



Pacific Food Systems for Children's Healthy Living

Pacific Food Systems for Children's Healthy Living

*CHILDREN'S HEALTHY LIVING
CENTER OF EXCELLENCE*

UNIVERSITY OF HAWAII AT MANOA OUTREACH
COLLEGE



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Preface

This open access textbook was developed as a Pacific food system resource to reflect the diverse food systems and dietary patterns of people across the Pacific region. Its intended audience are students from the University of Hawai'i at Mānoa enrolled in the Nutritional Sciences graduate program. However, this open access textbook may be of interest to other courses interested in teaching about food systems through a Pacific framed lens. This book is best viewed online using the pressbooks format however, multiple formats (e.g., pdf, epub, mobi) are also made available.

About the Contributors

This open access textbook was made possible through the collaboration of the Children's Healthy Living (CHL) Center of Excellence faculty, students and staff at the American Samoa Community College, Northern Marianas College, University of Alaska, Fairbanks, University of Guam, and the University of Hawai'i at Mānoa funded by the Food System Resiliency for Children's Healthy Living grant 2021-68012-35899.

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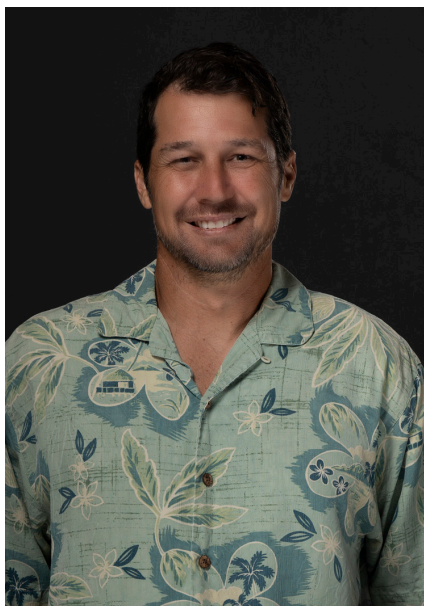


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Open Educational Resources

This text is provided to you as an Open Educational Resource (OER) which you access online. It is designed to give you a comprehensive introduction to human nutrition at no or very nominal cost. It contains both written and graphic text material, intra-text links to other internal material which may aid in understanding topics and concepts, intra-text links to the appendices and glossary for tables and definitions of words, and extra-text links to videos and web material that clarifies and augments topics and concepts.

About the Cover Art



(Click image to enlarge)

Nurturing Our Pacific Neighborhood

“Nurturing Our Pacific Neighborhood” highlights special elements from the unique homelands of Alaska, American Samoa, the Commonwealth of the Mariana Islands, Guam, and Hawai‘i. From diverse mountain ranges, indigenous trees and plants to animals, our neighborhood is connected by the Pacific Ocean to which we are kin.

Artist

Lemalualosina Reggie Meredith Fitiao



The artist, Lemalualosina Reggie Meredith Fitiao is from Leone village in American Samoa. She holds an M.F.A. degree In Painting from San Diego State University, has over 35 years experience of teaching Art, both contemporar y and traditional, specializing in Siapo the bark cloth art of Samoa. Visit www.faasamoaarts.com for more details.

Accessibility Statement

The Children's Healthy Living Center of Excellence believes that education must be available to everyone; this means supporting the creation of free, open, and accessible educational resources. We are actively committed to increasing the accessibility and usability of the textbooks we produce.

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This statement was last updated on August 11, 2026.

Adopting this Book

While this book is targeted at early graduate learners in food systems courses, some chapters will also be relevant in undergraduate classrooms and community-based learning environments. As time goes on, we anticipate adding chapters to complement the current selection, expanding the book's relevance and reach within the many spheres that comprise Pacific food systems.

Whether you use one or several chapters, we ask you to formally register your use of the OER using our [reuse log form](#). This helps in several ways. First, it will allow us to stay in contact with you, if new or revised editions of *Pacific Food Systems for Children's Healthy Living* are released. In the same way, you can maintain contact with us, to provide feedback on how the book is working for you, or to identify errors or omissions that need to be corrected in future editions. And, of course, knowing how many people are using the book—and where and in what contexts—is important feedback for us. It will help us keep making changes that address real needs, while also supporting future efforts to expand or evolve the OER more broadly.

Eventually, we hope to build on this collection with future calls for contributions centered on Indigenous foodways, global/localization, research, policies, and many other themes. While our contributors covered a wide range of topics, the breadth of what encompasses the food systems is evolving. We will be delighted if this

volume spawns (potentially multi-lingual) future editions, remixes, and/or sub-volumes.

To that end, *Pacific Food Systems for Children's Healthy Living* is published under a [Creative Commons CC BY-NC-SA license](#). With some exceptions noted in text (related to artistic material), the content in this book may be reused, remixed, repurposed, and maintained at will, provided that no commercial derivatives are created and that all future editions also carry the “share-alike” (-SA) license. Any republication of the content, however, must follow Creative Commons terms.

Version History

This page provides a record of changes made to this textbook. New editions are released when significant edits are made to the textbook. The exported files for this textbook reflect the most recent version.

Table i. Pacific Food Systems Textbook Version History

Version	Date	Details
1	September 1, 2026	Pacific Food Systems for Children’s Healthy Living textbook published by the Children’s Healthy Living Center of Excellence.

CHAPTER I. INTRODUCTION

Food Systems

Food systems are dynamic and always changing. Food systems play a significant role in shaping diets, influencing nutrition and health, driving economic growth, and affecting environmental sustainability. The Food and Agriculture Organization of the United Nations (FAO) defines food systems as intricate networks involving all elements and activities related to the production, processing, distribution, preparation, consumption, and disposal of food (The Food and Agriculture Organization of the United Nations [FAO], 2018). The food resources derived from agriculture, forestry, or fisheries are crucial within the broader economic, societal, and natural contexts of these systems. Food systems are composed of subsystems (e.g., farming systems, waste management systems, input supply systems) and interact with other key systems such as energy, trade, and health systems (FAO, 2018).

The FAO High Level Panel of Experts on Food Security and Nutrition (HLPE-FSN) created the [Food Systems Conceptual Framework](#) which proposes the different interactions among all the factors of the food system (HLPE, 2017). This conceptual framework identifies five main drivers of food system changes: biophysical and environmental; innovation, technology, and infrastructure; political and economic; socio-cultural; and demographic (HLPE, 2017; Ingram, 2011). These five drivers identified by FAO impact three core constituent elements of the food system: food supply chains, food

environments, and consumer behaviors. When modifying food systems, it is important to note that some drivers, such as biophysical and environmental factors and political and economic structures, are firmly established and integrated into a system and typically difficult to change in short to medium term periods (Kennedy et al., 2021).

The FAO Food Systems Conceptual Framework displays how the food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) related to the production, processing, distribution, preparation, and consumption of food. These elements shape diets and determine the socioeconomic, environmental, nutritional, health, economic, and social outcomes of food systems (HLPE, 2017). Food system drivers and elements do not exist in isolation but interact with one another and with other systems such as health, energy, and transportation systems (HLPE, 2017).

The relationships between food systems, nutrition, and health are complex, with environmental changes serving both as drivers and consequences of the food system (Fanzo et al., 2020). In this context, consequences refer to the effects or outcomes that the food systems have on the environment. Although the Food Systems Conceptual Framework and the HLPE 2017 report do not address the impact of food systems across different life stages, connections between the FAO's food systems drivers and elements with health, beginning with children, are evident (Agostoni et al., 2023). Child malnutrition, both undernutrition and overweight/obesity, is a public health concern with

lasting impacts on long-term health (Martins et al., 2011; World Health Organization, 2024). Further research is needed to better understand how food systems affect this critical period of the lifespan across the globe.

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Pacific Food Systems

The United States Affiliated Pacific (USAP) Region comprises hundreds of islands and atolls throughout the Pacific Ocean. The USAP includes two US states: Alaska and Hawai‘i, three US territories: American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands, and three independent countries: the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau. Uniting this extensive region is the Pacific Ocean, the largest body of water on Earth. The Pacific Ocean serves as the oceanic homeland and heritage region for all Indigenous peoples connected to the islands and continents embraced by its waters. Many names of the Pacific vary across the different Indigenous languages, such as “Pasifiku” [the Pacific, at large] in CHamoru, “Moananuiākea” [the vast Pacific] in Hawaiian, and “Le Vasa Loloa” [the great expanse, great ocean] in Samoan. Indigenous peoples used environmental elements to navigate the Pacific, connecting the USAP. This region is rich in languages, traditions, culture, and innovation driven by indigenous knowledge; however, the Pacific Ocean’s diverse food systems are inadequately described (Andrew et al., 2022). The modern Pacific region is profoundly dependent on fisheries as well as globalized trade in food commodities, and food systems are vulnerable to trade dynamics and a range of other external drivers, most notably climate change and urbanization (Andrew et al., 2022). The unique nature

of Pacific food systems has facilitated a convergence between traditional food production methods and modern systems, accommodating the challenges posed by urbanization and population growth. Shifts to policies have been dramatic in 2024 and 2025 which shaped and shifted the food system resulting in several uncertainties, influencing how we understand future directions in the field (Levy & Perez-Velazco, 2026).

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Children's Healthy Living Program

The Children's Healthy Living (CHL) Program for Remote Underserved Minority Populations of the Pacific Region aims to improve child health through food systems, specifically across the Pacific (Novotny et al., 2013). CHL was established in 2010 as a collaborative initiative across the Pacific region with the mission to improve child health. CHL is a partnership among land-grant colleges in the USAP Region and aims to serve remote minority populations of the Pacific region. The CHL collaboration included Alaska, Hawai'i, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), and the Freely Associated States (FAS), which comprises the Federated States of Micronesia (FSM: Kosrae State, Yap State, Pohnpei State, Chuuk State), the Republic of the Marshall Islands (RMI), and the Republic of Palau. The FAS is in "free association" with the US, politically and economically (Novotny et al., 2013). CHL's previous work centered around the prevention of obesity in young children through fostering a health-promoting environment in the remote, underserved, and primarily indigenous populations in the Pacific. The mission was to elevate the region's capacity in partnership with Pacific communities, and to build and sustain healthy food and physical environments to help maintain healthy weight and prevent obesity among young children in the

region. In 2013, the CHL program conducted a community randomized clinical trial that successfully decreased the prevalence of obesity in the region (Novotny et al., 2018).

This randomized clinical trial found that the outcomes of the CHL intervention were maintained and enhanced 6 years after the intervention among young children in the USAP Region. The prevalence of overweight, obesity, and acanthosis nigricans was further reduced in communities, suggesting that multilevel and multicomponent interventions may help reduce child overweight and obesity in this region (Novotny et al., 2022). The CHL Program, now recognized as a Center of Excellence, remains committed to fostering long-term improvements in environments that promote and sustain child health. The CHL Center of Excellence is actively contributing towards the efforts of increasing the number of educators, practitioners, and researchers who receive training and effectively model behaviors necessary to address the complex problem of childhood obesity prevention (Novotny et al., 2013).



Figure 1.1
Jurisdictions
Represented in the
Children's
Healthy
Living
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CHL Training Program

Since its inception in 2013, CHL has been committed to cultivating the next generation of leaders in the Pacific focused on child health and nutrition. The CHL Training Program was initiated as part of the original five-year USDA grant that provided financial support for undergraduate and graduate students across the Pacific to attend selected higher education institutions and degree programs. Through experiential learning opportunities, the CHL Training Program has equipped its student trainees with practical, hands-on experiences that have allowed them to deepen their understanding of child health and nutrition and empower them to address real community challenges. The training pro-

gram emphasizes the importance of intentional capacity building. CHL has expanded its reach and impact by implementing subject matter expertise into training activities, ensuring that both students and communities benefit from this enriching experience.

Each CHL training program has offered unique opportunities for the participating students to gain training in research, outreach, and other approaches promoting child health in the Pacific region (Fialkowski et al., 2015). The CHL Original Program was the first training program with 22 students across two cohorts enrolled in food, nutrition, and public health settings being trained in research and evaluation methods at different levels of need in the region to maintain healthy weight and prevent young childhood obesity. The goal of this training program was to provide scholarship and build capacity of future professionals in the Pacific region by developing culturally appropriate nutrition courses and programs within existing academic institutions in the region. From the successes of these two cohorts, CHL continued to develop numerous training programs for students across different educational levels to carry on the same mission of increasing capacity of skilled, trained professionals to address childhood obesity.

Many CHL trained professionals have evolved within CHL; starting off as a CHL staff member to a CHL trainee or being a CHL trainee to a postdoctoral fellow. The training pathways CHL offers over the years has demonstrated many opportunities for the program trained professionals to further their degrees in their careers and pursue advanced degrees after completing

CHL training. As of Fall 2025, CHL has successfully trained approximately 80 newly degreed professionals across all levels and disciplines of education since 2013.

These training programs have modeled a reciprocal relationship where training builds individual expertise and contributes to community well-being, ensuring sustainable growth and impact. To learn more about the Training Programs affiliated with CHL, see the links below:

- [CHL Foundational Program](#)
- [Child Health Assessment in the Pacific \(CHAP\) Undergraduate Summer Fellowship](#)
- [CHL Summer Institute](#)
- [Children's Health Living Dietetics \(CHLD\) Scholarship Program](#)
- [CHL Food Systems Training Program \(CHL FST\)](#)

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CHL's Connection to Food Systems

In 2021, CHL received a USDA National Institute of Food and Agriculture (NIFA) grant, initiating CHL's focus on food systems in the jurisdictions of American Samoa, Alaska, the CNMI, Guam, and Hawai'i. Through collaborative efforts and using system science dynamics methods, CHL partners investigated food systems across the USAP region to discern complex relationships and feedback loops among the multifaceted factors shaping these systems. With the ongoing work towards food system efforts, CHL strives to create valuable insights into Pacific food systems, specifically focusing on child health.

Using the FAO HLPE 2017 [Food Systems Conceptual Framework](#), the development of the CHL Food Systems (CHL FS) Analytical Framework (Figure 1.2) emerged after extensive discussions and interpretations involving CHL personnel, partners, and collaborators to anchor CHL's focus among the Pacific food systems (Wilkins et al., 2026). Inspired by the FAO HLPE 2017 [Food Systems Conceptual Framework](#), the CHL FS framework was developed to analyze measures collected in the 2013 CHL intervention as this framework relates to systems in the FAO's Food Systems Conceptual Framework (Wilkins et al., 2026). The food system conceptual components that CHL highlights are: Food Environment, Consumer Behavior, Diet and Health

Outcomes, and Demographic Drivers. These five conceptual components identified by CHL are synonymous with the five main drivers in the FAO framework. Attached to the conceptual components are the CHL analytic measures (i.e., variables gathered by CHL during the CHL intervention). These CHL analytic measures are the equivalent to the core elements in the FAO framework. In addition, the Policies and Institutions and Demographic Drivers conceptual components influence the food environment, consumer behavior, child diet, health outcomes, and other behaviors, which have bi-directional relationships. For example, what the child eats (child diet) relates to what is purchased at food outlets (consumer behavior). And what is purchased at food outlets (consumer behavior), affects what the child eats (child diet).

These analytic framework discussion sessions aimed to pinpoint the measures influencing the outcomes of conceptual components within the food systems related to child diet. Notably, the CHL analytical framework, drawing inspiration and adaptation from the [Food Systems Conceptual Framework](#), can further enrich the analytical depth and comprehensiveness of the Pacific food systems and identify key drivers of diet and health.

- Child food preference and healthy eating habits
- Food cost
- Social media
- Household resources
- Land use
- Funding
- Availability of quality time
- Food storage and distribution
- Physical activity and exercise
- Environment climate change and weather
- Mental health
- Resource extraction based economy
- Access to local foods
- Quality of preventive healthcare

These key factors, and their relationships, are the focus of local community actions and simulation modeling that began in 2021.

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CHL Food Systems Graduate Training Program

To build upon CHL's efforts to build capacity throughout the Pacific, the [CHL Food Systems Graduate Training Program](#) (CHL FST) was established from the CHL FS grant. CHL FST is an integral part of CHL's food systems initiative, designed to foster the growth of future leaders of food and nutrition resiliency and security. This program selected five dedicated student trainees representing the diverse CHL FS jurisdictions: Alaska, American Samoa, CNMI, Guam, and Hawai'i. These five trainees are graduate students of the University of Hawai'i at Mānoa's PhD in Nutritional Sciences program, each having lived experiences in the jurisdiction they represent. Their personal and academic commitments reflect a shared dedication to advancing food and nutrition resources and education in ways that integrate the distinct histories, cultures, and values of their home communities. Using strategies and modeling from previous CHL training programs, CHL FST focuses on preparing these trainees through an innovative curriculum that blends traditional knowledge with Western practices, systems science, and robust community engagement to address food system resiliency.



Figure 1.3
Children's
Healthy
Living
Food
Systems
(CHL FS)
Trainees
Courtesy
of
Children's
Healthy
Living
Food
Systems
(CHL FS)

Open Educational Resources

The CHL Training Program's unique approach emphasizes the development of open-access educational tools. One key outcome of the CHL FS grant is the creation of an [Open Educational Resource](#) (OER) product tailored to the food systems within the CHL FS jurisdictions. Members of CHL have previously contributed to existing [Human Nutrition](#) OER textbooks used in courses at the University of Hawai'i at Mānoa. OER materials are designed to provide the reader an educational resource, at no or very nominal cost, that are easily accessible and adaptable for teachers and professors to customize for specific learning and teaching. These materials contain written and graphic text material, intra-text links to other internal material which may aid in understanding topics and concepts, intra-text links to the appendices and glossary for tables and definitions of words, and extra-text links to videos and web material that clarify and augment topics and concepts. All material displayed in this OER has been designed and adapted to align with accessibility measures for individuals with visual impairments and other reading disabilities.

This OER is focused on food systems in the CHL FS jurisdictions. The CHL FS trainee graduate students have diligently worked on these chapters, specific to their respective regions, collaborating with subject

matter experts from their jurisdictions. The contents of this textbook aim to describe concepts of the food systems as outlined in the CHL FS Analytical Framework, with a specific emphasis on the USAP Region. Throughout this resource, readers will be guided through an overview of the Pacific food systems, beginning with the region's agricultural history, food environments, and consumer behaviors that shape local food practices. Before focusing on the specific CHL jurisdictions, the textbook presents a background understanding of how these conceptual components have influenced food systems across the Pacific. To highlight distinct characteristics and challenges faced by each location, detailed case studies are provided for each of the five CHL FS jurisdictions. These case studies offer insight into the uniqueness of each location through its history, food evolution, and community efforts focused on food system resiliency.

Positionality and Intentionality of This OER

The authors and contributors wish to clarify the intentions of this OER. This OER is not intended to be a political or historical analysis of each of the five jurisdictions. Rather, the goal is to highlight specific aspects, anchoring on variables from the CHL Analytical Framework. This approach allows for this OER to center its content towards the factors identified as critical to understanding the complexities of food systems in this region. The relevance of this OER is also shaped by the timing of when it is accessed, as food system policies and conditions continue to evolve.

It is crucial to approach this knowledge cautiously, as each jurisdiction grapples with identity and historical narratives told from predominantly non-Indigenous perspectives. The positionality of this OER is rooted in lived experiences and deep respect for the intricacies of Indigenous culture and the relationships between land, tradition and culture, history, and people. Users should acknowledge that this OER may not capture the depth of all aspects of each jurisdiction through this resource alone.

This OER is committed to ensuring Indigenous perspectives are accurately reflected in the information

provided while being grounded in nutritional science, and acknowledging the importance of the scientific peer-review publication process to generate new knowledge. A peer-reviewed process was used to vet the content in this OER, ensuring accuracy and cultural sensitivity of the material. Additionally, subject matter experts from all jurisdictions provided further review to uphold the quality and relevance of the material. A complete list of contributors and reviewers of this OER can be viewed in the preface section.

The *Pacific Food Systems for Children's Healthy Living* OER contains chapters on the agricultural, food environment, and consumer behavior components of Pacific food systems, followed by five case study chapters on shared experiences of food systems across communities participating in CHL. The authors and contributors of the *Pacific Food Systems for Children's Healthy Living* acknowledge that this OER textbook provides only a snapshot of the Pacific food system, offering a starting point for further exploration of these topics. The case study chapters were developed collaboratively among the CHL FS trainees, with each trainee leading the writing of their respective jurisdiction's case study. All chapters were developed in partnership with subject matter experts. Subject matter experts for the case study chapters in particular possessed jurisdictional local knowledge, lived experience, and community-specific perspectives. The emphasis of this OER remains on providing an educational resource to build the capacity of the next generation of collaborative leaders in the Pacific to use innovative methods blending traditional and contemporary approaches, systems

science, and community engagement to promote child health and prevent nutrition-related chronic conditions later in life. This OER may serve as both a source of inspiration for forthcoming chapters and a blueprint for crafting OER tailored to diverse regions worldwide.

For further information about food systems across the globe, please visit [University of Southern Maine Open Educational Resources by Subject: Food Studies](#).

CHAPTER 2. AGRICULTURE OF PACIFIC FOOD SYSTEMS

Agriculture of Pacific Food Systems

A food system encompasses all processes and infrastructure involved in feeding a population such as demographic drivers, policy and institutions, the food environment, consumer behaviors, diet, and health outcomes (Wilkens et al., 2026). Agriculture is an integral component of the food system involving the growing, harvesting, processing, packaging, transporting, marketing, consumption, and disposal of food and food-related items. It includes the inputs needed and the outputs generated at each step, from human labor and machinery to waste products. Such food chains can be very short, like harvesting fresh vegetables from your backyard, or very long, such as receiving processed food from far-away international sources. Most food systems today are a mix of local, national, and international value-chains that bring food to our plates. Value-chains are composed of all the collaborators who participate in the coordinated production and value-adding activities that are needed to make food products (FAO, 2026). The form of a food system relates to multiple aspects of a place, such as the land tenure, workforce availability, economics, international relationships, built infrastructure, and so on.

In the Pacific, agriculture is a cornerstone of local food systems, serving not only as a means of subsistence and livelihood security but also as a critical com-

ponent of cultural heritage, identity, community cohesion, and economics (Lincoln, 2025). Although this textbook is focused on the food systems within the USAP (United States Affiliated Pacific) Region, this chapter explores the multifaceted role of agriculture in Pacific Island food systems, examining both historical and contemporary practices. Agriculture practices specific to Alaska's food systems will be discussed in detail in the [Alaska chapter](#).

Cultural and Historical Context

Historically, Pacific Islanders developed agricultural systems that were highly adapted to diverse local environments (Handy, 1940; Lincoln et al., 2023; Lincoln and Vitousek, 2017). These systems were designed to maximize the use of available space and resources while ensuring sustainability (Winter et al., 2018a). For instance, traditional Hawaiian land divisions exemplify how ecology was embedded into the socio-political systems. The moku (district or region) were “ecoregions” defined by major differences in land-type (e.g., wet windward, dry leeward, etc.) (Winter et al., 2018b). Nested within the moku were ahupua‘a (a community-level division) which typically stretched from the mountains to the sea, encompassing various ecosystems and resources. This system aligned with the flow of water and nutrients for growing, and allowed for the sustainable management of land and water resources, ensuring

that communities had access to diverse food sources and environmental resources. Within the ahupua'a, the 'ili (land strips occupied by extended family groups) managed the on-the-ground agricultural production (Figure 2.1) (Handy & Pukui, 2012).

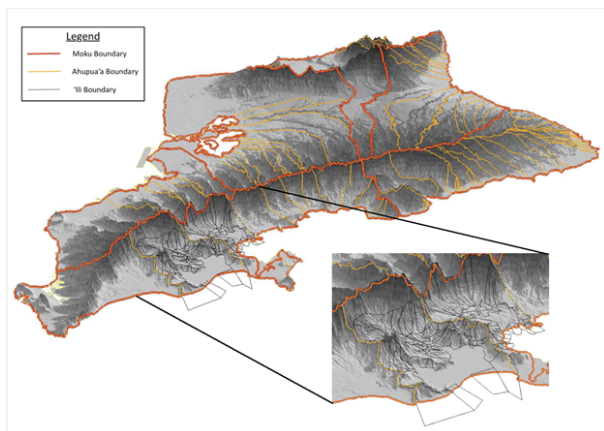


Figure 2.1
Moku,
Ahupua'a,
and 'Ili
Boundaries
of
O'ahu,
Hawai'i
Courtesy
of Noa
Lincoln

These land divisions related explicitly to agricultural systems, often based on the local ecology. For instance, the traditional pākukui system, in which slash-and-mulch agriculture was used to grow **taro (*Colocasia esculenta*)** within cultivated candlenut, (*Aleurites moluccanus*) forests, was practiced in the moku of Hāmākua on Hawai'i Island, but stopped abruptly at the moku boundary (Lincoln, 2020). Within an ahupua'a, the type of agriculture may have changed spatially or temporally. For instance, ahupua'a in the moku of Kona had banded elevational zones that represented different planting methods (Kelly, 1983), while ahupua'a in the moku of Kohala moved up and down the mountain, fol-

lowing the seasonal patterns of rainfall (Kagawa-Viviani et al., 2018).

Similarly, in Fiji, the traditional teitei (farm) system reflects intimate knowledge of and adaptation to local ecosystems (Figure 2.2). Indigenous Fijian farmers utilize a mix of diverse **agroforestry** systems that are adapted to different portions of the landscape. Along the coast, or in steeper areas, permanent food forests and tree crops are used for protection against erosion, winds, and waves. In other areas, a shifting mosaic of forested, fallowed, and planted areas are employed to maintain soil fertility. The trees and weeds in the fallow forests accumulate nutrients, which are released when they are cut down to plant shorter term crops. After a couple years of intensive planting that uses more of the nutrients, agroforestry is employed since tree crops can persist with few nutrients (Clarke & Thaman, 1993). Finally, the land is let to rest before starting the cycle over again, allowing for sustained production without the use of fertilizers. These methods are based on generations of empirical knowledge, passed down through oral traditions and hands-on practice.



Figure 2.2
Fijian
teitei
system
Courtesy
of Ashley
McGuigan

In Micronesia, the pwe (taro patch) system of Palau exemplifies another form of sustainable agriculture (Figure 2.3). These patches are often integrated into complex agroforestry systems, which include **breadfruit** (*Artocarpus altilis*) trees, **bananas** (*Musa spp.*), and **coconuts** (*Cocos nucifera*). This multi-crop approach provided food security and resilience against environmental stresses such as storms and droughts. The trees protect the more delicate annual crops from winds and storms, while also providing mulch and nutrients. The plants also offset each other throughout the year. In Pohnpei there are two recognized seasons: rahk (the time of plenty) when breadfruit is in season during the summer, and isol (the time of scarcity) when breadfruit trees are not bearing and the harvest of **yams** (*Dioscorea spp.*) becomes the dominant food (Heinrich, 2009).



*Figure 2.3
Pwe
system in
Palau
Courtesy
of Noa
Lincoln*

The Role of Agriculture in Community and Identity

In many Pacific cultures, agriculture is more than just an economic activity; it is a way of life that shapes social structures and cultural identities. Traditional farming practices are often embedded in rituals and ceremonies that reinforce community bonds and cultural values. For example, in Tonga, the planting and harvesting of yams are central to social and ceremonial life, and are not only a staple food but also a symbol of wealth and status. Similarly in Pohnpei, the size of yams given in tribute to the chiefs mark an individual's stature in the community.

In Samoa, the concept of fa'a Samoa (the Samoan way) emphasizes the importance of communal living and shared resources. Agriculture plays a key role in this social structure, with families working together on

communal farms and sharing the harvest. This collective approach to farming ensures that everyone in the community has access to food, reinforcing social cohesion and mutual support. This same concept exists throughout the Pacific, for example as *solesolevaki* in Fiji, or the *ahupua'a* system in Hawai'i. For instance, for flooded cultivation of taro in Hawai'i and elsewhere, the irrigation canals were considered communal property, and were built and maintained by collective effort so that everyone could share in the benefits of the infrastructure.

Across the Pacific Islands, food and agriculture are rooted in a deep sense of kinship, in which all aspects of the land, living and non-living, are considered beloved manifestations of the gods, if not living relatives. Taro is a vital crop in Hawai'i and in traditional Hawaiian culture (Figure 2.4). Taro is the elder sibling of humanity, symbolizing the deep relationship of land and people (Kame'eleihiwa, 2016), and breadfruit is seen as arising from the personal sacrifice of the deity Kū, who gave his earthly life to support his family and community in a time of famine. While specific examples from individual islands or locations are provided, it is important to note that these patterns are common throughout the Pacific, with shared ancestry driving commonalities in the relationships between Pacific Island peoples, their environments, and the food and agricultural systems. Despite different crops, landscapes, and potential, traditional Pacific Island agriculture shares underlying foundations of a respect and appreciation for land, adaptation to place, and communal living and reciprocity.



Figure 2.4
Taro
Fields in
Hanalei,
Kaua'i
Source:
[Green
Fields of
Kauai,
Hawaii](#) by
John
Williams
Hammond
/ [CC BY
SA 2.0](#)

Contemporary Relevance

Today, the principles of sustainability and resource management that underpin traditional Pacific agricultural practices are more relevant than ever. Modern agriculture in the Pacific faces numerous challenges, including climate change, land degradation, and economic pressures. Traditional knowledge offers valuable insights into how to cope with these challenges. Leveraging modern technologies can enhance indigenous thinking to produce a new generation of food systems that promote environmental, cultural, and social sustainability (Chang et al., 2019).

Maintaining connections to cultural roots and identity is of high importance for many Pacific Islanders. In Hawai'i, the revival of traditional taro farming is seen

as a means of reconnecting with cultural heritage and promoting food sovereignty. The resurgence of taro farming is part of a broader movement to assert cultural identity and practices in the face of modern challenges (Bremer et al., 2018). These practices have helped many non-Hawaiians connect to land, place, and culture in ways that shape their values, actions, and priorities, helping to bring cultural values such as “aloha ‘āina” (love for the land) to the forefront of food systems discussions today (Lincoln, 2025).

As it pertains to ecological outcomes, the practice of agroforestry—the intentional integrations of trees and shrubs into agricultural systems—is now being promoted as a sustainable farming method that enhances biological and nutritional diversity, improves soil health, and increases resilience to climate change (Clarke & Thaman, 1993). In Fiji, programs are being implemented to perpetuate traditional agroforestry practices, combining them with modern techniques to boost productivity and sustainability. In the Commonwealth of the Mariana Islands, the Cooperative Research, Extension, Education Services (CREES) department at the Northern Marianas College works collaboratively with farmers, ranchers, growers, government agencies, non-government organizations, community groups, and other stakeholders to provide outreach and educational support to promote sustainable technologies and practices in regenerative agriculture agroforestry, and livestock systems. As Western science recognizes the benefits of such systems of production, indigenous knowledge and practices are finding new relevance and importance in a modern world.

However, Pacific Island food systems have always evolved, and continue to evolve and adapt to new technologies and opportunities, particularly ones that parallel traditional technologies. Hydroponics and aquaponics are innovative methods being adopted in the Pacific to address the limitations of arable land and water resources. These soilless cultivation systems allow for efficient use of water and nutrients, making them suitable for atolls and other areas with poor soil quality. Such methods have parallels to traditional Hawaiian plantings of **kavakava (*Piper methysticum*)** as soilless epiphytes in trees, flooded cultivation of taro, and aquaculture systems (Handy, 1940). Projects in the Marshall Islands and Palau have successfully demonstrated the potential of these technologies to enhance food security.

Mechanization and the use of modern agricultural tools are also being integrated with traditional practices to improve efficiency and reduce labor demands. In Samoa, small-scale mechanization initiatives aim to increase productivity while preserving the cultural values and communal aspects of farming. Simple two-wheel tractors (aka power tillers) and power tools like grass cutters have allowed people to care for and cultivate larger farms of taro, while simple processing equipment such as cocoa shellers, roasters, grinders, and winnowers have improved the efficiency and profitability of the expanding cacao industry.

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Overview of Pacific Agriculture Geography

The Pacific Islands span a vast area, encompassing diverse climates and landscapes that range from high volcanic islands to low-lying coral atolls. This geographic diversity dictates much regarding agricultural practices and productivity. Understanding the geographic and climatic contexts is crucial for developing effective agricultural strategies that enhance food security and sustainability.

Geographic Zones

High Islands

High islands, such as Hawai'i and Fiji, are typically formed by volcanic activity. These islands are characterized by volcanic soils, which are rich in nutrients and conducive to growing a wide range of crops when young, but become increasingly acidic and infertile as they age. Differences in age also drives topography of the islands, shifting from gentle slopes when young, to increasingly dissected landscapes as river valleys

develop, and finally to large, lowland flats that abut steep mountain slopes. The elevational differences drive multiple microclimates, each suitable for different types of agriculture, as the rainfall and temperature shift along the mountain slopes and around the mountain sides with the prevailing winds. For example:

Hawai'i: The Big Island of Hawai'i features two-thirds of all the ecological zones on the planet. A strong division across the island exists, from the wet, tropical windward side, where traditional crops like taro and banana thrive; to the dry, leeward side, ideal for growing **sweet potato (*Ipomoea batatas*)** and bitter melon (*Melastoma malabale*). Within each region, gradients of temperature and rainfall vary with elevation, creating different ecological bands that effectively support different crops, today represented by tropical fruits (e.g. breadfruit, mango, etc.) in the lowlands, and more subtropical crops (e.g., figs, longan, macadamia nut, etc.) in the uplands. High elevation sites even lend themselves to stonefruit and berries typically found in temperate areas. The volcanic soils support high-value crops such as Kona coffee, which is renowned for its quality. The shallow slopes of the volcanic surfaces can be mechanized, while the steep slopes and alluvial flats of the valleys cannot.

Fiji: Fiji's two largest islands, Viti Levu and Vanua Levu, have rich soils and ample rainfall, making them ideal for sugarcane cultivation, particularly in the lowlands where warmer temperatures, flatter landscapes, and deep soils deposited

from the uplands are conducive to mechanization and intensification. Taveuni, the third largest island in Fiji, has soil best for growing taro and produces the majority of Fiji's taro exports. The steeper and wetter slopes as one moves upland are occupied by more diverse agricultural output that includes kava, root crops, fruits, and vegetables, supported by traditional and modern farming practices. The islands' varying altitudes and rainfall patterns allow for a wide range of agricultural activities.

Atolls and Low Islands

Atolls and low islands, such as Tuvalu, Kiribati, and the Marshall Islands, present significant agricultural challenges. These islands are typically formed from coral reefs or tectonic uplift and typically have sandy, nutrient-poor, calcareous soils. Limited freshwater resources and vulnerability to ocean influences (e.g., shallow salt-water table, storm surge, sea-level rise) further complicate agricultural activities. Innovative techniques are essential to overcome these challenges which can be seen in the following examples:

Tuvalu: Agricultural practices in Tuvalu often involve the use of composted organic matter to improve soil fertility. Traditionally, systems utilized salt tolerant trees to generate mulch, which was used to amend the soils for taro cultivation.

Today, similar systems are used, modified by using raised-bed gardening helps manage salinity and waterlogging issues, making it possible to grow root crops like pulaka (swamp taro). Water availability is a major concern, with rainwater harvesting and the use of brackish water being common practices to supplement limited fresh-water sources.

Kiribati: Hydroponics and container gardening have been introduced in Kiribati to address the lack of arable land. These methods allow for the cultivation of vegetables and herbs, providing fresh produce despite the challenging environment. The scarcity of freshwater necessitates efficient irrigation practices, such as drip irrigation, to minimize water use and maximize crop yield. The use of salt-tolerant crops and trees, such as coconut, breadfruit, and hala, is common for resilience against salinity and drought.

Climate Patterns

The Pacific region experiences a wide range of climatic conditions, from tropical rainforests to arid zones. These climate patterns significantly influence agricultural productivity and require tailored approaches to farming.

Tropical Rainforests

Regions with tropical rainforest climates, including parts of Papua New Guinea, the Solomon Islands, Tahiti, Pohnpei, and others, receive abundant rainfall year-round, above ~2,000 mm (~80 inches) per year. These conditions support lush vegetation and diverse crop production. However, high humidity and frequent rains can also pose challenges, such as increased pest and disease pressure. The fertility of the soils is also depleted by the high rainfall, and in these regions soil conservation practices must be practiced to maintain fertility through practices like tree crops, shifting cultivation and the use of organic mulches. Traditionally these areas were often agroforestry systems, while today they are often dominated by cash-crops such as tropical fruits.

Mesic Areas

In between very wet and dry locations are the mesic habitats that receive moderate rainfall, from ~1,000 to 2,000 mm (~40 to 80 inches) per year. These areas are often ideal for agriculture, receiving adequate rainfall to support agriculture, but not an excessive amount that depletes soil fertility and enhances erosion and diseases. These habitats can often support species from either the wet or the dry landscapes. However, they are

often more variable in their rainfall (or rather, the variability is across the critical rainfall levels that may push the region into being wet or dry in different years). In Hawai'i, these areas traditionally supported vast dry-land gardens, up to 150 km² (60 mi²) that were intensively farmed with productive crops such as sweet potato, taro, sugarcane, and bananas, while today they are dominated by cattle ranches and hardier plants like coffee and lychee.

Dry and Arid Zones

Some Pacific Islands, including parts of Hawai'i and Tonga, have dry or arid zones, with annual rainfall below ~1,000 mm (40 inches) per year. These areas experience prolonged dry seasons, requiring efficient water management practices. Traditional methods such as seasonal cultivation of fast growing crops like sweet potato, or the use of rock mulch/mounds would be applied in these areas (Sirabis et al., 2022). Today, techniques such as drip irrigation and the cultivation of drought-resistant crops are vital for sustaining agriculture in these regions. Soil fertility may be a concern in arid zones due to lower levels and slow breakdown of organic inputs, and the use of organic fertilizers and soil amendments is common to maintain productivity.

El Niño and La Niña Events

El Niño and La Niña events, part of the broader El Niño–Southern Oscillation (ENSO) cycle, have a profound impact on the Pacific’s climate and agriculture. El Niño typically brings drier conditions to the western Pacific and wetter conditions to the eastern Pacific, while La Niña has the opposite effect. These fluctuations can cause extreme weather events, such as droughts and floods, disrupting agricultural production and food security.

El Niño: During El Niño years, islands in the western Pacific often experience drought conditions, which can severely affect crop yields and water availability. Farmers may need to implement water-saving techniques and diversify crops to mitigate the impacts. Soil moisture conservation methods, such as mulching and cover cropping, are crucial during these periods.

La Niña: La Niña events can lead to excessive rainfall and flooding in the same regions, causing soil erosion, crop damage, and increased incidence of plant diseases. Proper drainage systems and flood-resistant crop varieties are crucial to coping with these challenges. The use of raised beds and contour farming helps manage water flow and prevent soil erosion.

Integration of Soil Fertility, Water Availability, and Topography

Soil Fertility

Soil fertility varies widely across the Pacific Islands. Volcanic soils on high islands are typically rich in minerals and organic matter, supporting diverse and productive agriculture. But their specific fertility varies widely as a function of the age of the lava flow, the amount of rainfall the region receives, and the slope/erosion of the land (Haensel et al., 2025; Autufuga et al., 2020). In the broadest generalization, younger, drier and depositional areas all equate to higher fertility, although there are many exceptions to that rule. In contrast, atolls and low islands have sandy, nutrient-poor soils that require substantial organic amendments to support crop growth. Traditional practices, such as the use of compost and green manures, help maintain soil fertility.

Water Availability

Water availability is a critical factor influencing agriculture in the Pacific. High islands generally have ample rainfall and freshwater resources, with even the “driest”

parts of many islands still being considered wet, though distribution can be uneven due to topography. On atolls and low islands, freshwater is typically scarce, and reliance on rainwater harvesting and efficient irrigation techniques is essential. Innovations such as hydroponics and aquaponics are valuable in these water-scarce environments.

Topography

The topography of the Pacific Islands ranges from flat coastal plains to steep mountainous regions. This variability affects agricultural practices, with terracing and contour farming being common on steep slopes to prevent soil erosion and manage water flow. In flat, lowland regions, traditional systems like the Hawaiian lo'i (irrigated taro fields) and Fijian teitei optimize land use and resource management.

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Agricultural Characteristics of Pacific Food Systems

Production

Key Crops

Pacific agriculture is dominated by staple crops that have been cultivated for centuries. These include taro (*Colocasia esculenta*), sweet potato (*Ipomoea batatas*), breadfruit (*Artocarpus altilis*), banana/plantains (*Musa spp.*), yams (*Dioscorea spp.*), and coconut (*Cocos nucifera*). These crops are not only nutritionally important but also hold cultural and economic significance.

Taro (*Colocasia esculenta*): Taro is a staple in many Pacific diets. Known as kalo in Hawai'i, talo in Samoa, and Suni in Guam, it is traditionally grown in both irrigated and dryland fields (Dela Cruz et al., 2022). Taro farming is widespread and grown using many different methods of cultivation, making it a prime example of adaptive agricultural practices. It may be grown in flooded lo'i as in Hawai'i, in irrigated fields as in Tonga in

rainfed gardens as in Guam, in mixed agroforestry systems as in Samoa, in raised composted beds as in Kiribati, in dryland farming in Fiji, or in other unique forms. Taro's resilience to flooding and its ability to thrive in both wet and dry environments make it an ideal crop for the varied microclimates of the Pacific. All parts of the crop are eaten, from the starchy corm, to the leafy greens, to the vegetable-like stalks (Figure 2.5).



Figure 2.5
Parts of
the taro
and
different
taro
varieties
Courtesy
of [CTAHR](#)

Sweet Potato (*Ipomoea batatas*): This versatile crop is grown across the Pacific, particularly in areas too dry or too cold for taro. Sweet potatoes are hardy and can thrive in a variety of soil types (provided adequate drainage) and climatic conditions, providing a reliable food source. Sweet potato is particularly valued due to its rapid development, which can be harvested in as little as four months compared to a minimum nine (and

typically 12 or more) months for taro, making it a valuable resource for food security in the face of climate disturbances (Kagawa-Viviani et al., 2018). In Papua New Guinea, sweet potato, known locally as kaukau, is a dietary staple and is integral to traditional farming systems that utilize shifting cultivation. The crop is highly susceptible to various pests and diseases today, and therefore cultivation often must move around to avoid buildup of these detriments. The crop is very easily propagated, and the young shoots can be eaten in addition to the tubers.

Breadfruit (*Artocarpus altilis*): Breadfruit is a large perennial tree crop that provides a significant amount of large, starchy fruit (Figure 2.6). Its cultivation is often integrated into agroforestry systems, which enhance biodiversity and soil health, but it is also commonly grown in backyards to enhance home food security and increasingly grown in orchard systems for economic development (Vergara & Nair, 1985). Breadfruit is celebrated in Polynesian culture, with many myths and legends surrounding its origins, and is the backbone of Yapese and Pohnpeian agricultural systems. The revitalization of breadfruit cultivation is seen as a way to address modern food security challenges while preserving cultural heritage. Breadfruit trees are also important for their low maintenance requirements and their ability to produce fruit for decades (Meilleur et al., 2024; Langston and Lincoln, 2018).



Figure 2.6
Breadfruit
Courtesy
of Noa
Lincoln

Yams (*Dioscorea spp.*): Yams are a staple food composed of different species, providing a reliable source of calories and essential nutrients, particularly in rural areas where they are a primary food source (Figures 2.7 and 2.8). Yams are a resilient and high yielding crop that can be stored for months after harvest, and grow exceptionally well on drier sides of the island, helping to secure food supplies. Yams are often grown in multi-storied gardens under trees, including breadfruit trees, which help maintain soil health and provide support. Cultivation is seasonal, timed with other crops like breadfruit. For example, in Pohnpei, the yam harvest season is typically from September to March, while breadfruit is harvested from May to August. They play a central role in ceremonies, festivals, and social gatherings, symbolizing prosperity and community bonding. For example, in Tonga, the Inasi festival is held to present the first

yam harvest to kings and nobles before the commoners can eat it, and the yam is considered the “noblest crop”.



Figure 2.7
Harvested
Yam
(*Dioscorea
alata*)
Courtesy
of Noa
Lincoln



Figure 2.8
Yam
(*Dioscorea
Alata*)
Leaves
Courtesy
of Noa
Lincoln

Banana (*Musa spp.*): Banana is a large herb that grows from an underground rhizome that can persist for many years (Figure 2.9). The fruits can be sweet or starchy, and are a good source of vitamins. Many different varieties of banana exist, with some being eaten raw and others needing to be cooked. Most banana types can be cultivated in the shade or in the sun, and therefore can be incorporated into agroforestry systems as an understory crop, or grown in full sun along with other crops. It is commonly grown in backyards to enhance home food security (Kepler & Rust, 2011).



Figure 2.9
Banana
Courtesy
of Noa
Lincoln

Coconut (*Cocos nucifera*): Essential for both food and non-food products, coconuts are a cornerstone of Pacific economies (Figure 2.10). The tree's various parts are used for food, drinking water, oil, fiber, and building materials. In many Pacific communities, the coconut palm is referred to as the “tree of life” because of its numerous uses. It is an important source of fats, and coconut cream is a common culinary element in a very wide-

array of Pacific Island dishes, combined with virtually all other crops and foods. The production of kopra for coconut oil is an important industry, providing economic opportunities and supporting local livelihoods. Coconut palms are also highly resilient to coastal conditions and saline soils, making them ideal for island environments.



*Figure
2.10
Coconut
Tree
Courtesy
of Noa
Lincoln*

More information about these foods and how they are

prepared and consumed across the Pacific will be discussed further in the Alaska, Commonwealth of the Mariana Islands, Guam, and Hawai'i chapters.

Traditional Farming Techniques

Traditional Pacific farming techniques are characterized by their sustainability and adaptability to the diverse local ecologies. These methods include shifting cultivation, agroforestry, and polyculture.

Shifting Cultivation: Also known as swidden agriculture, this method involves rotating fields to allow soil recovery and maintain fertility. Crops are grown for a few years, then the field is left fallow for a period before being cleared (such as by burning) for the planting of new crops. This practice is common in Melanesia, where it is known as “slash-and-burn” agriculture. While often criticized for its environmental impact, when managed properly, shifting cultivation can be a sustainable way to use land resources. The fallow period allows the land to regenerate, restoring soil fertility and reducing pest and disease cycles.

Agroforestry: This practice integrates trees and shrubs into agricultural landscapes (Figure 2.11). It enhances biodiversity, improves soil health, and provides multiple products such as fruits, nuts, and timber. The traditional Pacific agroforestry system often includes a mix of

breadfruit, bananas, coconuts, yams, and taro, along with non-food plants, creating a diverse and resilient agricultural ecosystem. Agroforestry systems also provide habitat for wildlife and help mitigate the effects of climate change by sequestering carbon. These systems take on multiple forms, from “food forests” that are left relatively wild, to more intensively managed orchards incorporating a range of other crops (Clarke & Thaman, 1993).



*Figure 2.11
Agroforestry in Yap
Courtesy
of Noa
Lincoln*

Polyculture: Growing multiple crops in the same space reduces pest pressure, improves soil fertility, and increases resilience to climate variability. In Fiji, for example, the traditional teitei incorporates a variety of root crops, vegetables, and fruit trees, optimizing the use of available space and resources. Polyculture systems are more resilient to environmental stressors, as the diversity of

crops can buffer against failures in any single crop type.

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Historical Transformation

The ongoing transition from traditional to modern food systems in the Pacific Islands has been shaped by various historical factors, including colonialism, globalization, and technological advancements.

