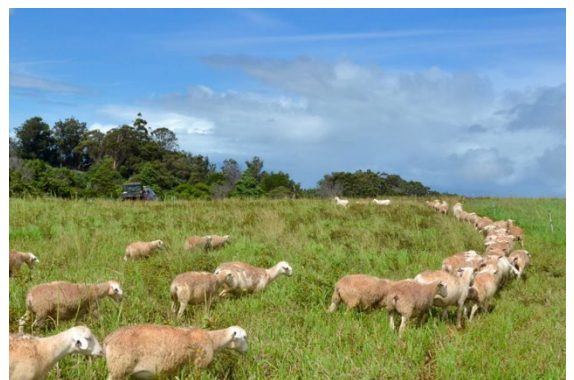
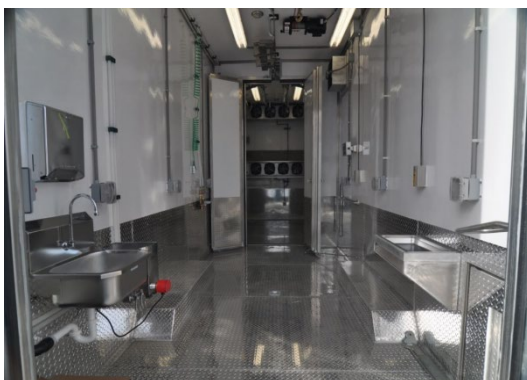


Local Slaughter in the Hawaiian Islands



Swette Center for Sustainable Food Systems, Arizona State University

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Authors

Cindy Farlee

Associate Program Officer
Native American Agriculture Fund (NAAF)

Ali Kelley

Regenerative Grain Entrepreneur
Former Brand Manager, General Mills

Emma Rotner

Farm to School Coordinator
Groton Public Schools, Connecticut

Nakasha Shoyinka

Local Foods Consultant
Metro Atlanta, Georgia

Carly Wyman

Public Health Program Instructor
Hui Mālama Ola Nā 'Oiwī, Native Hawaiian Healthcare System for Hawai'i Island
Co- founder, Center for Getting Things Started (501(c)3)

Client Partner

Hōkūni Regenerative Farm, Makawao, Hawai'i
www.hokunui.com

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Michael Amado

Hawai'i Island Meat Cooperative

Joshua Bell

Maui Cattle Company

Glenn Haae

Solid and Hazardous Waste Branch
Hawai'i Department of Health

Lea Hennessy

Kīpuka Lāna'i Farms

Keir Johnson-Reyes

Intertribal Agriculture Council

Duane Lammers

Hana Ranch

Sarah Lemon

Research Associate, Swette Center for Sustainable Food Systems

Morgan Maki

Biological Capital

Dr. Kathleen A. Merrigan

Executive Director, Swette Center for Sustainable Food Systems
Arizona State University

Chris Roper

Quapaw Services Authority

Mark Thorne

Rangeland Management Specialist
Department of Human Nutrition, Food & Animal Sciences
UH CTAHR Agriculture Extension

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Executive Summary

Cattle and livestock make up a significant portion of agricultural production value in Hawai'i. However, 95 percent of Hawai'i-raised cattle are shipped to the Continental United States for grain-finishing and slaughter. This means that rather than purchasing meat that has been raised and processed locally, Hawai'i-based consumers are most often buying meat that has been shipped from far away, and in some cases, may be the very cattle that left Hawai'i and crossed the Pacific as live animals months earlier. There is a need to increase local slaughter capacity in the islands to avoid such inefficiencies, help build a local meat economy that contributes to increased food security, animal welfare, and employment, and meet consumer demand for locally grown and raised food. Hōkūnui Farm LLC, a regenerative ranch and real estate development located near the town of Makawao on the northwestern portion of Maui, has recently constructed a slaughterhouse facility on their property in the pursuit of these goals. Hōkūnui intends to dispose of animal mortality waste through a nutrient cycling compost program and they enlisted the Swette Center for Sustainable Food Systems to advise them on their waste management proposal to the Hawai'i Department of Health (DOH), which oversees such operations. Although animal mortality composting is permitted by State law, the lack of clear regulations on this matter have stymied Hōkūnui and others' efforts to advance new slaughter operations.

The purpose of this report is to provide an overview of current ranching and slaughter capacities in Hawai'i, highlight relevant regulations and identify missing elements, offer case studies of similar operations and their procedures, and provide recommendations that Hōkūnui might consider in their pursuit to expand their slaughter capacity, while processing slaughter waste safely and sustainably.

Introduction

There is a critical need to address slaughter capacity in the Hawaiian Islands. The history of ranching in the Hawaiian Kingdom began with the introduction of cattle with a gift of 400 head to King Kamehameha I in 1793. From this small herd, grew a beef industry that thrives today, with 25 percent of the landmass in the islands currently operating as rangeland. These rangelands span over 76,000 acres and account for 83 percent of all productive agricultural land use in the islands (State of Hawai'i Department of Agriculture, 2016). Despite the booming cattle industry, since the 1990's, there has been a steady decline in slaughter capacity as the cost of importing grain for feedlot operations became more expensive than shipping calves to the Continental United States for finishing and slaughter (Thorne, 2020).

According to the USDA's National Agricultural Statistics Service, Hawai'i had a total cattle herd of 140,000 as of January 2020, up from ~137,000 in the 2017 Census of Agriculture (National Agricultural Statistics Service, Pacific Region Cattle, 2020). Of those 140,000 head, there were 33,000 potentially marketable calves and 15,000 steers and non-replacement heifers over 500 pounds, marked for beef production. Sheep and lambs accounted for 27,181 of the livestock inventory of Hawai'i (third highest) and only 1,559 were located in Maui county (National Agricultural Statistics Service, 2019, 2017 Census of Agriculture- State Profile: Hawai'i). The 2017 Census of Agriculture recorded the value of sales for cattle and calves in Hawai'i at over \$34.5 million while the total value of sheep, goats, wool, mohair and milk was \$1.5 million. Combined, this accounts for 6.4 percent of the total market value of all farm products sold in the state. (National Agricultural Statistics Service, 2019, 2017 Census of Agriculture- State Profile: Hawai'i).

There is increasing consumer demand for locally- produced meat in Hawai'i, as well as increased interest in addressing food security and sovereignty in the islands, one of the most geographically- isolated island chains in the world. Though the ranching industry is such a large part of agricultural production in Hawai'i, the lack of local infrastructure to keep more beef for local consumption must be addressed.

Hökūnui Regenerative Farm, located on the island of Maui, can play a key role in helping increase local slaughter capacity for Hawai'i and thereby keep more meat, including beef, lamb, and mutton, local. Hökūnui originally approached the Swette Center for support in reaching their goal of getting their newly constructed mobile slaughter unit certified for USDA inspection in early 2020. At the time, they had already submitted several drafts of their proposed waste management plan to the Hawai'i Department of Health (DOH) for permitting review, which was met with significant requests from the department for further project revisions. Research support was

requested from the Swette Center on best practices for composting offal, to help develop evidence to present to the DOH that demonstrates that the risks associated with these waste products could be managed both safely and in a manner that would utilize these valuable nutrients by incorporating them into the farm system.

