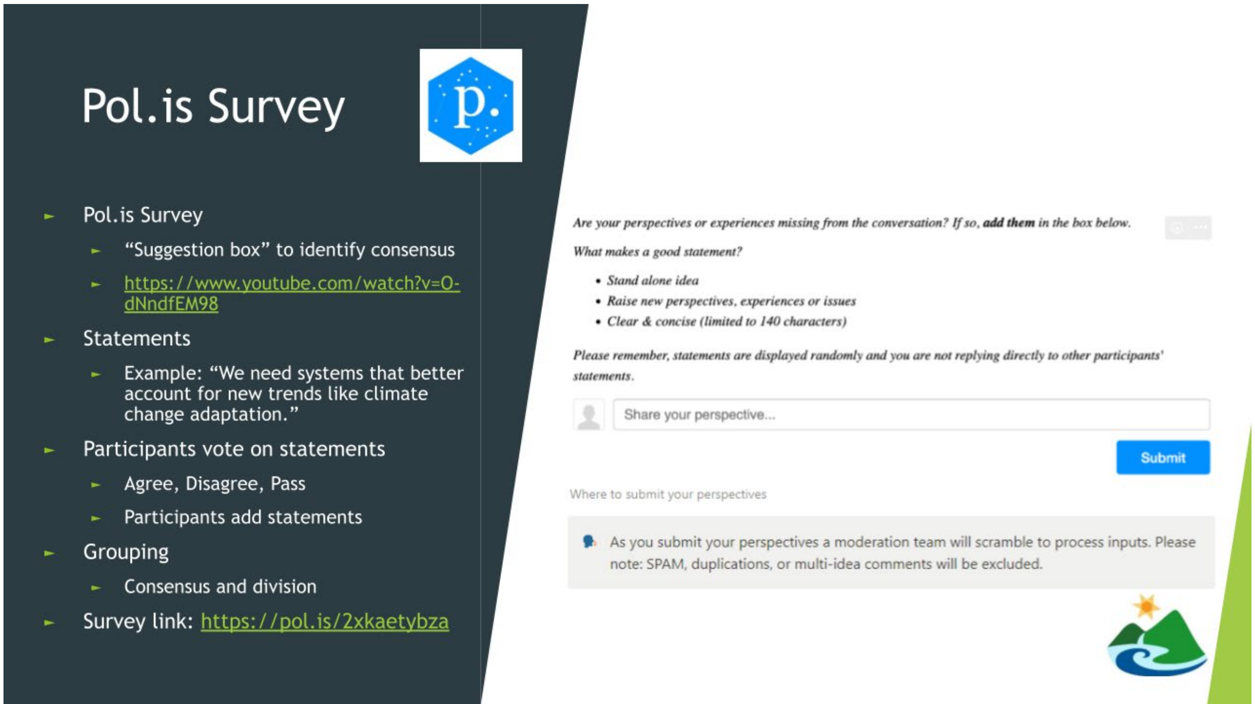
<u>Related to Retention in the Agricultural District</u>

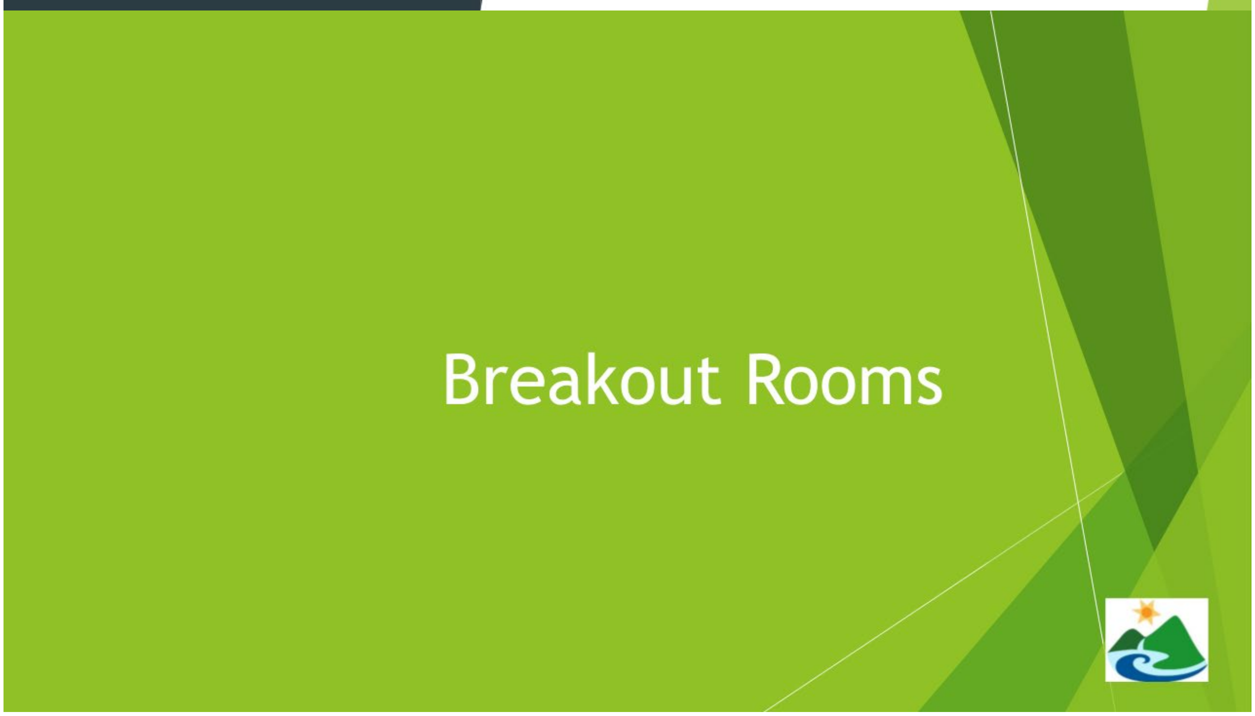
- Maui County §19.30A.020
  - District criteria

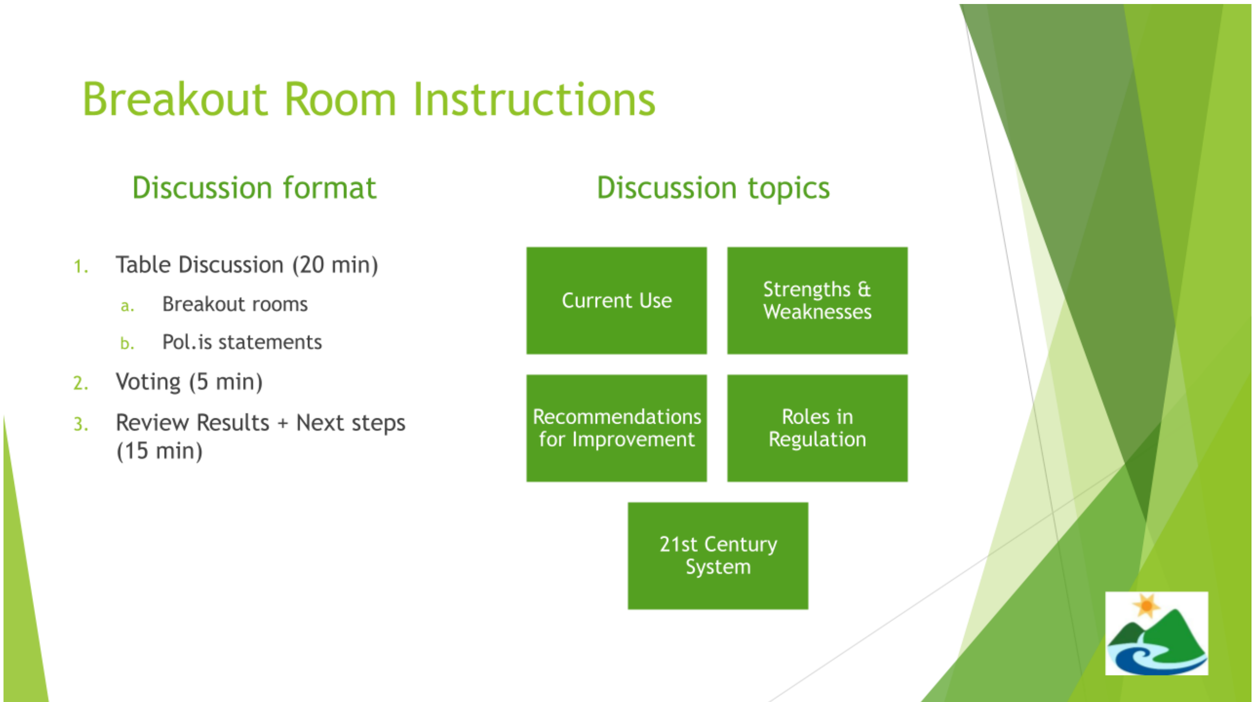
ALISH is one of three possible criteria used to determine the highest priority for retention of agricultural lands in the agricultural district


