

Hawai‘i Carbon + Natural Capital

A Policy + Institutional Analysis for
Payment for Ecosystem Services (PES)
Approaches in Hawai‘i

Report produced by Conservation International

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**HAWAIIAN
AIRLINES.**



CONTENTS

INTRODUCTION.....	7
PART I: PAYMENTS FOR ECOSYSTEM SERVICES-ESSENTIAL ELEMENTS	8
Ecosystem Services	8
Conditionality + Additionality.....	8
Unifying Problem + Purpose.....	8
Basic Legal Frameworks	8
Ecosystem Services Providers (“Sellers”).....	10
Ecosystem Services Beneficiaries (“Buyers”)	11
Payment + Price	12
Governance + Institutional Functions	12
PART II: APPROACHES IN OTHER GEOGRAPHIES	12
Costa Rica	13
Socio-Bosque, Ecuador	14
Tualatin Basin, Oregon.....	15
Denver, Colorado	16
PART III: HAWAI’I READINESS	18
Ecosystem Services	18
Unifying Problem + Purpose.....	19
Existing Commitments + Targets	21
Basic Legal Frameworks	22
Policies to Support Design.....	22
Information Gathering Policies	23
Primary Compliance Policies	23
Policies Imposing Taxes or Fees that Support Ecosystem Services	26
Potential Ecosystem Services Providers (“Sellers”).....	30
Hawai’i’s Potential Ecosystem Services Providers (“Sellers”).....	31
Funding + Capacity Support Programs for Sellers	32
Potential Ecosystem Services Beneficiaries (“Buyers”).....	37
Potential Beneficiaries (“Buyers”) of Hawai’i’s Ecosystem Services.....	38
Payment + Price	40
Governance + Institutional Functions	40
Government-Funded PES Programs in Hawai’i	48
PART IV: CONCLUSIONS + RECOMMENDATIONS	50
Endnotes.....	52
Works Cited	60

Executive Summary



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Hawai'i's natural resources provide tangible benefits and major economic value to the 1.4 million people who live in the islands year-round and to the additional 8 million people who visit the islands annually. These benefits, or “ecosystem services,” include providing food, freshwater, and coastal protection, contributing to a stable climate, securing cultural practices, and providing a home for a rich diversity of terrestrial, freshwater, and marine plants and animals – more than 40% of which are found nowhere else in the world. The uniqueness of Hawai'i's ecosystems provide a powerful lure to tourists, allowing Hawai'i to become the world's premier vacation destination. It has also made them vulnerable to damaging land use practices by people and degradation from invasive, non-native plants and animals on land and in the ocean. Although these threats have long been understood, they have not been removed because the scale of investment in Hawai'i's natural resources has not been commensurate with the scale of the threats that face them. To increase this investment to appropriate levels and to protect the value that people get from nature, Hawai'i needs to explore alternative ways to finance its conservation efforts.

To begin this exploration, business leaders that comprise the Sustainability Business Forum asked Conservation International, in collaboration with the Sustainability Business Forum's Working Group, to undertake a Policy and Institutional Analysis to explore the feasibility of Payment for Ecosystem Services (PES) in Hawai'i. PES is an approach that makes clear the connection between the importance of natural resources and the financial investment individuals are willing to make to care for those natural resources.

PES approaches began with a pioneering effort to reverse deforestation on private lands in Costa Rica in the 1990s. Since then, PES approaches have been pursued at national, municipal, and watershed scales in more than 60 countries across the globe, including in the United States. These approaches take many different forms to support a variety of national or community-level goals. In general, however, a PES approach is a system in which beneficiaries provide payments to incentivize stewardship of an ecosystem service.

This report analyzes a potential PES approach for Hawai'i in four parts. **Part I** provides a high-level overview of the essential elements of PES approaches, as identified by scholars and experienced practitioners in the field. **Part II** provides summaries of how these essential elements have been interpreted and implemented in four different geographies and at different scales. **Part III** provides an overview of Hawai'i's readiness in relation to the essential PES elements, and, finally, **Part IV** provides specific conclusions and recommendations for next steps to pursue a PES approach in Hawai'i.

The main recommendations are the following:

A Unifying Problem + Purpose Must Be Identified

Hawai'i's private sector, as well as leaders from its diverse communities, need to join Hawai'i's public sector in identifying the unifying problem and purpose that will guide the PES approach design. A truly unifying problem will be one that reflects a shared sense of threat to ecosystem services that are commonly valued and provide benefits to a diversity of people in Hawai'i. The problem that resonates with the greatest number and diversity of Hawai'i businesses and residents will be one capable of generating the political and social will necessary to address it through a PES approach.

Hawai'i has policies and target-setting initiatives that have, among other things, created



a statewide commitment to sustainability. There is a lot to build on from initiatives like the Aloha+ Challenge, Promise to Pae ‘Āina, and the Sustainable Hawai‘i Initiative, such as clear alignment around the need to increase local food production and protect Hawai‘i’s priority watersheds. Building on these initiatives, PES could provide a mechanism for Hawai‘i’s public, private, and civil society partners to work together to finance and implement agreed-upon sustainability and climate priorities. A need still exists, however, for a clear message that speaks directly to Hawai‘i’s private businesses, private citizens, and visitors in a way that generates enthusiasm and unified support to pay for the ecosystem services that benefit all the people in Hawai‘i.

Create a Common Agenda for Shared Action

A unifying purpose will help identify what success will look like for a PES approach and the people and places that must be involved to achieve that success. This can help create a common agenda or roadmap for a diverse set of stakeholders that may only participate in a small part of the overall PES approach.

An example of this would be the new approach designed to meet wastewater temperature regulations in Oregon’s Tualatin Basin watershed. In that approach, rural landowners planted native trees and shrubs near streams on their own properties to help cool water that ran into the Tualatin River. In cities within the same watershed, volunteers worked with city authorities to plant trees near streams on public property that also ran into the Tualatin River. Each individual planting effort was small on its own, but coordinated together and deployed for a single purpose, these efforts resulted in 500,000 trees being strategically planted over five years to provide the shade necessary to cool 50 million gallons of wastewater effluent released each day by the basin’s wastewater plants. This approach also avoided the need to invest more than \$100 million in new technology at the plants, the cost of which would have been passed on to the Tualatin Basin ratepayers.

Having a common agenda can help different stakeholders see how their participation in a specific effort or specific PES tool will contribute to a larger collective approach for a common purpose that they all value.

Existing Funding + Capacity Support Programs Should Be Leveraged

Part III of this analysis details the many resources and capacities that are in place in Hawai‘i. These resources could be leveraged for greater impact, but they must be aligned. These resources are currently deployed to serve separate mandates and priorities. The real opportunity presented by a PES approach, is the ability to align existing public resources, determine where the capacity and funding gaps exist, and engage the private sector to make strategic investments that maximize impact and leverage public funds, political will, and broad social engagement.

In Hawai‘i, federal and state agencies currently fund programs that pay qualifying landowners to protect forested lands, protect wetlands, or convert degraded lands to native habitat. Public-private partnerships, such as the Hawai‘i Watershed Partnerships and the Hawai‘i Invasive Species Committees, offer technical expertise and experience working effectively across property boundaries. State agencies with economic mandates recognize the critical role of Hawai‘i’s natural resources, such as the Hawai‘i Tourism Authority and Hawai‘i’s Department of Business, Economic Development, and Tourism. Strong nonprofit organizations, such as The Nature Conservancy, the Trust for Public Land, and Hawaiian Islands Land Trust, work with Hawai‘i landowners to secure unique natural resources. And importantly, leaders of locally owned Hawai‘i businesses, such as those in the Sustainability Business Forum, have been looking for opportunities to secure the long-term health of Hawai‘i’s natural resources and the economy that relies on them. A PES approach offers an opportunity to harness all of these strengths and assets in a collective effort.



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Evaluate the Role that Different PES Tools Can Play

The actual strength or weakness of any particular PES tool will not be apparent until the unifying problem and purpose and common agenda have been identified and the existing resources have been evaluated for potential leverage and gaps. That being said, a few high-level observations can be made about the varied advantages of different PES tools that are not currently in use in Hawai'i or are being used at a very small scale.

PES Tools with Potential to Capture New Revenue Sources

(Greatest Economic Impact)

The PES tools with the potential to tap into new revenue sources for Hawai'i would include carbon offset credits (in voluntary and in compliance markets, like California's carbon emission cap-and-trade program and the developing carbon emissions offsetting program for international aviation), biodiversity offsets, in lieu fees, and tourism activities that directly support ecosystem services (e.g. tree planting voluntourism, reservation tools with options to offset carbon emissions with local nonprofits, etc.). These tools have the potential to tap into revenue streams that exist or are developing and would provide buyers to which Hawai'i does not currently have access.

Potential to Support Multiple Ecosystem Services

(Greatest Ecosystem Impact)

The PES tools with the greatest potential to support multiple ecosystem services would be forest-based projects, because of the frequent overlap of existing native forests and areas of recharge for groundwater aquifers. Forest-based projects that are used to generate carbon offset credits, improve water supply, temperature, or quality, or secure the habitat of native species would provide benefits for all three ecosystem services of interest to this analysis (i.e. freshwater, biodiversity, and carbon dioxide removal). Native forests may not have the highest rate of carbon dioxide removal, but they would likely provide more benefits for freshwater and biodiversity security than other project types with higher carbon dioxide removal rates.

Policy Change Required in Hawai'i

(Lowest Hanging Fruit)

The PES tool that would require the least amount of policy change to implement in Hawai'i would be private agreements between landowners and ecosystem service beneficiaries (for example, those currently used in the government-funded PES programs, such as Hawai'i Conservation Reserve Enhancement Program (CREP) and Hawai'i Forest Stewardship). Private agreements funded from private sources would not be restricted or limited by the goals and priorities of government funding and would not be reliant on legislative appropriations at the federal or state levels of government. For this reason, private agreements between landowners and ecosystem service beneficiaries would be the lowest hanging fruit tool.

INTRODUCTION

Hawai'i is home to unique natural landscapes and oceanscapes that are rich in biodiversity and globally recognized as one of the world's biological hotspots, providing a home for more than 17,000 terrestrial, 500 freshwater, and 5,500 marine species of plants and animals.¹ More than 40% of these plants and animals are found nowhere else on the planet.²

Unfortunately, habitat loss through land use changes, introduced and invasive species, and disease threaten Hawai'i's irreplaceable natural resources. Among the 50 states, Hawai'i has the greatest number of extinct plants and animals with over 31% of the nation's endangered species and 75% of the nation's documented extinctions.³ The loss of native plants and habitats have harmful effects on the well-being of people in Hawai'i. Introduced, invasive plants have already reduced the groundwater recharge for the aquifers that supply Hawai'i's drinking water by up to 10% in certain parts of the state.⁴ Loss of native forests increases the impact of heavy rains, eroding soils and increasing the amount of sediment and pollutants that flow into streams and oceans, destroying coral reefs and degrading Hawai'i's beaches.⁵ Hawai'i has also lost more than 6,000 acres of its original wetlands.⁶ Loss of native wetlands reduces Hawai'i's ability to absorb damaging floodwaters that can threaten lives and property during storms and tsunamis.⁷

This degradation of Hawai'i's unique natural heritage stands in stark contrast to the values of Hawai'i's people, which are well-reflected in the State Constitution, providing that:

For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawai'i's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State.

All public natural resources are held in trust by the State for the benefit of the people.⁸

The social and cultural values of Hawai'i's natural resources are reflected in this and other core public policies in Hawai'i. Unfortunately, the financial resources invested and policy tools available to act on those values continue to be insufficient to cover the need to maintain and improve the health of these natural resources. Despite the essential role that they play in creating a unique quality of life for Hawai'i's residents and in generating \$15 billion per year in visitor spending,⁹ the money invested to secure Hawai'i's natural resources continues to be inadequate. Natural resources must compete for public funds with other essential social services and an aging infrastructure. In a state where living expenses are two-thirds higher than the rest of the United

States,¹⁰ voters and consumers will often see investment in the security of Hawai'i's natural resources as a direct conflict with their own, immediate needs. They often do not realize how critical Hawai'i's natural resources are to making life possible on islands as isolated as Hawai'i.

This Policy and Institutional Analysis explores payment for ecosystem services (PES) approaches used in other places to make a clear, direct connection between the importance of their natural resources and the financial investment that individuals are willing to make to care for those natural resources.

PROJECT OVERVIEW

Hawai'i Carbon + Natural Capital is a project of the Sustainability Business Forum and Sustainability Business Forum Working Group. The project anticipates three primary components: 1) a Policy and Institutional Analysis; 2) an Economic Analysis of a potential PES approach for Hawai'i; and 3) coordination and engagement of Hawai'i Leaders. This Policy and Institutional Analysis aims to identify potential economic incentives and associated revenue streams that can support three particular ecosystem services, of the many and various types of ecosystem services in Hawai'i: freshwater, biodiversity, and carbon dioxide removal. The objective of the project is to assess the potential to adapt a PES approach for Hawai'i that will incentivize conservation and restoration of Hawai'i's globally important ecosystems and their environmental services to people.

Conservation International Hawai'i led the Policy and Institutional Analysis. Hawai'i Green Growth is convening and coordinating the Sustainability Business Forum and Working Group, which are exploring a phase two Economic Analysis of a potential PES approach and carbon offset pilot project for Hawai'i.

METHODOLOGY

Part I of this Policy and Institutional Analysis uses a review of literature and case studies to provide a high-level overview of the essential elements of PES approaches that have been identified by experienced practitioners and scholars in this developing field. Part II selects four different geographies to review how the essential PES elements have been interpreted at different levels of government and in service of different unifying purposes in these locations. Part III uses legal research and interviews to provide an inventory of the essential PES elements that already exist in Hawai'i. Part IV provides conclusions and recommendations for next steps for a potential PES approach in Hawai'i, based on the policies and institutions that are currently in place.

PART I: PAYMENTS FOR ECOSYSTEM SERVICES- ESSENTIAL ELEMENTS

Payment for ecosystem services (PES) approaches began with a pioneering effort to reverse deforestation on private lands in Costa Rica in the 1990s.¹¹ Since then, PES approaches have been pursued at national, municipal, or watershed levels across the globe and in the United States. These approaches can take many different forms in support of diverse national or community-level goals. In general, however, a payment for ecosystem services approach is “a transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources.”¹² Put simply, a PES approach is a system in which beneficiaries provide payments to a steward of an ecosystem service.¹³ This Part reviews the individual elements that are essential to the design of any PES approach, including identification and assessment of the ecosystem services of interest, the presence of conditionality and additionality, a unifying problem and purpose, basic legal frameworks, policies to support the design, sellers and buyers, payment types, and necessary governance and institutional functions.