Over three months of research, our team encountered many of the barriers that Hōkūnui leaders had faced. Regulations for managing slaughter facilities are non-existent in Hawai'i, data about slaughter are sparse, and there are high barriers to USDA inspection, leaving aspiring processors to forge their own paths. At the state level, operations seeking to become certified for slaughter are routed through the DOH. The Hawai'i Department of Agriculture, despite its likely ties to the USDA, does not provide guidance for slaughter facilities. With DOH oversight, the regulatory priority is safe waste management, having facilities prove that their waste products can be safely composted on the farm level rather than being taken to the landfill.

The report that follows is a product of this experience. Our team hopes that it contributes to the conversation about the importance of increasing slaughter capacity in Hawai'i, particularly as experienced at Hōkūnui. In writing this report, we aim to shine a light on the barriers at hand and propose a potential path forward toward a more consistent and accessible slaughter system for Hawai'i, for Hōkūnui and others seeking to enhance food security through enhanced meat processing infrastructure. In support of these goals, this report provides an overview of the state of food security in Hawai'i and its relationship to current ranching and slaughter capacities, highlights relevant regulations and missing regulatory elements, offers case studies of similar operations and their procedures, and provides recommendations that Hōkūnui might consider in their pursuit to expand their slaughter capacity.

Background

The cost of food is 61% percent higher in the Hawaiian Islands than in the Continental United States (Hawai'i Department of Health, 2018) and island residents often live in remote locations that make accessing food vendors difficult. USDA estimates show that 8 percent of Hawai'i residents are food insecure, compared to 11 percent at the national level (Finnerty, 2019). However, this data is widely considered to be an undercount. The Hawai'i Food Bank, which distributes over 1 million pounds of food per week, estimates that 12 percent of households experience food insecurity (Finnerty, 2019). Similarly, the Hawai'i Department of Health reports 13 percent of households experiencing food insecurity in 2018 (Hawai'i Department of Health, 2018). Figure 1 below shows food insecurity in Hawai'i using SNAP participation as a proxy indicator based on Hawai'i Department of Human Services (DHS) records for average monthly SNAP participation in 2019 by county, normalized to the 2019 US Census population estimates. According to DHS, there is substantial SNAP use across the islands with the greatest percentage of users, over 17%, on the island of Hawai'i. While the most current data available, SNAP enrollment is also an incomplete measure of food insecurity, since not all SNAP-eligible households enroll in the program. Altogether, these various data sources indicate substantial food insecurity in the state.

SNAP Enrollment in Hawaii

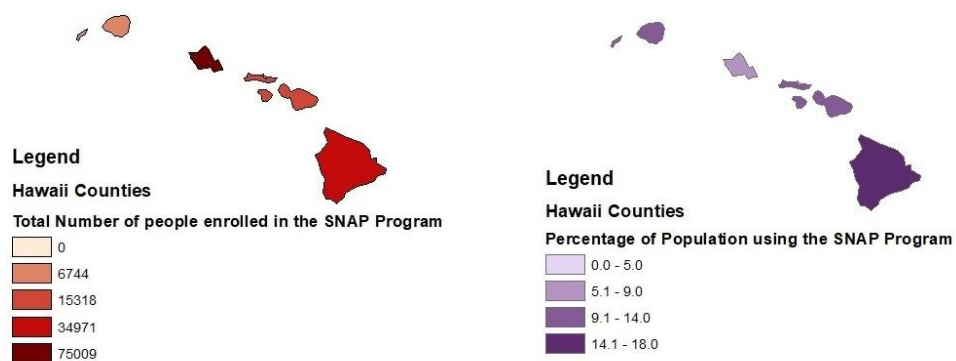


Figure 1: 2019 Average monthly SNAP enrollment. Maps by Swette Center.

In addition to individual food insecurity as just described, there is another compelling food security risk that all residents face. In 2012 the Hawai'i state legislature reported that the state has only enough fresh produce to feed residents for approximately 10

days at a time and more recently, the University of Hawai'i reports that the number of days may be as low as five to seven (Miles, 2020). Considering that Hawai'i is one of the most remote island chains in the world, this puts the islands at high risk. Like many remote islands, Hawai'i is highly vulnerable to disruptions in incoming food shipments. It is predicted that such disruptions will become more frequent as we face increasing challenges from climate change (Kent, 2016) as well as pandemics such as the 2019 novel coronavirus.

Officially, Hawai'i imports an estimated 85-90 percent of its food (Office of Planning: Department of Business Economic Development & Tourism, 2012, p. 2). While it is important to remember that these numbers do not take into account the informal gift economy in which things like produce, meat and fish are shared freely among community members, all of which is uncounted, the overarching trend is dependence on off-island food sources. This lack of food self-sufficiency, which has been increasing since the 1970's (Office of Planning: Department of Business Economic Development and tourism, 2012, p.3) is due to several factors, including:

- Cost of production due to higher land, labor and input cost
- Competition for land with development
- Large proportion of products produced for export
- Lack of basic staples being grown in favor of specialty crops

Though much of Hawai'i's land is dedicated to agricultural production, the vast majority is used to produce high value crops for export. Cattle production specifically, which accounts for a large portion of the agricultural land use in Hawai'i, meets only about 5 percent of local beef consumption demand. This suggests the need for a significant expansion in local beef production and processing, which could provide a substantial improvement in the overall food security of the state.

Slaughter Capacity in Hawai'i

Currently, about 95 percent of cattle raised in Hawai'i (71,535 head) are shipped to the Continental United States for finishing and slaughter annually, indicating that still today only about 5 percent are slaughtered in-state, amounting to a total of about 3,765 head. This has decreased significantly since 2007, when approximately 150 cattle were slaughtered weekly in the islands, for a total of ~6,3000/year (Hawai'i Sustainability Task force, 2008, p. 86).

This slaughter capacity is spread across several islands in the Hawaiian Island chain including Hawai'i Island, Kaua'i, O'ahu, and Hōkūnui's home island of Maui. The

following list provides an overview of some of the major slaughter facilities in the islands, though is not exhaustive of all slaughter operations.

On Hawai'i Island, where the majority of ranch land is located, there are two brick and mortar USDA-certified slaughter facilities in operation, and one stationary Mobile Slaughter Unit (MSU).

- The Hawai'i Island Meat Cooperative (HIMC) MSU slaughters 4 days per month for a total of about 18 cattle, 12 sheep, and 5 hogs monthly.
- Kulana foods processes cattle as well as hogs, sheep, and goat.
- Hawai'i Beef Producers slaughter about 200 head of cattle per month. Though their facility has the capacity to slaughter more, their limited chill space prevents them from increasing this amount.

On the island of O'ahu, there is currently one slaughter facility in operation.

- Kunoa Cattle Company / Hawai'i Meats (became Hawai'i Meats in September 2019.) As of 2016, only 8-10 cattle per month were being slaughtered at the facility (Gomes, 2019).