Policy Feedback


Initial Pol.is Voting
Survey link: https://pol.is/2xkaetybza


Pol.is Survey
Pol.is Survey
"Suggestion box" to identify consensus
https://www.youtube.com/watch?v=O-dNndfEM98
Statements
Example: "We need systems that better account for new trends like climate change adaptation."
Participants vote on statements
Agree, Disagree, Pass
Participants add statements
Grouping
Consensus and division
Survey link: https://pol.is/2xkaetybza
Are your perspectives or experiences missing from the conversation? If so, add them in the box below.
What makes a good statement?
Stand alone idea
Raise new perspectives, experiences or issues
Clear & concise (limited to 140 characters)
Please remember, statements are displayed randomly and you are not replying directly to other participants' statements.
Share your perspective...
Submit
Where to submit your perspectives
As you submit your perspectives a moderation team will scramble to process inputs. Please note: SPAM, duplications, or multi-idea comments will be excluded.


Breakout Rooms


Breakout Room Instructions
Discussion format
1. Table Discussion (20 min)
a. Breakout rooms
b. Pol.is statements
2. Voting (5 min)
3. Review Results + Next steps (15 min)
Discussion topics
Current Use
Strengths & Weaknesses
Recommendations for Improvement
Roles in Regulation
21st Century System


Review Results + Next Steps

Review Results

- View Report: https://pol.is/report/r4tfrhexm3dhawcfav6dy

1. Where on the spectrum from consensus to division do we trend?
2. What's hot? Majority support items
3. Opinion Groups:
   a. Voted similarly on multiple statements
   b. Voted distinctly differently from other groups
4. Waffling - where are we uncertain?

Next Steps

Phase I

July 2023
Project Kick-off

July-Aug 2023
Preliminary Research

October 2023
Initial Focus & County Group Meetings

Phase II

Nov-Dec 2023
Interim Report

Jan-March 2024
Initial Recommendations

March-April 2024
Additional Focus & County Group Meetings

May 2024
Meeting Summary Memorandum

May-June 2024
Follow-up Recommendations

Oct-Nov 2024
Final Report


Mahalo
Project website:
https://storymaps.arcgis.com/stories/aceb7c1d500e4cfe9eaf57274c0db123
Project email:
hisoils@g70.design

APPENDIX C: INDIVIDUAL MEETING SUMMARIES

MEETING SUMMARY: FOCUS GROUP 1A TECHNICAL LEGAL - OCTOBER 3, 2023

Contractor Team: Supersistence: Hunter Heaivilin; G70: Barbara Natale, Ryan Ringuette; Plasch Econ Pacific: Bruce Plasch; Dr. Adhann Iwashita

OPSD Staff: Katia Balassiano, Ruby Edwards

Participants: 22

Overall takeaways from participant comments:

- Important Agricultural Lands (IAL) should be included in the study.
- Other factors other than productivity should be considered in agricultural land regulation.
- A recommendation was requested for criteria other than soil classifications to determine non-agricultural use on agricultural land.
- The current systems are outdated, and should be updated.
- More information is needed to understand how best to use the Polis survey tool.

Presentation summary:

The first Focus Group meeting was held with stakeholders that the contractor team identified as having technical or legal expertise related to soil classifications and agricultural land regulation.

During the question-and-answer section, a stakeholder commented on the static nature of most datasets, except for SSURGO, which undergoes an annual review. This opens the question for potentially pursuing funding of an agricultural committee for a major update of datasets. A stakeholder asked what the composition of focus groups were, and what other groups of people would be involved, which was answered by describing the composition of the other Focus (technical / legal, agricultural / land protection, energy / large landowner / developer) and County (Kauaʻi, Hawaiʻi, Oʻahu and Maui) Group meetings.

A suggestion was made to include Important Agricultural Lands (IAL) in the study. Soil classification is one of the many factors in designation of IAL. For example, it acknowledges the importance of agricultural lands with less ideal soil quality but are still productive, such as orchid or coffee farms, ornamentals and ranching. These types of agricultural issues may not be the focus of this study in particular, but as a side note, readers of the study will recognize that there is a lot of agriculture that takes place on lands that don't have perfect soil, but can still be recognized as important ag lands. Hunter acknowledged the interest of including IAL in the study, but identified the need to confer with OPSD regarding this inclusion, as this was not included in the original scope of the study for analysis. However, mapping of the IAL is included as an overlay on a number of soil systems in the project storymap website (https://storymaps.arcgis.com/stories/aceb7c1d500e4cfe9eaf57274c0db123).

There was also a call for potential recommendations for allowing non-soil-based agricultural developments, like solar farms, churches or golf courses, to aid in decision-making at the county level. It seems that lower-rated soils tend to almost be the only criteria needed to get a special permit.

After the breakout session, Barbara brought up a question from her discussion: are we looking at the properties of soils themselves in order to protect agricultural land use? Hunter responded that this is something that was in the original bill from the legislature directing this study. However, the outputs, or the impacts of these classification systems, which in some cases were really focused on productivity or soil quality, have much broader implications for agricultural development, land protections, etc.

Breakout room summary:

In Hunter's breakout room, participants discussed the need for a more robust, modern soil classification system and that the current system does not reflect current uses. Factors other than productivity should also be considered (i.e.

distance to services, history of use, economic value, previous and potential uses). The potential for new State land use districts and the rural classification to allow for other uses and as a buffer between agricultural and urban uses were also discussed. Finally, IAL and the need for water infrastructure to use lands were mentioned.

In Barbara's breakout room, LSB classifications are used to determine whether requests to rezone agricultural land are appropriate, typically to downzone for smaller lots. No ALISH prime or Other land is used for Family Agricultural district zoning, unless it is immediately adjacent to urban lands. OPSD uses LSB and ALISH for comments on petitions, HRS 343, and permit review. There is a need to update the data; LSB E is being used for agriculture. LSB has protected agriculture but may not be doing the best job in protecting agricultural lands, or holding policy goals like promoting a viable agricultural economy. Soil classification systems don't necessarily include indigenous perspectives, and other factors (e.g. proximity to housing, water, viability for on-site worker housing).

In Ryan's breakout room, LSB is used in the context of renewable energy development, and ALISH factors into environmental assessments. Soil classifications are also used in plan updates, specific soil applications are used in SMA application review, and specific soil types are important to identify traditional/cultural resources and vegetation. While having soil classifications is helpful for providing a framework, the system feels outdated and different soil classification layers don't always align with each other. These soil classification systems should not just be a checklist, and developers should be educated so that soil classifications are a part of the project's design. Other factors (e.g. flood zones, sea level rise, salt water inundation) should be included in agricultural land regulation.

Post-meeting Zoom survey:

One comment recommended that participants should be guided in breaking their comments into smaller, discrete thoughts and to show them how to enter each one into Polis. This would help to reduce complex thoughts that might cause people to pass. Another comment stated that advance prompts for Polis could have been voted on first, which could lead to a more robust discussion in the breakout room. Finally, a comment asked us to be forthright and clear in future representations of the weight and significance of the feedback defined using the Polis voting system, that questions were seeded from the perspective and goals of the project, and that all later suggestions by participants do not get equal votes as a function of the Polis system configuration.