ECOSYSTEM SERVICES

“Ecosystem services” are defined as the benefits that people obtain from nature,¹⁴ which include supporting services (e.g. nutrient cycling and providing productive soil for growing food), provisioning services (e.g. food, fresh water, wood and fiber, fuel, etc.), regulating services (e.g. climate regulation, carbon dioxide removal and sequestration, flood regulation, disease regulation, water purification, etc.) and cultural services (e.g. aesthetic, spiritual, educational, recreational, etc.).¹⁵

Conservation and sustainable use of natural resources that allow ecosystems to function properly can provide positive externalities, or a flow of positive benefits to other social and economic activities. Yet the market does not often recognize those ecosystem services so the associated cost of maintaining or enhancing them is not borne by those who benefit. Essentially, there is a disconnect between the costs incurred by the providers of ecosystem services and the compensation paid by the beneficiaries of those ecosystem services.¹⁶

CONDITIONALITY + ADDITIONALITY

Conditionality and additionality are also essential elements for a PES approach. In an agreement between the PES providers and beneficiaries, “conditionality” is created by the specific conditions under which payments will be made and ecosystem services will be provided.¹⁷ This conditionality is key to incentivizing human behavior change

and to monitoring compliance with the agreement. While conditionality focuses on the behavior of the people involved in a PES approach, “additionality” focuses on the positive change in the ecosystem services that should result from that behavior change, which would not have occurred otherwise. Additionality is the key to monitoring how effective a PES approach is at improving management of natural resources.¹⁸

Both conditionality and additionality are dependent on the design of a PES approach, the scientific information available, and how a PES approach is ultimately implemented. And both elements are necessary for a successful PES approach. A poorly designed PES approach can achieve a high level of compliance (through conditionality), but if the wrong land owners or land locations are being targeted, the PES payments will not result in the intended positive impact on natural resources and ecosystem services.¹⁹

UNIFYING PROBLEM + PURPOSE

If the main goal of a PES approach is to incentivize a change in individual or collective behaviors from what would otherwise deteriorate ecosystems and natural resources, it is critical to recognize the role that social relationships, values, and perceptions can play. Monetary incentives are an important driver for PES approaches, but social motivators can sometimes be equally -- or more -- important if a PES approach has been designed to meet a commonly held goal. Designing an effective PES approach will often require a high level of coordination between diverse stakeholders and broadly supported strategic decisions about trade-offs and the management of uncertainty. PES approaches that are designed around local and regional institutional frameworks can more effectively cope with complexity and diversity and leverage existing resources focused on rural development and environmental protection.²⁰

For any PES approach, it is vital that stakeholders (particularly beneficiaries), lawmakers, and policymakers share the same sense and degree of resource scarcity and resource value.²¹ This will guide the design of the PES, increase its likelihood for sustained social support, and drive the necessary demand for the PES. Once a socially validated level of resource scarcity and value has been identified, specific and tangible metrics can be defined that will let beneficiaries know what type and level of service they are paying for and what they are receiving in return for their payments.²² This is particularly important for user-based PES approaches where water bills or other taxes are part of the design. Transparency and a participatory approach are important to the success of the PES approach.²³

BASIC LEGAL FRAMEWORKS

Some basic legal frameworks must be in place to allow ecosystem service beneficiaries (or buyers) and providers

(or sellers) to rely on the promises they make to each other in a PES approach (i.e. to pay or to change certain land use behaviors). The most essential legal frameworks for a PES approach are contract law and property rights. Contract law specifies the rights of each party to a contract or agreement and provides mechanisms for holding each party accountable to the commitments they make in the agreement. In a PES agreement, the rights of the parties would include the objectives and obligations, participation mechanisms, monitoring and verification provisions, payment structure, and timeframe of a particular PES project.²⁴

Property rights are the legally enforceable uses of property that can be held and exchanged between parties. Property rights can be held by individuals, by legally created entities (e.g. corporations, partnerships, etc.) or by a collective of individuals or entities. Before considering a PES approach, the legally enforceable rights to PES project sites need to be clearly delineated. This includes use rights to access the land, control rights to make decisions about natural resource use on the land, and transfer rights to reallocate use and control rights to others. For any PES approach to work, it must be clear that the ecosystem services seller has all of the necessary rights to enter into a PES contract to sell and deliver what is being paid for by the buyers. This is also necessary to prevent parties outside of the PES contract from claiming rights to the project property and claiming a right to payments that were not negotiated or anticipated in the PES contract. Proof of the necessary property rights is often required before a potential seller can participate in a PES program. Any questions about the property rights of indigenous peoples or possible reservations of rights to government agencies should be explored and addressed during the PES approach design and during individual contract development to avoid uncertainty.²⁵

Policies to Support Design

Depending on the design, PES approaches are often driven by public policy tools, market-based tools, or both that reflect the unifying problem and drive participation for some or all stakeholders.²⁶ Such public policy tools include direct regulation through prohibitions and zoning (hard approaches or “sticks”) or through efforts to provide information and capacity support that incentivize desired behavior (soft approaches or “carrots”). Market-based tools include taxes and fines (“sticks”) or tax credits, government-funded incentives, and private contract payments (“carrots”). A hybrid approach with public policy and market-based tools can use regulatory authorities and market mechanisms, such as in cap-and-trade programs where regulated entities that emit substances that are harmful to the environment must stay under a certain emissions limit or “cap,” but are allowed to trade emissions allowances among themselves or with others to meet their regulatory requirements or sell their unused allowances for a profit.²⁷

For the public policy tools, PES approaches are usually built on existing public policies, but some have created new laws specifically to support a PES approach. In place of creating

formal policies and regulations, some PES approaches have used existing public institutions to develop informal but consistent guidance to support a PES approach. In Rwanda, for example, national-level guidance is provided to inform and steer projects, but the sub-national projects determine how their PES will be funded.²⁸

PES approaches work best when they can be linked to national and/or sub-national priorities and integrated into existing policy and legal systems. Any new policy or legislation created to support a PES approach should specify its purpose and provide a clear statement of intent that links the PES approach to existing policies, laws, and programs. In addition to clearly defining the intent, any new policy should define the ecosystem services that the PES approach will focus on and how improvements in these ecosystem services will be measured overtime in relation to existing policies, laws, and programs.²⁹ Clarifying the intent, focus, and scope of the PES approach in any new policy will also help anticipate and mitigate “leakage,” where ecosystem service gains from a PES approach are offset by increased negative behavior in areas that are not included in the PES program. Examples of this were seen in early PES approaches when landowners intentionally degraded their lands in order to receive PES payments for restoration.³⁰

“Stick” Designs

Ecosystem services, such as biodiversity and carbon dioxide removal, are “non-excludable,” which means that it is very easy for people to enjoy and benefit from them without paying for them. For non-excludable ecosystem services, it is usually necessary to put some form of regulation in place to drive demand to pay for those ecosystem services in a PES approach. For non-excludable ecosystem services, a PES approach will work best when the source of the ecosystem service is at risk of degradation by the actions of a definable group of people and the same service is valuable to another group of people. A legally imposed limit to the degradation will create the supply for a regulation-driven PES approach. Legally permitting or requiring payment for the ecosystem service creates the buyers and demand for the limited supply. These policies can lay the groundwork to create a trading program. Additional policies will likely be required to regulate the trading system and the market, including a clear definition of the activities that cause degradation and the mandatory obligations required to offset that degradation, a transparent standard to measure the ecosystem service unit that will be traded, any procedural frameworks needed to support the market transactions, and insurance and liability systems to guarantee the long-term offsetting and stewardship of the ecosystem services represented by the tradable units.³¹

“Carrot” Designs

Voluntary PES approaches do not use regulation to drive participation by sellers and buyers. As such, voluntary PES approaches can provide more flexibility in design, but they can also be less consistent (in terms of participation and price) and less efficient and effective at achieving ecological goals.³² One way to improve the ability to reach ecological

goals through a voluntary PES approach is to ensure that the PES contracts or incentive programs explicitly target project sites that are important to the health and functioning of the ecosystems that provide the services. For example, in a payment for water services approach, critical areas can be targeted by directing payments to watersheds that are important for direct ecosystem services, prone to higher levels of degradation, or at greater risk of land use changes.³³

Funding

Any PES approach will require a sustainable source of funding. This can be provided through multiple sources, including public financial instruments, such as taxes, tax exemptions, and fees (e.g., in lieu fees,³⁴ user fees,³⁵ and regulatory fees), and through agreements with private parties, such as with bottling and beverage companies.³⁶

existing administrative processes for fund disbursement, registration, and project monitoring.³⁷

ECOSYSTEM SERVICES PROVIDERS (“SELLERS”)

In general, sellers of ecosystem services are landowners or land managers of properties that generate valued ecosystem services. These are generally lands that are managed to preserve intact natural ecosystems (often forested lands or wetlands) or lands that are being actively managed or restored to improve or increase the ecosystem services that they provide (such as reforestation or wetland restoration projects or projects that apply best management practices for productive farm or rangelands). The behavior of the sellers should be able to affect the quality or quantity of the ecosystem services available to potential buyers. Best management practices (BMPs) on agricultural land,



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Most large-scale PES approaches collect funds from one or more sources and distribute them from a central fund or account to the sellers of the ecosystem services. The funding sources used to support the PES approach should be identified in the legal framework and supported by appropriate and transparent legislation, if necessary. Many PES programs began as government-supported efforts that are now trying to develop independent, sustainable funding sources that do not rely on public funds, taxpayers, or fiscal resources, such as Mexico and Ecuador. It is beneficial to work on an independent, sustainable funding source in the early development of a PES approach. Whichever funding sources are ultimately used, however, they will be used more effectively if the PES approach can integrate with

for example, have the potential to enhance ecosystem services, such as pollination, biological pest control, soil fertility and structure, water regulation, and support for biodiversity.³⁸ Below is a table that describes various land use management project types that can generate improved ecosystem services and the land stewards that can act as providers and sellers of those improved ecosystem services.

Project Type	Activity or Behavior	ES Benefits	Potential Sellers & Providers	Examples
Avoided Conversion	Prevent conversion of forest land to non-forest land uses through conservation easement or transfer to public ownership	Increased freshwater supply, ³⁹ improved water quality, carbon dioxide removal, reduced flooding, reduced erosion, reduced siltation of reefs and fisheries	Private landowners with native forest on their lands	North Carolina ⁴⁰
Forest Enhancement	Prevent logging of forests; maintain or increase carbon stocks on forested land by increasing rotation ages, thinning diseased or suppressed trees, controlling invasive species	Increased freshwater supply, improved water quality, carbon dioxide removal, reduced flooding, reduced erosion, reduced siltation of reefs and fisheries	Private landowners with native forest on their lands, Managers of public lands with native forest	Costa Rica, Finland, ⁴¹ Sweden, Austria ⁴²
Forest Restoration	Restoring tree cover through tree planting or removing impediments to natural reforestation, controlling invasive species	Increased fresh water supply, improved water quality, carbon dioxide removal, reduced flooding, reduced erosion, reduced siltation of reefs and fisheries	Public land managers, private landowners of previously forested lands	Mexico, Uganda, Mozambique ⁴³
Wetland Enhancement or Restoration	Removing tidal barriers, improving hydrological connectivity, restoring tidal flow to wetlands, altering sediment supply, reducing nutrient loads, reseeding or replanting native plant communities, removing invasive species, reducing grazing ⁴⁴	Carbon dioxide removal, soil carbon sequestration, ⁴⁵ wildlife habitat, water quality, storm protection, food production	Public and private land owners or managers of current or former wetlands	Delaware, Minnesota, Nebraska, New York, South Carolina, Wisconsin, California, Virginia, Georgia, Mississippi, Louisiana, Florida, Alaska, South Dakota ⁴⁶
Agroforestry ⁴⁷	Alley cropping, windbreaks, riparian buffers	Soil carbon sequestration, ⁴⁸ water quality improvement, habitat benefits	Public and private land owners of agricultural land	Costa Rica, ⁴⁹ Indonesia, ⁵⁰ Honduras, ⁵¹ China ⁵²
Agriculture and Aquaculture services	Set aside cropland, ⁵³ short-rotation woody crops, ⁵⁴ planting buffer strips between ditches and crops, ⁵⁵ Conservation tillage, no-till, ⁵⁶ using aquaculture to remove excess nutrients from coastal waters, ⁵⁷	Soil carbon sequestration, Water quality improvement	Owners or managers of rangeland or farmland, owners or operators of aquaculture programs	Netherlands, Sweden, New York
Rangeland	Improved grazing management, ⁵⁸ Species management, Irrigation, Rotational grazing, Manure application	Soil carbon sequestration, ⁵⁹ Water quality improvement, Biodiversity enhancement, Improved water retention, Reduced surface water runoff, Increased healthy soil microbes	Owners or managers of rangeland or farmland	Florida, Texas, Oregon, ⁶⁰ Colorado, ⁶¹ California ⁶²

ECOSYSTEM SERVICES BENEFICIARIES (“BUYERS”)

Potential buyers of ecosystem services will be defined, in part, by whether they are making purchases as part of a formal market and whether their purchase is driven by compliance or by voluntary choice. Formal ecosystem markets can be created by a need to meet regulatory compliance or by an individual desire to safeguard essential ecosystem services.⁶³ Individual ecosystem markets can be created to focus on specific ecosystem services (for example, carbon dioxide removal, freshwater provision, or biodiversity protection) that are generated from multiple projects and locations. Other markets, allow multiple ecosystem services to be generated from the same project or same location. For example, in some markets, forest conservation is expected to also maintain existing water quality and quantity, protect biodiversity and safeguard the beauty of the landscape, and is therefore often marketed as a “bundle” of ecosystem services.⁶⁴

According to a 2016 report by Forest Trends, at least \$2.8 billion is transacted every year through ecosystem markets in the United States. On the demand side of these markets, project activities that were most popular with U.S. buyers involved re-establishing, preserving, and enhancing wetlands; watershed restoration and preservation and dedication of water rights for instream flows; habitat preservation and establishment; and improved forest management, afforestation, or reforestation.⁶⁵

In compliance markets, buyers are regulated entities that are identified through a legal mandate. Examples of compliance buyers include entities that must: 1) limit their annual carbon dioxide emissions (such as in carbon cap-and-trade programs); 2) limit the amount of pollutants they can discharge into groundwater sources, streams, or lakes (such as in water quality trading programs); 3) replace or enhance protected species habitat damaged by development projects (such as through mitigation banks); or 4) pay fees or taxes for certain activities that have a negative impact on ecosystem services (such as in lieu fees or carbon taxes).

By contrast, in voluntary markets, buyers are self-selected. They choose to make purchases from a voluntary ecosystem market because they are motivated by: 1) personal values; 2) corporate commitments to social responsibility goals; 3) real or anticipated demand from customers or shareholders; or 4) anticipated future regulatory requirements. Buyers in voluntary markets rely on transparency and verification in the mechanisms that measure the ecosystem services being traded. Because of their individualized motivations for participating, the volume of demand from voluntary buyers can be more difficult to predict.

Buyers may also want to purchase ecosystem services outside of a formal market, such as through direct PES contracts with one or more sellers (e.g. conservation easements). These buyers will often be more involved in shaping the conditions of the ecosystem service payments, selecting the sellers, and selecting the locations generating the ecosystem services. These types of purchases will require more time and involvement from the buyers, but it also allows them to have more control over what they are purchasing.

PAYMENT + PRICE

Depending on the design, payments in a PES approach can take many forms, including: 1) trading and offsets; 2) conservation agreements; 3) collective action funds; and/or 4) public subsidies. With trading and offsets, the benefits of restoration or conservation actions are packaged as a standardized credit that can be bought or sold among multiple sellers and buyers, often to meet regulatory obligations. With conservation agreements, a single buyer contracts with one or more sellers to pay them for restoration or conservation activities measured by specified metrics (such as trees planted, acres reforested, stream miles shaded, etc.). With collective action funds, multiple buyers with a shared purpose can pool resources and expertise to fund ongoing ecosystem restoration or conservation activities. With public subsidies, agricultural or landholder incentive payments can be linked to conservation or restoration activities as part of or instead of farming and ranching.⁶⁶

The most successful PES approaches are those where participating parties agree on a price that they feel is fair and provides the necessary incentive to change the targeted behavior. Finding the right price point for an ecosystem service is essential. It is necessary to determine if the value of the ecosystem service to the buyer exceeds the opportunity costs to the seller for changing land use behavior. In general, PES approaches work best at the margin, where purchases from buyers can change the seller's land use to more sustainable practices without incurring high costs. In designing a PES approach, it is essential to gather information through an economic study on the overall worth of the ecosystem service being provided to the buyers and the likely costs to the sellers to produce them.⁶⁷ PES approaches need to

cover the opportunity costs to the sellers in order to avoid compromising their long-term participation.⁶⁸

Payment structures in a PES approach can be differentiated or non-differentiated for different buyers. A non-differentiated (or flat) payment structure may be considered by the buyers as more equitable and easier to implement. A differentiated payment structure can be more responsive to difference in types of ecosystems (such as priority watershed locations or forest with high-levels of biodiversity) and take into account varied participation costs and project co-benefits. Differentiating payments can be used to reduce the burden on lower income households in compliance-driven PES approaches through the use of rebates or dividends, but these differentiated payments should be supported by a cost-benefit analysis that compares the advantages of implementing a PES approach to other actions that could protect ecosystems.⁶⁹

GOVERNANCE + INSTITUTIONAL FUNCTIONS

A PES approach's design will determine whether public institutions must be involved in implementation and whether gaps exist in current institutional mandates that must be expanded or augmented by the involvement of other entities (such as nonprofit organizations or third-party technical experts). To make that determination, it is important to consider the institutional functions that will need to be filled for any PES approach design:

- Supporting project development (e.g., scientific research and project planning);
- Collecting and managing financial resources;
- Managing participation in the PES, access to information, and conflict resolution (e.g., capacity building, stakeholder dialogues, facilitation of negotiations, etc.);
- Monitoring compliance (e.g., contractual obligations, management of public funds, and project monitoring, verification, and reporting);
- Enforcing laws, regulations, and contracts; and
- Coordination of the whole program across institutions and levels of government (including providing transparency, accountability, necessary political negotiations, and stakeholder participation).⁷⁰

PART II: APPROACHES IN OTHER GEOGRAPHIES

This section provides summarized overviews of the PES approaches taken in several other countries and U.S. states to understand how they interpreted the essential elements in their PES design and what lessons they have learned from their experience so far. There is an incredible diversity of examples that could have been reviewed here. These geographies were selected for their potential to demonstrate the diversity of choices in PES design, in terms of scale (i.e. national, state, and watershed), unifying public purpose (e.g. deforestation threats, water quality

compliance), and PES tools utilized (i.e. taxes, conservation agreements, license fees, offsets credits, and government incentive programs).