Contact Era

During the colonial era, many Pacific Islands were integrated into global trade networks as producers of commodities such as sugar, copra, and cocoa. Colonial powers introduced new crops and agricultural practices aimed at maximizing production for export markets. This shift often disrupted traditional food systems, which were based on subsistence farming and sustainability, and in many cases interrupted traditional land tenure, political, and cultural systems.

Introduction of Cash Crops: Colonizers introduced cash crops such as sugarcane, rubber, and tobacco, which required large tracts of land and intensive labor. The focus on monoculture reduced biodiversity and made local food systems more vulnerable to pests, diseases, and market fluctuations.

Labor and Land Use Changes: The introduction of plantation agriculture altered traditional land use patterns and labor dynamics. Indigenous people were often displaced from their ancestral lands or coerced into labor on plantations, leading to social and economic upheaval.

Post-Contact Period

In the post-colonial period, many Pacific Island nations gained independence and sought to develop their economies. However, the legacy of colonial agriculture continued to influence food systems.

Economic Development: Many Pacific Islands continued to prioritize cash crop production for export as a means of generating revenue. This focus on export-oriented agriculture often came at the expense of local food production.

Introduction of Modern Technologies: The adoption of modern agricultural technologies, such as chemical fertilizers, pesticides, and mechanization, increased productivity but also brought environmental and social challenges. These technologies often replaced traditional, sustainable practices.

Globalization: Globalization has further transformed Pacific food systems by increasing the availability and affordability of imported foods

and integrating local markets into global supply chains.

Imported Foods: The influx of imported foods, often cheaper and more convenient than locally produced items, has changed dietary patterns and reduced the reliance on traditional crops. This shift has contributed to the rise of non-communicable diseases (NCDs) such as diabetes and obesity.

Market Access: Globalization has also opened up new market opportunities for Pacific agricultural products. High-value crops like coffee, cacao, and vanilla are now being produced for niche markets, emphasizing quality and sustainability.

Contemporary Trends

Today, there is a growing movement to revitalize traditional agricultural practices and integrate them with modern techniques to create resilient and sustainable food systems.

Agroecology: The principles of agroecology, which emphasize biodiversity, ecological balance, and social equity, are being applied to modern agriculture in the Pacific. This approach combines traditional knowledge with scientific research to create sustainable farming systems.

Food Sovereignty: Efforts to achieve food sov-

ereignty—where communities control their own food production and distribution—are gaining momentum. This involves supporting small-scale farmers, preserving traditional crops, and promoting local food consumption.

Climate Resilience: Addressing the impacts of climate change is a priority for Pacific agriculture. Strategies such as developing climate-resilient crop varieties, implementing water-saving techniques, and restoring degraded lands are essential for ensuring long-term food security.

Collective Action: Due to the small-scale nature of most land-holdings and production systems in the Pacific, collective or collaborative actions are increasingly seen as a critical mode of activity to increase scale and impact. Cooperatives, food hubs, or other collective organizational structures have helped small scale producers feed into aggregation or processing facilities to reach larger markets and impacts. Some of these have been government sponsored, while others are grassroots. In Tahiti, Rotui Juice, the largest and most common juice brand found throughout the islands, represents a government sponsored cooperative that is fed by dozens of small farmers.

Contemporary Crops

In addition to traditional crops, Pacific agriculture has diversified to include a variety of contemporary crops that cater to both local consumption and export markets. These crops include:

Coffee: Particularly in Hawai'i, coffee has become a major agricultural product. Kona coffee, grown on the Big Island, is renowned for its quality and flavor. The unique volcanic soil and microclimate of the region contribute to the distinct characteristics of Kona coffee.

Cacao: Cacao (Figure 2.12) is increasingly being cultivated in Pacific Islands such as Samoa and Vanuatu, contributing to the global chocolate industry. The tropical climate and rich soils provide ideal conditions for cacao cultivation, and there is growing interest in producing high-quality, single-origin chocolate.



Figure
2.12 Cacao
pods
Courtesy
of [CTAHR](#)

Vanilla: Vanilla (Figure 2.13) is an important export crop for islands like Tahiti and Fiji. Vanilla orchids require specific climatic conditions and careful management, making them a valuable but labor-intensive crop.



Figure
2.13:
Vanilla
Pods
Courtesy
of [CTAHR](#)

Tropical Fruits: A wide variety of tropical fruits, including **mangoes**, **papayas**, lychee, citrus, **pineapples**, and **bananas**, are grown throughout the Pacific Islands. These fruits are essential for local diets and are also exported to international markets.

Modern Farming Techniques

Modern agriculture in the Pacific incorporates both traditional knowledge and contemporary innovations.

Greenhouse Farming: Protected cultivation techniques, such as greenhouses and shade houses, help manage environmental conditions and extend growing seasons. In Guam, greenhouse farming has been adopted to produce high-value crops like tomatoes and bell peppers, reducing dependency on imports and enhancing food security. Greenhouses also protect crops from extreme weather conditions and pests, improving overall yields.

Hydroponics and Aquaponics: These soilless cultivation methods are particularly valuable in atolls and other areas with poor soil quality. They allow for the efficient use of water and nutrients, producing high yields in small spaces. In the Marshall Islands, hydroponic systems have been introduced to grow leafy greens, providing fresh produce in areas where traditional farming is challenging. Aquaponics, which combines fish farming with hydroponics, creates a closed-loop system that maximizes resource efficiency (Figure 2.14).



Figure
2.14
Aquaponics System
Courtesy
of [CTAHR](#)

Mechanization: While small-scale farming dominates, there is a growing trend towards mechanization to improve efficiency and reduce labor costs. In Samoa, initiatives to introduce small-scale mechanization, such as motorized tillers and harvesters, aim to increase productivity and reduce the physical burden on farmers. Mechanization also helps streamline operations, allowing farmers to manage larger areas more effectively.

Role of Small-Scale and Subsistence Farming: Small-scale and subsistence farming remains prevalent in the Pacific, providing food security and livelihoods for many communities. These farms often operate on family land, utilizing traditional knowledge and labor-sharing practices. They contribute significantly to local economies and cultural continuity. Small-scale farming practices often prioritize biodiversity and ecological

balance, making them more sustainable in the long term.

Pacific Island Food Systems

Aggregation

Aggregation is the process of collecting and combining agricultural products from multiple small-scale producers to create a marketable volume. This is particularly important in the Pacific, where small farms are the norm, and individual production may not be sufficient to access larger markets.

Importance of Cooperatives and Community Groups:

Cooperatives and community groups play a crucial role in aggregation. They provide a platform for farmers to pool resources, share knowledge, and negotiate better prices. Examples include taro cooperatives in Samoa and vanilla producer groups in Tonga.

Case Study: Samoa Taro Cooperative

The Samoa Taro Cooperative has successfully aggregated taro from small farmers, enabling them to meet export standards and access international markets. The cooperative provides training, quality control, and marketing support, significantly improving farmers' incomes. The success of the cooperative has inspired similar initiatives in other Pacific nations, demonstrating the potential of collective action in overcoming market barriers. By working together, farmers can achieve economies of scale, reducing costs and increasing their bargaining power.

Case Study: Fiji Vanilla Producers

In Fiji, vanilla farmers have formed groups to collectively process and market their products. This has helped them overcome the challenges of small-scale production and achieve better prices for their high-quality vanilla. The cooperative structure allows farmers to share the costs of processing and marketing, increasing their overall profitability. Vanilla cooperatives also provide technical assistance and support, helping farmers improve their cultivation practices and product quality.

Processing

Processing transforms raw agricultural products into forms that are more convenient for consumption, storage, and transport. Traditional and modern processing methods coexist in the Pacific, each with its advantages and challenges.

Traditional Food Processing Methods

Traditional methods of food processing include fermenting, drying, and smoking. These techniques not only preserve food but can also enhance its flavor and nutritional value.

Fermentation: Used for foods such as poi (steamed and mashed taro) in Hawai'i and kab-wiro (fermented breadfruit) in many Micronesian islands, fermentation preserves food and improves digestibility. The fermentation process also enhances the nutritional profile of these foods by increasing the availability of certain vitamins and minerals. Fermented foods are integral to many Pacific diets, providing probiotics and other health benefits.

Drying: Drying is a common method for preserving fish, fruits, and vegetables. It reduces moisture content, preventing spoilage and extending shelf life. In the Solomon Islands, dried fish is a staple food item that provides essential

protein to local diets. Sun drying and smoking are traditional methods that have been passed down through generations.

Smoking: Smoking fish and meat is a traditional method that imparts flavor and increases storage time. It is still widely practiced in many Pacific communities. Smoked products are often considered delicacies and are an important part of cultural celebrations and ceremonies. The smoking process also helps protect food from spoilage in humid climates.

Modern Processing Facilities and Techniques

Modern processing facilities are essential for meeting the demands of urban populations and export markets. They ensure food safety, quality, and longer shelf life. Below are some examples of modern processing in the Pacific:

Tuna Processing in American Samoa: American Samoa is a hub for tuna processing, with facilities that handle large volumes of fish for export. These processing plants adhere to strict hygiene and quality standards, ensuring that the tuna meets international market requirements. Modern processing techniques, such as canning and freezing, help maintain the quality and safety of the product.

Breadfruit Flour Production in Hawai'i: Breadfruit flour is a value-added product that extends

the shelf life of breadfruit and provides a gluten-free alternative to wheat flour. Modern processing facilities in Hawai'i produce high-quality breadfruit flour for both local and export markets. The production of breadfruit flour supports local farmers and promotes the utilization of this traditional crop in new and innovative ways.

Impact on Food Quality and Shelf Life

Processing has a significant impact on food quality and shelf life. While traditional methods are valued for their cultural significance and flavor, modern techniques offer greater consistency and safety. Balancing these approaches is key to maintaining food heritage while meeting contemporary demands.

Distribution

Distribution involves moving agricultural products from producers to consumers. In the Pacific, distribution networks must navigate the challenges posed by geography, infrastructure, and scale. Moving products between islands adds a layer of difficulty that is nonexistent on continental systems, and the cost-effective modes of transportation such as rail are not viable.

Local and Regional Distribution Networks

Local markets are vital for food distribution in the Pacific. They provide a direct link between farmers and consumers, supporting local economies and food sovereignty. Some examples of local and regional distribution networks in the Pacific include:

Farmers' Markets in Hawai'i: Farmers' markets are popular across Hawai'i, offering a wide range of locally grown produce. These markets support small-scale farmers and provide consumers with fresh, seasonal food. The markets also serve as community hubs, fostering connections between producers and consumers.

Village Markets in Samoa: In Samoa, village markets play a crucial role in distributing locally produced food. These markets operate on specific days, allowing farmers from different villages to sell their products. The markets are an important venue for social interaction and cultural exchange, as well as for economic transactions.

Challenges of Transportation and Infrastructure

Transportation and infrastructure are major challenges for food distribution in the Pacific. Many islands lack adequate roads, ports, and storage facilities, making it difficult to move products efficiently.

Inter-Island Shipping in the Solomon Islands:

The Solomon Islands face significant challenges in transporting agricultural products between islands. Limited shipping services, high costs, and inadequate port facilities hinder distribution. Efforts to improve inter-island shipping are essential for enhancing food security and economic development.

Road Infrastructure in Papua New Guinea: In Papua New Guinea, poor road conditions and limited connectivity between rural areas and urban centers impact the timely delivery of fresh produce. Efforts to improve infrastructure are ongoing but face financial and logistical hurdles. Improved road infrastructure would not only facilitate food distribution but also support broader economic development.

Efforts to Improve Access to Markets

Various initiatives are underway to improve market access for Pacific farmers. These include enhancing infrastructure, developing new distribution models, and leveraging technology.

Mobile Markets in Vanuatu: Mobile markets, where vendors travel to different villages to sell their products, have been introduced in Vanuatu. This model improves access to fresh food in remote areas and provides new sales opportunities for farmers. Mobile markets are particularly

valuable in areas with limited infrastructure and transportation options.

Community-Supported Agriculture (CSA) in Hawai'i: CSA programs, where consumers subscribe to receive regular deliveries of fresh produce, are gaining popularity in Hawai'i. These programs support local farmers and ensure a steady market for their products. CSAs also strengthen the connection between consumers and the source of their food, promoting a greater appreciation for local agriculture.

Conclusion

In conclusion, agriculture in the Pacific is a dynamic and evolving system that balances tradition and innovation. The geographic and climatic contexts of the Pacific play a pivotal role in shaping agricultural practices. Understanding the historical and cultural contexts of Pacific agricultural practices can help us appreciate the depth of knowledge and resilience embedded in these systems. By considering and leveraging these factors, farmers and policymakers can develop sustainable and resilient food systems that support local communities and preserve cultural heritage. Integrating traditional knowledge with modern scientific approaches can enhance the resilience of Pacific agriculture to environmental challenges. While agriculture of the Pacific food system consists of growing, harvesting, processing, packaging, and transporting foods in the USAP Region, this sets the stage to understanding the food environment and consumer behavior within the Pacific. The next chapter examines how these agricultural components interact with Pacific food environments to influence food availability, affordability, accessibility, advertisement, assistance, and quality across the region.

CHAPTER 3. FOOD ENVIRONMENT OF PACIFIC FOOD SYSTEMS

Introduction

Understanding the food environment is critical for addressing food security and improving public health outcomes, especially for children in the Pacific Region. The food environment encompasses the physical, economic, political, and socio-cultural contexts that influence how individuals access, choose, and consume food (HLPE, 2017). Examining the food environment reveals the complex components that shape access to food and its impact on dietary behaviors and food preferences. Food preferences are influenced by numerous factors which are shaped by the availability of foods, adapted tastes, cultural and social norms, the cost of food items, and broader structural conditions such as transportation, import reliance, and policy (Figures 3.1, 3.2, 3.3., 3.4, 3.5) (Blake et al., 2021; Butel et al., 2025).



Figure 3.1
Example
of a
Farmer's
Market
Stand at
the
Matanuska
a
Communi-
ty
Farmers
Market in
Alaska
Courtesy
of Alaska
Farmers
Market
Associatio-
n



*Figure 3.2
Example
of a
Farmer's
Market in
Hilo,
Hawai'i
Courtesy
of Jessie
Kai*



Figure 3.3
Example
of a
Farmer's
Market in
American
Samoa
Courtesy
of Jordan
Oshiro



Figure 3.4
Farmer's
Market
Co-Op in
Guam
Courtesy
of Kristi
Hammond



Figure 3.5
Example
of a
Farmer's
Market in
Saipan
Courtesy
of Hannah
Isabel
Deleon
Guerrero

The key factors of the food environment covered in this chapter include food availability, affordability, accessibility, assistance, advertising, and quality. These elements of the food environment largely shape food choices which in turn influences diet quality and health outcomes. Healthy food environments are known to support and enable the consumption of nutritious food, yielding potential to improve diet quality and reduce the burden of malnutrition (HLPE, 2017). Conversely,

unhealthy food environments make it more difficult and challenging to consume nutritious food. Such environments may promote unhealthy intakes by limiting access to affordable healthy foods and through strategic marketing and advertising, product placement, pricing strategies, and packaging (HLPE, 2017). This chapter will highlight the various and complex food environment factors that are specific and may be unique to the USAP, including challenges, opportunities, and recommendations.

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Overview of key factors influencing the food environment in the USAP

The food environment in the USAP Region is influenced by a combination of geographical, cultural, economic, and historical factors. The region's remote and island geography dispersed throughout the Pacific Ocean creates significant logistical challenges for food distribution and transportation (Figure 3.6). Limited agricultural land, presence of commercial fishing, vulnerability to natural disasters such as typhoons and cyclones, and dependence on imported goods all contribute to the region's food insecurity (Barnett, 2020). The USAP is susceptible to the adverse impacts of climate change, including rising sea levels, ocean acidification, and extreme weather events. These environmental changes pose threats to food security, agricultural productivity, and traditional food sources, exacerbating existing challenges in the food environment (Parsons, 2022).



Figure 3.6
Map of the jurisdictions involved with the CHL research with the US continent inlay on the region to provide context by showing the vastness of the region Courtesy of Children's Healthy Living Center of Excellence

While local capacity exists to produce staple and traditional foods from both land and sea, the output is not able to fulfill the quantities needed to meet supply demands, resulting in a heavy reliance on imported food. This dependence has been shaped by historical economic structures and federal trade policies favoring U.S. continental imports (Merchant Marine Act of 1920

(Jones Act), 1920). The Jones Act requires that no vessel may transport any merchandise by water, by land and water, or via a foreign port, for any part of the transportation, between points in the U.S., unless the vessel is U.S.-built, U.S.-owned, and coastwise endorsed by the U.S. Coast Guard (Merchant Marine Act of 1920 (Jones Act), 1920). The influx of mass-produced goods from foreign countries also contributes to the region's food insecurity. Furthermore, certain locations within the USAP region are limited in local food production due to global warming effects causing sea-level rise and salinization of fresh water (Islam et al., 2023). Most imported food products to the region (that are not perishable items such as fruits, vegetables, and poultry and meat products) are processed and shelf-stable foods to combat the transportation time and food production challenges of USAP communities. This dependency exposes these remote USAP communities to fluctuations in global food prices and supply chain disruptions, affecting food availability, affordability, accessibility, assistance, advertising, and quality of nutritious foods. Lower socioeconomic status—including income inequality, high poverty rates, and limited employment opportunities—further restrict food access, disproportionately affecting vulnerable populations such as children, the elderly, and low-income households (Levy & Perez-Velazco, 2026).

The USAP Region also faces significant health challenges related to diet and nutrition, including high rates of obesity, diabetes, and other diet-related diseases (Novotny et al., 2016; Pacific Islands Health Officers Association, 2010). Food environments that promote

unhealthy diets and physical inactivity contribute to these health issues (French et al., 2001; Salois, 2012; Yamanaka et al., 2023). Factors contributing to these health issues include the overconsumption of highly processed and unhealthy foods and limited access to fresh fruits and vegetables, influenced by industrialization and Westernization (Figure 3.7).

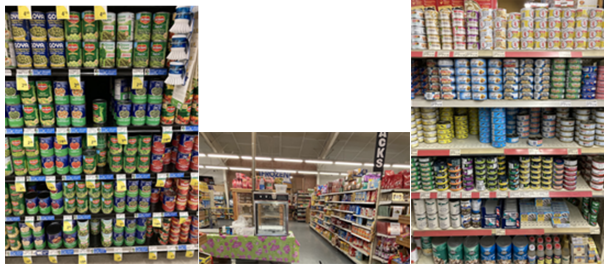


*Figure 3.7
Influences
of
industrial
ization
and
Westerniz
ation on
dietary
habits in
USAP.
Courtesy
of Jordan
Oshiro*

Understanding and addressing the key factors of the food environment that influence nutrition and health are essential for developing sustainable, equitable, and resilient food systems in the USAP. Efforts to promote local food production, enhance food distribution networks, support cultural food traditions, improve nutrition education, and strengthen policy interventions can help address the complex challenges facing the region's food environment. This chapter will ground the context

of the USAP food environment for children’s health within the CHL Analytic Framework (Figure 3.8) (Wilkins et al, 2026). Specifically, the USAP food environment will be explored through the framework’s key components: food availability, food affordability, food accessibility, food assistance, food advertising, and food quality.

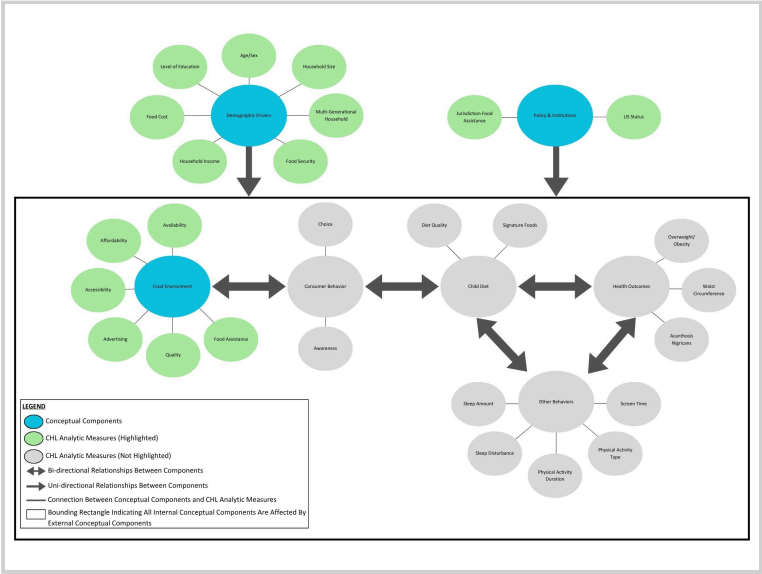


Figure 3.8 Food Environment highlighted in the CHL Analytic Framework (Click image to enlarge)
Image by Wilkins et al., 2026 licensed under / [CC BY-NC-ND 4.0](#)

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Food Availability

Food availability refers to the physical availability of nutritious food within a given location in desired quantities. Availability is influenced by both domestic and non-domestic food production and the suitability of storage, transportation and market infrastructure. Availability in any given community extends beyond individual choices as it is also shaped by unique agricultural, physical, political, economic, and sociocultural influences. The built environment plays a significant influence on the types of markets available (e.g. small vs. super) and abundance of restaurants, fast food establishments and other markets of convenience (Zenk et al., 2009). Efforts towards achieving local food production and availability across the USAP Region can be seen through different agricultural techniques such as agroforestry, greenhouse farming, hydroponics and aquaponics, mechanical farming methods, and small-scale and subsistence farming (Figure 3.9). These collective efforts highlight the diverse strategies being employed to enhance local food availability throughout the USAP Region.



Figure 3.9
Agricultural and fish
production systems
in the
USAP
Region.
Clockwise
from top
right, food
in the
figure are:
Kole reef
surgeonfish
(*Ctenocha
etus
strigosus*),
aerial
view of
lo'i kalo
patches in
Hanalei,
Kaua'i,
ground
view of
lo'i kalo
patches in
Halawa,
Moloka'i,
sprouted
coconut
or
"coconut
apple."
Courtesy
of Jordan
Oshiro

In 2021, a Food Cost Survey adapted from the United States Department of Agriculture Community Food Security Assessment Toolkit (CFSAT) was conducted in 92 stores across five jurisdictions in the USAP (Alaska, American Samoa, Commonwealth of the Northern Mariana Islands (CNMI), Guam, and Hawai'i). The CFSAT examines the costs of 87 unique food items from 8 food categories. Unique to the version of this survey conducted by CHL was the inclusion of questions about whether food items were locally produced. "Locally produced" was defined as items grown, harvested, and/or produced in the jurisdiction. When comparing the food item categories across the jurisdictions, the grain group had the most locally produced food items (n=21) (Butel et al., 2025).

The association between fruit and vegetable availability and the food store environment was examined among children residing in five communities on Guam which were participating in the CHL community randomized trial looking at child food environments (Matanane et al., 2017). Community food stores were surveyed using the *Communities of Excellence in Nutrition, Physical Activity, and Obesity Prevention (CX3)* Food Availability and Marketing Survey and Store Environment Walkability Survey. A total of 111 food stores were surveyed, with the majority being small markets (73%) typical of the USAP Region, and more stores were located in one community (n=53) in comparison to the others. Supermarkets and large grocery stores were most similar in availability and accessibility scores for fruits and vegetables, in combination or separately, although supermarkets had the highest total store

scores, while convenience stores scored lowest. Of all stores surveyed, over 75% had fresh fruit and vegetables for sale, but only 23 (21%) and 41 (37%) stores met the modified cutoff score for fruit and vegetable variety and good quality, respectively. The mean number of food stores within 1 mile of a participant's residence was 6 stores with the mean fruit and vegetable availability scores being 7.9 and 11, respectively, out of 20 possible points.

Although most food stores surveyed across the Guam food environment offered a selection of fruits and vegetables, very few stores met the standard for adequate availability of produce variety and quality. This suggests that children in this food environment may not have adequate access to nutritious produce; therefore, the food environment is a barrier for children to consume fruits and vegetables in recommended amounts to support child diet and health. In addition, the proximity of stores to participants' residences may not play a significant role in food availability in Guam, because of the low scores of adequate availability of fruits and vegetables. These findings highlight how fruit and vegetable availability remains a persistent challenge for USAP communities, influenced by the food environment.

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Food Affordability

While the availability of food in the USAP Region is largely shaped by reliance on imports and limited local production, the affordability of these food options presents an additional challenge. Food affordability refers to the ability to purchase enough safe and nutritious food, given household income and expenses (Chaudhary et al., 2018; Gregory & Coleman-Jensen, 2013). In contrast, food prices refer to the cost of purchasing food for all population groups, regardless of their income status. While lower prices may not result in lower diet quality, food cost significantly influences consumer choices, and fluctuations in price can impact both what consumers buy and how much they purchase (Carlson & Frazão, 2014). The role of non-purchased food in determining diet quality in the USAP (grown, hunted, harvested, gifted, etc.) is an area of ongoing investigation.

Based on a 2013 global study, healthy diets that contained more whole foods such as whole grains, fresh fruits, and vegetables, were, on average, approximately \$10.50 per week more expensive than less healthy diets (Rao et al., 2013). Since then, inflation and the long-lasting effects of the COVID-19 pandemic in 2020 have contributed to an increase in overall food cost, especially for fruits, vegetables, animal proteins, and processed foods (Lewis et al., 2023; FAO, 2020).

In the USAP Region, limited documentation is available on food cost, making it challenging to develop bud-

get meal planning recommendations that balance nutritional needs with cost constraints (Greenberg et al., 2020). To characterize food cost across the region, the CHL Program conducted a food cost survey in March 2014 adapted from the [Thrifty Food Plan \(TFP\)](#) by USDA (Cohen, 2002). The TFP is a low-cost option to satisfy nutritional requirements for a healthy diet at minimal cost. From this survey of the USAP jurisdictions, 74 stores were identified and categorized as supermarkets, large grocery stores, small markets, and convenience stores. These surveys showed the food cost for a family of four (two adults and two children) across the entire USAP Region is very high in comparison to the food cost for a family of four in Portland, Oregon (Greenberg et al., 2020; see Table 3.1).

Table 3.1 Food and Average Household Income Values for U.S. Jurisdictions and Portland, Oregon–March 2014* (adapted from [source], et al., 2020)

Jurisdiction	Towns Surveyed (N)	Median Food Price (\$)**	Avg. weekly (wk) cost of food (\$/wk)***	Avg. weekly costs, as percent of Portland (%)	Avg. weekly income (\$)
Alaska	4	2.50 (2.91)	181.9 (13.2)	127	1344
American Samoa	3	2.22 (2.75)	198.42 (15.2)	139	496
CNMI	6	2.24 (2.63)	213.58 (10.8)	150	414
FSM	2	2.80 (3.54)	264.37 (26.4)	185	–
Guam	6	2.66 (3.17)	236.73 (11.8)	166	100
Hawai‘i	4	2.66 (3.43)	217.27 (13.2)	152	1183
Palau	1	2.68 (3.74)	260.13 (26.4)	182	–
Marshall Islands	1	2.86 (2.48)	245.32 (26.4)	172	–
Portland	1	1.70 (2.46)	142.37 (26.4)	100	1013

*Income data unavailable for some jurisdictions.
 ** Median (interquartile range) using Kruskai-Walis

($P < .01$).

*** Means (standard deviation) using ANOVA ($P < .05$).

Mean does not include Portland

CNMI: Commonwealth of the Northern Mariana Islands

Sources: Alaska, Hawai'i, and Portland median household income, 2009-2013 American Community Survey 5-Year estimates, US Census Bureau, US Department of Commerce. American Samoa, CNMI, and Guam median household income, 2010 Census, US Census Bureau, US Department of Commerce [inflation adjusted by the Consumer Price Index For All Urban Consumers (CPI-U) to 2013 dollars)].

Further analysis calculated the mean food costs based on the food groups determined by the What We Eat In America (WWEIA) categories (Greenberg et al., 2020):

- Beverages
- Condiments and sauces
- Dairy
- Fats and oils
- Fruit
- Grains
- Mixed dishes
- Protein
- Snacks and sweets
- Sugars
- Vegetables
- Other

The WWEIA foods within the food categories may not accurately reflect the foods and diets commonly found

across the USAP Region, since they are drawn from the continental U.S. Nonetheless, the leading contributors to weekly food cost in the USAP Region by this metric were protein foods (28.4%), grains (12.0%), fruits (11%), and vegetables (11%). These food group contributions to overall cost highlight how food cost can significantly impact household expenses. The weekly food cost for a family of four represented high percentages of the median weekly family income in the CNMI (51.6%) and American Samoa (40.0%) compared to Guam (23.6%), Hawai'i (18.4%), and Alaska (13.5%). These findings emphasize the economic strain of food affordability that families experience in the USAP Region.

This economic burden has direct implications for child health. Affordability of food is crucial to child health outcomes as it influences the quality, quantity, and consistency of the child's diet. All of these components of affordability of food are key factors to supporting healthy growth and behaviors for children. Given limited food cost data in the USAP Region, tracking costs and documenting local diets are vital research areas. This data will help determine food affordability across the USAP and inform policy to improve local food environments.

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Food Accessibility

While food may be available and/or affordable, it may not necessarily be accessible. Accessibility has been defined as a concept that is relative to individuals, and falls within the personal food environment domain (Gebremariam et al., 2017). Accessibility is highly dynamic and can include distance, time, space and place, daily mobility, and modes of transport that collectively shape individual activity spaces (Turner et al., 2018). While there is no consistent measure of food access, attempts to measure and assess accessibility to nutritious and affordable food have utilized a combination of geospatial tools, measures of transportation, and physical proximity to food (Bloom, 2022; Dutko & Ver Ploeg, 2013). In the context of child health, food accessibility has also been conceptualized as foods that are “retrievable, ready to eat, and in a location that facilitates their consumption” (Nepper et al., 2014). As the USAP is a remote region, many of the USAP communities are considered rural. For example, many communities in rural parts of Alaska do not have road systems or are only accessible by small planes or in Hawai’i where it may take more than 30 minutes to drive to a large grocery store. The transportation and road systems within the USAP present a challenge for residents of these communities to access food stores, largely due to their location. In addition, limited public transportation access and the infrastructure of the road systems across USAP communities can affect people’s ability to

shop at food stores. Accessible accommodations for individuals with disabilities, such as in-store wheelchair accessibility, are other factors that can enhance the ability of individuals to shop effectively (U.S. Department of Justice, 2020). While definitions of accessibility to foods have focused on proximity to foods, broader ideas of food access consider social and economic access to food (Turner et al., 2018). The ability of individuals and households to access food that is affordable and socially/culturally acceptable can also play an impact on diet and health.

Although little research in the USAP region has explored the relationship between food accessibility and child diet and health, the CHL Program collected data on the food environment across the CHL communities. As of 2025, the analysis of accessibility of food in the USAP region using CHL data is limited to Guam. Based on the secondary analysis completed on food accessibility in Guam, accessibility to stores with higher fruit and vegetable availability scores within school food environments was associated with lower odds of obesity among children (Perez et al., 2023). Children in Guam who were located closer to a convenience store had a higher BMI (Matanane et al., 2017). Similar research suggests increased availability of supermarkets was statistically significantly associated with lower adolescent Body Mass Index (BMI) and overweight and that greater availability of convenience stores was statistically significantly associated with higher BMI and overweight (Powell et al., 2007). Studies conducted outside of the USAP region on food access and BMI displayed similar results as Guam (Morland et

al., 2002; Powell et al., 2007). These findings suggest that accessibility of nutrient-dense foods differs by store types. Larger grocery stores and supermarkets typically offer a wider selection of fruits, vegetables, whole grains, and low-fat dairy products, while smaller grocery stores like markets and convenience stores are more likely to carry processed and high-calorie foods (Farley et al., 2009). To explore this aspect of food accessibility in more detail, further research is needed across the USAP region to strengthen these results and learn if this pattern is consistent across the various communities in the USAP.

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Food Assistance

Food assistance programs play an important role in mitigating household food security, though their reach and effectiveness can vary across regions. These programs can alleviate household food insecurity among families with young children, including decreasing children's risk of experiencing food insecurity from a young age (Drennen et al., 2019). Food insecurity among children can result in growth and development complications in the early stages of life (Behrman et al., 2019; Drennen et al., 2019; Holben & Marshall, 2017). In the USAP Region, the availability of U.S. federal food assistance programs is dependent on the state or territories' political affiliation with the U.S. Furthermore, U.S. federal food assistance programs are subject to change due to federal government policies and availability of funding (see Table 3.2).

Table 3.2 Nutrition Assistance Program Eligibility in Jurisdictions Participating in CHL

Program	Alaska	American Samoa	CNMI	Guam	Hawai'i
SNAP	✓			✓	✓
NAP		✓	✓		
WIC	✓	✓	✓	✓	✓
NSLP	✓	✓	✓	✓	✓
SBP	✓	✓	✓	✓	✓
TEFAP	✓	✓	✓	✓	✓
CSFP	✓			✓	✓
CACFP	✓	✓	✓	✓	✓

✓: Program Available

CACFP: Child and Adult Food Program

CNMI: Commonwealth of the Northern Mariana Islands

CSFP: Commodity Supplemental Food Program

NAP: Nutrition Assistance Program

NSLP: National School Lunch Program

SBP: School Breakfast Program

SNAP: Special Supplemental Nutrition Assistance Program

TEFAP: Temporary Emergency Food Assistance Program

WIC: Special Supplemental Nutrition Program for Women, Infants, and Children

The key [federal food assistance programs](#) in the USAP Region that target various ages and address the varying nutrition recommendations across the lifespan are the

Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), National School Lunch Program (NSLP) & School Breakfast Program (SBP), Supplemental Nutrition Assistance Program (SNAP), Nutrition Assistance Program (NAP), the Child and Adult Care Food Program (CACFP), the Emergency Food Assistance Program (TEFAP), Commodity Supplemental Food Program (CSFP), and the Freely Associated States Nutrition Assistance Program (U.S. Department of Agriculture, 2025a).

Starting with the prenatal period and infancy, the [Special Supplemental Nutrition Program for Women, Infants, and Children \(WIC\)](#) operates in Alaska, American Samoa, CNMI, Guam and Hawai'i (U.S. Department of Agriculture, 2024a; see Table 3.3). It is not available in the Freely Associated States. WIC serves pregnant women, breastfeeding women, non-breastfeeding postpartum women, infants, and toddlers and children up to age 5 years old (U.S. Department of Agriculture, 2024a). Administered by the USDA, WIC aims to improve health outcomes and reduce food insecurity for economically and nutritionally at-risk populations. WIC clients are able to receive food benefits that are designed to supplement participants' diets with specific nutrients such as infant cereals, baby foods, fresh fruits and vegetables, and dairy products. In addition, WIC participants participate in health and nutrition education such as breastfeeding counseling, nutrition education, and health screening referrals.

For children enrolled in public schools, the [National School Lunch Program \(NSLP\)](#) and the [School Breakfast Program \(SBP\)](#) are federally assisted meal programs that

operate in Alaska, American Samoa, CNMI, Guam, and Hawai'i (U.S. Department of Agriculture, 2025c, 2025h). The programs provide low-cost or free nutritious lunches and breakfasts to eligible students in public and nonprofit private schools. Eligibility and cost varies by state. Administered by the USDA, the program aims to support student health and academic performance by ensuring access to balanced meals.

Expanding food assistance programs to aid other age groups, the [Supplemental Nutrition Assistance Program \(SNAP\)](#), formerly known as food stamps, is available in Alaska, Guam and Hawai'i (U.S. Department of Agriculture, 2025e; see Table 3.3). SNAP is a federal program that provides low-income individuals and families with monthly benefits to purchase eligible food items using an Electronic Benefit Transfer (EBT) card, and aims to reduce food insecurity and improve nutrition by helping recipients afford groceries at authorized retailers.

The [Nutrition Assistance Program \(NAP\)](#) block grant is a federally funded federal food assistance program that operates in American Samoa and the CNMI as an alternative to SNAP, providing benefits to low-income individuals and families through a block grant system (U.S. Department of Agriculture, 2025g; see Table 3.3). Unlike SNAP, NAP has a fixed budget, which limits the number of participants and benefit amounts available each year. However, this structure allows for local variability in program implementation.

Across the lifespan, the [Child and Adult Care Food Program \(CACFP\)](#) provides reimbursement for nutritious meals and snacks served to children in child care settings and adults in certain care facilities (U.S.

Department of Agriculture, 2024b). It is available in Alaska, American Samoa, CNMI, Guam and Hawai‘i.

Table 3.3 Participation in SNAP, NAP, and WIC Programs Across the Jurisdictions that participated in CHL as of December 2024 (U.S. Census Bureau, 2020; U.S. Department of Agriculture, 2025b)

Jurisdictions	Total Population*	SNAP Participants**	NAP Participants***	WIC Participants****
Alaska	733,391	64,351		14,319
American Samoa	49,710		4,874	3,989
CNMI	47,329		14,084	2,658
Guam	153,836	33,011		6,307
Hawai‘i	1,455,271	157,257		25,096

*Total population based on the 2020 Census

**As of Jan. 2025

***As of Dec 2024

****As of Apr 2025

CNMI: Commonwealth of the Northern Mariana Islands

Other federal food assistance programs to support populations are the [Emergency Food Assistance Program \(TEFAP\)](#) and the [Commodity Supplemental Food Program \(CSFP\)](#). The Emergency Food Assistance Program (TEFAP) provides food to low-income individuals through food banks and local organizations and is available in Alaska, American Samoa, CNMI, Guam and Hawai‘i (U.S. Department of Agriculture, 2025f). The Commodity Supplemental Food Program (CSFP) aims to enhance the nutritional status of low-income seniors, aged 60 years and older, by providing them with food

packages containing nutritious, shelf-stable foods (U.S. Department of Agriculture, 2025d). It is available in Alaska, Guam and Hawai'i.

The Federated States of Micronesia (FSM), the Republic of the Marshall Islands (RMI), and the Republic of Palau do not receive SNAP or NAP benefits. These nations have different forms of US-funded nutrition assistance programs negotiated through the [Compact of Free Association \(COFA\)](#).

The funding for U.S. federal nutrition programs varies by jurisdiction and is limited. High food costs and supply chain challenges along with the variations in food availability and dietary preferences may impact the effectiveness of these programs. Further details of each jurisdiction represented in CHL food assistance programs will be discussed in the later chapters.

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Food Advertising

Beyond the challenges of availability and accessibility of healthy foods, food advertisements can play significant roles in shaping food preferences, purchases, and dietary patterns. Food advertisements are used to influence individuals' food choices and are often displayed outdoors, at checkout counters, during TV programs, and on online platforms (Gebauer & Laska, 2011; Coleman et al., 2022). Often, food advertisements include price promotions or multi-buy deals to encourage purchasing multiple items to receive a discount. Prolonged exposure to unhealthy food and beverage advertising may significantly influence children's food preferences, choices, and consumption behaviors (Zhao et al., 2025). Advertisements may come from the stores themselves, or companies may provide incentives for the stores to advertise their products, aiming to boost sales and revenue for the business. Marketing advertisements and the placement of these advertised products plays an important role within the food environment and consumer behavior (Ghirardelli et al., 2011).

Although limited research has been conducted on food advertisements throughout Pacific communities, nutrition information and interior marketing was evaluated within the USAP environment data of food stores (n=288) during the CHL study (2013 – 2014). The jurisdictions participating in CHL were categorized as lower-middle, upper-middle, and high income commu-

nities. Within food stores, nutrition related advertisements were assessed by the display of any health promotional items around fruits and vegetables, with a maximum score of 4 for nutritional information. As for the store marketing interior, the occurrence of any ads or promotions and unhealthy or healthy food products by the register counter was assessed, with a maximum score of 8. No stores across the USAP communities participating in CHL met the standard of quality for nutrition information or interior marketing, highlighting a concern in the region's food environment (Yamanaka et al., 2023; see Table 3.4). Despite small increases in average scores in high income communities compared to lower-middle and upper-middle income communities during the CHL study time period, nutrition information was minimal, suggesting that consumers are exposed to food environments where promotional food advertisements outweigh advertisements that convey nutrition information. This may have significant health implications, as limited access to visible and comprehensible nutrition information can impact informed-decision making for food purchase. As advertisements play a role in consumer behavior and health outcomes, more research is needed on advertisements within the types of stores and the broader food environment in the USAP such as signboards and advertisements near schools.

Table 3.4 Store and Fast-Food Outlet Criteria Score by World Bank Income Level Jurisdictions, the CHL Program, 2013- 2014 (adapted from Yamanaka et al., 2023)

	Lower Middle¹ (N = 80)	Upper Middle² (n = 68)	High³ (n = 140)	p-value
Nutrition information score (0-4)	0.5 ± 1.06	0.6 ± 1.21	1.0 ± 1.50	0.01
Interior marketing score (0-8)	2.5 ± 1.34	2.5 ± 1.05	3.0 ± 0.95	0.001

¹Chuuk, Kosrae, Pohnpei, and Yap

²American Samoa, Republic of the Marshall Islands, and Republic of Palau

³Guam, CNMI (Commonwealth of the Northern Mariana Islands), Hawai‘i, and Alaska

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Food Quality

The overall quality of food is determined by several related factors, such as its nutrient composition, sensory properties, microbiological and chemical safety, and economic value. Food quality typically refers to external sensory properties such as appearance (size, shape, color, gloss, and consistency), texture, flavor, and nutrient composition of a food (Tanner, 2016). Food composition generally encompasses the nutrient contents of foods, particularly the macronutrients and micronutrients, and whether or not the food item may meet health needs and dietary requirements. For example, nutrient-dense foods are considered high quality by containing significant amounts of one or more essential nutrients relative to the amount of calories they provide. In contrast, “empty-calorie” foods such as sugary soft drinks provide many calories and very little, if any, other nutrients. Since many perishable foods, like fresh produce and dairy, are nutrient-dense, fresh foods are often of high food quality, which is often associated with high diet quality. The attributes of food quality are critical aspects of food environments which can shape consumer dietary behaviors, nutritional status, and health outcomes across populations. Perceptions of food quality are influenced by culture, traditions, and location, especially across populations in the USAP. In the USAP, the quality of foods available in the local communities is crucial to understanding

and explaining the food system and environment in this region, and the nutritional health of its people.

Foods produced within the Pacific food system are composed of many nutrient dense produce and protein type foods; however, Pacific foods are not produced in adequate amounts to meet demands. Challenges to providing quality foods across the USAP region begins with the overwhelming majority of the foods being imported. Imports require transportation of foods, efficient travel time to the destination, ideal weather conditions during transportation, and adequate infrastructure to ensure proper and safe handling of food.

Food imports to the region need to be transported by cargo ship or plane from the continental U.S. or nearby countries, adding additional days to the limited shelf life of certain foods. Transporting imports to its destination needs to take into account the travel time of these imports and potential delays on the cargo ship and plane, in addition to the Jones Act requirements. These challenges lead to increased food loss due to food expiration and higher transportation costs, which are passed on to consumers and are reflected in the elevated cost of food across Pacific communities. In addition, time affects food quality as the food needs to be shipped and transported to the communities. Imported foods such as fruits and vegetables are often picked while unripe to survive long shipping times. As produce is being delivered to its final destination, it is essential for these foods to be carefully handled and maintained at the appropriate temperature and humidity to ensure that it arrives at the best quality possible.

Furthermore, weather factors influence transportation time which contribute to the challenges the USAP food environment faces. Across the Pacific, environmental conditions such as snow, tropical storms, and natural disasters can delay shipments and cause uniquely challenging temperature conditions that are not ideal for transporting food, especially produce. For example, when produce gets delayed on the shipping tarmac during colder months en route from Anchorage, Alaska to a smaller Alaskan community, the frost damage done to the produce can make it unmarketable. Collectively, these key transportation factors can substantially affect the quality of imported foods, with important implications for the health of communities across the USAP region.

Although the majority of the USAP regions' food supply relies on imported goods, locally produced foods are available to these communities. Locally grown foods in the USAP region can be shipped to other USAP islands, however, domestic transportation presents challenges getting the foods from island to island. Locally produced foods staying within the region might mitigate some of the challenges transporting imported foods presents, and ensure the produce can reach the consumer within the desired shelf life to maintain food quality.

Food Safety

Food safety is closely aligned with food quality. Food safety refers to the practices and measures that ensure food is free from harmful contaminants such as bacteria, viruses, chemicals, and physical hazards which are essential for food quality and consumer protection (World Health Organization, 2024). With an increasing reliance on imported foods and changing diets across the Pacific, the safety and quality of food is a priority when being transported, distributed, prepared, and sold to consumers. During transportation, storing and maintaining the imported foods at safe handling temperatures is crucial to avoid entering the danger zone where pathogens and bacteria can develop. Appropriate packaging to ensure the food is protected from any contaminants throughout the travel duration is important to maintain food safety. This food safety is especially important for vulnerable populations such as elderly, pregnant individuals, and infants and children. To maintain food safety standards in schools, the [National School Lunch Act of 1946](#), which established the NSLP in the U.S., requires schools to have a food safety program to prevent potential foodborne illness outbreaks (Richard B. Russell National School Lunch Act, 1946). Maintaining food safety is essential in the food system, as it directly impacts public health and consumers' food choice, while contributing to the overall food quality of the food environment.

Limited Data Availability in the Pacific

There is limited data available on food quality in the USAP. The geographic isolation, heavy reliance on imports, and susceptibility to weather and other types of environmental events in the USAP present a unique logistical situation when developing and implementing a system that monitors and collects food quality data across and within different jurisdictions in the USAP. These systems must also be responsive to the dietary patterns and behaviors across and within the USAP. Surveillance and monitoring of food quality is lacking (Amato-Ali et al., 2025; Solis, 2024).

The FDA's food labeling regulations mandate the accuracy of information on ingredients, nutrients, and serving sizes of imported and locally manufactured food sold in the USAP. Regulation enforcement occurs at the local level through the jurisdictions' Department of Health. However, labeling is poor (Fusi et al., 2024). For locally produced foods, grading standards are set at the local level (e.g., local Department of Agriculture), unless these foods are being procured through federally operated programs like the NSLP/NSBP. More resources are needed to collect data on food quality in the USAP region to better address the components of the USAP food environment.

The CHL study collected data on the quality of fruits and vegetables available within the jurisdictions and communities; however, the data has yet to be further analyzed. The CHL data showed a high proportion of convenience stores in communities with lower-middle

incomes and upper-middle incomes. However, these stores did not carry many produce options, and when produce was available, the quality of these foods varied according to stores (Yamanaka et al., 2023).

The [Pacific Monitoring Alliance for NCD Action \(MANA\) dashboard](#) is a novel system that monitors policy and legislation adoption related to prevention and management of non-communicable diseases for the 22 Pacific Island countries and territories that include some of the USAP jurisdictions (Pacific Data Hub, n.d.; Tolley et al., 2016). As of 2026, the MANA dashboard highlighted the ratings of salt and trans fat consumption, food marketing to children, food policy, and food-based dietary guideline indicators across the region. This system may be a potential model for expanding the monitoring of the food environment in the USAP.

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Conclusion

The USAP food environment, depicted in the CHL Analytic Framework, shows that challenges in availability, affordability, accessibility, assistance, advertising, and quality create a systemic barrier to healthy dietary choices for children and communities in the region. This environment is uniquely strained by the region's remote geography, heavy reliance on imports, policy context (eg. Jones Act), and vulnerability to climate change and supply chain disruptions. Specifically, the extremely high cost of food, which, in some cases, can be upwards of 51.6% of the median weekly family income in jurisdictions, represents a severe economic strain that directly undermines efforts to improve child health and nutrition.