On the island of Kaua'i, there are three USDA- inspected slaughter operations, each slaughtering about 10 head of cattle per week. Sheep account for a negligible amount of these operations' production, particularly since the covid- 19 pandemic has slowed demand from local restaurants (Katulski, 2020). Slaughter capacity in Kaua'i, like elsewhere in Hawai'i, is partially hindered by limited chill space for aging carcasses (Katulski, 2020). Though still an essentially niche market, grass-finished beef on Kaua'i is a growing industry with high consumer demand (Parachini, 2018).

On the island of Maui, there are currently two operating brick and mortar slaughter facilities and one MSU.

- The Maui Cattle Company, a collective of 5 large ranching companies, runs a facility with the capacity to process 25 head of cattle/day (Imada, 2020).
- DeCoit Packing House is a USDA-certified facility that provides slaughter and cut and wrap (Sugidono, 2014). Information could not be found as to the capacity or volume of the facility for slaughter.
- Kia Hawai'i is a private USDA-inspected MSU, which only processes wild-harvested venison.
- The island of Kaua'i has three slaughterhouse operations that contribute to their local food supply (Parachini, 2018). Though still an essentially niche market, grass-finished beef on Kaua'i is a growing industry with high consumer demand (Parachini, 2018).

Animal Welfare Issues

The shipment of cattle raised in Hawai'i to the Continental United States for finishing and processing brings up significant animal welfare concerns. Currently there are no standards governing the welfare of these animals during the 2,500+ mile sea journey. In describing the long-range transport of live animals, the Animal Welfare Institute (AWI) emphasizes the stress on such animals from issues “including inadequate ventilation, loud noises, motion sickness, and heat stress,” which can “make the animals more susceptible to illness and disease” (Animal Welfare Institute, 2020, During Transport).”

The World Organisation for Animal Health (OIE), of which the U.S. is a member, has adopted standards for animal transport. Chapter 7.2 of the Terrestrial Animals Code, “Transport of Animals by Sea,” specifies these standards (World Organisation for Animal Health, 2019). These form the basis of United States federal standards for shipping live animals internationally (Animal Welfare Institute, 2020). However, these standards do not apply to cattle shipped from Hawai'i to the Continental United States because such shipments, despite the long voyage and number of animals shipped, are all within the US. This is unfortunate, especially given the large numbers of animals shipped from Hawai'i to the Continental United States each year, at around 71,535 head.

Inter-island transportation also raises significant animal welfare concerns. In December of 2019, 21 pregnant heifers died from suffocation while being transported from O‘ahu to Kaua‘i due to inadequate ventilation and overly packed shipping containers (Daysog, 2019). Young Brothers, the shipping company responsible for the deaths, claims the company has only ever had one other death of an animal in its history. Nevertheless, this incident brought attention to the lack of regulations governing intrastate shipping of live animals. The incident sparked controversy among animal welfare groups and led to the February 2020 announcement from the Hawai‘i Department of Agriculture committing to creating standards for shipping live animals to be implemented within two years. These standards will be based on federal standards and will include basics such as requiring access to food, water, and ventilation during the journey.

Selected overview of OIE

Chapter 7.2 of the Terrestrial Animals Code, “Transport of Animals by Sea.”

These standards specify minimal welfare standards and include the following:

- Evaluation of the fitness to travel of each animal: are they sick, injured, weak or disabled?
- Humane handling of animals during loading, transport and unloading
- Requirement of experienced animal handlers informed of animal behavior
- Removal of distractions for the animals
- Sending animals on journeys that are only as long as necessary
- Suitable facilities that include food and water both during loading and unloading
- Monitoring and evaluation of the health and welfare of animals before, during and after the journey
- Adequate planning for the journey including space, feed, water and ventilation requirements
- Maintenance of journey logs and records
- Vaccination of animals against possible diseases to which they are likely to be exposed at their destination
- Keeping animal species separate
- Humane killing of animals should it become necessary
- Clean vessels and shipping containers

(World Organisation for Animal Health, 2019).

Even with such welfare standards, the shipment across such distances is still stressful and could be avoided with increased local slaughter capacity in the islands.

Hōkūnui Regenerative Farm Project

Overview of Hōkūnui

Hōkūnui is a 258-acre regenerative farming community that aims to address issues of food insecurity, shortage of local food and meat, and the lack of slaughter capacity in Hawai‘i. Hōkūnui is a multi-faceted project that incorporates regenerative farming techniques and Native Hawaiian practices. The site includes a ranch for livestock

production, a forestry project that is utilizing Native Hawaiian practices to rebuild a tree canopy, and lastly, a sustainable housing project located on the property. Using regenerative agricultural practices, Hōkūnui aims to rebuild the soil and create a sustainable habitat (Hōkūnui, 2019). Additionally, there is a Mobile Slaughter Unit located on site that Hōkūnui will use for slaughter and a cut and wrap facility is planned to facilitate processing.

It is important to understand some of the hydro-geo-climatic specifics of the Hōkūnui site, as these form the basis for some of the DOH concerns. The farming community is located just outside of Makawao, commonly referred to as the “hub” of the Maui Upcountry, an area dominated by ranching and agricultural production. Located to the northwest of Mt. Haleakala, the Hōkūnui property gradually slopes over 400 ft of elevation change from 2,100 ft at its highest to the lowest elevation at 1,690 ft (Gomes, 2019).