COSTA RICA

Unifying Problem + Purpose

To reverse rapid deforestation on private lands in Costa Rica. Costa Rica's forest cover fell from 70% in the 1950s to 20% in the 1980s. This was one of the fastest deforestation rates in Latin America.⁷¹

Approach: Create New National-Level Policies

This national level, multi-objective PES program focuses on four ecosystem services: 1) capturing and storing atmospheric carbon; 2) protecting water sources; 3) conserving biodiversity; and 4) conserving scenic beauty. This approach uses a blend of regulatory and economic tools, including:

- **Public Policy Driver:** National legislation that prohibits deforestation and allows a public agency to make payments to private property owners to incentivize desired land management behavior;
- **Public Financing:** National legislation designates a portion of the taxes collected from a fossil fuels tax and a water fee to the PES program, which has provided the majority of the program's funding. The program also receives funding from other countries through bilateral agreements and bank loans (e.g. loans from the World Bank and grants from the Global Environment Facility (GEF) for biodiversity services and biodiversity conservation and carbon sequestration);
- **Quasi-Public Administration:** The National Forest Fund (FONAFIFO), a quasi-governmental organization, administers the PES program. FONAFIFO enters into legal contracts with sellers, sells certificates for ecosystem services to buyers, and monitors compliance with the PES program.
- **Private Financing:** Contracts with private sector entities and grants from nongovernmental organizations also provide funding for the program.

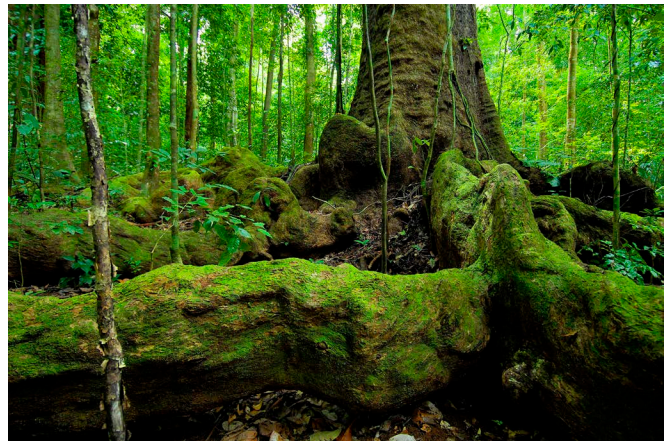
Policies to Support Design

In 1996, a national law was passed that banned the conversion of established forest to other land uses and imposed prison sentences rather than fines for breaking the law (i.e. Forestry Law 7575). The same law offered payments for reforestation, protecting forests, or managing existing forest on private properties and outside of national parks. An institutional framework was created for the PES program, and funding was provided from former forestry trusts and allocations from the fossil fuels tax to develop the PES program. In 1997, the program was implemented.⁷² In 2006, water taxes were increased in stages with 25% of the collected increase (approximately \$5 million USD) going to the PES program for projects in specific watersheds. This water tax shifted the PES program from purely voluntary agreements to include compliance-driven payments;

however, water users that make direct payments to FONAFIFO through voluntary agreements can deduct those amounts from what is due under the water tax to avoid double-paying.⁷³

Ecosystem Services Providers ("Sellers")

Private Landowners sign legal contracts with FONAFIFO for rights to the ecosystem services from their lands. The property under a PES contract is not subject to property taxes. These private landowners are legal entities (40%), individuals (31%), indigenous communities (13%), and development or conservation cooperatives (7%). FONAFIFO monitors compliance with the contracts and makes regular payments to the sellers. Payment levels are based on five types of land use on private lands: 1) forest protection; 2) commercial reforestation; 3) agroforestry; 4) sustainable forest management; and 5) regeneration of degraded areas. Forest protection contracts account for the majority of contracts (67%), the largest number of forest hectares in the PES program (90%), and the largest share of the PES program budget (83%).⁷⁴



Osa Peninsula, Costa Rica © Trond Larsen

Ecosystem Services Beneficiaries ("Buyers")

To make payments to the sellers, FONAFIFO receives funds from government funds, private sector agreements, and international loans or bilateral agreements in exchange for certificates of ecosystem services credits that have been generated from the sellers' properties. Certificates of ecosystem services are generated for watersheds (Aqua Viva CSA), biodiversity and landscape beauty (Bosque Vivo CSA), and carbon sequestration (Viaje Limpio CSA). Purchases of these certificates are tax deductible for the buyers. Government funds provide the largest amount of funding for Costa Rica's PES program, specifically, its fossil fuels tax revenue (at an average of \$11.3M USD per year) and its water tax revenue (approximately \$3.6M USD from 2007 to 2012). Private sector agreements (approximately 80 separate contracts) account for less than 3% of the PES program's funding.⁷⁵

Governance + Institutional Functions

Aside from enforcing all relevant laws and regulations, FONAFIFO fills most of the necessary governance and institutional functions.

Results

Between 1997 and 2012, approximately 961,000 hectares of forest were part of Costa Rica's PES program. Since 1997, more than \$340 million USD in payments were made to private landowners for forest protection (90%), reforestation (6%), sustainable management (3%), and regeneration (1%). These payments represent promoting conservation on private property at an average of 60,000 hectares per year. Since 2003, the PES program has resulted in 4.4 million trees being planted through agroforestry contracts alone. Forest cover in the country, which had been reduced from 70% in the 1950s to only 20% in the 1980s has been restored to approximately 50%.⁷⁶

Challenges

Costa Rica pioneered the PES approach, and was therefore in the position of learning while doing. As a result, it encountered challenges along the way, some of which the country is currently working to address, these include:

- heavy dependence on government funding, which requires continuous effort to maintain the political support and receive funding allocations;
- unavoidable trade-offs, such as avoiding costly monitoring but lacking evidence of ecological impact;
- lack of deliberate alignment with overall conservation policy at the national level, specifically with a shift in focus from quantity to quality of ecosystem services;
- limited understanding of the opportunity costs of forest activities, specifically the revenue and benefits that a landowner foregoes by signing up to the PES program;
- potential for negative impacts on jobs if forest protection causes the abandonment of agricultural lands that could have generated jobs;
- land tenure issues can delay PES contract development; and
- voluntary nature of the program does not allow high priority conservation areas to be targeted.⁷⁷

SOCIO-BOSQUE, ECUADOR

Unifying Problem + Purpose

To conserve forests and to improve the socioeconomic conditions of the poorest among Ecuador's rural population.

Approach: Build on Existing National Policies

This national-level, dual-objective program went from design phase to implementation in just eight months. Ecuador's Ministry of the Environment (MAE) was looking for a program that would reward people for good forestry management rather than just penalize bad behavior. Because there was political will and momentum at the highest levels of national government, this program was able to prioritize simplicity and flexibility during its design phase, draw on existing data and maps to develop scenario analyses and priority areas, and draw from the international experience and expertise of other countries, including Costa Rica and Mexico.⁷⁸ The priority areas for the program were selected based on three criteria: 1) deforestation threat; 2) importance for carbon

storage, water provision services, and biodiversity habitat; and 3) poverty levels.⁷⁹

Technically this approach is not a PES, because Ecuadorian law does not permit nature to be given a price. It is an approach, however, that financially incentivizes landholders to maintain forest cover on their lands. The regulatory and economic tools used in this approach include:

- **Public Policy:** Ecuador's national constitution and national development plan both had combined objectives of nature conservation and poverty alleviation. Both documents explicitly recognized ecosystems and their services as important contributors to human welfare. This allowed the top levels of the national government to provide political will and momentum for the program;
- **Public Financing:** Initially, the program was funded entirely by the Ecuadorian government. Other options are being explored, including creating new green taxes, payments from extractive industry licenses and other high-impact activities, voluntary offsets payments from domestic and international companies, international cooperation funds, and international REDD+ payments;⁸⁰
- **Quasi-Public Administration:** The MAE administers the program and enters into conservation agreements directly with the landholders.
- **Private Financing:** Private financing options are being explored, but have not played a major role in the program.



Socio Bosque project sign, Ecuador © CI/photo by Katrin Olson

Policies to Support Design

This approach benefited from existing, high-level policies that already identified nature conservation and poverty alleviation as national objectives.

Ecosystem Services Providers (“Sellers”)

Individual landholders or collective landholders entered into 20-year, “opt-in” contracts that made two payments per year to the landholder and would automatically renew unless the landholder opted out. The majority of the contracts were with individual landholders (93%), which ranged in payment rate from \$30-\$60 USD/hectare of maintained forest cover/year. Collective landholder contracts have a maximum

payment rate of \$35 USD/hectare of maintained forest cover/year. Selection criteria for lands selected for contracts, include the risk of deforestation, along with local poverty levels and the proportion of forest in protected areas.⁸¹

Ecosystem Services Beneficiaries (“Buyers”)

The MAE was the only buyer in these agreements, but the priority areas were selected to align with conservation and poverty goals embraced by the entire country of Ecuador.

Governance + Institutional Functions

The MAE served most of the governance and institutional functions required for a PES approach, though it relied on external experts, including environmental lawyers during the design phase. During implementation, the MAE realized that it needed more capacity than it had available for outreach and field site monitoring, because of the program’s priority of reaching rural, poor areas.⁸²

Results

As of 2012, the MAE had signed 1,474 agreements with individual landholders and 92 agreements with communities. These agreements cover 881,933 hectares of land with forest cover, and the program reaches 90,255 beneficiaries. As of 2012, the program had invested \$14.4 million USD in this effort.⁸³

Challenges

The program’s focus on rural and remote areas revealed the MAE’s capacity limits, particularly for outreach and monitoring. Also, the “opt-in” conservation agreement was designed to be simple and reduce the time spent on contract negotiation. The trade-off, however, was that there was a risk that some sellers didn’t understand the agreement, which increased the likelihood for noncompliance with the contract terms. On a related point, the program received some criticism for not consulting with indigenous communities during the design phase of the program. The adaptive management approach to designing the project gave the MAE flexibility to learn and adapt over time, but that also created a risk that participants would not understand rule changes once they were already part of the program.⁸⁴

TUALATIN BASIN, OREGON

Unifying Problem + Purpose

To meet compliance-driven, water quality temperature limits for wastewater treatment plants in the Tualatin Basin in a way that provided positive outcomes for both the environment and the economy.

Approach: Meet Existing Policy Requirements with New Watershed Approach

This watershed-level approach was applied in the Tualatin Basin in northwestern Oregon, which includes 12 cities with more than 536,000 urban water users and surrounding rural areas. Clean Water Services is the district-level public

wastewater utility (“District Wastewater Utility”) that owns and operates four wastewater treatment plants within the Tualatin watershed. The District Wastewater Utility’s wastewater treatment plants are regulated by water quality requirements of the federal Clean Water Act and must receive a National Pollutant Discharge Elimination System (NPDES) permit to discharge treated water into the Tualatin River.⁸⁵

In 2001, the District Water Utility anticipated that two of its wastewater treatment plants would be required to meet thermal load restrictions (or limits to temperature increases) when its NPDES permit was reissued in three years. At that time, the District Water Utility would be required to cool 50 million gallons of wastewater effluent per day. The technological options for accomplishing this (installing refrigeration equipment or building a pipeline to transfer the effluent to other rivers) were prohibitively expensive (i.e. more than \$100 million).⁸⁶

The District Water Utility explored non-technological options that took a new, watershed-based approach to meet its requirements of the NPDES permit. It received a grant from the Environmental Protection Agency (EPA) to develop this approach and was granted a watershed-based permit, which included water quality trading for temperature. This allowed the District Water Utility to offset its excess thermal load (the amount it could not reduce onsite) with tree planting projects that increased shade along the streams that fed into the Tualatin river and by restoring a certain amount of water flow to the river. The shade credits and flow restoration credits that the District Water Utility was required to meet were specified in a Temperature Management Plan. The District Water Utility worked with existing federal, state, and local agencies to create incentive programs for rural landowners to plant native trees on their property and for public property owners to work with nonprofit groups to plant native trees and shrubs on urban public property. This community-based trading model allowed the District Water Utility to meet its compliance requirements by purchasing shade credits from multiple sellers within the Tualatin Basin, while contributing to overall improved watershed health.⁸⁷

The regulatory and economic tools used in this approach, include:

- **Public Policy Driver:** An existing, national law, the federal Clean Water Act, requires an NPDES permit that regulates water quality standards for wastewater treatment facility discharges, including temperature, into nearby surface waters;
- **Public Financing:** Existing federally-funded landowner incentive programs were expanded and adapted to increase participation (i.e. Enhanced Conservation Reserve Enhancement Program (ECREP)), a new locally-funded landowner incentive program was created to address gaps (i.e. Vegetated Buffer Areas for Conservation Program (VEGBAC)), and public-private partnerships were created in urban areas that utilized public property and tax-deductible non-profits for plantings;⁸⁸

- **Public Administration:** The District Water Utility was primarily responsible for providing oversight for the incentive programs, but its success with rural landowners relied on its partnership with the Tualatin Soil and Water Conservation District (TSWCD) and the U.S. Department of Agriculture’s Natural Resource Conservation Service (USDA/NRCS) and Farm Service Agency (USDA/FSA). Administration of the urban tree planting program relied heavily on its partnership with the cities, county, and local nonprofit organizations.⁸⁹
- **Private Financing:** The funding used by the District Water Utility to create these non-technological solutions ultimately came from the wastewater treatment fees paid by its ratepayers.

Policies to Support Design

The EPA’s flexibility and grant support allowed the District Water Utility to explore an approach to compliance that was new and had the potential to create watershed benefits that could not be achieved through traditional methods. There were also existing, government-funded landowner incentive programs that were being under-utilized in the area, these included the Environmental Quality Incentives Program, Agricultural Water Enhancement Program, Wildlife Habitat Incentive Program, Oregon Watershed Enhancement Board Small Grant Program, Oregon Riparian Tax Incentive Program, Oregon Wildlife Habitat Conservation and Management Program, and Nonpoint Source Pollution Control Facilities Tax Credit. The District Water Utility and its partners worked with agricultural landowners to modify some of these programs and create new programs to fill in gaps to incentivize participation from the right landowners. This also allowed the program to expand faster and to wider areas than originally anticipated.⁹⁰

Ecosystem Services Providers (“Sellers”)

The sellers in this PES approach were owners of farmland willing to convert part of their land to buffer areas in exchange for annual per-acre payments, rural landowners willing to contribute a portion of the costs to have native trees and shrubs planted by TSWCD on their property, and public property owners that were willing to have native trees and shrubs planted on their urban properties by volunteers organized by nonprofit organizations.⁹¹

Ecosystem Services Beneficiaries (“Buyers”)

The District Wastewater Utility was the sole buyer, but the Tualatin Basin ratepayers were also beneficiaries.

