

MAUI ISLAND PLAN 2030

QUALITY OF LIFE  
INDICATORS REPORT

April 2020

Maui Tomorrow Foundation, Inc.

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## Introduction

“Quality of life” is a phrase that is frequently used in various contexts, but is seldom well defined. A high quality of life provides people with the freedom to attain their needs in ways that they choose. Indices that are used to measure quality of life are commonly developed using weighted measures of economic growth, health, and environmental quality. The quality of people’s lives is subjective, due to the fact that it is personal in nature, filtered by their perceptions, and related to all of their needs.

People who feel that their quality of life is high report greater levels of happiness. However, it is also difficult to objectively quantify happiness; asking individuals whether they are happy typically yields a subjective answer. This difficulty is not insurmountable, but must be recognized when considering which values to include when choosing quality of life indicators. In order to identify local values and understand cultural perspectives regarding the quality of life, it is helpful to reach out widely to obtain community input.

The Maui Island Plan 2030 (MIP) is a component of the Maui County General Plan that provides direction for future growth, the economy, and social and environmental decisions on Maui through 2030. The MIP builds upon previous efforts which examined quality of life, such as Decisions Maui and Focus Maui Nui. Each of these efforts incorporated extensive community input in order to elicit the values of Maui’s people.

Throughout the MIP, the phrase “quality of life” is used many times, and the plan states that many things such as scenic resources and adequate infrastructure contribute to Maui’s quality of life. Although a clear definition of “quality of life” is not discussed, the Monitoring and Evaluation Program outlined in Chapter 9 “establishes a strategy to track the implementation, evaluate the effectiveness of policies and programs, monitor the quality of life on Maui, and allow for periodic program adjustments.” The MIP states that the core set of 36 indicators contained in Table 9-1 of the Plan will be monitored by the Department of Planning, and “could be used to monitor progress toward achieving the goals and objectives of the MIP.” To the extent that these indicators are “based on available and reliable data to ensure their usefulness throughout the planning horizon”, and are “modified and updated as new data becomes available,” Maui’s quality of life can be improved.

The purpose of this report is to evaluate the indicators that the MIP prescribes to measure progress toward achieving the goals and objectives of the plan (and therefore Maui’s quality of life); to evaluate their effectiveness; and to suggest possible improvements to these indicators that would facilitate implementation of the Plan.

## Quality of Life on Maui

In order to understand and track the quality of life on Maui, the values of our Maui community need to be understood, and measurable indicators that reflect policy implementation based on those values need to be tracked. A high quality of life depends on fulfillment of both long term and immediate needs; this is an important factor when considering the suitability of indicators for quality of life measurement and tracking. Short term needs generally pertain to the attainment of basic life-sustaining elements, such as food, water, shelter, and immediate safety. Long term needs include the attainment of goals such as sustainability, health, and social well-being.

During development of the Maui Island Plan, preliminary informal interviews with Maui residents revealed that a good quality of life was characterized by the freedom to realize a good standard of living and meet personal needs through:

1. Access to basic needs like clean water, food, security, and electric power.
2. Freedom to take ownership and pride in their locality.
3. Freedom to engage in personal development on their own terms.

A locality with a high quality of life was described as a location with a safe environment, good opportunities, and sustainable resources. On the other hand, locations with low quality of life were described as unsafe, bereft of opportunity, and either lacking resources or actively destroying them.

### Benchmarks and Indicators

An *indicator* is a measurable quality or quantity that can be used to identify the current status of a factor – in the case of the MIP, a factor that is deemed to influence the quality of life. Observed trends in MIP indicators can be used to maintain or change policies in the plan.

A *benchmark* is a point of reference against which the current status of a particular indicator can be measured. A benchmark usually corresponds with a desired goal.

The MIP provides for measurement of indicators against corresponding benchmarks as a way to measure progress in the implementation of policies. Physical, environmental, cultural, and socio-economic indicators and their benchmarks are used to assess the overall quality of life on Maui. The MIP says in several places that benchmarks need to be set for quality of life indicators; this still needs to be done.

### The Maui Island Plan and Quality of Life

The purpose of the Maui Island Plan is to provide guidance on decisions regarding future growth, the economy, the community, and the environment through the year 2030. The MIP commits to striving toward a higher quality of life for Maui's inhabitants, and to using quality of life indicators as measures of success during implementation.

The Maui Island Plan makes a commitment to improving the quality of life of Maui’s people, and prescribes an approach that involves the measurement of progress through tracking quality of life indicators in comparison to benchmarks that are to be set. Specific review steps called for as part of the implementation of the MIP include a) regularly conducting a community satisfaction survey; and b) preparing a monitoring report on quality of life indicators.

## Overview of Maui Island Plan Indicators

Chapter 9 of the Maui Island Plan lays out a strategy to “track the implementation [of the plan], evaluate the effectiveness of policies and programs, monitor the quality of life on Maui, and allow for periodic program adjustments. This strategy includes establishing and monitoring performance indicators to help implementing agencies attain planned outcomes.”

The intent of the MIP is to have the Department of Planning monitor a core set of indicators (shown in Table 9-1 of the plan) that can be used to monitor progress toward achieving the goals and objectives of the MIP. Some of these indicators are based on available and reliable data, but others are not. Fortunately, the MIP specifies that the indicators can be modified and updated as new data becomes available.

The indicators are grouped into three broad thematic areas and nine categories, as shown below:

Built Environment	Social Environment	Natural Environment
<ul style="list-style-type: none"> <li>• Land Use</li> <li>• Infrastructure and Public Facilities</li> <li>• Transportation</li> </ul>	<ul style="list-style-type: none"> <li>• Cultural Heritage Resources</li> <li>• Economic Development</li> <li>• Population</li> </ul>	<ul style="list-style-type: none"> <li>• Watershed Systems</li> <li>• Marine Environment</li> <li>• Wildlife and Natural Areas</li> </ul>

In the following sections, each indicator is reviewed with regard to:

- a description of the associated MIP goals
- an analysis of the trends found in available data
- an analysis of the quality of the specific indicator, and
- suggestions for improvement, if needed

## Theme: Built Environment

*MIP: “The design of the built urban environment will greatly influence the sustainability of all communities and the overall quality of life.”*

### Built Environment Category: Land Use

	INDICATOR	GOAL ASSOCIATION
LAND USE	Building Permits issued inside UGB vs. outside UGB	Protect Agricultural Land, Make Livable Communities
	Average Density of New Developments	Make walkable communities, increase housing affordability
	% of Infill vs. Greenfield Development	Create compact, efficient, human scale communities
	Housing Affordability Index	Increase housing affordability

*MIP: “The purpose of the land use chapter is three-fold: to provide an overview of Maui’s past and current land use patterns; to explore future land use challenges and opportunities; and to provide policy direction that will enhance Maui’s agricultural lands and protect the rural character and scenic beauty of the countryside.*

## Built Environment > Land Use Indicator:

### *Building Permits Issued Inside UGB vs. Outside UGB*

Development outside of a county designated urban growth boundary (UGB) where there is no infrastructure can raise the cost of housing, add to sprawl, take away valuable agricultural land, and create non-walkable communities. The Land Use chapter of the MIP includes many policies and actions designed to concentrate development within urban growth boundaries.

#### Analysis of Trends

Information related to this indicator is not currently maintained by the County of Maui Planning Department. Since this information is not currently available, no trend analysis can be performed at this time.

#### Indicator Quality

If the requisite data were to be compiled, this indicator would provide a reasonable basis for evaluating if growth is being concentrated within urban growth boundaries.

## Built Environment > Land Use Indicator:

### *Average Density of New Developments*

*MIP: “At the island and regional scale, increasing the density of housing is a more efficient use of land. It also saves on linear miles of roads, water lines, and other utilities that need to be built and maintained. Increasing the density of housing also preserves more land for agriculture and open space. At the project scale, increased density can reduce land and building costs and thereby result in more affordable sale and rental prices.”*

Increasing the density of new housing developments also promotes the use of public transportation, and facilitates the design of walkable communities. The average density of new development projects is a relevant factor that will influence the quality of life for residents of these new developments.

The average density of new developments can be calculated by dividing the total number of units for new developments by the total acreage of new developments.

$$\text{Average density of new developments} = (\text{total new development units})/(\text{total acreage of new developments})$$

#### Analysis of Trends

Information regarding the number or acreage of new developments is not currently maintained by the County of Maui Planning Department in a form that is readily retrievable. Therefore, no trend analysis can be performed at this time.



## Indicator Quality

If the requisite data were to be made available, the average density of new housing developments could be calculated using the above formula. This indicator could then be used to evaluate the effectiveness of policies that encourage affordable housing development and walkable community design, each of which positively influence the quality of life in a community.

## Built Environment > Land Use Indicator: *Percentage of Infill vs. Greenfield Development*

*MIP: “Ensure higher-density compact urban communities, infill, and redevelopment of underutilized urban lots within Urban Growth Boundaries.”*

Urban infill is the development of land found within the boundary of an existing built-up area. Although it is likely that infill will take place within a UGB, it is possible that it may not.

Greenfield development, on the other hand, occurs when previously undeveloped land is built upon.

Tracking infill vs greenfield development will help to track adherence to policies that encourage higher-density compact urban communities, infill, and redevelopment of underutilized urban lots, whether development occurs inside or outside of a UGB.

## Analysis of Trends

No information regarding infill or greenfield development is currently maintained by the County of Maui Planning Department. Since this information is not readily retrievable, no trend analysis can be performed at this time.

## Indicator Quality

Since both infill and greenfield development can occur either inside or outside of the UGB, this indicator is slightly different from the previous indicator, “Building Permits Issued Inside UGB vs. Outside UGB.” The fact that a greenfield is developed will be counted in the “*Building Permits Issued Inside UGB vs. Outside UGB*” indicator as furthering the objectives of the MIP. On the other hand, the “*Percentage of Infill vs. Greenfield Development*” indicator would count the same greenfield development as a negative, whether inside or outside of a UGB.

If the data were to be made available, this indicator could be used to track progress toward building dense, walkable communities that increase the overall efficiency of development with respect to space.

## Built Environment > Land Use Indicator:

### *Housing Affordability Index*

*MIP: “Maui will have safe, decent, appropriate, and affordable housing for all residents developed in a way that contributes to strong neighborhoods and a thriving island community.”*

Housing costs on Maui have reached record highs in recent years, but income has not kept pace. This has reduced the ability of Maui’s residents to afford to buy or rent a home.

The Housing Affordability Index compares the median price of a home with the price that a median income family can buy. Separate indices are maintained for single-family homes and for condominiums (condos).

#### Analysis of Trends

The data shows that between the years 1998 and 2018 in Maui County, the housing affordability index for single-family homes was consistently below the housing affordability threshold value of 100. There were only two exceptions, in 2011 and 2012, when the housing affordability index value was slightly above 100 (meaning that median income families could buy median-priced homes).

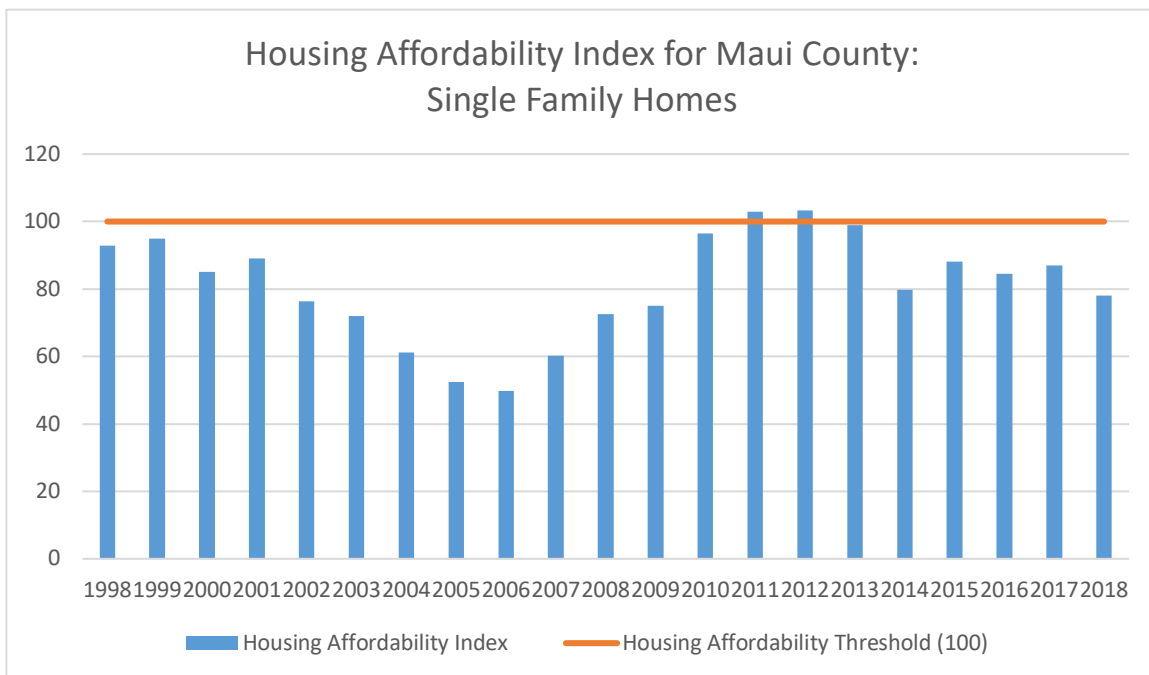


Figure 1 (Housing Affordability Index: Single-Family Home, 2019).

Condominium (condo) ownership is more affordable to households that earn the median income. Between the years 1998 and 2018, most years had a housing affordability index above 100 (meaning that median income families could more than afford to buy median-priced condos). The exception to this was between the years 2005 and 2009, when the housing affordability for condos index dropped below the threshold for 5 consecutive years.

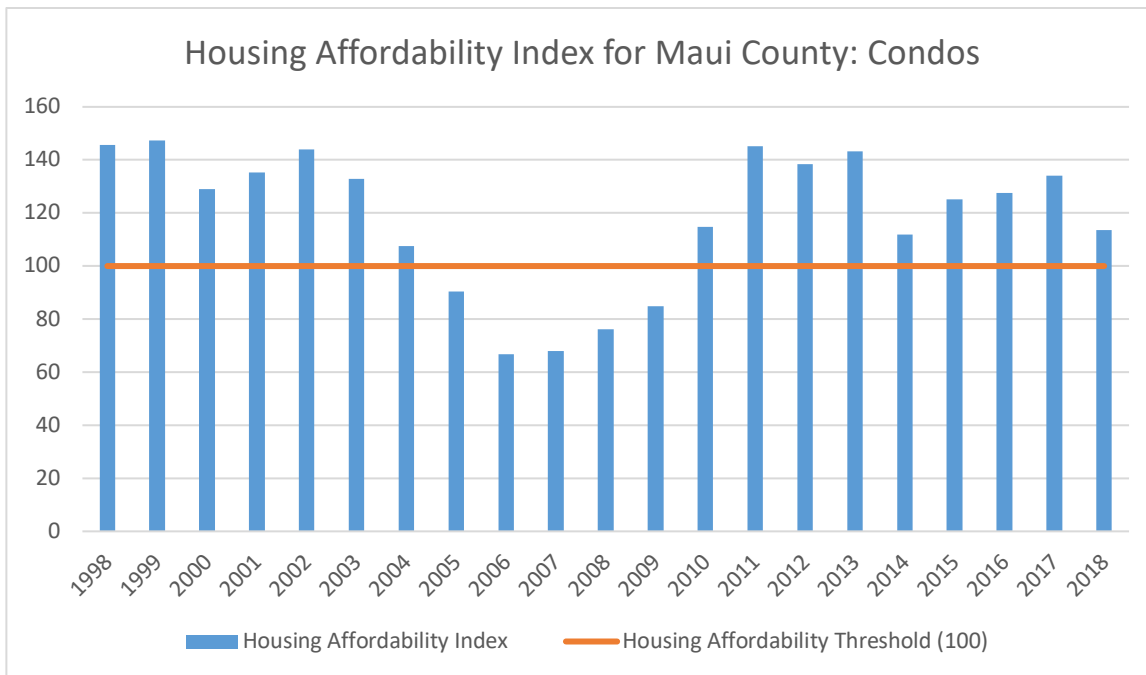


Figure 2 (Housing Affordability Index: Condos, 2019).

### Indicator Quality

#### Advantages:

The Housing Affordability Index is published on a regular basis by the University of Hawaii Economic Research Organization and is likely to remain available to use over time.

#### Disadvantages:

- The Housing Affordability Index does not take into account the actual availability of affordable housing to residents.
- The index only measures the affordability of homes for prospective purchasers.
- The index does not measure housing affordability for existing homeowners.
- Household size is not taken into account.
- The index does not take into account affordability for renters, who may experience higher shelter costs than homeowners.
- The index does not measure how much affordable housing remains affordable in perpetuity, as opposed to the number of homes that get sold at market price after affordability restrictions expire.
- The index does not measure the influence of non-resident buyers on housing prices.
- This index does not take into account the fact that many buyers pay less than the assumed 20% down payment.

Despite its limitations, this indicator is useful for tracking housing affordability for Maui residents. This is an important factor in determining the quality of life perceived by people who want to own their own homes.

## Built Environment Category: Transportation

	INDICATOR	GOAL ASSOCIATION
TRANSPORTATION	Vehicle Miles Traveled (VMT)	Reduce fossil fuel consumption
	Commute mode shares	Provide transportation options, reduce fossil fuel consumption
	Annual Transit Ridership	Provide integrated transit systems
	Total Mileage of dedicated bike lanes	Provide a multi-modal transportation system

MIP: *“The quality of the roadway system affects various modes of travel including automobile, transit, bicycle, and pedestrian. The condition of Maui’s roadway system also impacts the safety of all roadway users, the movement of goods and products, efficiency of emergency public services, and quality of life.”*

Maui residents predominantly rely on the use of fossil-fueled vehicles for travel to and from work, to run errands, and for recreation. Ownership of a vehicle significantly improves an individual’s capability to travel long distances without waiting for public transit or walking. Personal vehicle use has enabled society to spread out over wide distances and travel to remote areas.

The wide use of individual vehicles has obvious benefits to society, but those benefits come with their own set of costs.

- The use of vehicles orients society in a way that makes walkable communities less relevant.
- New infrastructure designed for single vehicle use often encourages more development that soon exhausts the additional capacity of that new infrastructure.
- Lack of daily walking may lead to negative health effects.
- Widespread use of fossil-fueled vehicles emits large quantities of carbon dioxide, which contributes to climate change.

### Built Environment > Transportation Indicator:

#### *Vehicle Miles Traveled*

MIP: *“Research suggests that increasing residential density can reduce household VMT by about 10 percent, and perhaps by as much as 25 percent when combined with higher employment concentrations, public transit improvements, mixed uses, and other demand management measures.”*

#### Analysis of Trends

Vehicle Miles Traveled (VMT) is a measure of the annual total mileage traveled by passenger cars, buses, trucks, and motorcycles (trailers and semi-trailers are excluded). Vehicle Miles Traveled is widely used to assess dependence on automobile travel. The MIP associates lower VMT with the goal of creating more compact communities. Data is available for Maui County, but is not available by island.

Vehicle Miles Traveled in Maui County has varied only slightly between the years 2007 and 2017. Over this time period, VMT has ranged from about 1.7 million miles to about 1.4 million miles, a variance of about +/- 13 percent. See Figure 3.

## Indicator Quality

VMT for fossil-fueled vehicles is influenced by petroleum prices. VMT for all vehicle types may be influenced by economic conditions that cause people to use their cars more or less; because of this, it is an imperfect measure of the success of MIP policies aimed at reducing residential densities. However, this indicator may be useful for that purpose if its limitations are recognized.

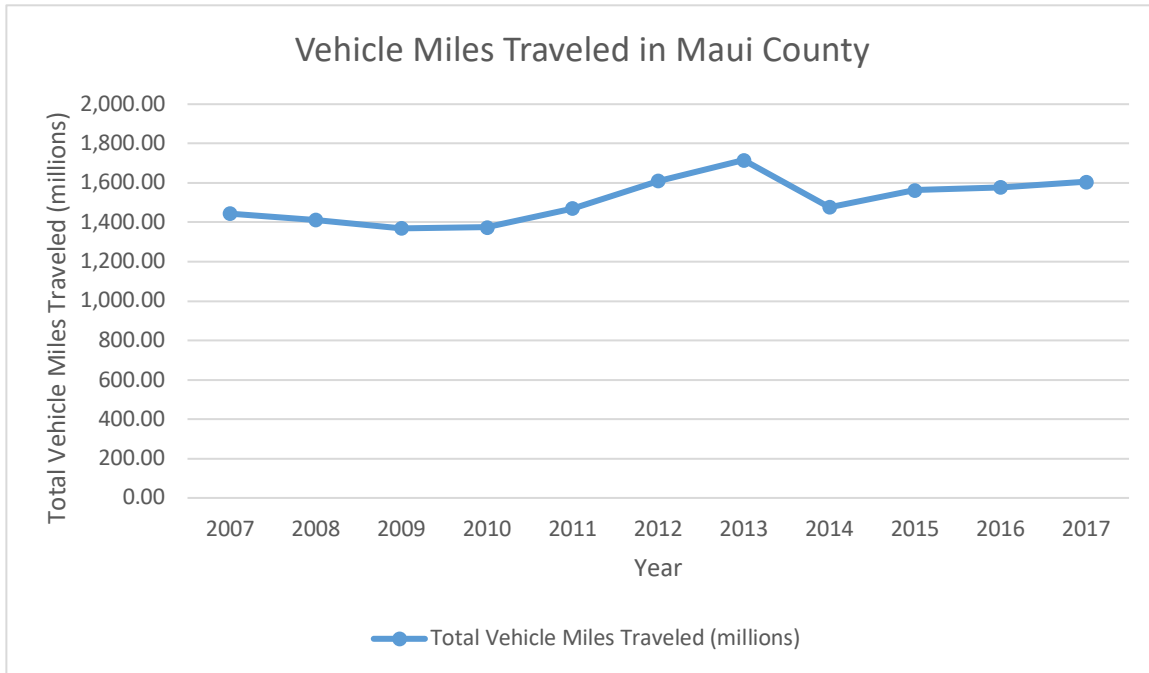


Figure 3 (Maui County Data Book 2018)

## Built Environment > Transportation Indicator: *Commute Mode Shares*

MIP: “Establish a sustainable transportation system that includes multiple modes, including walking, biking, and mass transit, as well as automobile-based modes.”