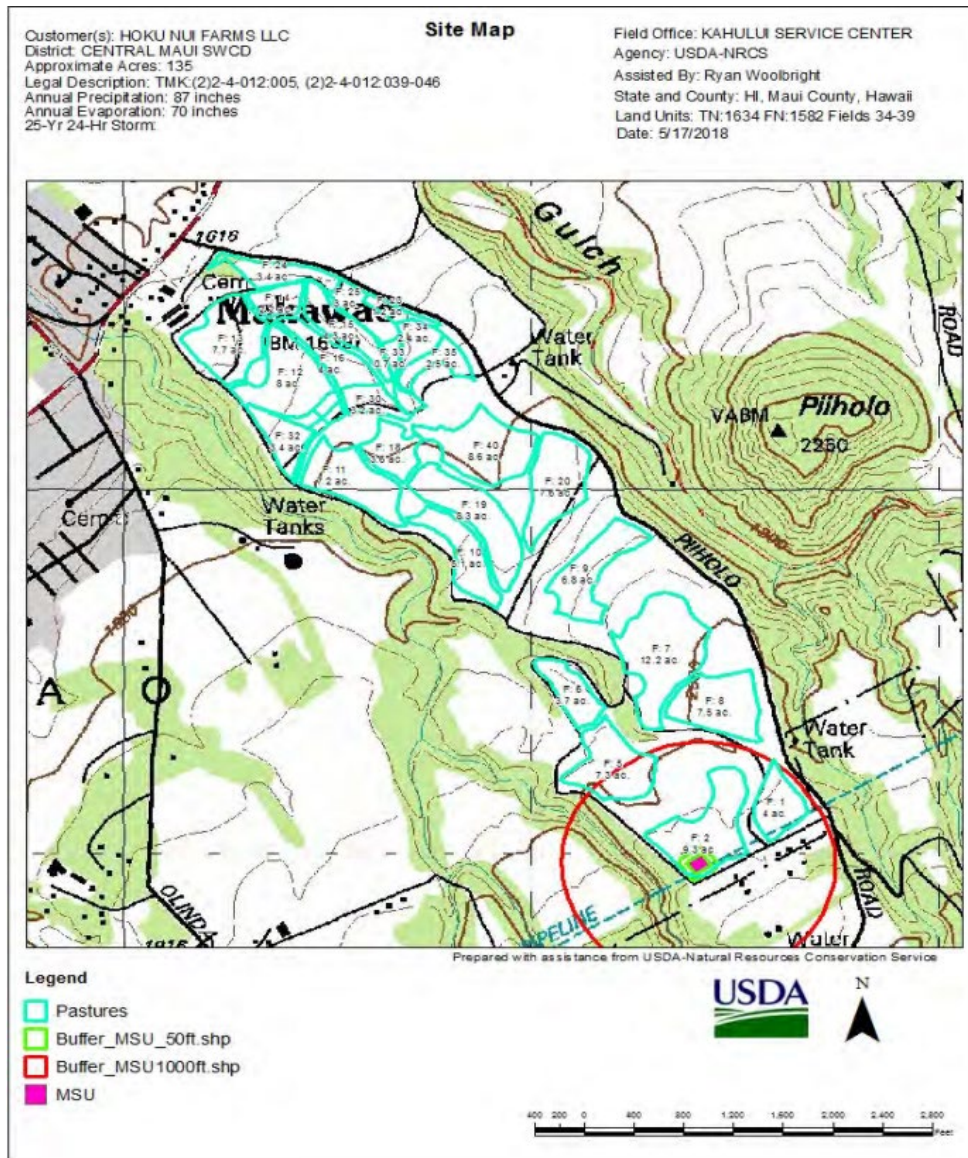


Figure 2: Hōkūnui Site Map

Like the other Hawaiian Islands, the rugged topography on Maui causes variances in climate and environment across the island. Humid trade winds hit the eastern sides of the island's mountains and contribute to heavier rainfall in the eastern region, leading to a rainforest environment with high amounts of water and lush vegetation. The western side of the island is sheltered from the trade winds by the eastern mountains, causing the western region of the island to be quite dry (To Hawai'i, 2020). In Makawao, the average annual precipitation is a moderate 87 inches making this area well suited to ruminant production (NRCS, 2019).

The soils of Hōkūnui farm are classified as ultisols, which are red-clay soils that are typically quite acidic. Ultisols most commonly support forest vegetation and are often

lacking in plant-available calcium, phosphorus, and magnesium. However, when ultisols receive proper fertilization and amendments to introduce lacking nutrients, they can become quite productive for agriculture (University of Idaho, 2020). Samples taken on the property found that the total carbon concentration in the soil averaged between 2.4 percent to 5.9 percent, which is on the low end of soil carbon storage. Additionally, the phosphorus levels are extremely low, as is common in ultisols. Hōkūnui hopes to increase the carbon and phosphorous levels through applications of compost made from slaughter waste that would serve as a valuable soil amendment.

Hōkūnui's ultisols are primarily silty clay, which are typically fairly well drained soils, however compaction, likely due to the site's prior history as a pineapple plantation, has lowered the permeability rate. Permeability on the site ranges from 0.6 to 2.0 inches per hour resulting in slow to medium runoff and erosion potential, however this should also be improved through proper grazing management and application of compost.

Field	Soil Test Year	P (ppm)	K (ppm)	% OC
1,2,5,6	2017	14	57	4.34
7,8,9	2017	51	76	3.89
10,11	2017	66	77	5.08
12,13,32	2017	28	130	4.1
18,19	2017	42	103	5.01
20,40	2017	36	67	3.87
14,15,16,30	2017	33	106	3.58
23,24,25	2017	32	134	3.09
33,34,35	2017	65	98	4.31

Figure 3: Hōkūnui Soil Test Data

Hökūnui Mobile Slaughter Unit Project

Hökūnui's project objectives are to increase the slaughter capacity on Maui, work with local ranchers to create a new local meat market and increase the local meat supply. When slaughter operations begin, Hökūnui intends to slaughter 10 cattle and 30 sheep per month, all raised on the property (Gomes, 2019). In the future, Hökūnui plans to partner with other local ranchers to process additional animals from other sites in Maui County.

Waste management has been the biggest barrier to beginning MSU operations on the Hökūnui site. After an animal is slaughtered, the organs, ligaments, tissue, hide, blood, bones, which cumulatively account for approximately 45 percent of the animal product referred to as offal, are separated and must be disposed of. Landfill and rendering are common disposal methods across the industry (Ragályi and Kádár, 2012). In Hawai'i, most slaughter operations employ a mix of strategies for dealing with slaughter waste, often combining composting for some of their waste and bringing the rest to landfill (Thorne, 2020). For instance, Hawai'i Island Meat Cooperative has successfully created a composting program for their slaughter waste. Their processes are described in a case study towards the end of this report.

As a regenerative ranch, Hökūnui is pursuing a nutrient cycling waste management plan, including composting of offal and lagoon treatment for wastewater. At the writing of this report, this plan is pending DOH approval. In this section, we examine the options for disposal, discuss the pros and cons of animal composting, and describe Hökūnui's proposed plan in detail before summarizing relevant regulations at the state level. Subsequently, we include case studies that pertain to the issues at hand and conclude with a set of clear recommendations for Hökūnui and its peers pursuing increased animal processing capacity.

Landfill

Landfill is perhaps the most straightforward, but least regenerative method of disposing of animal mortality waste. The process of raising an animal requires a great deal of resources and energy. When the slaughter by-product is sent to a landfill, the resources put into that animal are then lost. A study conducted in 2003 found that all slaughter facilities in Hawai'i were disposing of their offal in local landfills (Cox and Bredhoff, 2003). In lieu of composting, Hökūnui could send offal and other slaughter waste to landfill however this can be costly and labor intensive for a slaughter facility. Disposing of animal byproducts in landfills increases labor for farmers and butchers. A 2002 study found that butchers were paying \$20 per barrel to dispose of their slaughter residuals

(Cornell Cooperative Extension, 2008). Given the age of that study, we expect costs have risen and altogether such costs can amount to a large expense for smaller operations. Additionally, it has become increasingly expensive and challenging for public work departments to dispose of the animal byproducts in an environmentally safe way, increasing risk of biosecurity threats (Bonhotal, et al others, 2014).