To encourage sustainable, equitable, and resilient food systems, more work is needed to identify and address critical gaps in research and policy. Future research around strategies for enhancing food and nutrition security and nutrition education is needed. Sustainable strategies must focus on investing in local food production to reduce reliance on imports which are often more costly and come with increased logistical challenges. This must be paired with culturally relevant nutrition education to strengthen food traditions (Dela Cruz et al., 2022; Englberger et al., 2010; Kaufer et al., 2010). Policy recommendations must address the structural factors, such as the fixed-budget limitations of the NAP program compared to SNAP. The implemen-

tation of evidence-based interventions around food marketing and food cost in these policy recommendations ensures healthy choices are affordable and accessible for all USAP communities.

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CHAPTER 4. CONSUMER BEHAVIOR OF PACIFIC FOOD SYSTEMS

Introduction

In the context of food systems, consumer behavior refers to the choices and decisions people make regarding what foods to acquire, store, prepare, cook and eat, as well as dietary behaviors related to what people eat and the allocation of food within the consumer's environment (HLPE, 2017). For the context of this chapter, the terms consumer behavior and dietary behavior will be used interchangeably.

Consumer behavior is influenced by personal preferences which are determined by a variety of interpersonal and personal factors including, but not limited to, taste, convenience, values, traditions, culture and beliefs (Glanz et al., 1998; Sobal & Bisogni, 2009). Consumer behavior is largely shaped by the surrounding food environment, which includes, as discussed in the Food Environment chapter, personal and collective determinants of consumer food choices such as food availability, food affordability, food accessibility, food assistance, food advertising, food quality, education, time and resources, and social and cultural norms. Dietary and consumer behaviors vary across the communities, households, and individuals within the United States Affiliated Pacific (USAP) Region.

Consumers face significant obstacles to healthy eating, creating a cycle where unhealthy habits further limit their ability to make healthy nutritional choices. Life experiences and influences are affected by food, as consumers' food choices define their identity as well

as their nutritional status and health (Sobal & Bisogni, 2009). Within the USAP Region, the food environment and consumer behavior are influenced by decisions made at the household or extended family level, shaped by shared resources, multigenerational caregiving, and cultural food practices. In addition, these decisions are influenced not only by personal preferences but also by geographic location, reliance on imported foods, and local food availability.

These household and environmental dynamics are particularly impactful during childhood, a critical developmental window where dietary habits and food preferences are shaped heavily by parent and caregiver dietary behavior and the food environments, such as schools, that children encounter daily. Child dietary behaviors are influenced by factors such as self-efficacy, food preferences, parental modeling and parental rules (Gebremariam et al., 2017). Understanding the modifiable factors influencing a child's diet are important not only for parents and families, but also for health professionals interacting with children and families/parents, to help shape diet-related behavior and optimize growth and development (Rohit et al., 2021). The promotion of healthy dietary behaviors among children during this period of life is crucial for the prevention of overweight/obesity and non-communicable diseases later in adulthood (World Health Organization, 2004; Swinburn et al., 2011; Gebremariam et al., 2017). Dietary behaviors of consumers that have been consistently associated with higher levels of obesity include excessive energy intake, a high intake of fats (particularly saturated fats), high intake of some types of carbo-

hydrates (starch, sucrose and high fructose corn syrup) and either an insufficient or excessive intake of protein (Wali et al., 2021; Dumuid et al., 2025). Consequently, mitigating these obesity-related dietary risks depends on influencing the consumer behaviors established in childhood, where individual food choices and systemic environmental factors intersect to dictate long-term health.

To further examine the consumer behavior of the USAP Region, this chapter will ground the context of the USAP consumer behavior for children’s health within the [Children’s Healthy Living \(CHL\) Analytic Framework](#) (Figure 4.1). Specifically, consumer behavior in the USAP will be explored through the framework’s key components: choice and awareness.

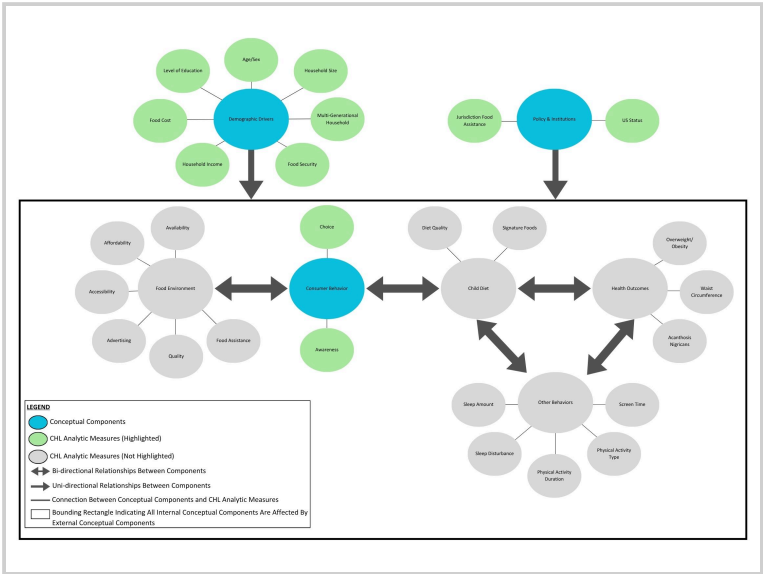


Figure 4.1 Consumer Behavior highlighted in the CHL Analytic Framework (Click image to enlarge)

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Consumer Awareness

Consumer awareness within food systems refers to the ability to interpret nutrition information to guide informed purchasing and consumption choices. Consumer knowledge and awareness play important roles in food and nutrition decision-making. Strategies to improve consumer awareness of nutrition and cooking methods can be informed by a basic understanding of consumer behavior. Children's awareness of food and nutrition is primarily influenced by learned behavior from caregivers through role modeling, which was a key strategy of the CHL intervention. Communities participating in CHL identified intervention strategies to address study target dietary behaviors (Braun et al., 2014).

The CHL intervention aimed to address 6 target behaviors: fruit and vegetable consumption, water consumption, sugar-sweetened beverage consumption, physical activity, sleep duration, and screen time. Interventions were aimed at promoting healthy behaviors through policy change, environmental change, messaging, and capacity building. Improving consumer awareness was primarily addressed through messaging and promotion of the 6 target behaviors through social marketing campaigns, advertising, and role modeling (Novotny et al., 2018).

Role modeling of healthy behaviors was identified through CHL as critical in improving the 6 target behaviors (Fialkowski et al., 2014). In Hawai'i, a school

wellness policy was implemented to improve Head Start environments for childhood obesity prevention. There was a significant increase in Head Start Environment and Policy Assessments and Observations (EPAO) of the classroom environment and physical activity in which teachers improved their knowledge, skills, and behaviors (Esquivel et al., 2015). This illustrates the important role of teachers' knowledge about health behaviors in influencing or leading wellness policies to improve children's health behaviors. The role of caregivers in child nutrition has also been studied in other settings and aspects of role modeling, including the home environment, parent dietary intake, and parental dietary practices (Østbye et al., 2013; Faught et al., 2016; Linde et al., 2022).

Nutrition Awareness and Education for Children's Health

Nutrition awareness and education serve as vital components of consumer awareness, significantly impacting the specific food decisions and purchases made by consumers and their children. In this section we will present guidelines and recommendations that have been developed throughout the USAP region and established across various platforms, including the Dietary Guidelines for Americans, federal nutrition programs, and technology-based resources. In addition, guidelines and recommendations specific to

Pacific populations are available from The *Pacific Community* (SPC) which established the Pacific guidelines for healthy living (The Public Health Division of the Pacific Community, 2018).

Dietary Guidelines for Americans

The Dietary Guidelines for Americans (DGAs) were first established and released by the U.S. Congress in 1977 as “Dietary Goals for the United States.” The purpose of the DGAs is to provide food-based recommendations to promote health, help prevent diet-related chronic diseases, and meet nutritional needs, while setting guidelines for federal nutrition programs. Nutrition experts agree and support recommendations that have been included in the most recent DGAs which are limiting highly processed foods, added sugar, sodium, and saturated fat and consuming water in place of sugar-sweetened beverages. The DGAs are updated and released in a five-year cycle by the U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (DHHS). The decision-making processes and final DGA recommendations affect overall nutrition awareness among caregivers and nutrition education, especially as part of programs discussed later in this section.

Federal Nutrition Education programs

Another avenue of nutrition awareness and education for children and adults throughout the U.S. are USDA funded nutrition education programs such as the National Institute of Food and Agriculture's Expanded Food and Nutrition Education Program (EFNEP) and Food and Nutrition Services' Supplemental Nutrition Assistance Program – Education (SNAP-Ed). Since 1969, EFNEP has been delivered throughout the U.S. to include U.S. territories, Commonwealth of the Northern Mariana Islands, the Republic of the Marshall Islands, and the Federated States of Micronesia. EFNEP has evolved from teaching one-on-one in the home, to directing small group education and community engagement strategies to teach, reinforce, and support changes that people are making in their lives. For ongoing success, EFNEP implements evidence-based national guidelines, tracks and applies trend data of the nation's changing food and learning environment, and listens to and actively engages with partners. EFNEP builds local capacity by training community educators through a paraprofessional model. Additionally, program coordinators utilize multi-state research findings and collaborate with federal partners to develop and share best practices.

Although no longer supported by USDA as of 2025 due to shifts in policies and funding, SNAP-Ed was an evidence-based program in U.S. states and Guam that helped people make their Supplemental Nutrition Assistance Program (SNAP) dollars stretch, taught them

how to shop for and cook healthy meals, and promoted physically active lifestyles. SNAP-Ed partnered with state and local organizations to meet people where they were, through initiatives such as nutrition education classes, social marketing campaigns, and efforts to improve community policies, systems, and environments (PSE). Unique to SNAP-Ed was the emphasis of using PSE changes for nutrition awareness and education such as social marketing campaigns that rallied community partners to implement place-based environmental changes in some jurisdictions. Indeed, the CHL intervention was identified as an effective approach in the SNAP-Ed toolkit. For more information on SNAP-Ed PSE initiatives, see the USDA webpage:

<https://snaped.fns.usda.gov/library/materials/policy-systems-and-environmental-change-initiative-data-toolkit>

Marketing and Technology Use in Nutrition Education

In addition to federal nutrition programs, marketing and advertising campaigns to consumers have been employed for nutrition education and awareness. Many marketing and advertising strategies for nutrition messaging are transmitted through technology platforms such as the internet, social media, and mobile devices. These platforms have become an integral part of consumer's daily lives and are able to provide opportunities

for consumers to learn about health and nutrition (Rini et al., 2024). Technological advancements enable consumers to search for recipes or cooking instructions, compare food products, and evaluate restaurants—all of which inform their ultimate decisions regarding the selection, purchase, and consumption of specific foods or dishes (Rini et al., 2024).

Technology-Based Nutrition Education in Alaska

The need for technology-based nutrition education was surveyed among participants of the Special Supplemental Nutrition Assistance Program for Women, Infants, and Children (WIC) program living in remote Alaska Native communities on the Yukon-Kuskokwim River Delta in southwestern Alaska. Out of 368 respondents, 85.8% of respondents thought it would be somewhat or very useful to obtain nutrition information on a phone or computer (Power et al., 2017). The most popular ways reported to receive nutrition information were through e-mail (67.8%), online videos (60.4%), social platforms such as Facebook (58.0%), and text message (54.4%) (Power et al., 2017).

As technology advances and broadband reach expands, there are increasing opportunities to deliver more comprehensive nutrition education and awareness materials to communities across the USAP Region.

Initiatives to Promote Traditional and Local Foods

As technology offers new ways to promote nutrition awareness and education, the shift from traditional and local foods towards ultra-processed, imported foods needs to be addressed in educational messaging to effectively improve children's nutrition and dietary habits later in life. Traditional food diets across the USAP Region have many health benefits, including maintaining a healthy weight and preventing the spread of certain non-communicable diseases (Dela Cruz et al., 2022). Traditional Pacific diets, in general, have been shown to be low in fat and animal products, and high in complex carbohydrates, fiber, and vegetables compared with diets of industrialized nations (Shintani & Hughes, 1994; Fialkowski et al., 2016; Dela Cruz et al., 2022). A study in preschool-aged children also found that a higher intake of traditional foods resulted in higher intakes of vitamins A and D, iron, magnesium, and zinc (Johnson-Down & Egeland, 2010; Dela Cruz et al., 2022).

Across the Pacific, there have been many initiatives to introduce traditional starches to children in elementary schools. The “Kids Eating Local” project in Hawai‘i provided free online educational materials to comprehensively enrich the local food tasting experiences of students through nutrition education and school gardening (Children’s Healthy Living Center, 2024). In Alaska, feeding infants traditional foods as their first food has been encouraged to form early connections

among the family, community, and the land (Palmer et al., 2025). More detailed information regarding the nutrition transition across each jurisdiction will be discussed in the CHL jurisdiction case study chapters. These initiatives demonstrate the growing recognition of the importance of traditional diets in promoting better nutrition and health outcomes for children across the USAP Region.

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Consumer Choice

A clear understanding of individual food choice is critical for transforming any type of food system. It has been proposed that consumer food choice is a learned behavior, while food preferences are influenced by culture, lived experiences, and the food environment (Fernqvist et al., 2024). What individuals eat—and don't eat—is influenced by their identities and surroundings. Consumers' food choices often reflect their multiple layers of self identities, situated within social and physical environments. To thoroughly understand food and its meaning, it is important to understand culture, community, societal values, assumptions, norms, and biases governing food. Food choices are generally influenced by food-internal factors (sensory and perceptual features), food-external factors (information, social environment, physical environment), personal-state factors (biological features and physiological needs, psychological components, habits and experiences), cognitive factors (knowledge and skills, attitude, liking and preference, anticipated consequences, and personal identity), as well as sociocultural factors (culture, economic variables, political elements) (see Figure 4.2; Chen & Antonelli, 2020). Understanding how people identify and what they value, what shapes them to be what they are, and their position within society (e.g., their privilege or marginalized experiences) will yield a meaningful understanding of consumer behavior. What consumers eat is influenced by what foods are grown or

natural system influences can be categorized into culture, demographics, social experiences, or situational factors and all of these factors contribute to consumers' food choices. While some information may appear redundant across these perspectives, each provides a necessary boundary to help readers understand the specific drivers behind consumer food choices.

Cultural Influences

Consumers' food choices are significantly influenced by culture, which determines what they prioritize as important or acceptable when making purchases. Cultural influences influence consumer preferences, purchasing decisions, and how food will be used. Culture can be defined as shared ideas and actions practiced by a group of people throughout generations, which relates to nutritional behavior through its influence on food choices. A person may make purchasing choices based on values, beliefs, norms, and preferences reflecting long-standing traditions and shared meanings, all of which are shaped by culture. For instance, staple foods are usually based on foods that are indigenous to a region. Using those foods, cultures develop recipes and patterns of eating that produce a pleasant flavor and aroma (i.e., beliefs, based on sense of smell and taste), which result in some benefit (i.e., opinions, based on relationships between food and health or food cookery), and that are rooted in prejudices or biased

social stereotypes (i.e., some foods or food practices are condemned while others are valued). While consumers may be unaware of what a given nutrition label means, the value of a food product may be related to its commodification (for some people) or cultural pride (for others). Clarifying these differences and understanding how such values are embedded in food culture helps us understand the meaning of foods in various contexts and settings.

In the CHL Intervention, anthropometric data from 2–8 year olds residing in the USAP Region and questionnaires from the children’s parent/caregiver, were examined with adult/caregiver acculturation/enculturation as this has been found to impact childhood health and obesity status (Tseng et al., 2015). Parents/caregivers who identified as culturally traditional had children who were more likely to be protected against overweight/obesity (OWOB) status. Being classified under traditional enculturation indicated that these caregivers maintained a strong connection to their traditional identity. (Sparks et al., 2024). Although further research is needed to explore the connection between culture and food choices, promoting culture may be warranted to understand the effect it has on the health of children and long-term health risks.

Demographic Influences

Demographics are an important set of factors when

attempting to respond to consumers and understand their behaviors. These factors shape consumer behavior by influencing people's needs, preferences, and purchasing decisions. Moreover, demographics can be further categorized into groups such as physical characteristics like mobility, and socio-economic factors like income, education, and marital status. By understanding these demographic factors, businesses can better tailor their marketing strategies, target specific audiences, and create products that meet the distinct needs of different consumer groups.

Physical Characteristics

Physical characteristics such as age and sex can influence consumer behaviors as they can shape preferences, needs, and lifestyles. Evidence of this in regards to age can be seen in the purchasing patterns of younger consumers, where they are more likely to buy trendy, innovative, and technology-savvy food products. Older consumers are more likely to prioritize quality, safety, and practicality. Outside of food consumption, age influences purchase choices; younger people may spend more on fashion, entertainment, and digital services, whereas older people may focus on healthcare products, home goods, and financial security.

Sex is another key factor that plays a role in consumption as biological differences among consumers

influence product choices. For example, females may be targeted by manufacturers through the use of graphics, designs, product placement. Males may be targeted through certain activities like outdoor activities and sports. In the context of food marketing, a study conducted among girls and boys, aged 12 to 16 years old showed that boys were more likely to view instances of food marketing featuring a male as the dominant user, appeals to achievement, an influencer and appeals to athleticism, whereas girls were more likely to view instances of food marketing featuring quizzes, surveys or polls (Amson et al., 2022). With the fluidity of societal roles these advertising patterns are in a constant state of evolution. What is clear, however, is the ability of age and sex to shape consumer behavior through preferences, priorities, valuation and responses to goods.

Socio-economic factors

A major factor in consumer behavior is income, as it dictates the accessibility and affordability of goods and services. A consumer's income helps determine their purchasing power, influencing whether consumers choose luxury or budget-friendly options. This is seen through product advertisements aimed to reach a specific audience. Behaviors are affected consciously and subconsciously, yielding insight into the attitudes associated with people's socioeconomic statuses (SES) when viewing specifically targeted product advertise-

ments. For example, consumers who are more cognizant of their spending behaviors may choose to value the price of products over product brands and their messages. Thus, their conscious and subconscious inclination to be prudent influences their consumer behavior. In addition to income, education and occupation can shape awareness, brand perception, and decision-making processes. Ultimately, socio-economic factors like income, education, and occupation collectively define a consumer's purchasing power and guide their decision-making processes toward products that align with their specific economic bracket.

Household Characteristics

The people surrounding a consumer, such as family members or friends, have major impacts on attitude and behavior. Specifically, the interaction between partners/spouses, the number and ages of children (if any), and other generations comprising the consumer's family have significant effects on buying behavior. An example of this in the USAP Region are the multi-generational households of the communities. The U.S. Census Bureau found that 8% of households with a multiracial householder were multigenerational during the years between 2009 and 2011. Among Native Hawaiian and other Pacific Islander households, about 18% consisted of three or more generations compared to 3.7% of non-Hispanic White households and 9% of

Black and Asian households were multigenerational. Residing in a multigenerational household influences consumer behavior through the perpetuation and practice of consuming cultural foods by more than one person in the household (Kai et al., 2022).

Social Influences

Social influences such as community norms and events and social circles all play a vital role in shaping consumer choice around food. The typical outcome of social influence is that beliefs and behaviors become more similar to those of others around us. At times, this change occurs spontaneously without any obvious intent of one person to change the other. Influence also sometimes occurs because we believe that other people have valid knowledge about an opinion or issue, and we use that information to help us make good decisions.

Across the Pacific region, food at small and large gatherings, both informal and formal, is an important part of life. For example, religious events for the villages in the Commonwealth of the Northern Mariana Islands (CNMI) are referred to as fiestas; celebrations with cultural foods served such as at a baby's first birthday are called lū'au in Hawai'i; and potlatches in Alaska are special Native Alaskan events where the community comes together over food to celebrate an event of great importance such as dedicating a house, raising a totem pole or honoring the deceased. At these gatherings,

specific cultural foods are served and sometimes, the distribution of the food is followed in accordance with specific cultural rules of hierarchy and etiquette (Pollock, 1992).

In the USAP region, local traditions strongly influence community diets. However, these communities are not isolated; the arrival of newcomers also introduces diverse consumer preferences. Across the USAP region, the U.S. military and tourism have a large share of the influence on what food is available in communities. Certain national restaurant chains, in particular fast food chains, are established to fill the demand from the influx of people from all over the U.S., and globally. The isolation and group-like behavior of those in the military, living on bases, and tourists who come in large groups provides an example of how social dynamics plays a big role in what people eat, and how what people want to eat influences what is available.

Especially among children, social influence from their peers can contribute to their food choice. School lunches can influence social norms and the perceptions of “normal” eating behaviors when children are at an impressionable stage of life. Social norms on portion sizes and meal composition (e.g., main + sides + drink) may be applied to eating outside of school thus affecting caregiver consumerism. Children are likely to consume foods that are accepted by their peers, showing us that peer pressure is also an influential factor in social norms around food consumption (Ragelienė & Grønhøj, 2020).

Situational factors and influences

Situational factors are external influences that can shape a consumer's behavior and choices. These factors can include an individual's eating location, food purchasing location, and the presence of others and activities while eating (McNaughton et al., 2020). The location of where children are consuming meals can have an impact on their overall diet quality.

Diet quality can be measured through the [Healthy Eating Index](#) (HEI). The HEI assesses how well a set of foods aligns with key recommendations and dietary patterns set by the Dietary Guidelines for Americans (DGAs). The HEI uses a scoring system (range from 0 to 100) to evaluate a set of foods. An ideal overall HEI score of 100 reflects that the set of foods aligns with key dietary recommendations and dietary patterns from the DGAs. In the CHL Intervention, dietary records for children 2 to 8 years of age were collected along with the location of where the food was prepared and consumed. In American Samoa, the HEI scores of children consuming foods at school or at home varied. Children living in American Samoa who had food prepared and consumed at school had higher HEI scores compared to children who had food prepared and consumed at home (Table 4.1). This suggests that children who have their meals prepared at school had higher (and healthier) diet qualities when compared to children who had meals prepared at home and other locations away from home (McFall, 2025). These findings concur with a San Diego, California based study that also showed that

children who eat school meals had higher diet quality compared to those who obtained their meals from home (Au et al., 2016). In contrast, studies among Alaska Native youth have also suggested the home food environment is conducive to the intake of traditional foods, thus increasing diet quality (Bersamin & Niles, 2011). These findings highlight that the influence of situational factors on consumer behavior and diet quality is highly context-dependent, varying significantly across different jurisdictions.

Table 4.1: HEI 2020 Total Score by Location where Food is Prepared and Consumed for Children 2-8 years in American Samoa (McFall, 2025)

Location where food is prepared and consumed	N = 581	HEI Score
Food prepared at home		
Yes	565	50.42 +/- 1.04
No	16	51.46 +/- 4.70
Food prepared at school		
Yes	150	57.74 +/- 1.47
No	431	47.9 +/- 1.05
Food consumed at home		
Yes	500	50.05 +/- 1.04
No	81	52.94 +/- 1.81
Food consumed at school		
Yes	143	58 +/- 1.22
No	438	47.9 +/- 1.17

School lunches are a significant influence on consumer behavior given how they shape children’s eating habits, food preferences, and food and nutrition perceptions early on, leading to consumption choices later in life (Bevans et al., 2011). The school lunch program in the

U.S. focuses on nutritionally balanced meals and healthy dietary patterns which regularly exposes children to fresh and processed fruits, vegetables, meats and grains, and in some cases culturally diverse meals as well as product brands. Moreover, school lunches shape future consumers by influencing early taste formation, eating habits, food brand familiarity and loyalty, social norms around eating, and attitudes toward food and their value, all the while feeding children while they are attending school. This becomes important given the child may develop a liking or disliking to flavors or textures and influence their caregivers on what to buy, and also how the child will buy once they become consumers making their own purchasing decisions. Early exposure and training on nutrition and healthy eating may influence consumer behavior later in life.

As previously mentioned in the [Food Environment chapter](#), food advertisements in TV programs and online platforms can play significant roles in influencing consumer choice. In the CHL Intervention, screen time among children 2 to 8 years of age across the USAP averaged 4.1 hours per day during the week and 4.5 hours per day during the weekend (Li et al., 2015). Compared to children of a healthy weight, overweight/obese children had more screen time, and spent more time playing video games and watching TV.

Consumer Decisions in Food Purchasing

The consumer decision making process to purchase a product, in this case food, is composed of multiple stages. Once the process is started, a potential buyer can withdraw at any stage of making the actual purchase. The tendency for a person to go through all stages is likely only in certain buying situations—a first time purchase of a food product, for instance, or when buying high-priced, long-lasting, infrequently purchased food products. This is referred to as complex decision making, or when consumer purchases are made when a (new) need is identified and a consumer engages in a more rigorous evaluation, research, and alternative assessment processes before satisfying the felt need. For many food products, the purchasing behavior is a routine in which the need is satisfied by repurchasing the same brand. That is, past reinforcement in learning experiences leads directly to buying, and thus the second and third stages are bypassed. This is called simple decision making, or refers to when consumer purchases are made when a need is identified and a habitual (“routine”) purchase is made to satisfy that need. However, if something changes appreciably (price, product, availability, services), the buyer may re-enter the full decision process which involves a more thorough search and evaluation of alternative brands before a selection is made. Whether complex or simple, the first step is need identification (Assael, 1987; see Figure 4.3).

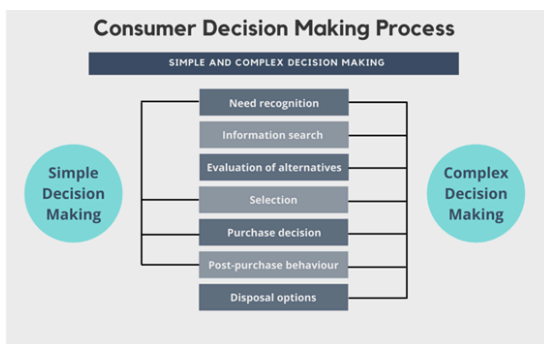


Figure 4.3
The
Consumer
Decision
Making
Process
Image by
[Niosi, A. \(2021\) / CC BY-NC-SA](#)

Marketers must understand potential impacts on buyer behavior, such as how raising or lowering a price will affect the buyer's perception of the product and therefore create a fluctuation in sales. Another example is how a specific review on social media can create an entirely new direction for the marketing mix based on the comments (buyer behavior/input) of the target market.

Consumption Patterns of Breadfruit in Hawai'i

To further demonstrate the factors that influence consumer behavior on a micro level, one study examined the consumption patterns, preparation methods, sources utilized, and awareness of health benefits of breadfruit (*Artocarpus altilis*) in Hawai'i (Needham & Lincoln, 2019). A 10-question survey was administered to 438 people in Hawai'i across various venues from July to December 2018.

On average, 13.7 servings of breadfruit per year were eaten by an individual; however, the distribution of consumption followed an exponential curve with 57% of participants only eating breadfruit three times per year or less. When examining breadfruit sources, a range of were utilized, with a majority (71%) sourcing their breadfruit from a backyard tree, while only 5% ever obtained fruit from a retail store. Tree ownership was the only category that significantly related to an increase in consumption (ANOVA r^2 0.18, $p < 0.0001$) with tree owners eating nearly 400% more breadfruit than non-tree owners (from a mean of 7.9 to 30.6 servings per year). Awareness of health benefits correlated to increased consumption, as did knowledge of how to prepare breadfruit. However, the amount consumers ate in a single sitting was not influenced by demographics, preparation, sourcing of breadfruit, or awareness of health benefits (Needham & Lincoln, 2019).

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Conclusion

Consumer behavior can be seen as a driver within food systems, as it has the power to influence what is produced, how food is processed, distributed, valued and consumed. As we have seen throughout this chapter and through the CHL Analytical Framework, consumer behavior is a complex interplay of psychological, societal, cultural, economic, and environmental factors. Consumers actively construct the food landscape through their individual preferences and habits and the social norms and marketing forces of the era. A key insight is that consumers are active participants within the food system. Their purchasing decisions send powerful signals up the supply chain, influencing agricultural practices, product innovation, and retail strategies. The growing demand for organic, plant-based, and locally sourced foods illustrates how shifts in consumer values such as health consciousness, environmental concern, and ethical considerations can reshape entire industries. At the same time, barriers such as price, accessibility, and information gaps highlight persistent inequalities in who can participate in these shifts.

In conclusion, understanding consumer behavior is essential for addressing some of the most pressing challenges facing global food systems, including public health, environmental sustainability, and food security. Meaningful progress requires multi-sectoral collaboration—engaging land-grant universities, community

partners, policymakers, and private stakeholders—to shift from reliance on imported, ultra-processed goods toward bolstering local food production, enhancing traditional food access, and implementing evidence-based nutrition policies. The CHL Analytical Framework strengthens the need for systemic changes that prioritize culturally relevant education, environmental improvements, and infrastructure to ensure sustainable, equitable, and healthy dietary choices for children and communities across the USAP Region.

CHAPTER 5. ALASKA

About the Author



Jennifer Galbreath

Jennifer is a student in the Nutritional Sciences PhD program at the University of Hawai'i at Mānoa, in the Human Nutrition track. Jennifer is a grant writer by trade, having supported com-

munity development, healthcare, environmental, early education, housing, and Indigenous priorities across Alaska since 2011. She decided to pursue a graduate degree to gain new skills and knowledge in her passion areas of food and health so that she may continue working towards improving the quality of life for all Alaskans on the land they call home.

Land Acknowledgement

I express my deepest gratitude to the First Peoples of Alaska. Thank you for holding this beautiful and abundant space – the lands, waters, airs, and all their inhabitants. I greatly benefit from thousands of years of Indigenous stewardship of culture and natural resources, which lives on today. The work I do as a person and a professional takes place on unceded territories of Alaska Native peoples, and colonialism remains in practice today across these spaces and to Alaska Native peoples. This acknowledgment is only that – an acknowledgment. As a visitor here, who calls Alaska home, it is my responsibility to move beyond and make reparations. I am committed to listening, learning, contributing, and spreading awareness about the priorities of and protections for the many ways of life around the state, especially around the foods that nourish us and keep us well. Tsin'aen to my family, the headwaters people of Mendaesde, for their wisdom, acceptance, energy, humbleness, steadfastness, perseverance, persistence, hard work, gentleness, and love.

Cultural, Demographics, and Geographic of Location

Cultural

Alaska Native peoples are the Indigenous peoples that have been in Alaska for over 10,000 years. In contrast, the term Native Alaskan often refers to anyone who was born in Alaska, regardless of heritage. Most of the Alaska Native cultural groups have oral stories that begin in pre-ice age settings. Of the 567 Tribes recognized by the federal Bureau of Indian Affairs (BIA), Alaska is home to 229, or nearly half (Dewitt, 2018; Native Governance Center, 2021; Tribal-Related Guidance for USGS Authors, 2024). As Alaska Native Tribes are sovereign governments, some sources capitalize the words Tribe and Tribal at all times to recognize the sovereign status, as is implied in writing Federal and State in reference to the United States (US) government (DeWitt, 2018). The state's population of Alaska Native peoples is composed of this multitude of Tribes as well as diverse cultures and languages, living in an area of 586,000 square miles, which is about one fifth the size of the entire US (Alaska Kids' Corner, n.d.-c).

The eleven distinct Alaska Native cultures share many

core values while being geographically distinct: Inupiaq and St. Lawrence Island Yupik (Arctic/North Slope area), Athabascan (Interior and Southcentral areas), Yup'ik and Cup'ik (Southwest area), Unangax and Alutiiq (Sugpiaq) (Southwest and Southcentral areas, including the Aleutians), and Eyak, Haida, Tsimshian, and Tlingit (Southeast area) (Alaska Federation of Natives, n.d.). These eleven cultures carry with them their own sub-cultures, cultural activities, and traditional ways of life (ANCSA Regional Association, n.d.).

Over 20 distinct languages and dialects are spoken across the eleven cultures (Figure 5.1) (Holton, n.d.). Even prior to the State of Alaska's recognition of the 229 federally recognized Tribes in Alaska, in 2014 under former Governor Sean Parnell, 20 Alaska Native languages were recognized as official languages of the state (The Alaska State Legislature, 2014), making Alaska only the second U.S. state to recognize Indigenous languages, after Hawai'i. In 2018, under former Governor Bill Walker, a linguistic emergency of the 20 Alaska Native languages was declared. Their revitalization, restoration, and preservation were ordered through educational initiatives, the establishment of an Alaska Native Language and Preservation and Advisory Council, and Alaska Native place name and signage efforts (Alaska Office of Governor, 2018). In September 2024, under Governor Mike Dunleavy, but without his signature, three more Alaska Native languages were recognized and signed into law—two of which are new additions and one of which was a reclassification of one already official language into two languages (Larson, 2024).

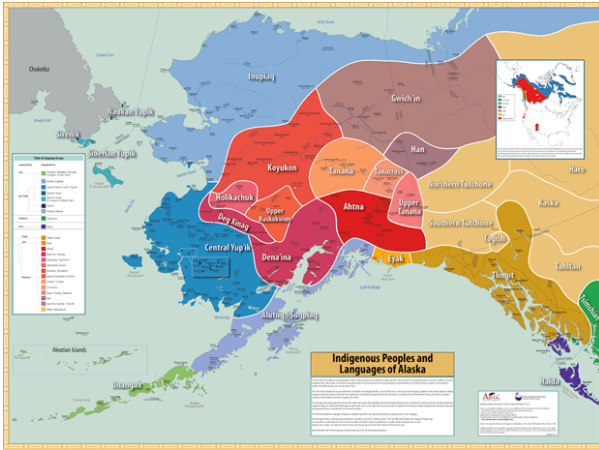


Figure 5.1
Alaska
Native
Language
Regions
Source:
Krauss,
Michael,
Gary
Holton,
Jim Kerr,
and Colin
T. West.
2011.

Indigenou
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Language
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Alaska.
Fairbanks
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Anchorage:
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Institute
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Research.
[Online
map / CC
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Alaska Native peoples have adapted to the ecological regions in which they have lived since time immemorial. Language is the harmonic representation of the relationship between Alaska Native peoples and the ecosystem. Traditional knowledge, history, and science are woven into language. Today, many Alaska Native people live both inside and outside of their ancestral cultural regions and Tribe-affiliated communities. Significant rural to urban migration has also occurred and may be associated with colonialism, traditional lifeways, climate change, healthcare, employment and opportunities, and reunification of family (Berman & Wang-Cendejas, 2024). Alaska Native cultures continue to evolve during the modern era; as such, the following overviews introduce mainly historical context from the ecological regions as well as general information that is still significant today and thus may be described in past and/or present tense. It is important to understand the ways that Alaska Native peoples and their cultures have been forced to assimilate or integrate into the dominant, non-Native culture. Alaska Native peoples have adopted new lifestyle practices while simultaneously maintaining, preserving, and adapting traditional lifestyle practices.

Northern – Inupiaq, St. Lawrence Island Yupik, and Gwich'in

The Inupiaq people range from northwestern, north,

and northeastern Alaska through the northwestern, north, and northeastern areas of Canada, all the way to Greenland. Their specialization in arctic ecosystems – coastal, mountainous, tundra, pack ice (frozen year-round), and seasonal ice – allows this group to thrive in these conditions. The northern groups are known for their reliance on the highly nutritious abundance from the ocean and land. Social and seasonal organization is formed around interdependence on whale and caribou migrations. For example, those engaging in whale harvests may establish a year-round settlement while nomadic or semi-nomadic patterns occur for those more reliant on caribou. Seasonal migration patterns of the people depend on which traditional and customary food harvesting activities are occurring. The northern-most group of the Dené nations, the Gwich'in, also live in the northern ecoregion in the Arctic National Wildlife Refuge. Gwich'in lifeways are completely interdependent on the largest caribou herd in the world, the Porcupine herd (Dewitt, 2018).

Interior and Southcentral – several Athabascan (Dené) language and cultural groups

Athabascan populations in Alaska range from the south of the Brooks Mountain Range down to the Kenai Peninsula, into Canada, and the Lower 48 states. Athabascan language groups thrive in the boreal forest

ecosystems that are quite mountainous, with thick spruce, birch, and cottonwood forests; complex river, creek, and lake systems; and sustained area of muskeg. The Athabascan language group is part of the Dené language group which also includes Tlingit, Eyak, Navajo, and Apache. These groups are nomadic and semi-nomadic with seasonal rounds based on resource gathering. For instance, this group will travel between a winter village and summer fishing grounds, with routes in-between based on what is available during the time of the year (e.g., greens, berries, roots, hunting, trapping, etc.) (Dewitt, 2018).

Southwest – Yup'ik and Cup'ik peoples

Yup'ik peoples live near the Bering Sea coast from Norton Sound to the northern Alaska Peninsula at Naknek River and Egegik Bay, as well as along the Yukon Kuskokwim River deltas, northern area of Bristol Bay, and Nelson Island. Cup'ik peoples are in Chevak, the Cup'ig peoples are from the Nunivak, and Siberian Yupik peoples live on St. Lawrence Island. These groups live in what is known as Sub-Arctic Tundra which consists of coastal areas, tundra, muskeg, some forests, vast river deltas, sloughs, and lagoons. Currently the Yup'ik language has the highest number of language speakers. This area is known for its vast tundra and river delta landscapes that were easily traveled across in the winter until the dramatic effects of climate change created

irregular seasons and unstable ice conditions. Bristol Bay, which has the largest and richest wild salmon runs in the world, is in this region (Dewitt, 2018).

Aleutians-Alutiiq and Unungax “Aleut”

The Unungan populate the Aleutian and Pribilof islands that have a temperate coast meadows ecosystem with very few trees. The Alutiiq populate coastal areas from the Alaska Peninsula, Prince William Sound area, lower Kenai Peninsula, and Kodiak Island. Unungan are known for their advanced kayak culture. The boats are made anthropomorphically (customized to a person’s specific body measurements). Even though the Unungan and Alutiiq have similar languages and origins, their culture shifts as the ecoregion shifts from temperate coastal meadows to temperate coastal rainforest. Both groups are highly dependent on foods from the sea such as marine mammals, fish, shellfish, sea vegetables, birds, and bird eggs. The rookeries in this region host birds that are year-round inhabitants as well as others that migrate seasonally to the area. This relationship with the sea and birds is apparent in their physical and spiritual culture (Dewitt, 2018).

Southeast – Eyak, Haida, Tsimshian and Tlingit

Eyak peoples are from the southeastern corner of Southcentral Alaska and along the Gulf of Alaska from the Copper River Delta to Icy Bay. Haida peoples are from Skidegate and Masset in British Columbia, Canada, and the Kaigani dialect of Alaska. Tsimshian peoples are from Alaska and British Columbia, including the Sm'algyax-Coast Tsimshian, Southern Tsimshian, Nisga'a, and Gitksan dialects. Tlingit peoples are from a centrally located area of Southeast Alaska from Icy Bay in the north to the Dixon Entrance in the south and the Yukon Territories in Canada, and includes Northern, Southern, Inland, and Gulf Coast dialects. Southeast Alaska is known for its temperate coastal rainforest ecoregion, which lies in the northern portion of the largest temperate rainforest of the world – the Pacific Coast Rainforest. This ecoregion is renowned for the abundance of plant and animal life. This abundance decreased the time needed for hunting, fishing, and gathering, and supported the advancement of visual representations of culture, social structures, and protocols. From Copper River to British Columbia, four distinct groups can co-exist due to the abundance. These cultures are based on stewardship in the form of guardianship and cultivation of the natural world. The spirituality of this region and the other regions are tied directly to nature, through being in a balanced healthy relationship. Plants, fish, birds, and land and water ani-

mals were considered relatives who have rights to live well, the same as humans (Dewitt, 2018).

Shared Traditional Values of Alaska Native Peoples and Culturally Specific Practices

Many traditional values of Alaska Native people are similar across various Tribes and community cultures (Autenrieth & David, 2014; Dewitt, 2018):

- Respect and honor your elders
- Help other people through compassion, love, and sharing
- Life is gifted to you; what you make of it is your gift in return
- Live with and respect the land, sea, and all of nature
- Engaging in a spiritual life, from ancestral beliefs to the diverse faiths of today
- Learn to preserve and be proud of the Native way of life
- Never give up
- Listen with your heart and mind
- Patience
- Humor
- Live in peace and harmony, positive conflict resolution
- Be strong in mind, body, and spirit

- Unity

The “Alaskan style” of living well encompasses traditional health-based practices which are also similar throughout the state. These practices consist of providing, gathering, growing, sharing, learning, craftsmanship (art), community gatherings, community support systems, rites of passage, and always “getting ready.” Getting ready refers to preparing food, gathering and chopping wood, mending nets, making and mending outdoor gear, cleaning and repairing hunting and trapping gear, home and yard maintenance, land management, and walking the land (Dewitt, 2018).

Demographics

Alaska is a large and sparsely populated state, with 1.2 persons per square mile in 362 communities, as compared to 87.41 persons per square mile per U.S. population density statistics. Over 700,000 people are spread out across an area that is larger than California, Texas, and Montana combined (Crum et al., 2019). Five boroughs – the Municipality of Anchorage, Matanuska-Susitna Borough, Fairbanks North Star Borough, Kenai Peninsula Borough, and the City and Borough of Juneau – make up around 80% of the state’s population, with the remaining 20% living in 318 communities with populations under 2,500 (Alaska Department of Labor and Workforce Development, Research and Analysis Sec-

tion, 2020). About 200 of these communities, including villages that are home to federally recognized Tribes, are located off the state's principal road system in rural and/or remote areas. This means that major roadways do not connect all areas and communities of the state, and some are only accessible by air or boat transportation. Topography, remoteness, and inclement weather all make public service delivery and infrastructure development challenging and costly (Crum et al., 2019).

In addition to having a widely dispersed population, Alaska is incredibly diverse. Anchorage alone is home to almost half the state's population and has the most diverse census tract in the country (University of Alaska Fairbanks et al., 2023). The largest school district in the state is in Anchorage, and over 100 languages are spoken by local students in the public school system, the most common being Spanish, Hmong, Samoan, Filipino, and Yup'ik. Across the rest of the state, populations are similarly diverse, and specifically within many remote and rural locations, populations are often predominantly Alaska Native. Population estimates in 2017 by race, both as single races and two or more races (combination), classified 66.9% of Alaskans as white; 18.5% as American Indian or Alaska Native; 9.7% as Asian or Pacific Islander; and 4.9% as African American. Six and half percent of Alaskans identify as Hispanic, independently of race. Alaska's population is considered "young" with a median age of 35.2 years using 2017 population estimates, which is lower than the U.S. median age by 2.5 years. Alaska's population of people over 64 years is also proportionately smaller than the rest of the U.S, although the older population is growing. Almost

20% of Alaskans of all ages live below 125% of the Federal Poverty Level, and this number increases to over 26% for Alaskans that are under 18 years. More people are without health insurance as compared to the rest of the U.S. (Crum et al., 2019).

In Alaska, cancer and heart disease are the two leading causes of death, with other chronic diseases, such as diabetes, chronic liver and lower respiratory diseases, and Alzheimer's disease also among the top 10 leading causes of death (CDC National Center for Health Statistics, 2025). Many of these diseases are associated with lifestyle risk factors such as poor diet (Gropper, 2023; Hacker, 2024). For Alaska Native people, including children, dietary lifestyle risk factors include decreased intake of traditional foods and a nutrition transition to the Western-type diet of low fiber and high fat intake (Story et al., 1998). Data in recent years also shows that historical trauma from colonization and assimilation and cumulative Adverse Childhood Effects (ACEs) from intergenerational trauma lead to higher levels of chronic disease and increase other health disparities and epigenetic changes in Alaska Native communities and populations. As a secondary response to these factors, there can be an increased occurrence of substance abuse, in the form of alcohol or drug abuse, or tobacco addictions (National Indian Health Board, 2024).

Alaska's rates of death by unintentional injury and suicide are drastically higher than the U.S. rates. Unintentional injury death is more than 10 people higher than the overall U.S. rate per 100,000 people, and the suicide rate is 86% greater per 100,000 people. The

highest suicide rates are for males between 15-24 years. Homicide deaths are also higher in Alaska than compared to the U.S. Systemic disparities in the health system disproportionately impact some Alaskans more than others, with social and economic-derived barriers that negatively impact health outcomes. Specifically American Indian/Alaska Native people (AI/AN) have higher mortality rates than non-Native people in cancer, heart disease, unintentional injury, homicide, and suicide, as well as higher colorectal cancer rates, increasing diabetes rates, and increasing prevalence of overweight and obesity (Crum et al., 2019).

The federal Indian Health Service (IHS) system, which serves federally recognized Tribes, is also uniquely operational in Alaska. Approximately 99% of the Alaska Area IHS budget is allocated to Alaska Native Tribes and Tribal Organizations, making health care facilities, such as hospitals, IHS-funded but managed by Tribes and Tribal Organizations at the local level (Indian Health Service, n.d.). Services are generally available to Alaska Native Tribal members regardless of employer-sponsored or marketplace health care coverage (Crum et al., 2019).

Geographic

Often called by the official state nickname, “The Last Frontier” (a term indicative of how early pioneers and explorers viewed the area in the 1900’s), the name

Alaska is derived from the Unungam Tunuu (the Unangan language) word “Alyeska,” meaning “great land” (Alaska Kids’ Corner, n.d.-a). Alaska is the largest U.S. state and is almost one-fifth the size of the contiguous 48 states. Due to its size, it is typical to refer to which region in Alaska a topic or location is associated with. There are six distinct regions: Arctic or North Slope, Southwest, Interior, Southcentral, Aleutians, and Southeast. For instance, the state capital of Juneau is in the Southeast region.

The 665,384 square mile landscape of Alaska is vast, diverse, and rich in natural resources. It has both the most land area and coastline of all U.S. states (University of Alaska Fairbanks et al., 2023). There are over 3,000 rivers across the state totaling thousands of river miles, and over 3 million lakes (Alaska Kids’ Corner, n.d.-b). The state is surrounded by the Pacific Ocean, Bering Sea, Chukchi Sea, and the Beaufort Sea (National Oceanic and Atmospheric Administration, n.d.), and approximately one quarter of Alaska’s land mass spans across the Arctic Circle (Brooks et al., 1906). The 2023 USDA Plant Hardiness Zone Map organizes Alaska into sixteen zones (Figure 5.2) (U.S. Department of Agriculture, Agricultural Research Service, 2023).

shrubs, mosses, sedges, and lichens in a treeless landscape. Persistent wind scours these areas, and the cold temperatures and saturation effects of the permafrost prevent an optimal growing environment for plant roots. In the northernmost areas, lack of sunlight and warmth combine with a low angle and thick atmosphere to cause cold air temperature. Summer sunlight is long and is present up to 24 hours during the summer solstice. In the winter, daylight hours are minimal and there is a several month period during which the sun stays below the horizon. This ecosystem is often called a cold desert; precipitation of both rain and snow is low. However, wetlands are abundant, with lakes dotting the landscape and permafrost creating a frozen barrier beneath the soil, which allows moisture to accumulate (Alaska Department of Fish and Game, n.d.-d).

The boreal forest, also known as the taiga, is the world's largest intact forest ecosystem and is the dominant ecoregion of the Interior. There are a limited number of tree species that make up the taiga. It is characterized by uplands, comprised of mixed stands of white spruce, paper birch, and quaking aspen, with willow and alder along riverbeds and deltas, and lowlands of expansive thick stands of black spruce with roots can handle the saturated bog conditions formed by the discontinuous permafrost throughout the region. The forests, wetlands, meadows, marshes, lakes, and rivers are home to many well-known fish, birds, and land animals, such as caribou, who feed on lichen underneath the snow in the boreal forest during winter migration. Forest fires from the thousands of lightning strikes that occur in the summer months are an integral part of the

ecosystem, recycling nutrients and providing important food resources and habitat for the animals that live there (Alaska Department of Fish and Game, n.d.-a; Alaska Fire PIOs, 2022).

