United States Department of Agriculture

Hoolehua Plant Materials Center
FY2025 Report of Activities

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Plant Materials Centers (PMC) support resource conservation efforts within the USDA Natural Resources Conservation Service (NRCS). PMCs select conservation plants and develop innovative planting technology to address today's natural resource challenges and help maintain healthy, productive farms and ranches. The Hoolehua Plant Materials Center (HIPMC) is one of 25 PMCs that serve USDA-NRCS Field Offices around the country. The service area of each PMC is based on unique environmental conditions, and together, they cover the broad environmental ranges within the United States. The service area for the HIPMC is the Pacific Islands Area (PIA). This report is a summary of activities the HIPMC conducted from October 1, 2024, to September 30, 2025.

The Hoolehua Plant Materials Center occupies 80 acres in the central part of the island of Molokai, Hawaii.

Studies

Forage Yield Potential

The number of cattle to put on a pasture is a critical decision ranchers make when managing their herd. How many cattle a pasture can support depends on how much forage the pasture can produce throughout the year. Too little cattle can undercut animal production. Too many cattle can lead to overgrazing and soil degradation. Using an ensemble of simple yield models, the PIA Grazing Management Tool generates yield estimates based on climate and soil conditions at specific locations in the PIA. Conservation planners use this tool to advise ranchers. One of the models in this tool requires the maximum yield for each of the 21 grass species that are recommended by the NRCS. In a previous study, the maximum yields for five species were determined. In the present study, an additional seven species are being evaluated for monthly maximum yield.

David Duvauchelle (HIPMC Manager, left) oversees harvest operations as John Colon (Biological Science Technician, right) harvests forage grass with a Carter Plot Harvester as part of a study to obtain near-maximum yield for eight grass species at the HIPMC.

Yield data collection started in January 2025. The replicated grass plots are well-irrigated and fertilized to produce maximum yields. Each month, yield data is collected and will be assembled to produce monthly yield curves across the year. Yield data collection will continue for 24 consecutive months, until December 2026. The yield curves will be incorporated into the PIA Grazing Management Tool to improve the accuracy of yield estimates. Better information on pasture forage production will lead to better decisions on stocking rate to balance animal production and soil conservation.

Technologies

Vegetation Specification Tool

The PIA Vegetation Specification (PIA-VegSpec) is a new tool that determines which plant species are adapted to specific locations in the PIA. Conservation planners use this tool to select plants for use in any plant-related conservation practices. This is one of the most widely used tools in the PIA. It was introduced last year but has undergone revision and evaluation this year.

The PIA-VegSpec was adjusted to make it more intuitive and user friendly, for example the planner can start a new search after a previous search with a click of a button, clearing all previous user inputs. Another added feature allows the user to view non-adapted species and the environmental factor that limits its growth for a particular site. Non-adapted species were hidden in the previous version. This new feature addresses an issue planners faced when clients questioned the absence of a particular species in the recommended plant list. The feature identifies what environmental factor may restrict the non-adapted plant growth, such as soil pH or soil depth. This information can be used by planners to help clarify the limitations of certain plants and reduce practice failures due to utilizing plants that are poorly adapted to an area.