Not all who travel on Maui roads use personal vehicles. Alternate methods of transportation include walking, biking, and public transportation. Hawaii maintains statewide information on the commuting methods that residents use. Information on commute mode shares is available from the U.S. Census for Maui County, but not for Maui island alone.

## Analysis of Trends

From 2010 to 2018, Maui County commute mode shares for workers 16 and over were relatively constant.

- Drive Alone **Increased** from 70.2 to 72.7 percent
- Walk Decreased from 3.3 to 2.3 percent
- Carpool Decreased from 14.7 to 13.9 percent
- Public Transportation Increased from 1.7 to 2.7 percent
- Work from Home Decreased from 7.7 to 6.0 percent
- Other Means Ended unchanged at 2.4 percent

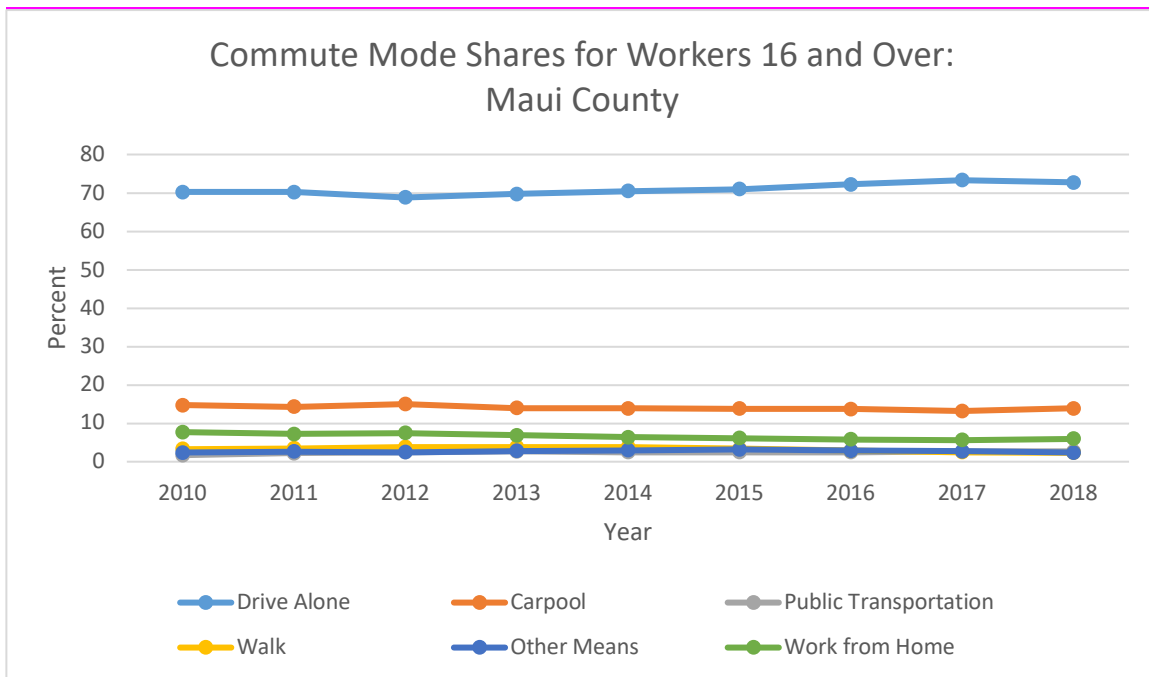


Figure 4 (Data.census.gov, United States Census Bureau, 2019)

## Indicator Quality

This is a good indicator for which the data is updated on a regular basis. It provides the necessary information to determine trends with respect to different commute mode shares.

## Built Environment > Transportation Indicator:

### Annual Transit Ridership

*MIP: Goal 6.5 “An island-wide transit system that addresses the needs of residents and visitors and contributes to healthy and livable communities.”*

*Objective 6.5.1: :An integrated transit system that better serves all mobility needs of Maui’s residents and visitors.”*

Integrated transit systems are public transit services that maximize usability for the public. Effective integration of transit systems is a massive undertaking, requiring years in planning, engineering, impact studies, and capital costs. To the extent that this integration is successful, ridership may increase.

### Analysis of Trends

The Maui County Department of Transportation collects annual ridership information for public transit, which began on Maui with the introduction of the Maui Bus in 2002. Public transit ridership peaked in 2012 with 2.7 million riders, but dropped to approximately 2.1 million by 2017.

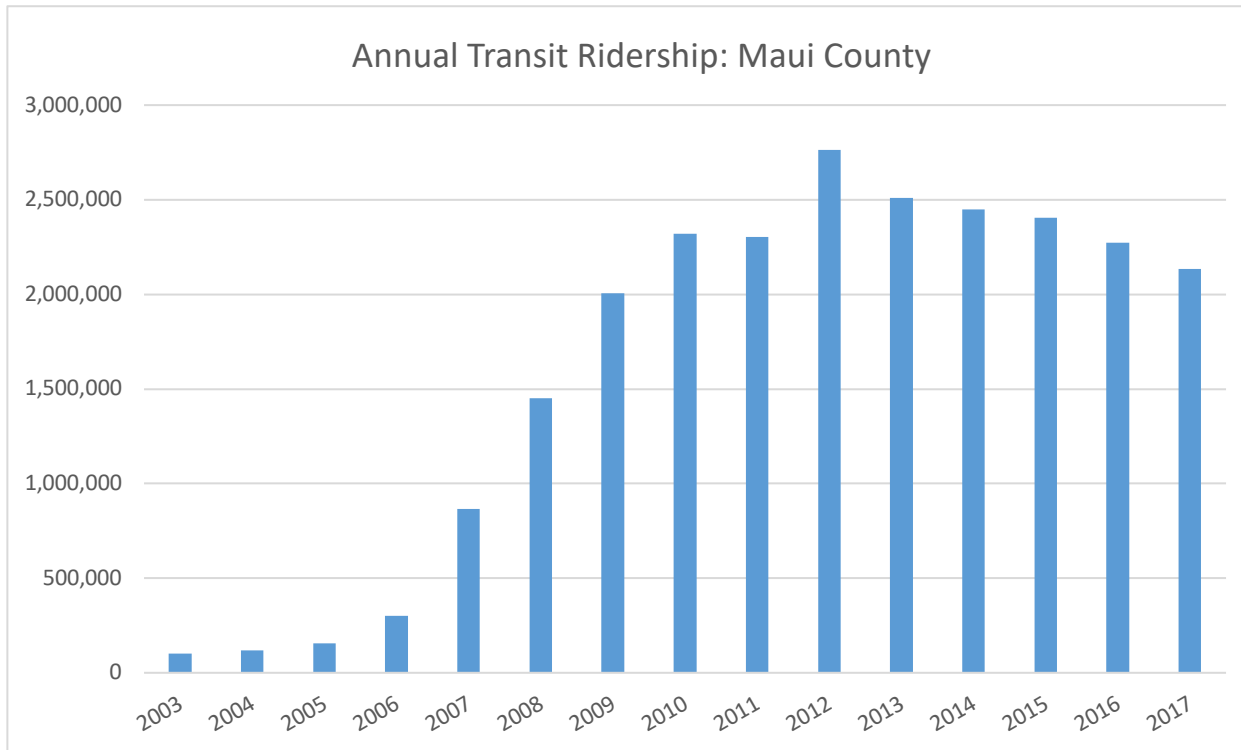


Figure 5 (Maui County Department of Transportation, 2020)

### Indicator Quality

Annual Transit Ridership is a reliable indicator of how many people are using public transit systems. Significant improvements in the integration of transit systems should result in increases in annual ridership, although factors external to transit system integration (such as the state of the economy) may play a significant role in whether people use public transit. Annual Transit Ridership data is collected regularly, and provides decision makers with timely information regarding the impact of policy decisions.

### Built Environment > Transportation Indicator:

#### Total Mileage of Dedicated Bike Lanes

MIP: “Well-designed streets generally have the following characteristics: . . . Bike paths, bike lanes, and greenways.”

“A system of sidewalks, greenways, and bike lanes should be developed to reduce community reliance on the automobile.”

Bike lanes encourage bicycling, and provide people with safe options for running errands, exercising, commuting to work or school, etc. Bike lanes allow people to access locations which might previously have required a car to safely access. Bike lanes also improve the quality of life by reducing pollution and providing practical alternatives to single-vehicle transportation.

### Analysis of Trends

The Hawaii Department of Transportation provides data for the Hawaii Bike Master Plan, but it is not published regularly. Data used is from master plan reports published in 1994, 2003, and most recently 2013.

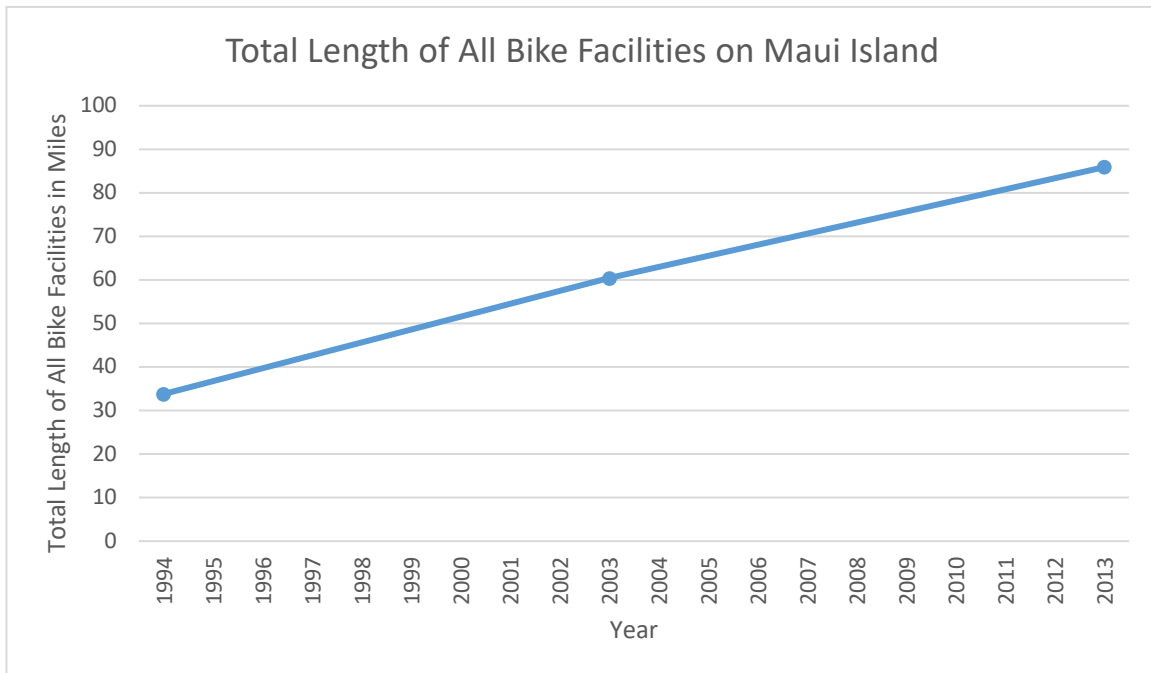


Figure 6 (Bike Plan Hawaii Master Plan, 2013). “All Bike Facilities” includes the length of signed shared roads, the length of dedicated bike lanes, and the length of shared use paths. The 2013 number includes the length of bike paths that are existing or underway. (Bike Plan Hawaii Master Plan, 2013).

As a result of efforts to improve the quality and abundance of bike facilities, 26.6 miles of bike lanes were added between 1994 and 2003. 25.5 miles of bike lanes were added to Maui between the years 2003 and 2013 (Bike Plan Hawaii Master Plan 2013).

### Indicator Quality

This indicator provides a fairly good measurement of the availability of bike lanes on Maui. This is another measure that can indirectly track the effects of creating compact communities. It could be improved with more frequent data collection.



## Built Environment Category: Infrastructure

*MIP: “The island’s infrastructure systems are vital to our community, economic prosperity, and quality of life.”*

*Core Values: “F. Secure necessary infrastructure concurrently with future development”*

*Key Highlights: “Integration of Land Use and Infrastructure Planning. We will implement a framework to ensure that our infrastructure and land use planning functions are integrated, so that infrastructure can be provided more effectively and efficiently. Financing tools will be developed so we can invest in water and wastewater systems, transit, parks, and other public facilities that will serve as a foundation for prosperity.”*

	INDICATOR	GOAL ASSOCIATION
INFRASTRUCTURE	Percentage of waste that is recycled	Minimize solid waste, divert solid waste to recycling
	Parks and Open Space per 1000/population	Expand opportunities for recreation, provide public amenities at LOS standards
	% of energy consumption by source of production	Reduce fossil fuel consumption, increase use of renewable energy
	Energy consumption per capita	Sustainable development indicator, reduce fossil fuel consumption

### Built Environment > Infrastructure Indicator:

#### *Percentage of Waste that is Recycled*

*MIP: “Goal 6.1 “6.1 Maui will have implemented the ISWMP thereby diverting waste from its landfills, extending their capacities.”*

Waste management is an essential function of municipal infrastructure and is a necessity for a sustainable community. Maui County’s Integrated Solid Waste Management Plan (ISWMP) “provides a comprehensive blueprint for the planning and expansion of the County’s solid waste management system. The updated ISWMP addresses several issues including the finite capacity of the County’s landfills, the growing waste stream, the rising cost of energy, and the desire to provide more and better services to Maui’s residents.”

#### Analysis of Trends

The County of Maui Department of Environmental Management (DEM) tracks waste diversion data for Maui County. Landfill diversion percentages specific to recycling activities are calculated annually.

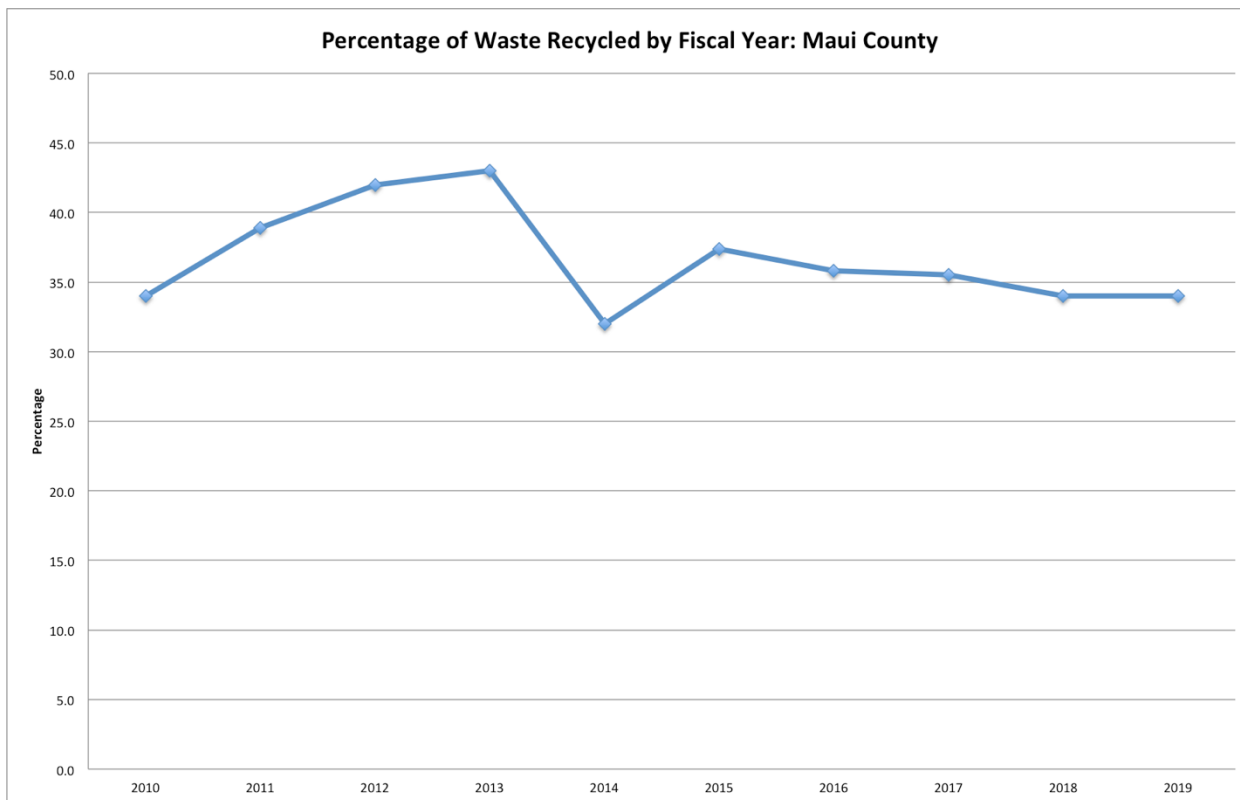


Figure 7 (Department of Environmental Management, Environmental Protection and Sustainability Division. 2020)

Recycling rates are influenced by local policy, recycling infrastructure capacity, commodity markets, and consumer choice. The percentage of waste recycled has declined since 2013.

### Indicator Quality

To the extent that materials recycling helps to extend the capacity of the County’s landfills, and is a service desired by Maui’s residents, this indicator does help to track implementation of the goals and objectives of the MIP. However, effective waste management takes place at multiple points in a product’s life cycle. When products are manufactured using smaller amounts of materials, the reduction is not measured as being diverted from the landfill, but still results in lowered impacts and costs. This indicator does not measure whether waste materials are actually brought to the landfill; items that are illegally dumped negatively affect the quality of life.

### Built Environment > Infrastructure Indicator: Parks and Open Space per 1000/population

*MIP: “As the island’s population continues to grow, local actions to designate and protect parks and open space will play a key role in ensuring a high quality of life for Maui’s residents.”*

Park infrastructure is comprised of facilities and space maintained for public enjoyment. Increases in de facto population (all people on the island, including residents and visitors) raise the demand for open space and park infrastructure. When parks are overcrowded, they do not provide as much open space, and the quality of life decreases.

The available information includes acreage for parks in all of Maui County, not just on Maui island. Comparing the acreage of parks to the de facto population of Maui County can help to indicate potential issues of overcrowding and provide insight into the quality of life for residents.

### Analysis of Trends

The wording of this indicator does not specify a unit of measurement. In addition, the phrase “per 1000/Population” should be written “per 1,000 Population.” For the purposes of this analysis, we will use acres as a unit for measurement of park space. The number of acres will be divided by the number of thousands in the defacto population. The formula for calculating this indicator is as follows:

*Parks and Open Space per 1,000 Population =*

$$Total\ Park\ Acreage \div \left( \frac{De\ fact\o\ Population}{1,000} \right)$$

Open space may occur in designated parks, on conservation land, or on private land. However, outside of designated parks, the degree to which a particular landscape is “open” is difficult to quantify, or even define. Data on this kind of “openness” is not readily available. Much of the land outside of designated parks is not readily accessible by the majority of the public, so its impact on quality of life is limited for most people. For purposes of this analysis, we will use readily available data on park acreage.

There are three different entities that oversee parks on Maui: 1) the National Park Service, 2) the Hawaii Department of Land and Natural Resources, Division of State Parks, and 3) the County of Maui Department of Parks and Recreation.

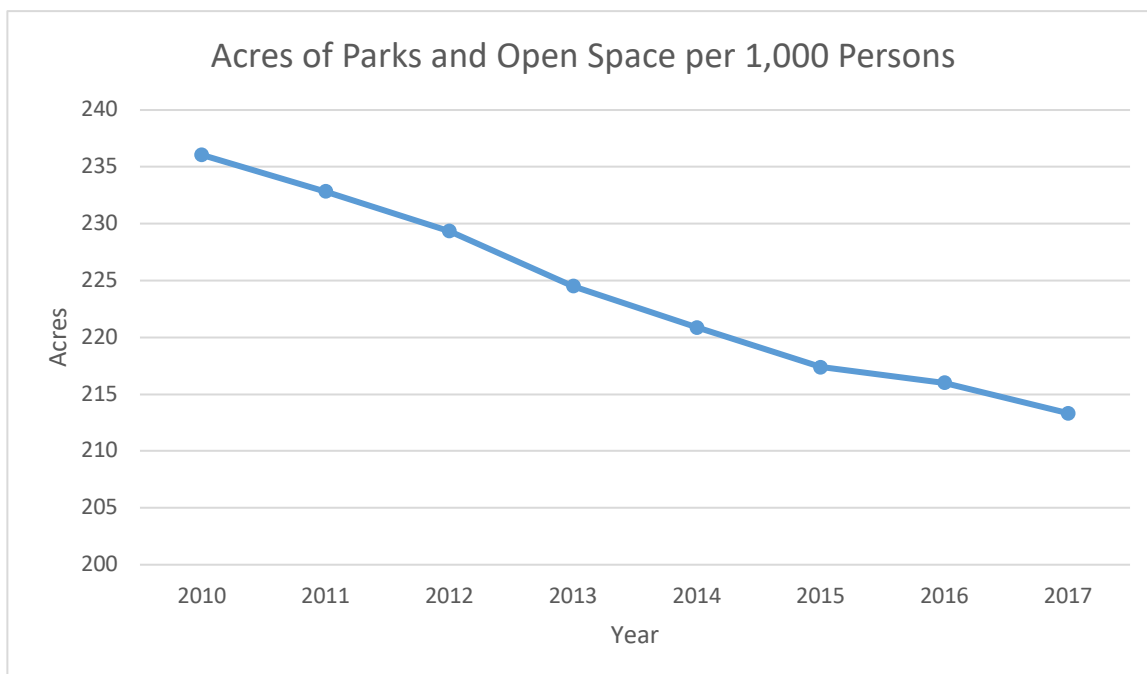


Figure 8 (Maui County Data Book 2014, 2018). Note: De facto population is measured annually on July 1<sup>st</sup>. Park acreage is the sum of national, state, and county parks

De facto population in Maui County has been steadily increasing, and projections suggest that this trend will continue. Based on the data available, since 2010 the number of acres of park space per 1,000 persons has declined by 10.6 percent. To the extent that parks are becoming more crowded, people may be denied access, or may avoid the spaces entirely. These situations negatively affect the quality of life on Maui.