MEETING SUMMARY: FOCUS GROUP AGRICULTURE AND LAND USE - OCTOBER 5, 2023

Contractor Team: Supersistence: Hunter Heaivilin; G70: Barbara Natale, Ryan Ringuette; Plasch Econ Pacific: Bruce Plasch; Dr. Adhann Iwashita

OPSD Staff: Katia Balassiano, Ruby Edwards, Aaron Setogawa

Participants: 23

Overall takeaways from participant comments:

- Current systems were viewed through the lens of sugar and pineapple.
- Soil classification systems should be updated, including unique lands.
- The need for bioremediation should be considered in soils classification.
- The presentation material was difficult for some to follow.

Presentation summary:

The second Focus Group meeting was held with stakeholders that the contractor team identified as having agriculture or land use expertise related to soil classifications and agricultural land regulation.

During the question-and-answer section, a stakeholder asked how contemporary the SSURGO data was. Amy Koch, a stakeholder who is also the NRCS's Assistant Director for Soil Science, answered that the data is annually refreshed, but that they haven't been able to do an extensive revision like what was done in the past. The 1970 survey focused on sugar and pineapple and not so much on the watershed areas, but most of the SSURGO data looks at inherent soil properties, which are not likely to change. Hunter also added that soil moved around due to methods that the sugar plantations used.

Another stakeholder asked what the ultimate outcome of the project is, which was answered by describing the purpose of the project, which is to evaluate current soil classification systems used in Hawaiʻi and develop recommendations to improve their role in agricultural land regulation. It was made clear that the project was not creating a new soil classification system.

A stakeholder described their personal experience with land designated as IAL. Rocky, sloped lands were classified as IAL, which in their view means that there is something wrong with the overall classification system. They also mentioned their experience with LSB. Similar-looking land was divided by a chain link fence, with one side classified as LSB A and the other side classified as LSB D, which also seems to be wrong. They also mentioned that these systems were based on sugar and pineapple and used broad-scale classifications rather than smaller-scale ones. Sugar was grown on the regular contours of the property, unlike most major crops on the mainland which operate on flat land. The land sugar grew on was hilly and rocky, which didn't matter because sugar was mechanically harvested. The older studies don't take that into consideration; they assumed that if sugar was grown there that you can grow anything there.

Another stakeholder asked whether loʻi were considered agricultural land and how they were rated. Hunter responded that loʻi was considered under the ALISH system. Ruby also mentioned that LSB does not incorporate wetland crops, and that they were usually listed as LSB E.

Finally, a stakeholder asked how kānaka ʻōiwi, or traditional ʻike or land management practices were being incorporated into the study. Hunter responded that the study has tried to do a broad outreach, but asked the stakeholder to also let the contractor team know of others to include the studies outreach.

Breakout room summary:

In Hunter's breakout room, SSURGO was mentioned as being useful for waterflow and erosion analysis for housing developments; however, it is not updated regularly, and a statewide update would be useful. LSB C class land and lower are used to discount land quality and upzone, despite their agricultural potential. The system needs to be updated, but on a manageable timeline the LSB soil productivity approach should be the foundation of the update. Soil classifications are one tool in the toolbox but may not be the best way to determine land use priorities; outcomes should be holistic and consider geology, land use, and land position (mauka/makai).

In Barbara's breakout room, LSB is one component for determining IAL lands. However, if landowners designate land as IAL, the State will accept the land as such. Some of these landowner-designated IAL lands are not very good, and can enable development without community input. USDA soil survey maps can be used to understand types, productivity and soil requirements. Unique land classifications need to be redone (e.g. kalo and ʻulu lands in Kona, macadamia nuts and coffee in Pahala). Slope should be one criteria, but unique climate conditions make for unique crops. Remediation is a huge aspect, especially bioremediation.

In Ryan's breakout room, stakeholders commented that soil classifications should be looked through the lens of climate change. The current soil classification systems are designed for outdated uses; modern uses include energy, land use, natural resources and agriculture. These systems could be improved by considering the resiliency of the land, water availability, and by annually updating data. There were concerns that soil data is limited due to its age.

Post-meeting Zoom survey:

One comment wanted more time to explain the current systems using less complex language. Another commenter agreed, saying that the presentation was difficult to keep up with and should be drastically simplified if the study wants to reach a larger audience (emphasis on including Kānaka ʻŌiwi). They also recommended having in-person talk story sessions. Another commenter found the use of Polis interesting , but felt the need to pass because they did not wholly agree or disagree with the statement. Statements that were passed on may warrant further discussion. Finally, another comment asked for better moderation to lead the participant discussion.

MEETING SUMMARY: FOCUS GROUP ENERGY, LARGE LANDOWNERS, AND INDUSTRY - OCTOBER 10, 2023

Contractor Team: Supersistence: Hunter Heaivilin; G70: Barbara Natale, Kira Ramos; Plasch Econ Pacific: Bruce Plasch; Dr. Adhann Iwashita

OPSD Staff: Katia Balassiano, Ruby Edwards, Aaron Setogawa

Participants: 16

Overall takeaways from participant comments:

- Soil classification systems are inaccurate and land use decisions are being made despite knowing of this inaccuracy.
- The systems don't reflect possible use.
- It's become difficult to site new solar farms.
- Soils are behaving differently due to erosion, deposition, etc., and there is a need to monitor and update the soil classification systems.
- An update to the soil classification systems could hurt agricultural land protections.

Presentation summary:

The third Focus Group meeting was held with stakeholders from energy, large landowners, and industry as identified by the contractor team.

During the question-and-answer section, a stakeholder asked whether LESA has been adopted. Hunter replied that it was a system that produced reports for the legislature, but were not incorporated into law.

After the breakout room session, Barb raised a point from her breakout sessions that solar farms are being put on C, D, and E soils, but E soils are primarily rocky soils that aren't necessarily good for solar farms either.

Breakout room summary:

In Hunter's breakout room, LSB, ALISH, and LESA are not used by soil scientists or agronomists. Site specific soil studies have determined that the existing classifications are inaccurate. Single parcels with the same LSB rating have slivers of different soil classes for reasons that are not readily apparent when assessing a site, and complicates efficient use of the land. Land use decisions are being made using these systems, even though users know these systems are faulty. Outdated LSB layers don't reflect possible use, and the State needs to determine if land quality should reflect current use or potential use. LSB is the primary system in solar scoping due to its use in land regulation. Agriculture and renewables can coexist productively.

In Barbara's breakout room, one stakeholder brought up the need to balance the usefulness of agricultural lands to address things like climate change, affordable housing, etc., especially as not that many people farm anymore though there is a push for backyard agriculture. Renewable energy generation on Kauaʻi has gotten to 60-70%, but needs to get to 100% and it's become difficult to site new solar. You cannot site on LSB A soils (some parcels have a sliver of LSB A land on them), and E soils can be difficult for solar; the window is B, C, and D lands. How many acres of B, C, D lands are available on each island? Another participant noted that the soil ratings should prioritize land being used for food security.

In Kira's breakout room, site assessment information may be more important than soil classification information. The fact that the soil classification information is online is a strength. However, some soils are behaving differently than they did when the original maps were made due to erosion, deposition, and long-term degradation. There is a need for ongoing monitoring and updates to these soil classification systems. There is a concern that whenever updates occur, it can act as an opportunity for people to remove agricultural land protections. They would rather see things added on rather than delisting others. Lands have degraded, which could be a rationale to urbanize more lands and attack prime agricultural lands.

Post-meeting Zoom survey:

One comment was that the soil maps should be a baseline with more recent data incorporated.

MEETING SUMMARY: HAWAIʻI COUNTY - OCTOBER 17, 2023

Contractor Team: Supersistence: Hunter Heaivilin; G70: Barbara Natale, Kira Ramos; Plasch Econ Pacific: Bruce Plasch; Dr. Adhann Iwashita

OPSD Staff: Aaron Setogawa, Ruby Edwards

Participants: 14

Overall takeaways from participant comments:

- Watershed, non-potable irrigation, and rainfall availability should be considered in soil classification systems and be updatable.
- Producers don't use the soil classification systems to determine what to produce.
- Historical data on previously farmed areas can be helpful to farmers.
- Soil composition can change in a matter of feet.
- Complex boundary lines that incorporate multiple layers aren't well tailored for regulatory functions.
- Soil classifications can be used to frame applications, HRS, and codes.
- New systems should use updated data and include erosion factors and economic considerations, not just productivity.
- Soil classification input layers should be provided along with any final classification system.
- Classifications on the Big Island and other islands could be different than Oʻahu due to density and land mass.