Governance + Institutional Functions

The District Wastewater Utility provided most of the necessary governance and institutional requirements, in partnership with the TSWCD, USDA/NRCS, USDA/FSA, cities, and county.

Results

This PES approach allowed the District Wastewater Utility to meet the regulatory permit requirements for its wastewater treatment plants in the Tualatin Basin.⁹² Additionally, during

the original 5-year permit period, more than 500,000 trees were planted in the Tualatin Basin and 15,000 acres of land were enhanced or restored.⁹³ From 2004 to 2013, approximately 48 miles of riparian vegetation was planted as part of the shade program.⁹⁴ There was also a sense of collective impact among a diverse group of stakeholders that worked together to solve a challenging social problem using a common agenda, aligned efforts, and common measures of success.⁹⁵ Existing funding sources were also leveraged for greater impact.

Challenges

Although the Tualatin Basin’s PES approach involved a complex and coordinated approach, the unifying problem and purpose of the PES program was limited to the scope of the District Water Utility’s permit requirements. In 2012, stream temperatures for some parts of the Tualatin River exceeded the ideal temperatures for some fish species during summer months.⁹⁶ Although shade credits were given to the District Water Utility immediately after the trees were planted, the trees wouldn’t provide the full amount of credited shade until they were fully established (up to 20 years later). The Temperature Management Plan took this into account and required twice the level of shade credits than should be required to offset the excess thermal load.⁹⁷ Still by 2012, the trees and shrubs were not yet established enough to reduce the stream temperatures to necessary levels. One problem was that 88% of the human-caused thermal load in the Tualatin basin was caused by nonpoint sources (e.g. urban, agriculture, and forestry activities), which were not covered by the District Wastewater Utility’s permit targets or its watershed approach. The tree planting that would be necessary to offset the nonpoint sources’ thermal load (an estimated 451 additional stream miles) would have to be funded by other sources.⁹⁸

DENVER, COLORADO

Unifying Problem + Purpose

To improve forest and watershed conditions to protect water supplies and water quality, as well as wildlife habitat and recreation opportunities

Approach: Municipal-Level, Existing Policies

This municipal-level PES approach is a watershed management partnership between the U.S. Forest Service (a federal agency charged with sustaining the health, diversity, and productivity of the U.S. forests and grasslands) and Denver Water (the public agency that provides water to the City of Denver).⁹⁹ Denver Water provides water to 1.4 million people in the Denver metropolitan area, and its key water sources are snowpack and streams that originate on U.S. Forest Service lands. These same forested areas are threatened by insect infestations that kill forest trees and increase the risk of wildfires.¹⁰⁰ Colorado’s summers have been extended by climate change, allowing the invasive northern pine beetle to multiply at unprecedented levels and destroy trees at a rate that is ten times higher

than previously recorded.¹⁰¹ Wildfires not only damage wildlife habitat and tourism values, but they also increase the sediment that must be removed from the water and infrastructure used by Denver Water to supply water to the City of Denver.¹⁰²

Two major wildfires in 1996 and 2002 burned 150,000 acres and deposited 40 years' worth of sediment into just one reservoir that fed Denver Water's supply.¹⁰³ The sediment that had to be removed from that single reservoir went from 250,000 cubic yards before the fires to 1 million cubic yards after the fires and subsequent rainstorms. This resulted in Denver Water spending \$27 million for water quality treatment, sediment and debris removal, reclamation activities, and infrastructure projects.¹⁰⁴

Both the U.S. Forest Service and Denver Water were struggling to meet their budgets in the aftermath of these fires. Based on their shared interest of improving the forest and watershed conditions, the U.S. Forest Service proposed a deal to Denver Water where the U.S. Forest Service would proactively manage 38,000 acres in five key watersheds for Denver Water, if Denver Water provided half of the money needed to do the work. The U.S. Forest Service and Denver Water entered into a Memorandum of Understanding (MOU) in 2010 (also referred to as the "Forests to Faucets" program), where they would split the \$33 million cost over five years for forest restoration projects on U.S. Forest Service lands to reduce wildfire and sedimentation risks.¹⁰⁵ In February 2017, Denver Water and the U.S. Forest Service entered into another 5-year MOU that included Colorado State Forest Service and Natural Resources Conservation Service as additional partners.¹⁰⁶ The 2017 MOU also anticipates expanding the restoration projects to privately owned lands in priority areas.¹⁰⁷

The regulatory and economic tools used in this approach, include:

- **Public Policy:** At the national level, the federal Safe Drinking Water Act requires states to create safe drinking water standards that apply to public water systems. In 2000, the Environmental Protection Agency approved a program submitted by the Colorado Department of Public Health and Environment to assess and address existing and potential threats to public drinking water supplies. The assessment determined the location of each public water system's source waters and what threatened those water sources.¹⁰⁸ Denver Water used that assessment to identify the areas of U.S. Forest Service lands that were a priority to restore and protect from wildfire to avoid high sediment removal costs for its customers;¹⁰⁹
- **Public Financing and Resources:** Under the 2010 MOU, \$33 million was committed to forest restoration projects with the cost split between Denver Water and the U.S. Forest Service. Under the 2017 MOU, Denver Water provided \$11.5 million to the U.S. Forest Service, \$3 million to the Colorado State Forest Service, and \$2 million to the Natural Resources Conservation Service. Each of these agencies matched the amount that

Denver Water provided to them.¹¹⁰

- **Public Administration:** Under the 2017 MOU, Denver Water made direct payments to the three public agencies in the partnership. The public agencies plan to work directly with any private landowners with parcels in priority areas that are interested in conducting restoration or fire mitigation projects.¹¹¹
- **Private Financing:** The funds that Denver Water invested in the original 2010 partnership, as well as the 2017 partnership, came from fees charged to Denver Water's customers. The 2010 MOU was funded by water fees that amounted to approximately \$27 total per household over five years, or approximately \$0.14 per month per household.¹¹²

Policies to Support Design

This program relies on existing policy drivers in federal and state regulations that require Denver Water to maintain certain water quality standards as a public water utility.¹¹³ Meeting this standard became more expensive through sediment removal compared to prevention via forest restoration and wildfire risk reduction. Additionally, Colorado Department of Public Health and Environment's Source Water Assessment and Protection (SWAP) program helped Denver Water identify its priority water sources and threats. The U.S. Forest Service's mandate to sustain the health, diversity, and productivity of U.S. forest lands provided an alignment of interests between Denver Water and the U.S. Forest Service that allowed the project costs to be shared.

Ecosystem Services Providers ("Sellers")

Under the 2010 MOU, the U.S. Forest Service was the primary seller. Under the 2017 MOU, the sellers have been expanded to include the Colorado State Forest Service, and the Natural Resources Conservation Service. The 2017 MOU also anticipates private landowners in priority areas as potential sellers.

Ecosystem Services Beneficiaries ("Buyers")

Under both the 2010 and the 2017 MOUs, Denver Water has been the direct buyer of the ecosystem service, but Denver Water has been making these purchases on behalf of its 1.4 million rate payers in the Denver metropolitan area.

Governance + Institutional Functions

Colorado Department of Public Health and Environment's SWAP program played a key role in supporting the project development for this PES approach. Denver Water coordinated the financial resources for this approach and managed participation of the public agencies. The public agencies will manage the participation of any private landowners in this approach. Coordination of the program across institutions appears to be done as part of the MOU negotiations and implementation.

Results

During the five-year period of the 2010 MOU, fire reduction, restoration, and prevention projects were implemented on more than 48,000 acres of National Forest System lands.

The 2017 MOU has a target of treating another 40,000 acres within critical watersheds over 5 years.¹¹⁴ The success of the Denver program has triggered the development of similar programs by other Colorado water utilities. Aurora Water has been collaborating with the U.S. Forest Service since 2011. Northern Water has been collaborating with the Bureau of Reclamation, U.S. Forest Service, and the Colorado Forest Service on the Colorado-Big Thompson Project since 2012. The Colorado Springs Utilities and the Pueblo Board of Water Works have been working with the U.S. Forest Service since 2013.¹¹⁵ Because the mountains in Colorado provide the headwaters for the water used in other states, some have also speculated about the potential for large cities like Las Vegas or Los Angeles to contribute to forest work in the Colorado mountains.¹¹⁶

Challenges

Since the Denver Water MOUs have been structured as 5-year agreements, the agreement has to be regularly renegotiated, which can be time consuming when public agencies are involved. This can also create short-term commitments with renewals that are subject to available public funding for public agency partners, such as the U.S. Forest Service and others. On the positive side, however, these short-term agreements can provide flexibility for funding partners that want to test the approach or its results before making longer-term funding commitments.

PART III: HAWAII READINESS

ECOSYSTEM SERVICES

Hawaii's natural resources provide ecosystem services to 1.4 million people who live in the islands and to an additional 8 million people who visit the islands annually.¹¹⁷ These ecosystem services are the basis of human health and well-being in Hawaii, providing provisioning, regulating and cultural services that include food and freshwater, biodiversity, a stable climate, recreation, coastal protection, clean water, cultural practices, and livelihoods. This report focuses on three ecosystem services in particular: freshwater provisioning (quantity and quality), biodiversity protection, and carbon dioxide removal.

Hawaii's forests supply freshwater by recharging the underground aquifers that supply the majority of the islands' drinking water. Importantly, Hawaii's complex and multi-storied native forests are more efficient than many introduced plants at recharging these aquifers. Native forests are highly adapted to Hawaii's unique conditions, allowing them to capture more water and retain that water for slow absorption into aquifers and streams.

Hawaii's complex and multi-storied native forests and its unique wetlands also remove from the air and store large amounts of carbon dioxide, mitigating against the effects of climate change. The carbon in soil is a large component of the global carbon cycles and the management of forests and wetlands can dramatically alter these cycles.¹¹⁸

Hawaii is globally recognized as a biological hotspot, home to more than 17,000 terrestrial, 500 freshwater and 5,500 marine species of plants and animals.¹¹⁹ Over 40% of these species are endemic, meaning that they are found nowhere else in the world.¹²⁰

Hawaii's endemic flora and fauna are adapted to the isolated archipelago's unique habitats and ecosystems, making them extremely vulnerable to extinction.¹²¹ Among the 50 states, Hawaii has the greatest number of extinct plants and animals with over 31% of the nation's endangered species and 75% of its documented extinctions.¹²² Globally, Hawaii has the reputation of being one of the extinction capitals of the world.¹²³

Habitat loss through land use changes, invasive species, and disease are some of the top threats to conserving biodiversity in Hawaii. The loss of native forests can also have huge repercussions for freshwater provisioning, with one study indicating that a 1% loss of recharge to the Ko'olau Mountain range alone could cost \$42 million in net present value. Unfortunately, it has been estimated that invasive plants may have already reduced groundwater recharge by up to 10% in certain aquifers.¹²⁴

Although forests still cover almost half of Hawaii's land area, many are in a degraded state because of introduced, hooved animals, including pigs, goats, and deer,¹²⁵ and competition from invasive, non-native plants. Historic county public policies (e.g. county property taxes) made this problem worse by incentivizing the conversion of forest to agricultural uses, such as pasture.¹²⁶ The invasion of non-native plants and the conversion of native ecosystems to other land uses can also negatively impact carbon removal, carbon soil storage potential, and Hawaii's ability to mitigate climate change.



Kauai Goats © CI/photo by Luana Luna

These ecosystem services and the threats to them can be complex and interrelated.¹²⁷ Although this report focuses on freshwater provisioning, biodiversity, and carbon dioxide removal, the preservation of native ecosystems and the responsible management of other lands can support additional benefits for Hawaii's land and sea. For example,

native forests buffer the impact of heavy rains, anchor soil, reduce erosion, and keep sediment and nutrients from running off into the streams and ocean, which can destroy coral reefs and degrade beaches. Similarly, coastal wetlands absorb floodwaters from heavy rains, storm surges, and tsunamis, which can prevent property damage and protect lives.¹²⁸ Healthy coral reefs provide food, buffer coastlines from storms and high waves, and are an economic driver for the visitor industry.¹²⁹

Scale

In Hawai'i, each of these ecosystem services (freshwater provision, biodiversity protection, and carbon dioxide removal) operates at a different scale. Freshwater provisioning happens at the watershed scale, so people are usually willing to pay to secure the water in their own watershed, but not in others. In Hawai'i, most municipal drinking water is supplied from groundwater aquifers. Each island is divided into groundwater hydrologic units that each provide a source of groundwater.¹³⁰ Beneficiaries and users of a particular groundwater hydrologic unit will likely want to invest in projects that support or secure the recharge of groundwater to the particular hydrologic unit that they benefit from.

In contrast to freshwater, biodiversity protection in Hawai'i may be measurable at an aggregated statewide scale. Some of these species may be limited, naturally or by human-induced extinctions, to a single island, but many of them may occur across the main Hawaiian islands. For that reason, an increase in the habitat or population of a species on Maui is still of value to someone on O'ahu who wants to pay for increased biodiversity protection.

Unlike freshwater provision and biodiversity protection, the ecosystem service of carbon dioxide removal in Hawai'i can be of value and benefit to anyone on the planet. Since the atmosphere that covers the entire planet is affected (negatively or positively) by actions based in any location, someone located in Europe may be willing to pay someone on Hawai'i Island to remove carbon dioxide from the atmosphere.

Priority Areas

In terms of freshwater provision, DLNR has identified priority watershed areas across the state, which are the areas of highest rainfall and re-supply for the state's water resources.¹³¹ Currently, only 10% of the priority watershed areas are fenced to protect them from introduced, hooved animals, which DLNR considers the first step toward protecting these watershed areas.¹³² Attaining that level of management has taken 40 years to accomplish.¹³³ Hawai'i Governor David Ige recently announced a goal to protect 30% of Hawai'i's priority watersheds by 2030.

In terms of biodiversity protection, the priority areas generally overlap with the freshwater priority areas and are areas that have the highest proportion of intact native plants. Priority areas for biodiversity have been designated by DOFAW and include critical habitat or essential habitat

for the recovery of plants, forest birds, seabirds and water fowl by the United States Fish and Wildlife Service (USFWS).¹³⁴ The largest areas are located on Hawai'i Island, followed by Maui. The smallest pockets of priority areas are located on Ni'ihau, Lana'i, and Kaho'olawe. However, biodiversity priority areas are located on every island to protect unique ecosystems and the biodiversity that they support.

In terms of carbon dioxide removal, there do not yet appear to be priority areas identified by the State of Hawai'i based on their potential for carbon dioxide removal. Studies have been conducted, however, that have identified Hawai'i Island as currently storing the largest amount of carbon and Kaua'i Island as having the highest carbon density for the state.¹³⁵ To maintain current levels of carbon dioxide removal, these islands would be priority areas for protecting existing terrestrial ecosystems. Additionally, DOFAW has stated that the lands under its jurisdiction statewide have the potential to sequester more than 4 million metric tons of carbon dioxide through reforestation projects.¹³⁶ Some private entities, such as The Nature Conservancy, are currently analyzing certain lands to determine which locations may provide an acceptable return on investment for carbon dioxide removal projects selling credits on the voluntary and/or compliance offset markets.¹³⁷

In terms of the potential to increase carbon dioxide removal through land management activities on croplands and rangelands, there are not yet clearly designated priority areas for the State. The 2017 State Legislature passed a bill establishing a Carbon Farming Task Force within the State Office of Planning to identify agriculture, aquacultural, and agroforestry practices to improve soil health and promote carbon sequestration in the state's agricultural, aquacultural, and agroforestry sectors.¹³⁸ The Task Force had its initial meeting on September 15, 2017 to begin outlining its plan and actions over the next few years.