#### Indicator Quality

Open space may occur in parks or on private land, but the degree to which a particular landscape is “open” is difficult to quantify and/or track. Although data is not readily available for the amount of actual open space on public land outside of designated parks, or on private land, this indicator will be useful to track the impact of the amount of accessible park space available to Maui’s people. Data on park acreage is easily obtained, and is updated regularly.

This indicator should be renamed “Acres of Parks and Open Space per 1,000 Population” to provide better clarity, and to reflect the intent of measuring the amount of park and open space available to people on Maui.

### Built Environment > Infrastructure Indicator: *Percentage of Energy Consumption by Source of Production*

*MIP: Goal 6.10 “Maui will meet its energy needs through local sources of clean, renewable energy, and through conservation.”*

The wording of this indicator mixes the terms “Consumption” and “Production”. Due to transmission and distribution losses, the amount of energy *produced* by a generating facility is always greater than the amount *consumed* at the point of use. In addition, some of the renewable energy produced is “curtailed” (not accepted onto the grid), because the balance of system production and consumption must be maintained.

Increasing the production and generation of renewable energy in Maui County will increase energy self-reliance. Additionally, increasing the use of renewable energy resources has the potential to improve the quality of life by decreasing greenhouse gas emissions commonly released through the use of other energy generating alternatives.

#### Analysis of Trends

Maui has made significant progress in reducing its use of fossil fuels to produce energy, primarily through wind and solar electricity generation. Between the years 2010 and 2018, renewable energy generation has steadily increased, with the exception of 2017, when the percentage of nonrenewable energy generation increased slightly; it has apparently resumed its downward trend. See Figure 9.

#### Indicator Quality

Tracking energy production by source is an appropriate indicator for measuring progress toward renewable energy goals. However, this indicator does not track energy conservation, which the MIP also supports.

## Built Environment > Infrastructure Indicator:

### Energy Consumption Per Capita

*MIP: Objective 6.10.1: “Reduce fossil fuel consumption. Using the 2005 electricity consumption as a baseline, reduce by 15 percent in 2015; 20 percent by 2020; and 30 percent by 2030.”*

*Implementing Actions, 6.10.1-Action 1: “Work with the Energy Management Program to: (3) Develop and maintain data and reports on island energy consumption;”*

Electricity is essential to modern life, and benefits quality of life in a wide variety of ways. More electricity use, however, is not correlated with an increase in the quality of life. To the extent that less energy is generated using fossil-fuels, whether it be through efficiency or conservation, Maui will have cleaner air, and will make less of a contribution to climate change.

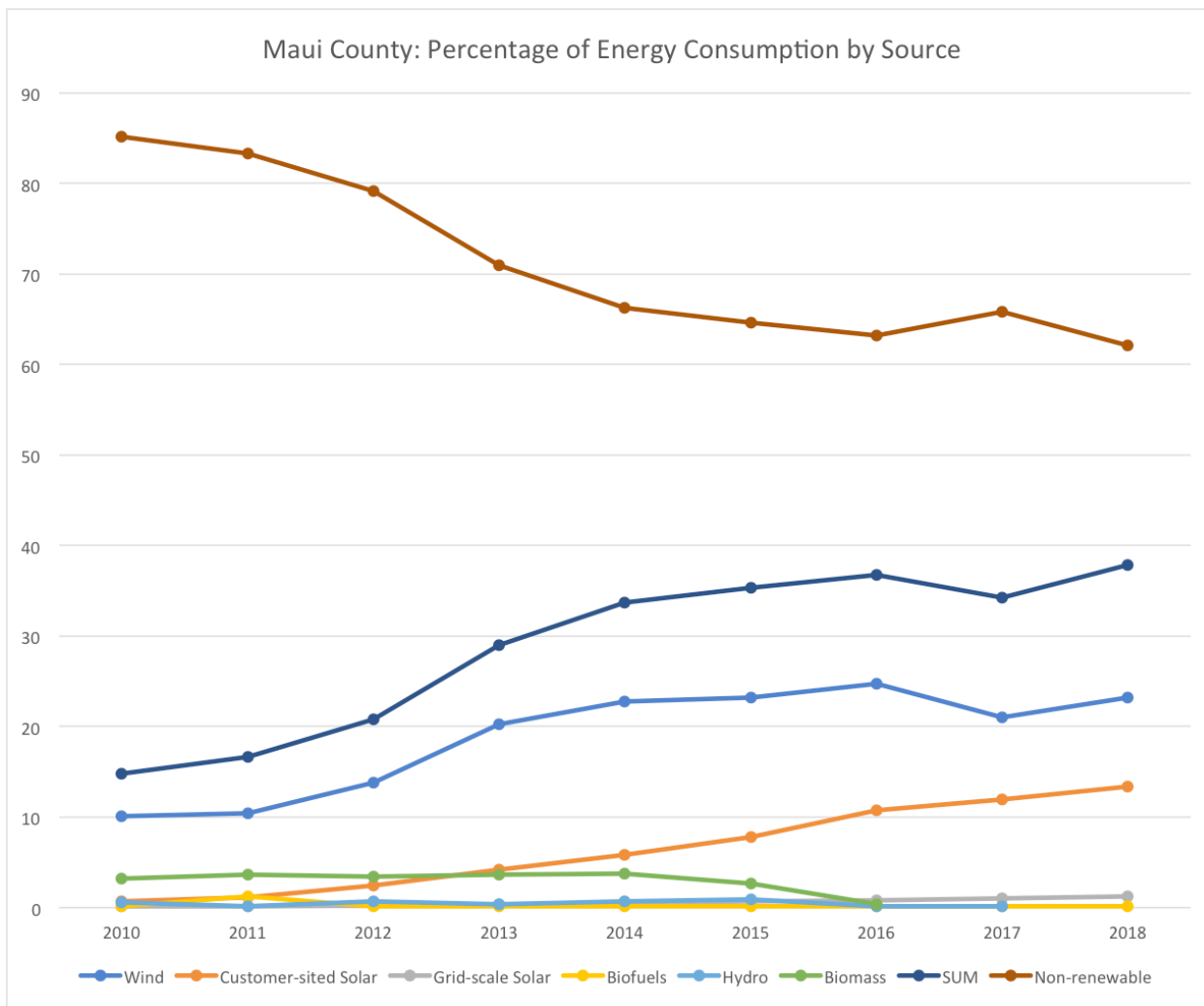


Figure 9 (Hawaiian Electric, Inc., Sustainability Reports, 2010 – 2018). Note: Percentages may not add to 100% due to rounding, estimating of original source data, and changes in reporting categories)

Data on de facto population and on the total electricity sold are available for Maui County (not for Maui island). These data can be used to calculate energy consumption per capita.

$$\text{Energy Consumption per Capita} = \frac{\text{Electricity Total kWh Sold}}{\text{De facto Population}}$$

## Analysis of Trends

Between the years 2006 and 2017, the energy consumption per capita in Maui County has continually decreased. The electricity total number of kilowatt-hours sold has fallen, even as the de facto population has increased. These trends suggest that the electricity grid is increasing in efficiency, people are conserving electricity, or a combination of both.

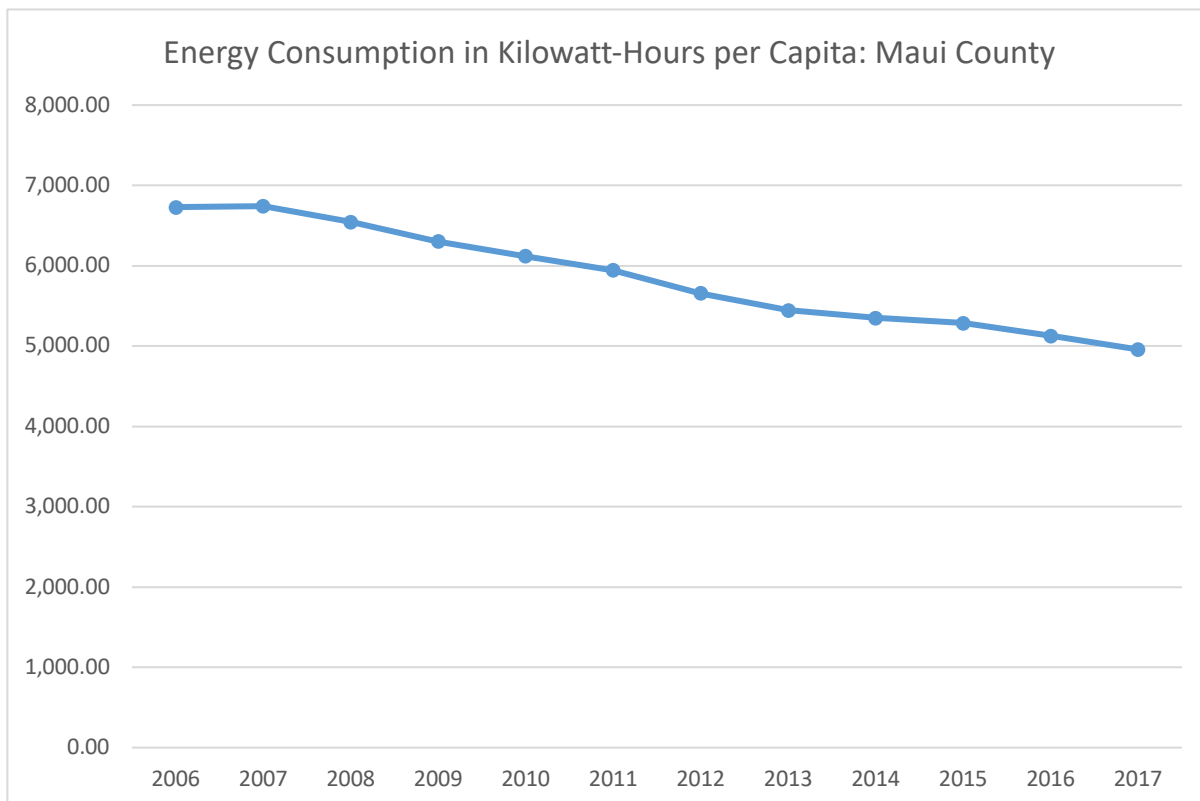


Figure 10 (Maui County Data Book, 2018; Data Warehouse, 2019)

The wording of MIP Objective 6.10.1 mixes the terms “fossil fuel consumption” and “electricity consumption,” and does not mention per capita consumption. As of 2015, overall energy consumption in Maui County had dropped by 9 percent from the 2005 base year, which falls short of the 15 percent called for in the objective, but per capita use had dropped by 23 percent, which exceeds it.

## Indicator Quality

Energy Consumption Per Capita is an appropriate indicator because it tracks progress in energy efficiency and/or conservation. It is more useful than simply tracking energy consumption, because it gives feedback on success of energy efficiency and conservation efforts.

## Theme: Social Environment

*MIP: “The Maui Island Plan is a blueprint that provides direction for future growth, the economy, and social and environmental decisions on the island through 2030.”*

The social environment is comprised of three categories: economic development, population and community dynamics, and the preservation of our cultural heritage. In recent decades, Maui has undergone significant changes in its society, making a transition from a plantation society to a tourist destination. Some of the defining qualities of Maui stem from its unique history and culture. To preserve the quality of life on Maui, economic and social progress must be linked to each other and cultural preservation.

### Social Environment Category: Economic Development

	INDICATOR	GOAL ASSOCIATION
ECONOMIC DEVELOPMENT	Cost of Living Index	Quality of life indicator
	Value of Agricultural Production	Maintain AG's share of island economy
	\$ spent per day per visitor	Increase financial contribution of tourism
	% of Fruit and Vegetables consumed that are grown on Maui	Increase locally grown food, decrease imported food

Economic development directly influences the quality of life experienced by Maui residents. In our current economic system, a good quality of life is possible when wages are commensurate with the cost of living. Individual quality of life is more likely to be preserved, especially through a potential food crisis, if there is a productive and healthy local agricultural sector.

### Social Environment > Economic Development Indicator:

#### *Cost of Living Index*

*MIP: Goal 4.1: “Maui will have a balanced economy composed of a variety of industries that offer employment opportunities and well-paying jobs and a business environment that is sensitive to resident needs and the island’s unique natural and cultural resources.”*

Hawaii has a high overall cost of living. Factors influencing this include the expense of shipping materials to our isolated island location, the high costs of shelter, and the influx of people moving to the island who are willing to pay a higher price for the privilege of living in Hawaii. A high cost of living depresses economic activity among residents, leading to lower savings rates, more debt, and fewer financial goals being reached by local residents. High costs of living without accompanying high earnings force people to choose to leave the island when they would not otherwise.

The United States Bureau of Labor Statistics tracks price changes over time in the Consumer Price Index for Urban Consumers in the Honolulu Area (CPI-U Honolulu). The index measures the change in prices of consumer goods in Honolulu County since the base period years of 1982 - 1984. An index value of 100 means that prices in Honolulu are equal to prices there in 1982 – 1984. Changes in this index over time indicate a change in the value of prices since the 1982 – 1984 reference point. The consumer price index is calculated by sampling the prices of food, energy, commodities, services, and shelter. The inflation rate that is cited in news

outlets and other publications is the percentage change in the consumer price index over a given time period.

### Analysis of Trends

The consumer price index is not tracked for Maui island. However, to the extent that the relationship between prices in Honolulu and those on Maui are maintained, CPI-U Honolulu can serve as an appropriate index to identify general trends. Although the annual inflation rate has varied between 1.0 and 3.7 percent between 2010 and 2018, the trend in CPI-U has been upward, increasing from 234.869 to 277.078. Prices have increased 18 percent during that time.

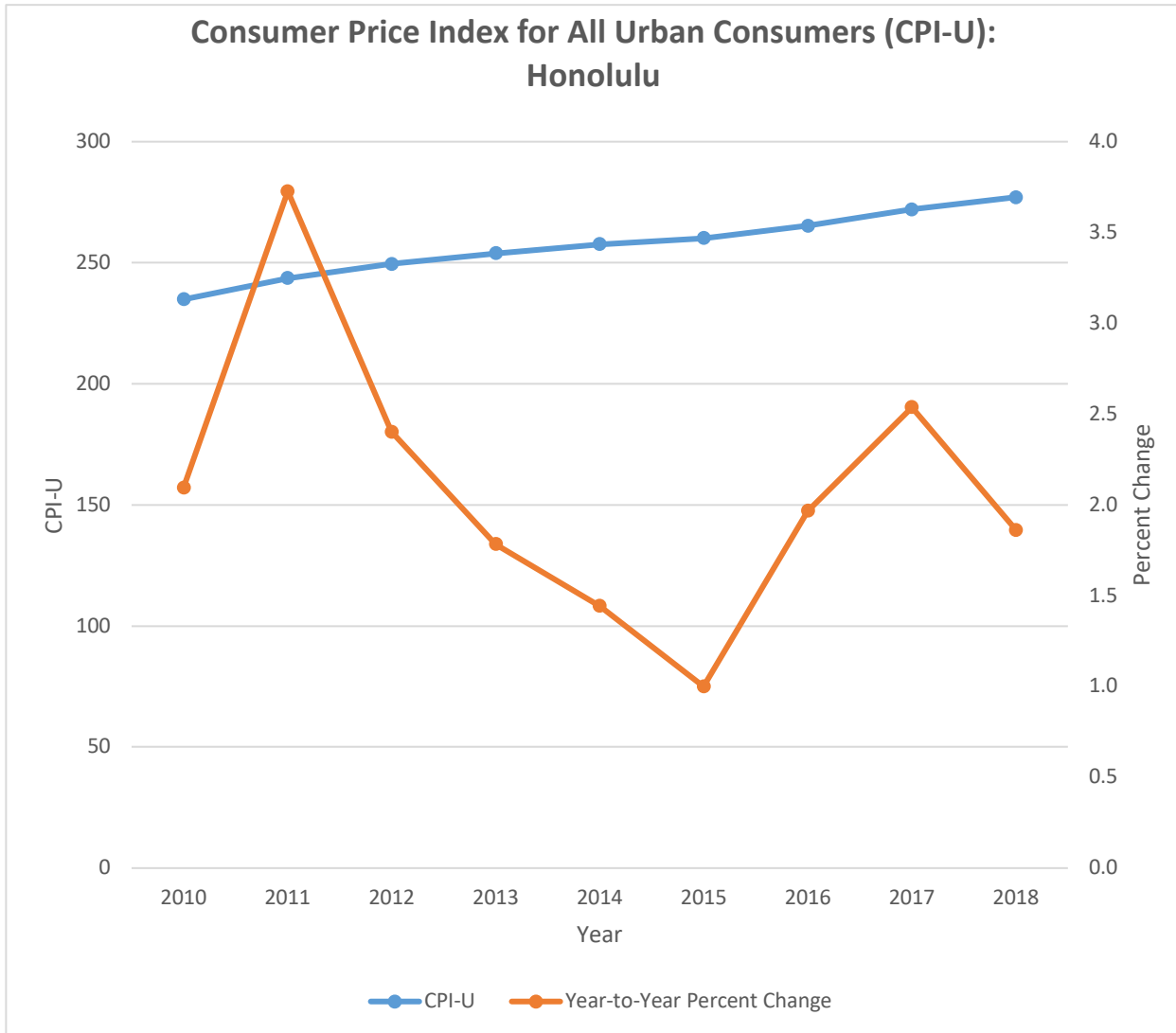


Figure 11 (Maui County Data Book, 2012). (Maui County Data Book, 2018).

### Indicator Quality

The consumer price index (CPI-U Honolulu) is a widely used tool that provides the basis for many economic decisions that need to take price inflation into account. When consumer prices rise or fall quickly, the quality of life of Maui residents can be negatively impacted.



## Social Environment > Economic Development Indicator: *Value of Agricultural Production*

*MIP: Objective 7.1.1 “Significantly reduce the loss of productive agricultural lands.”*

In recent history, Maui was a center for agriculture in the Pacific. This agricultural connection dominated the history of the islands and ended only recently with the shuttering of Hawaiian Commercial and Sugar Company (HC&S) in 2016. Agriculture is a critical sector for Maui’s economy, which is sorely in need of diversification. It is particularly important for an isolated island community that would benefit by increasing food security.

The value of agriculture in Maui County includes the value of crops, livestock, poultry, and animal products. For both of these measures, the Maui County Data Book provides data for the county as a whole, not specifically for Maui island. Data are compiled every 5 years.

### Analysis of Trends

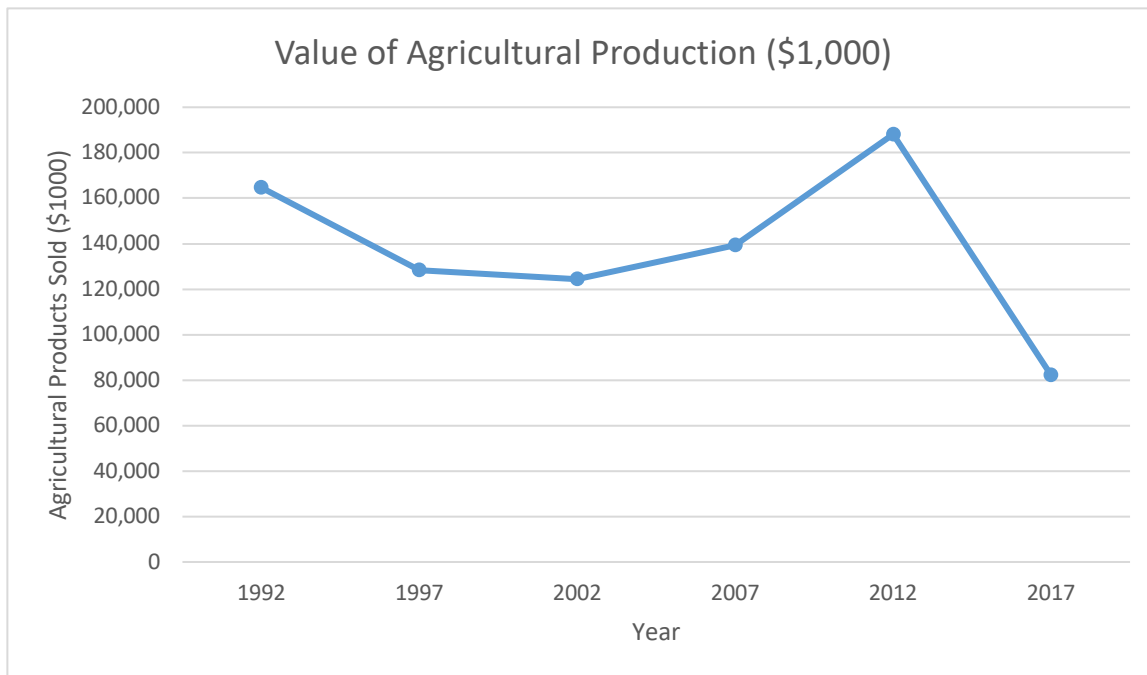


Figure 12 (Maui County Data Book 2005 - 2018).