The Southeast region of Alaska is home to one of the rarest ecosystems in the world, the coastal temperate rainforest. The Tongass National Forest is 16.7 million acres and covers most of the Southeast. The lush old-growth forests of Western hemlock, Sitka spruce, mountain hemlock, Alaska yellow cedar, Western red cedar, and shore pine are abundant with wildlife, many of which are endemic to this area. The region is characterized by islands, long fjords, and mountains. The proximity of mountain ranges to these coastal rainforests creates plentiful precipitation and fog, and waters are warmed due to ocean currents (Alaska Department of Fish and Game, n.d.-b).

The quality and quantity of sea ice as an ecosystem plays a critical role in Alaska's arctic environments, which exists as shorefast or floating ice. It provides a home to animals that live on the ice pack, such as polar bears, walrus, and seals. Shorefast ice undergoes winter formation and melts over the summer. Floating ice, also called pack ice, is present year-round (Alaska Department of Fish and Game, n.d.-c). The extent of sea ice protects the coastline and coastal communities from winter storm surges, flooding, and coastal erosion.

Alaska's temperatures have great seasonal contrast, which is more dramatic in some regions. In communities, such as Fairbanks, which is located in the Interior region, summer heat can reach past 70°F, with extreme readings above 90°F; 100°F was recorded once in 1915 in

the Interior community of Fort Yukon. In the winter, the Interior can see weeks of subzero temperatures down to -50°F, with -80°F recorded in 1971 in the community of Prospect Creek (National Centers for Environmental Information, n.d.).

Climate change in Alaska has been accelerated by the state's northern latitude and rising temperatures have induced changes to the sea ice extent, glacier coverage, early river breakup, and permafrost degradation. Ongoing loss of sea ice is currently threatening people, infrastructure, safe subsistence hunting grounds, and animal habitat, with relocation being forced upon heavily impacted communities (University of Alaska, Fairbanks Institute of Northern Engineering et al., 2019). The impacts of erosion, flooding, and thawing permafrost can amplify each other to form a combined threat known as *usteq*, a Yup'ik word in the Yungtun language. *Usteq* means "surface caves in" and represents a catastrophic form of permafrost thaw collapse that occurs when frozen ground disintegrates under the compounding influences of thawing permafrost, flooding, and erosion (State of Alaska, 2023). Studying and addressing the level of threat from erosion, flooding, thawing permafrost, and *usteq* is challenging as long term spatially and temporally discrete monitoring is not available. For many Alaska communities, the only information available to determine potential damage from these threats is found in historic records, disaster declarations, anecdotal information, or physical evidence (University of Alaska, Fairbanks Institute of Northern Engineering et al., 2019).

Some areas of the state have seen precipitation

increases while in other areas it has decreased, which has resulted in drought, ocean acidification, and wildfires. In 2016 and 2019 the hottest years were recorded. The devastating Swan Lake wildfire on the Kenai Peninsula in 2019 consumed 170,000 acres and led to the state's most expensive fire suppression efforts (*Welcome to the USDA Climate Hubs | USDA Climate Hubs*, n.d.). Logging, mining, insect infestation, drought, and salmon stream quality are health concerns for many ecoregions (Alaska Department of Fish and Game, 2015; Bathke et al., 2019).

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History

Alaska's history is a complex history, beginning with migration across the Bering Land Bridge to the significant colonization and Westernization events that have led to Alaska's contemporary society today (Figure 5.3).

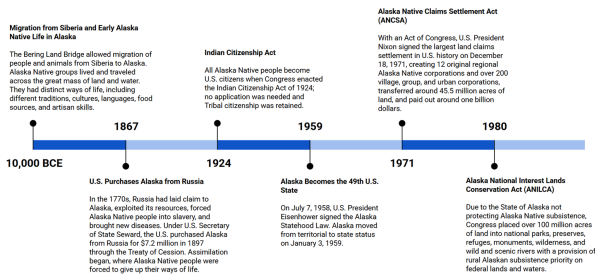


Figure 5.3
High level
timeline
of Alaska's
early
history
and
significan
t events
Image by
Jennifer
Galbreath
/ [CC](#)
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Governance

Long before contact with non-Native people, traditional systems of governing were well established in Tribal communities and varied from place to place in Alaska. Today there are 229 federally recognized Tribes in Alaska. Being considered federally recognized means that Tribes have 'sovereignty,' or the authority to gov-

ern. There are three kinds of sovereign governments in the U.S., which are the federal government, state governments, and Tribal governments. Almost all 229 Tribes in Alaska have Tribal councils as their governing bodies. The sizes of the councils range from five to nine members, with seven being the most common. There are a variety of names for these councils including 'Native council,' 'Tribal council,' 'IRA council,' 'village council,' and 'traditional council.' All of these refer to the governing body of a Tribe (University of Alaska Fairbanks, n.d.). It wasn't until July 28, 2022 that the State of Alaska formally recognized Alaska's 229 federally recognized Tribes through the signing of House Bill 123 by Governor Mike Dunleavy (Alaska Office of Governor, 2022).

US Involvement with Alaska

Russia invaded Alaska beginning in the 1770s, mainly occupying the coastal areas with a primary interest in exploitation of furs. The Unangan people were the first Alaska Natives to be impacted by being forced into slavery to hunt fur-bearing marine animals for the Russians. An estimated 80% of the Unangan population died from introduced diseases against which they had no immunity. Russians moved onward to Kodiak, then to Southeast Alaska impacting the Tlingit and Haida, who continued to wage war on the Russians into the 1850s. The diseases carried by the Russians traveled to

Alaska Native people well beyond the areas occupied by the Russians (University of Alaska Fairbanks, n.d.).

In 1867, U.S. Secretary of State William Seward made the deal to purchase Russia's claim to Alaska for \$7.2 million, proclaimed by the Treaty of Cession. The treaty classified Alaska Native peoples into 'civilized groups' which were to be regular citizens of the U.S. with no special relationship, and the rest were recognized as 'uncivilized groups' which were to be subject to federal Indian law. This confusing classification of Alaska Native peoples in the Treaty of Cession fueled debate over the status of Alaska Native people in the years to come. Without a special political relationship with the federal government, Alaska Native peoples would have no aboriginal claim to land and resources, receive no special federal services under the trust responsibility of the federal government, nor have Tribal status with the government-to-government relationship needed to operate Tribal governments and justice systems (University of Alaska Fairbanks, n.d.). The federal Indian trust responsibility is a legal obligation under which the U.S. "has charged itself with moral obligations of the highest responsibility and trust" towards Indian tribes, and as such is one of the important principles in federal Indian law. It is also a legally enforceable fiduciary obligation on the part of the U.S. to protect tribal treaty rights, lands, assets, and resources, and a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes and villages (U.S. Department of the Interior, Indian Affairs, 2017).

Land Ownership and Rights

After the U.S. purchased Alaska in 1867, the tone towards American Indians was focused on assimilation, primarily through boarding schools and allotting what was termed “Indian lands” to individuals. After the purchase, all the land went into the ‘public domain.’ Transfer of land to private individuals and Tribes and designation of land for specific public purposes required future congressional action. At first there was a relatively small federal presence in the Alaska territory and little attention was paid to potential aboriginal claims, the political status of Alaska Native people, and the special relationship of Alaska Native people to the federal government (University of Alaska Fairbanks, n.d.).

With the steady stream of outsiders coming into Alaska, demand and competition for land continued to increase. Miners could claim land under the 1884 District Act and non-Alaska Native people could claim a home site under the 1891 Townsite Act or a homestead under the 1898 Homestead Act. Churches sought land and acquired it through the Missions Act of 1900, which allowed a religious denomination to acquire up to one square mile of land in Alaska. Disputes over land, particularly between miners, resource developers, and Alaska Native people, arose. A string of court cases concerning Alaska Native land rights began and continued up to the settlement of the Alaska Native Claims Settlement Act (ANCSA) in 1971. There were contradictory decisions in these court cases, but two early cases, in particular,

held that non-Alaska Native people could not acquire land from Alaska Native people without the consent of the federal government (United States v. Berrigan, 1905; United States v. Cadzow, 1914) (University of Alaska Fairbanks, n.d.).

Congress passed the Indian Reorganization Act (IRA) in 1934, also known as the 'Wheeler-Howard Act' or the 'Indian New Deal.' The IRA began a new era of federal government and Tribal relations. The most important thing the IRA accomplished is said to be the promotion of the exercise of Tribal self-governing powers. Whether Tribes organized under the IRA or not, they were influenced by it to formalize their governmental authorities in new ways including adopting Tribal constitutions. Today, around a third of the 229 Tribes in Alaska are 'organized under the IRA.' The Tribes that are organized under the IRA and the rest of the Alaska-based Tribes are equally recognized by the federal government. As sovereign nations they have the same powers (University of Alaska Fairbanks, n.d.).

The 1950s were then deemed the 'termination era' in federal Indian policy because Congress adopted policies aimed at terminating federal obligations to Tribes. The three main tools the federal government used to accomplish this were the Bureau of Indian Affairs (BIA) relocation program, actual termination of some Tribes, and by extending state jurisdiction into Indian country through Public Law 280 (University of Alaska Fairbanks, n.d.). Indian country is defined in 18 U.S.C. § 115 and is in general reference to federal reservations (including fee land), dependent Indian communities, and Indian allotments to which title has not been extinguished. Addi-

tionally, any land held in trust by the U.S. for a Tribe and individual Indian is considered Indian country (U.S. Department of Justice, 2015).

While Congress applied federal Indian legislation to Alaska Native Tribes such as the IRA and Public Law 280, it had not yet settled the aboriginal claims to land and resources. In the 1950s and 1960s there were several events that led to the settlement of the claims. Early Alaska court cases indicated that Alaska Native people had an aboriginal claim to land and resources that only the U.S. government could settle. Some land was given to individual Alaska Native people through the Alaska Native Allotment and Alaska Native Townsite Acts; however, these early land acts were not the settlement of aboriginal land claims. In 1906, Congress adopted the first land grant to Alaska Native people through Alaska Native Allotment Act. Congress passed the second land grant to Alaska Native people through the 1926 Alaska Native Townsite Act, which was a special type of Townsite designed to give Alaska Native people small land lots under their homes in villages in a restricted status. Both acts have since been terminated (University of Alaska Fairbanks, n.d.).

Alaska became a state in 1959. Statehood brought very significant changes to governance and landownership patterns in Alaska. The Alaska Statehood Act authorized the State to select over 100 million acres of land from the “vacant, unappropriated, unreserved” public land in Alaska, but it also included provisions recognizing property and right to title of land and resources “which may be held by any Indians, Eskimos, or Aleuts.” The State began its land selections, often

selecting some of the most prime land around villages and on hunting and fishing areas. Statehood also had significant impacts on the role village councils had on local governance. Statehood also raised concerns over Alaska Native land claims that had not yet been settled because the State began selecting land throughout Alaska. Although State land selections and large proposed projects such as the Rampart Dam and Project Chariot increased pressure to settle Alaska Native claims, it was the discovery of oil on the North Slope that finally stimulated the settlement (University of Alaska Fairbanks, n.d.).

Alaska Native people were very alarmed by these events as their aboriginal land claims were not yet settled. They protested and organized to fight for their land claims, filing administrative protests to state land transfers, petitions to establish reservations, and lawsuits. In 1966, the Alaska Federation of Natives (AFN) was formed to achieve the passage of a fair settlement. That same year, Secretary of Interior, Stewart Udall, imposed a freeze on issuing patents or federal approval of any state land selections on all lands in Alaska until Alaska Native land claims were resolved. The discovery of North America's largest oil field at Prudhoe Bay in 1967 became the ramrod for settling the Alaska Native land claims to build the trans-Alaska pipeline. The land claims needed to be settled and the land freeze lifted before the oil could flow (University of Alaska Fairbanks, n.d.).

Alaska Native Claims Settlement Act

Aboriginal claims to land were extinguished by Congress through the passage of the Alaska Native Land Claims Settlement Act (ANCSA) in 1971. Land claims were subsequently settled through the establishment of Alaska Native Regional Corporations, which were designed as private, for-profit entities collectively owned by Alaska Native shareholders. These corporations were tasked with land management, including title holding, for almost 27 million acres across Alaska (ANCSA Regional Association, n.d.-b; University of Alaska Fairbanks, n.d.).

However, aboriginal hunting and fishing rights failed to be protected and continue to be major areas of ongoing concern for Alaska Native people. Whereas opportunities for Tribal self-governance dramatically increased through the passage of the Indian Self-determination and Education Assistance Act of 1975 (IDSEAA) and through the Indian Child Welfare Act of 1978 (ICWA), the State of Alaska began challenging the existence of Tribes in Alaska after the passage of ANCSA. While ANCSA was the largest land claims settlement in U.S. history, it failed to protect Alaska Native subsistence and left questions about the status of Tribes and their jurisdiction (University of Alaska Fairbanks, n.d.).

From the signage of ANCSA, Alaska Native regional and village corporations had two years to enroll shareholders, a challenging pursuit as Alaska Native people were spread across the state, thousands of miles from each other, and living off the road system in ancestral

areas (ANCSA Regional Association, n.d.-a). Around 80,000 people of at least one-quarter Alaska Native blood, living at the time of the passage of ANCSA, became the shareholders in the ANCSA corporations. People could enroll under ANCSA based upon residency in 1971 or past residency, place of birth, or based on family heritage. Alaska Native people could also choose to enroll in a region only, and not in a village. These shareholders, known as “at-large” shareholders, received additional stock in the regional corporation that village shareholders did not receive, whereas village shareholders received stock in the village corporation (University of Alaska Fairbanks, n.d.).

Alaska Native people born after December 18, 1971, could not receive ANCSA stock except by inheritance or court order in a divorce or child custody dispute. Later amendments to ANCSA allowed the shareholders of the corporations to decide if they want to admit children born after 1971 as new shareholders. Some village and regional corporations have done so, but this continues to be an issue of controversy within many of the Alaska Native corporations (University of Alaska Fairbanks, n.d.), with concerns ranging from the dilution of stock-based dividend payouts to potential future repercussions of excluding younger generations from corporation benefits, leadership opportunities, and cultural connection (Herz, 2021).

Through the Alaska Native Claims Settlement Act, twelve regions (Figure 5.4) were defined across the state, influenced by “common heritage and shared interests” that represented which communities would be served by which corporation, rather than being

marked by land ownership of the new Alaska Native regional corporations. Today, a variety of governance, land ownership, roles, and relationships exists in each region, between the people and [Alaska Native regional corporations, Alaska Native village corporations, Tribes, city and borough governments, and Alaska Native regional non-profit organizations](#). ANCSA also resulted in the federal government transferring 44 million acres to Alaska Native regional and village corporations for corporate ownership by Alaska Native shareholders, as well as \$962.5 million to account for lost land (ANCSA Regional Association, n.d.-a). The regional corporations created under ANCSA were:

- [Ahtna, Incorporated](#)
- [The Aleut Corporation](#)
- [Arctic Slope Regional Corporation](#)
- [Bering Straits Native Corporation](#)
- [Bristol Bay Native Corporation](#)
- [Calista Corporation](#)
- [Chugach Alaska Corporation](#)
- [Cook Inlet Region, Inc.](#)
- [Doyon, Limited](#)
- [Koniag, Incorporated](#)
- [NANA Regional Corporation](#)
- [Sealaska Corporation](#)
- 13th Regional Corporation (a regional corporation based in Seattle and established to ensure inclusion of Alaska Native people who were not permanent residents of Alaska but were otherwise eligible to enroll in an Alaska Native regional corporation (ANCSA Regional Association, n.d.-c))

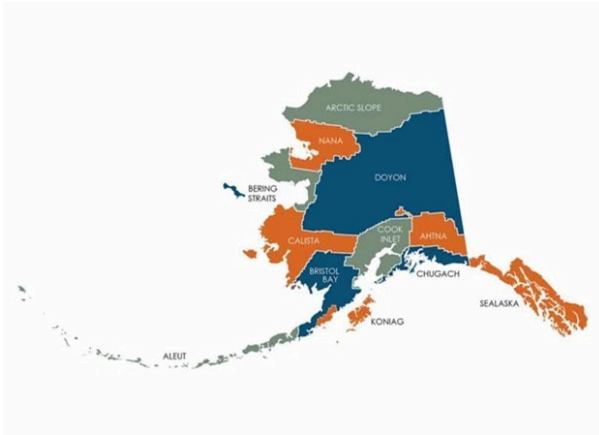


Figure 5.4
Alaska
Native
Claims
Settlement
Act
(ANCSA)
regions
Courtesy
of [ANCSA
Regional
Association](#)

Alaska National Interest Lands Conservation Act

Alaska Native people have been significantly impacted by additional state and federal policy beyond the IRA and ANCSA. Other acts, including ISDEAA, ICWA, and Alaska National Interest Lands Conservation Act of 1980 (ANILCA) have impacted schooling and healthcare organizations, Alaska Native Tribal priority in child welfare situations, and rural Alaska subsistence use priority, respectively.

In 1980, ANILCA was passed by Congress. The Alaska National Interest Lands Conservation Act designated over 100 million acres of federal land across the state as new or expanded conservation system units, including national parks and preserves, national wildlife refuges, designated wilderness areas, wild and scenic rivers, and

the Iditarod National Historic Trail. Currently, around two-thirds of Alaska lands, or approximately 222 million acres, are federally owned or managed (Alaska Department of Natural Resources, n.d.). Alaska is now home to 10 National Parks and Preserves, two National Monuments, nine National Wildlife Refuges, two National Conservation Areas, and 25 Wild and Scenic Rivers. Today, about 60% of all land managed by the federal National Park Service is in Alaska (National Park Service, 2025). At the state level, the Department of Parks and Outdoor Recreation manages millions of acres in over 100 state parks and other recreation areas (Alaska Department of Natural Resources, n.d.).

Since 1992, the federal government has managed subsistence activities on federal lands in Alaska giving rural citizens priority, while the State of Alaska manages subsistence on State and private lands, including ANCSA lands, giving no rural priority. Originally, the federal management only applied to hunting and not to fishing. Alaska Native Elders Katie John, Gene Henry, and Doris Charles brought a suit, claiming that waters should be included too, and the federal courts sided with them in *Katie John, et al. v. U.S.* (University of Alaska Fairbanks, n.d.).



*Figure 5.5
Katie John
holds a
salmon
from a
fishwheel
on the
Copper
River at
the village
of
Chistochi
na with
Bob
Anderson,
her
original
Native
American
Rights
Fund
(NARF)
attorney.
Courtesy
of Bill
Hess*

In August 2024, Deb Haaland, former Secretary of the Interior in the Biden-Harris Administration, enacted a public land order to retain protections for 28 million acres of public lands across Alaska, also known as D-1 lands, which were originally set aside during the ANCSA land claims. A few years earlier in 2021, during the final days of the Trump-Pence Administration, the protec-

tions, also known as withdrawals, had been ended without undergoing standard impact analysis, Tribal consultation, or legal requirement compliance. The end of withdrawal on these public lands would have potentially opened up the lands to resource extraction, such as mining and oil and gas drilling, and would have removed the federal subsistence priority that was previously secured through ANILCA. Under the Biden-Harris Administration, the federal Bureau of Land Management (BLM) held a public comment period and engaged in public process through rural and urban community meetings and with Alaska Native Tribes and corporations. Ultimately, in a final Environment Impact Statement (EIS) a recommendation of “No Action” was put forward. The BLM analyzed the environmental consequences of removing the protections, which included negative lasting impacts of wildlife and vegetation as well as subsistence dependence for rural Alaskans, many of whom are Alaska Native. Around 15,000 public comments on the EIS were received during public process (U.S. Department of the Interior, 2024).

The D-1 lands are important in multiple contexts. Over 100 Alaska Native communities are located on D-1 lands (SalmonState, n.d.-a). Additionally, 183 Alaska Native communities are located within 50 miles of D-1 land. Seventy-five percent of D-1 lands are designated as federal subsistence lands and half of all D-1 lands are located in the range of the Western Arctic Caribou herd. There are also 2,422 miles of waterways in or adjacent to D-1 lands that are used for fish spawning and 3,277 waterway miles that provide fish rearing habit, such as for wild salmon, which are anadromous—fish

that are born in and return to freshwater after living the majority of their lives in saltwater (SalmonState, n.d.-b).

Indigenous Trauma

A description of the cultural, demographic, and geographical interplay in Alaska would be incomplete without an explanation of how these factors have contributed to historical, intergenerational, and persisting trauma for Alaska Native people. The experiences of Indigenous peoples of North America since European contact include historical and ongoing traumas such as genocide, loss of land and foodways, and forced conversion to Western lifeways, affecting individuals, families, communities, cultures, and health (Bombay et al., 2014; Brave Heart & DeBruyn, 1998; Carothers et al., 2021; Grinëv, 2018; Rogers-LaVanne et al., 2023; Williams, 2009). Historical trauma experienced by Native American and Alaska Native peoples is associated with physiological embodiment and has been hypothesized to be associated with epigenetic traits, which are traits based on changes in gene expression that are heritable but also reversible as they do not change the original DNA sequence (Brockie et al., 2013; Conching & Thayer, 2019; Rogers-LaVanne et al., 2023; Walters, Beltran, et al., 2011). Further, Indigenous cultural connections, community, and revitalization are evidenced as a source of resiliency and healing

from trauma (Elm et al., 2016; Lewis et al., 2013; Rogers-LaVanne et al., 2023; Schultz et al., 2016).

Historical trauma is defined as the “cumulative emotional and psychological wounding across generations, including the lifespan, which emanates from massive group trauma” (Brave Heart et al., 2011; Rogers-LaVanne et al., 2023). Notorious examples of historical trauma in Native American and Alaska Native peoples include genocide and cultural genocide, forced relocation, and the boarding school era (Brave Heart, 1998; Brave Heart et al., 2011; Grinëv, 2018; Lewis et al., 2013; Rogers-LaVanne et al., 2023; Williams, 2009). Violence against women, including sterilization without informed consent in the Indian Health Service (1960s–1970s) and high rates of missing and murdered Alaska Native women are also noted in historical trauma discussions (Lawrence, 2000; Mallonee, 2021; Rogers-LaVanne et al., 2023). Local historical traumas in Alaska also included discriminatory policies, such as school policies with harsh punishments barring students from speaking their languages and federal policies barring Alaskan Native people from gathering traditional food sources (Rogers-LaVanne et al., 2023). Public health disparities experienced by Alaska Native people, such as higher prevalence of chronic diseases and lifestyle risk factors including diabetes, obesity, asthma, and smoking (Small-Rodriguez & Akee, 2021), are a source of stigmatization and discrimination. However, many of these disparities have been recognized as stemming from the pervasive impact of historical trauma and ongoing colonial violence (Rogers-LaVanne et al., 2023; Walters, Mohammed, et al., 2011).

Changes in gene expression are researched through a field of study called epigenetics. Traditionally, AN/AI people understand this to be a part of cellular memory, and it is important to note that cellular memory also codes positive experiences. Epigenetic changes are handed down to offspring and can continue in the lineage. These effects may manifest in people even if they do not know about the historical trauma. Learning about the original stressor and taking actions to heal from them is necessary to facilitate deep healing. Dr. Rita Blumenstein (passed, 2021) was a Yup'ik Tribal doctor who taught that a person who goes through their healing journey heals themselves, their ancestors, and their future generations (Dewitt, 2018).

Traumatic sociocultural and public health impacts also increase from the advancement of industrial, extractive resource work, and other development, notably, the increasing rates of Missing and Murdered Indigenous Women (MMIW) and the subsequent strain on judicial systems (National Inquiry into Missing and Murdered Indigenous Women and Girls (Canada), 2019). The introduction of extractive industries, most prominently oil and gas fields, often creates 'man camps,' or temporary housing communities meant to host a mainly transient male workforce (Deer, 2010). These transient extractive industry worker populations can cause significant societal disturbance in surrounding communities, with the most vulnerable groups – Indigenous women and children – often suffering the most (Amnesty International, 2016). There is a well-documented relationship between extractive industries and a rise in violent crime, sexual harassment, and

exploitation, a connection that has led to a human rights crisis that requires immediate attention (Lockie et al., 2010).

To truly understand the comprehensive impact of extractive industries on Indigenous communities, it is crucial to consider the history of colonization, extractive industries, and the historical injustices inflicted upon Alaska Native women and children. These complexities include jurisdictional issues when crimes occur on rural lands, especially between federal, state, and Tribal entities. These complications and overwhelming backlogs often result in unsolved crimes and victims being left without justice, indicating a vital need for administrative, legislative, and financial support to allow local court systems to operate effectively and fairly.

Historical trauma is the total collective emotional and psychological wounding over the lifespan and across generations, stemming from massive group trauma. Either acute or chronic occurrences can cause historical trauma (Brave Heart, 2015). In Alaska, historical trauma can be attributed to a series of occurrences directly associated with colonization. These occurrences can be broken down into four main categories, or the Four Deaths (Dewitt, 2018):

1. Diseases — Influenza, smallpox, tuberculosis, and venereal diseases (presently referred to as sexually transmitted diseases (STDs)).
2. Alcoholism and Substance Abuse — Alcohol was used as a tool to weaken the Alaska Native people. Then, it was used to self-medicate depressing

emotions and memories. Substance abuse is not the problem; it is a symptom of deeper wounds that need to be healed.

3. Enslavement and Boarding Schools – “Kill the Indian to save the man” was the motto for the Carlisle Indian Industrial School in Pennsylvania. Government and Mission run boarding schools were utilized for the purpose of assimilation. These experiences are not ancient history; they are living memories for many Alaska Native people. For instance, the Unangan people experienced economic slavery by the U.S. until the late 1960’s. Repatriation efforts are occurring in the 2020’s to bring the remains of Alaska Native children home from Pennsylvania, such as Sophia Tetoff from St. Paul Island and Anastasia Ashouwak from Kaguyak and Old Harbor (Dobroth, 2022; Horazdovsky, 2021).
4. Disconnection from the land, water, each other, and self – This disconnection leads to a significant increase in violence and suicide, especially in the male population. This fourth death is the one that is currently being experienced to the greatest degree. One manifestation is the outward migration from rural to urban communities because of the forced transition into the cash economy.

Intergenerational trauma is the transference of mental, emotional, physical, spiritual, or relational wounds caused in new generations from the trauma that past generations still carry. These wounds are passed down in cyclical fashion through displayed behaviors, atti-

tudes, and through epigenetics or cellular memory (Dewitt, 2018).

Persisting trauma is the social, economic, institutional, judicial, or other extenuating factors that perpetuate the effects of historical or intergenerational trauma, creating environmental triggers and reinforcement of original traumas. Persisting trauma mechanisms are set in place through and perpetuated by oppressive laws and social norms (Dewitt, 2018).

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Food Evolution and Agricultural History

To differentiate between periods and transitions in Alaska's traditional foodways, approaches to new agricultural development, and the environment and status of today's food system, this section is categorized into three periods – pre-contact, contact, and post-contact (Figure 5.6). The periods progress through time yet influence each other and have overlapping relationships.

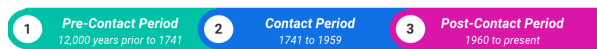


Figure 5.6
Timeline
of Alaska's
Pre-Contact
Period,
Contact
Period,
and
Post-Contact
Period
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Pre-Contact Period: Traditional Foodways, Wild Harvesting, and Subsistence throughout History and Today

For at least 12,000 years, the bountiful wilderness and oceans that make up and surround Alaska have supported human life. Alaska Native people created lasting cultural rituals and expert art to praise this bounty. The necessity of eating was transformed into a cause to bring families and clans together for harvest, hunting, and celebration. Any food harvested was widely shared (Meter & Goldenberg, 2014).

Historically, Alaska Native-based societies integrated health and wellbeing in social structures and practices. Two core concepts supported creating healthy well-adjusted people: balance and connection, to nature and each other. These are fundamentally simple but require culture to be built around them to work. Health and wellness were not considered to be separate domains or activities. The actions and beliefs that led to being healthy on a physical, mental, emotional, spiritual, and relational level were intertwined into the culture and worldview. Traditional activities were based on being active and productive simultaneously within the structure of the day. Still today, many traditional and customary activities are done through working in groups that have designated or natural roles that members fill. With the products of the labor distributed to the family and community members, these actions teach how to

work productively and directly contribute to the community. During traditional and customary activities, social protocols are taught to children and are the basis for creating a respectful relationship with the natural world (Dewitt, 2018).

It is customary for many Alaska Native cultures to move to fishing, hunting, and berry picking camps throughout the year. Children are expected to learn to hunt, fish, and gather at a young age. Most Alaska Native children (boys, in particular) will have direct knowledge of the use of firearms and other weaponry. Alaska Native children are encouraged to become independent at an early age and are allowed to freely explore the world around them unsupervised. The cultural feature of “alloparenting,” where the whole family is responsible for raising the child, makes it common, acceptable, and advantageous for children to live with different relatives or friends (Dewitt, 2018).

Living close to the land promoted regular physical activity as a part of daily activities. Some groups lived seasonally with semi-nomadic patterns of travel to food sources. This led to long-distance walking as a regular activity, traveling between the winter village and fish camps which could be fifty miles apart. Even in the last generation, this long-distance walking would be recounted as an action to go to visit family or to the neighboring village for a social gathering such as a dance or potlatch. All Alaska Native groups regularly engaged in activities like this that promoted strength and movements for successful living. Some of these activities can still be viewed today at the Native Youth Olympics (NYO) or World Eskimo Indian Olympics

(WEIO) practices and competitions. Activities such as preparing food, gathering and chopping wood, mending nets, making and mending outdoor gear, cleaning and repairing hunting and trapping gear, home and yard maintenance, land management, and walking the land are a part of the cultural value of always “getting ready.” These enduring activities promote engagement in healthy activities, create strong cultural bonds, and help to increase an individual or family’s preparedness, security, and resiliency factors. However, there is also deeper meaning. Walking the land provides physical activity, but also involves observing the weather, birds, animals, plants, land formations, and community while surveying any changes in their appearance, quality, quantity, or health status. The observations are analyzed through a lens of traditional ecological knowledge and then the observer can make decisions on which actions or behaviors are needed to adapt to the changes or to help augment the natural surroundings for improvement (Dewitt, 2018).

Nutritionally, living in northern climates creates a higher need for nutrients like vitamin D and fats. Traditional food sources are high in quality fats, protein, plant fibers, vitamins, minerals, complex carbohydrates, enzymes, and antioxidants. Traditional diets are low in simple carbohydrates and high in nutrition. Traditional food sources in Alaska may have greater nutritional value and nutrient density due to environmental factors, such as adaptation to the unique and often harsh growing conditions they develop in, including large variations in temperature and sunlight. Regional and seasonal (place-based eating) patterns allow for the

optimum nutrition profile, as the environment will provide the nutrients necessary to thrive. Additionally, nutrient dense foods are put up for winter – root vegetables and berries are dried or packed in oil and meat and fish are dried or frozen. Contemporary preservation styles now include canning, jarring, and freezing along with traditional styles that are still in use (Dewitt, 2018).

This “Alaskan” way of life has utilized fish, other marine, seafood, and game resources, and wild plants as food stuff for millennia, and it is still practiced today by tens of thousands of people across the state as part of family economic self-reliance and/or cultural connection (Alaska Department of Fish and Game, n.d.-c). The primary source of local food in the state is actually from the harvesting of these wild (and sometimes traditional) foods, by both rural and urban, and Indigenous and non-Indigenous populations, much of which is through processes legally categorized as subsistence and nonsubsistence fisheries and hunts. Generally, residents of urban Alaska areas are allowed to harvest wild foods through personal use, sport fisheries, and general hunts, which are all legally defined regulatory categories. Residents of regions considered as rural Alaska, which includes Alaska Native and non-Alaska Native people, harvest wild foods through subsistence hunting and fishing regulatory categories (University of Alaska Fairbanks et al., 2023).

In addition to legal definitions, wild food terminology often includes historical, cultural, and conversational interpretations. In summary, traditional foods are in reference to foods that are traditional to a person’s cul-

ture. In Alaska, and for Alaska Native people specifically, traditional foods are of cultural significance and are harvested from the land, and as such, these foods are also commonly referred to as wild foods, wild harvested foods, foraged foods, etc. Wild foods in general, however, are harvested beyond the Alaska Native population, as many non-Alaska Native residents participate in berry picking, fishing for salmon, hunting game meat, etc. All of these wild foods, regardless of terminology, are of great importance in Alaska and make up a second distinct arm of the food system, beyond retail food options. However, the act of harvesting wild foods, whether they are considered traditional foods or wild foods for any person or community, is a regulated process at state and federal levels regarding subsistence and nonsubsistence areas.

The state's first subsistence statute was passed by the Alaska legislature in 1978 and subsistence was established as the priority use of fish and wildlife. In 1980, the federal counterpart of this new subsistence law was passed through ANILCA (Alaska Department of Fish and Game, n.d.-h). While both state and federal laws recognize subsistence uses as the "customary and traditional uses" of wild resources for food, clothing, fuel, transportation, construction, art, crafts, sharing, and customary trade (Alaska Department of Fish and Game, n.d.-h), the laws have different definitions and ramifications that are legal in nature, which do not consider or capture the full cultural context of traditional foods or what subsistence practices provide socially, culturally, economically, and spiritually to the Indigenous food system of the state (Inuit Circumpolar Council-Alaska,

2015). Regardless, subsistence is widely practiced year-round and exists alongside other important uses of fish and game in Alaska, including commercial fishing, sport fishing, personal use fishing, and general hunting. Many people residing within Alaska's legal subsistence areas depend on fishing and hunting. A substantial proportion of these households harvest and use wild foods (Fall, 2018). This is culturally significant for many, and also practical, as hundreds of Alaska communities are geographically remote, making transportation and purchase of other limited retail food and goods logistically challenging and higher cost.

Wild foods contribute significantly to energy intake, particularly in rural communities, where 92-100% of sampled households have reported using fish, 79%-92% using wildlife, 75%-98% harvesting fish, and 48%-70% harvesting wildlife (Fall, 2016). State of Alaska calculations estimate the annual harvest of wild foods to average 276 pounds per person in rural Alaska. This amount provides 176% of the protein requirements and 25% of the caloric requirements of the rural population – that is, it provides about 81 grams of protein per person per day, in comparison to the mean daily requirement of 46 grams, and about 518 kcal daily, assuming a 2,100 kcal/day mean daily requirement. compared to 19 pounds per person in urban Alaska. In comparison, the annual wild food harvest estimate per person in urban Alaska averages 19 pounds, providing 12% of the protein requirements and 2% of the caloric requirements of the urban population (Fall, 2018).

The monetary value of subsistence food harvested by Alaskans is also significant and is generally understood

to be between \$450 – \$900 million dollars a year, based on a variety of estimates. The Alaska Department of Fish and Game (ADF&G) compiles harvest records that put the annual usable weight at almost 37 million pounds of harvest by rural Alaskans (excluding plants, e.g., roots, berries, greens, etc.) and over 11 million pounds for urban residents. These numbers lack the contribution of incalculable cultural values encompassed by harvested foods and harvesting practices and traditions, and in rural Alaska, the importance of mixing a subsistence-based economy with the cash economy, which is vital for food security. It should be known that subsistence and personal use-harvested fish and game cannot be commercially sold or used for trade or barter but may be gifted (University of Alaska Fairbanks et al., 2023).

Fishing is deemed the single greatest source of wild food that contributes to food security in Alaska (University of Alaska Fairbanks et al., 2023). In addition to subsistence, fish is harvested by Alaska residents through personal use and sportfishing, and in total makes up anywhere from 50-60% of annual wild food harvest, with salmon as the key species (Fall, 2018). To participate in personal use fishing, one must hold a valid fishing license; this opportunity provides Alaskans in rural areas to harvest fish (both near and beyond the urban locations), and utilizes gear that efficiently supports larger harvests, such as dipnets for coastal and riverbanks, and setnets for boats. Key seafood harvests include salmon, halibut, crab, trout, other finfish, and shellfish (Alaska Department of Fish and Game, n.d.-d). Additional fishing regulations exist for commercial,

aquatic farming, hatcheries, research, and sport fishing, for which Alaska is a world-renowned destination. Excise tax on certain sport fishing supplies generate funds for state investments into management, research, and restoration activities (Alaska Department of Fish and Game, n.d.-f).

Subsistence and personal use hunting for game animals is also an important and defining aspect of life in Alaska. Similar to fishing, the economics of hunting also includes locals acting as hunting guides, operating hunting lodges, and providing peripheral services such as taxidermy and gear. Game and other land animals vary by region and include moose, caribou, deer, bears (Black and Brown), Dall sheep, mountain goats, and beavers. As for marine mammal harvesting, seals, sea lions, walruses, and various whales are commonly harvested species (Alaska Department of Fish and Game, n.d.-g). Multiple regulated hunting opportunities exist, including general season hunting, registration permit hunts, drawing permit hunts, subsistence permit hunts (Tier I, Tier II, Cultural and Subsistence harvest), targeted hunts (e.g., game from animal-vehicle collisions), and federal hunts. Hunters must hold a hunting license, harvest tags, and follow strict regulations on location, gear (gun, bow, trapping, etc.), species, and species characteristics (e.g., moose sex, age, and size, including antlers). Some hunts are exclusive to Alaska residents while others are also open to non-residents (Alaska Department of Fish and Game, n.d.-a).

Alaskans also harvest timber products such as logs, firewood, and Christmas trees, and non-timber forest products (NTFP) for food, medicine, cultural, and arti-

san purposes. Non-timber forest products such as mushrooms, berries, bark, burls, conks, cones, boughs, diamond willow, landscaping transplants, and sap are often incorporated into value-added products for sale. Permits are required when the resources will be used commercially, and permits are not required when the harvest is for reasonable personal use (Alaska Division of Mining, Land, and Water, n.d.). Without personal use permit data or self-report survey data, it is difficult to quantify the extent that plant sources contribute to food security, difficult to monitor the health of the plant communities (plants that live in the same environment and thus interact with and respond to the same environmental conditions), and difficult to understand the extent of equitable harvesting in rural and urban areas. Food sovereignty for Indigenous peoples and commodification of plant resources are two aspects of this emerging conversation on plant harvesting and use (University of Alaska Fairbanks et al., 2023). It is becoming increasingly important, especially in populated areas and popular harvesting areas, for people to consider the ethics and safety of wild harvesting NFTP as to avoid toxins (e.g., chemicals), respect land ownership, and ensure the survival of the plants.

Overall, harvesting food is a special and unique aspect of Alaska life, culture, and history for Alaska Native peoples and Alaskans in a broader sense. When traditional foodways are disrupted, Alaska Native populations experience an increase in suicide and mental health disparities (Allen et al., 2011; Brinkman et al., 2022; Gone & Trimble, 2012). Participation in traditional harvesting practices is used as a prevention strategy,

most prominently with young people, to reduce risk and promote well-being (Brinkman et al., 2022; Rasmus, Allen, et al., 2014; Rasmus, Charles, et al., 2014). Traditional harvesting practices can be used to bring multiple generations together in the sharing of knowledge, skills, and understanding of identity. Elders pass on these lessons to youth, including what it means to be on the land from a spiritual perspective (Brinkman et al., 2022; Rasmus, Allen, et al., 2014). Youth who are more involved in traditional harvesting practices have higher levels of protection from substance abuse and suicide risk than their peers (Brinkman et al., 2022; Philip et al., 2016; Rasmus, Charles, et al., 2014; Rasmus et al., 2019; Wexler et al., 2020).

Yet, the opportunity and right to subsist off the land is not without threat. Tribal lands across the globe have experienced expropriation and deposition for centuries, Alaska included, and Indigenous peoples are resultantly among the highest at risk of hunger and malnutrition, due to histories of social, political, and economic exclusion (United Nations Human Rights, n.d.). With food insecurity rates in rural Alaska often being twice as high as in urban Alaska, subsistence hunting and fishing and all other wild food harvesting nourishes Alaskans in multiple ways, as both a way of life and provision of sustenance. The importance of these foods is also embedded into the social culture of the state in unique ways, such as employers providing paid time off during harvest seasons (University of Alaska Fairbanks et al., 2023). On the other hand, as an example, when fisheries are disrupted, such as early closures or reduced harvest limits, rural communities

are disproportionately impacted. One example of climate-based change is permafrost degradation. In certain regions of Alaska, harvested foods were historically often dried, smoked, canned, and/or stored in underground root and ice cellars. These practices still exist today, however, as permafrost thaws and land experiences subsidence, these preservation methods are threatened and may introduce foodborne illness, loss of harvested foods, and financial hardship. Cash-based electric grid power and fuel sources are now also used to refrigerate and freeze harvests (University of Alaska Fairbanks et al., 2023).

Institutions recognize the importance of traditional foods and have supported their access in a number of ways. The 2014 and 2018 Agricultural Acts are one such example, which allows harvested and donated local and traditional foods to be accepted and used (stored, processed, cooked, and served) in a variety of settings, such as hospitals, child nutrition programs, long-term care facilities, and senior care programs. An exemplary program is the Alaska Native Medical Center, which now serves donated and/or traditional foods in 66% of the hospital menu (Figure 5.7) (University of Alaska Fairbanks et al., 2023). Elders living in the Utuqqanaat Inaat long-term care facility operated by Maniilaq Health Association in the remote northwestern community of Kotzebue were served seal oil – the most desired traditional food at the facility – in 2021 after approval from the Alaska Department of Environmental Conservation (DEC) (*Cultural “Big Deal,”* 2021).



Figure 5.7
Wild
harvested
foods in
Alaska:
morel
mushroo
ms (upper
left),
smoked
salmon
(lower
left), rose
petals and
spruce
tips
(middle),
and
blueberrie
s (right)
Image by
Jennifer
Galbreath
/ [CC](#)
[BY-NC-SA](#)
[4.0](#)

Nonprofit and other advocacy efforts also support traditional ways of life and foodways for Alaska Native peoples. The Alaska Native Tribal Health Consortium (ANTHC) offers traditional food learning opportunities through the *Store Outside your Door* program and regional *Alaska Plants as Food and Medicine* symposiums (Alaska Native Tribal Health Consortium, n.d.). The working group, Protecting Our Ways of Life (POWOL), formed during the COVID-19 pandemic, and

is “a collective effort to address the enduring inequities and injustices of colonial management systems over ourselves and our homelands, and end the criminalization of our Native ways of life,” (First Alaskans Institute, n.d.). Native Movement, a nonprofit organization, leads environmental justice and food sovereignty efforts to protect lands and halt destructive environmental projects and practices that may be detrimental to Alaska Native communities and peoples and subsistence resources (Native Movement, 2023). The Imago Initiative at the Wilderness Society has worked to protect the Arctic National Wildlife Refuge (home to Porcupine Caribou Herd, an important subsistence food source in the region) from oil development and incorporate local Indigenous voices into the conservation movement (The Wilderness Society, n.d.). The Intertribal Agriculture Council (IAC) and its Alaska Region Technical Assistance Network program connects Tribal agriculture producers in Alaska to USDA resources; Alaska Native people are able to designate eligible land that they harvest wild foods on as operational farmland through the USDA’s Farm Service Agency (Intertribal Agriculture Council, n.d.). The Inuit Circumpolar Council of Alaska publishes ongoing white papers and other reports on food security and food sovereignty (Inuit Circumpolar Council-Alaska, n.d.). Sustainable Southeast Partnership, a network of members including Tribal governments and Native corporations, is a catalyst for projects across Southeast Alaska on abundant lands and waters, food sovereignty, localized economy, energy independence, and cultural vitality (Sustainable Southeast Partnership, n.d.). Ahtna Intertribal Resource

Commission established a cooperative management agreement in 2016 with the U.S. Department of the Interior for subsistence wildlife management on Ahtna lands in Interior Alaska (Ahtna, Inc., 2016). Chugach Regional Resources Commission is working to develop cooperative management agreements for the Tribes in the Chugach region, specifically for the conservation and management of marine mammals used as subsistence. Negotiating cooperative management agreement is the responsibility of the Federal government under the Marine Mammal Protection Act Amendments of 1994 (Public law 103-238); however, currently, no formal co-management role for Chugach Regional Resources Commission has been granted at the federal level (Chugach Regional Resources Commission, n.d.). The Aleutian Pribilof Islands Association (APIA) has a traditional foods program with a film series on traditional foods from the region, nutritional-fact animated films, nutritional labels for most of the traditional foods utilized in the region, nutrition comparison charts, a recipe book documenting traditional foods and uses from the region, and traditional foods curriculum for Head Start in the region (Aleutian Pribilof Islands Association, n.d.). This list is representative but is by no means comprehensive with many other on-going efforts by Alaska Native people and advocates to protect and preserve their diverse, life-sustaining cultural practices.

In conclusion, it is important to note that traditional, wild, and subsistence foods and practices are commonly regarded in an Alaska Native or rural context. This is for multiple—and very relevant—reasons, such

as the existence of most Alaska Native Tribes being located in rural Alaska and the legal definition of subsistence to state and federal government being a concept of ruralness. Traditional, wild, and subsistence foods and practices are indeed incredibly important in these contexts, and the contexts are complex. However, the foods and practices are also important, for multiple and relevant reasons, to people in urban Alaska. However, there is a paucity of research to support this in literature and provide the nuance it needs. For example, Alaska Native peoples existed throughout Alaska prior to any area being a modern-day urban area. The Native Village of Eklutna and its land are located in what is today called the Municipality of Anchorage. Furthermore, Alaska Native people live in all areas of the state, including in urban areas, and migrate to and from rural and urban areas for a variety of reasons. Non-Alaska Native people in both rural and urban areas also harvest traditional, wild, and subsistence foods, and the experience is often lauded, such as through television shows, as an integral part of Alaska life. This is to say that these foods and practices are important to many people, for many reasons, and in many places across the state. In guidance to programs and partners that are providing services to Alaska Native people, one State of Alaska publication states that if a family is living outside of their home community or region, that service providers should encourage exploration of traditional activities that could be modified or replicated in the local environment, such as berry picking or beading. Additionally, regional-specific foods may play a particularly strong therapeutic role for people receiving

services, highlighting why children and their parents should be served as close as possible to their home community (Dewitt, 2018).

Contact Period: Agricultural Dreams for the North and the Influx of “Outsiders”

Five thousand years after Alaska Native peoples arrived to what is today called Alaska, after migrating across the Bering Land Bridge, agriculture took hold in human society (Meter & Goldenberg, 2014). At some point, whether through indigenous trading routes or Spanish colonists, **potatoes** were conveyed from South America for cultivation in Tlingit seaside gardens (Meter & Goldenberg, 2014; Zhang et al., 2009). Later, in the 1700s, Russian settlers brought gardening techniques with them, planting provisions for themselves in scattered settlements in the Southeast region, but still depending on food imported from their mother country (Ellis, 1975; Meter & Goldenberg, 2014). Later again, in the 1800s, explorers, like naturalist John Muir, exclaimed about the agricultural potential of Alaska, and commented on the cultivation he witnessed some Tribes in the Southeast practice (Muir & Parsons, 1915). Still today, Alaska Native peoples are often disregarded in agricultural conversations, but have long been cultivators of wild resources (University of Alaska Fairbanks et al., 2023).

This section introduces one key U.S. government led

agricultural development project in Alaska's history – the Matanuska Colony. By no means though is it the only such project that occurred. Agricultural dreams began earlier, with big U.S. movement in the later 1800s with agricultural experiment station setups in Sitka, Kenai, Rampart, Copper Center, Kodiak, and Fairbanks due to the Morrill Act of 1862 that established land-grant colleges and the Hatch Act of 1887 that authorized agricultural experiment stations. In 1915, the Alaska Agricultural College and School of Mines was approved by Congress, which opened its doors to students in 1922. In 1935, it became the University of Alaska (University of Alaska Fairbanks, Agricultural and Forestry Experiment Station, n.d.).