Presentation summary:

The first County Group meeting was held with stakeholders from Hawaiʻi County, including county planners and elected officials identified by the contractor team. Due to low registration for and cancellation of the Kauaʻi County meeting, participants from Kauaʻi were also included.

During the presentation, a comment was made that SSURGO's class 6 lands on Kauaʻi are mollisols, the richest soils on Kauaʻi and used to be cane fields. It would be better if those classes contained soil taxonomy data. Hunter confirmed that the SSURGO data does.

During the question-and-answer section, a stakeholder commented that during the IAL study on Kauaʻi, they could only address land currently being farmed, not past areas of kalo production. They liked the LESA system, but would also like systems to use the locations of where people were farming 500 years ago. They are also interested in a watershed approach to land use and food production, which the current maps do not really do so. They also recommended looking at IAL. They brought up an example of IAL designated land that received a lot of rainfall, but that would be poor for agriculture due to slope.

During the policy feedback section, a stakeholder commented on the need to take into adequate rainfall or gravity flow non-potable water, and a climate and topography approach. Hunter commented that rainfall was included specially for Hawaiʻi in our soil classifications.

After the review of the initial Polis results, one stakeholder asked for clarification on the timing of deliverance of the interim report and the initial recommendations to the Legislature. Hunter clarified that the interim report will be submitted prior and separately from the initial recommendations. Another stakeholder asked why this effort couldn't have been conducted through the counties. They also commented on the need to consider ahupuaʻa and watershed approaches due to their holistic nature.

Breakout room summary:

In Hunter's breakout room, producers don't use the soil classification systems to determine what to produce. Additionally, complex boundary lines that incorporate multiple layers aren't well tailored for regulatory functions. A new system should incorporate updatable rainfall and irrigation availability. A new system should also separate out zoning and regulatory decisions from the technical, productive quality of the land. Finally, input layers should be provided along with any final classification system.

In Barbara's breakout room, LSB and ALISH are used for analysis and whether a particular use is permitted or not. Historical data of crop placement can set up farmers for success because the history of agriculture on the land (e.g. whether herbicides or pesticides were used) contributes to soil conditions. Soil composition can differ in a matter of feet, and soil sampling can help to determine the success of a crop. The data used for the classification systems are old, even though there are modern Geotech datasets available. Soil classifications can be used to frame applications, HRS, and codes. New systems should also include economic considerations, not just productivity, and consider erosion factors (e.g. the Hāmākua coast).

In Kira's breakout room, from a regulatory standpoint, it would be helpful to better understand the complex boundaries of the LSB system by extracting each layer (e.g., water availability, soil type, accessibility) out. There are parcels of land that have very similar features; however, have different ratings and have implications on the use of land. The availability of water and irrigation were included in the LSB classification system when it was established in the 1960s; however, the availability of water and irrigation has likely changed since its establishment and should be updated in any update to the LSB classification system.

Post-meeting Zoom survey:

One comment asked what the ultimate purpose of the study was other than an academic one, and that new forms of agriculture depend on location as priority over soil type. Another comment suggested restating participant input rather than stating agreement with a particular viewpoint to better understand why people are passing on statements. A comment mentioned that the classifications on the Big Island and other islands could be different from Oʻahu due to density and land mass. Finally, one comment asked for more time to go over the Polis material, and another asked for earlier notice of future focus group meetings.

MEETING SUMMARY: OʻAHU COUNTY - OCTOBER 19, 2023

Contractor Team: Supersistence: Hunter Heaivilin; G70: Barbara Natale, Ethan McKown; Plasch Econ Pacific: Bruce Plasch; Dr. Adhann Iwashita

OPSD Staff: Aaron Setogawa

Participants: 7

Overall takeaways from participant comments:

- Current soil data may not be curated towards producers.
- LSB is geared for planation agriculture and less so for diversified agriculture.
- ALISH comes from a base of LSB.
- Previous pineapple and sugar lands can identify the best general lands for agriculture, but may not include the best lands for some unique crops.

Presentation summary:

The second County Group meeting was held with stakeholders from Oʻahu County, including county planners and elected officials identified by the contractor team.

During the question-and-answer section, one stakeholder commented that they are working on a web mapping tool for producers, which includes soil data. However, after learning more about the existing data, it may have been collected and curated for a specific purpose—but not necessarily for producers.

Hunter confirmed this by reviewing the purpose of each soil classification system. Not all of these systems are necessarily developed with solely agricultural land use planning in mind. The SSURGO database/NRCS Web Soil survey does have tools embedded to try and facilitate understanding of how physical chemical properties may factor into engineering considerations, for example. But the LESA system was explicitly about identifying important agricultural lands. The ALISH system has a corollary function in that it identifies prime, unique, etc. lands. The LSB is more about informing about the quality of lands. However, early outputs from the LSB were used both in the development of our State land use districts because these were passed in the same session. And so, while it was more about agricultural output, its function in the way it's been applied is often for some volume of agricultural land regulation.

Another stakeholder commented that SCS and NRCS soil survey work was mainly for conservation planning. Additionally, the LSB study was mainly geared towards plantation agriculture, and isn't really geared towards diversified agriculture. However, ALISH and IAL does include this to some degree (e.g. taro loʻi). Finally, Hawaiʻi has a large diversity of soils, and thus production capabilities, and makes Hawaiʻi unique and special, but also difficult.

Another stakeholder commented that the base for the preservation of the best agricultural lands comes from LSB. The rest depends on the type of crop being grown and the location of where it's being grown.

After the Polis tutorial, a stakeholder recounted their experience with ALISH in the legislature. ALISH was first introduced in 1985, but by 1987-88 it had disappeared. The characteristics of ALISH—prime, unique, other—were usable, simplify the process of identifying lands, and came from a base of LSB soil classifications. Then what mattered was what you did to make the lands more productive. Pineapple and sugar were the primary users of the best agricultural lands, and were a good bet of where the best lands actually were, barring some areas for unique crops. The most productive lands are the ones you want to keep and not lose to urbanization but are also the best for urbanization (due to flat lands, access to water, etc.).

Breakout room summary:

(No breakout room occurred due to the small number of participants in attendance)

Post-meeting Zoom survey:

One comment was that the Legislature does too many studies with very little follow through on lessons learned. Another comment was that limiting the Polis survey to 10-15 questions would provide better and more complete input as the stakeholder felt rushed and without enough careful thought. This stakeholder also found the discussion on past systems excellent, and in the future, would like to hear more about the potential uses of the findings of this effort.

MEETING SUMMARY: MAUI COUNTY - OCTOBER 24, 2023

Contractor Team: Supersistence: Hunter Heaivilin; G70: Barbara Natale, Ryan Ringuette; Plasch Econ Pacific: Bruce Plasch; Dr. Adhann Iwashita

OPSD Staff: Aaron Setogawa, Ruby Edwards

Participants: 13

Overall takeaways from participant comments:

- Agrivoltaics can benefit agriculture.
- Systems should consider land cover change from sea level rise, the intensity of water use by the land user, and invasive species on land degradation.
- Wetlands often don't have adequate soil data.
- Updated soil classifications would help Maui county, but not necessarily new zoning.
- The current systems are not doing a good job of regulating agricultural land; it doesn't consider irrigation, other crops, or pasture.

- Current systems do not have an appeal process.
- State and counties should agree to using only one soil classification system.
- The LUC could use a systemized approach to reviewing SUP's.

Presentation summary:

The third County Group meeting was held with stakeholders from Maui County, including county planners, elected officials identified by the contractor team.

Breakout room summary:

In Hunter's breakout room, one stakeholder commented on the amount of Polis statements concerning agrivoltaics. Options for solar production within urban areas should be exhausted before the use of prime agricultural lands for photovoltaics. Another stakeholder commented on the benefits to agriculture provided by agrivoltaic systems. Soil classification system updates are necessary but may be resource intensive. Systems should consider land cover change as a result of sea level rise, as well as the intensity of water use by the land user. A new system should also take into account the impact of invasive species on land degradation and its subsequent suitability for agriculture.