Between 1992 and 2002, the value of agricultural products gradually decreased, and then experienced an upswing. After 2012, however, there was a sharp decrease in agricultural products sold.

### Indicator Quality

The Value of Agricultural Production does not directly measure whether Maui is losing productive agricultural lands, but it does help in evaluating progress toward other MIP goals such as economic diversification. Since data on the value of agricultural products is only reported for Maui County as a whole, it is not a perfect indicator for the island of Maui. It is regularly collected and reported, but its utility would be improved by more frequent data collection.

## Social Environment > Economic Development Indicator: *Dollars Spent Per Day Per Visitor*

MIP: “Dollars Spent per day per Visitor” . . . can be used to assess the economic value of tourism . . .”

Visitor spending comprises a significant portion of Maui’s economy. However, tourism affects the island in many ways, including wear on infrastructure, upward pressure on housing prices, and impacts to natural resources. To maximize the returns versus the impacts of tourist travel, Hawaii tracks the amount of spending per visitor, with the goal of increasing the amount of money spent per visitor per day.

### Analysis of Trends

Daily spending per person on Maui fluctuates, however, the general trend indicates that daily visitor spending has been steadily increasing. There was a drastic drop in daily spending between the years 2008 and 2009, which correlated with the drop in the number of visitors during that same time period.

### Indicator Quality

This indicator is useful for showing the trend in the economic value of visitors to Hawaii, and the average economic benefit that a tourist is able to provide. It is measured frequently, making it a suitable indicator for quality of life analysis. However, this indicator is not adjusted for inflation; which would make it a more useful policy tool to determine the real economic benefit of tourism.

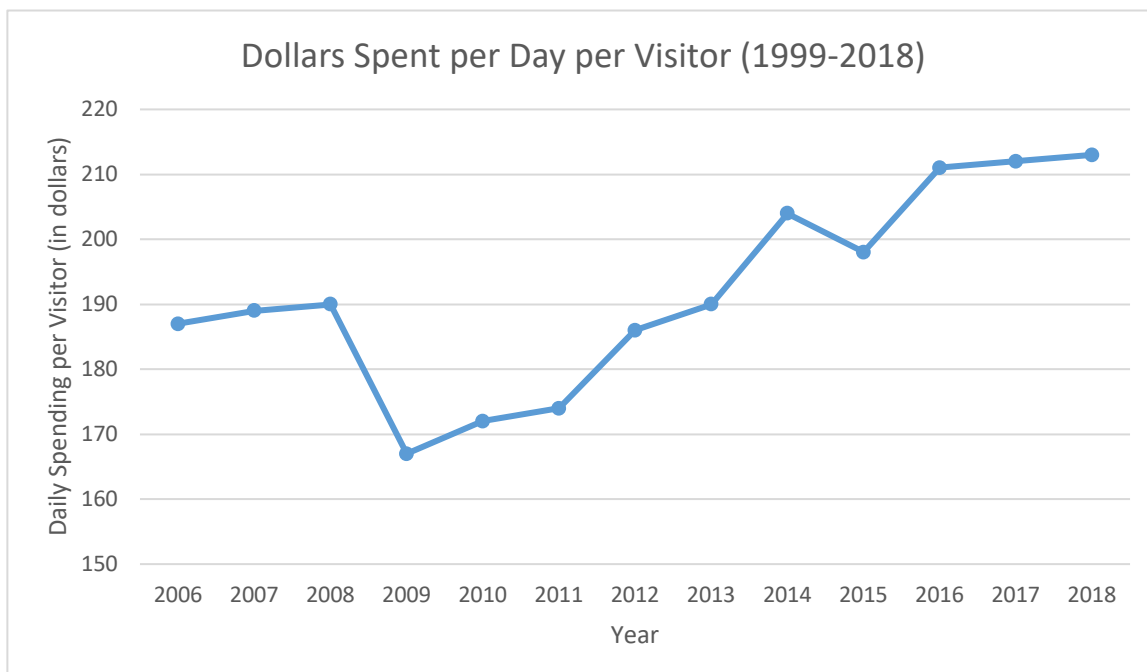


Figure 13 (Annual Visitor Research Reports 1999-2018).

## Social Environment > Economic Development Indicator:

### *Percentage of Fruits and Vegetables Consumed that are Grown on Maui*

*MIP: Goal 4.3 “Maui will have a diversified agricultural industry contributing to greater economic, food, and energy security and prosperity.”*

*Objective 4.3.1 “Strive for at least 85 percent of locally-consumed fruits and vegetables and 30 percent of all other locally-consumed foods to be grown in-State.”*

Local food production enhances community resilience by increasing stocks of food available in the event of a natural disaster or a disruption in regular commodity shipments. A healthy agricultural marketplace is one that profits local farmers and provides food that Hawaii can grow.

The majority of food eaten on Maui is imported from out of state; this includes food that would grow readily on the island. Although there is data on the amount of food produced on Maui, it is not clear how much of that produce is consumed here; some is shipped off island.

#### Analysis of Trends

Due to a lack of information on local food consumption, no trends could be identified.

#### Indicator Quality

If the data were to be made available, yearly tracking of this information would help to assess the health of the local agricultural marketplace, as well as community resilience.

## Social Environment Category: Population / Community

	INDICATOR	GOAL ASSOCIATION
POPULATION / COMMUNITY	Unemployment rate	Quality of life indicator
	Poverty rate	Quality of life indicator
	College bound rate	Increase post-secondary education
	Prevalence of overweight and obese adults	Quality of life indicator

*MIP: “Population growth can have positive and negative impacts on the environment, socio-economic and cultural composition of the island, and visitor experience.”*

*MIP: “There is a renewed emphasis throughout the country on educating citizens to make healthy lifestyle choices to reduce the prevalence of chronic disease.”*

*Goal: 1.1 “Maui’s people, values, and lifestyles thrive through strong, healthy, and vibrant island communities.”*

*Objective: 1.1.1 “Greater retention and return of island residents by providing viable work, education, and lifestyle options.”*

*Policies: 1.1.1.a “Expand programs that enable the community to meet the education, employment, housing, and social goals of youth and young adults.”*

This category contains indicators that are directly related to personal and collective quality of life. Although each of the indicators in the Population/Community category is expressed in collective economic terms, the effects are experienced by individuals, and the perceived impacts have a direct impact on the quality of life for those people.

## Social Environment > Population/Community Indicator: *Unemployment Rate*

*MIP: Objective: 1.1.1 “Greater retention and return of island residents by providing viable work, education, and lifestyle options.”*

In general, employment benefits an individual’s quality of life by providing structure, money, regular social contact, and a general boost to self-esteem (Axelsson et al., 2007). The unemployment rate is a metric of the labor force population that is not employed. The labor force is defined as the population of people employed or actively seeking employment (Bureau of Labor Statistics, 2015).

According to data collected for Maui Island in 2018, there were 81,850 labor force members, of which 79,950 were employed. Also, in 2018, there were 1,900 members of the labor force who were unemployed, which means the percentage of the labor force unemployed was 2.3% (Maui County Data Book, 2018).

### Analysis of Trends

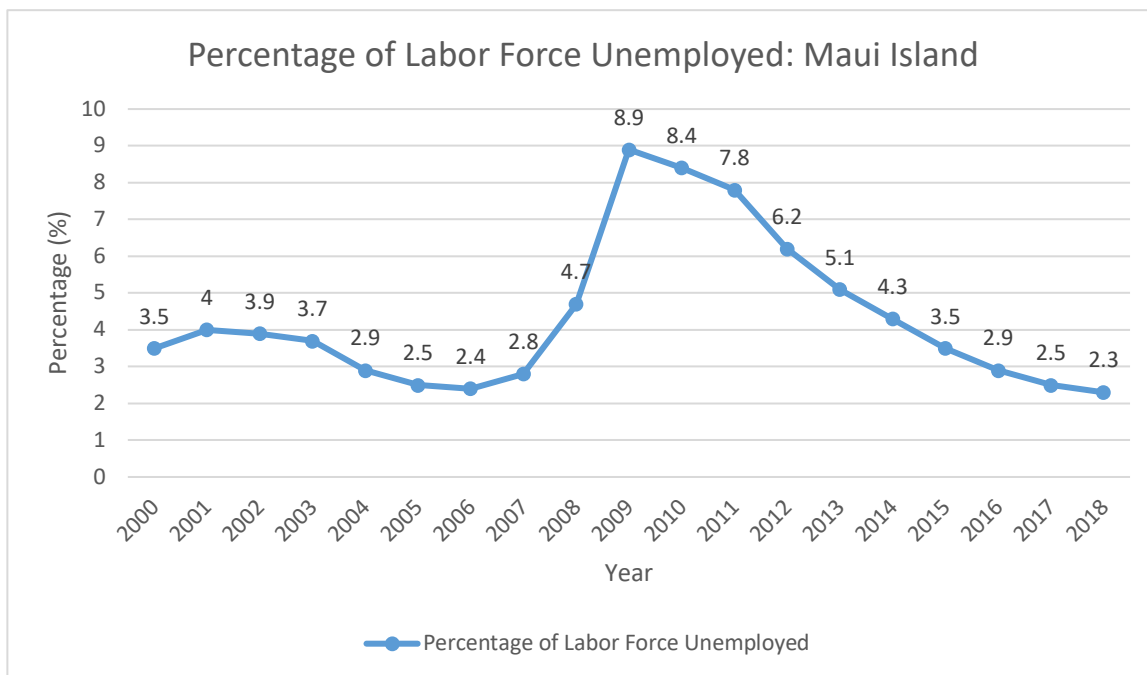


Figure 14 (Maui County Data Book 2018).

With the exception of the period between 2008 and 2013, Maui’s unemployment rate has remained relatively low.

## Indicator Quality

The Unemployment Rate is a widely accepted and suitable indicator of the number of people who are not able to find viable work. This number generally indicates the ability of individuals to meet their basic needs and achieve a basic level of quality of life.

## Social Environment > Population/Community Indicator:

### Poverty Rate

*MIP: “When adequate or appropriate housing is unattainable to a large portion of the population, it negatively impacts the entire community and decreases overall quality of life.”*

The Federal Poverty Level is a measure of income issued every year by the Department of Health and Human Services (HHS). It is dependent on family size and the number of related children under the age of 18 in a household. The data upon which the poverty rate in a community are calculated are collected by the American Community Survey.

Other than the Poverty Rate indicator itself, there is no specific mention of “poverty rate” in the plan. However, the related concept of “homelessness” is mentioned several times in the context of the Economic Development and Housing chapters.

Poverty poses challenges to maintaining a good quality of life because individuals experiencing poverty have less access to basic needs, such as food, shelter, and clothing. People in poverty experience adverse health conditions, have fewer educational opportunities, and often live in physically unsafe environments. If many individuals are experiencing poverty in a community, the quality of life of the community is negatively affected as a whole. Tracking the poverty rate enables us assess to what degree our economic development and housing goals are being achieved.

## Analysis of Trends

Data is tracked for all of Maui County and not by island. Between the years 2012 and 2018, the percentage of the population below the poverty level varied from 11.4% in 2014 and 9.7% in 2018. See Figure 15.

## Indicator Quality

The Poverty Rate is commonly used to track the overall prosperity of a community. Increases in the poverty rate signal that more people are having trouble fulfilling their basic needs, and therefore, an acceptable quality of life. It is useful as an indicator because when tracked, it can alert decision makers that policy changes and/or action to alleviate poverty in the community are needed. The data are collected regularly, and will continue to be collected in the future; this makes Poverty Rate a useful indicator.

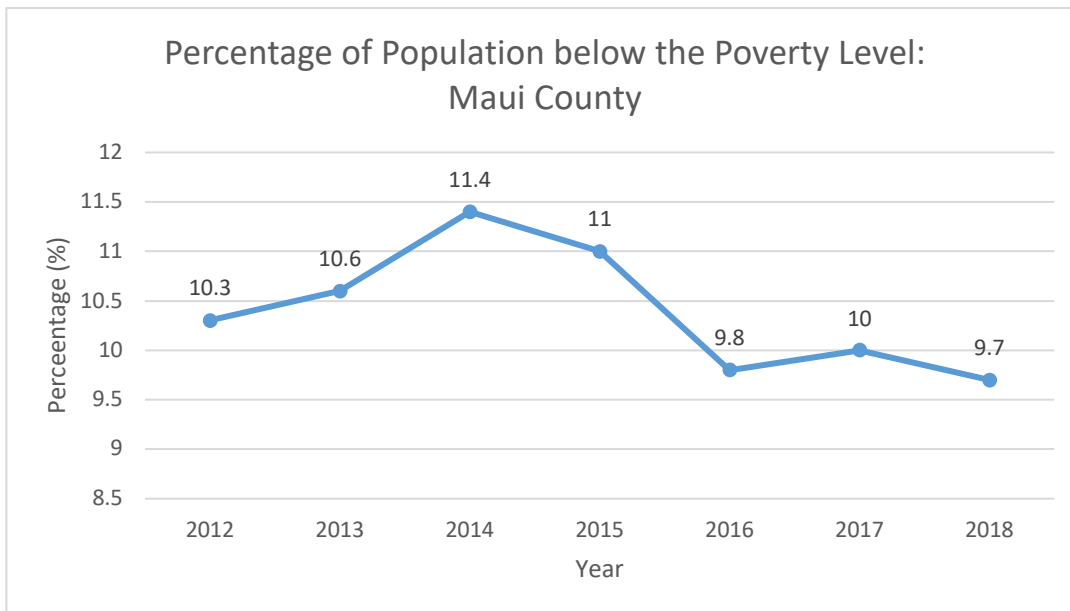


Figure 15 (Percent of Population below the Poverty Level in Maui County, HI, 2019).

## Social Environment > Population/Community Indicator: College Bound Rate

MIP: There is no specific mention of the College Bound Rate in the Maui Island Plan. However, in the Economic Development chapter, there is some discussion of the 2010 County of Maui Comprehensive Economic Development Strategy (CEDS). This strategy, mandated by the Economic Development Administration (EDA) of the US Department of Commerce focused on the need to train Maui’s residents to qualify for high-skill jobs and the related need to improve the public education system. One of the CEDS recommendations was to make improved connections between industries and employers, high schools and the college system, and to offer stronger programs in technical and high-skill fields, including 4-year programs where necessary.

The College Bound Rate is the proportion of high school seniors who continue on to post-secondary education. The implicit assumption of having a College Bound Rate indicator is that students who go to college will attain higher levels of education, higher incomes, and other attributes associated with a higher quality of life.

The Hawaii Department of Education tracks postsecondary school completion of high school graduates 6 years after high school graduation. The data is tracked by island, which means that data can be analyzed specifically for the island of Maui. The most recent data was collected in 2018 and pertained to the high school graduating classes of 2012.

### Analysis of Trends

The data show stable percentages that have had minimal annual variation for all four of the following categories:

- Earned Degree or Certificate – earned a postsecondary degree or certificate at any time during the 6 years after high school graduation.

- Enrolled - did not earn a degree or certificate, but was still enrolled in postsecondary in the 6th year after graduation.
- Stopout - was previously enrolled in postsecondary but was not enrolled in the 6th year after graduation and did not earn a degree or certificate within 6 years.
- No Postsecondary Record - no postsecondary enrollment or award record at any time in the 6 years after high school graduation.

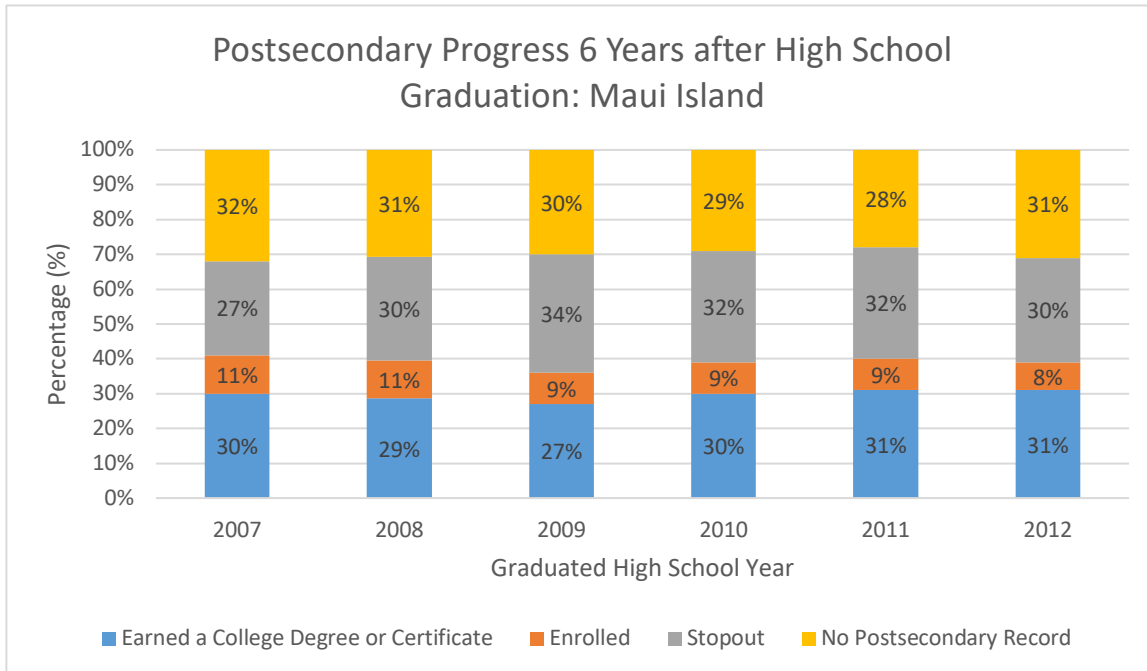


Figure 16 (High School to Postsecondary, 2018).

Additionally, the percentages of high school graduates that earned a college degree or certificate and the percentages of high school graduates that stopout of college are almost equal most years. As more data is recorded, changes in these percentages may predict changes in educational attainment, and therefore for quality of life on Maui.

### Indicator Quality

Tracking the College Bound Rate of enrollment in college is a common measure in communities that view education as a way to improve people’s quality of life. The actual outcome of that education may or may not be beneficial to particular individuals. Similarly, whether the long-term benefits of a college education outweigh the high costs of college enrollment vary from case to case. This could be a good indicator, but it is not specifically tied to any goals, objectives or policies of the MIP.

### Social Environment > Population/Community Indicator: Prevalence of Overweight and Obese Adults

MIP: There is no specific mention of a goal, objective or policy that addresses the prevalence of overweight and/or obese adults.

Unhealthy weight also raises per capita costs to health systems, and may negatively impact a person’s self-esteem. The United States Centers for Disease Control Behavioral Risk Factor Surveillance System tracks the prevalence of overweight and obese individuals.

### Analysis of Trends

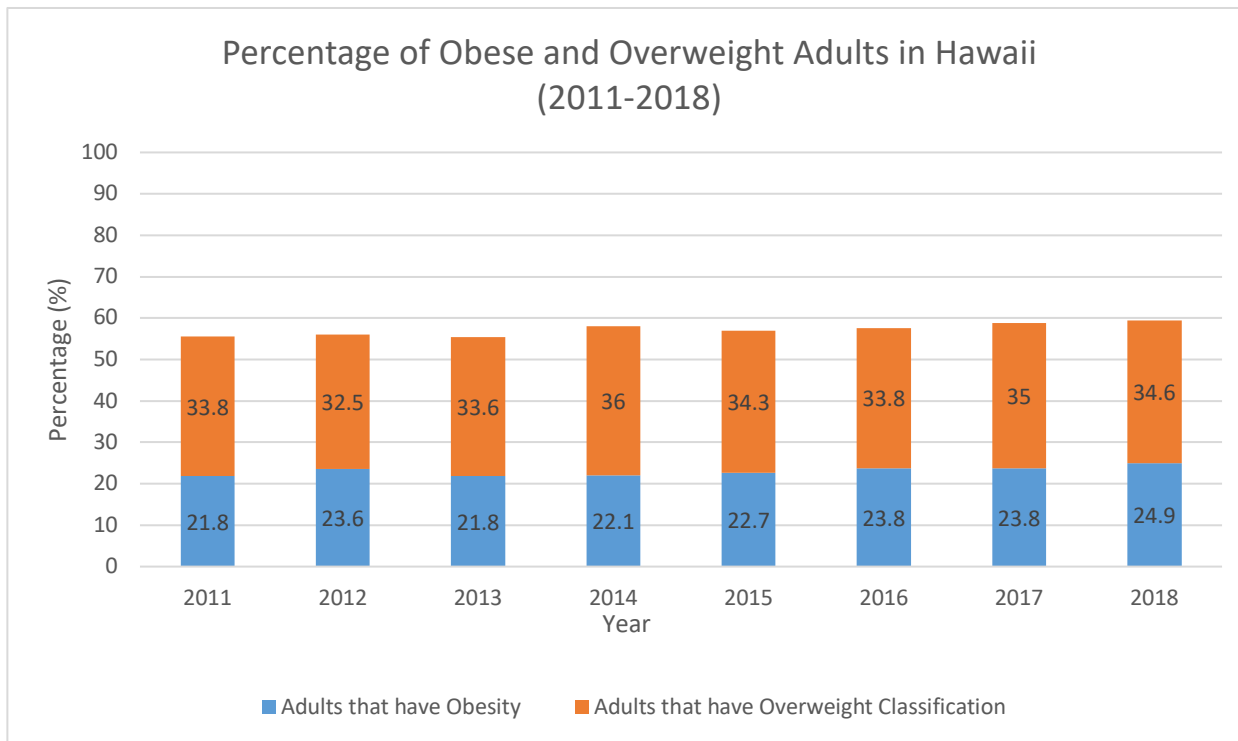


Figure 17 (DNPAO Data, Trends and Maps: Hawaii 2019). Note: Centers for Disease Control and Prevention did not provide Maui-specific data; these data reflect obesity and overweight percentages for the population of all of Hawaii.