Rendering

Rendering, the process by which animal remains are transformed into other usable products, is a traditional method of waste disposal for larger slaughter operations. Rendering has become less prevalent since being linked to several outbreaks of BSE (commonly known as mad-cow disease) (Alao et al, 2017). Prior to these safety concerns, rendering facilities used to pay farms in exchange for animal byproducts. However, now that rendering facilities have become relatively scarce, farmers and slaughter facilities often need to pay for rendering services (Bonhotal, et al others, 2014). Currently, there are no rendering facilities in the Hawaiian Islands. However, another potentially profitable and nutrient beneficial alternative to composting could be the production of bone meal via rendering. Bone meal provides high-caliber plant fertilizer and can be applied more broadly than animal mortality compost. As an ingredient in animal feed, bone meal from cattle and sheep could be used to nourish pigs and chickens. This could create a more affordable and sustainable alternative to grain-based animal feed, which given limited supply, is expensive across Hawai'i. Given the highly resource-intensive processes required to make bone meal, Hōkūnui might consider partnering with Maui Cattle Company (MCC), a collaborative of five sustainable, grass-fed cattle ranches, to construct a commercial rendering facility. The team at Hana Ranch, an MCC member, estimates this would require a \$700,000 investment.

Composting

Composting provides a way to close the nutrient cycle and reutilize and repurpose the slaughter by-product. Slaughterhouse byproducts contain beneficial nutrients and tend to be rich in nitrogen (Gulliver and Gulliver, 2001). Animal byproduct compost is higher in nitrogen, phosphorus, and potassium (NPK) than plant compost and can subsequently serve as a beneficial fertilizer and soil amendment for farms (Cornell Cooperative Extension, 2006). When properly managed, finished compost can be used as a soil amendment to add nutrients back into the farmland and continue the animal-crop nutrient cycle. A 2004 study found that using finished slaughterhouse waste compost on agricultural fields increased the crop yield threefold in comparison to the control fields and boosted the nitrogen, phosphorus, and potassium levels of the soil

(Ragályi and Kádár, 2012). A 2014 study found that slaughterhouse waste used as fertilizer on soybean and corn crops added Ca, Mg, K, P-Mehlich, and P-resin to the soil and additionally increased the soil pH (Gomes de Alburque Nunes et al, 2014). With fairly acidic ultisol soils, Hōkūnui's site could benefit from this increased pH. Additionally, the low levels of carbon (at 2.4- 5.9 percent) in these soils would also benefit greatly from the addition of the carbon present in this animal compost product.

Risks of Animal Composting

While there are many benefits associated with composting animal offal as described above, the composting process can increase potential hazards and health risks on the farm or ranch when not properly managed. Improperly managed compost can increase the risk of zoonotic disease spread among flocks or herds and could contaminate local soil or water supplies. Offal and other slaughterhouse waste are potential hosts of various bacteria, viruses, prions, and parasites, which can pose a major health threat for other animals and humans alike (Franke-Whittle and Insam, 2012). Most of these pathogens, bacteria, and viruses are destroyed when compost holds a temperature of 130 degrees or higher for at least six consecutive days.

A major concern is Prion diseases, such as Transmissible Spongiform Encephalopathy (TSE), also known as Scrapie, and Bovine Spongiform Encephalopathy (BSE), also known as Mad-Cow Disease, which have been found to withstand the heat of compost piles. Prions have the potential to bind with soil minerals, making them durable and less likely to break down, even at proper composting temperatures. To prevent the spread of prion diseases, the byproduct of an animal with a suspected neurological disease should not be composted (Auvermann et al, 2006), though, having flocks and herds certified to be Scrapie or Mad-Cow Disease free prior to slaughter is the best way to mitigate this risk (Bass and Ashcraft, ND). To minimize the risk of Scrapie, the Hawaii Department of Agriculture (HDOA) complies with national guidelines by monitoring and sampling sheep and goats for the disease and the department offers the Scrapie Flock Certification Program to producers on the islands. Additionally, the HDOA has implemented the State Scrapie quarantine order (QO 109-A), requiring producers to receive a "permit to ship" from the HDOA prior to sheep changing owners or when producers are moving sheep off of their premises for purposes other than slaughter (HDOA, 2020)

While offal decomposes, it releases gases such as ammonia, hydrogen, sulfide, and methane, which can be toxic to humans. Additionally, the offal will begin to leach, releasing a large quantity of fluids once decomposition begins, creating the potential to mix with runoff or groundwater. Animal waste contamination of runoff, groundwater, or

surrounding land areas can have serious implications for public health. Both of these risks can be minimized with the proper containment and management of the compost piles. Piles should be constructed on a non-porous surface to minimize leachate runoff or infiltration of groundwater. Additionally, the animal offal and other slaughter byproducts should be surrounded by a large amount of carbon rich compost material, such as wood chips. The ideal carbon: nitrogen ratio for animal composting is 30:1 (Auvermann et al, 2006). Large quantities of wood chips will ensure the proper decomposition of slaughter byproducts and will help to capture gases and the leachate that occur during the decomposition process. The Hawai'i Island Meat Cooperative (HIMC) put together composting guidelines for MSU's in Hawai'i that are planning to compost slaughter waste. HIMC recommends building an animal waste composting facility on a flat surface at least 200 feet away from any water sources or sinkholes. They should be monitored frequently to ensure they are not susceptible to scavengers, leaching, and that the pile is reaching the proper temperature (Hawai'i Island Meat Cooperative, 2020).

Other proper compost management practices include surrounding the animal by-product with at least a 12-inch layer of compostable carbon material in order to catch the leachate and maintain the proper nutrient balance.

Hökūnui's Proposed Waste Management Plan

Hökūnui has been mindful of the risks associated with composting animal offal and has been working with NRCS and Engineering Dynamics Corp. to create a thorough and safe plan to dispose of slaughterhouse waste. At this time, Hōkūnui plans to compost only the sheep offal and will separate the rest of its slaughterhouse waste for landfill disposal. Liquid waste will be collected and treated before being stored in a lagoon and treated for 90 days and cattle offal will be disposed of in the Maui County landfill (NRCS, 2019).

The compost facility will be located on a graded area to ensure a firm and flat foundation for the facility. The facility will be lined and covered to ensure that rainwater will not come in contact with the compost pile and to prevent any contact with surface or groundwater. Sheep offal will be composted in a static pile and surrounded by 18 inches of wood chips throughout the composting process. The wood chips will absorb any leachate released during the decomposition process and will also maintain the proper nitrogen to carbon ratio of the compost pile.

There will be 6 concrete compost bays allowing for frequent turning of the compost piles. The compost temperature will be monitored and will be maintained at a

temperature of 131-170 degrees Fahrenheit for at least five consecutive days to kill off any pathogens. Prior to these five days, the compost will be turned, and this cycle will repeat itself for five more cycles (NRCS, 2019). Once the compost has gone through at least 6 turning cycles, it will then be applied to the farmland as a soil amendment. The finished compost will only be applied to non-food areas such as grazing pastures, landscape plants, and forestry areas. Additionally, Hōkūnui has stated it will not apply compost when rain or heavy winds are expected to mitigate possible runoff contamination and biohazard threats (NRCS, 2019).