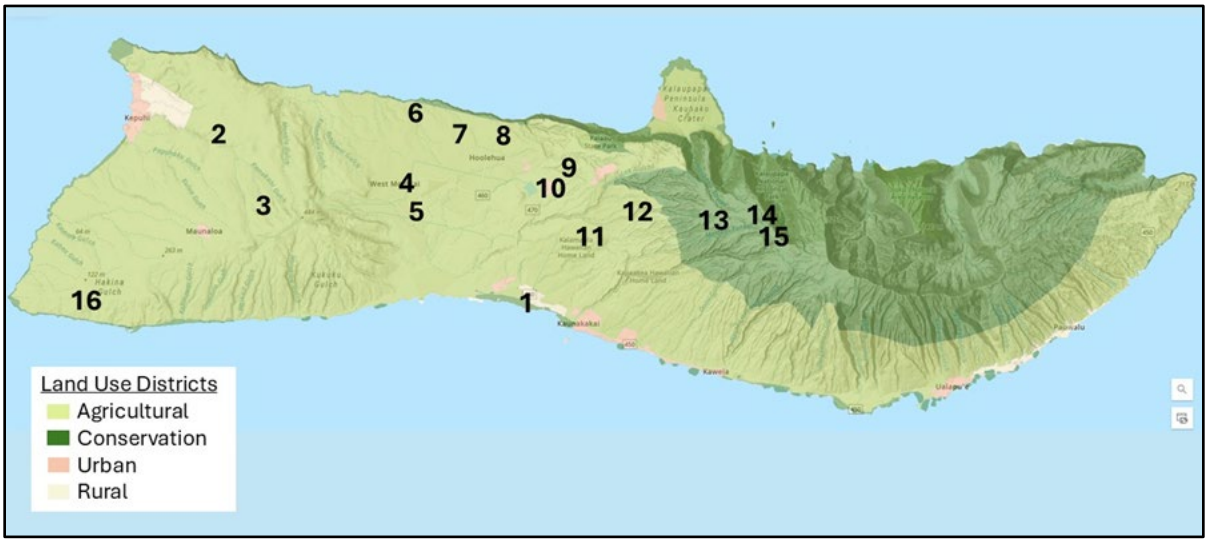


Figure 1. Sixteen locations on Molokai Island, Hawaii, where the presence/absence of five plant species were recorded to test the accuracy of the new Vegetation Specification tool. Location conditions showed a wide range of annual rainfall (15 – 110 inches), soil pH (4.3 – 8.2), and soil electrical conductivity (0.1 - >20 mmhos/cm). The distance between locations 15 and 16 is 22 miles. Map data is from the Hawaii Statewide GIS Program (2017).

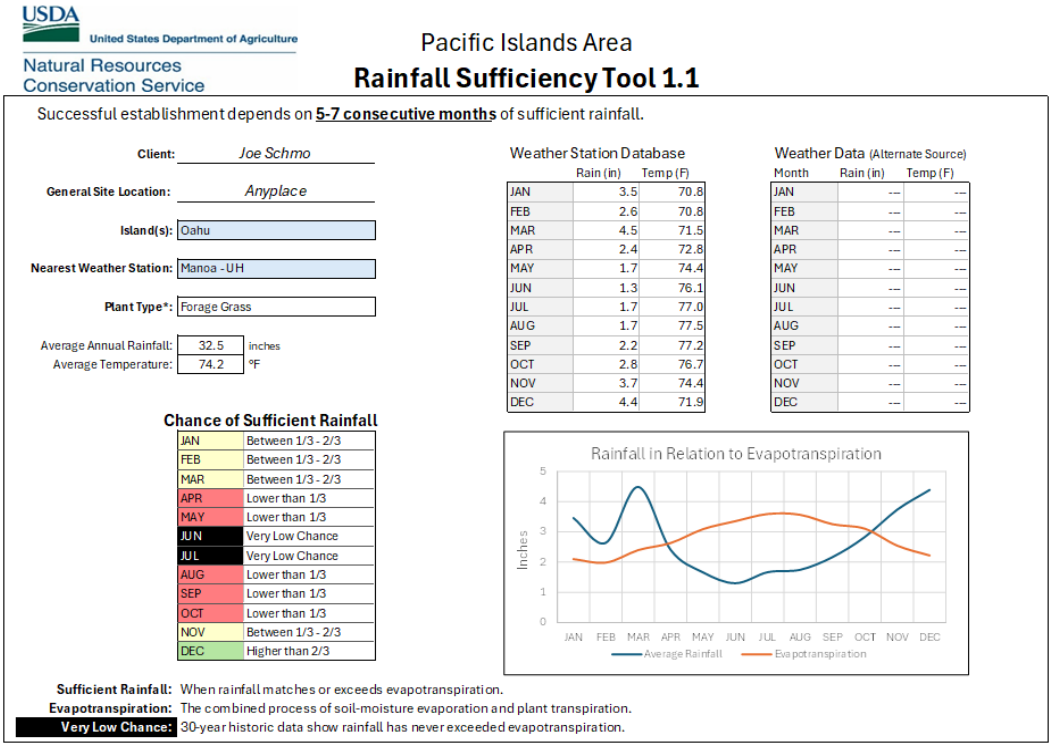
The new PIA-VegSpec was tested for accuracy against real environmental conditions on the island of Molokai, Hawaii. Sixteen locations on the island were selected to represent a wide range of environmental conditions, annual rainfall 15 – 110 inches, annual temperature 67 – 76 F, soil pH 4.3 – 8.2, soil depth 53 - >200 inches, and soil electrical conductivity 0.1 - >20 mmho/cm. The presence or absence of five plant species (*Leucaena leucocephala*, *Megathyrsus maximus*, *Pennisetum ciliare*, *Sida fallax*, *Waltheria indica*), presumed to be prevalent, were recorded at the 16 locations (Figure 1.). The presence or absence of plant species were compared to the predicted presence/absence from the new and old VegSpec. The new PIA-VegSpec correctly classified 74% of the species location instances (80 total instances) while the old VegSpec scored 65% correctly. The new PIA-VegSpec will allow conservation planners to better recommend plant species for installation in vegetative conservation practices.