The percentage of obese and overweight adults has remained fairly steady, with only minor variations, between the years 2011 and 2018.

### Indicator Quality

This indicator is appropriate for tracking progress with regard to general public health, and therefore quality of life. Over time, as communities become more walkable, the prevalence of overweight and obese adults may begin to decline. However, this indicator is not specifically tied to any goals, objectives or policies of the MIP.

## Social Environment Category: Cultural Heritage

	INDICATOR	GOAL ASSOCIATION
CULTURAL HERITAGE	Course enrollment in Hawaiian Language programs	Healthy + vibrant Island culture
	Tons of Taro grown and sold	Healthy + vibrant Island culture, local traditions
	# of new designated heritage and cultural sites	Protection of cultural resources
	Scenic Roadways – total miles	Protect + enhance scenic vistas



*MIP: Maui Island Vision: “Ua mau ke ea o ka `āina i ka pono. Maui Island will be environmentally, economically, and culturally sustainable with clean, safe, and livable communities and small towns that will protect and perpetuate a pono lifestyle for the future.”*

*Core Values B: “Respect and protect our heritage, traditions, and multi-cultural resources”*

Hawaii has a unique cultural heritage which permeates the Maui community’s lifestyle. The Hawaiian way of life is often ranked as one of the most important reasons that residents choose to live on Maui, despite the high costs of living, moderate wages, and increasing traffic congestion.

**Social Environment > Cultural Heritage Indicator:**  
*Enrollment in Hawaiian Language Courses*

*MIP: Challenges and Opportunities, Perpetuation of Cultural Practices and the Hawaiian Language: “The MIP aims to perpetuate the Hawaiian culture as the basic foundation in the lives of our residents.”*

Hawaiians have made significant progress in reclaiming their heritage, but although fluency in ‘Ōlelo Hawaii (Hawaiian language) is increasing, it is still unusual to hear this language spoken in most of Hawaii. Language immersion programs for ‘Ōlelo Hawaii exist, but are not offered to all students.

Language affects the way people think and perceive the world. Preserving the Hawaiian way of thinking and living by maintaining the language is an important step Hawaii can take to preserve its cultural heritage and improve the quality of life for natives and non-natives.

**Kaiapuni Schools**

The Hawaii Department of Education is contributing to the revitalization of the Hawaiian language by providing K-12 Hawaiian language programs in Kaiapuni schools. These programs focus more on Hawaiian language immersion than other schools do (Hawaii DOE: Kaiapuni Schools - Hawaiian Language Immersion 2020). There are 7 Kaiapuni schools on Maui, as shown in this table:

**Kaiapuni Schools on Maui**

<b>School</b>	<b>Grade Levels</b>	<b>Location</b>
<b>Hana High and Elementary</b>	K-3	Hana
<b>Kalama Intermediate</b>	6-8	Makawao
<b>King Kekaulike High</b>	9-12	Pukalani
<b>Lahaina Intermediate</b>	6-8	Lahaina
<b>Lahainaluna High</b>	9-12	Lahaina
<b>Princess Nahi‘ena‘ena Elementary</b>	K-5	Lahaina
<b>Pā‘ia Elementary</b>	K-5	Paia

*(Hawaii DOE: Kaiapuni Schools - Hawaiian Language Immersion, 2020)*

‘Aha Pūnana Leo is a non-profit, family-based educational organization dedicated to the revitalization of the Hawaiian language. There are three Hawaiian language immersion pre-schools on Maui in Wailuku, Lāhaina, and Hāna.

Data was obtained from each of these schools, and is shown in the following chart. There are also Hawaiian language programs being taught during day and evening classes at University of Hawaii Maui College, but the school was not able to provide course enrollment numbers.

### Analysis of Trends

The data show that school enrollment has been increasing steadily between 2014 and 2020. See Figure 18.

### Indicator Quality

Enrollment in Hawaiian Language Courses is an appropriate indicator with which to track the reintroduction of ‘Ōlelo Hawaii to the community, and to perpetuate the Hawaiian culture as the basic foundation in the lives of Maui residents.

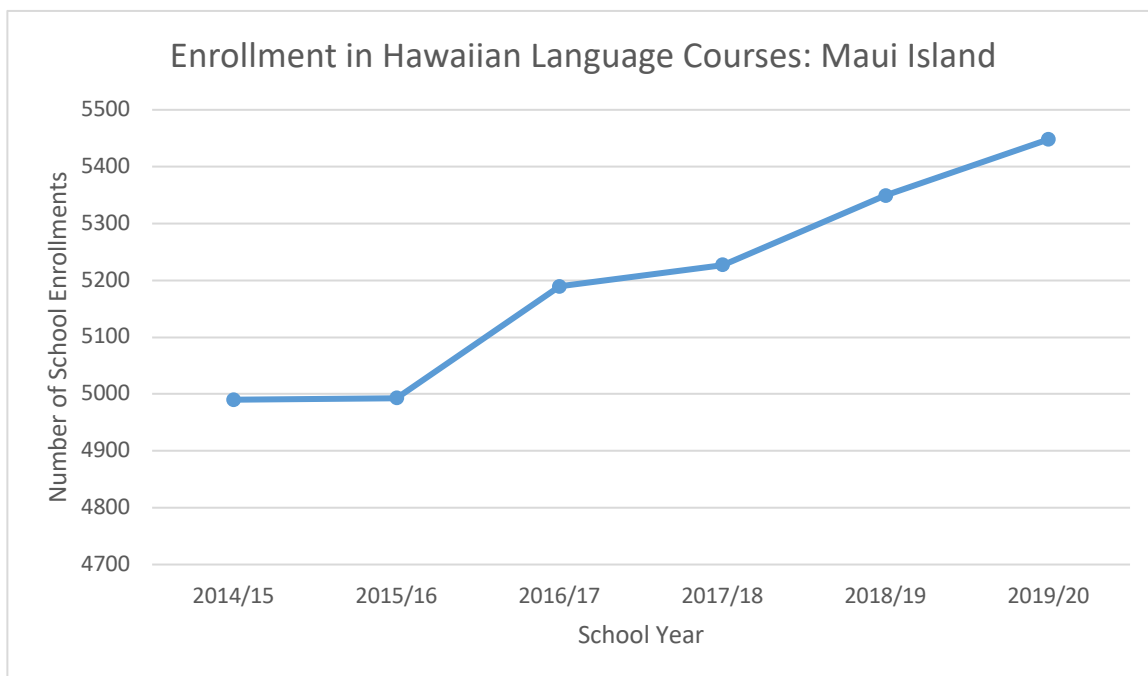


Figure 18 (Hawaii DOE: School Reports, 2020; ‘Aha Pūnana Leo, 2020)

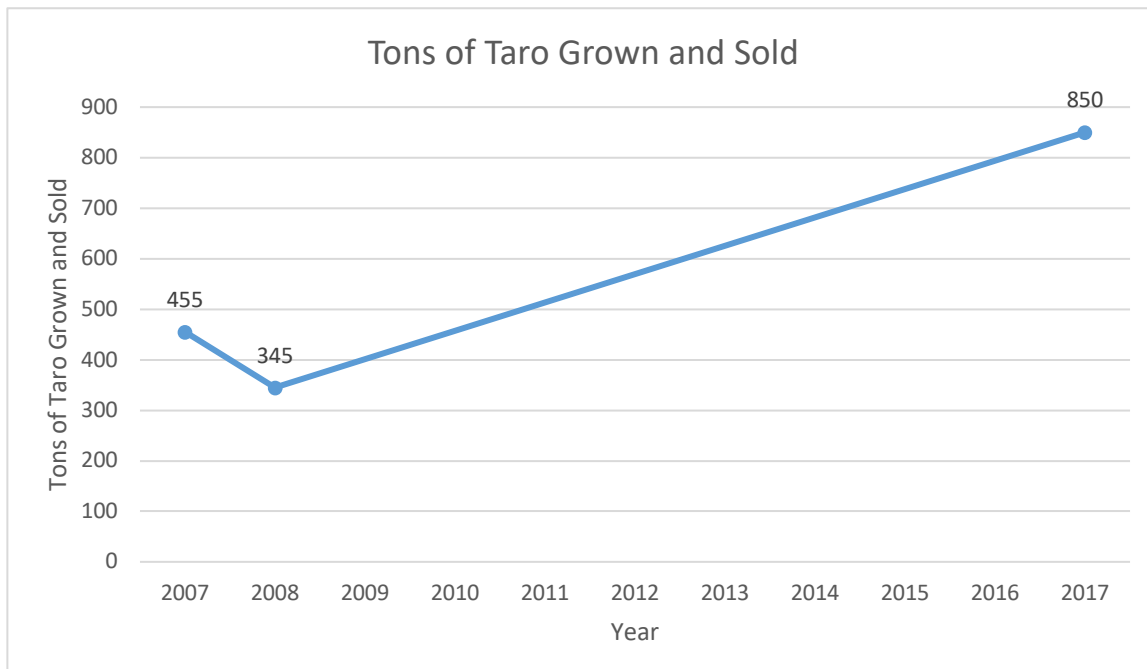
## Social Environment > Cultural Heritage Indicator: *Tons of Taro Grown and Sold*

*MIP: Objective 2.1.1: “An island culture and lifestyle that is healthy and vibrant as measured by the ability of residents to live on Maui, access and enjoy the natural environment, and practice Hawaiian customs and traditions in accordance with Article XII, Section 7, Hawai`i State Constitution, and Section 7-1, Hawai`i Revised Statutes (HRS).”*

*Policy 6.6.1.e: “Support lo`i and dryland taro restoration in County, State, and Federal parks.”*

Taro (*kalo*) is an integral part of the Hawaiian creation story, and has been a staple food for centuries. As the Hawaiian culture continues its resurgence after a long period of repression, more and more *kalo* is being grown. There are many known efforts by kanaka maoli to restore taro lo‘i that have been abandoned for decades. Reclamation of old lo‘i is being facilitated by recent increases in stream water allocation in several places across Maui. Much of this renewed *kalo* production is taking place in remote valleys, and is likely not recorded in official production numbers. In addition, new efforts to irrigate upland (dryland) taro are substantially increasing production.

### Analysis of Trends



*Figure 19 (Fleming, 1994; Maui County Data Book 2012; Sato). Note: It is assumed that all taro listed as “grown” is sold; although much taro is given away, the amount is difficult to quantify.*

After a period of decline, official taro production numbers appear to be on the increase. The Maui County Data Book provides values for pounds of taro for the years 2007 and 2008. In order to calculate tons of taro, pounds of taro were divided by 2,000. For 2017, the Maui County Data Book reported acres of taro grown instead. Two studies were done that calculated the productivity of taro in tons per acres. The average production numbers were applied to the 85 acres of land that was reported to be under cultivation in 2017; this resulted in 850 tons of taro being grown in 2017.

## Indicator Quality

Tons of Taro Grown and Sold appears to be a fairly good indicator of the returning health and vibrancy of Hawaiian culture. However, it should be noted that much taro that is grown is consumed by the farmers or given away, and is therefore not sold. To the extent that the indicator does not count that produce, it will miss that element that contributes significantly to the quality of life of both growers and customers.

## Social Environment > Cultural Heritage Indicator:

### *Number of New Designated Heritage and Cultural Sites*

*MIP Goal 2.1: “Our community respects and protects archaeological and cultural resources while perpetuating diverse cultural identities and traditions.”*

Historic sites help to tell the history of a geographic location and help to keep a location’s history and culture alive. Historic sites are culturally important, and preservation of these sites keep cultural heritage vibrant.

## Analysis of Trends

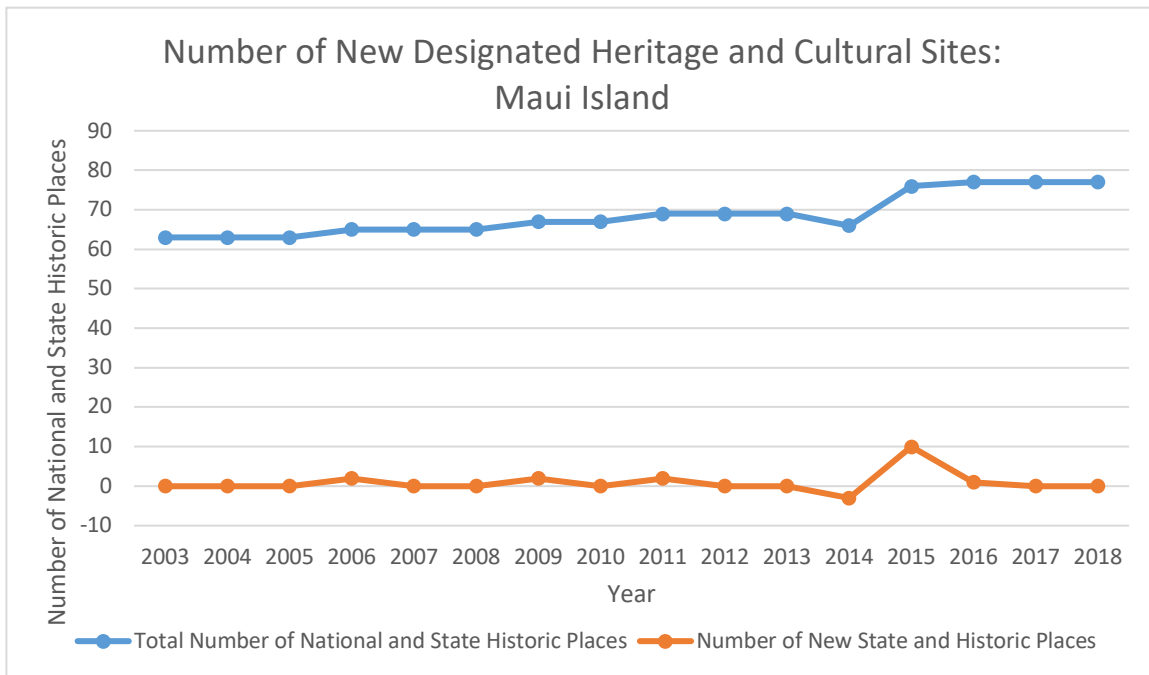


Figure 20 (Maui County Data Book, 2003-2018).

The number of national and state historic places on Maui island has increased from 63 sites in 2003 to 77 sites in 2018. Between 2013 and 2014, there was a decrease of 3 sites. This was followed by an increase of 10 sites in 2015.

## Indicator Quality

Regular public tracking of heritage and cultural sites is an appropriate indicator of the effort that Hawaii dedicates to preserving sites of significant cultural and historic value. It would be helpful if data were to be reported in a consistent manner.

## Social Environment > Cultural Heritage Indicator:

### *Miles of Scenic Roadways and Number of Scenic Vistas*

*MIP: “Maui’s shoreline, tropical rainforests, rugged valleys, vast open spaces, historic towns, pastoral landscapes, and panoramic Pacific Ocean views are all a part of the island’s scenic resources. In the past few decades, the island has experienced rapid growth of the visitor industry, as well as an increase in population, which have dramatically impacted the island’s scenic corridors and view planes. The current network of laws established to protect scenic resources is focused on coastal lands. Areas outside of coastal lands also possess significant scenic resources that could benefit from regulatory controls and preservation strategies.”*

*Policy 2.1.2.b: “Require the update of existing planning and regulatory mechanisms to protect the natural, cultural, scenic, and historic resources within designated Heritage Areas (see Cultural Resources Overlay/Scenic Corridor Protection Technical Reference Map).”*

*Policies 6.4.3a: “Ensure that the roadway and transit alignments respect the natural environment and scenic views.”*

Scenic roadways and scenic vistas are especially valuable to both visitors and long-time residents. Maui has many aesthetically pleasing locations with desirable views. Aesthetic enjoyment is valuable for the tourism industry and personal fulfillment. Maui County has an interest in promoting scenic views as an asset that enhances the quality of life for its people.

## Analysis of Trends

The County of Maui does not maintain quantified data on the number of miles of scenic roadways or the number of scenic vistas. Therefore, no information on county-designated scenic roadways or vistas was obtained, and no trends could be identified.

## Indicator Quality

If data on designated scenic roadways and/or vistas does becomes available, this will be a valuable indicator useful in determining changes to the quality of life on Maui.

## Theme: Natural Environment

*MIP: Objective: 2.1.1 “An island culture and lifestyle that is healthy and vibrant as measured by the ability of residents to live on Maui, access and enjoy the natural environment, and practice Hawaiian customs and*

*traditions in accordance with Article XII, Section 7, Hawai`i State Constitution, and Section 7-1, Hawai`i Revised Statutes (HRS)."*

*Policies 4.2.2.a: "Mitigate the impact of tourism on the host culture, natural environment, and resident lifestyles."*

*Objective 6.4.3: "An island-wide, multimodal transportation system that respects and enhances the natural environment, scenic views, and each community's character."*

Maui's natural environment is critical to the quality of life of both residents and visitors. Residents rely on a healthy natural environment to enable them to fish, farm, and pursue healthy outdoor recreational activities. The visitor industry relies on a healthy natural environment as a main draw for tourists. Monitoring the health of the natural environment can provide information that serves as an early warning to enable Maui's people to protect the 'āina from unhealthy changes. Properly cared for, the environment provides us with many ecosystems services, including clean water, healthy food, clean air, and nature itself; this gives Maui's people the opportunity to improve the quality of their lives by enjoying the natural environment.

## Natural Environment Category: Watershed Systems

	INDICATOR	GOAL ASSOCIATION
WATERSHED SYSTEMS	% of streams on monitoring list	Enhance the functioning + vitality of streams
	Reclaimed water use	Decrease pollution , sustainability indicator
	Watershed health	Protect + enhance native eco-systems
	Drinking water quality	Increase water quality, basic quality of life

### Natural Environment > Watershed Systems Indicator:

#### *Percentage of Streams on Monitoring List*

*MIP: Goal 2.3: "Healthy watersheds, streams, and riparian environments."*

*Objective 2.3.1: "Greater protection and enhancement of watersheds, streams, and riparian environments."*

*Objective 2.3.1.h: "Maui will protect all watersheds and streams in a manner that guarantees a healthy, sustainable riparian environment."*

Water quality is an end goal of watershed systems protection. In order to track progress and identify water quality issues that need to be addressed, there must be regular monitoring of the water quality on Maui. The State of Hawaii Department of Health Environmental Management Division lists the streams that are monitored for water quality on all islands in their biannual Water Quality Monitoring and Assessment Report.

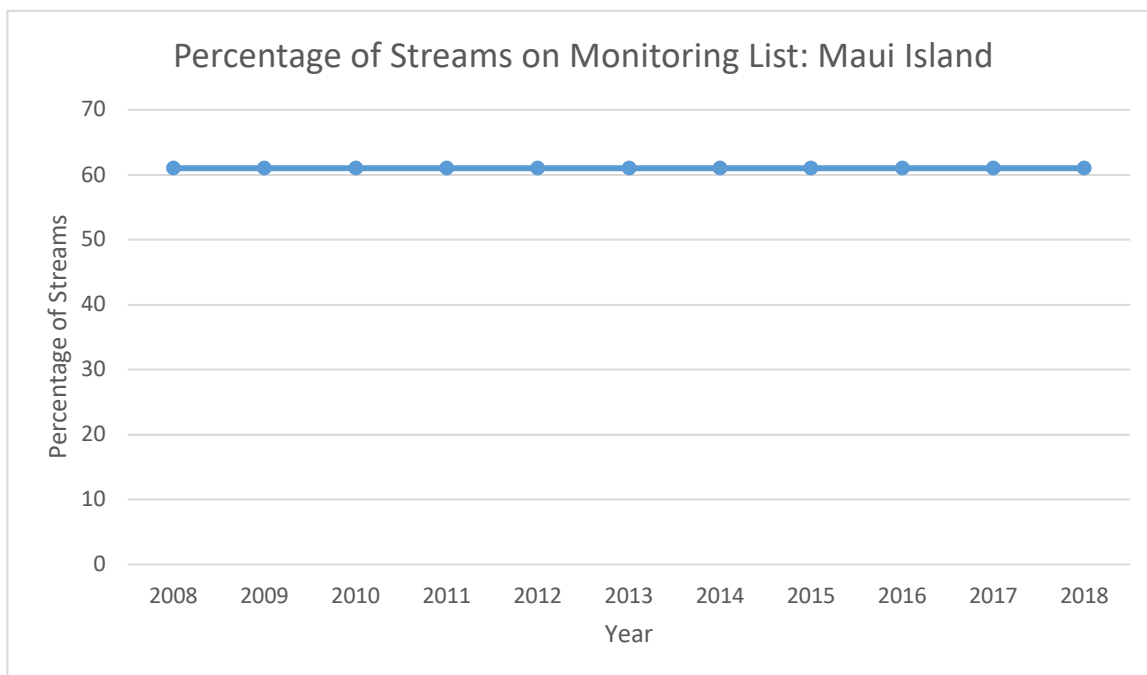


Figure 21 (2018 State of Hawaii Water Quality Monitoring and Assessment Report, 2019).