Ultimately, the Matanuska Colony can be viewed as giving a slice of perspective into the modern agricultural beginnings in Alaska and context into migration from outsiders to the (eventual) state, outside of events such as the Gold Rush. It remains today as the quintessential area of Alaska for agriculture and is adjacent to the Municipality of Anchorage, Alaska's biggest urban area. However, the Matanuska Colony should also be viewed in its juxtaposition to the colonialism and land issues that Alaska Native peoples endured—and continue to endure—that are prior detailed regarding ANCSA and ANILA, for example, which occurred before, during, and after periods like the development of the Matanuska Colony. In one well-known report on food security in Alaska, it is stated that, “It was a tragically flawed vision that assumed Native families would be forced into extinction so that land would be freely available to Whites (Meter & Goldenberg, 2014).”

Following the stock market crash of October 29, 1929, thousands of banks and businesses failed, putting 25% of America's workforce, over 15 million people, out of work. In 1930, as the financial crisis gripped the nation, a severe drought swept across the Great Plains, including around 100 million acres of farmland. To ease the country's economic problems President Roosevelt spearheaded a series of relief, recovery, and reform programs called "The New Deal," including the Resettlement Administration, Federal Emergency Relief Administration (FERA), and Farm Security Administration, which were aimed at getting displaced families off government provided relief and into resettlement communities. At the heart of the New Deal resettlement program was a growing support for getting back to America's agricultural roots, called a back-to-land movement (Lewis & Clemens, n.d.).

Nearly 100 resettlement communities were established under these programs, including one in the Territory of Alaska called the Matanuska Colony. The Matanuska Colony did not follow the established pattern of the resettlement program of bringing assistance to those in need. There were no dire reasons within the Territory of Alaska to establish a resettlement colony. Unlike most communities where the colonists moved to the next county or maybe across the state, Alaska was the only resettlement community in which the settlers had to travel thousands of miles to start a new life (Lewis & Clemens, n.d.).

The decision to establish a colony in Alaska was largely economic and strategic. From the federal Department of Interior's perspective, an increase in

Alaska's population would help the territory to become economically self-supporting. At the same time, the War Department was looking to bolster Alaska's defenses in response to Japan's expansion. In planning for a build-up of military personnel, the development of large-scale farming would provide a more reliable and secure food source (Lewis & Clemens, n.d.).

The Matanuska Valley is in Southcentral Alaska about 40 miles north of Anchorage. In 1934, when President Franklin D. Roosevelt decided to establish a resettlement community in Alaska, the area was considered to have good agricultural potential. Surrounded by mountains on three sides, it is a broad basin drained by the Matanuska and Knik Rivers. The mountains help shelter it from severe winter temperatures and from Gulf of Alaska storms. Good soil, long summer daylight hours, mild temperatures, and low precipitation make the Matanuska Valley one of the best places in Alaska for agriculture (Lewis & Clemens, n.d.).

In selecting the colonists for the Matanuska Colony, FERA officials drew comparisons between Alaska's climate and that of Scandinavia, noting that Scandinavians were very successful farmers. They observed that the climate, soil, and agricultural conditions of the Matanuska Valley were comparable to those of the northern Midwest and that many people from this region were of Scandinavian descent. FERA officials believed that because of these similarities Midwestern people would be best suited for the strenuous pioneer life and already have knowledge of dairy and truck farming. In March 1935, county social workers were given the task of selecting a pool of possible applicants

for the project. In April and May 1935, two hundred families made the journey from Minnesota, Wisconsin, and Michigan to southcentral Alaska's Matanuska Valley to start their new lives (Lewis & Clemens, n.d.).

The New Deal resettlement program was unpopular among many in Congress who saw it as wasteful, inefficient, and lacking a clearly defined mission. For some, communities like the Matanuska Colony were viewed as communistic and radical because of the collectivist nature of their governance. Resettlement program administrators needed positive news to help foster support for the program and the Matanuska Colony provided that opportunity. Photographers and cinematographers traveled with the colonists, filming many aspects of their experience. News of the colonists' voyage was reported widely in newspapers. Alaska's mystique and the long distance that the Matanuska colonists had to travel captivated the nation. In 1935, Alaska was best known for the gold rushes at the turn of the century and viewed with awe by many Americans. Unlike the settlers of other resettlement communities, the Matanuska colonists received much fanfare on their way to the colony site. They participated in parades, dinners, and other celebrations in their honor. Like the gold seekers of earlier years, the colonists were perceived as pioneers on their way to a distant and mysterious land to carve a new life "out of the wilderness." Newspapers called the colonists "Alaskan Pioneers" and "America's 20th Century Pioneers," referring to the Matanuska Colony as the "pioneer colony" and to their journey north as the "new American pioneer pilgrimage." A Broadway play based on their experience, titled

“200 Were Chosen,” ran 35 performances in November and December of 1936. The story of the Matanuska colonists provided uplifting news for a struggling nation (Lewis & Clemens, n.d.).

After first living in a tent city, the colonists then selected their farmland by drawing lots. There was a total of 208 tracts of land. These were divided into 144 tracts of 40-acres each; 52 tracts of 80-acres each; and twelve tracts were reserved for future use. “Rustic cottages” were constructed and colonists, unhappy with the accommodations, demanded changes until colony administrators relented and allowed colonist involvement. It was not colonists that built the colony though – it was workers hired from transient camps in California and Washington, whose contributions have been nearly invisible in the history of the colony, as “Alaskans” were upset with the influx of cheap labor. The federal government in turn tried to force the workers to leave by ending their wages back to bank accounts in California and Washington (Lewis & Clemens, n.d.).

After construction, some colonists became discouraged and left. Others were just not cut out for the Alaska experience. Health concerns like tuberculosis, heart disease, anemia, and asthma, as well as lack of farm experience forced others out. But by summer of 1936, the Matanuska Colony was nearly complete, and the community had a hospital, school, railroad depot, trading post, community center, social clubs, home-making instruction, gift shop, and multiple churches. The farms, however, were initially challenging to develop, due to the geography and ecology of the area and land clearing. There was a market though, for the

food products, and farming approaches quickly changed to specialize and meet needs into the 1940s. A fair was held annually near the colony, which eventually moved and grew to 221 acres nearby, which is where the Alaska State Fair continues to operate today. Also today, many original colony buildings are on the National Register of Historic Places and the area's farming heritage continues (Lewis & Clemens, n.d.). Organizations like Alaska Farmland Trust protect the area's farmland from other future development opportunities as the population in the Matanuska-Susitna Valley region continues to grow (Alaska Farmland Trust, n.d.).

Post-Contact Period: Modern Food Production and Current Agricultural Affairs

Current conversations about Alaska's food system and food security usually start by acknowledging that as much as 95% of Alaska's food is imported and that Alaska has little capacity for fresh food storage when it arrives. Any interruptions in transportation or supply chains result in low stock on urban grocery store shelves. Rural and remote communities have additional issues in maintaining high quality fresh food supplies, with food shipped from the urban centers requiring costly, easily disrupted air freight transportation or infrequent barges. According to the Alaska Department of Transportation and Public Facilities, 82% (or 402) of

Alaska communities depend on aviation for year-round access – this includes food and other goods delivery (*Statewide Aviation, Transportation & Public Facilities, State of Alaska*, n.d.). In other words, only 18% of Alaska's communities are accessible via the road system.

Perishable food is transported in temperature-controlled trucks, by air or by barges, each of which may be delayed due to weather or environmental conditions (e.g., volcanic eruptions). Once products reach Alaska, retailers must have cold storage equipment and facilities to safeguard perishable foods (University of Alaska Fairbanks et al., 2023). For small retailers, acquiring and maintaining such equipment and facilities is financially burdensome and brick and mortar locations often lack such infrastructure in the first place.

However, with only 18% of Alaska communities being accessible via the road system, food transportation and storage is a different story for the rest of Alaska's rural and remote residents. Alternative systems include Bypass Mail and barge (e.g., out of Tacoma, Washington or through the Alaska Marine Highway System). These systems are not without challenges either and are often fraught with delays and funding issues. Bypass Mail allows shipments to bypass the post office and instead go straight to the air carrier for delivery off the road system. The cost for grocery retailers is almost half the cost of shipping via private freight. Shipments generally move from Anchorage to midsize regional hubs such as Bethel, Dillingham, and Kotzebue. Shipments are then transferred to "Bush" airlines for delivery to more remote communities, which have similar issues for storing perishable food. Inclement weather often

delays shipments to remote communities and appropriate cold storage and limited cargo capacity also reduce locally available fresh, nutritious food (University of Alaska Fairbanks et al., 2023).

The 95% food importation statistic is important to food system conversations in Alaska because as described, the supply chain can be easily disrupted due to weather, infrastructure and equipment, or even the COVID-19 pandemic, and can put Alaskans at risk for food insecurity. Store shelves empty quickly, and it can take two weeks for new food shipments to arrive (University of Alaska Fairbanks et al., 2023).

The reliance on imported food means that Alaskans spend approximately \$2 billion dollars on food that is produced and processed outside of the state (University of Alaska Fairbanks et al., 2023). Recognition of this has stimulated Alaska efforts to encourage the use of local, wild harvested foods, boost and highlight local production, and support other food development initiatives in hopes to keep more food dollars in the local economy and enhance food security.

As such, agriculture in Alaska is receiving attention at all levels. For example, the Nenana-Totchaket Agricultural Project designated 100,000+ acres for agricultural development. Governor Mike Dunleavy proposed \$5 million to move the project forward, and the Alaska Legislature funded the first phase in the FY22 budget (Alaska Department of Natural Resources, n.d.). However, the project is not without challenge as nonprofits and local Tribal members have expressed concern over the impact of agricultural development on these remote lands and a potential detriment to subsistence

food resources and loss of Indigenous food sovereignty (Petersen, 2022).

Overall, agriculture in Alaska is valued at \$40 million (University of Alaska Fairbanks et al., 2023). According to the 2025 State Agriculture Overview for Alaska from the USDA, there are 1,200 farm operations across 870,000 acres (U.S. Department of Agriculture, National Agricultural Statistics Service, 2026). The typical farm in Alaska is under 50-acres, which, as compared to agriculture across the rest of the nation, seems insignificant, however, the dispersion and activity of small farms in all regions of the state are critical to many communities. Forty-three percent of growers produce on less than 10-acres (University of Alaska Fairbanks et al., 2023). Interestingly, only 5,700 acres of agricultural land is said to be needed to feed all Alaskans an annual demand of carrots, potatoes, lettuce, and cabbage (Alaska Farm Bureau, n.d.).

Vegetable production and cut flowers, such as peonies, are often gateway crops into larger scale food production, including a nascent but growing barley, hay, wheat, alfalfa, oat, and potato subsector. Seed potatoes are a viable industry for Alaska as potatoes benefit in Alaska from an optimal growing environment, low labor needs, and few diseases or pests (University of Alaska Fairbanks et al., 2023). In addition to food, fiber, fodder, and flowers, animals are also raised and processed across the state, including chickens, turkeys, pigs, cows, goats, cattle, yak, bison and reindeer. A common challenge of animal raising is the requirement of utilizing a USDA-certified slaughter facility for packaged and/or processed portion sales, of which only

three exist on the road system, in addition to two mobile units in remote locations. Another challenge is the cost of imported feed and therefore the importance of in-state access to hay, hay-producing land, and grazing acres (University of Alaska Fairbanks et al., 2023). Additionally, although innovative and traditional growing techniques are being used successfully in Alaska agriculture, including traditional soil-based operations, hydroponics, community farms and gardens, and even mariculture, farmers and food producers are faced with a variety of entry, operational, and market barriers. Top barriers include land affordability, clearing, and agricultural preparation; affordability of agricultural equipment and infrastructure, including shipping from the continental U.S.; food processing and storage facilities; adequate skilled labor and labor costs; distribution systems; financial capital; market penetration, growth, and customer and retail-base relationships (University of Alaska Fairbanks et al., 2023).

Some dairy has been produced historically in Alaska, although industry has been hit hard over the last 50+ years. In 1959, there were 525 dairy farms in Alaska and milk accounted for 49% of agricultural products (Tarnal, 2013). However, in 2022 only two dairies certified by the federal Food and Drug Administration (FDA) remained, one of which is a goat dairy. The other, Alaska Range Dairy, began to offer products commercially in 2022 at Alaska Walmart locations (Alaska Division of Environmental Health, Food Safety and Sanitation Program, 2023). Dairy regulations of pasteurization deter small producers, and many utilize a “share” system to

skirt the regulation and provide products directly to Alaska consumers.

Alaska is also an ideal location for marine shellfish and aquatic plant production. The industry is young but burgeoning with aquatic farms and hatcheries. Products include oysters and seaweed (Alaska Department of Fish and Game, n.d.-b). In early 2023, ADF&G reported 88 operation permits (Morris, 2023). Fishermen, who have boats and gear and often work seasonally, are interested in mariculture opportunities to diversify the year. Mariculture training is in high demand. Alaska's successful seafood infrastructure, workforce, markets and branding is primed to support a growing mariculture industry (University of Alaska Fairbanks et al., 2023). Alaska also operates hatchery programs for commercial fisheries, as by mandate, wild stocks of fish must be protected. A variety of distinct hatchery types release more than a billion fish each year into Alaskan waters (Alaska Department of Fish and Game, n.d.-e). Fish harvested commercially from these hatchery releases contribute to the approximately 5.7 billion pounds of seafood worth \$2.0 billion that was harvested in 2019. Processors turned this harvest into 2.8 billion pounds of product worth \$4.7 billion. Nationally, the Alaska seafood industry creates over 100,000 fulltime employment jobs, \$6 billion in annual labor income, and \$15 billion in economic output (McKinley Research Group, 2022).

Farmers Markets are also on the rise in Alaska. According to the Alaska Farmers Market Association, in 2023 there were 56 markets, up from 13 in 2005 (Alaska Farmers Market Association, n.d.). Farms stands

and Community Supported Agriculture shares also exist. Food hubs (defined by the USDA as “a centrally located facility with a business management structure facilitating the aggregation, storage, processing, distribution, and/or marketing of locally/regionally produced food products”) are in development to support sale and distribution of Alaska products, as well as to strengthen local economies and offer convenience to producers and consumers. Alaska grown food and value-added products are also sold in grocery stores and restaurants, and retailers can ensure that consumers experiencing financial hardship can access local goods through food and nutrition assistance programs.

While demand for local food seems high, retailers often struggle with making a profit on the cost of Alaska grown products and being able to depend on consistency, quality, and quantity of products (University of Alaska Fairbanks et al., 2023). State and federal government programs have offered incentives for restaurant purchases of local food over the last decade. Other community institutions with large purchasing power could also help support the purchase and serving of Alaska grown food but they too require consistency and reliability, such as senior facilities, schools, medical centers, and military bases.

What the local food system in Alaska has on its side is promotion programs such as Alaska Grown, the Alaska Seafood Marketing Institute, and the Alaska Farmers Market Association (University of Alaska Fairbanks et al., 2023). Other organizations, like Alaska Food Policy Council (AFPC), also contribute substantial efforts towards improving Alaska’s food system by connecting

Alaskans, advocating for related policy recommendations at the local, state, federal, and Tribal level, and keeping all Alaskans, who are food system stakeholders, informed. Staff, board members, working group members, partners, and collaborators through AFPC represent many aspects of the food system, such as restaurateurs, farmers, educators, medical professionals, health advocates, state agencies, agricultural organizations, and other food policy experts (Alaska Food Policy Council, n.d.).

In 2022, Governor Mike Dunleavy issued Administrative Order 331 establishing the Alaska Food Security and Independence Task Force to develop recommendations on increasing food production and harvesting and identifying statutory or regulatory barriers preventing food security. The task force produced a final report drafted by University of Alaska Fairbanks and AFPC (University of Alaska Fairbanks et al., 2023). To continue the work of the task force, the 32nd Alaska State Legislature passed House Bill 298 (HB 298) in 2022, and established the Alaska Food Strategy Task Force (AFSTF) to 1) develop a comprehensive statewide food strategy, 2) strengthen the state's diverse food systems, 3) improve food security for all residents of the state, and 4) grow the local food economies of the state. The task force will be making recommendations for state policy, legislation, and strategy implementation (Alaska Food Strategy Task Force, 2023). On December 20, 2024, Governor Mike Dunleavy additionally announced plans to establish the Alaska Department of Agriculture, making a new department that removes the Division of Agriculture responsibilities from the Department of Natural

Resources. The new department would have the mission to bolster Alaska's agricultural sector, increase economic activity, and strengthen Alaska's food security, and with it, a Cabinet-level position and dedicated budget. The department had also been recommended by the task force (Alaska Office of Governor, 2024). On March 20, 2025, Governor Dunleavy's Executive Order to establish the Department of Agriculture was denied by the Alaska Legislature in a 32-28 vote. Alaska is one of only two states that do not have a Cabinet-level Department of Agriculture. Opposition voters stated reasons such as Executive Orders not being able to be amended, the cost to establish the department, and a need to look beyond Alaska's well-known agricultural areas and acknowledge access to Alaska's wild food sources as part of the state's food security. The establishment of the department may still pass through other bills (Brooks, 2025).

Food Assistance

Several food and nutrition assistance programs offered through the USDA help to feed Alaskans. The State of Alaska administers the Supplemental Nutrition Assistance Program (SNAP) and SNAP Education (SNAP-Ed), the Farmers' Market Nutrition Program (FMNP), the Commodity Supplemental Food Program (CSFP), and the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). Through SNAP,

food benefits are provided to low-income households and SNAP-Ed provides complementary nutrition education. Alaska's SNAP served 13% of the state's residents in 2022, or one in eight Alaskans. Of the participants, more than 66% represented families with children and more than 37% represented working families (Food Bank of Alaska, n.d.). The FMNP issues coupons for the exchange of foods at Alaska farmers' markets and farm stands. The CSFP supplements food for seniors aged 60 years and older. Food supplements from WIC provide targeted nutrient-based food support for women, infants, and children (Alaska Department of Health, n.d.).

The State of Alaska's Child Nutrition Programs (CNP) provide quality nutrition programs to ensure that families are well-nourished and healthy and that children are ready to learn. Current and past programs offered by CNP include Alaska Farm to School, USDA Food Program, Child and Adult Care Food, Fresh Fruit and Vegetable, Summer Food Service, School Nutrition Programs of National School Lunch Program and School Breakfast Program, and Special Milk Program (Alaska Department of Education and Early Development, n.d.). In 2021, 12.8% of children under 18 years old in Alaska experienced food insecurity (Feeding America, n.d.). In 2022, over 66% of SNAP participants in Alaska were in families with children (Center on Budget and Policy Priorities, 2025). Through CNP programming, children may receive one to two hot and prepared meals, every day, at school, which may help to alleviate child hunger in Alaska. Some school meals even include Alaska seafood. The USDA purchased \$120 million of

Alaska seafood products in 2019 for school lunches, food banks, and other national programs (McKinley Research Group, 2022).

The Federal Food Distribution Program on Indian Reservations (FDPIR) is led by ANTHC and provides income eligible Alaska Native households and other households in Tribal communities with food packages, and similar to Alaska seafood in school meals, the packages include foods that are traditional and/or local to Alaska (Alaska Native Tribal Health Consortium, n.d.). Traditional and local foods are made available in FDPIR through contracts with Tribal partners, currently Kodiak Island WildSource and Knik Tribe, which provide Alaskan halibut, cod, and potatoes (U.S. Department of Agriculture, Food and Nutrition Service, n.d.).

Other state efforts at traditional and local food integration into federal food and nutrition assistance programming in Alaska includes a SNAP partnership between the Alaska Division of Public Assistance with the Alaska Department of Fish and Game. The SNAP subsistence program allows SNAP eligible recipients in some rural areas across the state to use SNAP benefits to purchase subsistence hunting and fishing gear to support the procurement of wild foods, including fishing rods, nets, and ice augers. Eligible recipients are those who live in a community with difficult access to retail stores and rely on hunting and fishing for subsistence (Alaska Department of Health and Social Service and Department of Fish and Game, n.d.).

Alaska's WIC program has also integrated aspects of traditional and local food into its efforts. In partnership with SNAP-Ed, the University of Alaska Fairbanks and

some individual Alaska Native women and Elder representatives, materials to celebrate the benefits of wild Alaskan foods were developed for WIC recipients. Mini-magazines feature nutrition information, recipes, and children's activity ideas, and videos are available on how to make simple, healthy dishes using locally gathered plants and WIC foods (WIC Works Resource System, n.d.).

The University of Alaska Fairbanks additionally implements the USDA-funded Expanded Food and Nutrition Education Program (EFNEP) in five communities across the state: Fairbanks, Wasilla/Palmer, Anchorage, Kenai/Soldotna, and Juneau. The program offers free nutrition classes to help families and youth cook healthy meals at home, be more active, save money on food costs, and handle food safely (University of Alaska Fairbanks, Cooperative Extension Service, n.d.).

Food banks, food pantries, soup kitchens, and other local community efforts also help to feed Alaskans and provide access to food. At the statewide level, the Food Bank of Alaska was created in 1979 by a dedicated group of Anchorage church and community volunteers founded on the belief that no one should go hungry. The Food Bank of Alaska works to ensure that nutritious food reaches Alaskans across the state, while preventing usable food from going to waste. Through partnerships with grocery stores, wholesalers, producers, farmers, and the fishing industry, surplus food that would otherwise be discarded is rescued. The organization also receives generous donations from community members and manages essential government food

programs. Through a network of 154 partner agencies across Alaska, including food pantries, soup kitchens, senior centers, and children's programs, the Food Bank of Alaska distributes food to the network which in turn distributes food to individuals and families in the community (Food Bank of Alaska, 2018).

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Overall Nutrition and Health Status of Children

Nutrition-Related Data and Research

Data collection, aggregation, and analysis on the health and nutrition status of children in Alaska is crucial. For example, Alaska is not included in the National Health and Nutrition Examination Survey (NHANES), a program led by the federal Centers for Disease Control and Prevention (CDC) (Murphy, 2003) and thus Alaskans in general are not represented in this surveillance program and data collection.

With recognition of this lack of inclusion of the Alaska population in national level surveys on health and nutrition, the Children's Healthy Living (CHL) program conducted similar data collection efforts in four populous road system regions in Alaska between 2013 and 2019: the Anchorage area, the Matanuska Susitna Valley area, the Fairbanks area, and the Kenai area. The CHL program was a community intervention trial in Alaska and other Pacific jurisdictions intended to prevent childhood overweight and obesity in children aged 2-8 years old (Novotny et al., 2018). As compared to the other U.S.-Affiliated Pacific (USAP) jurisdictions that

participated in the CHL program, Alaska participants had the highest total fruit component scores (child level), significantly higher diet quality scores (child level mean Healthy Eating Index or HEI score of 63.2 out of 100), reported the lowest (household level) food insecurity at just under 28% using a one item measure adapted from the USDA's Household Food Security Survey Module, and most participants identified as white (Hingle et al., 2023). CHL also found that potatoes were the most frequently consumed vegetable in Alaska child participant diets and that although low overall, Alaska children had one of the highest vegetable consumptions. Recommendations for grain intake were met in Alaska and milk intake was higher than the rest of the participating jurisdictions (Novotny et al., 2022). Investigators from CHL also examined dietary intake by children according to their early care and education (ECE) setting, including children from Alaska's participating communities. Over 50% of the Alaska child participants in the analysis attended a Head Start program and Head Start children were more likely to meet calcium intake recommendations than children not in an ECE; however, this was the only statistically significant association across all of the standard nutrient intake levels (Esquivel et al., 2023).

At a statewide level, Alaska was reported to have a food insecurity prevalence of 10.4% according to 2021-2023 numbers from the USDA; the U.S. average was 12.2%. (U.S. Department of Agriculture, Economic Research Service, n.d.). The Mind the Meal Gap research from Feeding America reported that the prevalence of food insecurity was 12.8% in Alaska in 2022 and that 63% of

those who were food insecure were above the financial threshold required for SNAP benefit eligibility. Among children, food insecurity is higher, with over 17% being reported as food insecure at the state level, but upwards of 25% in some remote and rural regions inhabited primarily by Alaska Native peoples (Feeding America, n.d.).

Much of the other nutrition related research in Alaska is focused on adults in rural and Alaska Native populations, and is often specific to traditional and local food intake and health status, as well as aligned factors such as utilization of Western dietary assessment methods, food security, climate shifts, economic and nutrition transitions, and gardening (Bersamin et al., 2006; Gerlach & Loring, 2013; Hill et al., 2023; Johnson et al., 2012; Koller et al., 2021; Loring & Gerlach, 2009; Luick et al., 2014; Mucioki et al., 2024; Walch et al., 2018). Research that is specific to children is limited. However, what does exist is indicative of the acculturation processes and nutrition transitions that are occurring in Alaska Native communities, and further, that traditional foods are associated with higher child diet quality and health outcomes (Bersamin et al., 2019; Hill et al., 2023).

At the state level, the State of Alaska and ANTHC implemented a *Play Every Day* social media marketing campaign in 2019-2021 to encourage parents to serve healthy drinks to young children. The campaign was directed to Alaska Native people, people in rural communities, people having low incomes, and people having low educational attainment, all of whom experience disproportionately poor nutrition outcomes, most

specifically in this campaign to sugar sweetened beverage (SSB) consumption. The participating parents, all with 3-year-old children, were sampled as part of the Alaska Childhood Understanding Behaviors Surveys, or CUBS, which is a follow-up to the Alaska Pregnancy Risk Assessment Monitoring System (PRAMS), a CDC-sponsored survey of mothers of newborns. Only 34% of parents reported seeing the campaign, and only 21% of those were compelled to change the drinks they served to their children (Potempa et al., 2022). Relatedly, analysis of 2013 and 2015 data from Alaska's Behavioral Risk Factor Surveillance System (BRFSS) concluded that for rural Alaska communities without in-home piped water, higher consumption of SSBs may occur, as compared to communities with in-home piped water (Mosites et al., 2020).

In urban nutrition research, a pilot text message intervention project called Txt4HappyKids was used in a low-income parent population in Fairbanks, Alaska, to promote fruit and vegetable intake among families with young children. Although the analysis of the pilot found no difference in the measures of behavior, self-efficacy, and attitudes towards fruit and vegetable intake, participants did report serving more fruits and vegetables due to a belief that they were healthy; trying to follow a healthier diet; trying different fruit and vegetable preparation methods; and being more aware of their child's food consumption (Power & Bersamin, 2018).

In some rural Alaska communities, research has shown that traditional food intake in Alaska Native children is associated parental intake of traditional foods, cultural identity, and income, and further, that parental

intake of traditional foods can predict lower child BMI (Maurice et al., 2019). However, the same study found that a higher parental educational level was negatively associated with traditional food intake and positively associated with child BMI. The speculation is that education is linked to employment, which leads to less time spent on the subsistence lifestyle and contributes to increased financial resources to obtain store bought food. Additionally, time spent obtaining education may result in acquiring less traditional knowledge (Maurice et al., 2019). It has also been reported in the literature that Alaska Native people from urban and rural areas who participate in physical activity to acquire traditional foods, such as berry picking or fishing, are more likely to eat those foods (Redwood et al., 2008).

In other rural Alaska research, for Head Start children in some Alaska Native communities, the combined overweight and obesity prevalence was found to be 70% in one study, and biomarker research showed that traditional food intake is inversely associated with BMI (Hill et al., 2023). A Fish-to-School program has also been implemented for adolescents living in a few remote Alaska Native communities. The research also utilized a biomarker as a measure of traditional food intake for fish, paired with the HEI as a modern measure of diet quality. The researchers found that both diet quality and fish intake increased in the intervention community as compared to the control community (Bersamin et al., 2019).

In traditional food research in urban Alaska, one study reported that for low-income Alaska Native women in Anchorage participating in WIC, low con-

sumption of traditional foods existed but participants generally believed traditional foods to be healthier and cheaper than store-bought foods. Most participants would prefer a diet of only traditional foods, mostly traditional foods, or an even distribution of traditional foods to store bought foods, but identified a lack of time and money for harvesting activities and access to traditional foods as barriers to consuming traditional foods (Walch et al., 2019).

Broad Health Data and Research

Beyond nutrition, other health status indicators are tracked in Alaska more robustly by a variety of national, state, and local initiatives and data collection efforts. Kids Count Data Center, a program of the Annie E. Casey Foundation, tracks child well-being across the U.S. and publishes data and trend analyses annually (The Annie E. Casey Foundation, n.d.). The 2024 Kids Count data for Alaska puts the state at an overall rank of 41 out of 50 states in childhood well-being. This ranking worsened from 38th in 2023. Alaska's categorical standings for 2024 are 37th for economic well-being (up from 46th in 2023), 47th for education (up from 48th in 2023), 26th for family and community (down from 22nd in 2023), and 37th for health (down from 27th in 2023) (Alaska Children's Trust, 2023). The health category is based on four nationwide core health indicators. For the core health indicators of percentage of

low birth-weight babies and percentage of children and teens (ages 10 to 17) who are experiencing overweight or obesity, Alaska's ranking has worsened since 2019. For the national indicators of children without health insurance and child and teen deaths, Alaska's ranking has improved since 2019 (Alaska Children's Trust, 2023).

Kids Count also published Alaska-specific data on expanded indicators in 2022. In the 2022 Kids Count Alaska Health report, overweight and obesity prevalence were shown to have fluctuated for Alaska children and teens since 2011, but the state prevalence has remained lower than the national prevalence. Five Alaska regions had an increase in high school students who are experiencing overweight or obesity from 2009 to 2017, excluding the Gulf Coast which decreased by a single percentage and the Interior which remained consistent at 27% prevalence. By race and ethnicity, American Indian/Alaska Native high school student overweight and obesity data in the same years remained consistent at 32% prevalence and increased by 5% to 27% prevalence for non-Hispanic white students. The percentage of overweight or obese Alaska high school males has been consistently higher than females from 2011-2019 (Alaska Children's Trust, 2022).

Of seven regions across the state, only one had more than 9% of children lacking health insurance in 2019. In 2021, American Indian/Alaska Native children had the highest uninsured rate at 14%. Thirty-three percent of women in Alaska receive less-than-adequate prenatal care, with disparities highest in the Northern and Southwest regions (2017-2021 five-year average) and for American Indian/Alaska Native versus non-Hispanic

white births, American Indian/Alaska Native births have an 80% higher rate of women receiving late or no prenatal care (Alaska Children's Trust, 2022).

In 2020, the most common form of child maltreatment in Alaska was neglect (71%), followed by emotional abuse (33%), physical abuse (21%), sexual abuse (9%), and medical neglect (4%). American Indian/Alaska Native children in Alaska are 25% less likely to receive a developmental screening than all other children. Total state percentages of three-year-old children screened has risen since 2015, but the results vary widely per region, with regions containing urban centers and road systems having higher screening rates than in rural and remote areas and are home to many Alaska Native children (e.g. 90% of three-year-olds in Anchorage versus 42% in the Southwest region, in 2018-2019) (Alaska Children's Trust, 2022).

The rate of child and teen deaths in 2020 was almost double the national rate, at 46 per 100,000 youth. For American Indian/Alaska Native youth in Alaska, the rate is two to three times higher than non-Hispanic white youth in Alaska, at 98 per 100,000 youth. Child (ages 1-14) and teen (ages 15-19) death rates are both highest in the Northern and Southwest regions (Alaska Children's Trust, 2022).

Between 2009 and 2019, the proportion of high school students in Alaska feeling sad and hopeless increased over 50%. Over the same years, these feelings among American Indian/Alaska Native children have significantly increased from 26% to 43% (Alaska Children's Trust, 2022). Through the Alaska Youth Risk Behavior Surveillance System (YRBSS), Alaska has made

progress with reducing high school student alcohol use since 2009. In 2019, alcohol use was higher for non-Hispanic white (25%) versus American Indian/Alaska Native (17%) and all other races (10%). The state's average marijuana use amongst the same population remained almost stable from 2009-2019 at 22-23%. Smoking tobacco has decreased considerably, down to 10% in 2019. Rates for the 7-vaccine series by the age of 35 months have fluctuated between 60% and 70% since 2011, with the highest rates in Anchorage (88%) and the lowest rates (70%) in the Matanuska-Susitna and Gulf Coast regions. Among American Indian/Alaska Native mothers, 81% reported not delaying or skipping vaccines in 2018-2020, compared to only 77% of white mothers (Alaska Children's Trust, 2022).

Alaska also has a state health improvement plan that aims to address objectives and strategies related to the data collected through Kids Count. The plan, Healthy Alaskans, represents a partnership between the Alaska Department of Health and Social Services and ANTHC, and is contributed to by professionals representing different sectors that impact health. The goal of Healthy Alaskans is to improve health and ensure health equity for all Alaskans through shared goals, united efforts, and collective accountability (Healthy Alaskans, n.d.-a). Priority health topics and objectives are selected for decade-long plans. The 2030 plan includes the specific health objectives of chronic disease, environmental health, healthcare access, healthy weight, infectious disease, injury prevention, mental health, nutrition, physical activity, protective factors, social determinants of health, substance misuse, suicide prevention,

tobacco use, and violence prevention, which are generally aligned with other health topic specific statewide plans, programs and organizations (Healthy Alaskans, n.d.-e).

Scorecards regarding the success of Healthy Alaskans are released annually. Scorecards released in January 2023 on the 2030 plan included “met” or “improving” objectives, including the percentage of 3-year-olds who had a well-child checkup in the last 12 months (Healthy Alaskans, n.d.-b). The final scorecard for the 2020 plan showed no improvement in the percentage of adolescents who are experiencing overweight (grades 9-12), adolescents who are experiencing obesity (grades 9-12), children (grades K-8) who are experiencing overweight, and children (grades K-8) who are experiencing obesity. All four of the indicators increased over the past decade. Similarly, the percentage of adolescents (grades 9-12) who engage in at least 60 minutes of physical activity a day decreased. Among only the Alaska Native population, improvements were made for the percentage of adolescents (grades 9-12) who are experiencing overweight, percentage of children (grades K-8) who are experiencing overweight, and percentage of adolescents (grades 9-12) who engage in at least 60 minutes of physical activity a day (Healthy Alaskans, n.d.-d). The 2030 plan saw the addition of the objective to reduce the percentage of 3-year-olds who drink any sugary drinks on a given day (Healthy Alaskans, n.d.-c).

School Programs and Policies

Under the Healthy Hunger-Free Kids Act, all school districts in Alaska participating in federally funded child nutrition programs must have a child nutrition and physical activity policy. The Alaska Obesity Prevention and Control Program created a Gold Standard Wellness Policy to meet the federal requirements to adopt and implement a Local School Wellness Policy (LSWP) (also known as the Student Nutrition and Physical Activity policy). The policy is to guide a school district's development and implementation of policy promoting healthy school nutrition and physical activity. The state's policy example includes Alaska-centric options such as utilizing Alaska farm and fish products, exempting traditional foods from federal school meal nutritional requirements when donated for educational purposes, and offering indoor and outdoor facilities to ensure that physical activity is safe and not solely dependent on the weather (Alaska Department of Health, n.d.).

Implementation of school wellness initiatives has been studied in some elementary schools in Anchorage. Teacher reports suggested that support and buy-in from administration were needed for wellness initiative success, to address difficulties teachers experienced in managing extra cafeteria time and extra student physical activity. However, teachers positively observed that students were calmer, more focused, and had few behavior issues due to components of the wellness initiatives, such as switching the schedule between lunch

and recess and incorporating movement into educational lessons (Olarde et al., 2022).

Unique to Alaska's climate among the other Pacific jurisdictions is subzero weather for many months out of the year, which may impact physical activity opportunities. In the Anchorage School District, students are expected to have appropriate winter clothing to participate in outdoor recess to a chill factor of -10°F (Anchorage School District, 2025). In the Fairbanks North Star Borough School District, outdoor recess is only canceled at -20°F and the district's strategic plan for extreme winter weather states, "The school district will not close schools simply because of cold weather" (Fairbanks North Star Borough School District, n.d.). Poor air quality is another factor which can limit outdoor activity of school children, specifically in the Fairbanks area where, in winter months, a temperature inversion traps cold air close to the ground, including air pollution particulate matter, for days, which is further exacerbated by a need for increased burning of fuel oil, wood, coal, and motor vehicle fuel to withstand the cold temperatures (Alaska Department of Environmental Conservation, n.d.).

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Community Highlight: Child Health

Child Health

Program/Project Description

Anchorage Park Foundation (APF) builds *Healthy Parks & Healthy People* by mobilizing public support and financial resources for Anchorage parks, trails, and recreation opportunities. APF's vision of Anchorage's citizens recognizing parks as vital components of community health and connectivity, and to demonstrate a strong park stewardship ethic, is exemplified through the organization's many successful programs and projects. Popular efforts include invasive plant removal, inclusive playground development, Indigenous place name signage, the Moose Loop Trail Challenge, and Youth Employment in Parks program (YEP) for 10-12th graders. Using YEP as a guide, APF plans to partner with the Anchorage School District (ASD) to provide a similar opportunity to 8-9th graders in a new summer program called Youth Outdoors (YO). At-risk teenagers will participate in skill-building activities in an outdoor environment by maintaining ASD gardens and other community service projects during the summer break. Garden harvests will be distributed to children and families in need. APF is planning

the YO program in 2024 and is fundraising to implement the YO pilot program in 2025.

Methods and Activities

The YO program APF envisions will recruit underserved youth ages 14-15 to participate in two supervised crews that build and maintain school gardens, remove invasive species, and plant trees. Over four weeks, the two groups of teens will learn about food forests, soils, gardening, permaculture, healthy foods, tree planting, civic engagement, team building, and outdoor recreation. Existing resources such as the Cooperative Extension Service and 4-H, Anchorage Soil and Water Conservation District, USDA Farm to School, and Alaska Master Gardeners will inform program components and activities.

Lessons Learned

APF anticipates that local youth will become empowered land stewards of thriving educational spaces (e.g., the school gardens) and concurrently gain valuable knowledge for their future careers. As the program planning is currently underway, the initial phase focused on building the foundation of the program by completing a needs assessment, convening partners, generating internal protocols such as safety protocols, partnership agreements, recruitment strategies, marketing materials, and program evaluation tools. The next phase of planning will consist of establishing a curriculum and activity plan for the youth

groups. Lastly, APF will seek funding to support program implementation. YO will be informed by community partners who support the vision, as well as those who will be requesting additional community service work projects from the youth crews throughout the summer of 2025.

APF has seen a decline in YEP applicants since the COVID-19 pandemic, which may be attributed to teens receiving higher paying jobs in the private sector. Overall, AFP anticipates that the YO program will complement the YEP program by preparing youth for future participation in the YEP program, where they perform paid summer work through the Municipality of Anchorage (Anchorage Park Foundation, n.d.).

Reference

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Community Highlight: Policy

Policy

Program/Project Description

At Alaska Native Medical Center (ANMC) in Anchorage, on the Alaska Native Health Campus, patients are fed traditional foods that are healing and nourishing medicine. Inpatient menu items such as *akutaq*—a wild berry-filled Traditional Alaska Native ice cream (with or without fish) and smoked salmon can be ordered and enjoyed (Alaska Native Medical Center, n.d.). The menu didn't always offer a wide variety of traditional foods. The 2014 Farm Bill (Section 4033 of the Agricultural Act of 2014) directed the USDA to allow for the donation to and serving of traditional foods through food service programs at public facilities and non-profit facilities that primarily serve American Indian and Alaska Native peoples (U.S. Department of Agriculture, Food and Nutrition Service, 2015). This was enacted as U.S. Code Title 25. Indians – Chapter 18. Indian Health Care – subchapter VI Miscellaneous – section 1685 (U.S. Office of the Law Revision Counsel, n.d.). The 2018 Farm Bill (or the Agricultural Improvement Act of 2018) then expanded protec-

tion from liability for the storage, preparation, donation, and serving of traditional foods (Kline, 2019).

Methods and Activities

The traditional ingredients in ANMC's meals are donated foods that have been hunted, fished or gathered as well as ingredients that have been otherwise procured. The seasonal nature of traditional foods and regulations regarding their harvest means that they may not be available on a regular basis for incorporation into standard operations. However, the addition of large freezer storage containers has vastly increased availability. Major food vendors in Alaska, such as Sysco and DiTomaso, and professional outfitters, commercial fishing operations such as FAVCO and Copper River Seafoods, have been engaged in the process by those working in traditional foods initiatives on issues such as legal purchasing of traditional foods and obtaining what some may consider waste, such as fish heads and bellies. ANMC can now accept most wild game meat and bones, such as caribou, moose, deer, sheep, goat, and beaver; most fish; seal meat and fat; and plants and berries, such as sour dock, spruce tips, blueberries, and lingonberries. Donated foods must comply with regulations such as fish being accepted only if it is whole and gutted and gilled, however, they may be with or without heads. Wild game must be whole, quartered, or in roasts, i.e., no ground meat is accepted. Plants and berries must be whole in either fresh or frozen form. Nothing is wasted, as leftover trim and items that are not served are shared with local organi-

zations as animal feed, such as the Alaska Zoo, also located in Anchorage (Alaska Native Medical Center, n.d.).

Amy Foote has developed and overseen traditional food programming since 2014. As the current Director of Indigenous Cuisine and Executive Chef for NANA Management Services (NMS), she has firsthand accounts of the process and spent years amongst food code and regulation discussions on municipal, state, and federal levels. In the kitchen, she has spearheaded the serving of traditional food dishes, such as providing patients with omega-3 fatty acids from salmon head broth (Lydon, 2023). She has also developed menus that include traditional ingredients and methods as well as creatively offered those ingredients in nontraditional dishes, such as fiddlehead fern pizza and tiramisu (the Italian dessert) made with chaga, an antioxidant-rich mushroom-like fungus that grows on birch trees, thus “chagamisu.” These types of traditional foods are part of the meal service that feeds up to 5,000 people a day on the health campus. Foote says:

“Our job is to heal people. We’re here to comfort them and nourish them back to health. They may be in pain. They’re vulnerable. They may have fear. Most have come a long way; some by boat, snow machine, small planes, through airports and cold places. Once they get here, they still have to go through processing: admittance, records—all in a new language (medical terminology), new words and acronyms. After all that, food plays an important role in bringing them comfort. Food is medicine.” (NANA Regional Corporation, n.d.)

Lessons Learned

NANA Management Services, which previously was the food service provider for ANMC, is very familiar with the long, multi-step process that must be endured to offer traditional foods safely. The arduous government certification process is redeemed by the experience witnessed in patients, who can be comforted by familiar, nutritious and culturally valued food while they receive health care services. Patients may be far from home during these often-challenging times (NMS, 2016). NMS also offers catering services that include traditional foods. For example, the 2023 Intertribal Agriculture Council Alaska Regional Summit held at the Alaska Native Heritage Center in November 2023 offered attendees from around the state cultural cuisine including dry reindeer meat, reindeer sausage, pickled beach asparagus, and boiled octopus thanks to NMS and Chef Amy (Intertribal Agriculture Council, n.d.).

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CHAPTER 6.

AMERICAN SAMOA

(COMING SOON)

About the Author



Pauline McFall

A recent graduate of the UH Mānoa PhD in Nutritional Sciences program,

Dr. Pauline M. McFall was a former CHL FST scholar whose research focused on children's diet in American Samoa. She currently serves as the Instructional Program Director and Community Nutrition Researcher at the American Samoa Community College, under the Agriculture, Community, and Natural Resources (Land Grant) division. She is a native American Samoan, born and raised, and currently lives there with her family.

Land Acknowledgement

Talofa, my name is Pauline Tuitele McFall

I am a native Samoan whose ancestors come from the islands of Tutuila & Manu'a American Samoa and the neighboring Independent Nation of Samoa.

At the moment I am a guest on the ‘āina of Manoa valley, Oahu Hawaii for the purpose of being a student at the University of Hawaii at Manoa. I would like to acknowledge that the ‘āina of Manoa is part of the larger territory recognized by Indigenous Hawaiians as their ancestral grandmother, Papahānaumoku.

It is certainly a blessing and honor to be a part of this ‘āina and this great university and the opportunity to learn from some of the best leaders and professionals who have provided service and knowledge to not only students, locals and natives of this ‘āina, but to the inhabitants and natives of the U.S. Affiliated Pacific Islands – including my home country of American Samoa.

I am grateful and honored to represent my home country of American Samoa and my native Samoan culture, which brings a unique and cultural perspective to my learning experiences here at the University of Hawaii at Manoa.

I would like to acknowledge my home ‘āina of American Samoa, which encompasses my immediate and extended families, my ancestors, my culture, and my community – all who have contributed greatly to the person that I am today. That it is who I represent and that is who I intend to reciprocate and apply the knowledge and wisdom I gain from this educational experience.

Chapter Statement

The content for the American Samoa chapter will be released in the next edition of the Pacific Food Systems for Children's Healthy Living OER.

CHAPTER 7. COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

About the Author



Hannah Isabel Shai Deleon Guerro

Hannah Isabel Shai Deleon Guerrero is a native of Saipan in the Northern Mariana Islands (NMI) and a student in the PhD Nutritional Sciences program at the University of Hawai'i at Mānoa. She is committed to improving child nutrition in the NMI through community engagement, research, and public health advocacy. Hannah's key areas of research include water security, food environments, dietary colonialism, and food and nutrition policy.

Land Acknowledgement

Tun Guelo yan Tan Guela kao siña yu kuentus para i taotao-ta. Si yu'us ma'åse'.

I acknowledge that the Mariana Islands are the rightful lands of the Indigenous people of the Marianas. I recognize that key world historical events have caused the separation of the Mariana Islands into the entities today known as the Northern Mariana Islands (NMI) and Guam. I recognize both the Chamorro and Refaluwasch people as descendants of the NMI.

I recognize inafa'maolek, which describes how the Chamorro people operate and embodies our cultural values of interdependence, reciprocity, harmony, and respect. I have experienced firsthand the benefits of such values and a culture that thrives in being there for others. For this reason, I am grateful and forever indebted to my ancestors and community who continue to bestow such gifts upon me that allow me to thrive today.

I recognize these privileges and I am grateful to those who have built this foundation for myself and others today. I recognize that it is critical to continue to build on this foundation so that others may continue to realize these privileges. I am committed to working with my community as we strive to ensure everyone has equal opportunity to thrive. I further recognize our responsibility to be steadfast and respectful stewards of our lands and natural resources for the generations yet to come. Siempre ta inafa'maolek.

Culture, Demographics, and Geography of Location

Culture

Note: Multiple spellings to denote the people and language of the Mariana Islands are used today including Chamorro and CHamoru. To align with the orthography utilized by the Northern Marianas Constitution and Chamorro-Carolinian Language Commission, the spelling Chamorro will be used throughout this chapter (CNMI Law Revision Commission, n.d.; Chamorro-Carolinian Language Policy Commission Act, 2007).

The ancient people of the Northern Mariana Islands (NMI) (formally the Commonwealth of the Northern Mariana Islands [CNMI]) are considered to be the Chamorros. The first inhabitants voyaged the Pacific from Southeast Asia and settled in the Marianas around 1500 to 1400 BC. Ancient Chamorro society operated according to a caste system, which included the chamori as the highest caste. The Spanish, who were among the first Europeans to arrive in the Marianas, coined the term Chamorro from the caste system

nomenclature and it is still used today (BBC News, 2023).

The most notable ancient Chamorro cultural artifacts are the latte stones, which are carved limestone pillars used for housing. These stones are made up of two parts: a top or cap structure called the *tasa* and a column or base structure called the *haligi* (Laguana et al., 2012). The latte stones can still be seen today across the Marianas, notably at the House of Taga on the island of Tinian, where some are still standing today. Although these structures no longer serve their original purpose, latte stones still remain today as cultural symbols of strength and resilience in the Marianas.