UNIFYING PROBLEM + PURPOSE

As discussed in Part I, for a PES approach to be successful, it is vital that stakeholders (particularly beneficiaries), lawmakers, and policymakers share the same sense and degree of resource scarcity and resource value.¹³⁹ This shared sense of risk to a resource of shared value can guide the design of a PES approach, increase its likelihood for sustained social support, and drive the necessary demand for the tools used to implement the approach. This unifying problem and purpose can also guide the metrics that will monitor the progress of the PES approach, let beneficiaries know what they are paying for, and sustain that sense of shared purpose.

Hawai'i has led the way, particularly recently, in creating policies that prioritize the protection of natural resources and commit to ambitious goals to better care for its ecosystem services. For example, in June 2017, Hawai'i's Legislature passed and the Governor signed Act 32 into

law, making clear that Hawai'i remained committed to the global response to the threat of climate change reflected in the Paris Agreement that was adopted by 195 countries at the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change in December 2016. The Paris Agreement was a global commitment to address greenhouse gas emissions mitigation, adaptation, and finance starting in the year 2020.¹⁴⁰ Hawai'i was the first U.S. state to enact a law in alignment with the Paris Agreement.

Act 32 specifically states, "Regardless of federal action, the legislature supports the goals of the Paris Agreement to combat climate change and its effects on environments, economies, and communities around the world." Through Act 32, Hawai'i's legislative and executive branches of government made clear that climate change is a priority and Hawai'i is not waiting for leadership or action from the federal level of the U.S. government. Even prior to Act 32, however, Hawai'i put in place public policies and pursued initiatives that identify priorities for action and set ambitious goals and targets for achieving better management of its natural resources. For example, the Aloha + Challenge, Hawai'i's statewide sustainability commitment, identifies 2030 goals with related targets and indicators that are endorsed by all four county mayors, the Governor, the Office of Hawaiian Affairs, Hawai'i's Legislature, and civil society partners. The Table below reflects some of the Existing Commitments and Targets that are currently guiding public sector priorities and efforts.

Building on these initiatives, there is an opportunity to identify a unifying problem and purpose that a PES approach could address through collective action. A unifying problem will be one that is meaningful to Hawai'i's diverse beneficiaries. Identifying a meaningful problem can lead to a unifying purpose and message that is shaped by the values and interests of the private sector, public sector and individual community members. When the public sector, private sector, and individual community members can see their own needs reflected in a single collective purpose of shared value, a PES approach can be designed for Hawai'i that uses PES tools that are consistent with the motivations of the various beneficiaries and suppliers.

Existing Commitments + Targets

Initiative	Initiated	Description	Endorsed by	Targets
Promise to Pae'āina o Hawai'i	April 23, 2014	Collective impact initiative supported by marine resource management organizations (federal, state, local government, and private sector) that committed to making improvements for Hawai'i's future before the Hōkūle'a returned home from a three-year, worldwide voyage in June 2017.	60 organizations & 150+ individuals	<p>By 2017:</p> <ul style="list-style-type: none"> • Explore a stronger fisheries management framework with scientists and fishers; • Strengthen fishpond restoration through knowledge pooling and improved collaboration among practitioners statewide; • Systematize marine monitoring to determine healthy reefs across Hawai'i and contribute to a centralized database for improved management; • Increase restoration in wao akua (upper watershed) through enhanced acreage of native forest under protection and policy support; • Improve watershed health in the wao kanaka (lower watershed) through coordinated action for sustainable and resilient communities; • Elevate actions for healthy, resilient and sustainable coastal communities through statewide networks; • Determine scope of existing conservation internships, fellowships, youth training programs and other similar education opportunities that are in Hawai'i today; • Based on the scope, build a career pathway tree for individuals interested in conservation careers; • Contextualized career map with broader scoped Promise to Children, the educational initiative of the Mālama Honua Worldwide Voyage • Effectively manage 30% of nearshore marine waters in the Main Hawaiian Islands by year 2030; • Build stronger community networks locally and internationally; • Launch central online resource for communities called auamo.org
Aloha+ Challenge	July 7, 2014	Statewide commitment to sustainability on six ambitious goals to be achieved by 2030	Hawai'i Governor, Mayor of Hawai'i County, Mayor of Maui County, Mayor of City & County of Honolulu; Mayor of Kaua'i County; Hawai'i Legislature; and over 70+ private sector and civil society partners	<p>By 2030:</p> <ul style="list-style-type: none"> • 70% clean energy (40% from renewables & 30% from efficiency); • At least double local food production (20-30% of food consumed is grown locally); • Increase freshwater security, watershed protection, community-based marine management, invasive species control, and restoration of native species; • Reduce solid waste stream prior to disposal by 70%; • Increase livability and resilience in the built environment through planning and implementation at the state and county levels; • Increase local green jobs and education to implement these targets
Sustainable Hawai'i Initiative	Sept. 1, 2016	Initiative of Governor Ige's administration to make Hawai'i more sustainable by working together with communities, businesses, and other partners	Hawai'i Governor Ige and the administrative agencies of his executive branch	<p>By 2017:</p> <ul style="list-style-type: none"> • Implement interagency biosecurity plan <p>By 2020:</p> <ul style="list-style-type: none"> • Double local food production <p>By 2030:</p> <ul style="list-style-type: none"> • Protect 30% of priority watersheds; • Effectively manage 30% of nearshore ocean waters <p>By 2045</p> <ul style="list-style-type: none"> • Achieve 100% renewable electricity

BASIC LEGAL FRAMEWORKS

As discussed in Part I, PES approaches require, at minimum the basic legal frameworks of contract law (to specify the rights of each party and enforce commitments of the parties) and property rights (to identify the legal uses of property and how they can be transferred from one party to another). In Hawai'i, the legal framework of contract law is protected by provisions of the federal and state constitutions, described by state statutes, and refined through the development of common law in Hawai'i court decisions.¹⁴¹ Legal contract commitments can be enforced through a civil lawsuit in Hawai'i courts, or through an alternative dispute resolution mechanism (such as mediation or arbitration), if agreed to by the parties to the contract.

Similarly, property rights are protected by provisions of the federal and state constitutions, described by state statutes, and refined through the common law of Hawai'i court cases.¹⁴² There are also unique property rights issues in Hawai'i, including the public's right to access the shoreline,¹⁴³ access to public and private property by Native Hawaiian practitioners of traditional and customary rights,¹⁴⁴ and the reservation of mineral rights by the State of Hawai'i in, on, or under all lands of the state.¹⁴⁵ As noted in Part 1, for any PES approach to work, it must be clear that an ecosystem services seller has all of the necessary rights to enter into a PES contract to sell and deliver what is being paid for by the buyers.¹⁴⁶ The necessary rights will differ based on the property and the property rights being transferred, but private property owners interested in participating in a PES program in Hawai'i would need to confirm prior to entering into a PES contract that they have all the necessary rights and can transfer them as envisioned by the terms of the contract. At present, Hawai'i law does not specifically address the property rights associated with carbon services, but this legal issue should be closely monitored moving forward.

POLICIES TO SUPPORT DESIGN

As noted in Part I, PES approaches are often driven by public policy instruments, market-based tools, or both that reflect a unifying problem and drive participation for some or all stakeholders.¹⁴⁷ There are existing public policy instruments and market-based tools that impose regulations on certain activities in Hawai'i (e.g. water pollution, greenhouse gas emissions from certain sources, and activities that threaten protected species or their habitats) and impose taxes or fees on other activities (e.g., municipal water usage, irrigation usage, importing fossil fuels, camping, hunting, etc.).

Currently, none of these policies allow trading to meet these regulatory limits or regulations. The Department of Health, however, is developing a program that, if approved by the U.S. Environmental Protection Agency, would allow pollution credits to be traded between permitted point sources (i.e. municipal, industrial, and federal wastewater facilities and municipal and industrial storm water facilities) and nonpoint

sources to help reduce Hawai'i's polluted runoff, which often carries sediment, nutrients, bacteria, and toxic chemicals to the nearshore environment where it can harm aquatic ecosystems, human health, and economic development opportunities.¹⁴⁸

It is also likely that new compliance policies will be developed to implement the recently enacted Act 32, which aligns Hawai'i with the Paris Agreement Commitments. Act 32 explicitly states that it reflects the State of Hawai'i's commitment to combat climate change by systematically reducing greenhouse gas emissions and improving Hawai'i's resiliency to climate change aligned with the principles and contributing to the goals set by the Paris Agreement.¹⁴⁹ Specifically, Act 32 states that the State of Hawai'i "shall expand strategies and mechanisms to reduce the greenhouse gas emissions statewide through the reduction of energy use, adoption of renewable energy, and control of air pollution among all agencies, departments, industries, and sectors, including transportation."¹⁵⁰ The strategies and mechanisms to achieve this must be "closely aligned with the climate change principles and goals adopted in the Paris Agreement and Hawai'i's share of obligations within the expectations apportioned to the United States in the Paris Agreement, regardless of federal action."¹⁵¹

It is unclear exactly how Act 32's mandate will be implemented through new regulations; for that reason, it has not been included in the Table of Primary Compliance Policies below. From the plain language of Act 32, however, the clear intent is that existing compliance policies will be expanded and new sectors will become subject to air pollution control regulation, including the transportation sector. For these reasons, the implementation of Act 32 will have relevance to a potential PES approach design for Hawai'i, and should be closely monitored moving forward.

The tables below reflect existing policies that could potentially support the design of a PES approach in Hawai'i, including Information Gathering Policies, Primary Compliance Policies, and Policies Imposing Taxes or Fees.

Information Gathering Policies

Policy	Type	Citation	Ecosystem Service Supported	Relevance	Status
Hawai'i Climate Adaptation Initiative Act	State legislation	HRS Chapter 225P	Multiple	Creates an Interagency Climate Adaptation Committee within DLNR. Among the various potential impacts of climate change, the committee shall, as a first step, focus on and develop sea level rise vulnerability and adaptation reports that identify the major areas of sea level rise impacts affecting the State and counties through 2050. The report must be made publicly available no later than December 31, 2017. Act 32 subsequently amended this act to change the committee to a commission and modify some of the duties defined by the original act.	Report in progress.
Hawai'i Freshwater Security Act	State legislation	Act 172, SLH 2016	Water Supply	Establishes two-year pilot program for a Water Security Advisory Group to enable public-private partnerships that increase water security by providing matching state funds for projects and programs that: 1) increase the recharge of groundwater resources; 2) encourage the reuse of water and reduce the use of potable water for landscaping irrigation; and 3) improve the efficiency of potable and agricultural water use. Approximately \$750,000 in general funds was appropriated for fiscal year 2016-2017 to accomplish this purpose. All approved projects and programs must track and report on the amount of water conserved, recharged, or reused. DLNR must submit an annual report on the pilot program 20 days prior to the convening of the 2017 and 2018 legislative sessions. The last contract for a project or program recommended for approval by the water security advisory group must be executed before June 30, 2018.	The Water Security Advisory Group selected 11 projects, which were awarded a total of \$600,000 in matching grants in June 2017.
Carbon Farming Task Force Act	State legislation	Act 33, SLH 2017	Carbon Dioxide Removal	Establishes a carbon farming task force within the Office of Planning that will, among other things, identify and study agricultural and aquacultural practices, public land and marine use policies, and on-farm management practices that would increase climate resiliency and improve carbon sequestration in Hawai'i. A preliminary report of its findings and recommendations, including any proposed legislation, must be submitted to the legislature 20 days prior to the convening of the regular session of 2023. Approximately \$25,000 in general funds was appropriated for fiscal year 2017-2018 for this purpose.	Carbon Farming Task Force began convening in September 2017.

Primary Compliance Policies

Policy	Type	Citation	Ecosystem Service Supported	Relevance	Related Policies
National Environmental Policy Act (NEPA) of 1969	Federal legislation	42 U.S.C. §§ 4321-4347	Multiple	Requires federal agencies to consider mitigation measures before taking actions that may have adverse environmental consequences	Federal Land Policy and Management Act (FLPMA) (43 U.S.C. § 1701 et seq.); Mineral Leasing Act of 1920, as amended (30 U.S.C. §181 et seq.)
Hawai'i's Environmental Policy Act (HEPA)	State legislation	HRS Chapter 343	Multiple	Requires the preparation of written evaluation of whether an action will have significant effect on the quality of the environment for any projects proposed by state and county agencies, or for projects using state or county funds, proposed projects in the conservation land use district, near the shoreline, within a historic site, within the Waikiki area of O'ahu, proposing amendments to existing county general plans that would re-designate lands to something other than agriculture, conservation, or preservation, reclassify conservation district lands, create, expand, or modify helicopter facilities, propose new waste or energy generation facilities, to prepare environmental assessments	NEPA
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	Federal legislation	42 U.S.C. §§ 961-9675	Multiple	Imposes a tax on chemical and petroleum industries and provides broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. Creates the Superfund trust fund to provide for cleanup when no responsible party can be identified.	Hawai'i Environmental Response Law
Hawai'i Environmental Response Law	State legislation	HRS Chapter 128D	Multiple	Makes land-based or offshore facilities that store hazardous substances, pollutants, or contaminants and waterborne vessels strictly liable for remediation costs, damages for injury to natural resources, and costs of health assessments resulting from a release of a hazardous substance, pollutant or contaminant into the environment.	Hawai'i Uniform Environmental Covenants Act (HRS Chapter 508C); Brownfields Cleanup Revolving Loan Fund (HRS §201-18); Hawai'i Coastal Zone Management Law (HRS chapter 205A)

Policy	Type	Citation	Ecosystem Service Supported	Relevance	Related Policies
Endangered Species Act (ESA)	Federal legislation	16 U.S.C. 1531 et seq.	Biodiversity	Requiring certain federal agencies to provide alternatives to proposed actions that will comply with the ESA and specifying how impacts to protected species must be minimized and mitigated	Fish and Wildlife Conservation Act (16 U.S.C. §§ 2901-2912); Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§ 703-7120)
Hawai'i Endangered Species Act	State legislation	HRS Chapter 195D	Biodiversity	Prohibiting the taking of endangered or threatened species and permitting temporary take permits authorized by the Board of Land and Natural Resources as part of a habitat conservation plan or safe harbor agreement	Hawai'i Coastal Zone Management Law (HRS chapter 205A)
Hawai'i Aquatic Mitigation Banking	State legislation	HRS §187A-41	Biodiversity	Authorizes DLNR to establish and operate aquatic mitigation banks to restore, create, enhance, or preserve aquatic habitats or resources as compensatory mitigation where a person is required to provide compensatory mitigation or for past damages to aquatic habitats or resources.	Hawai'i Coastal Zone Management Law (HRS chapter 205A)
Hawai'i Water Code	State legislation	HRS Chapter 174C	Water Supply	Creates a comprehensive water resources planning program charged with obtaining the maximum beneficial use of the waters of the State for purposes, such as domestic uses, aquaculture uses, irrigation and other agricultural uses, power development, and commercial and industrial uses. Adequate provision must be made for the protection of traditional and customary Hawaiian rights, the protection and procreation of fish and wildlife, the maintenance of proper ecological balance and scenic beauty, and the preservation and enhancement of waters of the State for municipal uses, public recreation, public water supply, agriculture, and navigation. Prohibits state and county government agencies from enforcing any statutes, rules, or orders affecting the waters of Hawai'i inconsistent with the Hawai'i Water Code.	County Boards of Water Supply fee schedules; Department of Agriculture irrigation fees schedule
Clean Water Act	Federal legislation	33 U.S. 1344	Water Quality	Federal regulation of water pollution that imposes a nationwide permit system on point source dischargers and water quality standards. Requires a permit from the US Army Corps of Engineers to discharge dredged material or fill material into a water of the US (including wetlands)	Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.); Rivers and Harbors Appropriation Act of 1899 (33 U.S.C. 401, 403, 407, 610); Food Security Act of 1985 (Swampbusters)/ Food, Agriculture, and Conservation Act of 1990; Federal Agriculture Improvement and Reform Act of 1996 (16 U.S.C. 3801-3862); Transportation Equity Act for the 21 st Century (23 U.S.C. 103); Federal Power Act (16 U.S.C. § 791-828c); Ocean Dumping Act (33 U.S.C. § 1401 et seq.); Coastal Zone Management Act (16 U.S.C. § 1451 et seq.); Oil Pollution Act (33 U.S.C. §2701 et seq.); Safe Drinking Water Act (42 U.S.C. § 300f et seq.); Hawai'i Safe Drinking Water Act (HRS Chapter 340E); Hawai'i Coastal Zone Management Law (HRS chapter 205A)
Hawai'i Safe Drinking Water Act	State legislation	HRS § 340E-2	Water Quality	Defines the state drinking water regulations that apply to each public water system	Clean Water Act
Hawai'i Water Pollution Act	State legislation	HRS chapter 342D	Water Quality	Authorizes the DOH director to prevent, control, and abate water pollution in the State and to control the management practices for domestic sewage, sewage sludge, and recycled water, whether or not the practices cause water pollution. Establishes Water Pollution Control Revolving Fund to provide financial assistance to counties, state agencies, and other parties for wastewater treatment projects. (HRS § 342D-83)	Hawai'i Coastal Zone Management Law (HRS chapter 205A)