Regulations

U.S. slaughter and processing establishments are subject to regulation by the USDA. At the federal level, stationary facilities and MSU's are guided by the same rules. For purposes of this report, we focus on the regulations pertaining to waste management only; we do not discuss rules applying to the slaughter process itself. Beyond federal directives, certain states, including Hawai'i, have additional requirements for slaughter facilities. Here, the Department of Health (DOH) Office of Solid and Hazardous Waste must approve a planned slaughter unit. Operators are required to provide a sewage and waste disposal plan, sanitation standard operating procedures (SSOP) and a Hazard Analysis and Critical Control point (HACCP) plan.

Hawai'i is one of forty-three states that classifies composting as an acceptable method of disposal for animal byproducts (Bonhotal, et al, 2014). However, the DOH offers no clear regulatory framework for permitting animal compost operations. Instead, slaughter facilities are treated as solid waste disposal sites and managed on a case- by- case basis. For example, we identified three MSUs in Hawai'i that are permitted through exemptions to solid waste facility regulations. Below, we offer information on these three projects and summarize the pertinent State regulations around solid waste.

State of Hawai'i Statutes

Here we discuss two important statutes that govern waste disposal in Hawai'i: ***Hawaii Administrative Rule 11-58.1-04***, which establishes the need for a permit for solid waste management facilities, and ***Hawai'i Revised Statute 342H***, establishing the need for a permit for solid waste pollution. The three currently- operating MSUs in Hawai'i have received exemptions under the former in order to operate without a solid waste management facility permit:

1. ***Hawai'i Administrative Rule (HAR) 11-58.1-04:***
2. Establishes the necessity for a permit for all solid waste management facilities.

- (b)(2)- Exemption for agricultural waste.
- (b)(5)- Exemption for minor sources of waste.
- 3. **Hawai'i Revised Statute (HRS) 342H** (Bell, 2020):
 - Establishes the need for a permit for solid waste pollution.
 - (c)(4)- Public Interest clause.
 - 31- Rules for siting design and construction of waste facilities.
 - 36- Encouraging the recycling of agricultural wastes, including animal waste.

Next, we will summarize each of these and their potential applications to Hōkūnui.

1. **Hawai'i Administrative Rule (HAR) 11-58. 1-04** establishes the necessity for a permit for all solid waste management facilities:

It shall be unlawful for any person to establish, modify, or operate any solid waste management facility or a part thereof or any extension or addition thereto without a permit issued in accordance with this chapter, Hawaii Revised Statutes, chapter 342H, and the integrated solid waste management plan for the State of Hawaii.

There are then several exemptions listed under this rule. As a small agricultural facility, Hōkūnui may be able to fall under the below exemptions:

(b)(2): *A solid waste disposal facility on which the agricultural solid waste from the operation or from its products processing facility is disposed...*

(b)(5): *Minor sources as determined by the director.*

As an agricultural operation, exemption **(b)(2)** could apply to Hōkūnui. **(b)(5)** allows for an exemption of a permit for a solid waste management facility for “minor sources” of waste, as determined at the discretion of the director of the Department of Health. Arguably, Hōkūnui’s operation of 30 sheep per month could be categorized as a “minor source” of waste.

2. **(HRS) 342H section (3)** establishes the need for a permit from the Department of Health for solid waste pollution, stating that “...*the director shall prevent, control, and abate solid waste pollution in the State.*” (Hawaii State Legislature, Ch. 342H)

(c)(4) outlines the requirement that a proposed project must be in line with the public interest in order to receive a permit for up to five years, balancing the economic benefit of the project with the environmental impact of it:

(c)(4) *Such is in the public interest.*

*In determining the public interest, the director shall consider the environmental impact of the proposed action, any adverse environmental effects which cannot be avoided should the action be implemented, the alternatives to the proposed action, the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented, **and any other factors which the director may by rule prescribe**; provided that any determination of public interest shall promote the optimum balance between economic development and environmental quality.*

If a solid waste facility permit is in fact required, Hōkūnui can use their environmental assessment conducted with NRCS to demonstrate they will not have an adverse environmental impact from their composting operation in order to satisfy this rule. Additionally, Hōkūnui should make efforts to demonstrate that the economic, environmental, and social benefits will in fact outweigh environmental costs. However, much is left up to the discretion of the director of the Department of Health in determining what is in the public interest.

(HRS) 342H-31 allows for the director of the Department of Health to establish design criteria for solid waste management systems:

The director may establish by rule the criteria for siting design, construction, financial responsibility, manifest, and operation of solid waste management systems.

In order to fulfill this rule, should the director of the Department of Health establish such criteria for siting design, Hōkūnui should continue to consult with the Engineering Dynamics Corps and follow best practice guidelines for the construction and upkeep of their compost facility.

(HRS) 342H-36 clearly establishes a preference for recycling (composting) of agricultural waste:

*Recycling for agricultural purposes; encouraged. **The director shall encourage** the recycling of solid wastes, including animal wastes and selected non-hazardous industrial wastes, and the composting of animal manures and by-products for agricultural and horticultural purposes. The use of treated sludge effluent for fertilizer and other agricultural purposes shall also be encouraged. Composting of agricultural secondary organic resources under approved methods shall also be encouraged.*

This statute encourages the recycling of agricultural “wastes,” recognizing the beneficial impact of closing the nutrient loop. Hōkūnui’s plans for composting sheep offal are supported by this rule.

Three “mobile” slaughterhouses in Hawai‘i are permitted under exemptions to these solid waste facility regulations. Two are for single companies with multiple, but geographically close, locations covered under **(HAR) 11-58.1-04(b)(2)**, the exemption for agricultural waste. The other exemption is for a co-op of several farmers that bring their livestock for slaughter to one location but consider it mobile since the operation is in a trailer. This facility only uses the compost on the farms in the co-op. This facility is covered under **HAR 11-58.1-04(b)(5)**, the “minor sources” exemption. (The specific names and locations of these facilities were not obtained by our team).

In looking at these rules that govern slaughter waste via the Department of Health, it is important to note that most fall under the discretion of the director of the DOH, as highlighted in bold in the above passages. This means that each case is very much treated independently. Additionally, the burden falls to the slaughter producers to show that their unique operation will not cause environmental damage, rather than on the departments to provide guidance on how operations should plan their processes. This is the key regulatory barrier at issue, causing significant data gathering processes and time delays that may hinder more local slaughter units from beginning operations in the islands.

Treating mobile slaughter units as waste management facilities doesn’t align with the reality that agricultural wastes, when composted correctly, have a beneficial impact on the fertility of the land, as outlined above. Such “waste” is not waste at all when responsibly managed. The lack of clear standards around slaughter waste management, and especially compost, has hindered Hōkūnui’s ability to advance their slaughter project. However, some of the exemptions listed above could apply to Hōkūnui’s operations, in particular the minor sources and agricultural waste exemptions.

Given the benefits of animal composting and the existing precedent, the need for clear policy and regulatory framework that is specific for composting offal is evident.