In Barbara's breakout room, vertical farms don't need soil. However, soil classifications can be used to protect agricultural land and regulate the uses on agricultural land (not necessarily only agricultural production). Wetlands often don't have adequate soil data and will be important for planning decisions and climate resilience. Maui County uses ALISH only for solar and updated soil classifications would help in regulating that. However, Maui County doesn't need new zoning. The current systems are not doing a good job of regulating agricultural land; it doesn't consider irrigation, other crops, pasture, and there is no appeal process. The state and counties should agree to using only one soil classification system. When the LUC reviews a SUP, it is on a case-by-case basis and they don't have a good handle on what works or have a systemized approach. Each case is different and they don't necessarily know what is appropriate on agricultural land.

Post-meeting Zoom survey:

One comment was that there should be more meetings with smaller groups. Another asked for the use of framing questions to achieve the desired input, and to distribute those questions prior to the meeting. They also asked presenters to be more proactive in engaging individuals who were not participating in the discussion. Another commenter asked for more time to review the previous Polis statements, as well as time in the breakout session. A comment was made asking for more opportunities to give input throughout the presentation. Finally, another liked the format, but would rather have a daytime meeting.

APPENDIX D: ALL ACCEPTED POLIS STATEMENTS

Accepted statements are statements that have been moderated into the Polis conversation based on their reflection of original, meaningful, and relevant statements expressing opinions of or thoughts about soil classification systems and their use in land use planning and agricultural land regulation in Hawaiʻi. Statements were moderated into the conversation in real time by a member of the team. Statements with superscript ([1]) reflect seed comments, which were used in the initial focus group meeting to seed thinking and conversation on soil classification systems. Statements with superscript ([2]) reflect statements added after the Focus and County meetings were concluded. Punctuation and spelling reflect user input; the Polis system does not allow for editing of statements on the backend.

Statement No.	Statement	Content	Category
3[1]	We regularly consult LSB ratings when assessing agricultural potential for land. It provides a useful baseline..	LSB	Current use
4[1]	We should be cautious about major changes to systems that still work reasonably well..	Systems	Recommendations for improvement
5[1]	A major limitation of current systems is the lack of regular updates to reflect changing conditions..	Systems	Weakness
6[1]	The LSB system undervalues land quality in some regions..	LSB	Weakness
7[1]	Digital soil maps like SSURGO offer more detailed insights, but can be difficult to interpret without adequate training..	SSURGO	Weakness
9[1]	Periodic re-evaluation and stakeholder input would help keep existing systems relevant..	Systems	Recommendations for improvement
10[1]	It's challenging to reconcile differences between multiple classification systems on the same land..	Systems	Weakness
11[1]	Protecting prime productive lands should remain a priority in agricultural land regulation..	Regulation	21st Century system
12[1]	Existing classifications overly focus on productivity, which shouldn't be the only consideration..	Systems	Weakness
13[1]	Existing systems don't account for climate change or traditional Hawaiian land management..	native Hawaiian perspective s	Weakness
16	Systems were designed to protect sugar and pine do not reflect current use, diversified use, agriculture on marginal lands or taro farming	Systems	Weakness
19	Enclosed agriculture (vertical, shade, green houses etc.) needs to be considered in any system update	Other factors	21st Century system
22	Distance to services and history of use are important considerations	Other factors	21st Century system

Statement No.	Statement	Content	Category
24	Soil classifications should take into account ahupua’a and indigenous perspectives, justice, land access, and water access.	native Hawaiian perspectives	21st Century system
27	Soil types are important to identify traditional/cultural resources and vegetation.	native Hawaiian perspectives	Current use
28	Water infrastructure is needed to ensure IAL and similar lands are able to be utilized	Other factors	21st Century system
30	Soil systems should be easy to use and understand	Systems	Recommendations for improvement
32	Need for a robust modern system that supports agricultural PRODUCTIVITY	Systems	21st Century system
33	The LSB soil classification system feels outdated	LSB	Weakness
34	Data should be updated to reflect how lands are currently being used	Data	Recommendations for improvement
38	Vertical farming should not be used as a diversion to authorize development of Agricultural lands.	Regulation	21st Century system
39	Soil remediation is not considered in the current assessment of soil quality.	Other factors	Weakness
41	Protecting prime productive lands should remain a FACTOR in agricultural land regulation.	Regulation	21st Century system
42	Different classification system each for crops, grazing/livestock, vertical farming, ornamentals, hydroponics.	Systems	21st Century system
44	Any system incorporating soils for land use decisions should be updatable, dynamic, and easily incorporated into land use decisions	Systems	Recommendations for improvement
46	Only LSB contains crop/animal yield estimates that are useful to farmers	LSB	Current use
47	The State should hold managers and owners accountable for fallow ag lands or crops that have little use in our lives (i.e., pineapple).	Regulation	Recommendations for improvement
48	We need to release ag land for energy use.	Energy	21st Century system
50	Systems like SSURGO should release original data to allow users to do their own interpolation	SSURGO	Recommendations for improvement
55	SSURGO is useful for identify inputs to see if lands are economically feasible.	SSURGO	Strength

Statement No.	Statement	Content	Category
59	Classification maps and indexes must be modernized to optimize for those factors of value in Hawaiʻi today, i.e., not just productivity	Other factors	Recommendations for improvement
60	Collective indices of "resilience" should be developed as a system to underlie a new classification system	Other factors	21st Century system
62	Indigenous values and water rights should be centered in the development of a classification system that may be used for land use regulation	native Hawaiian perspective s	21st Century system
65	Dynamic soil properties, like soil health, should be part of a new classification system	Other factors	21st Century system
67	SSURGO needs to be updated to include relevant, local data and methodologies for collecting data about Hawaiʻi's soils	SSURGO	Recommendations for improvement
68	SSURGO is useful for waterflow and erosion analysis for housing developments	SSURGO	Current use
71	Soils could be classified based on potential for improvement in soil quality and health or as a factors in climate mitigation	Other factors	Recommendations for improvement
72	Soil classifications are one tool in the toolbox, but may not be the best way to determine land use priorities	Systems	Current use
74	Systems need updating, but we need to have a system that isn't constantly being updated too	Systems	Recommendations for improvement
75	LSB's soil productivity approach should be foundation for any update, additional considerations and uses could be add-ons but not the focus.	LSB	Recommendations for improvement
76	Pastureland should be separated from agricultural lands. Not less important, just separate, based on the quantity of food produced alone.	Regulation	21st Century system
78	Any new system should not be so oversimplified that bad actors manipulate/take advantage of it	Systems	21st Century system
79	The State should come up with a cohesive classification of what use proper use of prime lands and isn't.	Regulation	Recommendations for improvement
81	LSB classes C and lowers are used to discount land quality and upzone, despite agricultural potential	LSB	Current use
82	A land's potential for soil carbon sequestration should be considered in any new integrated framework	Other factors	21st Century system
88	Agrivoltaics can help stimulate agriculture in areas that have not recently been used for agriculture.	Energy	21st Century system
89	Class A land should also be allowed for renewable energy use if there is an appropriate and approved agriculture plan for the land.	Energy	Recommendations for improvement