Policy	Type	Citation	Ecosystem Service Supported	Relevance	Related Policies
Coastal Zone Management Act	Federal legislation	16 U.S.C. § 1451–et seq.	Water Quality	Requires states to adopt programs to control nonpoint sources of coastal water pollution and requires federal actions in coastal areas to be consistent with state coastal management plans and programs	Clean Water Act
Hawai'i Nonpoint Source Pollution Management Control Act	State legislation	HRS chapter 342E	Water Quality	Authorizes rules for water quality standards for specific areas, types of nonpoint source pollution discharges, or management measures in control of water pollution, allowing for varying local conditions	Clean Water Act; Hawai'i Coastal Zone Management Law (HRS chapter 205A)
Clean Air Act	Federal legislation	42 U.S.C. § 7401, et seq.	Air Quality	Regulates air emissions from stationary and mobile sources, and authorizes the Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and regulate emissions of hazardous air pollutants.	Hawai'i Air Pollution Control Act
Hawai'i Air Pollution Control Act	State legislation	HRS chapter 342B	Air Quality	Requires the owner or operator of a covered source ¹⁵² to obtain a permit from DOH. Permit fees for covered sources are based on the number of tons of regulated air pollutant, excluding carbon monoxide, allowed or emitted by the permitted source are not less than \$25/ton/year.	Clean Air Act, Statewide Greenhouse Gas Emissions Limit
Statewide Greenhouse Gas Emissions Limit	State legislation	HRS § 342B-71	Air Quality	Established a statewide greenhouse gas emissions limit to be achieved by 2020 that is equal to or below the level of the statewide greenhouse gas emissions in 1990. Does not apply to greenhouse gas emissions from airplanes.	Clean Air Act, Hawai'i Air Pollution Control Act

Policies Imposing Taxes or Fees that Support Ecosystem Services

Tax/Fee	Purpose	Paid By	Activities Funded	ES Benefited	Annual Collection	Jurisdiction
Agricultural Fees ¹⁵³	Fees charged for inspection, disinfection, fumigation, and quarantine for imported animals or articles	Individuals importing articles or animals into the State of Hawai'i	Inspection, disinfections, fumigation, and quarantine of imported animals or articles	Biodiversity; Water quality (fresh and salt)	Varies	State
Aquaculture Fees ¹⁵⁴	Fees for aquaculture diagnostic services, certificates of health for aquaculture animals or plants, and non-routine technical services	Aquaculture operators	Implementing the aquatic disease management programs and activities of DLNR and supporting research and development programs and activities related to the expansion of the state aquaculture industry	Biodiversity; Water quality (fresh and salt)	Varies	State
Camping Fees	Imposes a fee for permits to camp in state parks and forest preserves	Residents (\$12-\$20/night) and nonresidents (\$18-\$30/night) at least 18 years of age that want to camp in state parks and forest preserves	State parks staff, planning and development of state parks program; construction, repairs, replacement, additions, and extensions of state parks facilities; operation and maintenance costs of state parks and state parks programs	Biodiversity	Deposited into State Parks Special Fund (HRS §184-3.4); Appropriations ceiling ~\$5-7 million/fiscal year	State
Coral Reef Mitigation Bank	To offset losses of Hawai'i's coral reefs caused by permitted actions (such as harbor improvements) or unplanned impacts (such as ship groundings)	Permittees or vessels	Coral reef recovery or replanting projects	Biodiversity	Damages recovered from actions by permittees or vessels. Not clear how much is currently available.	State
Environmental Response, Energy, and Food Security Tax ("Barrel Tax") (HRS § 243-3.5)	Imposes a tax on every barrel of liquid fuel or fossil fuel imported into Hawai'i. Does not apply to aviation fuel or to barrels of fuel sold to a refiner.	Importers, manufacturers, producers, compounders, and distributors that sell liquid fuel or fossil fuel to any retail dealer or end user	Environmental Response Revolving Fund (5 cents/barrel); Energy Security Special Fund (15 cents/barrel); Energy Systems Development Special Fund (10 cents/barrel); Agricultural Development and Food Security Special Fund (15 cents/barrel)	Carbon Dioxide Removal	\$27 million in FY 2016 ¹⁵⁵	State
Fishing License Fees	Imposes a fee for commercial marine fishing and recreational freshwater fishing	Resident and nonresident fishers	Programs and activities for projects concerning aquatic life for commercial purposes; resource monitoring programs, conducting studies to determine sustainable use of aquatic life for commercial purposes; Research programs; Programs and activities that concern the management, enforcement, preservation, propagation, and protection of aquatic life; research programs and activities for sport fish conservation and management; trails and access into public fishing areas	Biodiversity	~\$325,000 in revenue/year ¹⁵⁶	State
Hawai'i County Property Tax	Annual tax assessed on property to fund the infrastructure and services provided by the County.	Hawai'i county property owners with rates differentiated by class (affordable rental housing, residential, apartment, commercial, industrial, agricultural and native forest, conservation, hotel/resort, homeowner)	Hawai'i Public Access, Open Space, and Natural Resources Preservation Fund	Biodiversity, Water quality, Carbon dioxide removal	2% minimum of property taxes for acquisition (~\$4 million/year); 0.25% of property taxes for maintenance (\$500,000/year)	Hawai'i County

Tax/Fee	Purpose	Paid By	Activities Funded	ES Benefited	Annual Collection	Jurisdiction
Honolulu City and County Property Tax	Annual tax assessed on property to fund the infrastructure and services provided by the County.	Honolulu City and County property owners with rates differentiated by class (residential, commercial, industrial, agricultural, preservation, hotel and resort, public service, vacant agricultural, residential A)	Clean Water and Natural Resources Fund	Biodiversity, Water quality, Carbon dioxide removal	0.5% of property taxes; ~\$4.1 million/year	City & County of Honolulu
Hunting License Fees	Hunting license required in order to hunt, pursue, kill, or take any game bird or mammal.	Resident and non-resident mammal and game bird hunters; fees range from \$20-\$105 ¹⁵⁷	Public hunting and game management facilities; sanctuary facilities; wildlife habitat improvements; wildlife management and hunter education; public shooting ranges; research, surveys, and inventories; rental of land for public hunting and wildlife management; law enforcement	Biodiversity	\$569,471.75 (FY16) Wildlife Revolving Fund (HRS §183D-10.5) ¹⁵⁸	State
Invasive species inspection fees	Fee imposed for the inspection, quarantine, and eradication of invasive species contained in any freight brought into Hawai'i	Person responsible for paying the freight charges to the transportation company, including for commercial container shipment, air freight, or any other means of transporting freight, foreign or domestic, but not including aggregate bulk freight, cement bulk freight, coal bulk freight, or liquid bulk freight brought into Hawai'i	HDOA's biosecurity and pest inspection, quarantine, eradication, and monitoring programs; electronic importer manifest program; training of inspectors; education of the agricultural industry, permit and certificate holders, and the general public about import requirements	Biodiversity, Water Quality (fresh and marine)	Pest Inspection, Quarantine, and Eradication Fund (HRS §150A-4.5)	State
Kaua'i County Property Tax	Annual tax assessed on property to fund the infrastructure and services provided by the County.	Kaua'i county property owners with rates differentiated by class (homestead, residential, residential investor, vacation rental, hotel and resort, commercial, commercialized home, industrial, agricultural, conservation)	Kaua'i Public Access, Open Space, and Natural Resources Preservation Fund	Biodiversity, Water quality, Carbon dioxide removal	1.5% of property taxes	Kaua'i County
Maui County Property Tax	Annual tax assessed on property to fund the infrastructure and services provided by the County.	Maui county property owners with rates differentiated by class (residential, apartment, commercial, industrial, agricultural, conservation, hotel and resort, time share, homeowner, commercialized residential)	Maui Public Access, Open Space, and Natural Resources Preservation Fund	Biodiversity, Water quality, Carbon dioxide removal	1% minimum of property taxes; ~\$2.4 million/year in revenues	Maui County

Tax/Fee	Purpose	Paid By	Activities Funded	ES Benefited	Annual Collection	Jurisdiction
Municipal Water Supply Fees ¹⁵⁹	Imposes fees on the use of municipal water resources and distribution. Each county sets the rates for its customers.	Municipal water users within the County	Operations and projects of the Water Supply Departments or Board	Freshwater	Differentiated rates with rate per 1,000 gallons increasing with increased water usage; Honolulu \$4.42-7.94/1,000 gallons ; Hawai'i County \$.92 - \$4.69/1,000 gallons; Maui \$2.00-\$11.10/1,000 gallons; Kaua'i \$3.80-\$10/1,000 gallons	County
Na Ala Hele Commercial Fees	Provides a mechanism for screening tour operators and ensuring that activities by multiple vendors do not exceed the established daily capacities for each trail.	Authorized trail tour operators who reserve slots for a particular day on a particular trail and pay a per patron fee according to a per unit system based on the impact mode of transport (i.e. hike, bike and horse, motorcycle, 4-wheel drive vehicle)	Maintaining trails and accesses; administering the Na Ala Hele program; manpower and materials to address degradation, depletion, or consumption of public resources for permittee's opportunity to make a profit off the use of public resources	Biodiversity, Water quality, Carbon dioxide removal	Net revenue \$81,424 (FY12) ¹⁶⁰	State
Park Entrance Fees	Imposes entrance fees into selected State Parks ¹⁶¹	Generally, nonresidents and commercial passenger carrier vehicles	State parks staff; planning and development of state parks programs; construction, repairs, replacement, additions, and extensions of state parks facilities; operation and maintenance of state parks and state parks programs	Biodiversity	State Parks Special Fund (HRS § 184-3.4)	Federal, State, or County
Pesticide License Fees	Fee charged for licenses to sell or distribute pesticides in the Hawai'i	Individuals seeking license to sell or distribute pesticides in Hawai'i	HDOA's pesticide registration and licensing program and pesticide training workshops, educational programs, integrated pest management strategies, and other services	Biodiversity, Water Quality	Pesticide Use Revolving Fund (HRS §149A-13.5)	State
Real Estate Conveyance Tax (HRS § 247-7)	Imposes a tax on all transfers or conveyances of realty or any interest therein, by way of deeds, leases, subleases, assignments of lease, agreements of sale, assignments of agreements of sale, instruments, writings, and any other document, whereby any lands, interests in land, tenements, or other realty sold shall be granted, assigned, transferred, or otherwise conveyed to, or vested in, the purchaser, lessee, sublessee, or assignee.	Grantor, lessor, sublessor, assignor, transferor, seller, or conveyor. Unless grantor, etc. is a federal or state agency; in that case, the tax is paid by the grantee, lessee, sublessee, assignee, transferee, purchaser, or conveyee.	Legacy Lands Conservation Program; Watershed Partnership Program; Forest Stewardship Program; Natural Area Reserves; Natural Area Partnership Program; Youth Conservation Corps	Freshwater; Biodiversity; Carbon Dioxide Removal	10% or \$6.8M, whichever is less goes to the Land Conservation Fund (HRS § 173A-5) Legacy Lands Conservation Fund; Forest Stewardship Fund; Natural Area Reserve Fund (HRS §195-9) ¹⁶²	State
Small Boat Harbor Fees ¹⁶³	Calculated to produce an amount at least sufficient to pay the expenses of operating, maintaining, and managing the facilities and services and improvement costs for boating facilities	Depending on the activity, commercial and recreational users of the State boat harbors and facilities	Operation, upkeep, maintenance, and improvement of the small boat harbors; improving boating safety; operating vessel registration and boating casualty investigation and reporting system; boating program activities; and planning, developing, managing, operating or maintaining lands and improvements under the BLNR	Water quality	Boating Special Fund	State

Tax/Fee	Purpose	Paid By	Activities Funded	ES Benefited	Annual Collection	Jurisdiction
State Irrigation Water Service Fees	To supply water intended to be used only for agriculture and aquaculture activities and may include livestock watering and pastoral irrigation	Customers who successfully applied for and received irrigation services	HDOA administrative costs, engineering surveys, economic studies, plans, and maps, and other water projects or purposes of the HDOA.	Freshwater	Irrigation System Revolving Fund (HRS §167-22)	State
Stormwater user fees ¹⁶⁴ (HRS § 46-1.5)	To encourage the protection of water resources by authorizing counties to charge user fees to create and maintain stormwater management systems or infrastructure	County property owners	Specific activities not yet known	Freshwater	Not yet implemented	County
Transient Accommodation Tax (HRS Chapter 237D)	Imposes a per-night tax on hotel, condo, and other rooms rented out to short-term visitors for stays of less than 180 consecutive days	Owners and operators of hotels, motels, condos, time share vacation rentals, and other rooming houses that rent out qualifying units	General Fund; Turtle Bay Conservation Easement Special Fund (\$1.5M); Convention Center Enterprise Special Fund (\$26.5M); Tourism Special Fund (\$82M); the Counties (\$103M) - Kaua'i County (14.5%), Hawai'i County (18.6%), City & County of Honolulu (44.1%), Maui County (22.8%); Special Land & Development Fund (\$3M) ¹⁶⁵	Freshwater, Biodiversity	~\$447 million in FY2016 ¹⁶⁶	State
Vessel Registration Fees	Annual registration for each vessel 20 feet or more in length	Vessel owners (\$20/yr); Boat manufacturer or boat dealer (\$30/certificate). Not required for nonprofits that train children in boating, water safety, scout-craft and camping, etc. and use the vessels for those purposes	Facilities and support for recreational boating and ocean-based recreation activities (DOBOR)	Biodiversity	~\$16 million/fiscal year; Deposited into the Boating Special Fund ¹⁶⁷	State

POTENTIAL ECOSYSTEM SERVICES PROVIDERS (“SELLERS”)

The design of a potential PES approach in Hawai‘i will determine which land management activities would need to be incentivized and, therefore, which land managers or land owners would become the sellers or providers within that PES approach. Some landowners in Hawai‘i are already selling ecosystem services, such as Hawaiian Legacy Hardwoods, LLC, which currently sells carbon offset credits from reforestation projects on Hawai‘i Island.¹⁶⁸

Other landowners are developing projects that intend to sell ecosystem services, such as the State of Hawai‘i’s Division of Forestry & Wildlife, which has identified existing lands on the islands of Maui and Hawai‘i that will be developed into reforestation projects to sell carbon offsets on the voluntary carbon market.¹⁶⁹ Some of these DOFAW projects will be developed directly by DOFAW and others will be developed by a contracted entity that will share proceeds from any carbon offset credits sold with DOFAW.¹⁷⁰ Other research and development efforts are underway for projects that could potentially provide ecosystem services sellers with additional funding streams. For example, the Agribusiness Development Corporation (ADC) is working with the Hawai‘i Department of Agriculture’s Aquaculture and Livestock Support Services Branch and the USDA to identify waste streams that have feed or fertilizer potential.¹⁷¹ ADC received \$3 million from the Hawai‘i Legislature in 2014 for a zero waste conversion project in Kea‘au, Hawai‘i to develop a demonstration facility that will use heterotrophic algae/fungi to convert papaya waste into oil and feed products. It is estimated that Hawai‘i’s papaya industry produces approximately 15 million pounds of unsold papaya. Hawai‘i’s Department of Agriculture anticipates that this demonstration facility could provide farmers with the opportunity to earn additional income from the waste portions of their crops in the form of feedstock that can be converted to oil for fuel or high protein feed for livestock.¹⁷²

The Table below provides a rough overview of Hawai‘i’s Potential Providers (Sellers) of ecosystem services based on existing land cover or use, and provides the potential project types, products that could be provided from those lands, and some of the project costs that would likely need to be covered by the sellers. This table is followed by a Table of Funding and Capacity Support Programs for Providers (Sellers), which identifies programs that are already available in Hawai‘i that, depending on the unifying problem, purpose, and design, may be leveraged to help meet the financial and other capacity support needs of sellers who want to participate in a PES approach in Hawai‘i.