Alternative uses for offal

If Hōkūnui is unable to receive approval from the Department of Health to begin an animal composting operation, they could seek alternative ways to utilize their offal that could reduce the quantity of waste sent to the landfill, saving on cost of disposal and utilizing the animal waste more sustainably. Parts of the animal, such as the specified risk material in bovine, cannot be saved under any circumstances and must be denatured/disposed of properly, as governed in the Code of Federal Regulations under **9 CFR 310.22** (U.S. Government Publishing Office (GPO), 2020). However, edible offal (heart/liver/kidneys, etc.) could be saved and marketed for human consumption. In these cases, the offal is presented for USDA inspection and must be properly labelled following **9 CFR 317.2** prior to sale (Haae, 2020). If this route is taken, the establishment would not have to identify alternative uses for the offal in their HACCP plan (Hazard Analysis Critical Control Point). Tripe could also be marketed, however, according to Glenn Haae from the Department of Health Solid and Hazardous Waste branch, "...the establishment would have to follow the established tripe protocols of removing membranes/bleaching, or obtain an exemption for cultural use and there would need to be a program/plan in place for this to happen." Pet food is also a potential use for the offal. Though not required, USDA provides voluntary inspection for pet food as a fee-based service.

Case Studies

Examining cases of other slaughter projects can offer new perspectives on the project at Hōkūnui. Below, we highlight two other slaughter models in Hawai'i in order to draw comparisons and possibly identify any missed steps or recommendations that could further the Hōkūnui project. We also highlight an acclaimed project led by a tribal nation in Oklahoma.

HIMC has been able to successfully compost 100% of its waste from slaughter on-site.

Case Study - Hawai'i Island Meat Cooperative

HIMC has been operating a MSU since 2017. It was publicly funded in part, due to interest in learning more about the viability of mobile slaughter in Hawai'i (Amado, 2020). Though their slaughter unit was initially built to be mobile, in practice, the unit stays on one site owing to the onerous approval process that would be required to move it to additional locations. HIMC currently slaughters four days out of the month, processing around 18 cattle, 12 sheep, and 5 hogs monthly.

During the process of becoming a certified MSU, HIMC encountered some barriers and the process of becoming a USDA approved facility required much coordination among diverse institutions and actors. Like Hōkūnui, HIMC also wanted to close the nutrient loop by composting on-site and had to prove that the land on which the slaughter would occur had the capacity to handle the nutrient load of the animal carcasses. As an island state with relatively young soils, contamination of waterways is of primary concern and risk of contamination is impacted by Hawai'i's diverse soils composition and age, as well as drastically different rainfall patterns depending on location. To address this concern, HIMC worked in coordination with the University of Hawai'i College of Tropical Agriculture and Human Resources (UH CTAHR) and NRCS to gather the required data to show that the land could handle the nutrient load from slaughter. Details, such as the percolation rates and rainfall levels were considered, as well as soil composition. Through this coordination, HIMC was able to show that it could responsibly manage the nutrient load from the proposed four days of slaughter per month on the large ranch on which the unit is located in south Kona, a process that took about two years of active work.

Currently, HIMC composts both their solid waste (offal) and wastewater onsite. Waste is composted in a pit. A large amount of green waste serves as the carbon source and it is also added to aid in heating the pile. The soil temperature and moisture levels are

monitored throughout the process, which takes about 6 months until it is finished. The finished compost is then spread on the property as fertilizer.

Case Study - Kīpuka Lānaʻi Farms

The island of Lānaʻi, like most other islands in the Hawaiian Kingdom, has had a complex and controversial history. Pre-colonial contact, the Native Hawaiians that first inhabited the island were skilled agriculturalists who utilized the practice of terracing and irrigation, as well as constructed taro and fish ponds (History of Water on Lānaʻi, 2019). When the Europeans began to invade and overrun the islands, the practices they brought with them changed the cultural and physical landscape that today's generation are still trying to repair. Privately owned pineapple and sugar plantations, as well as cattle ranching and other foreign livestock that was introduced to the islands have been detrimental to its soil health and has impaired freshwater availability. The other factor that has heavily influenced the state of agriculture on the island of Lānaʻi is that it is close to 90 percent privately owned, making it extremely difficult to acquire land to start up an individual or community agricultural operation (Hennessy, 2020).

Kīpuka Lānaʻi Farms is finding ways to connect meat production and processing to important cultural histories.

Kīpuka Lānaʻi Farms (KLF) is a small for-profit, privately owned pig farm whose goal is to assist in reclaiming the local food system through natural farming techniques that also promote waste management, sustainable crop production, and community action (Hernandez, 2015). KLF currently manages around 40 head of a variety of heritage breeds of pig that customers are able to purchase with the understanding that they only offer customary slaughter and no processing at the farm (Hennessy, 2020). The organization has an agreement with the breeder that they do not allow the animals to leave the farm alive in order to keep track of the bloodlines.

This unique method is not without complications and KLF is currently in discussions with a larger organization on Lānaʻi that has a mobile slaughter unit, mainly used for the deer on the island, to explore the possibility of partnering with one another. If Lanaʻi would be willing to work together and update their mobile unit to accommodate processing of pigs, KLF would be able to start selling their hogs to local restaurants and hotels. As a smaller operation, KLF does not always have hogs available for sale and depending on demand they only slaughter every 2-3 weeks. Diversity of cultures on Lānaʻi also determines sales based on different cultural traditions. For example, the Filipino customers on the island have a traditional blood meat dish that requires a specific

method of slaughter and usually favors larger pigs. This is in comparison to the Samoan customers who generally prefer smaller pigs. KLF also provides hogs for Hawaiian cultural events that take place on the island.

Since Kīpuka Lānaʻi Farms does not process the pigs there is not much waste from the animals. However, if they succeed in partnering on slaughter, many opportunities exist to connect byproducts with Hawaiian culture. Historically, Native Hawaiians used pig skulls as markers of agricultural fields, jaw bones were used in artwork, and artifacts have been found of jewelry and tools that were also made of bone (Hennessy, 2020).

Case Study - Quapaw Tribe of Oklahoma

In 2010 the Quapaw Tribe, following multiple discussions with the Tribe’s Business Council, acquired five bison to start a tribal herd (Seifert, 2019). In 2014, after a couple of decades of unsuccessful cattle operations, the Tribe decided to jump back into the cattle business, and it created the Quapaw Cattle Company (QCC) with the purchase of 75 Black Angus cow-calf pairs from a nearby ranch. Later that fall, QCC bought 117 more cow-calf pairs hoping to keep up the positive momentum. However, the various issues and added costs that came up as a result of having to haul the tribe’s cattle to places like Nebraska to feed them and then Colorado to process them highlighted the need for opening up their own facility (Seifert, 2019). In Fall 2017, the Quapaw Tribe opened a 25,000 square foot multi-species meat processing plant, which they built, equipped, and for which tribal members were trained to operate. It was the first USDA inspected slaughter and processing facility owned and operated by a tribe in the United States and located on tribal land (Stotts, 2017). Today, the QCC primarily slaughters beef, pork, and bison, at a rate of around 100 beef cattle and pigs per month, along with a handful of bison (Roper, 2020). QCC finishes about three beef per week, so the rest of their processing is done for outside customers.