Statement No.	Statement	Content	Category
90	climate change effects on endangered species movement needs to be also addressed	Other factors	Recommendations for improvement
91	identify AG lands that could be rehabilitated and not just classified as A and B classifications	LSB	Recommendations for improvement
94	LSB soil classifications appear to be arbitrary compared to current use of parcels	LSB	Weakness
95	The classification system needs to recognize that there is a need for both agricultural productivity as well as energy production	Systems	Recommendations for improvement
96	Site specific soil studies determine that the existing classifications are inaccurate	Systems	Weakness
97	LSB is the primary system used in solar scoping due to use in land regulation	LSB	Current use
98	Outdated LSB layers don’t reflect possible use	LSB	Weakness
99	Food sustainability is more important than energy production.	Other factors	Current use
100	The system should consider a classification for land that can be used for dual purposes like agrivoltaics (plants/crops or animals)	Energy	21st Century system
101	The priority of any classification should be identifying the ground truth rather than agreeing with current classifications	Systems	Recommendations for improvement
102	Energy versus food production is a false dichotomy.	Energy	Current use
103	Soils that are being used for food security should receive a higher soil classification rating	Systems	Recommendations for improvement
104	The LSB system is fine because soils don't change over time.	LSB	Strength
105	The soil classification system needs an appeal process	Systems	Recommendations for improvement
106	An updated soils survey should be completed since soils have eroded and composition has changed due to topsoil loss	Data	Recommendations for improvement
107	The opportunity to analyze soil classification should focus on protecting ag lands and not an opportunity to lose more land to non-ag uses	Regulation	Recommendations for improvement
108	In Hawaiʻi, there is a need for soil monitoring with changes in land management and ongoing erosion	Data	Recommendations for improvement
113	Regarding food sustainability and energy production these issues should be approached simultaneously if possible	Energy	Recommendations for improvement
116	There should be a clear distinction between technical land classification schema and land use policy/designation schema	Systems	Recommendations for improvement

Statement No.	Statement	Content	Category
117	Modern Geotech datasets should be integrated into current soil classifications	Data	Recommendations for improvement
118	Input layers should be provided along with any final classifications	Data	Recommendations for improvement
119	Complex boundary lines that incorporate multiple layers aren't well tailored for regulatory functions	Regulation	Weakness
120	It is challenging to hold landowners accountable for land conditions when market determines use	Regulation	Weakness
121	Soil sampling should occur regularly in order to know what the composition is and the determines the success of the crop.	Data	Recommendations for improvement
122	Soil classifications should consider highly erodible land during updates	Other factors	Recommendations for improvement
123	Soil class. should consider comprehensive economic considerations. For ex, is it ag vs energy, ag + energy, food vs fiber, or food + fiber?	Other factors	Recommendations for improvement
124	Regulation incorporating soil classifications would happen more quickly at the county level vs the legislature	Regulation	Recommendations for improvement
126	It would be good if conservation plans coming through the soil and water districts included reference to local soil classification systems.	Regulation	Recommendations for improvement
130	Hard to strike the balance between long-term preservation of ag land and updates to that system that reflect changing land use dynamics	Regulation	Current use
132	Agroforestry was a widespread traditional practice and important today. Traditional agroforestry areas are usually classified as marginal	native Hawaiian perspectives	Current use
133	the system should consider forestry potential when classifying soil. Sustainable native timber forestry is an emerging industry in Hawaiʻi	Other factors	Recommendations for improvement
135	remote sensing technologies can be used to regularly inform us on soil conditions and changes	Data	Recommendations for improvement
137	Options for solar production within urban areas should be exhausted before use of prime agricultural lands for photovoltaics.	Energy	Recommendations for improvement
138	The State and County should agree on one type of soil classification.	Regulation	Recommendations for improvement
139	It isn't a loss for agriculture to have photovoltaic if it's agrivoltaic. It's been seen to be a benefit in some cases.	Energy	Recommendations for improvement

Statement No.	Statement	Content	Category
140	Systems should consider land cover change as a result of sea level rise.	Other factors	Recommendations for improvement
141	Intensity of water use by the land user should be a factor in a rating.	Other factors	Recommendations for improvement
142	Systems should consider the impact of invasive species (e.g., weeds, deer), on land degradation and its subsequent suitability for agriculture	Other factors	Recommendations for improvement
143	Minimize administrative costs for managing soil classifications by streamlining processes with digital systems.	Systems	Recommendations for improvement
144	Pasturelands should be a distinct category within the classification system	Systems	Recommendations for improvement
145	In order to provide a systematic approach to soils, wetlands/hydric soils should be added to the soil classification systems.	Systems	Recommendations for improvement
146	Loopholes that allow for Gentlemen Estates must be addressed to ensure proper use of agricultural lands.	Regulation	Recommendations for improvement
147	There should be a mandatory quota for production on agricultural lands to ensure agricultural lands remain productive.	Regulation	Recommendations for improvement
148	Agricultural activities that benefit the surrounding ecology and improve ecosystem services need to be prioritized and incentivized.	Other factors	Recommendations for improvement
150[2]	This process should focus on soil classification, what is the soil composition, porosity, etc. at a specific point of time.	Systems	Recommendations for improvement
153[2]	The LSB soil classifications should not be used as a system of regulatory land-use zoning.	Regulation	Recommendations for improvement
154[2]	Combining renewable energy with agriculture on Class-A land could make farming and ranching more successful.	Energy	Recommendations for improvement
156[2]	Land classification should include fuel load growth potential, fire susceptibility of lands and fire management options.	Other factors	Recommendations for improvement
157[2]	Important ag lands need good soil types, relatively flat, have gravity-flow non-potable water.	Systems	Recommendations for improvement
158[2]	Soil classification should be just one factor in many to determine the best use of land	Regulation	Recommendations for improvement

Statement No.	Statement	Content	Category
159[2]	"best use" should not be limited to economics	Other factors	Recommendations for improvement
161[2]	Statements only refer to LSB. The ALISH and LESA systems have qualities that should be included in any agriculture and soil discussion.	Systems	Recommendations for improvement
164[2]	ALISH and LESA systems should be considered when discussing land use, agriculture and soil qualities.	Systems	Recommendations for improvement
165[2]	Real-time updated systems are very costly and may not be a reasonable use for policymaking	Data	21st Century system
167[2]	County of Hawaiʻi has determined Ag Tax exemptions based on soil rating and not on how the land is used. This is a problem for ranchers.	Regulation	Current use
168[2]	Classifications and updates should be based on new scientific learning about soil, not just creating a new numbering system.	Systems	Recommendations for improvement

APPENDIX E: ALL REJECTED POLIS STATEMENTS

As described above, "Rejected" statements are statements that are moderated out of the Polis conversation in order to facilitate the most productive conversation about the topic. Statements that were moderated out included spam or nonsensical comments; non-specific or irrelevant statements; questions; statements that contained more than one idea; and duplicative statements. For examples of each of these, please see Summary of Outreach Activities, which includes a description of the Polis system.

Rejected statements are being included in this report to provide transparency on the comments that were moderated out of the conversation.

The following table lists the rejected Polis statements.

Rejected Statements
Thanks for the follow-up survey
I am concerned about how the superficial nature of this input consolidation system will affect the outcome of this important project.
That would depend by on users financial abilities
ALISH and LESA systems should be used when considering land use, agriculture and soil qualities.
Should ALISH and LESA systems be considered in land use, agriculture and soil discussions?
The statements only referred to LSB. Why aren't ALISH and LESA systems being discussed?
Thanks
To protect important ag lands need good soil types, relatively flat, have gravity-flow non-potable water. Stop interbasin transfer of water.
Soil classification should be just one factor in many to determine the best use of land, and "best use" should not be limited to economics
Mahalo
Agree that crop land should be distinct from pasture land but not based, but disagree that food quantity should be a consideration.
what "productive" ag lands means is different to a soil scientist, a farmer, a land owner, an investor...
A project at UH to consider is the Benchmark Soils Project, which proved that ag technologies can be transferred based on Soil Series.
Does crosscutting issues, like agrivoltaics, demonstrate some limitations to thinking behind more static classification systems?
Existing systems don't account for climate change or traditional Hawaiian land management. Separate into two questions.

Rejected Statements
How might a classification system help incentivize soil remediation and GHG sequestration on working lands?
Consider the old with the new.
There are extensive data sets compiled from modern geotechnical literature that should be used in developing the current study
What capacity are we considering for renewable energy development? Power the specific plot of land for ag production?
Land , and vegetative condition could be a fact of use for land conversion
“Highest and best” land use is to increase our collective resilience. Soil classification is one factor in determining potential.
Soil type/classification needs to inform the design of individual wastewater systems, especially in proximity to the coast/water.
Regulation based on agricultural land classification system - land for variety of crops/uses, existing specialty crops, and Hawaiian crops.
Some of the comments are more technical than I am familiar with, but I do understand the need for a new large update and consistent updates.
how will the data be updated - per legislative session, etc.?
Soils that have undergone or continue to be at high risk of massive erosion.
Soils with high potential for sustained food production with minimal nutrient export (for ecosystem health)
Soils that have high potential for carbon sequestration management
Be clearer about what soil classification is classifying. If it is more than soil quality, be clearer about all factors in the index.
Utilizing hydroponic or aquaponic farming renders preservation of agricultural lands solely based on soil classification obsolete
Important to ID how differences in historical vs. current use will be incorporated (ex. lo’i ~100 yrs. ago, now developed or filled, etc.)
Uncertainty should be explicitly stated and included, even if large
xxx
Underlying geology and land use and land position (mauka/makai) should be considered
Underlying geology and land use and land position (mauka/makai)
OPSD uses OSPD and ALISH when reviewing land use district boundary amendments that go before the LUC
A statewide update to SSURGO would be useful
Resilience should be a factor: water availability, natural and cultural resources, future climate, crop suitability, regenerative capacity.
There are too many systems. They need to be congruent.