Hawai'i's Potential Ecosystem Services Providers (“Sellers”)

Current Land Cover/Use	Statewide (acres)	Potential Project Types	Potential Products	Major Project Costs	Potential Ecosystem Services	Potential Providers
Forest	1.7 million ¹⁷³	Forest Enhancement; Reforestation	Carbon offsets, Biodiversity/ Conservation offsets, Development rights, Water quality offsets, Water supply security	Native plantings, fencing to exclude hooved animals, ¹⁷⁴ invasive weed control, ¹⁷⁵ other invasive species control, ¹⁷⁶ labor, transportation fuel and maintenance, monitoring	Water recharge, water quality, climate control, biodiversity, cultural values, aesthetic values, recreational values, commercial values ¹⁷⁷	State of Hawai'i, Hawaiian Legacy Hardwoods, LLC, The Nature Conservancy, Kaua'i Watershed Alliance, Wai'anāe Mountains Watershed Partnership, Ko'olau Mountains Watershed Partnership; East Moloka'i Watershed Partnership; Lana'i Forest and Watershed Partnership; West Maui Mountains Watershed Partnership; Leeward Haleakala Watershed Restoration Partnership; East Maui Watershed Partnership; Kohala Watershed Partnership; Mauna Kea Watershed Alliance; Three Mountain Alliance
Wetland	51,800 ¹⁷⁸	Wetland Restoration; Wetlands Enhancement	Carbon offsets, Biodiversity/ Conservation offsets, Development rights, Water quality offsets	Design, construction, permitting, native plantings, fencing to exclude hooved animals, invasive weed control, other invasive species control, labor, monitoring	Freshwater, Biodiversity, Carbon Dioxide Removal ¹⁷⁹	State and County Agencies; Office of Hawaiian Affairs; Kamehameha Schools; Hawaiian Islands Land Trust; Trust for Public Land; The Nature Conservancy
Agriculture	151,831 ¹⁸⁰	Agroforestry, BMP Agriculture, Wetland Restoration, Afforestation, Soil Health	Carbon offsets, Biodiversity/ Conservation offsets, Development rights, Temperature offsets, Water quality offsets	Tree planting, watering, fencing to exclude hooved animals, invasive weed control, other invasive species control, labor, monitoring, transportation fuel and maintenance, manure application, cover crop planting, composting and application,	Carbon Dioxide Removal, increased biodiversity	Alexander & Baldwin; Pūlama Lāna'i, Castle & Cooke; Monsanto Company; Robinson Kunia Land LLC; Grove Farm; Mahaulepu Farm LLC; E.A. Knudsen Trust; County of Kaua'i
Rangeland	1.1 million ¹⁸¹	BMP Rangeland, BMP Agriculture, Agroforestry, Wetland Restoration, Afforestation, Soil Health	Carbon offsets, Biodiversity/ Conservation offsets, Development rights, Temperature offsets, Water quality offsets	Tree planting, watering, fencing to exclude hooved animals, invasive weed control, other invasive species control, labor, monitoring transportation fuel and maintenance, manure application, cover crop planting, composting and application	Carbon Dioxide Removal – Possibly Freshwater and Biodiversity	State of Hawai'i; Hawai'i Dept. of Hawaiian Homelands; Kamehameha Schools; Parker Ranch; Haleakala Ranch; Ulupalakua Ranch; Hana Ranch; Moloka'i Ranch; Kawela Plantation; Pu'u O Hoku Ranch; Dillingham Ranch; Mahaulepu Farm LLC; County of Kaua'i

Funding + Capacity Support Programs for Sellers¹⁸²

Program	Purpose	Support Type	Eligible Participants	Implementing Entities	Capacity	Jurisdiction
Agricultural Development and Food Security Special Fund (HRS § 141-10)	Uses a portion of the Environmental Response, Energy, and Food Security Tax (Barrel Tax) to increase agricultural production or processing that may lead to reduced importation of food, fodder, or feed from outside of Hawai'i.	Grants	Farmers seeking grants related to agricultural production or processing for activities, acquisition of real property, improvement of real property, dams, reservoirs, irrigation systems, and transportation networks, equipment purchases, market research and testing, promotion and marketing, water quality testing and improvement.	HDOA	\$3.7M in annual revenue from the Barrel Tax and an equal amount of annual expenditures; a reserve of ~\$3.7M in the fund; In 2015, 13 grants awarded directly to farmers ¹⁸³	Statewide
Agricultural Leadership Program	To provide leadership development opportunities for people committed to strengthening Hawai'i's agriculture. Offers specialized training and education from renowned industry representatives to prepare for a career as effective leaders for agriculture in each perspective business, industry, and community	Training, Education	Promising leaders from Hawai'i's agriculture, natural resources management and rural community sectors who are US citizens and residents of Hawai'i for at least 2 years	Agricultural Leadership Foundation of Hawai'i	~10 people per cohort	Statewide
Alternative Energy Loan Program	To establish a new loan program to help full-time farmers, ranchers, and aquaculturalists to reduce dependence on fossil fuel by producing renewable energy through sources such as photovoltaic, hydroelectric, wind, methane, biodiesel, and ethanol. Also allows for loans for food safety projects to ensure a safe food supply for Hawai'i's people.	Loan funds; Direct Funding	Full-time farmers, ranchers, and aquaculturalists. "Lender of last resort" program.	HDOA	Maximum loan amount is \$1.5M or 85% of the project cost, whichever is less	Statewide
Aquaculture Development Special Fund (HRS § 141-2.7; HAR chapter 4-170)	To hold fees collected for special microbiological and histological procedures and expert aquaculture-related services, money from sales of items related to aquaculture development, and money directed to aquaculture development from other sources.	Research funding	Research and development programs and activities related to the expansion of the state aquaculture industry.	HDOA	Approximately \$144,000 per year	Statewide
Biomass Crop Assistance Program	Provides financial assistance to owners and operators of agricultural and non-industrial private forest land who wish to establish, produce, and deliver biomass feedstocks. Establishment payments (for growing new biomass crops), Maintenance payments (annual) (to maintain the new biomass crop as it matures until harvest), Retrieval payments (matching) to collect existing biomass residues that are not economically retrievable	Payments	Producers with acreage within an approved USDA project that can supply to an existing or in-progress biomass conversion facility located within an economically practicable distance.	USDA/FSA	\$25 million annually through FY 2018	National

Program	Purpose	Support Type	Eligible Participants	Implementing Entities	Capacity	Jurisdiction
Clean Water and Natural Lands Fund	To provide for the purchase of or to otherwise acquire real estate or any interest therein for land conservation in the City of Honolulu	Land acquisition funds	Landowners with qualifying lands that fulfill the purposes of: protection of watershed lands to preserve water quality and water supply; preservation of forests, beaches, coastal areas and agricultural lands; public outdoor recreation and education, including access to beaches and mountains; preservation of historic or culturally important land areas and sites; protection of significant habitats or ecosystems, including buffer zones; conservation of land in order to reduce erosion, floods, landslides, and runoff, and acquisition of public access to public land and open space	City Council/ Clean Water and Natural Lands Commission	Supported by one-half of 1% of O'ahu's real property tax.	City & County of Honolulu
Coastal and Estuarine Land Conservation Program (CELCP)	Matching funds for permanent protection of coastal and estuarine resources with high ecological value	Matching funds to purchase lands or obtain conservation easements	State and local governments	NOAA	Subject to available funding. More than 100,000 acres protected nationally since 2002	National
Conservation Innovation Grants (CIG)	Drive public and private sector innovation in resources conservation. Public and private grantees develop the tools technologies, and strategies to support next-generation conservation efforts on working lands and develop market-based solutions to resource challenges.	Federal grants that require 1-to-1 matching	Non-federal governmental or nongovernmental organizations, American Indian Tribes, or individuals. Producers involved in CIG-funded projects must be eligible for the Environmental Quality Incentives Program.	USDA/NRCS	Average national funding is \$20 million; 711 awards and \$286.7 million awarded since 2004	National (National competition and state competition)
Community Based Restoration Program	Invests in high-priority habitat restoration projects that instill strong conservation values and engage citizens in hands-on activities and actively restore coastal, marine, and migratory fish habitat.	Funding; Technical expertise	Institutions of higher education, non-profits, commercial (for profit) organizations, U.S. territories, and state, local, and Native American tribal governments	NOAA Habitat Conservation – National Marine Fisheries Service	Up to \$5 million available.	National
Energy Feedstock Program ¹⁸⁴	Promote and support worthwhile energy feedstock production activities in Hawai'i, serve as an information clearinghouse for energy feedstock production activities, coordinate development projects to investigate and solve biological and technical problems involved in raising selected species with commercial energy generating potential.	Technical assistance, Coordination	Public and private entities researching or developing energy feedstock projects in Hawai'i.	HDOA	Capacity is currently limited because of limited funding appropriated by Legislature for staff.	Statewide
Fuel Tax Credit for Commercial Fishers (HRS § 235-110.6)	Allows principal operator of a commercial fishing vessel to claim an income tax credit against Hawai'i's individual or corporate net income tax	Income tax credit	Principal operators of a commercial fishing vessel for an amount equal to the fuel taxes imposed and paid by the principal operator during the taxable year	HDOTax	In tax year 2014, tax credit was claimed on 181 tax returns for a total amount of \$293,00. ¹⁸⁵	Statewide

Program	Purpose	Support Type	Eligible Participants	Implementing Entities	Capacity	Jurisdiction
Hawai'i's Coastal Zone Management Program	To provide a common focus for state and county actions dealing with land and water uses and activities.	Technical and planning assistance	Local governments and permit applicants	State of Hawai'i Office of Planning, NOAA (Federal-State partnership)	Based on project needs and on annual funding appropriations	Statewide
Hawai'i Food Producers Fund	To increase the amount of capital available to local food producers and stimulate local food production in Hawai'i.	0% interest loans	Hawai'i-based farmers and food processors utilizing at least one Hawai'i-grown ingredient	Kohala Center; HDOA; County of Hawai'i; Kiva (peer-to-peer online lending program)	Loans are available up to \$10,000	Statewide
Hawai'i Public Access, Open Space, and Natural Resources Preservation Fund	Uses a portion of annual property tax revenues to protect open space, natural and cultural resources, and preserve public access to lands.	County acquisition funds	Landowners with qualifying lands worthy of preservation and recommended by the Commission	Hawai'i County Mayor/Public Access, Open Space, and Natural Resources Preservation Commission	Since 2012, has provided over \$18 million to acquire 955.2 acres of land	Hawai'i County
Important Agricultural Lands Tax Credit	Refunds qualified agricultural costs such as roads or utilities, agricultural processing facilities, water wells, reservoirs, dams, pipelines, agricultural housing, feasibility studies, legal and accounting services, and equipment.	Tax credit	Agricultural business with more than 50% of the land used deemed "important agricultural land." Tax credits must be certified by HDOA. Applicants claiming credits must submit annually an outcome assessment report to HDOA.	HDOTAX, HDOA	Aggregate amount of credits cannot exceed \$7.5 million in any tax year. Not available in 2014 tax year because HDOA had not certified any claims for the tax credit. ¹⁸⁶	Statewide
Kaua'i Public Access, Open Space, and Natural Resources Preservation Fund	Uses a portion of annual property tax revenues to protect open space, natural and cultural resources, and preserve public access to lands.	County acquisition funds	Landowners with qualifying lands worthy of preservation and recommended by the Commission	Kaua'i Planning Commission/ Open Space Commission	As of 2012, balance of ~\$2 million	Kaua'i County
Kukulu Ola: Living Hawaiian Culture Program	To support organizations that enhance, strengthen, and perpetuate the Hawaiian culture.	Funding	Community-based nonprofits in Hawai'i with projects that strengthen the relationship between the visitor industry and the Hawaiian community, nurture the Hawaiian culture by supporting Hawaiian programs and cultural practitioners, craftsmen, musicians, and other artists that preserve and perpetuate the Hawaiian culture	HTA	Up to \$100,000 per year	Statewide
Land Conservation Fund	For acquisition of interests or rights in land having value to the State for the preservation of: watershed protection; coastal areas, beaches, and ocean access; habitat protection; cultural and historical sites; recreational and public hunting areas; parks; natural areas; agricultural production; and open spaces and scenic resources	Funding to purchase interests or rights in land with preservation value	State agencies, counties, and nonprofit land conservation organization landowners interested in selling their fee title or establishing a permanent conservation easement or agricultural easement with the State	DLNR, Hawai'i Senate President, Hawai'i Speaker of the House of Representatives; BLNR	Approximately \$14 million in the fund at the end of FY 2016. Approximately \$4.3 million spent on grants in FY 2016.	Statewide

Program	Purpose	Support Type	Eligible Participants	Implementing Entities	Capacity	Jurisdiction
Land & Water Conservation Fund Act ¹⁸⁷	Funding generated from revenues from offshore, oil and gas extraction, provides federal grants for the acquisition and development of public lands to meet the needs of all Americans for outdoor recreation and open space	Federal grants	Counties of Hawai'i, Maui, O'ahu, and Kaua'i acquiring or developing public lands. Includes purchase of wetlands.	USNPS	\$900 million is deposited into Land & Water Conservation Fund each year, ¹⁸⁸ but Congress only appropriates an average of \$340 million per year ¹⁸⁹ - Hawai'i receives approximately \$400,000/year ¹⁹⁰	National
Maui Public Access, Open Space, and Natural Resources Preservation Fund	Uses a portion of annual property tax revenues to purchase or otherwise acquire lands or property entitlements for land conservation purposes in the County of Maui	County acquisition funds	Landowners with qualifying lands that fulfill the purposes of: public outdoor recreation and education; preservation of historic or culturally important land areas; protection of significant habitat or ecosystems, including buffer zones; preserving forests, beaches, coastal areas and agricultural lands; protecting watershed lands to preserve water quality; conserving land for the purpose of reducing erosion, floods, landslides, and runoff	Maui County Council/Budget & Finance Committee	As of 2013, balance of ~\$14.4 million	Maui County
National Estuarine Research Reserve System (NERR)	Network of areas representing different biogeographic regions of the U.S. that are protected for long-term research, water-quality monitoring, education and coastal stewardship	Funding; National guidance; Technical assistance to support research	Coastal states and territories	NOAA; Hawai'i OP/CZM	He'eia National Estuarine Research Reserve established on 1,385 acres within the Kaneohe Bay estuary on the windward side of O'ahu. Funds are provided under the Coastal Zone Management Act and it is anticipated that the Hawai'i reserve would be eligible for fiscal year 2017 funding to begin operations ¹⁹¹	National
Natural Capital Investment Partnership (HB2040; Act 172, SLH 2016)	Established a two-year pilot program for a water security advisory group to enable public-private partnerships that increase water security by providing matching state funds for qualifying projects and programs	Grants	Projects and programs that: 1) increase the recharge of groundwater resources; 2) encourage the reuse of water and reduce the use of potable water for landscaping irrigation; and 3) improve the efficiency of potable and agricultural water use.	DLNR	\$750,000 in state matching funds	Statewide
Pittman-Robertson Wildlife Restoration Program	Nation's oldest and most successful wildlife restoration program with the purpose to restore, conserve, manage, and enhance wild birds and mammals and their habitat.	Grants	States and insular areas fish and wildlife agencies with projects that include providing public use and access to wildlife resources, hunter education, and development and management of shooting ranges	USFWS	Funded through the purchases of firearms, ammunitions, and archery equipment	National
Renewable Fuels Production Tax Credit (Act 202 SLH 2017)	Establishes a 5-year renewable fuels production tax credit to achieve greater energy security for Hawai'i.	Tax credit	Taxpayers producing qualifying renewable fuels in amounts that have been certified by HDBEDT. Applicable to taxable years beginning after 12/31/16.	HDOTAX, HDBEDT	Amount claimed per taxpayer cannot exceed \$3 million per taxable year.	Statewide
Rivers, Trails, and Conservation Assistance Program	Supports community-led natural resource conservation and outdoor recreation projects	Technical assistance; Planning support	State and local agencies, tribes, nonprofit organizations, or citizen groups	NPS	Based on project needs.	National