According to reports published by the Hawaii Department of Health, there are 55 streams that were monitored on Maui Island between 2008 and 2018. According to a 1990 report published by the Hawaii Dept. of Land and Natural Resources, there are 90 streams located on Maui. The number of monitored streams did not change; therefore, 61% of the streams on Maui were on the monitoring list for water quality during that time period (2018 State of Hawaii Water Quality Monitoring and Assessment Report, 2019).

### Indicator Quality

This indicator is not adequate to meet the stated goal of protecting healthy watersheds, streams, and riparian environments. A number of the streams that are listed as being tracked lack information on what pollutants are actually being tested for, or what the results are. In the 2018 report, 33 out of the 55 streams on the monitoring list did not have enough data collected to be evaluated for any tests.

## Natural Environment > Watershed Systems Indicator:

### Reclaimed Water Use

MIP: “Policies 6.3.2.c: “Maximize the efficient use of reclaimed wastewater to serve nonpotable needs.”

Watersheds are affected by the demand for water we collectively exert on them. Without careful planning and sustainable practices, the community is capable of exhausting water resources past their carrying capacity. Water conservation and re-use addresses the potential problem of overusing the available resources by limiting the amount of water needed to meet community needs.

The wording of this indicator, “Reclaimed Water Use,” is somewhat vague. However, given the goal association of “Decreasing pollution, sustainability indicator,” it would be useful to track the percentage of reclaimed wastewater that is produced.

Data on the percentage of reclaimed water on Maui island is compiled by the County Wastewater Reclamation Division.

### Analysis of Trends

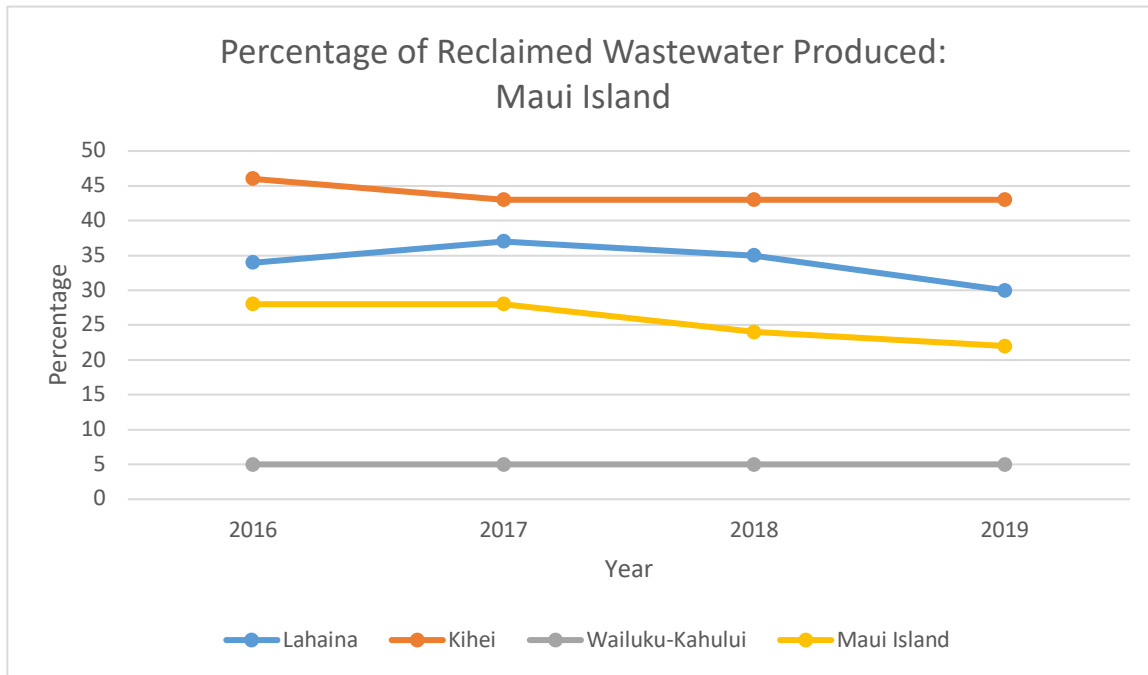


Figure 22 (County of Maui, Department of Environmental Management, Wastewater Reclamation Division, 2020). Note: The Kihei and Lahaina wastewater plants only produce R-1 reclaimed wastewater and the Wailuku-Kahului wastewater plant produces only R-2 reclaimed wastewater. R-3 reclaimed wastewater is not produced on Maui island. The percentage for the Maui Island includes R-1 and R-2 wastewater produced.

Reclaimed water use has remained steady at the Wailuku-Kahului Wastewater Reclamation Facility, but the overall percentage for Maui island has dropped due to reduced water reclamation at the Kihei and Lāhaina facilities.

### Indicator Quality

As an indicator of water quality, this is an appropriate index for use of technology to maximize efficient use of reclaimed wastewater to serve nonpotable needs, and in turn, to reduce unnecessary reliance on scarce water resources.



## Natural Environment > Watershed Systems Indicator: *Watershed Health*

*MIP: Goal 2.3: “Healthy watersheds, streams, and riparian environments.”*

*Objective 2.3.1: “Greater protection and enhancement of watersheds, streams, and riparian environments.”*

Healthy watersheds supply drinking water to the island community. Degradation of the natural ecosystems negatively impacts the amount of water that replenishes streams and recharges groundwater. Watersheds run from the mountain to the ocean (mauka to makai) and all watersheds that reach the coast interact with the marine environment.

There is currently insufficient data to provide consistent information about overall watershed health on a regular basis. However, there was a Department of Land and Natural Resources report written in 2010 that can provide some insight into the health of the upper watersheds on Maui.

A publication entitled “*Hawaii Statewide Assessment of Forest conditions and Resource Strategy 2010*” (Conry et al., 2010) was written in order to assess the health of watersheds and to create strategies for conservation and healthier watersheds. The below chart shows the degree of threat that watersheds on the Hawaiian Islands face. The two Maui island watersheds assessed in the report are West Maui Watershed and East Maui Watershed. These watersheds were ranked as having an overall rank Medium in terms of threats to the health of the watersheds. The highest threats to these watersheds are ungulates, weeds, fire, small mammals, pathogens, and stream diversion. These factors harm watershed health, and need to be addressed in order to achieve the goals of the MIP, improve the health of the watershed, and improve the overall quality of life of the Maui community.

### Threat Assessment Summary by Geographic Landscape<sup>11</sup>

Threat	Kauai	Waianae (Oahu)	Koolau (Oahu)	East Molokai	West Maui	East Maui	Kohala (Hawaii)	Mauna Kea (Hawaii)	Windward Mauna Loa	Kau/Kapapala (Hawaii)	Kona (West Hawaii)	Pohakuloa/Puuwaawaa
Ungulates	H	H	H	H	H	H	H	H	H	H	H	H
Weeds	H	VH	VH	H	H	H	H	H	VH	H	H	H
Fire	L	H	M	H	M	L	L	M	L	L	H	VH
Small Mammals	M	H	M	L	L	M	L	M	M	M	M	L
Pathogens	M	L	L	L	L	M	L	M	M	M	M	L
Development	L	M	M	L	L	L	L	L	H	L	H	L
Military Training	L	H	M	L	L	L	L	L	L	L	L	H
Recreational Use	L	L	L	L	L	L	L	L	L	L	L	L
Stream Diversion	L	NA	L	L	M	M	L	M	NA	NA	NA	NA
Overharvesting	L	L	L	L	L	L	L	L	L	L	L	L
Logging	L	L	L	L	L	L	L	M	L	L	H	L
Grazing	L	L	L	L	L	L	M	M	L	L	H	M
Overall rank:	M	H	H	M	M	M	M	H	H	M	H	H

VH=Very High Threat, H = High, M = Medium, L = Low, NA = Not Applicable, no perennial streams.

(Conry et al., 2010).

In addition, the Hawaii Department of Health publishes information on coastal watershed standards attainment in their Biannual Water Quality Monitoring and Assessment Report. Tracking for attainment and non-attainment of standards for assessed watersheds began in the 2016 report. Between 2016 and 2018, all categories (bacteria, nutrients, turbidity, and chlorophyll a) either declined or showed no improvement in percentage of attained standards for assessed watersheds.

#### Analysis of Trends

The available information provides some insight on the ocean boundary of a watershed, and some about the upper watersheds. Taken together, this information can provide a snapshot of the overall health of the watershed system on the island, which can better direct action for improving the health of the watershed system. There are two years of data that seem to be showing significant declines in water quality; however, there is currently insufficient information to confidently identify any trends.

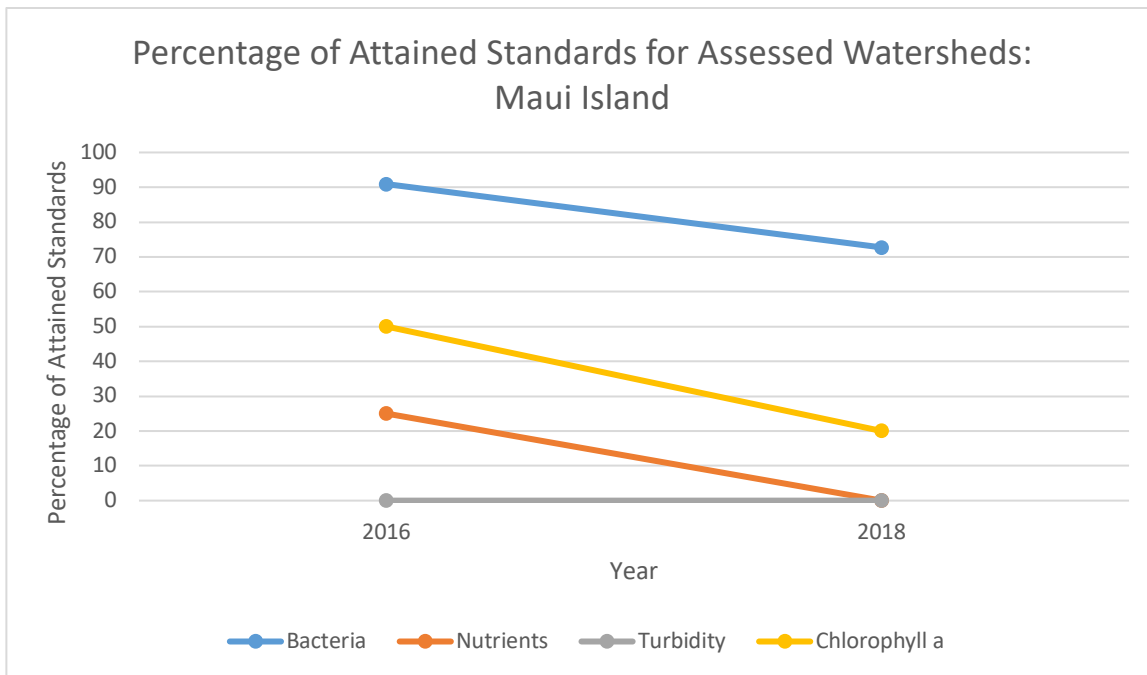


Figure 23 (2018 State of Hawaii Water Quality Monitoring and Assessment Report, 2019).

### Indicator Quality

The name of this indicator, “Watershed Health,” is very broad; for purposes of this report, it was necessary to better define it in order to assess its suitability. Available data provides some insight into the health of the ocean boundary of a watershed, as well as some information about the characteristics of upper watersheds. Taken together, this information can provide a snapshot of the overall health of the watershed system on the island, which can better direct action for improving the health of the watershed system. A healthier watershed will not only provide more water for human and ecological use, but will also improve coastal water quality. Unfortunately, until there is more consistent data collected for a longer time period, this indicator may not be very useful in determining the impact of MIP policies.

## Natural Environment > Watershed Systems Indicator:

### Drinking Water Quality

*MIP: “Proper disposal of the millions of gallons of wastewater produced on Maui protects the drinking water supply, coastal water quality, and other important environmental resources.”*

Clean drinking water is essential for a basic quality of life; this is specified in the MIP as a goal association for this indicator.

To address potential water quality issues, the County of Maui Department of Water Supply operates a water testing facility, and provides notices to the public if any contaminant is found at a level higher than current water standards. The department of water supply can issue direct notices to the public regarding water quality issues. The department also issues annual drinking water quality reports for each of its water systems.

The County of Maui Department of Water Supply provides reports on drinking water quality for the twelve water systems that it manages. Nine of these twelve water systems are located on Maui island, and include the

Lahaina System, Honokōhau System, Wailuku System, Makawao System, Lower Kula System, Upper Kula System, Ke‘anae System, Nāhiku System, and Hāna System (Water Quality Report - 2019 Publication, 2019). Contaminants are listed in the reports when detected at least once over an entire year. The 90<sup>th</sup> percentile value is displayed for each contaminant, along with a count of the number of days during which a given contaminant exceeded that level. The federal government mandates the display of tracking information for lead and copper in water systems. All other contaminants that are detected at least once are displayed on a basis of whether they were detected.

### Analysis of Trends

According to the 2019 reports, all nine water systems on Maui met their requirements for the chemicals that were tested for in 2018 (Water Quality Report - 2019 Publication, 2019). Different water systems show results for different contaminants, based on which chemicals are present (not all water systems come in contact with certain contaminants). Links to the full reports can be found at: <https://www.mauicounty.gov/247/Water-Quality-Report>. See Figure 24.

### Indicator Quality

All nine water systems on Maui are meeting current standards. Water quality is highly regulated, and is taken very seriously at all levels of government. This means that this indicator is not likely to show anything but excellent water quality. Still water quality is so essential to the quality of life that it is recommended that this indicator be retained.

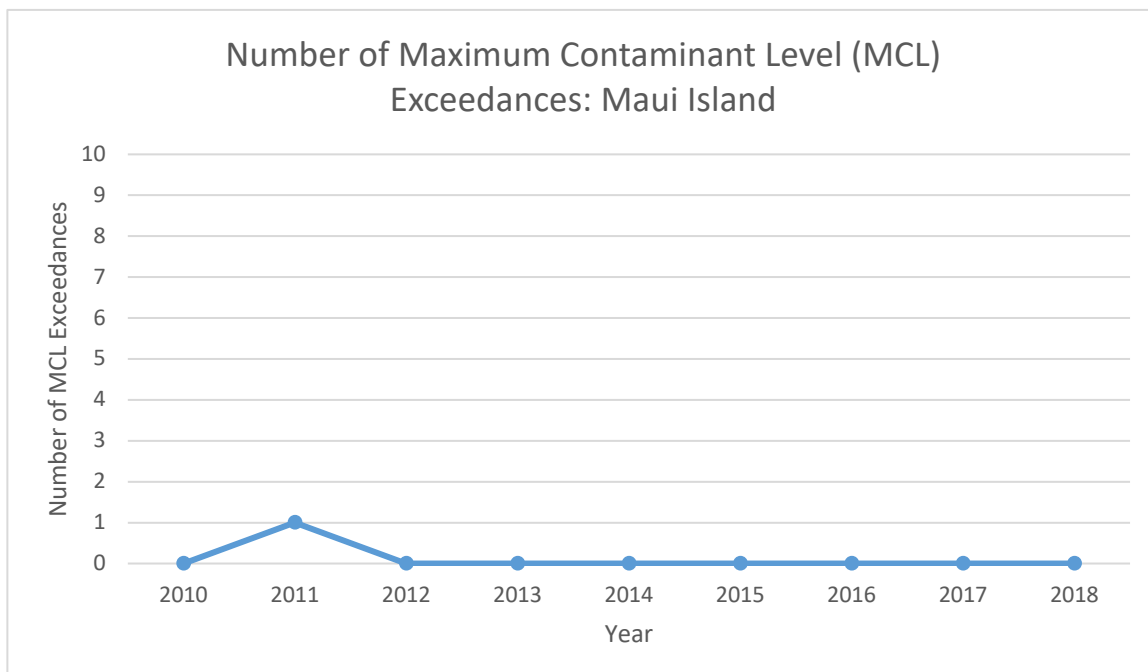


Figure 24 (Department of Health: Safe Drinking Water Branch, 2020).

## Natural Environment Category: Ocean /Marine Environment

	INDICATOR	GOAL ASSOCIATION
OCEAN / MARINE ENVIRONMENT	Coastal water quality	Decrease pollution
	% of healthy coral reefs	Increase reef health
	# of Shoreline postings (beach closures due to pollution)	Decrease pollution
	Amount of reef fish biomass	Increase reef health, preserve biodiversity

The ocean and marine environment comprise the environmental resources off the coast of Maui. These resources provide an important food source, enhance the ecosystem and recreation, and are vital for Hawaiian culture. A healthy ocean/marine environment is essential to quality of life for the Maui community.

### Natural Environment > Ocean/Marine Environment Indicator:

#### *Coastal Water Quality*

Coastal water quality measurements assess the quality of the marine environment. High coastal water quality means the absence of contaminants that negatively affect the marine ecosystem and the people interacting with it. A marine ecosystem with poor water quality will have unhealthy levels of those contaminants, and may have degraded coral reefs, low or stressed fish populations, and may be unsafe for recreational uses.

The Department of Health (DOH), Surfrider Foundation, and Hui O Ka Wai Ola work together to maintain datasets on marine surface water quality. DOH issues a biannual Water Quality Monitoring and Assessment Report with tabulated information on ocean water quality. See <https://health.hawaii.gov/cwb/files/2018/09/Final-2018-State-of-Hawaii-Water-Quality-Monitoring-Assessment-Report.pdf> for the full report.

#### Analysis of Trends

The overall trend for the percentage of standards attained for bacteria, nutrients, and chlorophyll a between 2014 and 2018 is one of general decline. Between 2014 and 2018, the percentage of standards attained for turbidity increased. Continuing to gather and understand this information provides the community with an opportunity to take steps to improve the health of marine water bodies, which in turn enhances the community's quality of life. See Figure 25.

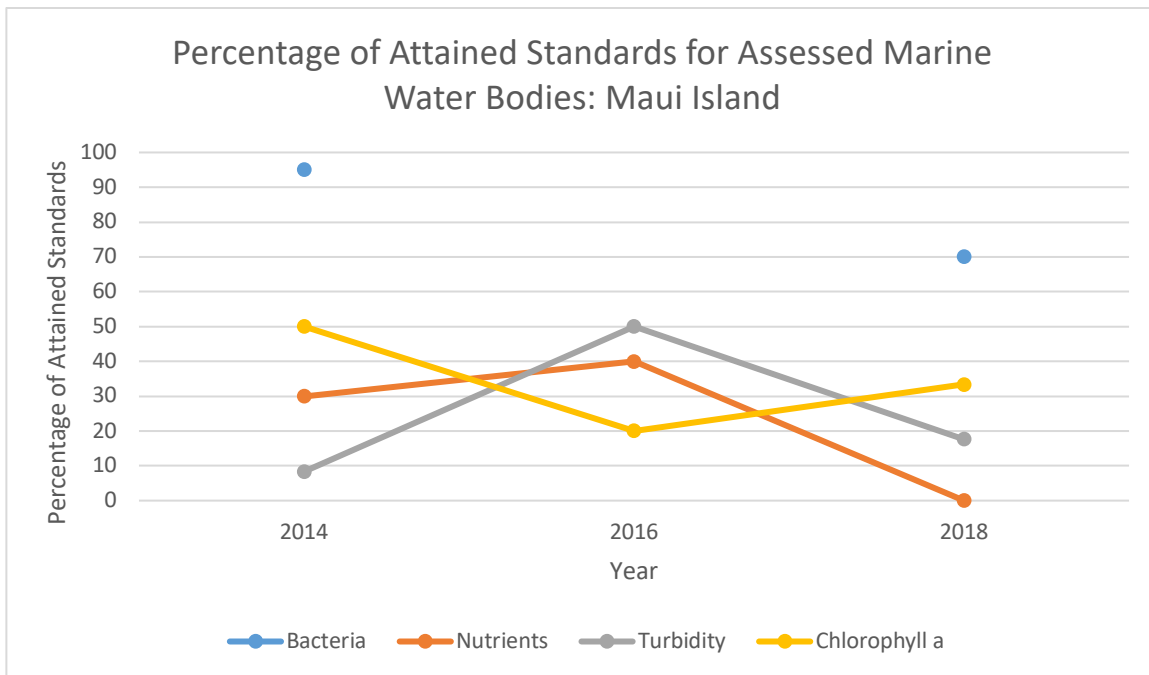


Figure 25 (2014-2018 State of Hawaii Water Quality Monitoring and Assessment Report). Notes: In 2016, no marine water bodies were assessed for bacteria

### Indicator Quality

Water quality information is essential to identify problems with water resources before they become critical. This is an essential indicator, and efforts should be made to improve the consistency and completeness of data collection.