Rejected Statements
Land and soil classifications must base their designations on a systems-based understanding of land use
Soil class systems don't consider the remediation many soils now require before anything can be grown safely (must be bioremediation).
utilizing land for more than one state priority should be considered since some land has multiple potential priorities
Outdated data underlying the SSURGO soil classifications limits usefulness in climate mitigation and adaptation forecasting
This statement is 2 issues. As for climate change there are many adaptable crops.
submitting separately
Soil carbon data is highly spatially interpolated and can be unreliable
As technologies develop there may be land available that just needs water once or occasionally. Agua culture! What else is developing??
A modern classification system should prioritize land for local consumption, not pure productivity
Vertical Farming is the future, like EVs. Cannot disregard it.
Permaculture is a popular system in Hawaiʻi County. It does not need flat lands, but it can still be productive.
New criteria should be included in agricultural land regulation
Education about soil classifications is important to inform project design.
The current land classification system is embedded in the racist dispossession of kanaka maoli
Having a soil classification system is helpful for providing a policy framework
Water availability should be considered. Even if there are great soils, if waster is not available, extensive ag may not be possible.
Need to look at how soil and labor will shape the future of ag
Rural classification was created to be a buffer between ag and urban use
IAL is based on ag productivity and protecting those lands
Productivity is part of the issue, need to consider previous and potential uses (hydroponics, etc.)
SWCD planners need to consider soil qualities (i.e., erosion) in their conservation planning
Consideration of economic value of agricultural output, beyond just soil quality, could improve classification
Updating soil systems could assist LUC to create new SLUD category to allow for other (non-urban/non-ag) uses
Need for a robust modern system that supports agricultural productivity and regulation (via protection).
Special Use Permit process focuses on LSB, but others are considered as well.
Technology and public input could enable more precise, frequently-updated models..

Rejected Statements
LSB is out of date because irrigation infrastructure has changed
Soils can be manipulated. Why regulate uses based on soils?
How can the current system be appealed or questioned?

APPENDIX F: SOIL SYSTEM REFERENCES IN STATE AND COUNTY CODES AND REGULATIONS TABLE

The table below is a significantly truncated version of the full dataset which is available online at https://airtable.com/appJYu3xHuTDuK6P6/shrRThXRCjpFWwiWi.

The online version includes additional columns with full language of the policy, a link to the reference document, the section placement within reference document structure, and other columns to enable filtering. The entire database is also full text searchable.

The columns in the table below are:

- Rule or Regulation Reference & Name
- Soil Classification System: The system(s) referenced (e.g., LSB, ALISH, etc.) or the note
- Focus: A categorization to aid readability and where possible lump similar types.
- Source: Original reference document
- Notes: Provided for policies that were either a) did not clearly define the system(s) to be used or b) mention general soil type or class along with the soil classifications of interest in this report. Direct quotes from statute or rules in these notes are *italicized*.

Rows are sorted by State, County, then by regulation number and lastly by rule number.

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
Hawai'i Revised Statutes § 46-4. County zoning	Soil class/type, Unclear	District/zoning definition	Hawai'i Revised Statutes	Does not explicitly list soil classification data to consider but states that "In establishing or regulating the districts, full consideration shall be given to all available data as to soil classification and physical use capabilities of the land to allow and encourage the most beneficial use of the land consonant with good zoning practices"
Hawai'i Revised Statutes § 141D-4. Transfer and management of agricultural enterprise lands and agricultural enterprises; agricultural enterprise program	LSB	Land transfer	Hawai'i Revised Statutes	
Hawai'i Revised Statutes § 166E-3. Transfer and management of non-agricultural park lands and related facilities to the department of agriculture	LSB	Agricultural and Non-agricultural parks	Hawai'i Revised Statutes	
Hawai'i Revised Statutes § 171-34. Planning; intensive agricultural and pasture uses	LSB	Agricultural planning	Hawai'i Revised Statutes	
Land Use Commission § 205-2. Districting and classification of lands	LSB	District/zoning definition	Hawai'i Revised Statutes	

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
Land Use Commission § 205-4.5. Permissible uses within the agricultural districts	LSB	Land use control	Hawaiʻi Revised Statutes	
Land Use Commission § 205-6. Special permit	LSB, IAL	Land use control	Hawaiʻi Revised Statutes	
Land Use Commission § 205-44. Standards and criteria for the identification of important agricultural lands	ALISH, IAL	Agricultural dedication	Hawaiʻi Revised Statutes	
Hawaiʻi State Planning Act § 226-104. Population growth and land resources priority guidelines	ALISH, IAL	Economic priorities	Hawaiʻi Revised Statutes	Notes agricultural land of importance. doesn't clarify if this is ALISH, IAL, or otherwise.

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
HDOA § 4-153-8. Planning.	Unclear	Agricultural and Non-agricultural parks	Hawai'i Administrative Rules	Regarding Agricultural Park development, section (b) lists multiple items that could involve use of classification systems: *(1) Site selection analysis, including preliminary site inspection and boundary mapping, sufficient to establish the suitability of the land for its intended uses;* *(3) Agricultural feasibility analysis, including agronomic suitability and production capability of the project area, identification of potential markets, costs and economic returns to farm production at the site, and recommended lot sizes;* *(7) Design of project improvements (such as roads and irrigation facilities), including construction drawings and specifications, cost estimates, soils and drainage reports, quantity takeoffs, approval signatures from permitting agencies, and arrangements for utilities installations; and*

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
HDOA § 4-158-13. Planning.	Unclear	Agricultural and Non-agricultural parks	Hawai'i Administrative Rules	Regarding Non-Agricultural Park Lands, section (b) lists multiple items that could involve use of classification systems: *(1) Site selection analysis, including preliminary site inspection and boundary mapping, sufficient to establish the suitability of the land for its intended uses;* *(3) Agricultural feasibility analysis, including agronomic suitability and production capability of the project area, identification of potential markets, costs and economic returns to farm production at the site, and recommended lot sizes;* *(7) Design of project improvements (such as roads and irrigation facilities), including construction drawings and specifications, cost estimates, soils and drainage reports, quantity takeoffs, approval signatures from permitting agencies, and arrangements for utilities installations; and*
DLNR § 13-5-16. Designation of subzones.	ALISH, LESA	District/zoning definition	Hawai'i Administrative Rules	

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
DLNR § 13-106-5. Management plan format.	Soil class/type, Unclear	Tree farm planning	Hawaiʻi Administrative Rules	Tree farm management plans should address soil types and classes, however classes are not defined. *(4) General Property Description - Covers the description of the property. The description shall include: Tax Map Key description, acres designated as tree farm property, location to nearest town, general aspect, slope, elevation, annual rainfall, access roads, forest composition, size and crown class, soil classes, threatened and endangered species information and conservation district use classification.* *(8) Soils classification and suitability - Each soil type shall be identified along with the acres involved. Information can be obtained from the United States Department of Agriculture, Soil Conservation Service's Soil Survey handbook.*
DBEDT § 15-15-25. Permissible uses within the “A” agricultural district.	LSB	Land use control	Hawaiʻi Administrative Rules	
DBEDT § 15-15-50. Form and contents of petition.	ALISH, LSB, Unclear	District/zoning definition	Hawaiʻi Administrative Rules	Boundary amendment petitions require the “soil classification” as well as specific classifications: *(10) Description of the subject property and surrounding areas including the use of the property over the past two years, the present use, the soil classification, the agricultural lands of importance to the State of Hawai'i classification (ALISH), the Land Study Bureau productivity rating, the flood and drainage conditions, and the topography of the subject property;*