During Spanish colonization in the late 1600s and early 1700s, the Chamorro population suffered a severe loss of up to 95% caused by the introduction of infectious diseases (BBC News, 2023). To repopulate the islands in the 1800s, the Spanish allowed migrants from the Caroline Islands to settle in the NMI, who had been seeking refuge from natural disasters that devastated their islands (Alkire, 1984). The natives of the Caroline Islands brought with them their unique cultural traditions, practices, and language and came to be known as the Refaluwasch or Carolinians.

Both Chamorros and Carolinians share similar indigenous, traditional values that place importance on community and kinship. These cultural values are embodied in the Chamorro term *inafa'maolek* and the Carolinian term *Tipiyeew*. These values place importance on relationships, emphasizing interdependence, reciprocity, and cooperation. *Inafa'maolek* translates literally to “making it good for each other” (Cunning-

ham, 1992, p. 86). Tipiyeew, meaning “of one mind,” is used to describe solidarity and unity (Jackson & Marck, 2019). These cultural values are still widely held today and are central to family and community life.

Today, both the Chamorros and Carolinians are considered the major cultural groups in the NMI, as well as the official languages alongside English. This is clearly depicted in the official NMI flag, which has three major symbols: a latte stone, a mwarmwar, and a white star. The latte stone is a cultural symbol representing the Chamorro people. The mwarmwar, a handmade cultural floral headpiece, represents the Carolinian people. The white star is reminiscent of those on the United States (US) flag, representing the NMI’s relationship with the US.



Figure 7.1
Latte
stones at
the House
of Taga
located on
the island
of Tinian
Image by
[DAVIDRA
DICH](#) /
[Public
Domain](#)

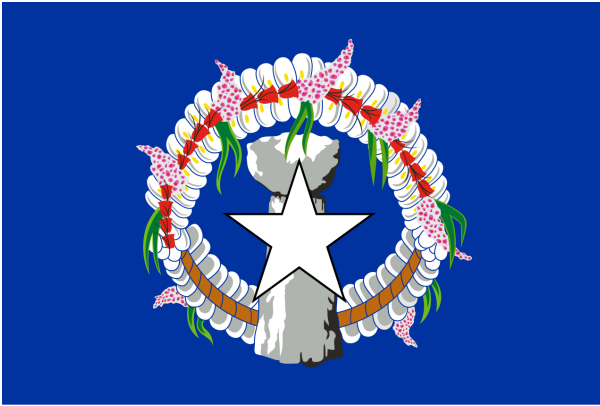


Figure 7.2
Official
flag of the
Northern
Mariana
Islands
Image by
[Sangjinh
wa /
Public
Domain](#)

Demographics

It is evident from ancient structures and historical accounts that Chamorros were healthy, thriving, and vigorous people. There was little to no evidence of severe illness or disease before external contact. Early accounts from missionaries in the 1600s estimate the Chamorro population at around 73,000 in the Marianas, which included Saipan, Tinian, Rota, and Guam. One account estimates a population of around 100,000. However, by the 1700s, there were only about 3,600 surviving Chamorros (Fritz, 1986). These historical accounts document the great decimation of the Chamorro people in the 16th to 18th centuries caused by infectious disease introduced by foreigners.

Over the course of various foreign occupations, many different ethnic groups arrived in the NMI. Most of these groups were brought to the NMI for farming dur-

ing agricultural development by foreign occupation, and included Japanese, Koreans, and Filipinos. Others arrived from other islands in Micronesia, seeking refuge from natural disasters on their islands.

Today, the demographic makeup of the NMI is primarily Pacific Islander and Asian. According to the 2020 US Census, the population consists of 25.4% Chamorro, 4.8% Carolinian, 32.7% Filipino, 13.9% other Asian, 13.5% other Pacific Islander, and 9.7% other race, including White and mixed race. Other Pacific Islanders in the NMI include Palauans, Chuukese, Kosraeans, Yapese, Marshallese, Pohnpeians, and Samoans. A majority of the population reside on the island of Saipan (92%), compared to Tinian (4%), Rota (4%), and the Northern Islands (<1%). The population has also decreased by 12.2% since 2010 (US Census Bureau, 2022).

Geography

The NMI is a 14-island archipelago located in the west Pacific, consisting of volcanic, limestone, and coral reef islands. It is part of the larger region in the Pacific known as Micronesia. From southernmost to northernmost, the islands are Rota, Aguiguan, Tinian, Saipan, Farallon de Medinilla, Anatahan, Sarigan, Guguan, Alamagan, Pagan, Agrihan, Asuncion, Maug Islands, and Farallon de Pajaros/Uracas. The islands are divided into 4 main municipalities: Saipan, Tinian, Rota, and the Northern Islands, which are all the islands north of

Saipan (Figure 7.3). Saipan is the capital and the largest, most populated island, consisting of 120 of the total 464-square-kilometer (sq km) land area of the NMI. Tinian (101 sq km) and Rota (85 sq km) are the two other major islands (Encyclopedia Britannica, 2023).

The Northern Islands are mostly volcanic islands. The most recently observed volcanic activities occurred in 2021 on Pagan and in 2003 and 2008 on Anatahan (Smithsonian Institution, n.d.). While volcanic characteristics dominate in the Northern Islands, primarily raised limestone originating from coral reefs make up Saipan, Tinian, and Rota. These coral reefs are abundant, highly diverse, and an important resource both economically and culturally (National Oceanic and Atmospheric Administration, n.d.).

The Mariana Trench, the deepest area in the world's oceans, is located east of the NMI. The trench is a vast, unique area and geologically very complex. Characteristics of the Mariana trench include undersea mud volcanoes, thermal vents, and extreme hydrostatic pressure (NOAA Fisheries, 2025). The Champagne Vent, which is found at the underwater volcano Northwest Eifuku, is one of only two known sites in the world that produces pure liquid carbon dioxide. The Daikoku Seamount, an undersea volcano, holds a pool of molten liquid sulfur, a phenomenon found nowhere else on Earth and only on Jupiter's moon Io. Despite these conditions, it is home to many life forms, many of which are yet to be discovered (NOAA Fisheries, 2025).

Because of its geological and geographical importance, the Mariana Trench Marine National Monument was established in 2009 (Figure 7.4). The 95,216-square-

mile area includes three units of protected submerged lands and waters. The Island Unit includes submerged lands and waters of the 3 northernmost islands of the NMI: Farallon de Pajaros, Maug, and Asuncion. The Volcanic Unit includes submerged lands within 1 nautical mile of 21 designated volcanic sites. The Trench Unit includes submerged lands extending from the northern limit of the NMI Exclusive Economic Zone (EEZ) to the southern limit of the Guam EEZ. The Mariana Trench Marine National Monument is cooperatively managed by the National Oceanic and Atmospheric Administration, US Fish and Wildlife Service, and the CNMI Government (NOAA Fisheries, 2025).

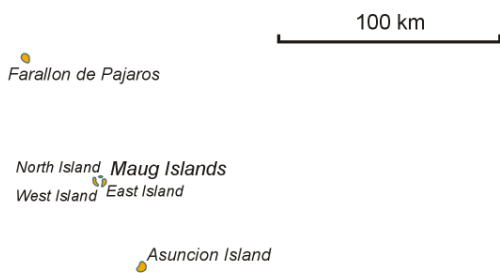
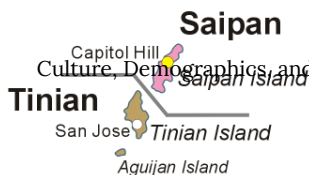


Figure 7.3
Map of
the
Northern
Mariana
Islands
Image by
[Aotearoa](#)
/ [CC](#)
[BY-SA 3.0](#)



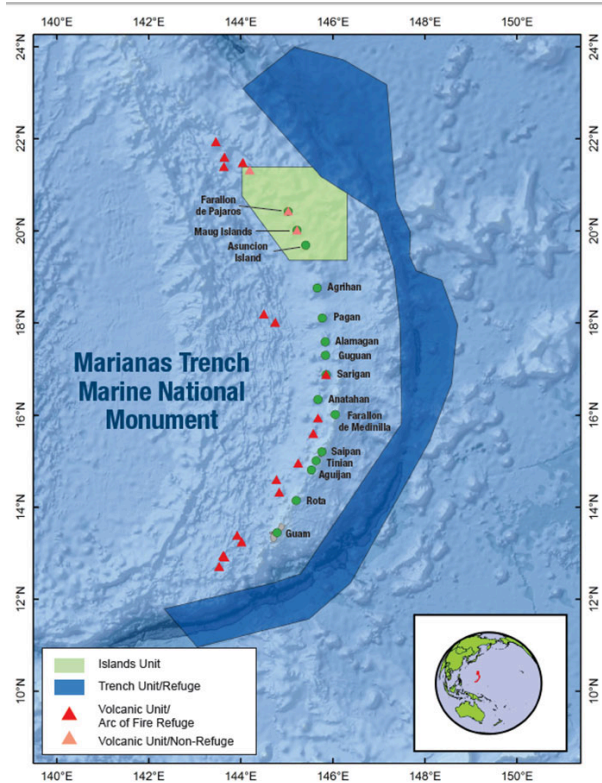


Figure 7.4
Map of
the
Marianas
Trench
Marine
National
Monumen
t
Image by
[NOAA](#) /
[Public](#)
[Domain](#)

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History

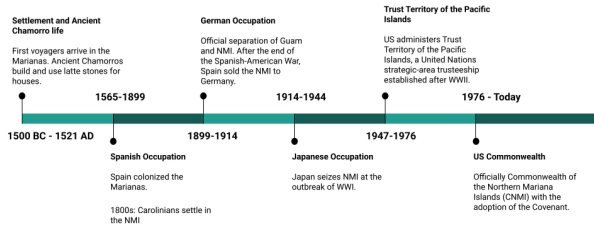


*Figure 7.5
High-level
timeline
of NMI's
history
with an
emphasis
on key
political
events
Image by
Hannah S.
Deleono
Guerrero
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Much of NMI history has been characterized by periods of occupation by various colonizers; much of the recorded history that can shed light on early contact and Indigenous life was written by Jesuit missionaries. As such, historical accounts written about the NMI are through a foreign lens and do not reflect Indigenous perspectives or values.

Before external contact and influence, the Mariana Islands consisted of the separate entities today known as the NMI and Guam. In 1565, the Spanish proclaimed sovereignty over the Marianas. However, permanent

colonization did not occur until 1668 with the arrival of Jesuit priests, accompanied by soldiers. The Marianas received its name during this time, after the Spanish regent Mariana of Austria (Encyclopedia Britannica, 2023).

The early years of Spanish occupation were marked by strife between the Spanish and Chamorros, who resisted Spanish rule, religious conversion, and baptism (Encyclopedia Britannica, 2023). Despite these early uprisings, the Spanish maintained sovereignty for the next 300 years, which is the longest historical occupation of the Marianas. Consequently, there remains heavy Spanish influence in Chamorro life, language, and culture.

In addition, the Carolinian people settled in the NMI during the Spanish occupation period around the 19th century (Encyclopedia Britannica, 2023). They settled in the NMI for various reasons, including repopulation due to Chamorro population decline and seeking refuge from natural disaster (BBC News, 2023; Pereda, 2015). The Carolinians settled on Saipan in the main village of Garapan beginning in 1815. They were migrants primarily from the islands of Lamotrek and Satawal, which were devastated by a typhoon. In 1870, a group of more than 200 Carolinians from the island of Namonuito Atoll settled north of Garapan in the village of Tanapag. By the 1950s, Carolinians constituted about a quarter of the population (Alkire, 1984). Today, both Chamorros and Carolinians are considered the Indigenous people of the NMI or NMI descendants. This is especially important in land considerations post-World War II.

Spanish occupation ended in 1899 after the Spanish-

American War, which marks the official separation of the Marianas. Guam was ceded to the US and the NMI was sold to Germany. The German occupation of the NMI was the shortest, lasting about 15 years. Their interest in the NMI was primarily for the production and exportation of copra, which later fell short of estimated potential. Although the German administration was the shortest in duration, several public improvement measures were imposed, such as the development of roads, schools, and a hospital (Bowers, 1950). These measures are among the most notable changes during that period.

The German occupation ended abruptly in 1914 when Japan seized the NMI at the outbreak of World War I (BBC News, 2023). Probably the most notable factor of Japanese occupation in the NMI was the mass production of sugarcane. During this time, there was an immense introduction of plantation workers. These events led to drastic shifts in the population, ways of life, and use of agricultural lands.

The US took control of the NMI in 1944 during World War II. At the end of the war in 1947, the NMI and other islands in Micronesia were designated as the Trust Territory of the Pacific Islands, which was to be administered by the US. Between December 1972 and February 1975, negotiations occurred between representatives of the NMI and the US to determine the NMI's political status. The final agreement, "Covenant to Establish A Commonwealth of the Northern Mariana Islands (CNMI) in Political Union with the United States of America", was approved by NMI voters in a plebiscite

and officially adopted and signed in March 1976 (Commonwealth Law Revision Commission, n.d.).

The Covenant outlined key factors in the political relationship with the US, including citizenship, taxation, US financial assistance, and requirements of the CNMI Constitution. The Constitution was drafted by elected delegates and became effective in January 1978. CNMI residents officially became US citizens in November 1986 (Commonwealth Law Revision Commission, n.d.).

One of the most notable agreements made in the Covenant and Constitution was the restriction of land ownership to persons of Northern Marianas descent. As outlined in the Covenant, this provision was enacted to protect Indigenous culture and traditions, to protect the NMI from exploitation, and to promote self-sufficiency (Commonwealth Law Revision Commission, n.d.). However, also outlined in the Covenant was a 50-year land lease agreement between the NMI and the US, which provided about 18,000 acres of land for national defense purposes. The land lease totaled about \$19.5 million for parts of Tinian (\$17.5 million), parts of the Tanapag Harbor on Saipan (\$2 million), and the entire island of Farallon de Medinilla (\$20,600).

Today, these lands are being utilized for military training and technology testing. In addition to these areas, the US military also utilize parts of the open sea and ocean surrounding the Marians for these purposes, an area known as the Mariana Islands Training and Testing Study Area (Mariana Islands Training and Testing Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement [EIS/

OEIS], n.d.). The Marianas has been described as being an ideal setting and advantageous location for military readiness activities in the Indo-Asia-Pacific region, which allows the US military to maintain “global and strategic presence” (U.S. Pacific Fleet, n.d.). Military use of the land and seas and its activities remain a highly controversial issue across the Marianas, including on Guam.



Figure 7.6
Audience
at the
signing of
the CNMI
Covenant
Image by
[Trust
Territory
of the
Pacific
Islands
Archives
Photograph
Collection
/ Public
Domain](#)

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Agricultural History and Food Evolution



Figure 7.7
Timeline
of the
Common
wealth of
the
Northern
Mariana
Islands
Pre-Conta
ct Period,
Contact
Period,
and
Post-Cont
act Period
Image by
Christina
Young /
[CC
BY-NC-SA
4.0](#)

Pre-Contact Period: Traditional Agricultural Systems and Foods

Farming, fishing, food gathering and other subsistence

ways of life were the primary agricultural systems for ancient Chamorros. It was understood and practiced that food and resources were used as needed, never taking more from nature than necessary (Cunningham, 1992). Food was exchanged and shared among people in reciprocal kinship and gift-giving, where all shared the products of their labor. These agricultural and food practices are rooted in the cultural values of *inafa'maolek* and *Tipiyeew* (CNMI Office of the Governor, 2024). Practices grounded in sustainability and regeneration allowed for the cultivation of various crops, including taro, banana, and yam. Tree crops were also available and required little effort and maintenance, such as breadfruit, mango, and coconut.

The cultivation of swamp taro required the most effort, as it had to be planted in muddy ground. Preparation of these areas required clearing and soil preparation. Ancient Chamorros utilized various types of thrust hoes for the preparation of land, including the *dagao*, *tanum*, and *bonga* (Cunningham, 1992). These tools were made from either wood or stone. It has also been posited that these cultivation methods were used to grow rice in muddy areas. Impressions of rice grains have been found in ancient Chamorro pottery, which is the primary indicator of rice cultivation (Cunningham, 1992). Rice cultivation in the NMI prior to foreign contact has been speculated, as it is a unique discovery and was not practiced by other Pacific populations.

The practice of agroforestry has also been documented as a means of producing food, described as “a complex and varied story culture of interplanted fruits and vegetables” (Bowers, 1950, p. 226). Agroforestry is

a land-use practice that combines agricultural production, tree crops, and forest plants on the same unit of land. It is a sustainable and productive cultural food production technique that has been utilized for centuries across the greater Micronesian region (Manner, 1993).

Thus, the traditional Chamorro diet consisted primarily of starchy vegetables, coconut, fruit, and seafood. Starchy vegetables, such as taro and yam, provided necessary carbohydrates and other essential nutrients. Protein foods were sourced primarily from the sea, including fish, shellfish, and turtles (Fritz, 1986). Other land-dwelling species that were eaten included coconut crab, fruit bat, and some birds. Some fruits were also available, such as bananas and mango (Cunningham, 1992).

In addition, each era of foreign influence and occupation in the NMI introduced foods that were incorporated into the local diet. Different sources of protein, such as beef, chicken, and pork, were introduced by the Spanish (Cassels, 2006). Other notable introductions include corn, sweet potato, and various fruits. These various introductions influenced traditional diets, complementing what was locally sourced with introduced foods. Aside from these minor changes and incorporations, there was little evidence of any major shifts away from the traditional diet during early occupations.



Figure 7.8
Cooked
locally
sourced
parrot
fish and
sweet
potato.
Parrot
fish is a
traditiona
l protein
source
and sweet
potato is
an early
introduce
d food,
both are
still
commonly
eaten
today.
Image by
Hannah S.
Deleon
Guerrero
/ [CC](#)
[BY-NC-SA](#)
[4.0](#)

Contact Period: Decline in Agricultural Lands and an Increase in Imports

Major changes in agricultural lands, lifestyle, and

imports occurred during the Japanese occupation, which spanned from 1914 to 1944. The Japanese governed the NMI under what was called the *Nan'yo cho* or South Seas Government. During this time, major commercial development occurred that changed the way of life drastically. Various businesses opened on Saipan, such as restaurants and specialty shops (Russell, 1983). As such, there was a rise in imported food and consumer goods. With the change in economy, jobs were also widely available for the local population to work for wages to supplement or sometimes replace subsistence living (Russell, 1983). However, there was much inequity between the local population and the Japanese in both wages and education (Russell, 1983). Despite working alongside one another, Japanese workers were paid higher wages. In addition, schools were segregated and of lower quality for the local population.

The most notable changes in agriculture were led by the *Nan'yo Kohatsu Kaisha* (NKK) also known as the South Seas Development Company. The NKK's primary interest in the NMI was the cultivation and exportation of sugarcane (Russell, 1983). Massive areas of land were cleared to accommodate sugarcane plantations and the necessary infrastructure for processing and exportation. By the 1930s, the sugarcane industry was well established and highly profitable. There were plantations on Saipan, Tinian, and Rota along with networks of railroads for transport to refining mills. It is estimated that sugarcane production accounted for more than 77% of the total value of all agricultural production on Saipan alone (Bowers, 1950). There was also dramatic population growth in order to support the industry

with foreign workers from Japan, Korea, and Okinawa. It is estimated that the total population in the 1930s was over 46,000 which included only about 4,000 Chamorros and Carolinians (Russell, 1983).

The Japanese governed the NMI until 1944 when the US took control during WWII. After the devastation of war, providing food to the surviving Chamorros, Carolinians, and other residents was of critical importance. There was a depletion of agricultural resources for local production, which necessitated the importation of food following the war. The post-war response, including administration of the Trust Territories by the US, have been criticized as promoting dependence on food imports and thus drastically shifting the traditional diet (Denman and Dewey, 1989).

One of the most important changes to the food system include the introduction of feeding programs in the 1960s, such as school lunches and those for limited-resource families (Englberger et al., 2003). There have been suggestions that these programs shifted food tastes and promoted the shift away from local, healthy foods (Cassels, 2006). Other critiques of these programs include that they disincentivized local agricultural production, disregarded traditional dietary preferences, and promoted the development of detrimental dietary and nutritional shifts (Denman and Dewey, 1989). Altogether, these factors point to increasing dependence on US imports.

By the 1970s, the strong reliance on local foods had diminished and the main sources of dietary energy came from imported foods. These imports consisted of energy-dense, nutrient-poor food, such as white rice,

refined wheat flour, canned meats, refined sugar, and other processed foods. These patterns persist today and are reflected in the typical diet. Today, it is estimated that over 90% of available food in the NMI is imported (Cabrera, 2020).

Agricultural and nutritional professionals in the NMI today, including major key players in the local food system, are avidly working towards increasing sustainability and self-reliance, which aim to promote food and nutrition security in the NMI (Northern Marianas College CREES, 2025). Such efforts are grounded in the United Nations Sustainable Development Goals and work towards improving and reclaiming the NMI food system for population and environmental health.

Post-Contact Period: Contemporary Food Production and Availability

Food Production

There are no major established food processing or production facilities in the NMI that contribute to sizable exports or mass availability of locally produced foods for community consumption. As such, value-added products made from locally sourced food are not widely available. Much of the food that is produced or har-

vested in the NMI is sourced from the land or sea, with little to no processing.

According to the 2023 Census of Agriculture, the NMI had 316 farms, a 25% increase compared to 2018. Farms that were included in the census were those that produced and sold at least \$1,000 of agricultural products. Only about 2% of total land, or 2,833 acres, in the NMI is utilized for farming. Compared to 2018, there was an increase of 1,318 acres, an increase of about 87%. The average farm size also increased by 50%, from 6 acres in 2018 to 9 acres in 2023. The majority of farmers identified as Chamorro (68%), male (82%), and are aged 55 or older (62%). The total value of agricultural sales was \$1.5 million in 2018 and \$2.8 million in 2023. The largest category of production, with sales of \$1.3 million, was vegetables and melons. The top produced vegetables and melons included cucumber, watermelon, eggplant, and tomato (National Agricultural Statistics Service, 2025).

An important source for locally harvested food in the NMI is its coral reefs. Coral reefs are important, as they provide both a source of food and cultural significance. It is a source of both subsistence and commercial fishing. The total value of NMI reefs was estimated between \$208,800 and \$1.4 million per year, based on household subsistence fishing (Beukering et al., 2006). In addition, fishing contributed about \$2.12 million to the NMI's 2014 gross domestic product (Coral Reef Conservation Program, 2018).



Figure 7.9
Mixed
catch of
Onaga,
Etelis
coruscans
(solid
color) and
Gindai,
Pristipom
oides
auricilla
(barred).
Image by
[M.
Trianni,
NOAA](#)



Figure 7.10
Various locally grown produce are available at the Garapan Public Market, a farmers' cooperative dedicated to promoting locally grown produce and harvested foods.
Image by Hannah S. Deleon Guerrero / [CC BY-NC-SA 4.0](#)

Food Assistance

Food assistance programs are administered in the NMI through funding from the US Department of Agricul-

ture's Food and Nutrition Service (FNS). NMI funding for these programs is unique compared to that received by states and other territories in that the majority of programs are funded by block grants. The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is the only program funded and operated similarly to states and other territories, which was funded later than other food assistance programs.

The Nutrition Assistance Program (NAP) is administered in the NMI in lieu of the Supplemental Nutrition Assistance Program (SNAP) through a capped block grant program. The funds are used for both food assistance benefits and administrative costs of the program. Because the program is funded under a capped block grant, an increase in eligible participants may lead to a decrease in participant benefits. In Fiscal Year 2023, the NMI received \$30 million for serving about 12,800 participants monthly (USDA Food and Nutrition Service, 2023).

The NAP block grant program allows flexibility for the NMI to implement a program that best fits the needs of the population. The program sets its own rules, which is approved by FNS every year through a memorandum of understanding. One unique characteristic of the NMI NAP program is the benefit percentage allotments for certain food categories. For all program participants, 30% of benefits are allotted for the purchase of local commodities. These include locally produced food and allow for the purchase of fishing equipment, garden supplies, and livestock (USDA Food and Nutrition Service, 2023).

Child food assistance programs are funded through a

Nutrition Assistance Grant (NAG) administered by the CNMI Public School System Child Nutrition Program (CNP). Programs implemented through the NAG are the School Meals Program, Summer Food Service Program, and Child and Adult Care Food Program. CNP currently serves 20 public schools, 9 Head Start centers, 6 Early Head Start centers, and 19 private schools and daycare centers. Beginning in summer 2024, the NMI will also receive funding in addition to the NAG for the Summer Electronic Benefit Transfer (EBT) Program, which will provide summer food for eligible children. An estimated 11,000 children will be eligible to receive food assistance through the Summer EBT program (CNMI Public School System, 2023).

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Overall nutrition and health status of children

The overall health status of children in the NMI is indicative of the dietary and nutritional shifts of the population over the last 60 years. There has been change in school nutrition, primarily through the implementation of the National School Lunch Program guided by the Dietary Guidelines for Americans. Other important programs aimed to improve the health of children in the NMI occur through the Special Supplemental Nutrition Program for Women, Infants, and Children and the Title V Maternal and Child Health Block Grant Program.

There is a lack of rigorous dietary assessment among middle and high school students in the NMI. The Youth Risk Behavior Survey (YRBS) is the primary data collected to assess health in this population. According to the 2021 NMI YRBS, 42% of middle school students described themselves as slightly or very overweight. Among high school students, about 43% were overweight or obese. About 72% of high school students also report drinking soda or pop in the last week. Only about 9% of high school students report not eating fruit or vegetables in the last week (CDC, 2021).

Much of the information on dietary and nutritional factors among NMI children is available from the Children's Healthy Living (CHL, 2025) study. The study aimed to measure and address childhood obesity across

the US Affiliated Pacific Region. CHL collected both individual- and community-level data, which included diet and anthropometric measures. According to the CHL study, the prevalence of obesity among 2 to 8 year-olds in the NMI was about 16.2% (Novotny et al., 2016). Dietary assessments showed that few children met recommendations for vegetable (1.5%), fruit (41.9%), and milk intake (2.6%) (Novotny et al., 2022). Most children met intake recommendations for grains (96%) and meat (76%). The most frequently consumed foods across all food groups included white rice, soy sauce, fruit juice, 2% milk, and chicken. Overall diet quality for children ages 2 to 8 was estimated utilizing the Healthy Eating Index-2005 (HEI-2005) and was about 61 after adjusting for age and sex (Dela Cruz et al., 2023). HEI-2005 reflects the 2005 Dietary Guidelines for Americans and is a measure of adherence to the guidelines out of a maximum score of 100. It was selected over more recent versions of the HEI because the 2005 version was the latest version available at the time of data collection (Dela Cruz et al., 2023).

The study showed promise in decreasing the prevalence of obesity through implementation of a multi-level, multicomponent community intervention (Wilken et al., 2013). The success of CHL's intervention indicates that efforts to address child health must be comprehensive, addressing all levels of the social ecological model from individual to policy factors (Novotny et al., 2018).

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Community Highlight: Sustainable Fresh Greens in Coral Coast Hydroponics Farm for the CNMI Public School System

*Sustainable Fresh Greens in Coral Coast
Hydroponics Farm for the CNMI Public School
System*

Program/Project Description

Overall, there is an underutilization of land for food production in the NMI coupled with high levels of food imports, which negatively impacts the food system, economy, and health of NMI residents. The Coral Coast Foundation Corporation's (CCFC) *Sustainable Fresh Greens in Coral Coast Hydroponics Farm for the CNMI Public School System*

(PSS) project aimed to address this need by establishing a functional hydroponic farm to grow and serve hydroponic lettuce to reduce reliance on imports and provide PSS with access to produce that is locally grown, sustainable, and nutritious.

The CCFC project was selected as one of five projects across the Pacific region for the Children's Healthy Living Food Systems Extension and Outreach Pilot Projects (Children's Healthy Living Center, 2025). Projects were selected by local advisory committees based on their ability to engage and empower communities to influence the food system to support the health of young children in the US Affiliated Pacific.

Methods and Activities

The project's main objectives were to establish an operational hydroponic farm and engage with the community regarding local food production. A key activity included a workshop for PSS students to reinforce the importance of nutrition and locally sourced food. The project will also conduct qualitative assessments among stakeholders and PSS students regarding the taste and overall experience with the hydroponic lettuce. The estimated production capacity of the hydroponic farm is about 100 to 200 heads of lettuce per week. An estimated 400 pounds of lettuce monthly were provided to PSS.

Lessons Learned

The project was implemented and evaluated from March 2024 through February 2025. In October 2024, CCFC held the official project and ribbon cutting ceremony of the Coral Coast Hydroponics Farm, which was attended by local officials and community members. CCFC emphasized the importance of partnership throughout the project, including the Division of Agriculture and the Northern Marianas College Cooperative Research, Extension, and Education Services. Such partnerships helped to address challenges and improve operations of the hydroponic farm. The project completed 6 lettuce harvests, which was provided for use in PSS school lunches. An average of 364 pounds of lettuce was distributed to the schools, which served over 2,000 students.

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Community Highlight: Health Ministry Policy

Health Ministry Policy

Program/Project Description

The Roman Catholic Diocese of Chalan Kanoa (RCDCK) is a diocese of the Catholic Church in the NMI. In January 2018, a critical partnership was initiated and formed by key partners, including RCDCK's Bishop, the Commonwealth Healthcare Corporation, and the Northern Marianas College – Cooperative Research Extension and Education Services. As a result of this partnership, RCDCK formulated and implemented a Healthy Ministry, along with a policy aimed to improve the health of church members.

Methods and Activities

The policy outlines activities and strategies overseen and implemented by the Health Ministry to promote healthier habits and a healthier environment in churches and during RCDCK events. There are 4 major areas addressed in the policy: healthy foods and beverages; education and out-

reach; physical activity; and tobacco and betel nut use. Key guidelines in the healthy food and beverages area include serving only water, coffee, or tea and serving at least one type of fruit or vegetable at all RCDCK functions (Roman Catholic Diocese of Chalan Kanoa, 2018). The Health Ministry has also hosted an annual 5K walkathon since 2018, which brings the community together for physical activity, offers preventative health screenings, and features various health-related resources for community members.

Lessons Learned

Although there has been no formal evaluation of the activities conducted by the Health Ministry, the Health Ministry's 5K Walkathon is hosted every year along with a health fair for health education and screenings available for participants. In 2019, over 500 community members participated in the event (Diocese of Chalan Kanoa, 2020a). This number rose to around 800 in 2020 (Diocese of Chalan Kanoa, 2020b). The most recent walkathon was hosted in November 2025 (Diocese of Chalan Kanoa, 2025).



Figure 7.11
Community members participating in the Diocese of Chalan Kanoa's annual 5K Walkathon on November 15, 2025. Courtesy of [Diocese of Chalan Kanoa](#)

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CHAPTER 8. GUAM

About the Author



Kristi Hammond

Kristi is a PhD student in the Nutritional Sciences program at the University of Hawai'i at Mānoa. She received her MS in Sustainable Agriculture, Food & Natural Resources (Food and

Nutrition track) from the University of Guam and her BA from Smith College. Kristi hopes to contribute to existing efforts to improve nutrition and strengthen food systems in Guam, where she was raised.

Land Acknowledgement

I am a settler on the island of Guåhan (Guam) who has the privilege of calling it home. I acknowledge that

Indigenous CHamorus continue to steward, as they have throughout time, the land, water, and air of the place that is dear to me. I recognize the space my presence takes up, the resources I have benefited from, and express my deepest gratitude for the people and their lands who have shaped me today. I commit to constant listening and learning, self-reflection, and the devotion of time and resources to promote the sustainability and resiliency of the island of Guåhan in a way that prioritizes Indigenous CHamoru perspectives and values.

I recognize that the evolution of Guåhan's food system has been shaped over centuries as a result of complex histories of colonization and westernization, which cannot sufficiently be captured in a single textbook chapter. As a non-indigenous person who calls Guåhan home, it is my responsibility to deepen my understanding of these complexities. I recognize the resiliency of the people of Guåhan both past and present in preserving and revitalizing traditional and sustainable food practices. My hope is that I can contribute to these ongoing efforts.

Si Yu'os ma'åse'.

Cultural, Demographics, and Geography of Location

Cultural Characteristics of the Location

Note: Multiple spellings to denote the island of Guåhan and the people and language of the Mariana Islands are used today including Guåhan and Guam as well as CHamoru and Chamorro. To align with the orthography adopted by the Kumisión i Fino' CHamoru yan i Fina'nå'guen i Historia yan i Lina'la' i Tåotao Tåno' (Commission on CHamoru Language and the Teaching of the History & Culture of the Indigenous People of Guam), the spellings CHamoru and Guåhan will be used throughout this chapter (Kumisión, 2020).

The CHamoru people are the Indigenous people of the Mariana Islands, which includes the island of Guåhan as well as the Northern Mariana Islands, having settled in the region over 3,600 years ago (Vilar et al., 2013). Divergent experiences of colonization throughout history led to the division of the Mariana Islands into two politically separate bodies. In the CHamoru language, Guåhan, commonly known as Guam, means “having” or “we have.” The word Chamorro was not a

term used by the indigenous people of the Marianas to describe themselves or their language. Rather, it was a name introduced by the Spanish during its colonial occupation (Kumisión, 2020). CHamoru language terms describing its people including *i Taotao Tåno'*, meaning the People of the Land, as well as *i Taotao Tåsi*, meaning the People of the Sea, reflect the connection of indigenous CHamorus to both land and sea. Ancient CHamorus were skilled navigators and canoe builders, which enabled them to settle in the region, engage in inter-island travel and trade, and fish beyond the reef (Bevacqua 2024; Goetzfridt 2024).

The legend of Puntan and Fu'una, brother and sister gods of creation, is an important account in CHamoru oral history (Hattori, n.d.). In it, the siblings used their supernatural powers to create the world, life, and the first people from their own bodies. From Puntan's body, Fu'una created the earth, the sun, and the moon. From her own, she brought life to the earth and sacrificed her body to create Fouha Rock. Fouha Rock, or Laso Fu'a, found in the southern part of the island, has been referred to as Creation Point and remains a place of significance today (Taitingfong & Marsh-Taitano, n.d.). The creation story of Puntan and Fu'una not only describes how things came to be, but reflects socio-cultural values of respect for both men and women as influential and essential members of society, a balance which extends beyond mythology and shapes social systems and even governance.

The cultural values of *inafa'maolek* (striving for harmony) are considered core principles in Guåhan and impact how people interact with one another, their

communities, and the environment (Hattori, 2011; Perez-Iyechad, 2024). Cunningham (1992) translated *inafa'maolek* to “to make good” and described it as encompassing values of interdependence, reciprocity, and preservation of social harmony. In contrast with western or American individualism, CHamoru interdependence prioritizes collective values and community gain over the individual. *Inafa'maolek*, in its simplest form, can be seen in day to day displays of generosity and reciprocity, for instance, in the sharing of food and feeding of others. It can also be seen as the underlying framework in collective efforts and activism against hegemonic discourse and the ongoing cultural and environmental destruction resulting from persisting colonization (Na'puti & Bevacqua, 2015; Oberiano & Ong, 2022). In addition to *inafa'maolek*, deep levels of respect for elders, ancestors, the environment, and CHamoru culture are clearly seen in Guåhan to this day.

Demographic Characteristics of the Location

Over time, the demographic makeup of Guåhan's population has shifted significantly as a result of colonization, immigration, and emigration. These shifts have diversified Guåhan's population, influencing the culture and cuisine of the island. The most recent 2020 Census estimates Guåhan's current population to be approximately 153,836 people, about a 3.5% decrease from 2010

estimates (U.S. Census Bureau, 2022). CHamorus make up 41% of the population (alone or in combination with other races) followed by Filipinos at 35.3% of the total population. Other race and ethnic groups living in Guåhan include Chuukese, White, as well as smaller percentages of Palauan, Pohnpeian, Yapese, Korean, Japanese, and Chinese individuals.

Migration from other islands across Micronesia such as the Federated States of Micronesia (FSM, which includes Yap, Chuuk, Pohnpei, and Kosrae), Palau, and the Marshall Islands as part of Compact of Free Association (COFA) agreements have played a role in shifts in demographic makeup over time (Bureau of Statistics and Planning, 2022). Additionally, emigration at various times throughout history has led to an efflux of CHamorus from Guåhan to the continental U.S. for a multitude of reasons, including military service, and greater economic and education opportunities (Untalan, 2023). As a result of this, a significant number of CHamorus live outside of the Marianas. Today, the largest CHamoru communities can be found in the states of California, Washington, Texas, Hawai'i, and Nevada (U.S. Census Bureau 2023). Many diasporic CHamorus have continued to create community ties and maintain connection to cultural practices of home and across the Marianas and the broader Micronesian region (Bennett, 2022).

Geographic Characteristics of the Location

Guåhan (13° N, 144° E) is the largest and southernmost island of the Mariana archipelago and largest in the broader region of Micronesia. The island is roughly 30 miles long and 4 to 10 miles wide (approximately 212 square miles) with the most narrow point occurring in the center region of the island.



8.1 Map of Guåhan
Image by [United States Department of the Interior / Public Domain](#)

Another CHamoru legend, The Young Maidens That Saved Guam, describes how the island developed its unique shape (Guampedia, 2024). In it, a giant fish steadily eats away the island from both sides, forming Hagåtña Bay to the west and Pago Bay to the east. To prevent the island from being split into two, fishermen set out to capture the fish to no avail. A group of women then gathered together to weave a net made from the lengths of their hair. They sang songs with their beautiful voices to lure the giant fish and cast the net they weaved to capture the fish, thus protecting their island from being eaten further. There are various renditions of this story, all which subtly reflect the strength of women in society as well as the strong desire to protect the land.

The geographical features of the island vary by soil type and topography, with the northern region generally consisting of flat land and slightly alkaline limestone and the more mountainous southern region consisting of slightly acidic, volcanic soil (Young 1988; Marutani et al., 1997). The island's tropical climate is hot and humid year-round and the seasons are distinguished by the amounts of wind and rainfall. Fañomnåkan, the dry season, runs from January to June while fanuchånan, the rainy season, occurs between July and December (USGS, 2015). In this climate, many fruits and vegetables can be grown year-round, and some are notorious for their seasonal availability, such as mǎngga (mango; *Mangifera indica*) and alageta (avocado; *Persea americana*). On average, one typhoon and three tropical storms are estimated to pass in close proximity to the island every year (USGS, 2015). Throughout history, the

frequency and severity of natural disasters has had serious implications for agriculture, in addition to the deleterious impact on communities and infrastructure more generally (U.S. NOCC, 1991). Thus, the climate, seasons, as well as propensity for storms and typhoons in the region present both opportunities and challenges for Guåhan's food system.

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Political History

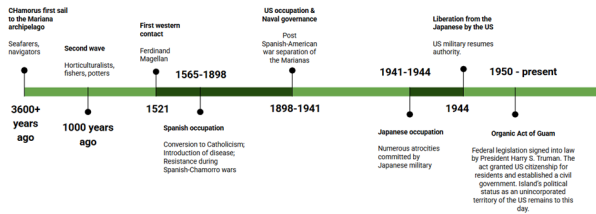


Figure 8.2
High level
timeline
of
Guåhan's
history
with an
emphasis
on
significan
t events
shaping
political
history
Image by
Kristi M.
Hammond
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[BY-NC-SA](#)
[4.0](#)

Ancient CHamoru society was based on matrilineal clan and caste/class systems (Tolentino, 2024a). Several aspects of ancient CHamoru society, including the caste system and lineage, influenced the way in which access to land and water were determined. Land ownership and access to ocean resources, in particular, was limited to the matao, the highest ranking clan members of the upper caste chamorri. Members of the man-achang, the lowest class within the caste system, were

only able to access resources if granted permission by the matao. Where one resided was dependent on lineage, and land was transferred through the maternal line (Tolentino, 2024b). Furthermore, ancestral lands were maintained by clans, rather than single lineages.

Spanish Colonial Era (1565-1898)

It is estimated that in 1521, the Portuguese explorer Ferdinand Magellan landed in Guåhan during his circumnavigation of the world, and the island was claimed by Spain in 1565 (Madrid, 2024; Farrell, 1986). Thus began intermittent contact and trade over the next 150 years until the 1660s, which marked a shift in Spanish colonial efforts and the prelude to the Spanish-Chamorro Wars. The arrival of Jesuit missionaries, including Father Diego Luis de San Vitores in 1668, resulted in the catholicization of the region and the introduction of Jesuit policies, known as the *reducción* (reductions). The *reducción* facilitated the movement of people into restructured villages centralized around the church (Wiecko, 2013). Close to the *reducción* villages were farms established and managed by the missionaries where CHamorus were taught European agricultural practices and animal husbandry techniques. Prior to this, CHamoru concepts of land ownership were based on community and family ties, drastically different from Spanish ideas of private and government-owned land, illustrating one example of marked differences in the

belief systems of the two groups (Evans-Hatch & Associates, 2004).

Forced relocation and changes to cultural beliefs and practices, in the name of Christianity, were opposed and actively resisted by many CHamorus. From 1670 to 1697, there was ongoing fighting between Spanish colonizers and CHamoru resisters during the period of the Spanish-Chamorro Wars (Evans-Hatch & Associates, 2004). As a result of the nearly three decades of violence, as well as the introduction of many diseases through European contact, the CHamoru population was severely decimated. The native population of Guåhan was estimated to be around 12,000 in 1668 and 1,800 by 1690 (Evans-Hatch & Associates, 2004).

Jesuit missionaries were expelled from the island in 1769, but their policies had drastically shaped culture, religion, and day-to-day practices, including those related to agriculture and food production (Wiecko, 2013). Religious administration fell to the Augustinian Recollect friars, another Catholic order, while Spanish military administration remained as well. For the next century, Guåhan would be a stopping point for expeditioners and traders from various nations, including European trade and scientific expeditions, and U.S. whaling and trade (Evans-Hatch & Associates, 2004). The island remained a Spanish possession until 1898.

U.S. Naval Occupation (1898-1941)

Following over 300 years of Spanish occupation, the U.S. captured Guåhan in 1898 as part of the expansion of their power in Central America and the Pacific following the Spanish-American War (Corbett et al., 2015). With interests in trade and naval dominance, the U.S. gained possession of the island of Guåhan, as well as other former Spanish colonies, upon the ratification of the Treaty of Paris in 1899 (Evans-Hatch & Associates, 2004). The Treaty of Paris granted the U.S. Congress complete control over any matters, including those concerning civil rights and political status (Lillian Goldman Law Library, 2008). It was at this time that Guåhan and the Northern Mariana Islands became separate entities, with the latter being sold to Germany. For the next 43 years, the U.S. Naval government would maintain control over the island of Guåhan, shaping both the health and agricultural systems of the island (Hattori, 2004; Marutani et al., 1997).

World War II and Japanese Occupation (1941-1944)

On December 8, 1941, shortly after the attack on Pearl Harbor in Hawai‘i, the island of Guåhan was invaded as part of Japanese efforts to militarize the Pacific. Two days later, the island was surrendered to Japan by the

U.S. naval governor at the time. Initially, the Japanese sought to establish an outpost in Guåhan with goals of peace and order, and self-sufficient acquisition of resources for its military, akin to its efforts in other Pacific Islands (Camacho, 2011). However, partly attributable to the island's previous affiliation with the U.S., efforts to eradicate the presence of American culture and symbolism and demand CHamoru loyalty to Japan became increasingly violent and abusive. By 1944, Japanese efforts were faltering, and the Kaikontai—a “quasi-military group specializing in agriculture”—was brought in. Its arrival marked the introduction of much stricter policies, including school closures, forced labor, and the forced relocation of people to concentration camps (Marutani et al., 1997; National Park Service, n.d.; Palomo, n.d.). During this dark time in history, the CHamoru people endured numerous atrocities committed by the Japanese military. Regardless of what views CHamorus held of the U.S. prior to World War II, the harshness and violence of Japanese wartime efforts and policies instilled in many an appreciation and nostalgia for the U.S. (Camacho, 2011).

Post World War II and Political Status (1944 – Present Day)

On July 21, 1944, which is now commemorated as Liberation Day, the U.S. reoccupied the island of Guåhan. Several years later, the Organic Act of 1950 granted self-

governance to the Government of Guam and citizenship to the people, albeit with limitations. Despite being considered U.S. citizens, individuals are unable to vote for president, if residing in Guåhan. Although a delegate is elected to Congress in the House of Representatives, they are unable to vote on legislation introduced to the full House, but may introduce policies, lobby for positions, and vote within House committees. Officially, Guåhan is considered an unincorporated territory, meaning it is technically considered a possession of the U.S. and the U.S. Constitution applies in a selective capacity.

Guåhan's current political status as an unincorporated territory means that it is one of 17 non-self-governing territories identified by the United Nations and has remained on this list since 1946 (United Nations, 2024). In 1997, the Commission on Decolonization was established and has since worked towards self-determination efforts (Commission on Decolonization, n.d). The island's future political status—whether independence, free association, or statehood—remains undecided, and each option could have significant implications for the food system.. Due to the relatively close proximity to the Asia-Pacific region, including countries such as China, Japan, and the Philippines, Guåhan is viewed as a strategic asset of the U.S. and the island continues to face threats to this day given the political climate and ongoing tensions in the region. Close to one-third of the island remains occupied by the U.S. military.



Figure 8.3
Current
military
presence
in
Guåhan
identified
in white
Image by
US Navy
/ [Public
Domain](#)

Although this section has provided only an abbreviated history of Guåhan's experience with other nations, it is important to state explicitly that the many years of occupation and colonization experienced by the people of Guåhan, both past and present, are intrinsically tied to the ways in which the food system has evolved and continues to be shaped today. Furthermore, ongoing militarization and a non-self-governing status are important contextual factors that may influence efforts towards achieving food sovereignty. This brief overview of some of the key points throughout Guåhan's history is intended to provide the critical background context

needed before describing specific changes to the island's overall food system that were influenced by these historical periods.

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Agriculture History and Food Evolution

The changes throughout Guam's agricultural and food systems history will be presented in three time periods: pre-contact, contact, and post-contact periods (see Figure 8.4). For consistency with other case study chapters, post-contact will be defined as the date in which current political status and affiliation with the U.S. commenced (e.g. territorial status).



Figure 8.4
Timeline
of Guam
Pre-Contact
Period,
Contact
Period,
and
Post-Contact
Period
Image by
Christina
Young /
[CC
BY-NC-SA
4.0](#)

Pre-Contact Period (prior to 1521): Agricultural Systems and Traditional Foods

Prior to colonization, the CHamoru diet was predominantly plant-based and consisted of root crops such as suni (taro; *Colocasia esculenta*) and dagu (yam; *Dioscorea* spp.), fruit from trees such as lemmai (seedless breadfruit; *Artocarpus atilis*), niyok (coconut; *Cocos nucifera*), and aga/chotda (banana; *Musa* spp.), dark leafy greens such as hãgon suni (taro leaves) as well as small quantities of a variety of seafood and crustaceans (Pollock, 1986). Many of these staple plant foods were either native to Guåhan or introduced to the Marianas by the CHamorus (Cunningham 1992). The traditional diet indicated that it was high in fiber, moderate in sodium, sugar, and saturated fat, hallmarks of what is promoted as a nutritious and healthy diet today. Traditional methods of food preparation included baking in earth ovens, drying, and boiling. Notably, breadfruit was preserved through drying, however not via fermentation, a distinction from the preparation techniques seen in many other Pacific Islands (Atchley & Cox, 1985; Pollock, 1986). Several other foods including fadang (federico or cycad nuts; *Cycas micronesica*) and gabgab/gapgap (Polynesian arrowroot; *Tacca leontopetaloides*) were eaten during times of scarcity such as after typhoons or during periods of famine. Both fadang and gapgap were ground into flours, but due to the toxins present in fadang nuts, additional preparation was

required. The nuts were first soaked in water to extract the toxins, then dried, and finally, ground into flour. Coconut was processed into oil and milk and used in the preparation of other dishes. Fa'i (rice; *Oryza sativa*) is thought to have been grown in Guåhan as early as 1526 AD though it appeared to be primarily eaten during special occasions such as fiestas (party or gathering), for ceremonial purposes, or used in trade (Hunter-Anderson et al., 1995; Pollock, 1985). Though rice is no longer cultivated today, imported rice remains a staple of diets in Guåhan.