Improved EcoCrop Forage Model in the PIA Grazing Management Tool

Conservation planners use the PIA Grazing Management Tool to help ranchers manage their pasture and herd. Herd management relies heavily on forage production estimates. The PIA Grazing Management Tool generates monthly forage production from an ensemble of five yield models. In a recent study that tested the accuracy of the five models, the poorest performing model predicted forage yield in months when no rain fell and locations where soil organic matter was low. A soil moisture and soil organic matter sub-model was inserted into the model and its performance improved substantially. The old and new model forage yield predictions were compared to the yield of three grass species at five locations over two years. The comparison was quantified with the statistic Nash-Sutcliffe Efficiency index that ranges from negative values to 1.0, where 1.0 means the model predictions perfectly matched the observed yields. The index value jumped from 0.08 with the old model to 0.49 with the new. The new model was embedded in the PIA Grazing Management Tool to improve the accuracy of forage production estimates, so conservation planners can better assist ranchers with managing pastures and conserving soil.

Revised Rainfall Sufficiency Tool

Knowing when to plant is crucial to successfully establish forage grass in a pasture under rainfed conditions. To help conservation planners acquire this essential information, the Rainfall Sufficiency Tool was developed. The tool identifies the chance of sufficient rainfall for grass establishment for each month by comparing the climatological forecast to the estimated evapotranspiration. The old tool compared rainfall terciles to evapotranspiration and left the calculation of the probability of sufficient rainfall to the planner. This approach proved to be very challenging for most planners. The new tool calculates and organizes the probability of sufficient rain into a table and uses color for emphasis, green for higher chance of sufficient, yellow and red for moderate and lower chance. The new tool has updated climate data to 2025 for each of the 110 weather station locations in the PIA. The old tool had climate data up to 2020. The revised tool (Figure 2.) provides conservation-planners with a user-friendly tool that is intuitive with the most up-to-date, location-specific information to help ranchers in their efforts to establish grasses.



USDA United States Department of Agriculture
Natural Resources Conservation Service

Pacific Islands Area
Rainfall Sufficiency Tool 1.1

Successful establishment depends on **5-7 consecutive months** of sufficient rainfall.

Client: *Joe Schmo*
General Site Location: *Anyplace*
Island(s): Oahu
Nearest Weather Station: Manoa - UH
Plant Type*: Forage Grass
Average Annual Rainfall: 32.5 inches
Average Temperature: 74.2 °F

Weather Station Database

	Rain (in)	Temp (F)
JAN	3.5	70.8
FEB	2.6	70.8
MAR	4.5	71.5
APR	2.4	72.8
MAY	1.7	74.4
JUN	1.3	76.1
JUL	1.7	77.0
AUG	1.7	77.5
SEP	2.2	77.2
OCT	2.8	76.7
NOV	3.7	74.4
DEC	4.4	71.9

Weather Data (Alternate Source)

Month	Rain (in)	Temp (F)
JAN	---	---
FEB	---	---
MAR	---	---
APR	---	---
MAY	---	---
JUN	---	---
JUL	---	---
AUG	---	---
SEP	---	---
OCT	---	---
NOV	---	---
DEC	---	---

Chance of Sufficient Rainfall

JAN	Between 1/3 - 2/3
FEB	Between 1/3 - 2/3
MAR	Between 1/3 - 2/3
APR	Lower than 1/3
MAY	Lower than 1/3
JUN	Very Low Chance
JUL	Very Low Chance
AUG	Lower than 1/3
SEP	Lower than 1/3
OCT	Lower than 1/3
NOV	Between 1/3 - 2/3
DEC	Higher than 2/3

Sufficient Rainfall: When rainfall matches or exceeds evapotranspiration.
Evapotranspiration: The combined process of soil-moisture evaporation and plant transpiration.
Very Low Chance: 30-year historic data show rainfall has never exceeded evapotranspiration.