### Natural Environment > Ocean/Marine Environment Indicator: Percentage of Healthy Coral Reefs

*MIP: Goal Association: "Improve reef health."*

*Executive Summary; Key Highlights: Protection of Watersheds and Coastal Resources. "Watershed and coastal zone management will be integrated to protect those areas of the island that contain critical marine resources, including coral reefs."*

*Heritage Resources: Shoreline Reefs and Nearshore Waters. "Maui's shoreline is a complex system of wetlands, gullies, dunes, beaches, lava fields, and hardpan substrate. Maui's coast serves as habitat for indigenous plants and animals. The health of the shoreline and beach areas is a key factor in sustaining sand resources, coral reefs, and marine wildlife. These areas serve as ecological, social, and economic resources. Various Federal, State, and County laws exist to conserve coastal resources while balancing development demands. Even with the existing regulatory framework, further management is necessary to balance rapid growth with shoreline protection."*

*Objective 2.2.2.h "Encourage the State to conduct a regular census of fish populations and monitor coral health."*

*Objective 2.2.2.j “Encourage the State to prohibit the collection and exportation of fish, coral, algae, and other marine species for the ornamental and aquarium trade.”*

Coral reefs provide vital habitat for fish that contribute to fisheries, and are a primary tourist attraction. Globally, coral reefs are affected by temperature rise due to anthropogenic climate change, invasive species predation, disease transmission, and other human activity. On Maui, and on most other developed areas with nearby reefs, coral reefs are experiencing stress from land-based nutrient pollution and sediment cover (Sparks et al., 2016). The healthiest coral reefs are typically those that are separated from human interaction. Reduction in stressors to coral reefs will likely improve their health. The Maui Island Plan designated this as an indicator with the goal of improving reef health.

### Analysis of Trends

Coral reef coverage can be affected by coastal development. For example, the Hawaii Division of Aquatic Resources released a report detailing the degradation of the ecosystem in Mā‘alaea, which stated,

“In 1972, the coral reefs within Maalaea Bay were described as being “striking in their diversity and in the presence of rare corals species” (Kinzie, 1972). Similarly, a U.S. Fish and Wildlife environmental assessment in 1993 estimated coral cover in the vicinity of the current CRAMP survey stations to be between 50% and 75% (USF&W, 1994). These scientific assessments describe a once healthy and diverse reef ecosystem. The Maalaea reef is now extremely degraded and has experienced periods of heavy algal overgrowth.”

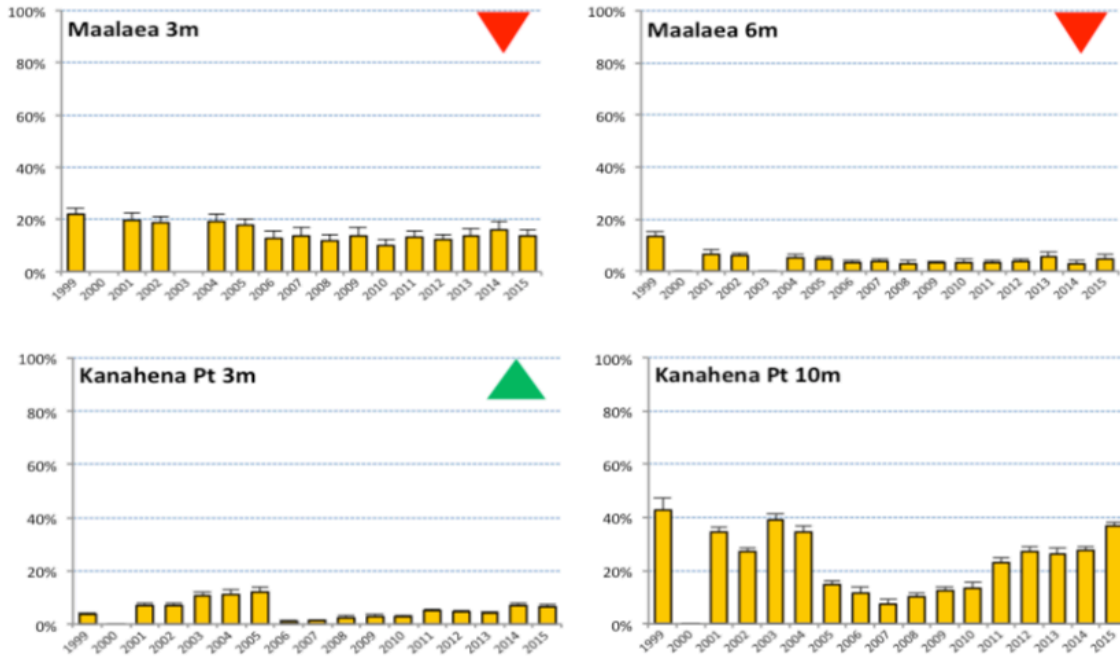
(Sparks et al, 2016).

In the Sparks report, the results of 15 years of monitoring coral reefs are presented. 26 sites were surveyed using random transects and statistical determinations were made on the trends for each reef. 12 reefs had no significant change, 8 reefs significantly lost coverage, 2 reefs lost marginally significant coverage, 3 reefs gained significant coverage, and 2 reefs gained marginally significant coverage. These determinations were made using scientific methods and statistical analysis. Overall coral cover averaged 30.7% for the sites around Maui County at the beginning of the study and declined to 26.8% by the end.

According to the researchers, “This slight decline in living coral cover does not appear to be ecologically significant when viewed as a whole, but the overall trend masks substantial changes occurring at individual sites” (Sparks et al., 2016).

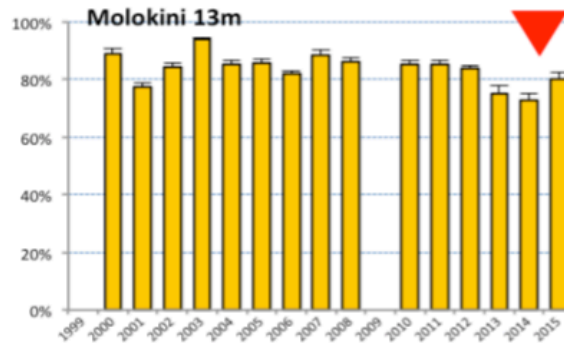
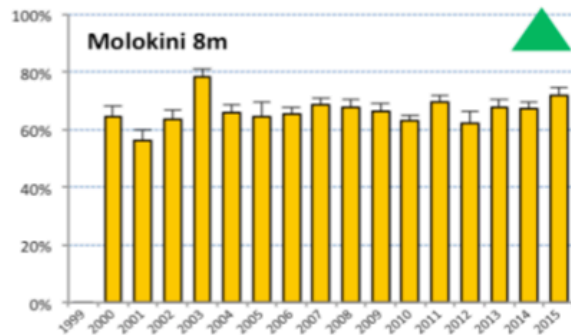
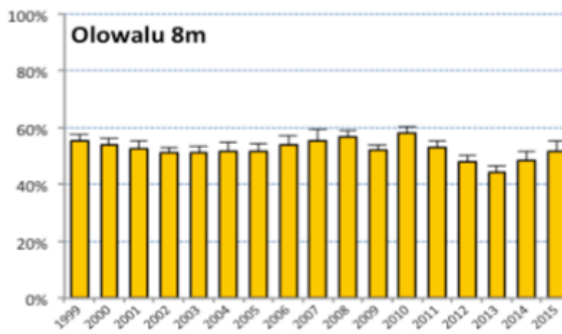
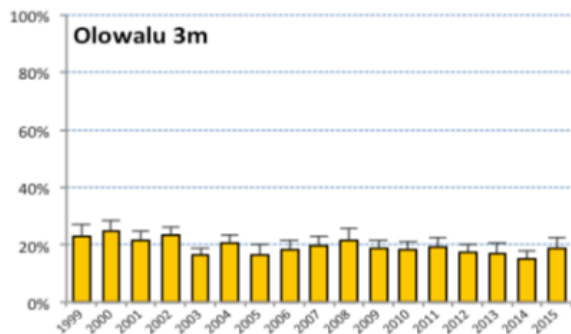
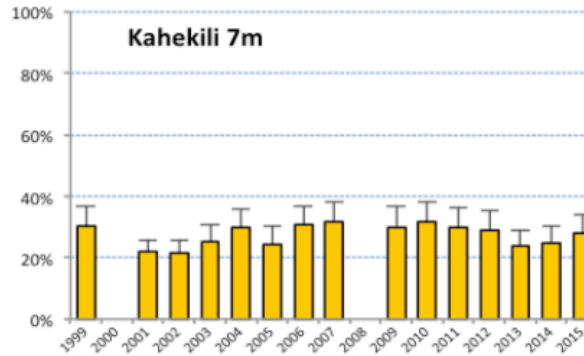
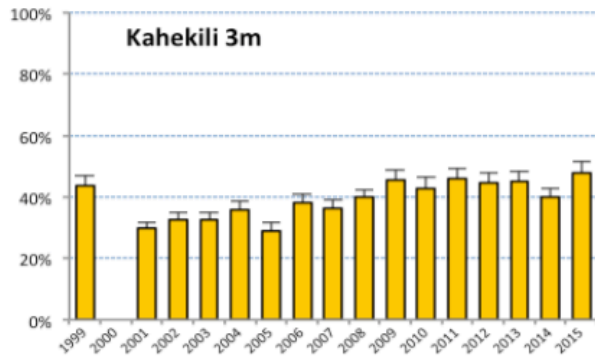
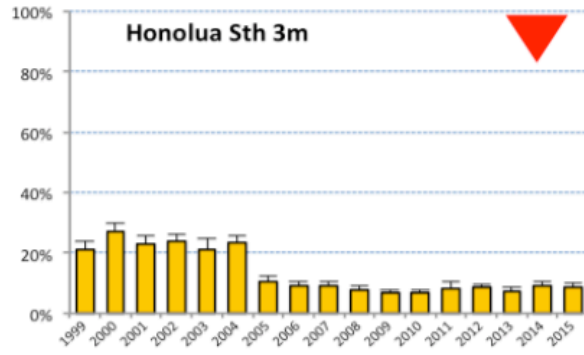
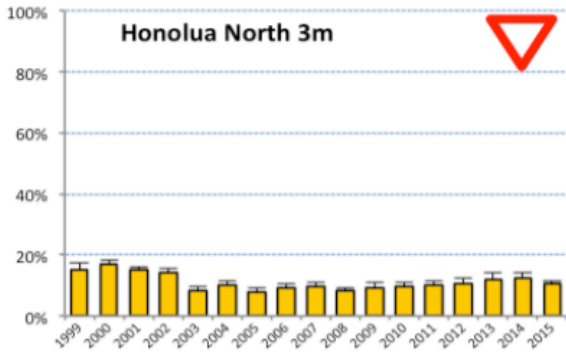
Following are a series of graphs from this study, showing coral cover at various locations offshore of Maui:

Figure 26 (Sparks et al, 2016)



(Sparks et al., 2016)





(Sparks et al., 2016)



(Sparks et al., 2016)

The above figures depict the temporal changes in percent coral cover at various locations and depths. The data represent results from significance tests which compare the tests from the first year's and the last year's coral coverage. The solid red arrows represent a significant decrease in coral coverage ( $p$ -value  $< 0.05$ ) and the solid green arrows represent a significant increase in coral coverage ( $p$ -value  $< 0.05$ ). The open red arrows represent a marginally significant decrease in coral coverage ( $p$ -value  $< 0.1$ ) and the open green arrows represent a marginally significant increase in coral coverage ( $p$ -value  $< 0.1$ ) (Sparks et al., 2016).

## Indicator Quality

Determination of the percentage of healthy coral reefs on Maui is a difficult, but a critical scientific undertaking. In order to maintain this as a viable indicator, a commitment would need to be made to regular yearly updates of this data.

## Natural Environment > Ocean/Marine Environment Indicator: *Number of Shoreline Postings (Beach Closures Due to Pollution)*

*MIP: Heritage Resources: “The Countywide Policy Plan, at page 47, establishes the following policy: ‘Protect and restore nearshore reef environments and water quality.’ The corresponding implementing action is: ‘Develop regulations to minimize runoff of pollutants into nearshore waters and reduce nonpoint and point source pollution.’ ”*

*Policy 2.2.3.g “Ensure that the County upholds its affirmative duty under the Clean Water Act by monitoring and reducing point and NPS pollution to help safeguard coastal waters.”*

Shoreline postings (the posting of warning signs about beach closures due to poor water quality) directly impact tourist and resident enjoyment of our public spaces. Postings also prevent transmission of the bacterial illness present in the water to people. Improvements in watershed management and other water quality preservation techniques may reduce the incidence of beach closures due to pollution.

According to the DOH Clean Water Branch, there is no such term as “Shoreline Posting.” Instead, here are water quality advisories on beaches, for which DOH posts a sign.

## Analysis of Trends

Water quality advisories are issued based on island, and the Department of Environmental Health Clean Water Branch stores a complete record of these advisories that began in 2014.

In general, the number of water quality advisories appears to have increased since 2014. See Figure 27.

## Indicator Quality

Information regarding Water Quality Advisories is essential to bringing attention to marine water quality issues on Maui, so that quality of life can be improved. The name of this indicator should be changed to “Annual Shoreline Water Quality Advisories.”

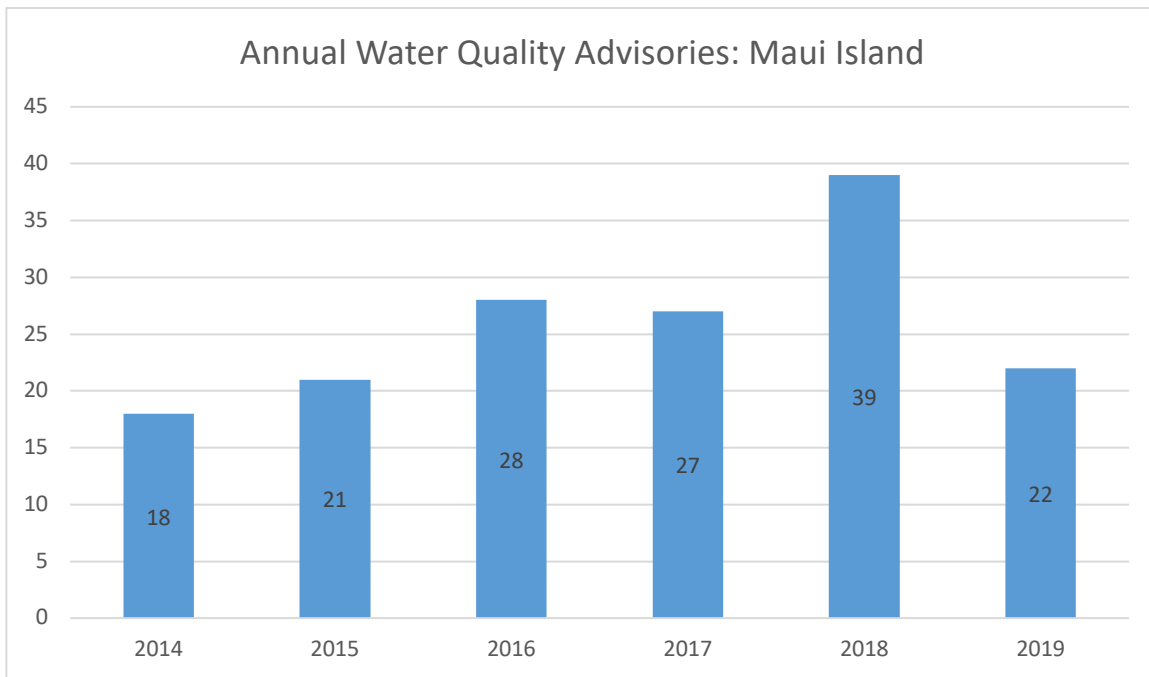


Figure 27 (Water Quality Advisories, DOH Clean Water Branch, 2020).

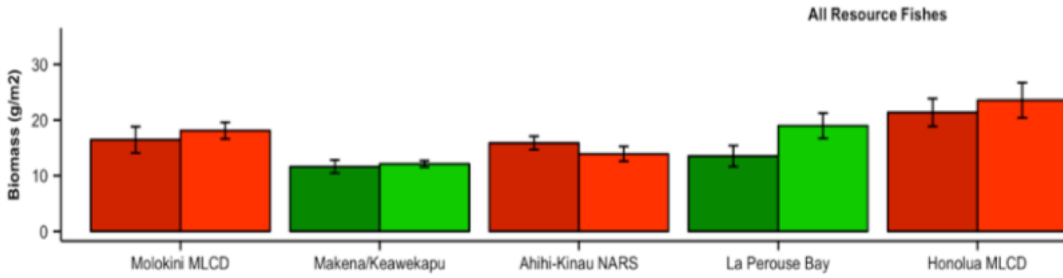
## Natural Environment > Ocean/Marine Environment Indicator: *Amount of Reef Fish Biomass*

*MIP: Goal Association: "Increase reef health, preserve biodiversity"*

*Policy 2.2.2.g "Support the development of regulations to prevent the excessive depletion of fish stocks due to non-sustainable practices and gear such as SCUBA spear-fishing and lay nets, within the context of nearshore ecosystems."*

Reef fish are an important component of the marine ecosystem. To protect our fisheries and the natural resources that attract tourism, management practices have been introduced, including the closing of certain fisheries. The Hawaii Division of Aquatic Resources has published fish biomass surveys for multiple sites in Maui County.

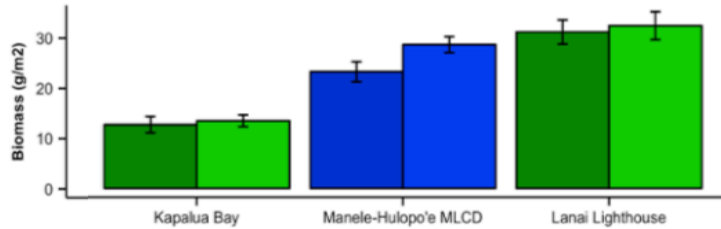
**Figure 28** Reef Fish Biomass Levels: Maui County



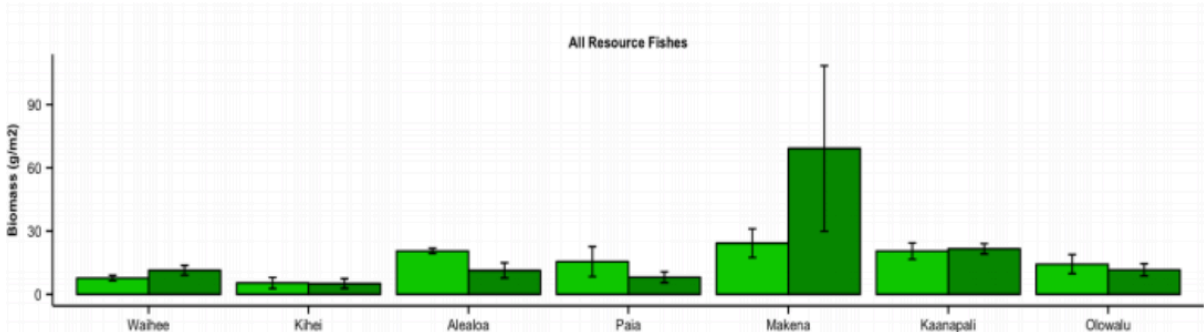
“Mean and SE [standard error] fishes biomass levels (g/m<sup>2</sup>) at County monitoring stations. Data comparisons between the surveys in the 2006-2010 period and the 2011-2015 period. Significant pair-wise differences between time periods at the same location are indicated by \* (90% confidence equivalent to p<0.1) Bar colors represent management status and time

of resource DAR Maui are shown as averages of all and the 2011-differences location are intervals, i.e. represent period; - 2010),

- dark red (no-fishing 2007
- lighter red (no-fishing 2012 - 2015),
- dark green (open to fishing 2007 – 2010),
- lighter green (open to fishing 2012 - 2015),
- dark blue (partial protection 2007 - 2010)
- and lighter blue (partial protection 2012 - 2015).”



(Sparks et al., 2016)



According to the Sparks report, fish stocks are depleted across all sites in Maui County, however current patterns indicate notable increases in fish population. Habitat and Fish Assessment (Hafa) surveys were also attempted, but high variability in the samples created difficulties in drawing a statistically accurate conclusion. Standard error often overlapped the changes in mean population for surveyed areas. According to the report:

“That high variability was likely due to combination of: (i) inherent high variability of fishes in shallow water, as many of the fishes we were interested in are sometimes found in large schools; (ii) a high degree of habitat patchiness in the surveyed shallow water areas; and (iii) large impact of conditions between surveys, e.g. wave energy and turbidity both on fish distributions and on the surveyors ability to conduct surveys” (Sparks et al., 2016).

## Indicator Quality

The success of efforts to develop regulations to prevent excessive depletion of fish stocks can be measured by tracking reef fish biomass. To the extent that similar data can continue to be collected on a regular basis using comparable methods and locations, this will likely remain a good indicator.

## Natural Environment Category: Wildlife and Natural Areas

	INDICATOR	GOAL ASSOCIATION
WILDLIFE AND NATURAL AREAS	# of Threatened and Endangered Species	Preserve biodiversity
	Acres of Protected and Conservation lands	Protect sensitive lands
	Air Quality Index	Quality of life indicator
	Habitat Fragmentation	Protect natural ecosystems

*MIP: “Wildlife and Natural Areas: Many of Maui’s natural areas and wildlife are in designated State and National Parks, nature preserves, forest reserves, natural area reserves, and private lands. These lands contribute to the quality of life on Maui, attract visitors, provide habitat for native species, and are inextricably tied to the Hawaiian culture. Maui’s natural areas and wildlife are key components of the island’s identity.”*

A high-quality natural environment is diverse, resilient, and provides for the needs of wild animals and people. Many natural ecosystems on Maui are threatened by invasive species and habitat destruction. Healthy natural areas provide filtration for stream water and protect against erosion and landslides, all of which can negatively affect people’s quality of life.