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
DBEDT § 15-15-90. Imposition of conditions; generally.	Unclear	Land use control	Hawaiʻi Administrative Rules	Part (17) references prime agricultural land, but doesn't specify the classification. Presumably USDA NRCS farmland classification, derived from SSURGO data, or ALISH is to be used.
DBEDT § 15-15-120. Criteria and procedure for the identification of important agricultural lands.	ALISH, IAL	Agricultural dedication	Hawaiʻi Administrative Rules	
DBEDT, HHFDC § 15-307-26. Project proposal; minimum requirements.	LESA, Soil class/type, Unclear	House development	Hawaiʻi Administrative Rules	Development of housing projects proposals are to include soil classification and LESA data, however soil classification is not defined: *(8) Description of the land for the proposed project as to present use, soil classification, agricultural importance as determined by the land evaluation and site assessment commission, flood, and drainage conditions;*
Kauaʻi County § 8-2.4(q)(20) Uses in districts.	LSB	Land use control	Kauaʻi County Code	
Kauaʻi County Department of Finance § RP-2-6 Findings of fact	Unclear	Agricultural dedication	Kauaʻi County Admin Rules	Notes that the productivity rating should be considered but does not define the rating system to be used. "RP" means the Rules of the Director of Finance Relating to Dedication of Lands to Agricultural Use under Section 5A-9.1 of the Kauaʻi County Code

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
Kauaʻi County Department of Finance § RP-2-9 Special tax assessment of dedicated lands.	Unclear	Agricultural dedication	Kauaʻi County Admin Rules	Notes that quality of soil should be a consideration in determining land value, but does not specify how it should be determined. "RP" means the Rules of the Director of Finance Relating to Dedication of Lands to Agricultural Use under Section 5A-9.1 of the Kauaʻi County Code
Honolulu County § 21-3.50 Agricultural districts—Purpose and intent.	ALISH	District/zoning definition	Revised Ordinances of Honolulu	
Honolulu County § 21-3.60 Country district—Purpose and intent.	ALISH	District/zoning definition	Revised Ordinances of Honolulu	
Honolulu County § 24-1.14 Golf course development.	LSB	Land use control	Revised Ordinances of Honolulu	
Honolulu County Department of Budget and Fiscal Services Real Property Assessment Division § 4-11-5 Findings of Fact.	Unclear	Agricultural dedication	Honolulu County Department of Budget and Fiscal Services Real Property Assessment Division Rules	Notes that the productivity rating should be considered but does not define the rating system to be used.

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
Maui County § 3.48.320 - Land classified as agriculture or commercialized residential and used for agriculture.	Unclear	Agricultural dedication	Maui County Code	Notes that soil quality should be used in determining land use value for agriculture, but does not specify how this should be determined.
Maui County § 3.48.350 - Dedicated lands.	Unclear	Agricultural dedication	Maui County Code	Notes that the productivity rating should be considered but does not define the rating system to be used.
Maui County § 19.04.040 - Definitions.	ALISH	Definitions	Maui County Code	
Maui County § 19.30A.020 - District criteria.	ALISH	District/zoning definition	Maui County Code	
Maui County § 19.30A.050 - Permitted uses.	LSB	District/zoning definition	Maui County Code	
Maui County § 5. Findings of Fact.	Unclear			Notes that the productivity rating should be considered but does not define the rating system to be used.

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
Hawaiʻi County § 19-60. Long-term commercial agricultural use dedication	Unclear	Agricultural dedication	Hawaiʻi County Code	References productivity rating but doesn't specify which.
Hawaiʻi County § 19-61. Short-term commercial agricultural use dedication.	Unclear	Agricultural dedication	Hawaiʻi County Code	References productivity rating but doesn't specify which.
Hawaiʻi County § 25-5-60. Purpose and applicability	ALISH, LSB	District/zoning definition	Hawaiʻi County Code	
Hawaiʻi County § 25-5-80. Purpose and applicability.	Unclear	District/zoning definition	Hawaiʻi County Code	References important agricultural lands but does not define them. May be referring to IAL, LESA, or another output.

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
Hawaiʻi County § 25-6-44. Application for project district; requirements.	LSB, ALISH, Soil class/type	District/zoning definition	Hawaiʻi County Code	Requires a County Environmental Report based on a form prepared by the Planning Director. A Project District Application was not found online. However the AGRICULTURAL PROJECT DISTRICT APPLICATION, which is also covered by RULE 14. COUNTY ENVIRONMENTAL REPORTS, in the COUNTY OF HAWAIʻI PLANNING DEPARTMENT RULES OF PRACTICE AND PROCEDURE, includes a Background and County Environmental Report form. In section C. PHYSICAL CHARACTERISTICS AND ENVIRONMENTAL SETTING OF THE PROPERTY AND SURROUNDING AREA, subsection Physical Characteristics/Environmental Setting lists, among other items, the following classification systems as required information to be included: *12. Agricultural Lands of importance in the State of Hawaiʻi (ALISH) designation:* *13. U.S.D.A. Natural Resources Conservation Services Soil Service Report soil type :* *14. Land Study Bureau soil rating :*"
Hawaiʻi County § 25-6-50. Purpose and applicability.	Unclear	District/zoning definition	Hawaiʻi County Code	The Agricultural Project District purpose references important agricultural lands but does not define them. May be referring to IAL, LESA, another output, or be a general statement.

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
Hawaiʻi County § 25-6-54. Application for agricultural project district; requirements.	LSB, ALISH, Soil class/type	District/zoning definition	Hawaiʻi County Code	Requires a County Environmental Report based on a form prepared by the Planning Director. The AGRICULTURAL PROJECT DISTRICT APPLICATION includes a Background and County Environmental Report form. In section C. PHYSICAL CHARACTERISTICS AND ENVIRONMENTAL SETTING OF THE PROPERTY AND SURROUNDING AREA, subsection Physical Characteristics/Environmental Setting lists, among other items, the following classification systems as required information to be included: *12. Agricultural Lands of importance in the State of Hawaiʻi (ALISH) designation* *13. U.S.D.A. Natural Resources Conservation Services Soil Service Report soil type* *14. Land Study Bureau soil rating*
Hawaiʻi County § 14-5 County Environmental Report - Content and Requirements	LSB, ALISH, Soil class/type	Environmental reporting	County Of Hawaiʻi Planning Department Rules Of Practice And Procedure Hawaiʻi County	Outlines what a County Environmental Report shall contain in form prepared by the Planning Director. The AGRICULTURAL PROJECT DISTRICT APPLICATION includes a Background and County Environmental Report form. In section C. PHYSICAL CHARACTERISTICS AND ENVIRONMENTAL SETTING OF THE PROPERTY AND SURROUNDING AREA, subsection Physical Characteristics/Environmental Setting lists, among other items, the following classification systems as required information to be included: *12. Agricultural Lands of importance in the State of Hawaiʻi (ALISH) designation* *13. U.S.D.A. Natural Resources Conservation Services Soil Service Report soil type* *14. Land Study Bureau soil rating*

Rule or Regulation Reference & Name	Soil Classification System	Focus	Source	Notes
Hawaiʻi County § 25-2-42. Amendments initiated by property owners and other persons.	LSB, ALISH, Soil class/type	Environmental reporting	County Of Hawaiʻi Planning Department Rules Of Practice And Procedure Hawaiʻi County	Requires a County Environmental Report based on a form prepared by the Planning Director. The CHANGE OF ZONE APPLICATION includes a Background and County Environmental Report form. In section C. PHYSICAL CHARACTERISTICS AND ENVIRONMENTAL SETTING OF THE PROPERTY AND SURROUNDING AREA, subsection Physical Characteristics/Environmental Setting lists, among other items, the following classification systems as required information to be included: *12. Agricultural Lands of importance in the State of Hawaiʻi (ALISH) designation* *13. U.S.D.A. Natural Resources Conservation Services Soil Service Report soil type* *14. Land Study Bureau soil rating*