Figure 2. Chart displayed from the Rainfall Sufficiency Tool. Users input client and location information and select Island(s) and nearest weather station from dropdown windows in upper left quadrant. Output information is automatically displayed; Monthly weather data populates in upper right quadrant; Chart of monthly rainfall and evapotranspiration drawn in lower right quadrant; Chance of sufficient rainfall for forage establishment for each month is calculated and displayed in the lower left quadrant.

Sunn Hemp Seed Production

Producing seed of conservation plants that are used to put conservation on the ground is a fundamental activity of all PMCs. The HIPMC produces foundation seed of 'Tropic Sun' sunn hemp (*Crotalaria juncea*), a popular cover crop and green manure grown throughout the tropical and temperate zones. In 2025, another producer on the island of Maui requested sunn hemp foundation seed. This new producer brings the total number of Tropic Sun seed producers to five. To meet the growing demand, Tropic Sun was planted on January 15 and harvested on June 25, 2025. A total of 400 pounds of foundation seed was produced. This additional seed will be shipped to growers who multiply and market bulk seed to farmers and others interested in using Tropic Sun.

A field of Crotalaria juncea 'Tropic Sun' at full bloom stage on April 4, 2025, being grown for seed at the HIPMC.

Technology Transfer

Technical Documents

- Final Study Report: Site-specific observed yield data collection for PIA-Prescribed Grazing Tool forage yield model testing: Kukuihaele, Waimea Plain, Kainaliu, Mana House, Kainalu, and Hoolehua. https://www.nrcs.usda.gov/plantmaterials/hipmcsr14220.pdf .
- Forestry Technical Note 14: PIA Forestry Planting Guide https://efotg.sc.egov.usda.gov/references/public/HI/FTN14_PIA_Forestry_Planting_Guide.pdf
- Plant Materials Technical Note 12: PIA Rainfall Sufficiency Tool (revised) https://efotg.sc.egov.usda.gov/references/public/HI/Rainfall_Sufficiency_Tool_1.1.xlsm
- PIA VegSpec (revised) https://efotg.sc.egov.usda.gov/api/CPSFile/54057/___
- PIA Grazing Management Tool (revised) https://efotg.sc.egov.usda.gov/api/CPSFile/54108/___

Trainings

- FY25 PIA Technology Rollout, David Duvauchelle; Nov 12, 2024; 74 participants
- Introduction to the PIA VegSpec; David Duvauchelle; Nov 26, 2024; 74 participants
- PIA Prescribed Grazing, Fence and Silvopasture; David Duvauchelle, Jill Ficke-Beaton, Daniel Bowman; 40 participants

HIPMC Staff Change

Joshua Pastrana joined the HIPMC on November 4, 2024, as a Biological Science Technician. Pastrana previously worked on agricultural research projects at the College of Tropical Agriculture and Human Resilience, University of Hawaii, for over 7 years. He owns and operates a taro farm and brings a wealth of experience in crop management, cultural practices, and natural resource management. Pastrana has become an integral part of the HIPMC team and has had a major impact on the work productivity at the Center.

Joshua Pastrana (Biological Science Technician) joined the HIPMC staff on NOV 4, 2024.

Who We Are

The HIPMC is one of 25 centers operated by the USDA-NRCS. The HIPMC services the PIA which includes the State of Hawaii, American Samoa, Guam, Commonwealth of Northern Mariana Islands, The Federated States of Micronesia, The Republic of Palau, and The Republic of the Marshall Islands. The HIPMC was initially established on the island of Maui in 1957 and was later relocated to the island of Molokai in 1973.

Hoolehua Plant Materials Center - FY2025 Progress Report of Activities

What We Do

The mission of the USDA-NRCS Plant Materials Program is to assemble and test plant species for use in conservation programs to solve natural resource concerns. The program's vision is to function as the plant experts for USDA-NRCS, fully integrated and coordinated with technical and field office staff, developing, and delivering vegetative solutions and conservation technology for USDA-NRCS customers. In working with a broad range of plant species, including grasses, forbs, trees, and shrubs, the program seeks to address priority plant needs of the USDA-NRCS field offices and land managers in both public and private sectors. Where practical, the use of native plants to solve conservation problems and to protect and restore ecosystems is emphasized.

HIPMC Staff

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