Much of the documented information about pre-contact agricultural systems is based on a mixture of archaeological evidence from pre-contact time periods, namely from what is referred to as the Latte Period or Era (AD 900-1521), as well as early reports from outsiders post-contact. There is limited archaeological evidence from the Pre-Latte Era. Pre-contact agricultural systems were smaller scale, and subsistence farming in gardens and plots would have included root crops and tubers, and other field crops, along with fruit bearing trees. These garden plots likely were located away from the coastal villages along nearby hills or in cleared areas of jungle (Dixon et al., 2012; Moore et al., 2024). Some plant species, such as sunen ba' ba' (swamp taro; *Cyrtosperma edule*) and other crops requiring wetland environments, were likely grown separately (Dixon et al., 2012). Specific agricultural techniques such as slash-and-burn may have been implemented pre-contact, though evidence is unclear (Moore et al., 2024).

A variety of tools made from stone, fishbone, shells, and bamboo were implemented for agricultural and

food production purposes (Tolentino, n.d.). Weaving with the leaves of coconut palms and pandanus was also common to make items used to hold food, such as a kottot (rectangular basket), or even cook foods (e.g. rice) in, such as a katupat (diamond shaped pouch). Some wooden agricultural tools for planting and harvesting included the dagao and tanum, long hoe-like tools with sharp, pointed ends, and the akao, a shovel-like tool with a blade (Tolentino, n.d.). To process plants for culinary or medicinal use, lusong (mortars), lommok (pestles), and guasa'on (grindstones) were made from large stones (Tolentino, n.d.). Pottery made with clay was also used for storing and cooking food, with pots increasing in capacity over time from Pre-Latte to Latte Period, suggesting larger quantities of foods being prepared with growing populations or settlement size (Moore, n.d.; Tolentino, n.d.).

Contact Periods (1521-1949)

Spanish Colonial Era (1565-1898)

As part of the *reducción* policies during the Spanish colonial era, CHamorus engaged in agriculture on a larger scale on the plots they worked under Jesuit missionary management (Wiecko, 2013). Though largely still subsistence farming in nature, many new crops and animals were introduced during this time, which would

influence what was grown and eaten. The Jesuits introduced crops such as ilotes/maï'es (immature corn kernels/mature corn kernels; *Zea mays*), chupa (tobacco; *Nicotiana tabacum*), kakao (cacao; *Theobroma cacao*), mendioka (cassava; *Manihot esculenta*), and kamuti (sweet potato; *Ipomea batatas*) (Pollock, 1985). Many of these foods, such as corn and sweet potato, were initially thought to have been introduced as a means of providing food for missionaries and soldiers (Pollock, 1985), but were gradually adopted into the local diet. For example, corn was ground into a meal to be made into a variation of titiyas, or tortilla, a common food to this day. Other plant foods introduced by the Spanish included tumâtes (tomato; *Lycopersicon esculentum*), âbas (guava; *psidium guajava*), laguanâ (soursop; *Annona muricata*), âtes (sweetsop; *Annona squamosa*), donne' (chili pepper; *Capsicum annum*), alageta (avocado; *Persea americana*), piña (pineapple; *ananas comosus*), and papâya (papaya; *Carica papaya*) (Cunningham 1992).

In addition to plant foods, the Spanish introduced livestock management of domesticated animals such as horses and karabao (carabao, water buffalo), and other animal protein sources including mannok (chicken), babui (pig), and binadu (deer) (Cunningham 1992). Tools made of metal such as lulok (iron), for instance, the machete, were incorporated into agricultural and food production practices during this time (Bevacqua, n.d.). Agricultural techniques such as slash-and-burn and hedging were also introduced (Wiecko, 2013).

In response to the reducción, CHamorus who maintained access to their lands began to practice a “dual-residence system of land use” (Bayman et al., 2020, p.

229). In addition to working Jesuit plots and participating in village life, many CHamorus engaged in small-scale farming on their lãnchos, or ranches (Bayman et al., 2020). Families, who were able to do so, engaged in farming and food production, as well as cultural practices and traditions, away from reducción villages and away from colonial eyes (Bayman et al., 2020). Because of the reducción policy, the lãncho came to symbolize resiliency, a meaning it retained even after the Spanish colonial period.

U.S. Naval Occupation (1898 -1941)

The U.S. Naval government encouraged agricultural production as a means of self-reliance as well as export. During most of this period, approximately 60% of the male population were working in the agricultural sector, with the remaining holding government or military jobs, reflecting a decline in farming (Marutani et al., 1997). Development projects included the creation of an experimental agricultural station and the establishment of a farmer's market in Hagåtña (Marutani et al., 1997). The primary export was copra, or dried coconut meat, sent to the U.S., Japan, and the Philippines, though this market eventually collapsed (Marutani et al., 1997; Bucayu-Laurent & Hollyer, 2016). Other fruit and tree crops were exported as well including but not limited to bananas, pineapples, coffee, breadfruit, though at a much smaller scale (Marutani et al., 1997). Additional

crops grown during this time included field corn, sweet potato, taro, yam, tobacco, cassava, rice, arrowroot (an introduced commercial cultivar, *Maranta arundinacea*), and sugarcane (Marutani et al. 1997; J. Tuquero, personal communication, October 28, 2025). A large amount of food continued to be imported during this time – prior to the Japanese invasion in 1941, food was estimated to be the largest import expense at approximately 39% of total expenditure (Marutani et al., 1997).

World War II and Japanese occupation (1941-1944)

During the Japanese occupation, food imports were not available and small scale agriculture was a necessity (Marutani, 1997). With the implementation of the *kaikontai* government, an agricultural unit was tasked to increase food production for Japanese soldiers (National Park Service, n.d.; Marutani, 1997). This brought mechanized farm equipment including tractors, plows, and cultivators (Palomo & Aguon, 2024). However, particularly once the war shifted away from Japan's favor, the Japanese occupation grew extremely hostile and militaristic. This resulted in the brutally enforced agricultural labor of CHamorus in order to meet food production goals. Some CHamorus sought refuge in their family *lānchos* during the Japanese occupation (Bayman et al., 2020).

Post-Contact Period (1950 to Present Day): Food Production and Food Availability

Post-World War II

After World War II, there was a significant shift from subsistence agriculture and fishing to a cash based economy, a decline that had already begun during the period of U.S. Naval governance. This is partially attributable to the loss of land to the U.S. military as well as to the destruction of land suitable for farming due to military activities (Marutani, 1997). Furthermore, U.S. citizenship acquired post-war saw with it an increase in migration to the continental U.S. for educational opportunities, military enlistment, or other career pursuits, decreasing the number of people involved in agricultural production. Small scale agriculture continued, though mostly in addition to wage income (Marutani et al., 1997). Some notable changes in agricultural production took place with locally grown field corn, rice, arrowroot, sugarcane, and tobacco declining substantially or being replaced entirely by imported equivalents (Marutani et al., 1997).

Research has highlighted food environment changes seen in Guåhan, and in the Pacific more broadly (Sievert et al., 2019). One study reported on the number of processed food products and source of manufacture

among Pacific Islands including Guåhan, Fiji, New Caledonia, Samoa, and Nauru, revealing the impact of political affiliation and regional location on the amount and types of food products available (Snowdon et al., 2013). In Guåhan, where the number of food products recorded vastly outnumbered those reported in the other islands studied, 59% of products were manufactured in the U.S., while 4.7% and 3% of products were manufactured in the Philippines and Japan, respectively.

Today, foods commonly eaten in Guåhan include traditional foods as well as dishes influenced by a variety of global and regional cuisine influences. The use of coconut milk in dishes is still common, seen in dishes such as gollai åppan (starchy produce such as breadfruit, banana, plantain, yam, taro, or sweet potato reduced in coconut milk) and tinaktak (chopped or ground meat cooked in coconut milk with vegetables such as long bean, eggplant, and tomato (modern rendition)), though the canned variety of coconut milk is mostly used instead of homemade coconut milk. Popular protein-based dishes include kelaguen (seafood, poultry, or meat marinated in citrus and salt), tinalan katne (dried meat), and barbecued meats. Commonly consumed starches include hineksa' aga'ga (red rice prepared with achote (annatto), fried rice, titiyas (tortillas), and pancit (a Filipino noodle dish). Stews and soups such as estufao (meat stew similar to Filipino adobo), chalakiles (soup made with chicken, toasted rice, and achote), and various kinds of kådu (soup) are comforting dishes (Young et al., 2025). Several dishes such as hineksa' aga'ga and chalakiles are prepared

using achote seed, either by extracting a dye through mixing mature achote seed with water or crushing and grinding the seeds to create a powder to be mixed with water (J. Tuquero, personal communication, October 21, 2025). Many of the dishes commonly consumed today incorporate both traditional and introduced crops, ingredients, and flavors.

A common estimate is that about 90% of food is imported (Economic Research Center, Department of Commerce, 1984). However, recent Agriculture Census results show an increase in local production (USDA, 2020; USDA, 2025). Between 2007 and 2018, the Agriculture Census showed about a 150% increase in the number of farms and acreage, after having been stagnant or in decline for many years (USDA, 2020; Marutani, 1997). In 2018, there were a total of 264 farms, totaling 2,441 acres with an average size of 9.2 acres (USDA, 2020). Sales of commodities increased from \$2.8 million to \$3.8 million, in this time frame, with nearly half of total sales attributable to vegetables and chandiha (watermelon; *Citrullus lanatus*). While long-standing crops such as yam, taro, banana, and tomato continue to be cultivated, crops introduced in more recent decades post-contact make up a greater portion of agricultural production. Biringhenas (eggplant; *Solanum melongena*), kamba (cucumber; *Cucumis sativus*), tomato, bittermelon (atmagosu; *Momordica charantia*), various beans such as friholis (yardlong beans; *Vigna unguiculata* var. *sesquipedalis*) and sigidiyas (wing beans; *Psophocarpus tetragonolobus*), and brassicas such as rapoya (head cabbage; *Brassica oleracea*) and nappa'/pechai (Chinese cabbage; *Brassica* spp.) were

the highest produced crops between the 1960s and 1990s (Marutani et al. 1997). Many of these vegetables remain among the top vegetables produced by poundage today, while bananas are by far the top fruit sold by poundage in Guåhan (USDA, 2020; USDA, 2025).

The most recent Agriculture Census in 2023 showed a continuing trend of growth in the number of farms, land use for farming, and sales of crops (USDA, 2025). In 2023, there were 583 reported farms, defined as “any place from which \$1,000 or more of agricultural products were produced and sold or, normally would have been sold, during the census year” (p. 5). Furthermore, while overall land use for farms increased to 2,848 acres, or 2.1% of the island, average farm sizes decreased from 9.2 acres to 4.9 acres between 2018 and 2023 (USDA, 2025). These highlights suggest increased participation in small-scale and subsistence agricultural efforts, reflecting growth in efforts towards local production and food security.



Figure 8.5
Locally-grown
produce
in
Guåhan
Image by
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A variety of crops can grow, at least moderately, year-round (View University of Guam PDFs: [Fruit Availability Chart](#), [Vegetable Availability Chart](#), [Guam Crop Chart](#)). However, the impact of natural disasters remains a significant challenge for farming and local food production. As a recent example, in May of 2023, Typhoon Mawar, resulted in an estimated 90% to 100% of local farmers' crops being lost according to preliminary reports by the Guam Department of Agriculture (DOA) (Post Guam, 2023). Local egg production is growing, though there is currently no dairy or slaughterhouse for large scale animal husbandry and production. Leg-

isolation is being considered to support the local food system while working within a limited resource setting, such as through the establishment of a mobile slaughterhouse, in addition to other policies, such as cottage food laws, that would allow for greater small-scale home production of food products without the need for commercial kitchens.

Many of the challenges to food production are around funding and access to land for farming and agriculture, which are being addressed through collaborative efforts by the Guam Department of Agriculture, the University of Guam, and community organizations such as the Farmer's Co-op, Guåhan Sustainable Culture, and Farm to Table Guam. Grant funding has included those for the Resilient Food Systems Infrastructure Program (RFSI) and the Micro-Grants for Food Security Program (MGFSP), which support projects to develop food supply chain resiliency and improve food security (USDA AMS, n.d.-a; USDA AMS, n.d.-b).

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Overall Nutrition and Health Status of Children

Changes in the food system in Guåhan have been reflected in the diets of children and adolescents. The nutrition transition, or shift in traditional dietary patterns and healthier lifestyles to a more modern and typically “Western” diet associated with poorer health outcomes, has been documented in children as early as the 1950s (Malcolm, 1958; Popkin, 1993). Dietary data collected among children in the 1990s revealed low contribution of nutrient-dense, traditional food sources to overall nutrient intake (Pobocik & Richer, 2002). Instead, some of the most frequently consumed food items in a sample of elementary aged children, included white rice, fried chicken, and canned fruit drink, whereas low frequencies of fruits and vegetables were reported (Pobocik et al., 1999).

Nearly two decades later, data collected by the Children’s Healthy Living (CHL) program presented a similar picture, with the majority of children sampled not meeting recommendations for fruit and vegetable intake and exceeding recommendations for sugar-sweetened beverage consumption. In the CHL study, prevalence of overweight and obesity (OWOB) was 27.4% among 2-8 year old children (Leon Guerrero et

al., 2020). OWOB prevalence among public school students grades pre-kindergarten through 12th grade was similar at 23.1% (Paulino et al., 2015). Lifestyle behaviors contributing to overweight and obesity during childhood increases risk of development of obesity-related chronic diseases later in life (WHO, 2025). Research among parent-child dyads in the Pacific Island's Cohort on Cardiometabolic Health (PICCAH) study showed a strong correlation between metabolic syndrome z-scores of children in Guåhan and their parents (Aflague et al., 2025).

However, healthy dietary choices and physical activity behaviors are highly dependent on the availability and affordability of healthy foods and the presence of a built environment conducive to healthy lifestyles. Cross-sectional analyses exploring child health in relation to food environment revealed higher BMI z-scores among children living closer to convenience stores and lower likelihood of obesity among children attending schools near stores with higher availability of fruits and vegetables (Matanane et al., 2017& Perez et al., 2023). Further exploration of the shift in the local food system and its impact on child health is needed and support for programs and policies working towards healthier food environments is warranted. Encouragingly, there are a number of existing efforts striving to create and promote healthier food systems.

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Community Highlight: Guåhan Sustainable Culture

Guåhan Sustainable Culture

Program/Project Description

Guåhan Sustainable Culture (GSC) is “a non profit organization that was established in January 2019 with a mission to cultivate ideas and strategies of environmental sustainability within the local community through practical education, social engagement, and collaborative partnerships. GSC believes that environmental sustainability translates into the well-being of the island community” (M. Crisostomo, personal communication, November 19, 2023; M. Oberiano, personal communication, November 19, 2023). Long-term, GSC’s objective is to encourage food sovereignty and promote food security for the people of Guåhan through community engagement, partnership, and education. Specifically, this involves sustainable food systems-focused education and training such as workshops for small-scale food production, the establishment of commu-

nity gardens, and creation of networks connecting consumers to farmers growing produce locally.

Methods and Activities

Several of GSC's early projects were implemented during the COVID-19 pandemic in response to community needs. These included the Supporting Farmers, Sustaining Families and Farm Fresh Produce' programs, which met goals to redistribute fresh, locally grown produce from farmers to the community. Not only do these programs contribute to farmers in the local economy, they increase food security and access to healthy food among members of the community. Key successes include the purchase of 25,000 pounds of produce from farmers and distribution of 7,900 pounds of produce to families (M. Crisostomo, personal communication, November 19, 2023; and M. Oberiano, personal communication, November 19, 2023). In response to Typhoon Mawar in 2023, GSC continued their support of farmers through the distribution of relief microgrant funding and the purchase of local produce (Anthropocene Alliance, 2025).

At the child level, GSC developed the Li'l Sprouts Academy through funding support from Newman's Own Foundation, offered as both after school and summer programs and made available to elementary and middle school students (GSC, 2024a). Program offerings are centered around content and activities related to environmental stewardship, sustainability, health, and nutrition. Students develop knowledge and skills in gardening, cooking, and engage in physical activity. As a recipient of the Patrick Leahy Farm to

School Grant Program administered by the USDA FNS, Guåhan Sustainable Culture has been able to bridge engagement with local farmers and youth education of agriculture and nutrition through field trips to GSC's community garden, where they are able to provide lessons in sustainable food production and food preservation highlighting locally-grown fruits and vegetables (GSC, 2024b).

Lessons Learned

GSC has been able to accomplish its goals to engage with youth in Guåhan and successfully provide education and resources through the use of several adaptive strategies. This has largely involved collaboration with other community partners, individuals, and organizations. As an example, bringing in individuals with experience and expertise working with elementary or middle school aged students and modifying lessons to be age appropriate, GSC has managed to create an environment in which engaging with and learning about local and sustainable food systems is accessible to all (M. Crisostomo, personal communication, January 2, 2024 and M. Oberiano, personal communication, January 2, 2024). To learn more, visit the [Guåhan Sustainable Culture \(GSC\) website](https://anthropocenealliance.org/guahan-sustainable-culture/#).

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Community Highlight: 5-2-1-Almost None

5-2-1-Almost None

Program/Project Description

The 5-2-1-Almost None (521AN) campaign promotes healthier lifestyles and behaviors among children through social messaging. Daily targets are encouraged and include consuming 5 servings of fruits and vegetables, engaging in 2 hours or less of screen time, engaging in at least 1 hour of physical activity, and consuming almost no sugar-sweetened beverages. 521AN messaging has been widely adopted nationally and is intended to drive policies promoting healthy lifestyles, and ultimately, targeting childhood obesity (Campbell et al., 2009). In Guåhan, it is promoted by the Supplemental Nutrition Assistance Program – Education (SNAP-Ed) and the reach of the 521AN campaign has extended into schools, grocery stores, and community spaces across the island (KUAM News, 2025).

Methods and Activities

Schools who have pledged to the 521AN campaign share messaging in school-wide materials, commit to model behaviors at school events and activities, and promote Smart Snacks that meet school nutrition standards (University of Guam, 2019; USDA FNS, 2023). Grocery stores that have taken the pledge have displayed Smart Snacks tags and conducted in-store food tastings, often incorporating local produce and recipes, to encourage healthier food choices (Guam Daily Post, 2018). Physical activity game boards have also been created at participating schools and organizations to promote youth physical activity (Pacific Daily News, 2020). Implementation of the 521AN social marketing campaign in Guam highlights existing community-based efforts to spread healthy behavior messaging across the built environment.

Lessons Learned

To learn more about the University of Guam's Community Nutrition Education Program, which includes SNAP-Ed, visit the [University of Guam Community Nutrition Education Program website](#).

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CHAPTER 9. HAWAI'I

About the Author



Christina Young

Christina Young is a Kānaka ‘Ōiwi wāhine Registered Dietitian Nutritionist and a student in the PhD Nutri-

tional Sciences program at the University of Hawai‘i at Mānoa. She was inspired to pursue her studies in nutrition and dietetics because of her interest in how food correlates to health and her family’s history of chronic disease. Christina’s key areas of interest include indigenous communities, breastfeeding practices, community nutrition, and nutrition education.

Land Acknowledgement

I acknowledge that the ‘āina on which University of Hawai‘i at Mānoa occupies is part of the larger territory recognized by Indigenous Hawaiians as their ancestral

grandmother, Papahānaumoku. I am of Kānaka ‘Ōiwi and Chinese descent born and raised in California and did not live on this ‘āina until my adult life. My ancestors come from the ‘āina of Kalihilihiolaumiha and Mākaha which has shaped me into the person I am today. I recognize that her majesty Queen Lili‘uokalani yielded the Hawaiian Kingdom and these territories under duress and protest to the United States to avoid the bloodshed of her people. I further recognize that Hawai‘i remains an illegally occupied state of America.

I recognize the resiliency and strength of Kānaka ‘Ōiwi, who have endured many hardships due to colonization which are still present to this day. It is my kuleana that this work contributes to debunking the misconceptions as well as honoring the truth of Kānaka ‘Ōiwi history and culture. I recognize that I have the great privilege to come back and reside on my ancestral lands to conduct research with the Indigenous peoples of Hawai‘i. For this I am grateful and as a Kānaka ‘Ōiwi I recognize my kuleana – both my responsibilities as well as my dear privileges – to care for this ‘āina for the many generations yet to come. I also recognize my kuleana to invite each of you to help me in this most important endeavor.

This land acknowledgement statement has been adapted from the Native Hawaiian Place of Learning Advancement Office at University of Hawai‘i: <https://manoa.hawaii.edu/nhpol/auamo/land-acknowledgment/>.

Cultural, Demographics, and Geographic Characteristics of the Location

Cultural

Kānaka ‘Ōiwi (Native Hawaiians) are the Indigenous peoples of the Hawaiian Islands. Kanaka (singular Native Hawaiian) is defined as a human, person, or individual and is commonly referenced as a person who is native and distinct from a foreigner (Pukui & Elbert, 1957). The term Kānaka ‘Ōiwi is traced back to the understanding of native or Indigenous peoples of Hawai‘i by describing the connection between a native person and their native lands. Therefore, we will be using the term Kānaka ‘Ōiwi throughout this chapter to refer to the Indigenous people of Hawai‘i.

Kānaka ‘Ōiwi are descendants of Polynesian voyagers who settled the vast Pacific Ocean. As Kānaka ‘Ōiwi ancestors traveled from island to island, they shared their knowledge and practices, stories and traditions, and their crops, agriculture, and food. Kānaka ‘Ōiwi had, and continue to have, an interconnected relation-

ship with the ‘āina. This relationship stems from the genealogical ties to the environment from mo‘ōlelo (stories) that have been passed down from our kūpuna (ancestors). In the Kumulipo, the longest recorded traditional Hawaiian chant, all forms of life evolved from Papahānaumokuakea, the earth mother. Wākea, the sky father, and Papahānaumokuakea birthed the Hawaiian archipelago together. Their first human offspring was their daughter, Ho‘ohōkūkālani. Wākea and Ho‘ohōkūkālani later birthed a stillborn child. Hāloanakalaukapalili was the first kalo (taro; *Colocasia esculenta*) plant that grew from where the stillborn child was buried and watered by the tears of Ho‘ohōkūkālani grieving the loss of her child (Ho‘okua‘āina, 2020). Ho‘ohōkūkālani birthed another child, Hāloa, who was the first Kānaka ‘Ōiwi and became the ancestor to all Kānaka ‘Ōiwi. Thus, Hāloanakalaukapalili, the kalo plant, is also the elder brother to all Kānaka ‘Ōiwi (Kamehameha Schools, 2008). The relationship described in the creation story of Kānaka ‘Ōiwi is familial, therefore, ‘āina (land) is viewed as one would a family member. Moreover, this relationship is deferential, as Kānaka ‘Ōiwi are the kaikaina (younger sibling) in the relationship. This dynamic implies the interplay of mentorship and guardianship by the ‘āina, and respect and attentive stewardship by all Kānaka.



Figure 9.1
Lo'i kalo
patches at
Kako'o
'Ōiwi in
He'eia,
Hawai'i
Image by
Christina
Young
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[4.0](#)

Demographic

Kānaka 'Ōiwi were once the only peoples living in the Hawaiian Islands. There is no known census of the Kānaka 'Ōiwi population prior to contact with foreigners, however, the estimated range is from 200,000 to 1,000,000 (Swanson, 2019). When contact was made with foreigners in Hawai'i beginning in 1778, Kānaka 'Ōiwi were exposed to many new diseases – including smallpox, measles, whooping cough, cholera, influenza,

and leprosy – to which they had no immunity and were highly vulnerable to infection. The epidemics of these diseases eradicated nearly half of the population of Kānaka ‘Ōiwi over the span of a couple of decades (Akana, 2020).

Throughout the post-contact period, the population of the islands was diversified through immigration, primarily facilitated by the many plantations of Hawai‘i. The bulk of the immigrants were of Chinese, Japanese, German, Puerto Rican, Korean, Portuguese, or Spanish descent. This influx of immigrants who came to Hawai‘i for work grew the population significantly.

Today, there are over 1.4 million people who reside across the Hawaiian Islands (United States Census Bureau, 2023a). As of 2023, the Hawai‘i population demographics of “race alone or in combination” groups were as followed: Asian (57.5%), White (43.7%), Native Hawaiian and other Pacific Islanders (27.3%), Hispanic, any race (10.1%), Black or African American (3.7%), and American Indian and Alaska Native (2.6%) (State of Hawai‘i, 2024b). Of those 1.4 million people, there is an estimated population of 317,500 Kānaka ‘Ōiwi full or part-Hawaiian in combination with other races living in Hawai‘i (United States Census Bureau, 2023c). An important point to note is that “Native Hawaiian” is an ethnicity classification. Unlike other states, living in Hawai‘i does not make an individual “Hawaiian,” it makes them a resident of Hawai‘i. The term Hawaiian is reserved for Kānaka ‘Ōiwi, who are the native people of Hawai‘i.

According to the 2021 U.S. Census, there are a total of 680,442 Kānaka ‘Ōiwi residents of the United States,

which includes those in Hawai‘i. Meaning, less than half of the Kānaka ‘Ōiwi, full or part-Hawaiian, lived in Hawai‘i (46.7%) in 2020, which is down from 55.0% in 2010 (United States Census Bureau, 2023b). Although there is no official documentation specifically for Kānaka ‘Ōiwi of 100% ancestry, it was estimated that there were 29,336 individuals in 1900 which declined to 8,711 in 1993 who identified as being of 100% Kānaka ‘Ōiwi ancestry (Hawaiiiloa, 2022; Swanson, 2019). The five states on the continent where the highest number of Kānaka ‘Ōiwi reside are California, Washington, Nevada, Texas, and Oregon. The 2021 U.S. Census marked the first time in Hawai‘i history that more than half of the total population of Kānaka ‘Ōiwi live outside of their ancestral lands.

Geographic

The Hawaiian Islands form an archipelago made up of 132 islands, atolls, reefs, shallow banks, and shoals stretching over 1,500 miles from the island of Hawai‘i in the southeast to Kure Atoll in the northwest (National Oceanic and Atmospheric Administration, 2021). There are eight main islands in the archipelago: Hawai‘i Island, Maui, Moloka‘i, Lāna‘i, Kaho‘olawe, O‘ahu, Kaua‘i, and Ni‘ihau. These eight islands are the largest, youngest, and southernmost of the archipelago. The lands of these islands age from 5 million year old soils on Ni‘ihau

to active volcanoes on Hawai'i Island that are forming new land into the Pacific.

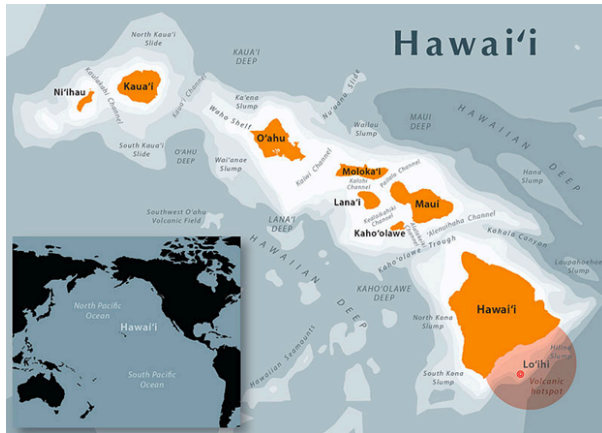


Figure 9.2
Map of
the Main
Islands of
Hawai'i
Image by
[Mapbliss](#)
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Prior to Western contact, the Hawaiian Islands were divided using traditional land management systems. These traditional land management systems supported the stabilization, expansion, and modification of local-scale habitats to increase the abundance and availability of essential resources from the land (Gould et al., 2019; Kealiikanakaoleohaililani et al., 2018; Winter et al., 2020). This management system contained many different types of land divisions with the relatively new classifications of the moku, ahupua'a, and 'ili. The moku (district or region) land divisions were created due to the strain of a growing population (Winter et al., 2018). Moku boundaries were created in alignment with the ecologically based zones which ran both horizontally and vertically to create a mosaic that integrated forests

and waterscapes into cultural landscapes (Winter et al., 2020). Moku were further divided into ahupua‘a (a community-level division) which helped localize resource management (Winter et al., 2018). Most boundaries of the ahupua‘a land divisions extended from the mountains to the sea and contained essential resources that helped Kānaka ‘Ōiwi thrive such as fresh water, soil to plant crops, and animals to hunt. However, not all key resources were confined to an ahupua‘a’s boundaries, making certain ahupua‘a not as self-sustaining compared to others (Winter et al., 2018). Nestled within ahupua‘a were ‘ili (land strips). Each ‘ili were land tenure units cared for by one or more ‘ohana (families). The ‘ili structure served as a basic unit of social organization within the ahupua‘a (Dye, 2021).

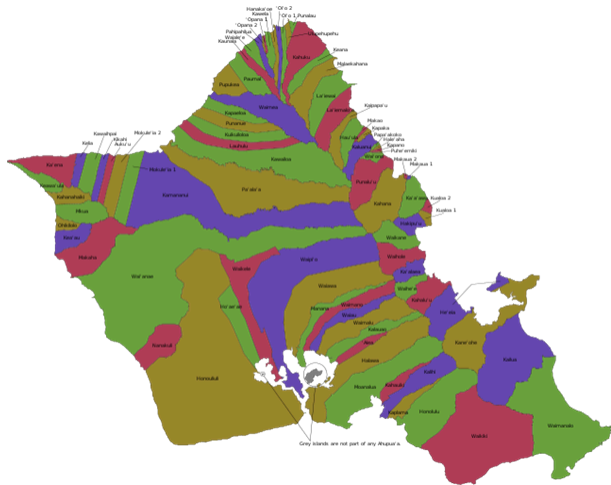


Figure 9.3
Ahupua‘a
system of
O‘ahu
Image by
[Mliu92](#) /
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Hawaiian Islands are located more than 2,000 miles

away from the nearest continent, making it the most geographically isolated group of islands on Earth today (Geology and Ecology of National Parks, n.d.). Across the eight main islands, there are a variety of landscapes and ecosystems. Hawai‘i contains over two-thirds of the [Holdridge Life Zones](#), making it one of the most ecologically diverse places in the world (Lincoln et al., 2020). With this diverse range of climates across Hawai‘i, these islands are today home to many native (introduced to a place naturally through wind, wave, and wing), non-native (introduced to a place by humans), indigenous (can be found in other parts of the Pacific and the world), endemic (occur naturally in one specific region or area), invasive (harmful to the environment and not native to Hawai‘i), and ornamental (grown for decorative purposes) plants and animals that contribute to the diversity of the ecosystem and food systems (Bishop Museum, 2023; Desha Beamer, 1984; Hawaii Invasive Species Council, 2024). Plants can belong to more than one of these classifications; for example, ‘ōhia lehua is endemic to Hawai‘i, but also planted for its ornamental blossoms (Department of Land and Natural Resources, 2020)

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History

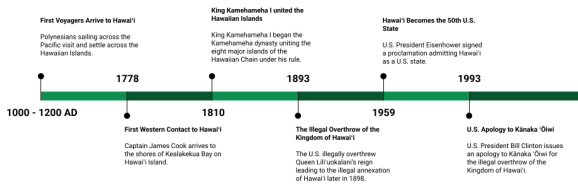


Figure 9.4
High level
timeline
of
Hawai'i's
history
and
significan
t events
Image by
Christina
Young /
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Prior to Western contact, the Hawaiian Islands were ruled by ali'i (chiefs) for generations. The ali'i had complete control over the lands, products produced from the land, and the lives and the personal property of the Kānaka who lived on it. The ali'i derived their powers and rights from their close genealogical ties with the akua (Hawaiian gods) and were considered akua themselves (Greene, 1993). There were many ali'i across Hawai'i who ruled the different islands. Maui ali'i typically governed Lana'i, Moloka'i, and Kaho'olawe, while O'ahu and Hawai'i Island had separate ali'i. Kaua'i and Ni'ihau were under rule by a single ali'i.

The first foreign contact was in 1778 when British

Captain Cook arrived in the Hawaiian Islands. Cook interacted with Kānaka ʻŌiwi in their religious rituals, sport, dance and other activities. During Cook's departure from his second trip to the islands in 1779, his crew were forced to turn around due to boat repairs. Upon returning to the shores of Kealahou Bay, the Kānaka were not as welcoming as they had been before Cook's departure. After one of the crew's boats was taken, Cook and his men seized the ali'i, Kalani'ōpu'u, as a hostage. Outraged by this act, the Kānaka retaliated, leading to Captain Cook's death at Kealahou Bay on February 14, 1779.

After the arrival of Captain Cook, numerous naval expeditions were conducted by Captain George Vancouver between 1792 and 1794. As a result King Kamehameha I established Hawai'i's first international alliance with Great Britain. This alliance was formed to secure British protection for the Hawaiian Kingdom (Hawaii* – Countries – Office of the Historian, n.d.). This relationship between Great Britain and Hawai'i is still seen today from the Union Jack in the Hawai'i state flag.

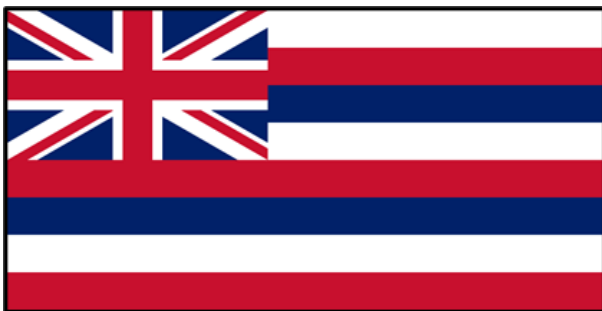


Figure 9.5
Hawai'i
Flag
Image by
[Dbenbenn](#)
/ [Public](#)
[Domain](#)

By 1796, King Kamehameha I had united the Hawaiian Islands, except for Kauaʻi, into the Kingdom of Hawaiʻi (Hawaiʻi State Archives, n.d.). In 1810, he extended his rule to include Kauaʻi, consolidating control over all the islands and solidifying the kingdom. The Kamehameha dynasty became the most famous lineage of Hawaiian royalty. After the five Kamehameha kings, King Lunalilo, King Kalākaua, and Queen Liliʻuokalani ruled the Kingdom of Hawaiʻi; all descendants of the Kamehameha family.



Figure 9.6
King
Paiʻea
Kameham
eha I

Source:
[Hawaiʻi
State
Archives](#)



Figure 9.7
King
Kalaninui
Kameham
eha II
Source:
[Hawai'i
State
Archives](#)



Figure 9.8
King
Kauikeaou
li
Kameham
eha III
Source:
[Hawai'i
State
Archives](#)



Figure 9.9
King
Alexander
Liholiho
Kameham
eha IV
Image by
[Hawai'i
State
Archives](#)



Figure
9.10 King
Lota
Kapuāiwa
Kalanima
kua
Aliʻiōlani
Kalanikup
uapaʻikala
ninui
Kameham
eha V
Source:
[Hawaiʻi
State
Archives](#)



Figure 9.11
King
William
C.
Lunalilo
Source:
[Hawaiʻi
State
Archives](#)



Figure
9.12 King
David
Kalakaua
(middle)
Source:
[Hawai'i
State
Archives](#)



Figure
9.13
Queen
Lili'uokala
ni
Source:
[Library of Congress](#)

U.S. Involvement with Hawai‘i

During the 1800s, the United States became interested in Hawai‘i due to its strategic location as an ideal site for a naval and commercial port in the Pacific. As Americans visited the islands, they advised the ali‘i that adopting Christianity would earn Kānaka ‘Ōiwi greater respect from foreign nations. This led to the arrival of missionaries during the reign of King Kamehameha II, who established schools to teach English language, reading, and writing. Over time, Hawaiian laws were

altered to reflect Christian principles, resulting in the suppression of traditional Hawaiian practices, language, and beliefs (Kanaeokana, 2022).

Land Ownership and Rights

The concept of private land ownership did not exist in Hawai'i. The Hawaiian Islands operated on a feudal system; kings were the sovereign owners of all the lands and distributed it to ali'i or high chiefs to oversee and control. The ali'i and high chiefs would then distribute the 'āina to be tended or farmed by the kānaka or maka'āinana (commoners). This system ensured that no individual would own the land and the land would be redistributed if the individual could no longer tend to it. By the early 1800s, foreigners began to arrive in Hawai'i, making demands to have the right to 'āina which led to the emergence of the concept of private property.

To address this issue, the Bill of Rights of the Hawaiian Islands was established in 1839 which guaranteed that people's lands would not be taken from them. Followed by the Bill of Rights, King Kamehameha III enacted the first Constitution of Hawai'i which established a governmental structure for the Kingdom of Hawai'i in 1840. The government consisted of island governors appointed by the King, two legislative councils – a house of nobles and house of representatives – chosen by the maka'āinana, and a supreme court made up of the king, the kuhina nui (prime minister or

regent), and four others appointed by the house of representatives. In addition, this constitution acknowledged Kānaka ‘Ōiwi are the original owners of the Hawaiian lands (Van Dyke, 2008b).

In 1848, the Great Mahele (great land divisions) occurred where the King, ali‘i, and konohiki (lesser chief) came together to divide and redistribute the land (Cachola, 1995). The land distribution was divided into three classifications: Crown Lands designated to the reigning monarch and his family, Ali‘i Lands distributed to the ali‘i and konohiki, and Government Lands which were distributed by the King. Of the four million acres redistributed, King Kamehameha III kept 1 million acres for himself, 1.5 million acres were distributed across 250 ali‘i and konohiki, and 1.5 million acres were Government Lands. This was the beginning of land privatization in Hawai‘i.

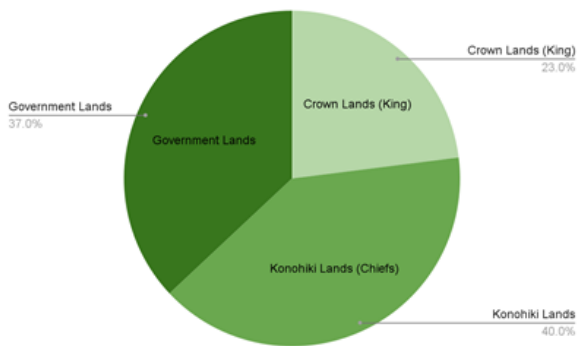


Figure 9.14 The Great Mahele Distribution of Land
Image by Jean Iwata Cachola

The Kuleana Act of 1850 made it possible for the

maka‘āinana to own private land in fee simple. Kuleana is known as responsibility in ‘ōlelo Hawai‘i, but in this Act it was referred to as land that people lived on and cultivated. King Kamehameha III believed that the Kuleana Act would protect Kānaka ‘Ōiwi stewardship of the ‘āina and offered his people options to their right to the ‘āina (*Kamehameha III: Kauikeaouli* – Ulukau Books, n.d.). He allowed them to choose when they can claim their rights to the ‘āina and receive private property with no deadline. If they did not want to claim their private property, maka‘āinana had the option to live on crown, government, or ali‘i lands and share the ‘āina while they worked on it. For those who did privately own ‘āina, the traditional access and gathering rights remained intact to allow maka‘āinana to access ‘āina resources on and around private property (Kanaeokana, 2022). Although King Kamehameha III created this hybrid land ownership rights system that would be more familiar to foreign powers, foreigners were still upset about this shared land system and the traditional access and gathering rights.

Around the 1830s, Hawai‘i’s sugar industry slowly started to emerge as whaling practices were no longer needed. Many foreigners wanted to establish their own housing and businesses in Hawai‘i but felt a lack of security to do so without owning the land they operated on. In 1850 King Kamehameha III passed the Resident Alien Act of 1850. This allowed foreigners the right to buy land in fee simple, meaning that individuals who own land may sell that land or pass it on to their heirs. This act was the start of foreign missionaries and busi-

nessmen acquiring land to grow large volumes of sugarcane on plantation sized lands.

During King Lunalilo's reign, negotiations on enacting the Reciprocity Treaty between Hawai'i and the United States, which would create a duty-free market for Hawai'i crops such as sugar and rice, were initiated. This allowed both Hawai'i and the U.S. to export crops to each other tariff-free, while preventing Hawai'i from granting similar privileges to other nations. During this initial negotiation, the U.S. wanted access to Pu'uloa (now known as Pearl Harbor), which King Lunalilo rejected immediately. Due to King Lunalilo's death in 1874, King Kalākaua was elected as the reigning monarch of the Kingdom and carried out the final processes for the Reciprocity Treaty to be enacted in 1875, for a duration of seven years (Van Dyke, 2008b). Hawai'i saw a drastic increase in wealth from the Reciprocity Treaty and the growth in sugar plantations from twenty to sixty-three in five years (Van Dyke, 2008b). This expansion in plantations supported the recruitment of contract laborers for work, which remarkably diversified the demographics of the Kingdom's population (Kuykendall, 1967). However, this led to more businessmen to purchase more land to expand their plantations which resulted in a decline of 'āina for the maka'āinana.

After seven years of the Reciprocity Treaty, King Kalākaua wanted to prioritize growing Hawaiian nationalism led by native leadership in the legislature rather than supporting those who favored closer ties with the U.S (Van Dyke, 2008b). At the end of what should have been the expiration of the Reciprocity

Treaty in 1882, the U.S. approached Kalākaua for an extension and repeated their demands for access to Pu‘uloa. Kalākaua refused this request which angered many non-Kānaka ‘Ōiwi businessmen about how he was governing the Kingdom. These businessmen formed a group called the Reform Party in which the leaders were descendants of Protestant missionaries. Members of the Reform Party were also members of the Honolulu Rifles which was associated with the Hawaiian League which was made up of immigrants or the children of immigrants living in Hawai‘i, majority of them being non-Kānaka ‘Ōiwi (Van Dyke, 2008b). The Reform Party and the Hawaiian League put political pressure on King Kalākaua’s ministers leading them to all resign. Kalākaua was forced to accept new ministers who were endorsed by the Reform Party.

The Constitution of 1887 was signed by King Kalākaua which no longer allowed him to make decisions for the Kingdom on his own, giving his cabinet the power to veto any bills over the King’s decisions. In addition, this new constitution extended voting rights to certain non-citizen male residents of the Kingdom (Hasegawa Lowe, 1999). This constitutional agreement became known as the Bayonet Constitution, implying that bayonets were used on Kalākaua by the Hawaiian League to have it signed into action. The Bayonet Constitution contained a clause that granted the U.S. access to Pu‘uloa allowing them exclusive use of the harbor for their imports and exports of goods. This provided the sugar businessmen a major stake in the economy of the Hawaiian Kingdom.

Princess Lili‘uokalani, Kalākaua’s sister, strongly dis-

approved of her brother's signing of the Bayonet Constitution. Many others were upset about the new constitution and tried to have King Kalākaua sign a new constitution which would restore control to the monarchy. They wanted the monarchy turned over to Lili'uokalani. This was unsuccessful as Kalākaua learned about their plans to dethrone him and sent soldiers to end the revolt. After these events, King Kalākaua set off on his travels to the United States, primarily spending most of his time in California. During his visit to California, he strengthened existing political and personal relationships and established new ones. However, King Kalākaua's health was weakening during this time. On January 20, 1891, King Kalākaua died of Bright's disease (inflammation of the kidneys; nephritis) in San Francisco. After Kalākaua's remains were brought back to Hawai'i, Lili'uokalani became the reigning Queen of the Kingdom.

Queen Lili'uokalani's Reign

When Queen Lili'uokalani established her monarchy in the Kingdom of Hawai'i, she hoped to restore power back to her people and the Kingdom through a new constitution. However, politics were rumored to be changing as the population consisted of a mixture of Kānaka 'Ōiwi and foreigners. Multiple political parties and groups were being formed, with Lorrin A. Thurston, an American politician and businessman, forming the

Annexation Club. Some of the most prominent businessmen in Hawai'i soon learned about the Annexation Club and formed a Committee of Safety chaired by Henry E. Cooper, an American lawyer, who supported and agreed with Thurston's views of annexation of Hawai'i (Kamehameha Schools Ho'okahua Cultural Vibrancy Group, 2017). In fear of their businesses being at stake with Queen Lili'uokalani's determination to restore power to the Kingdom through her new constitution, the Committee of Safety made false claims of chaos happening under the Queen's rule to the U.S. Ministry. Although no unjust actions were committed by the Queen or were proven to be true through a public notice, Thurston sent a letter directly to U.S. Minister Stevens which repeated the false claims of dangers and requested U.S. military forces. On January 17, 1893, the members of the Annexation Club, Committee of Safety, and U.S. troops invaded the Hawaiian kingdom and took over the government building and revolted against Queen Lili'uokalani's rule. Forced to surrender to protect the lives of Kānaka 'Ōiwi, Queen Lili'uokalani was taken into U.S. custody by armed and uniformed U.S. military members (Kamehameha Schools Ho'okahua Cultural Vibrancy Group, 2017).

Lili'uokalani came to learn that this overthrow had been in planning for a while and that the overthrow was supported by then President Benjamin Harrison. President Harrison was in favor of expanding U.S. control to other territories nearby and put forth a treaty to Congress to consider annexing Hawai'i. President Harrison's term ended before Congress came to a decision on the treaty. The new president, Grover Cleveland,

heard Lili‘uokalani’s request to restore her Kingdom and pulled the treaty from Congress. President Cleveland initiated an investigation on March 11, 1893 with James Blount in charge. Blount investigated the overthrow of the Queen’s monarchy by force and the sentiment of the people towards existing power and authority. Concluding the investigation, President Cleveland reported that the U.S. committed acts of war against the Hawaiian Kingdom through threats and force and stated these actions led to the unlawful overthrow of the government of an independent and sovereign nation (Kanaeokana, 2022).

Despite President Cleveland’s position, the Hawai‘i provisional government defied international law and installed Sanford B. Dole as their president. Dole and the rest of the provisional government, made up of mostly foreign businessmen, declared themselves as the rulers of the Republic of Hawai‘i. These political actions were not aligned with the Kingdom of Hawai‘i and the Kānaka ‘Ōiwi.

The new president, William McKinley, was looking to expand the U.S. during his presidency alongside the foreign businessmen in Hawai‘i who wanted to expand their sugarcane plantations. More than 38,000 people, majority Kānaka ‘Ōiwi, in the Kingdom of Hawai‘i signed the Ku‘e petition which opposed annexation of Hawai‘i to the US (Papakilo Database, 1897; Shim, 2023). Queen Lili‘uokalani’s protest against the annexation, the signatures from the Ku‘e petitions, and the documentation of false claims of chaos persuaded Congress to stop actions towards annexation (Shim, 2023).

In response to the congressional decision, the foreign

businessmen in Hawai'i pursued a joint resolution to annex Hawai'i, which required fewer congressional votes to be passed. Although a joint resolution was not lawful due to it only applying to laws within the U.S. (Hawai'i was still considered to be international), the joint resolution was signed by Sanford B. Dole and the U.S. proceeded with the annexation, illegally. On July 6, 1898, the annexation of the Kingdom of Hawai'i was decided and the governance and its people were under U.S. control (Kanaeokana, 2022).