### Natural Environment > Wildlife and Natural Areas Indicator: *Number of Threatened and Endangered Species*

*MIP: Goal 2.4: “Maui’s natural areas and indigenous flora and fauna will be protected.”*

The US Fish and Wildlife Service provided a list of endangered species listings for Maui island from 1967 to 2016; this information was sorted by year and charted.

### Analysis of Trends

The number of threatened and endangered species can vary considerably; although the rate at which new species are added or removed from the list varies considerably, the trend is clearly upward. Due to the fact that such listings may have significant economic consequences, there can be substantial opposition to listings by landowners. Political influences may result in defunding of responsible agencies. Legal challenges from supporters or opponents of listings can delay listing decisions, and may result in large numbers of listings in years when court decisions are rendered; the resulting numbers are not strictly correlated with the state of the natural environment. See Figure 29.

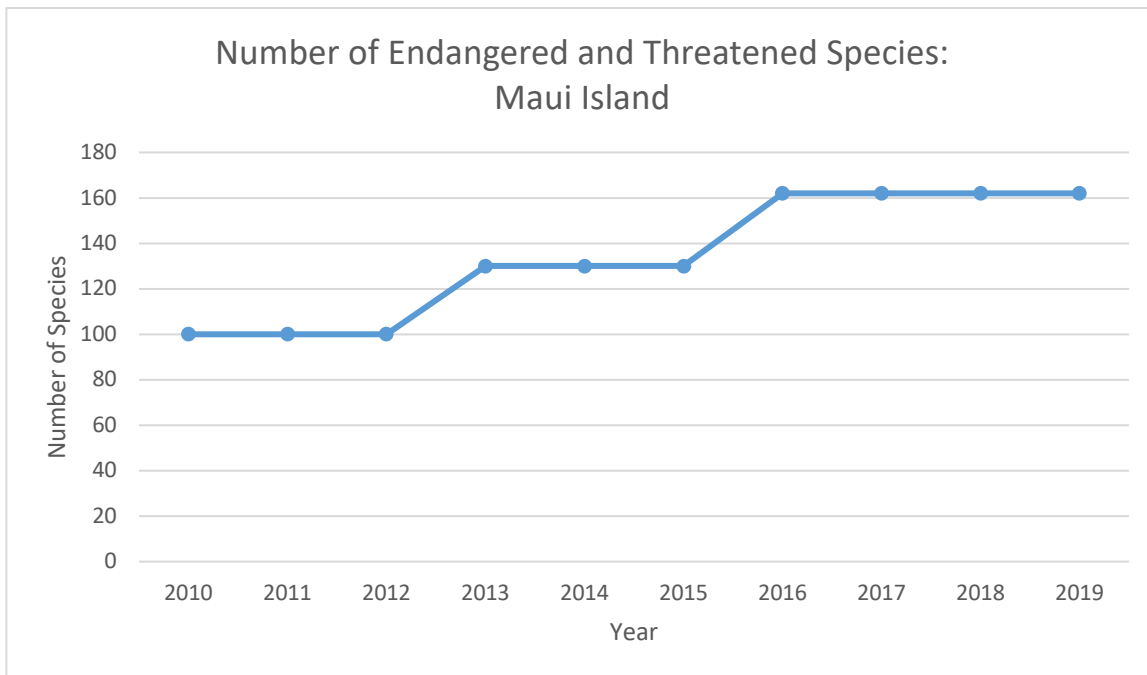


Figure 29 (USFWS, 2013 & 2016; ECOS, 2020) Note: No species were removed from the threatened/endangered species lists between the years 2010 and 2019 (US Fish and Wildlife Service Pacific Islands Office, 2020).

### Indicator Quality

The Number of Threatened and Endangered Species is a measure of the scale of the threat to native species. To the extent that the lives of Maui’s people are enriched by the perpetuation of these species, this indicator does help measure the quality of our lives. A disadvantage of this indicator is that extinction determinations and recovery delistings are often delayed due to political issues and/or agency inaction. Also, endangered species listings are not necessarily correlated with actual progress in protection of endangered species. For example, when a species that goes extinct gets taken off the list the number of threatened/endangered species goes down, but according to the MIP, another key component of the island’s identity is been lost, and the quality of life is diminished.

### Natural Environment > Wildlife and Natural Areas Indicator: *Acres of Protected and Conservation Lands*

*MIP: Objective 2.3.4: “Greater preservation of native flora and fauna biodiversity to protect native species.”*

Designating areas for conservation is a widely used method for natural resource protection. Areas are designated as protected, and management of those lands is handled by a government agency or a public-private partnership. The Maui Island Plan 2030 resolved to track acreage of protected and conservation lands to protect the biodiversity of native flora and fauna.

## Analysis of Trends

Between 2010 and 2017, the acreage in the Conservation land use district on Maui island has remained unchanged at 194,836 acres. However, during that time, the Hawaiian Islands Land Trust has protected almost 12,000 acres through acquisition of fee title or conservation easements.

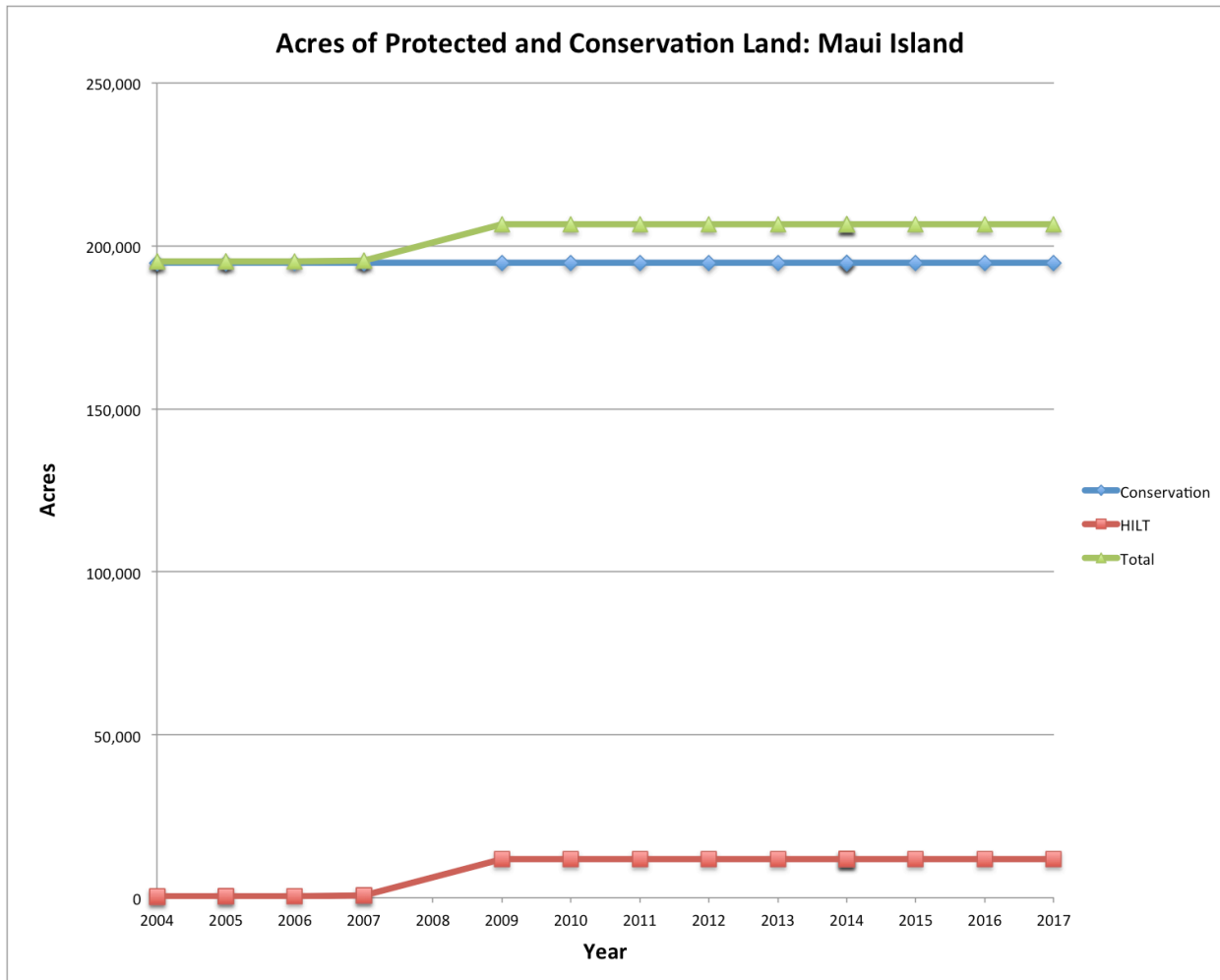


Figure 30 (Maui County Data Book 2011-2018. Hawaiian Islands Land Trust, 2020)

## Indicator Quality

This indicator tracks the current area of protected and conservation lands. While this is a factor influencing Maui's quality of life, it does not measure the actual effectiveness of conservation activities within designated lands. This indicator could be improved, for example, by factoring in the acreage of fenced-in areas that protect watershed areas from feral ungulates that wreak havoc on native flora and fauna. However, collecting information on a regular basis is key to the long term utility of an indicator, and collection of such detailed information may be costly. Given these limitations, the current indicator provides a reasonable approximation of native species protection.



## Natural Environment > Wildlife and Natural Areas Indicator:

### *Air Quality Index*

*MIP: “. . . more compact mixed-use developments can help produce reductions in CO<sub>2</sub> emissions as well as energy consumption, both directly and indirectly. These reductions can mean improvements to air quality, healthier conditions for human beings and the surrounding natural environment.”*

The Air Quality Index (AQI) is maintained by the U.S. Environmental Protection Agency (EPA) as a uniform indicator of daily air quality, and as a general guide for the public. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health. Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health. (Environmental Protection Agency, 2020).

Ozone (O<sub>3</sub>) at low elevations is linked to respiratory illnesses. Fine particulate matter (PM<sub>2.5</sub>, 2.5 microns (size) or smaller) transfers directly from the air into the human circulatory system, causing various negative health effects, including cancers. Particulate matter (PM<sub>10</sub>, 10 microns (size) or smaller) can settle in the lungs, blocking respiration and causing respiratory distress.

On Maui, air quality is tested by the State Department of Health at two sites: one in Kahului and the other in Kihei. Data for PM<sub>2.5</sub> has been collected consistently at these sites since the early 1990s. However, since Maui data for PM<sub>10</sub> or O<sub>3</sub> is not collected, the Air Quality Index on Maui is the same as the measurement for PM<sub>2.5</sub>. Air quality may be affected by exhaust from fossil-fueled vehicles, by volcanic activity on Hawai‘i island, by agricultural activities, and by wildland fires.

### Analysis of Trends

The Air Quality Index for Maui has increased over the years, but has been generally in the 0 to 100 range, which is classified “Good” to “Moderate” in Levels of Health Concern. In 2014 and 2016, there were two instances in which air quality deteriorated to levels that were “Unhealthy for Sensitive Groups.” Unfortunately, continuous data are not available after 2017, so the effects of a cessation in cane burning, major brush fires, and the end of the volcanic eruption on Hawai‘i island are not shown.

### Indicator Quality

Although the air quality index could be an appropriate indicator for identifying trends in air quality, it is not currently useful on Maui as a proxy for determining the success of MIP goals to promote compact mixed use developments. This is particularly true because ozone, which is associated with fossil fuel use, is not measured on Maui, and there are only two widely separated monitoring stations. Ongoing data availability is also an issue. Air quality measurement on Maui would be improved by installation of additional air quality monitors that also measure for PM<sub>10</sub> and O<sub>3</sub>.

## Air Quality Index (AQI)

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
<i>When the AQI is in this range:</i>	<i>..air quality conditions are:</i>	<i>...as symbolized by this color:</i>
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

(Hawaii Ambient Air Quality Data, 2020).

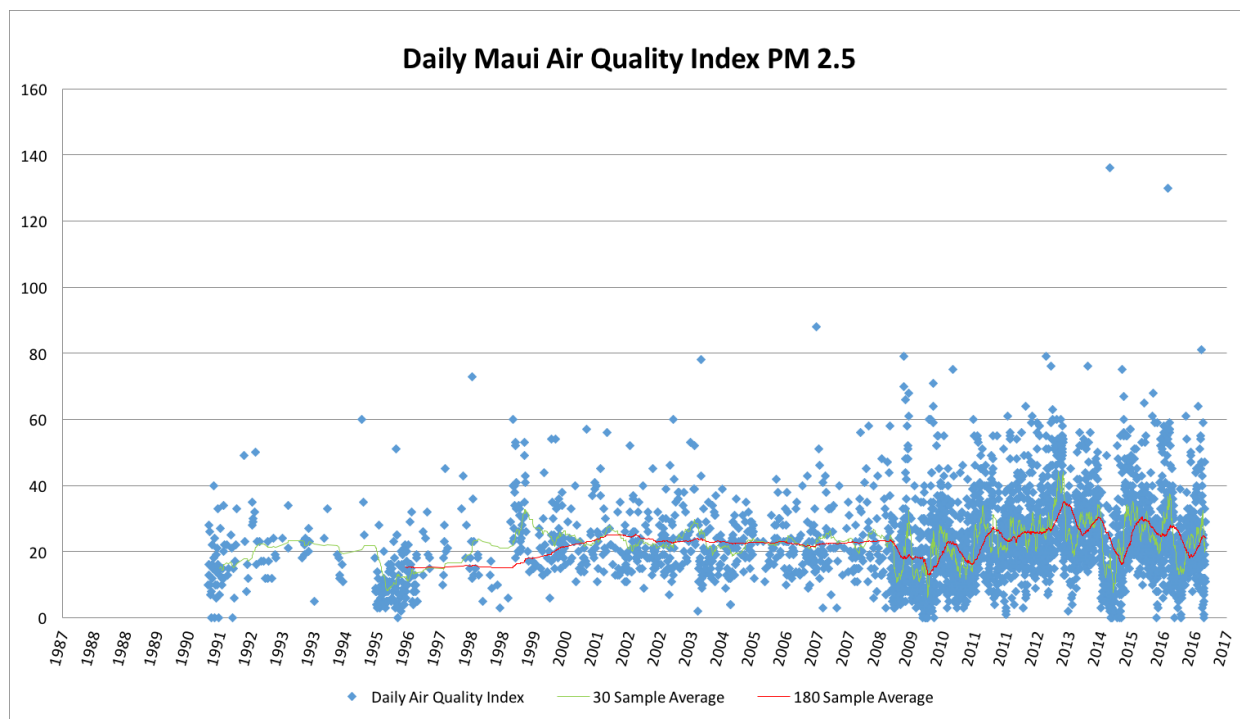


Figure 31 (Hawaii Ambient Air Quality Data, 2020)

## Natural Environment > Wildlife and Natural Areas Indicator: *Habitat Fragmentation*

*MIP: Heritage Resources* “The longevity of a species is directly related to the health of its habitat. In addition to the individual species, the native habitats can be considered endangered because of habitat fragmentation. Vast expanses of Maui’s native habitats have already been lost; therefore, preservation of remaining habitat is vital to the survival of many species.”

Fragmentation of natural habitat has occurred rapidly since human contact. Entire ecosystems have been displaced and fragmented. Different species require different amounts of space in order to thrive. When habitat is fragmented, the required space may be unavailable, and genetic diversity may be compromised; this can lead to reduced resilience and viability. Historical records can be used to understand the changes in natural habitat.

### Analysis of Trends

Significantly, Habitat Fragmentation is the only indicator in the MIP that does not list a potential data source.

In general, habitat for native species has been lost and/or significantly fragmented over the last several centuries. Some information on habitat fragmentation is available in academic studies, but it is not collected frequently and/or regularly enough to facilitate analysis of ongoing trends. See Figures 32 and 33.

Figure 32

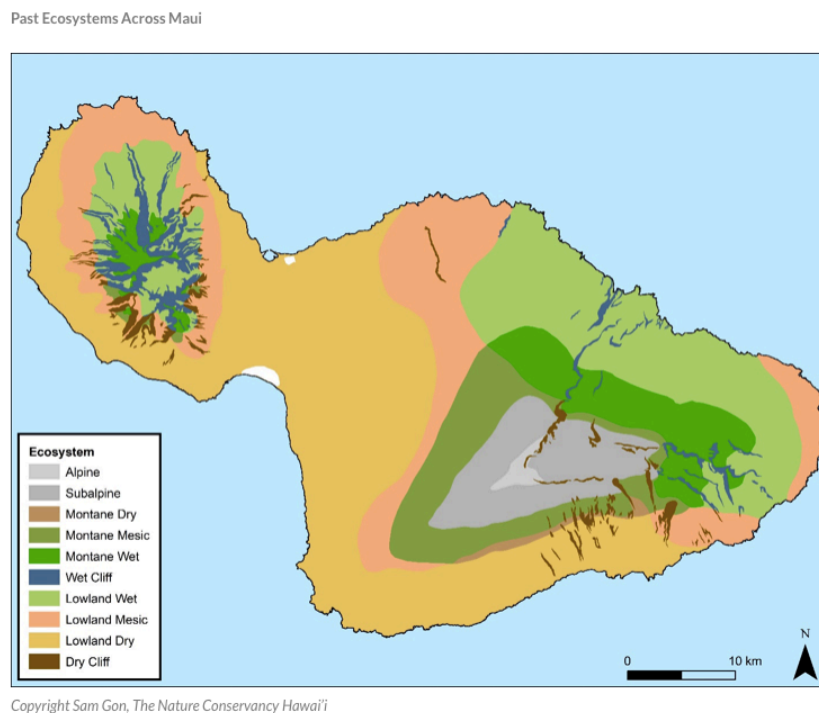
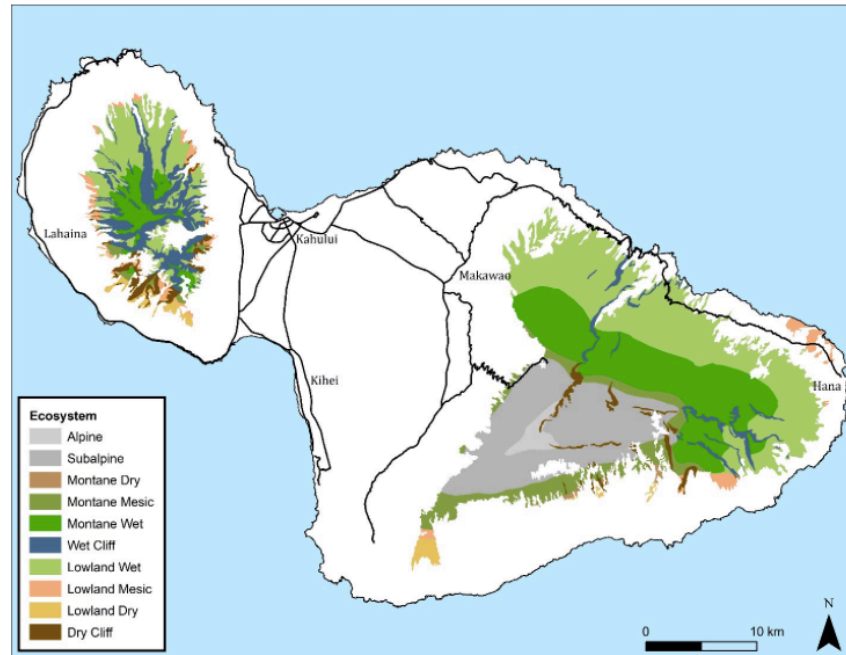


Figure 33

Ecosystem Cover Across Maui Today



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## Indicator Quality

Data for Habitat Fragmentation are not readily available. Unless data can be collected on a continuing basis, this indicator will not be useful in implementing the goals, objectives of policies of the MIP.

## Conclusion and Recommendations

Monitoring of Maui's quality of life is a continuous process that will require the tracking of multiple types of information, identifying trends, and then implementing appropriate policy changes, based not only on how we measure quality of life, but also on how quality life is defined by Maui's people. The Maui Island Plan was a major step in this process. Much work has been done over the years to elicit the values of Maui residents, and the MIP made a first attempt at creating measurable indicators based on those values. Now, several years after adoption of that plan, this report constitutes the first evaluation of the specified quality of life indicators.

In order for the quality of life indicator monitoring system to be successful, the data needed to calculate the indicators need to be actively and regularly collected, compiled, and monitored; this process should be automated as much as possible. The results need to be made available to decision makers and the public on a regular, timely, and continuous basis over the long term. Dedicated staff and permanent funding for these activities need to be put in place.

Once a robust quality of life monitoring infrastructure has been built, the indicators in the Maui Island Plan will be able to yield good, actionable information. If the analysis of indicators in this report results in improved indicators, the results will be even better. In order to build understanding and support for this process, public input needs to be encouraged. Multiple small group discussions, patterned after the methods used during Focus Maui Nui, would be very productive, and would help to build appreciation and acceptance, especially if followed by tangible results. The goal of community engagement should be to obtain direct feedback based on local experience. Conflicts over resources or values are to be anticipated as valid expressions of community

sentiment that must be recognized and responded to if quality of life indicators are to be improved upon and supported by the public.

The reasoning behind the development of quality of life indicators needs to be communicated to the public; to facilitate this, presentations should be made accessible in multiple formats, including graphics, data tables, and videos of different lengths. A range of methods for disseminating this information will need to be utilized, including web pages, social media, written materials, and public presentations. These steps will ensure that different demographic groups will be reached, and that their opinions will be taken into account.

Skillfully done, an ongoing quality of life indicator update process will be able to make a significant contribution toward measuring and improving the quality of life on Maui.

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