Without local slaughter capacity, the Quapaw Tribe was unable to make the economics of livestock production work.

Like any other facility, the Quapaw have had to come up with alternative “waste” disposal, and like Hōkūnui, they see waste as a value component and are seeking alternatives to industrial disposal methods. Historically, when hunting, gathering, or harvesting many Native American tribes from this continent would use nearly every part of the animal, plant, or crop they were breaking down. The Quapaw recognize the cultural significance and try their best to engage in those practices. Some examples of cultural uses of the animal parts include, but are not limited to: bison hides that can be used for robes, drums or moccasins; rib bones that can be used to make dice, name

plates, and bows; beef and bison skulls that can be used for art or cultural events; and bison mounts that can be used as displays, art, or cultural events/practices. Waste such as blood, organs, and leftover bones can be used as animal feed sources (mostly in pet food) in some areas, although the QCC does not currently do that at their plant (Roper, 2020).

Recently, the Quapaw Tribe and Harvard Law School conducted a feasibility study for alternative uses for the various types of “waste” from their operations including waste from the meat processing plant (liquid waste), the coffee roastery (coffee chaff), and food waste from the casino (pre- and post-consumer). The result was a recommendation that the tribe invest in a small anaerobic digester or “micro-digester” to compost the collective waste that would otherwise be sent to an already overflowing landfill.

Lessons Learned

Each case study brings a particular perspective and situation that Hōkūnui could take into consideration when evaluating their project pursuits. The case of HIMC can serve as a model, showing that though difficult, it is possible to create a viable slaughter operation that closes the loop on nutrient management in Hawai'i. However, the HIMC experience also demonstrates the difficulties that are faced in becoming certified when there is no clear roadmap or regulations in place to follow. The case of KLF provides an alternative waste management option that Hōkūnui has mentioned in their research. KLF shows a different side of slaughter and livestock management in the islands and it could serve as a future collaborator or partner for Hokunui. The Quapaw case demonstrates the importance of slaughter to business viability. Both the KLF and Quapaw cases show the relevance and importance of culture in the implementation of each operation as a factor of their ultimate success.

Recommendations and Conclusion

Our research has led us to develop three concrete recommendations to support the expansion of slaughter capacity for Hōkūnui, and more broadly throughout the Hawaiian Islands. Acting on these recommendations would encompass multiple stakeholders across sectors and while complex, could lead to lasting change.

First, we encourage comprehensive and holistic policy change at the State level. Specifically, the Hawai'i Departments of Agriculture and Health can collaborate on a policy(ies) that recognize the economic, social, and environmental benefits of increasing local food security through expanded slaughter capacity. As it pertains to the meat industry, the state should establish clear regulations and guidance for the processing and disposal of locally raised animals. At this time, the Hawai'i Department of Agriculture does not have a comprehensive set of regulations for slaughter facilities in Hawai'i and, in particular, there are minimal regulations on the proper methods of offal and other slaughter waste disposal. Subsequently, the Hawai'i Department of Health is in charge of approving slaughter facilities and animal composting operations on a case by case basis. The lack of comprehensive regulations has made it difficult for Hōkūnui to receive approval and proceed with their onsite composting facility. Ideally, the Hawai'i Department of Agriculture will recognize the growing push to find alternative methods of offal disposal and will establish clear regulations for doing so. Policies should consider Hawai'i's unique soils and climates, which means that some regulations that work in the Continental United States may not 'fit' Hawai'i.

Second, we believe the private sector can play a meaningful role in driving systemic change. We recommend continued collaboration among businesses, ranches and other organizations involved in the local livestock economy. The Maui Cattle Company, with its shared processing, waste management and marketing infrastructure, is a strong example of the power of pooling resources. Hōkūnui and other smaller operations can find synergies with like-minded partners to have a greater collective impact. As mentioned above, this could apply to the treatment of livestock mortality waste through compost and, with sufficient investment, rendering.

Finally, our team recognizes the need for current data and research as pertains to livestock production and slaughter in Hawai'i. While the USDA collects data every five years through the Census of Agriculture, the survey does not include information pertaining to slaughter capacity. In particular, the University of Hawai'i has a role to play in surveying the status of slaughter including active slaughter operations and their capacity, best practices for sustainable and safe waste disposal options, and opportunities for growth in the industry.

As it continues its pursuit of slaughter and disposal systems that make sense, it is advised that Hōkūnui follows best practices to ensure biosecurity. This includes following proper composting procedures, frequently monitoring and testing of compost to minimize the risk of pathogens, and lastly certifying that their animals are disease-free prior to slaughter to minimize the risk of spreading a prion disease.

Given the multiple potential benefits of increased slaughter capacity, the Hōkūnui facility, which intends to slaughter 10 cattle and 30 sheep per month, thus contributing 480 animals annually to the local Maui meat supply, is poised to make a positive impact on the local food system. While the DOH is justified in exercising caution, the carefully compiled Hōkūnui waste management plan, in conjunction with the urgent food security needs for the people of Maui, should compel the DOH to approve this facility.

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About the Authors

Cindy Farlee

B.A. Indigenous and American Indian Studies, emphasis in Sovereignty. Cindy is an enrolled citizen of the Cheyenne River Sioux Tribe and works for the Native American Agriculture Fund (NAAF) as an Associate Program Officer and Youth/Beginning Farmer and Rancher Liaison. NAAF is a private charitable trust that provides grants to eligible entities for business assistance, agricultural education, technical support and advocacy services to support Native American farmers and ranchers.

Ali Kelley

B.A. Politics and M.B.A. Ali Kelley is working to start a regenerative grain company for the Great Plains region, based in her hometown of Denver, Colorado. Previously, Ali worked as a brand manager at Annie's, the top organic kids' food company, owned by General Mills. Prior to her tour at Annie's, Ali worked at the National Park Service and then in the White House office of Let's Move!, First Lady Michelle Obama's initiative to end childhood obesity.

Emma Rotner

B.A. International Relations and Environmental Studies. Emma Rotner works as the Farm to School Coordinator of Groton Public Schools in Groton, Connecticut. She incorporates food, nutrition, and garden education into daily curriculum, giving students an understanding of where food comes from and how it grows. She also assists with the procurement of local foods for the school cafeterias.

Nakasha Shoyinka

B.A. Integrated Studies. Nakasha works as an Administrative Consultant for non-profits in the local food space. She is the Marketing Manager for the Monroe Farmers Market and works with Organix Matters as a Market Associate for Fresh MARTA Market to bring local and accessible food to Metro Atlanta transit riders.

Carly Wyman

B.A. International Affairs and Political Economy, M.S. Candidate Sustainable Food Systems. Carly works in public health as a program instructor for Hui Mālama Ola Nā 'Oiwī, the Native Hawaiian Healthcare System for Hawai'i Island. She is also a co-founder of Center for Getting Things Started (501(c)3), a non-profit organization focused on initiating the regenerative economy through fostering climate-cooling culture.



Contact for more information:

Swette Center for Sustainable Food Systems
Email foodsystems@asu.edu | Website foodsystems.asu.edu

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