U.S. Overthrow

After the illegal U.S. overthrow of Queen Lili'uokalani's reign in 1893 and the illegal annexation in 1898 which transitioned Hawai'i to a U.S. territory, a change in political tide began to occur with a more unwavering U.S. presence. After the annexation, Sanford B. Dole unlawfully took power of the 1.8 million acres of crown lands and government lands which became property of the US (Kanaeokana, 2022; Van Dyke, 2008a). With this newfound U.S. power, military personnel and bases were established as the location and unique landscape of the islands were highly sought after. In 1959, U.S. President Eisenhower signed the official proclamation admitting Hawai'i as the 50th state.

Due to immigration to Hawai'i to work on the plantations and the U.S. military occupation, Hawai'i has faced cultural and land transformations since the illegal

overthrow (Goodyear-Ka'ōpua, 2009). Agricultural and ancestral lands have been transformed into privately-owned lands by foreigners, plantations for crop exports, and military training areas and housing sites. Roads have been extended and highways paved, and offshore islands have been used as practice bombing sites preventing any future inhabitation. Urban expansion and the influence of capitalism in Hawai'i with U.S. occupancy have significantly impacted the availability and use of land resources, reshaping both the physical and social environment of the 'āina.

In 1993, 100 years after the illegal overthrow, the U.S. Congress issued a joint resolution addressing an apology to Kānaka 'Ōiwi for the overthrow of the Kingdom of Hawai'i which was signed by President Bill Clinton (Sen. Akaka, 1993). Today, Hawai'i still remains under U.S. occupation.

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Agriculture History and Food Evolution

To adequately capture the vast changes to Hawai‘i’s agriculture and food systems across many centuries, this section will be categorized into three different time periods: pre-contact, contact, and post-contact periods (see Figure 8.15).

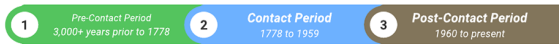


*Figure 9.15
Timeline
of
Hawai‘i’s
Pre-Contact Period,
Contact Period,
and
Post-Contact Period
Image by
Christina
Young /
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Pre-Contact Period: Traditional Agricultural Systems and Foods

Early agriculture in Hawai'i can be traced back to early inhabitants who arrived from the Marquesas between 500 and 700 AD. They brought with them **taro**, sugar cane, bananas, nuts, pigs, chickens, sweet potatoes, and other food items that they managed through small farms throughout the islands. Over the centuries, these early Kānaka 'Ōiwi also created extensive systems along the coasts to raise aquatic products (Takeguchi, et al, 1999; Kikawa, 1994).

The traditional Hawaiian diet prior to contact was high in complex carbohydrates (78%) with limited amounts of protein (12%) and fat (10%) (Blaisdell, 1985). Foods from the traditional Hawaiian diet were found from the 'āina or from fresh and saltwater sources like the ocean, rivers, or flooded pond fields. Kānaka 'Ōiwi agricultural practices were grounded in the connection between human and environmental health (Beamer et al., 2022). This connection helped establish the Kānaka agricultural systems which focused on producing food and resources while preserving the function and health of the environment (Beamer et al., 2022; Lincoln & Vitousek, 2017; Winter et al., 2020). Some of the systems that Kānaka 'Ōiwi used to cultivate food included lo'i kalo (irrigated terrace for taro), loko i'a (fishponds), and māla (garden, patch, cultivated field).

Lo'i kalo are wetlands consisting of terraces or shallow pits dug into the ground that are commonly found

near freshwater sources like rivers and streams to produce kalo. It was estimated that lo'i kalo covered at least 20,000 acres across six islands in the Hawaiian archipelago (Goodyear-Ka'ōpua, 2009). The 'auwai, or an irrigation ditch system, transported the freshwater between the lo'i kalo fields to water the kalo. The 'auwai were designed to work harmoniously within an ecosystem (Goodyear-Ka'ōpua, 2009). When multiple lo'i kalo terraces were near each other, the 'auwai would start at the top corner of the kalo terrace and exit out to the next through the bottom corner on the opposite side of the terrace. This would help the water circulate in the kalo patch which influenced the pH of the soil and water.

There were key elements that could influence the flow of the freshwater to the lo'i. The po'o wai (headwater; water source or head) refers to the start of the water source for the lo'i which was drawn from a river or other freshwater source. The mānowai (place where water is assembled for the purpose of leading it out; the heart; the place whence the blood comes together, as in a fountain, and flows out again) would slow the water from the po'o wai to prevent excess water flow during high water events; similar to a dam. From the mānowai, the makawai (small outlets for water through banks of taro patches; small waterways; water sources) would divert the water to the lo'i to water the kalo (Lincoln & Vitousek, 2017).



Figure
9.16 Lo'i
Kalo
Terraces
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Young /
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Loko i'a are estuaries which utilize natural enrichments from freshwater and submarine groundwater to farm fish (Möhlenkamp et al., 2019). Kānaka 'Ōiwi built loko i'a kuapā (walled fishponds) at the interface of freshwater streams and the ocean. These water sources created an immersion which promoted the growth of primary producers from the nutrients found in streams. The kuapā (walls) allowed water to flow in and out while mākāhā (size-slotted sluice gates) controlled the water flow and helped trap fish inside the loko i'a. The slots on the mākāhā allowed small fish from the ocean inside

but prevented the larger farmed fish from escaping out. Loko i'a system allowed microbes to form the base of the food web within the water and yielded efficient protein production of different fish species (Möhlenkamp et al., 2019).

Māla are a part of Hawai'i dryland system of food production. Māla are agricultural areas that are dependent on seasonal or intermittent rainfall which help create fertile soil for crops to grow (Kagawa-Viviani et al., 2018). Māla are traditional gardens or cultivated plots used for growing a variety of plants, particularly food crops. Common crops grown in the māla include kalo, 'uala (sweet potato; *Ipomoea batatas*), uhi (yams; *Dioscorea alata*), mai'a (banana; *Musa*), and kō (sugarcane; *Saccharum officinarum*).



Figure 9.17
Māla
Image by
CTAHR

Complex carbohydrate sources that Kānaka 'Ōiwi con-

sumed include kalo, 'ulu (breadfruit; *Artocarpus altilis*), 'uala, uhi, and mai'a. Common vegetables such as lū'au leaves (leaves from the kalo plant), 'uala leaves, and limu (seaweed) were low in carbohydrates and high in vitamins and minerals. Fruits like the 'ōhi'a'ai (mountain apples) were consumed to provide simple carbohydrates. Most protein was sourced from i'a (finfish), other seafood such as he ia mea iwi mawaho (shellfish), moa (chicken), pua'a (pig), 'ilio (dog), and 'iole (rat). Fat sources included niu (coconut; *Cocos nucifera*), i'a, moa, and pua'a (Leslie, 2001). Common traditional methods of preparation for these foods were boiling, broiling, a combination of steaming and roasting in an 'imu (earth oven), and pounding using a pōhaku (stone) and papa (board), while traditional practices for preserving fish and meat were salting and sun drying..



Figure
9.18 'Ulu
Bearing
Fruit Tree
Image by
[Forest and
Kim
Starr/CC
BY 3.0](#)

Although not crops or protein sources, certain mea kanu (plants), were an important part of Kānaka 'Ōiwi

lifestyle and diet during the pre-contact period. Mea kanu were used for lā‘au lapa‘au (herbal medicine) to aid and combat disease and illness. Some examples of mea kanu used for lā‘au lapa‘au were ‘awa and noni. ‘Awa (kava; *Piper methysticum*) was used to make a common beverage consumed by Kānaka ‘Ōiwi during this period of time. ‘Awa is traditionally consumed as a ceremonial drink and has many medicinal and psychoactive properties (Winter & McClatchey, 2009). The ‘awa’s ground-up roots were strained in water to prepare the drink. Noni (Indian mulberry; *Morinda Citrifolia*) was used more for medicinal purposes such as healing external injuries (bruises, sprains) rather than for consumption due to its “cleansing” properties for the body.

Contact Period (1778 to 1959): Decline in Agricultural Production and an Increase in Imports

Once U.S. government control became more dominant throughout the Hawaiian Islands due to the events that occurred in King Kalākaua and Queen Lili‘uokalani’s reign, more U.S. migrants and foreign immigrants settled across the region for work opportunities. By the mid-19th century, cattle ranches and single-crop plantations, predominantly sugar and pineapple, began to dominate agriculture in the Hawaiian Islands which brought in an influx of workers (State of Hawai‘i, 2012). Enacting laws like the Reciprocity Treaty of 1875

changed land tenure and water rights which diverted natural resource availability to food production. Water-usage laws emerged after the Reciprocity Treaty of 1875 was signed into effect during King Kalākaua's reign. "The Big Five" (Castle & Cooke, Alexander & Baldwin, Brewer & Co., American Factors, and Theo H. Davies & Co.) had complete control over Hawai'i's sugar plantations and were the first to form private water companies to support their businesses.

After World War II, the strong U.S. economy and the advancement of air travel contributed to Hawai'i's transitioning agriculture and food supply (Kent, 1993; State of Hawai'i, 2012; Takeguchi et al., 1999). When Hawai'i became the 50th state of the US, federal funds became available for the development and growth of Hawaii's agricultural industries with funding for programs such as farm credit, natural resources, and statistical services (Takeguchi et al., 1999). Large areas of agricultural land like Mānoa Valley, which was home to an abundance of lo'i kalo, were destroyed due to a change in land tenureship and used to build an agricultural college, supported by U.S. federal land grant legislation (Goodyear-Ka'ōpua, 2009). The plantation era that dominated Hawai'i agriculture since the mid-19th century peaked in production by the mid-1960s and then declined due to the new tourism industry. Many plantation companies started to move their operations to lower income countries where cheaper labor, land, and transportation offered greater profits contributing to the decrease in plantation work and increase in imported goods (State of Hawai'i, 2012). Imports for food products, such as rice, flour, canned meats, and

other canned goods, and vegetables increased significantly as the tourism trade continued its expansion throughout the state, particularly on O‘ahu. Although half of the fruits, vegetables, and milk products produced in Hawai‘i were consumed locally in the 1960s, consumption of local foods continued to decline into the next decade (Takeguchi et.al., 1999). The effects of colonization and the illegal overthrow of Hawai‘i to the agricultural lands and food production were observed more clearly during the post-contact period.

Post-Contact Period (1960 to Present Day): Contemporary Food Production and Availability

Food Production

After more than 100 years of U.S. occupation, land transformations related to urbanization have led to a decline in agricultural land availability. Once known as an agricultural lāhui (nation), a significant decrease in lands designated for traditional agricultural systems like lo‘i and māla has been seen (Lincoln & Vitousek, 2017).

Mass tourism to Hawai‘i gained momentum in the mid-1970s with the introduction of commercial jetliners, increasing the food supply demand. Hawai‘i’s econ-

omy increasingly shifted its focus toward the tourism industry, relying more heavily on agricultural imports to meet rising demands. The 1970s experienced a decrease in plantation size farming from the previous decade and an increase in diversified agriculture production in macadamia nuts, the nursery and flower industry, and fruits and vegetables. Livestock production (dairy, hogs and poultry) also decreased, still local egg production in Hawai'i exceeded in shipments in 1989. Furthermore, the number of small farms (3-9 acres) has increased since 1964. Many of these small farms produced a more diversified selection of crops than the larger, single-crop plantation that produced sugar and pineapple.

The 1980s was a decade where diversified crop production stands out as the dominant trend, as nursery products and fruit and vegetable production led the way in capturing a larger share of agriculture's contribution to the economy in Hawai'i. The number of livestock farms decreased while local egg production still outpaced imports (State of Hawai'i, 2012). A challenge to the "Hawaii Milk Control Act by Safeway Stores versus the Board of Agriculture, State of Hawaii, 1984" impacted local milk prices to farmers by changing the dynamics of the marketplace.

By the 1990s, local agricultural production struggled to keep place, leading to the decline in the plantation system. Mass closing of numerous sugar and pineapple operations throughout Hawai'i during this decade resulted in observed record sales in diversified crop industries notably vegetables, melons, papayas, bananas, and the seed crops. The end of the 20th cen-

ture witnessed a rise in the total number of leading crop farms as smaller “mom and pop” diversified agricultural farms that replaced single-crop plantations. Drought affected much of Hawai‘i in the late 1990s, carrying on into the early years of the 21st century. Drought and volcanic emissions also contributed to declines in food crop output between 2006 and 2009 (State of Hawaii, 2012), and 2018. Natural disasters in 2018 from Hurricane Lane in Puna, and the Kīlauea fissures in 2018 decreased papaya and nursery production with the loss of farms and nurseries on Hawai‘i Island (Bui & Kerr, 2018; Perroy & Collier, 2020).

Today, Hawai‘i imports the majority of its food which makes it particularly vulnerable during natural disasters and global events that may disrupt the food and shipping supply (Leung & Loke, 2008). Although the last two decades have seen diversified crops supplant the plantation era of sugar and pineapple crop productions, in shipments of vegetables and fruits, and animal proteins still greatly exceed what are locally grown and produced. Environmental issues, invasive pests, feed costs, transportation costs, and an aging ownership in the livestock industry, combined with lower-cost competition from mainland and foreign markets, made it difficult to find the once abundant local livestock, and triggered the decline in livestock farms and production value. It was increasingly difficult to compete with (cheaper) frozen mainland animal protein, which also contributed to the shut-down of processing operations.

These supply chain demands have led to shut downs of local food production companies. An example of this is Hawaiian Commercial & Sugar, the last sugar plan-

tation, ceasing operations at the end of 2016 due to a combination of factors, including rising labor costs, competition from other sugar-producing regions, and the industry's struggle to keep up with mechanization in continental mills. A couple years after their closure, Alexander & Baldwin announced the sale of 41,000 acres of the former Hawaiian Commercial & Sugar Company lands to Mahi Pono LLC. Mahi Pono LLC's purpose of these lands were for cultivating a variety of food, citrus, and energy crops, ensuring the continued agricultural use of these lands, the preservation of green, open space in Central Maui, and a consistent and long-term source of revenue for the local economy (Hawai'i News Now, 2018). Outside of the major decline in sugarcane from 2015 to 2020, statewide gains in diversified agriculture (tropical fruits, papaya and kalo) are an important step forward in food self-sufficiency, but more substantial increases in cropland acreage will be needed to make significant progress towards local food production target, particularly in the face of climate change (Perroy & Collier, 2020).

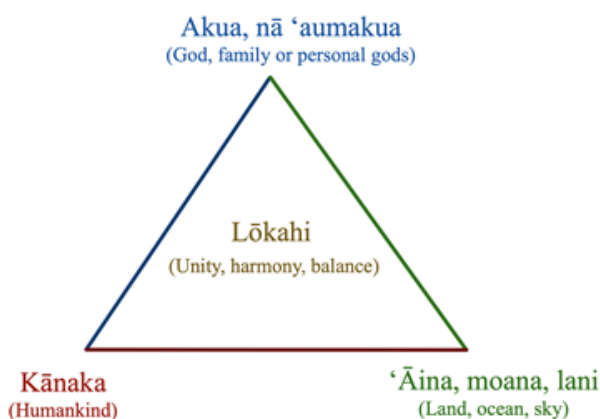
As for animal protein production in Hawai'i, less than 10 percent of all the fresh slaughtered pork consumed locally is raised across the islands today. Due to the high demand for fresh pork, the majority of the hogs slaughtered in Hawai'i are shipped live from the mainland, then slaughtered within a week or so of arrival. Many of the hogs grown in Hawai'i are not commercially slaughtered. They are sold live for private (subsistence) consumption, which brings in a substantially better price for the farmer than if it was sent to commercial slaughter. As for cows and dairy, only one com-

mercial dairy, Cloverleaf, remains in Hawai‘i due to a closure of Big Island Dairy on Hawai‘i Island in 2019.

All of these changes to the food system, specifically for food production, were exacerbated further due to the COVID-19 pandemic in 2020. The pandemic was devastating for agriculture statewide. Demand for fresh produce dropped dramatically with mandated stay-at-home orders and closures to the tourism industry, severely affecting farming operations and the agricultural workforce across Hawai‘i (Perroy & Collier, 2020). The COVID-19 impacts and even the Maui wildfires in 2023 reshaped the economy and will affect the state’s agricultural footprint moving forward, making the demand for food assistance programs crucial.

Just as natural disasters and economic disruptions have left lasting effects, cultural and historical trauma in Hawai‘i has shifted and continues to shift the status of health across the total population since the contact period (Mokuau et al., 2016). With ongoing effects of colonization and settler colonialism that stem from the first Western contact to U.S. occupation of Hawai‘i, Kānaka ‘Ōiwi continue to face unique health complications that go beyond physical health. Prior to Western medicine, Kānaka ‘Ōiwi viewed health with a more holistic approach; balancing all aspects of life in harmony. A modern framework, the Lōkahi triangle, displays three anchor points that can impact health: Kānaka, Akua (God) or nā ‘aumakua (Gods), and ‘āina, moana (ocean), and lani (sky) (Daniels et al., 2022; Stanford Medicine, 2014). This framework is designed to represent traditional health beliefs; all three anchor points working in harmony in an individual’s life in

order to thrive as healthy. This holistic perspective of health has changed significantly since Western colonization of Hawai‘i which has played a major role in the nutrition transition occurring across Hawai‘i (Stanford Medicine, 2014). A number of health implications have resulted due to food system and dietary behavior changes.



8.19
Lōkahi
triangle
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Hawai‘i is now home to a diversity of cultures. The regional cuisine today is a mixture of traditional Polynesian foods and dishes from Asia and North America. The diet found on the U.S. continent is consumed across all populations in Hawai‘i today in addition to international foods. Traditional foods – poi (steamed and mashed kalo), laulau (meat steamed in fresh taro leaves), kalua pork (pork cooked in an imu or earthen oven), and haupia (creamy coconut pudding) – remain core dishes of the everyday cuisine with the addition of

poke (cubed raw fish), limu (seaweed, algae), and squid lū'au (taro leaves cooked with coconut milk and squid). These foods are commonly seen in the local favorite, “plate lunch,” which usually contains a protein (chicken, beef, fish, or pork), a starch like rice, noodles, or poi, and either a side of macaroni salad or green salad.



8.20 Poi
Pounding
Image by
CTAHR



8.21
Hawai'i
Plate
Lunch
with
Tradition
al Foods
Image by
CTAHR

Food Assistance

A number of federal nutrition and food assistance programs are available across the State of Hawai'i funded by the USDA Food and Nutrition Service (FNS). Administered by state and local agencies, these food assistance programs provide nutrition and food security support for individuals and families that qualify based on mean income tested eligibility. These food assistance programs target all ages and address the varying nutrition recommendations for the different stages of life. Available programs in Hawai'i include the [Special Supplemental Nutrition Program for Women, Infants, and Children](#) (WIC), the [School Breakfast Program](#) (SBP) and the [National School Lunch Program](#) (NSLP), the [Supplemental Nutrition Assistance Program](#) (SNAP), the [Child and Adult Care Food Program](#) (CACFP), and the

[Senior Farmers' Market Nutrition Program](#) (SFMNP). Other food assistance programs available by the U.S. can be viewed in the [Food Environment chapter](#). As of September 2025, federal government policy may change the status of the nutrition and food assistance programs that are available across the country, nonetheless, across Hawai'i.

Under the Hawai'i State Department of Health (DOH), the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides nourishing supplemental foods, nutrition education, breastfeeding promotion and health and social service referrals (State of Hawai'i Department of Health, 2025; USDA, 2024). WIC participants are either pregnant, breastfeeding, or postpartum women, and infants and children under age five who meet income guidelines and have a medical or nutritional risk. Based on 2021 Hawai'i WIC data, 47% of WIC participants were pregnant (n=5,413), 37% were breastfeeding (n=4,262), and 16% were non-nursing mothers up to six months after birth or end of pregnancy (n=1,777) (DeBaryshe et al., 2023). As for infant and children participants, 28% were infants (n=8,517), 23% were one year of age (n=6,739), 18% were two years of age (n=5,417), 15% were three years of age (n=4,456), and 16% were 4 years of age (n=4,758) (DeBaryshe et al., 2023).

For children enrolled in grade school in Hawai'i, the [School Breakfast Program](#) (SBP) and the [National School Lunch Program](#) (NSLP) offer eligible children free or reduced-price breakfast and lunch through the Hawai'i Department of Education (HIDOE) (Hawai'i Department of Education, 2024). These meals served in

the SBP and NSLP comply with the USDA's nutritional guidelines and standards. Child eligibility in this program may be determined by their participation in other federal assistance programs, or due to their status as homeless, migrant, runaway, or foster child. In addition, children enrolled in the federally-funded Head Start program or a State-funded equivalent program are eligible for free meals. Children can also qualify for free or reduced school meals based on household income and family size. In Hawai'i, the Community eligibility provision program (CEP) can also qualify a student for free or reduced-price breakfast and lunch. Hawai'i Schools classified as Title I, meaning that 47.2% of households within the school's surrounding community are considered low income, provide all enrolled children with free breakfast and lunch (Hawai'i State Department of Education, 2024). For more information regarding the meal prices and eligibility, visit: [Hawai'i Public Schools web-site](#).

Looking at nutrition assistance that expands to other age groups, the Supplemental Nutrition Assistance Program (SNAP) provides nutritional support to qualifying low-income and in-need households. In Hawai'i, this service is provided by the Department of Human Services (DHS) Benefit, Employment & Support Services Division (BESSD). Eligible households must meet certain income and work requirements that the State of Hawai'i determines, as each state eligibility may differ. SNAP benefits allow participants to purchase fruits and vegetables, meats, poultry, fish, dairy products, breads and cereals, seeds and plants that can produce food for the household to eat, and foods such as snack foods and

non-alcoholic beverages (State of Hawai‘i, 2024a). SNAP benefits may be used at certain farmers markets and can have doubling capabilities through DA BUX program, which is discussed later in this chapter.

The Child and Adult Care Food Program (CACFP) provides reimbursements for nutritious meals and snacks to eligible children and adults who are enrolled for care at participating child care centers, day care homes, and adult day care centers (State of Hawai‘i, 2024b). Eligible entities include public or private nonprofit child or adult care centers, outside-school-hours care centers, preschools, Head Start programs, comprehensive services to nonresidential adults who are functionally impaired or aged 60 and older at day care homes, adult day care centers, etc., and other similar institutions. The Senior Farmers Market Nutrition Program (SFMNP) is designed to provide low-income kūpuna (elders) in Hawai‘i with access to locally-grown fruits, vegetables, honey, and herbs. This program is administered by the USDA FNS and processed through the Hawai‘i Office of Community Services (OCS). Kūpuna must be Hawai‘i residents aged 60 or older, with a household income at or below 185% of the U.S. Federal poverty guidelines. Eligible participants will receive \$50 worth of coupons (10 coupons valued at \$5 each) to obtain eligible foods without charge from participating farmers and farmers market vendors.

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Overall nutrition and health status of children

The transition from traditional diets containing locally grown foods to acculturated diets centered on introduced and imported foods is recognized as a key factor contributing to the decline in dietary quality and health among Indigenous Pacific populations (Dela Cruz et al., 2022; Sievert et al., 2019; World Health Organization, 2003). Introduced and imported foods can differentially affect the nutrition and health of the different stages of the lifespan. Children and adolescents especially can have long-term effects on later health and disease outcomes based on their nutrition and lifestyle during this stage of lifespan (Dela Cruz et al., 2023; Koletzko et al., 2019; Martín-Rodríguez et al., 2022). Childhood obesity prevalence and its associated health complications are a major global and national public health issue, disproportionately affecting indigenous peoples, including Kānaka 'Ōiwi (Braden & Nigg, 2016; Fialkowski et al., 2014). Promoting healthy nutrition and health behaviors during childhood and adolescence through culturally tailored interventions offers an effective approach to prevent childhood obesity in the Pacific region (Fialkowski et al., 2014).

Starting with the first food system of life, infant and toddler nutrition is an important aspect to building long-term health outcomes and behaviors. Human milk provides all the energy and nutrients that infants need

for the first 6 months of life, and it continues to provide up to half or more of keiki's (children) nutritional needs during the second half of the first year, and up to one third during the second year of life (World Health Organization, 2024). Human milk is the ideal food for infants and is safe, clean, and contains antibodies which help protect and lower risk against many common health diseases like obesity (World Health Organization, 2024). The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommend early initiation of human milk within 1 hour of birth and exclusive human milk feeding for the first six months of life (World Health Organization & UNICEF, 2003). In Hawai'i, the rate of human milk initiation after birth was 96.6% of births in 2022 (Hawai'i Health Data Warehouse, 2024). Although data is unavailable for six month postpartum human milk exclusivity, 57.9% of Hawai'i infants surveyed in 2022 were being fed human milk past 9 weeks postpartum (see Table 9.1) (Hawai'i Health Data Warehouse, 2021).

Table 9.1. Human Milk Exclusivity Duration Across Hawai‘i in 2022 (n=14,800)

Human milk exclusive duration (by group)	Percentage	Count
Never fed human milk	3.5%	500
Fed human milk <1 week	25.1%	3,700
Fed human milk 1-4 weeks	12.7%	1,900
Fed human milk 5-8 weeks	0.9%	100
Fed human milk 9+ weeks	57.9%	8,600

Source: Hawaii State Department of Health, Hawaii Health Data Warehouse, Pregnancy Risk Assessment Monitoring System. Breastfeeding – (exclusive) duration (grouped), 2022. Published May 23, 2024. Accessed May 13, 2025. https://hhdw.org/report/query/result/prams/BFExclDurationCat/BFExclDurationCat_ST.html

Note. Adapted from Breastfeeding – (exclusive) duration (grouped), 2022, by Hawaii State Department of Health, Hawaii Health Data Warehouse, Pregnancy Risk Assessment Monitoring System, 2024, [HHDW.org\(https://hhdw.org/report/query/result/prams/BFExclDurationCat/BFExclDurationCat_ST.html\)](https://hhdw.org/report/query/result/prams/BFExclDurationCat/BFExclDurationCat_ST.html). Copyright 2024 by Hawaii State Department of Health. Adapted with permission.

To further encourage human milk feeding for infants during this time of life, efforts across Hawai'i are being made, both by the community and the State. An example of this is through the [Healthy Hawai'i Strategic Plan 2030](#) developing a statewide maternity care hospital recognition program which will set policies and standards to support exclusive human milk feeding by convening a workgroup to create, administer, and evaluate the program.

Continuing to focus on Pacific keiki's health and nutrition patterns, efforts by the Children's Healthy Living (CHL) through their prevalence study and trial surveyed keiki across the Pacific between the ages of 2 to 8 years old. The aim of the CHL study was to prevent young child overweight and obesity and to improve the health in the US-Affiliated Pacific region, including Hawai'i, Alaska, CNMI, Guam, American Samoa, Palau, Republic of the Marshall Islands (RMI), and the four Federated States of Micronesia: Pohnpei, Yap, Kosrae, and Chuuk. In Hawai'i, there were a total of 942 keiki that were surveyed at baseline in 2013. A subsample of 430 keiki provided two nonconsecutive days of food records, providing nutrition information for the CHL study. The trials involved partnership with six communities across the State of Hawai'i. Four communities were paired and randomized to intervention and control (receiving a delayed optimized intervention), and two sites served as temporal comparisons (where only BMI, waist circumference, and selected demographics were assessed) (Novotny et al., 2018). Communities were selected based on trial eligibility criteria of population size of >1,000 , >25% of the population of indige-

nous/native descent, having more than 25% indigenous/native ethnic groups, and >10% of the population under age 10 years (Wilkens et al., 2013). Variables included the following for keiki:

- Sex
- Age
- Race
- Body mass index
- Physical activity
- Screen time
- Sleep duration

Caregivers across four Hawai'i CHL sites collected 2 days of food records on the child from which fruits and vegetables intake, water intake, and sugar-sweetened beverages intake were calculated.

At baseline of the CHL study for Hawai'i keiki (n=430), the overall breakdown percentage of body mass index (BMI) categories were as follows (Novotny et al., 2022):

- 2.8% with underweight (n=12)
- 65.1% with healthy weight (n=280)
- 16.5% with overweight (n=71)
- 15.1% with obesity (n=65)
- and 0.5% were missing (n=2)

After collecting food logs from the caregivers of these keiki, the intake of the foods recorded were categorized into food groups averages (Table 9.2 and Table 9.3).

Table 9.2. Adjusted child dietary intakes in Hawai'i keiki (n=430) (Novotny et al., 2022)

Food Group daily intake¹	Measurement (SE)
Grains, oz	6.28 (0.19)
Vegetables, cup	0.72 (0.01)
Fruits, cup	1.05 (0.06)
Milk, cup	1.48 (0.03)
Meats, oz	5.11 (0.14)

¹Adjusted for age and sex

²Values are means (SE)

Table 9.3. Percentage of energy from macronutrients per day¹

Macronutrient¹	Percentage of Energy (SE)
Carbohydrates	53.33 (0.42)
Starch	26.27 (0.34)
Protein	15.27 (0.10)
Total fat	32.42 (0.28)
Omega-3 fatty acids	0.63 (0.01)
Omega-6 fatty acids	5.61 (0.05)
Monounsaturated fat	12.06 (0.13)
Polyunsaturated fat	6.18 (0.06)
Saturated fat	11.44 (0.20)

¹Values are means (SE)

Of the Hawai'i keiki surveyed, 90.9% met recommen-

dations on percent of energy from carbohydrate, 69.8% met recommendations on percent of energy from fat, and 99.3% met recommendations on percent of energy from protein. Based on the food logs collected from participants, the top food consumed across Hawai'i keiki was white rice (Novotny et al., 2022). Recommendations of incorporating indigenous tubers, such as 'uala and kalo, as a substitute for white rice may increase overall vegetable consumption and nutrition patterns among keiki to improve their diets. To explore more about the top foods across Hawai'i and other CHL jurisdictions during the CHL study, visit the [Top Foods Dashboard](#).

Although data is not available for Hawai'i keiki specific CHL outcomes, the overall CHL intervention reported a reduction of prevalence of young childhood overweight and obesity for keiki aged 2 to 8 years of age living across the Pacific (Novotny et al., 2018). To further address overweight, obesity, and nutrition patterns for keiki in Hawai'i and the broader Pacific, comprehensive, effective, and sustainable interventions are needed to address overall child health in the USAP region.

Outside of CHL's work in Hawai'i and the Pacific, the Hawai'i Youth Risk Behavior Survey collected data on the prevalence of overweight and obesity among middle and high school students. In 2021, 28.9% of 6th grade students, 32.8% of 7th grade students, and 33.5% of 8th grade students across Hawai'i self described themselves as being overweight (Hawai'i State Departments of Education and Health, Hawaii Health Data Warehouse, 2021a). In the same year, high school students were surveyed on their weight status. Of the esti-

mated population of 43,700 high school students across Hawai'i, 30.3% of 9th grade students (n=3,800), 30.1% of 10th grade students (n=3,300), 25.1% of 11th grade students (n=2,600), and 29.7% of 12th grade students (n=2,900) were reported to be overweight or have obesity (Hawai'i State Departments of Education and Health, Hawaii Health Data Warehouse, 2021b).

The findings from CHL studies and the Hawai'i Youth Risk Behavior Survey display the critical role of improving nutrition and access to locally grown foods in addressing the prevalence of overweight and obesity among keiki in Hawai'i. These results highlight the importance of early dietary interventions and culturally grounded initiatives to support healthier eating patterns. The Hawai'i Department of Health released the [Healthy Hawai'i Strategic Plan 2030 for Physical Activity and Nutrition](#) (Hawai'i State Department of Health, 2021) with long-term nutrition goals targeted across all age groups. Starting with the youngest generation, it is targeted to have 94.9% of infants to be breastfed at birth and 42.4% of infants to be exclusively breastfed at 6 months of age. Currently, there are no set targets by the Hawai'i Department of Health in the Healthy Hawai'i Strategic Plan 2030 around nutrition and weight efforts for keiki in elementary schools. As we move to the older group of children, the targeted amount of teens who are consuming five or more servings of fruits and vegetables per day is 16% by 2030. Lastly, by 2030, teens who are classified as having a healthy body weight (BMI 18.5 – 25) are targeted to improve to the goal of 80.9% from a baseline of 71.6%.

The State of Hawai'i's efforts and initiatives for the

Healthy Hawai'i Strategic Plan 2030 includes supporting 'āina-based education, which promotes healthy eating in preschool through grade 12 education settings. By strengthening local food systems and promoting the availability of affordable, nutrient-rich options through programs, such as Kids Eating Local in schools and Da Bux's subsidized produce, communities across Hawai'i can foster healthier lifestyles and reduce the burden of overweight and obesity across generations.

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Community Highlight: Kids Eating Local

Kids Eating Local

Program/Project Description

The “Kids Eating Local” project utilizes experiential farm to school education through expansion of the [Hawai‘i Harvest of the Month \(HOM\) Ho‘opili ‘Ai Program](#) to increase student preference for fresh fruits and vegetables and their willingness to try new foods. In Hawai‘i, HOM is also known as Ho‘opili ‘Ai, which signifies the uniting of keiki (children) with Hawai‘i’s unique, nutritious, and local food crops. The “Kids Eating Local” project will enable continued operation and expansion of the HOM/Ho‘opili ‘Ai program for one year from March 2024 through February 2025 across Hawai‘i.

Methods and Activities

The goal of Kids Eating Local is to provide experiential farm to school education to 8,500 students in preschool through grade 12 (PreK-12) at 50 public and charter schools

across O'ahu (Children's Healthy Living Center, 2024). Participants will be supported to utilize free online educational materials to comprehensively enrich the local food tasting experiences of students through nutrition education and school gardening. At least half of the schools served (25) will be designated as Title I schools (minimum poverty threshold of 47.2%). Through this program, Kids Eating Local plans to distribute 2,625 pounds of local foods from food hubs for farm to school tasting events with students.

Lessons Learned

The Kids Eating Local program was influenced by the National Farm to School Network which has been shown to enrich the connection communities have with fresh, healthy foods and local food producers by changing food purchasing and education practices at schools and early care and education settings (National Farm to School Network, 2020). Using this vision at the forefront of the program, Kids Eating Local hopes to increase lifelong health of children, youth, and adults, including decreased levels of obesity and chronic disease in Hawai'i, and the development of resilient and sustainable local food systems across Hawai'i with an emphasis on community-level food security, food self-sufficiency, and food sovereignty for all. More information about the lessons learned and findings of this program will occur once the program completes in 2025.

For more information on keiki eating local education, check out this playlist of videos that share about the foods in the harvest boxes: [Keiki Education Videos](#).

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Community Highlight: “DA BUX” Double Up Food Bucks Program

“DA BUX” Double Up Food Bucks Program

Program/Project Description

The DA BUX Double Up Food Bucks program (also known as “DA BUX”) is a program of [The Food Basket \(TFB\)](#). TFB is a non-profit organization who serves as Hawai‘i Island’s food bank to end hunger in Hawai‘i County. DA BUX allows SNAP recipients to use their SNAP food dollars on Hawai‘i grown fruits and vegetables and receives a 50% discount on these purchases. DA BUX was established based on the early work of local non-profit organizations providing nutrition incentives for Supplemental Nutrition Assistance Program (SNAP) recipients. Pilot programs were launched starting in 2012 by Kōkua Kalihi Valley Comprehensive Family Services (KKV) on O‘ahu and The Kohala Center on Hawai‘i Island. Later this expanded to the Wai‘anae Coast Comprehensive Health Center on O‘ahu in 2013 and One Island & TFB on Hawai‘i Island in 2015. These pilot programs sparked the idea to the Hawai‘i Good Food Alliance

(HGFA) for a statewide nutrition incentive program. In 2019, TFB, with the support of HGFA and in collaboration with many Hawai'i community partners, secured a USDA Gus Schumacher Nutrition Incentive Program (GusNIP) award to unify all SNAP nutrition incentive programs under a statewide "DA BUX Double Up Food Bucks" program. The GusNIP award required a 100% match which has been successful with the support from many organizations (found on page 15 of [Da Bux 2020-2021 Outcomes Report](#)) as well as the State of Hawai'i. Hawai'i Governor Josh Green released \$500,000 to continue the benefits of DA BUX on October 31, 2023 for SNAP recipients. From 2019 to 2025, DA BUX was able to be funded statewide for all SNAP participants.

Methods and Activities

When this policy was implemented statewide, DA BUX was able to partner with food retailers across the state, including local grocery stores like Times Supermarket, KTA Super Stores, along with select Foodland stores, farmers markets, and food hubs, to offer the same program benefits to all SNAP participants in Hawai'i. At participating grocery stores, SNAP shoppers needed to show a DA BUX Access Card at checkout for the cashier to scan the barcode on the back of the card and trigger the discount.

Lessons Learned

DA BUX is a great example of success at the community

level being translated to the state level. This program is considered a triple win for Hawai'i because not only does it support families, but also farmers and the local economy. Low-income SNAP households were able to afford more healthy local produce; local farmers increased their sales to food retailers and local consumers; and more federal SNAP dollars were circulated in the state's economy. Families across Hawai'i were able to receive more healthy foods to consume for a fraction of the cost using their SNAP benefits. From these successes, legislative measures are planned for proposal in future Hawai'i legislative sessions to secure additional funding to continue DA BUX.

To learn more about DA BUX program, check out their website: ["DA BUX" Double Up Food Program](#).

CHAPTER 10. FUTURE DIRECTIONS

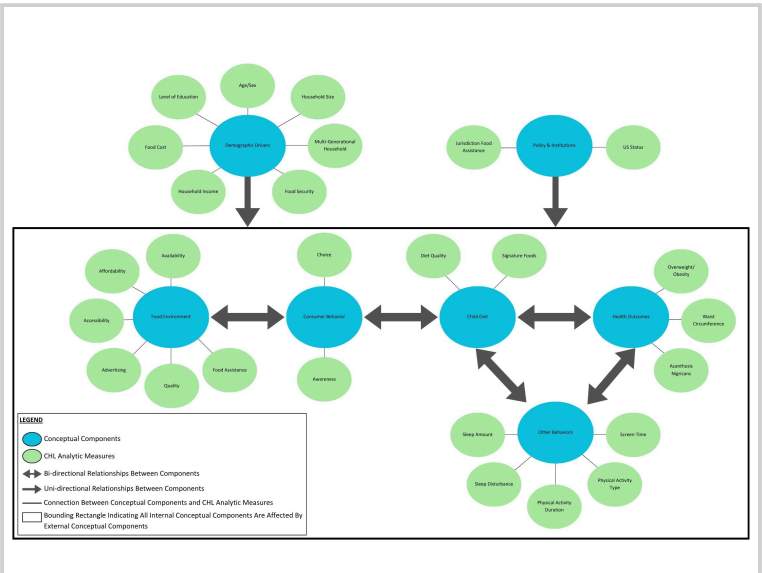
Future Directions

Food systems in the Pacific face unique challenges due to the geographic location, cultural values, and political affiliations. In order to improve and maintain the overall health status of children living in the U.S. Affiliated Pacific (USAP) Region, these challenges must be addressed with systems-level changes. When considering effective approaches for working within the USAP Region's food systems, it is crucial to be adaptive and innovative, as the system is dynamic, fluid, and non-static. Important drivers to overcome challenges include research, implementing new policies, and developing thoughtful organizational structures. For example, developing forward-thinking policies and organizational structures while adopting new research methods and technologies can improve nutrition measurement for children and populations and strengthen systems thinking within Pacific food systems. Continuing to develop culturally-relevant nutrition programs and education designed to meet the region's specific needs will improve the health status of children in the USAP Region.

This book highlights how a food systems transformation could be realized to support the health of children for future generations. Taken all together, the chapters express the overarching message of transforming food systems to change how things are done and what is done. Drawing from the Children's Healthy Living (CHL) Analytic Framework (see Figure 9.1), the concep-

tual components of diet and health display the complexities of all the moving parts of the food systems in the USAP Region. As the [Agriculture](#), [Food Environment](#), and [Consumer Behavior](#) chapters have highlighted, these conceptual components are critical drivers that play a role in the Pacific food systems. The bidirectional relationships between the conceptual components influence what is available in the food system. Although agriculture is not encompassed in the CHL Analytic Framework (Figure 9.1), agriculture is also a key conceptual component of food systems change. Agriculture is present throughout all measures of the framework and moreover, food systems could not exist without it. Furthering regenerative agriculture that is locally acceptable and environmentally suited to the Pacific can improve nutrition and increase resiliency to aid recovery from natural disasters.

The Food Environment and Consumer Behavior chapters explored the CHL analytic measures in greater detail, focused on the communities participating in CHL. From these three chapters, the bidirectional relationships between agriculture, the food environment, and consumer behavior underscore the critical role of human influence on food systems.



The case study chapters focused on [Alaska](#), the [Commonwealth of the Mariana Islands, Guam](#), and [Hawai'i](#) shed light on the depth of lived experience within Pacific food systems across all aspects of the CHL Analytic Framework (see Figure 9.1). These case studies highlight the unique characteristics of each jurisdiction, demonstrating distinct differences even among those within close geographical proximity. Furthermore, Alaska's inclusion in the USAP Region is significant; despite its vast landmass, it shares many food systems and other correlated challenges with the Pacific Islands across the Pacific Ocean. Notably, these chapters collectively suggest that the challenges of imported food systems could potentially be overcome by leveraging indigenous food systems and the existing efforts in place that uplift indigenous ways of knowing.

Future iterations of this textbook will include a case study of American Samoa's food system.

In regard to child nutrition programs, this OER textbook captured the existence of a complex, interconnected, and long standing network of governmental policies and procedures, community interests, scientific experts, business/economic stakeholders, and Indigenous cultural practitioners all focused on childhood nutrition. Furthermore, the matrix of conceptual components interact with each other, with some leading, others stepping back, and all adapting to one another to create the inner workings of the USAP Region's food systems. In summary, child nutrition programs work within national, regional, and local government and economic spaces, therefore, influencing education, community, and household environments.

What sets food systems in the USAP Region apart is the food and nutrition environment and culture, including its traditions and histories. Influential food systems drivers, as described as CHL conceptual components, in this region's food system are dietary patterns established in infancy and shaped over time by the cultures present in the USAP. The culture surrounding food is heavily influenced by other drivers not mentioned in the CHL Analytic Framework (Figure 9.1) such as the immediate food environment, built infrastructure, and societal transitions, among many others. As a result, these drivers influence the food system surrounding child nutrition and educational programs.

Future steps for the CHL program will be shaped by the shifting federal policy landscapes and evolving priorities over time. Adapting to this new environment

demands innovative thinking and the development of locally-rooted approaches. Essential research priorities include a more comprehensive analysis of the agriculture, food environment, consumer behavior, food composition specific to the Pacific region, and a deeper understanding of Pacific food sources. Simultaneously, we must identify and leverage existing community and institutional programs that can be utilized to effectively monitor food environments and their long-term impact on child health.

Potential Next Steps in the U.S. Affiliated Pacific Food System

Research and policy are essential for transforming food systems because they generate the knowledge and evidence needed to guide, support, and evaluate meaningful change. Harnessing this potential can help transform food systems to sustainably manage resources, adapt to current and future challenges, and improve resilience. Ultimately, these efforts can create food systems that ensure all people, now and in the future, have access to safe, nutritious food and achieve long-term food and nutrition security.

This book provides an overview for potential opportunities to transform the Pacific food systems and support research focused on supporting children's healthy living. Transformation will require big, bold investments from both public and private actors to support funda-

mental changes in our food systems. At the same time, it is crucial to ensure there is continuous, rapid multidimensional and multi-level feedback through transdisciplinary metrics and measurements, to secure directed transformation that maximizes food systems performance while minimizing inputs such as costs and associated resources.

The CHL Analytic Framework (see Figure 9.1), which framed the content reviewed in the OER, is one tool in which to assess the transformation of Pacific food systems in the context of child health. Child health and nutrition exists within dynamically complex socioecologic contexts, including family, schools, culture, and larger food systems. Applying systems approaches, including participatory systems mapping approaches such as community-based system dynamics (CBSD) and group model building (GMB), allows for building the capacity and empowering communities to apply system dynamics to understand the contexts of child nutrition and health in food systems (Hovmand et al., 2025). CHL developed, conducted, and evaluated a series of GMB community workshops on children's healthy eating from October 2022 to March 2023 in Hawai'i, Alaska, the Commonwealth of the Northern Mariana Islands, Guam, and American Samoa, sequentially. As a result, causal maps were created to support broad efforts in understanding, planning, communicating, and changing local food systems in ways that emphasizes the relational nature of knowledge to the local context, including the culture and environment of food systems driving children's diets and health (Hovmand et al., 2025). These causal maps serve as critically important

data-driven strategies that are socioeconomically and culturally relevant to the richly diverse groups of the USAP.

In addition, future steps to positively influence Pacific food systems to improve child health also requires accurate approaches to measuring diet and the composition of the foods that are locally grown, prepared, and consumed in the region. This is a critical component to shaping nutrition guidance and food policy that is appropriate for the USAP Region. In addition to the application of dietary assessment tools that are specific to measuring diet among Pacific populations, various dietary assessment tool enhancements as a result of technological innovation have also contributed to growing the knowledge of what people consume in the USAP Region (Kolonel et al., 2000; Stram et al., 2000; Murphy et al., 2006; Martin et al., 2008; Novotny et al., 2013, 2021; Aflague et al., 2015; Guerrero et al., 2015; Yonemori et al., 2017; Fialkowski et al., 2022; Proctor et al., 2025). Such research and development activities are vital for the USAP Region as it is not covered in primary nutrition surveillance and monitoring efforts in the U.S., while U.S. food composition databases and dietary assessment tools are based on these national efforts. As a result of these USAP Regional efforts, a food composition database has grown to over 1500 single foods and 1100 recipes in order to serve research, government, and other programmatic needs in the region (Murphy, 2002).

Continued innovation in dietary assessment methodology and robust data on food composition are needed in order to positively influence Pacific food systems for

children's healthy living. This needed innovation and expansion may consider the integration of machine learning (ML). ML uses computational methods to automatically learn patterns from reference data and/or previous iterations with mathematically describable principles which can produce high-dimensional data and capture nonlinear relationships. ML may be able to uncover dietary patterns, assess nutritional status, and decipher intricate nutritional mechanisms that have not yet been explored (Quan et al., 2025).

Beyond dietary assessment and food composition, artificial intelligence (AI) may also evolve food production, distribution, and consumption. Regardless of the application, a collaborative and ethical approach with all relevant partners, grounded in indigenous principles and values, and underpinned by robust ethical frameworks and transparent policies, is essential to ensure the responsible usage and equitable deployment of any type of technological innovation that will foster resilient and sustainable food systems (Perera et al., 2025; Harikrishnan et al., 2025).

Key priorities for CHL include strengthening transdisciplinary collaborations across sectors and levels, while creating environments that support shared learning, common targets, standardized metrics, and continuous learning from both successes and failures. For CHL and the USAP Region, advancing food-system transformation will require adaptive strategies and innovative thinking that can respond to changing policies, shifting government priorities, and evolving funding landscapes. Strengthening and leveraging existing food and nutrition programs across the USAP can

improve monitoring of foods that influence child health, expand regional food composition data, and build local research and workforce capacity to sustain long-term improvements. Future revisions of the CHL Analytical Framework (Figure 9.1) should explicitly position agriculture as a core driver of food systems, aligning the framework with the Food and Agriculture Organization of the United Nations [Food Systems Conceptual Framework](#) and ensuring that agriculture remains central to efforts to improve child health and nutrition in the USAP Region. Achieving this transformation will require coordinated leadership from researchers, practitioners, policymakers, community organizations, and other critical partners to reorient research and innovation systems, strengthen partnerships, and translate evidence into sustainable actions that improve food systems and child health.

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