Program	Purpose	Support Type	Eligible Participants	Implementing Entities	Capacity	Jurisdiction
Small Business Innovation Research Program	Invites science-based small business firms to submit research proposal for funding. Topic areas include Forests and Related Resources; Plant Production and Protection; Animal Production and Protection; Air, Water, and Soils; Aquaculture; and Marketing and Trade	Grants	Small businesses and small proprietorships that are in business for profit.	USDA	Up to \$100,000 for Phase I projects, which prove the scientific or technical feasibility of an approach or concept. \$8 million available for current year. Successful Phase I projects are eligible to apply for Phase II projects. \$12 million available during previous year.	National
Sport Fish Restoration Program	To restore and better manage America's declining fishery resources	Grants	States, the District of Colombia and insular areas fish and wildlife agencies for fishery projects, boating access, and aquatic education	USFWS	Funded through purchases of fishing equipment, motorboat, and small engine fuels and import duties	National
State and Local Assistance Program	To create and maintain a nationwide legacy of high quality recreation areas and facilities and to stimulate non-federal investments in the protection and maintenance of recreation resources across the U.S.	Matching grants	States and counties for eligible public outdoor recreation projects; Acquisition, development, and renovation of public outdoor recreation areas and facilities	USDOI/NPS; DLNR/DSP	Has given out 42,000 grants totaling \$4.1 billion to States, Territories, the District of Columbia, and local units of government. Matched by \$8.2 billion by local participants. ¹⁹²	National

POTENTIAL ECOSYSTEM SERVICES BENEFICIARIES (“BUYERS”)

As discussed in Part I, potential buyers of ecosystem services will be defined, in part, by whether they are making purchases as part of a formal market and whether their purchases are driven by compliance or by voluntary choice. On the voluntary choice side, a recent study found that recreational beach users in Hawai‘i were willing to pay between about \$11 to \$30 per day to reduce excessive levels of bacteria in the water and between about \$35 to \$50 to improve underwater visibility.¹⁹³ Additionally, a growing number of private companies have also voluntarily made commitments to reduce their greenhouse gas emissions (or “carbon foot prints”) to align with the Paris Agreement. For example, more than 200 cities and counties, more than 300 higher education institutions, and more than 1,700 businesses and investors, including more than a dozen Fortune 500 businesses, signed onto the “We Are Still In” statement, committing to meet the Paris Agreement targets.¹⁹⁴

On the compliance side of potential purchases, there are currently no policies in Hawai‘i that explicitly allow natural resource-based offset trading to meet greenhouse gas emissions limits for regulated entities. As mentioned earlier, a trading mechanism is being explored in Hawai‘i to meet point source water quality requirements. That mechanism would likely include natural resource-based offset credits. Under federal law, biodiversity offsets and wetland offsets are required for Hawai‘i development projects that will have unavoidable impacts on wetlands and other important habitats.

In addition to compliance mechanisms for activities taking place in Hawai‘i, there have also been efforts to access compliance markets that are located outside of Hawai‘i. For example, The Nature Conservancy of Hawai‘i has been exploring the possibility of accessing the California cap-and-trade market for carbon.¹⁹⁵ Hawai‘i forest projects are not currently eligible to sell carbon offset credits within California’s cap-and-trade program. However, after several years of effort by The Nature Conservancy, the U.S. Forest Service, and DOFAW to address technical data gaps, the third-party whose forest project standards are the basis for California’s program amended its guidelines in June 2017 to include forest projects in Hawai‘i.¹⁹⁶ The next step is to develop some pilot voluntary offset projects under those standards and, ultimately, demonstrate the validity of Hawai‘i forest projects to the regulatory body that administers the California cap-and-trade program and have it accept Hawai‘i projects into its market.

In addition to the California market, there is also a new cap-and-trade program being developed by the International Civil Aviation Organization (ICAO) called the Carbon Offsetting and Reduction Scheme for International Aviation (CORSA). ICAO has set a global goal of reaching carbon-neutral growth from 2020 onward.¹⁹⁷ CORSA would address any annual increase in total carbon dioxide emissions above

the 2020 levels from international civil aviation (i.e. civil aviation flights that depart in one country and arrive in a different country). In any year from 2021 when international aviation carbon dioxide emissions exceed the average baseline emissions, the sector will be required to offset the difference for that year. The CORSA pilot and first phases (2012 to 2026) will be limited to countries that have opted to participate.¹⁹⁸ Starting in 2027, however, CORSA will become mandatory for the ICAO member countries that do not qualify for an exemption.¹⁹⁹ The process for approving the offset programs that will be eligible to sell carbon offsets to CORSA participants is still being developed. For that reason, it is unclear at this time whether Hawai‘i natural resource-based projects would be able to sell to the CORSA buyers.

Finally, as mentioned earlier, it is possible that Hawai‘i’s recent Act 32 will result in new compliance mechanisms in Hawai‘i, creating a new pool of potential compliance buyers that do not currently exist in Hawai‘i. Implementation of the mandate in Act 32 should be monitored going forward for this reason, as well. The Table below provides some of the Potential Beneficiaries (Buyers) of Hawai‘i Ecosystem Services, based on demand for existing compliance-driven purchases and potential voluntary purchases.

Potential Beneficiaries (“Buyers”) of Hawai‘i’s Ecosystem Services

Type	Number	Geography	Compliance-Driven ES Payments	Potential Voluntary ES Purchases
Airlines ²⁰⁰	35	Statewide	County water fees	Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); Ecotourism Services; supporting Agricultural and Rangeland BMP projects
Anglers	157,000 ²⁰¹	Statewide	Fishing license fees; ²⁰² Park entrance fees; Camping fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Architects	575 ²⁰³	Statewide	County water fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Bars	228	Statewide	County water fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Boats ²⁰⁴	11,689 ²⁰⁵	Statewide	Vessel registration fees	Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Car Rental Companies	116	Statewide ²⁰⁶		Carbon offsets (tradable credits or non-tradable tree planting projects), Temperature offsets (tree planting projects), Ecotourism Services
Commercial Developer Companies	7 ²⁰⁷	Statewide	Real Estate Conveyance tax; Wetland offsets; Biodiversity/Conservation offsets	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects; Transfer of development rights
Commercial Property Managers	332 ²⁰⁸	Statewide	Real Estate Conveyance tax, TAT tax, Property tax	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects; Transfer of development rights
Commercial Trail Tour Operators	32 ²⁰⁹	Statewide ²¹⁰	Na Ala Hele Commercial fees; Park entrance fees; Camping fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects; Ecotourism Services
Condominiums	117 ²¹¹	Statewide	County water fees, Property tax, Real Estate Conveyance tax, TAT tax	Carbon offsets (tradable credits or non-tradable tree planting projects), Temperature offsets (tree planting projects); Ecotourism Services; supporting Agricultural and Rangeland BMP projects
Cruise ship passengers	240,282 ²¹²	Statewide	Park entrance fees; Fishing license fees	Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); Ecotourism Services; supporting Agricultural and Rangeland BMP projects
Energy Producers	26 ²¹³	Statewide	Barrel tax, County water fees; State irrigation fees; Real Estate Conveyance tax; Property tax	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); Ecotourism Services; supporting Agricultural and Rangeland BMP projects
Gas stations	284 ²¹⁴	Statewide	Barrel tax, County water fees; Real Estate Conveyance tax; Property tax	Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Golf Courses	92 ²¹⁵	Statewide ²¹⁶	Property tax, Real Estate Conveyance tax, Municipal water fees and/or State irrigation fees	Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Government Construction Contractors	14 ²¹⁷	Statewide	Wetland offsets; Biodiversity/Conservation offsets	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects; Transfer of development rights
Helicopter Tour Operators	10 ²¹⁸	Statewide		Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Hotels ²¹⁹	1,595	Statewide ²²⁰	County water fees, TAT tax, Property tax, Real Estate Conveyance tax	Carbon offsets (tradable credits or non-tradable tree planting projects), Temperature offsets (tree planting projects); Ecotourism Services; supporting Agricultural and Rangeland BMP projects

Type	Number	Geography	Compliance-Driven ES Payments	Potential Voluntary ES Purchases
Hunters	23,000 ²²¹	Statewide ²²²	Hunting license fees; Park entrance fees; Camping fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Land Developer Companies	11 ²²³	Statewide	Real Estate Conveyance tax; Wetland offsets; Biodiversity/Conservation offsets	Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); Transfer of development rights
Major Sporting Events	~8/yr ²²⁴	O'ahu, Maui, Moloka'i, Hawai'i Island		Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects
Military Installations	11 ²²⁵	O'ahu, Kaua'i, and Hawai'i Island	County water fees; Wetland offsets; Biodiversity/Conservation offsets	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects; Transfer of development rights
Motion picture and video production related services	59 ²²⁶	Statewide	County water fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); Ecotourism Services; supporting Agricultural and Rangeland BMP projects
Real Estate Agents ²²⁸	13,559	Statewide	County water fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects; Transfer of development rights
Residential Developer Companies	12 ²²⁹	Statewide	Real Estate Conveyance tax; Wetland offsets; Biodiversity/Conservation offsets	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects; Transfer of development rights
Residents	1.4 million ²³⁰	Statewide	County water fees, Property tax, Real Estate Conveyance tax, Camping fees, Fishing license fees, Hunting fees, TAT tax, Park entrance fees	Carbon offsets (tradable credits or non-tradable tree planting projects),
Restaurants	2,841	Statewide	County water fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); Ecotourism Services; supporting Agricultural and Rangeland BMP projects
Travel agents ²³¹	395	Statewide	County water fees	Carbon offsets (tradable credits or non-tradable tree planting projects); Temperature offsets (tree planting projects); Ecotourism Services; supporting Agricultural and Rangeland BMP projects
Visitors	~8 million/yr ²³²	Statewide ²³³	Camping fees, Fishing license fees, Hunting fees, Park entrance fees	Carbon offsets (tradable credits or non-tradable tree planting projects), Ecotourism Services
Wildlife Watchers	358,000 ²³⁴	Statewide	Park entrance fees; Camping fees	Carbon offsets (tradable credits or non-tradable planting projects); Temperature offsets (tree planting projects); supporting Agricultural and Rangeland BMP projects; Ecotourism services

PAYMENT + PRICE

Clearly articulating the unifying problem and purpose for a potential PES approach in Hawai'i will be critical to determining which payment types would be appropriate and how the price for the ecosystem services involved will be set. As discussed earlier, it is vital that stakeholders (particularly beneficiaries), lawmakers, and policymakers share the same sense and degree of resource scarcity and resource value.²³⁵ Creating appropriate metrics to monitor the progress of a PES approach, will also let beneficiaries know what they are paying for, and sustain a sense of shared purpose.

Currently, Hawai'i pays for ecosystem services through water fees charged at the county level and regulations on development that require compensatory mitigation for habitat or species damage. The price for compensatory mitigation for habitat or species damage will vary considerably, because it will depend on the size, design, and location of the project. The cost of the mitigation activities will determine whether a property developer will attempt to implement the mitigation activities directly, or pay for mitigation credits from a project that has been implemented by a third party. For Hawai'i's municipal water fees, they are set at the county level and vary depending on the user category (residential/urban, agriculture, and non-potable) and rates are typically grouped into blocks by the amount of water used. These rates currently range from \$2.11 to \$5.33 per gallon for the 13,001 to 30,000 gallon price block. Recently, however, the Fresh Water Council, a group of stakeholders from agriculture, private landowners, scientists, and government officials in Hawai'i, concluded that citizens in Hawai'i (and Americans at large) have not paid the true cost of capturing, treating, and delivering clean, safe water to their taps.²³⁶ If this view is broadly shared and openly endorsed by stakeholders and beneficiaries of Hawai'i's freshwater, an appropriate price increase or other PES approach could be identified and receive the necessary public support to implement it.

In terms of compliance mechanisms for carbon, there have been recent proposals to impose a carbon tax at the federal level of the United States. A proposal for the American Opportunity Carbon Fee Act of 2017 sponsored by U.S. Senators Sheldon Whitehouse (D-Rhode Island) and Brian Schatz (D-Hawai'i) would put a price on carbon emissions to encourage cleaner energy and return the revenue to the American people.²³⁷ The tax would be imposed on carbon emissions from fossil-fuel combustion and other major emitters at approximately \$49/ton of carbon dioxide (with inflation increases until an emissions target is attained) and use the revenue to reduce the top corporate tax income rate to 29%, provide a refundable tax credit to working Americans, provide additional payments to Social Security and veterans' benefits recipients, and provide \$10 billion in annual block grants to the states.²³⁸ A similar proposal ("The Conservative Case for Carbon Dividends") has been endorsed by the Climate Leadership Council, an international policy institute "founded in collaboration with

business, opinion, and environmental leaders to promote a carbon dividends framework as the most cost-effective, equitable, and politically-viable climate solution."²³⁹ Under this proposed carbon dividends program a carbon tax would begin at \$40/ton and increase overtime with the proceeds being returned to the American people on an equal and monthly basis through dividend checks, direct deposits or contributions to their individual retirement accounts. It would also phase out much of the Environmental Protection Agency's regulatory authority over carbon dioxide emissions, repeal President Obama's Clean Power Plan, and end federal and state tort liability for emitters.²⁴⁰ Additionally, at the state level, a recent report by a consultant to the Hawai'i Tax Review Commission recommended the creation of a state carbon tax that was estimated to be capable of generating \$365 million per year in revenue for the State of Hawai'i.²⁴¹ It is unclear if any of these proposals will get traction in the U.S. Congress or in the Hawai'i Legislature in the near future or otherwise. If they do, and a carbon tax is imposed at the federal or state level, it could have positive impacts on overall climate change mitigation in the United States and in Hawai'i, but negative impacts on the demand and price for voluntary carbon offset credits and on the compliance offset systems that exist at the regional or state levels, such as California's cap-and-trade system.

For voluntary payments for ecosystem services, these prices generally depend on market forces that will reach beyond Hawai'i's boundaries. Assuming that no federal carbon tax is imposed, the price for voluntary carbon offsets, for example, will be influenced by sellers located all over the United States and beyond and by the specific interests and needs of those voluntary buyers. A recent report from Forest Trends' Ecosystem Marketplace found that overall, the volume of voluntary carbon offsets traded in 2016 dropped by 24% and the prices ranged considerably, from \$.50/tCO₂e to more than \$50/tCO₂e.²⁴² In general, the prices were lower on higher volumes of credits traded. Credits from forestry and land use were the second most traded offset category.²⁴³ It is possible that Hawai'i-based projects could be valued at a higher price than the average, since the carbon credits generated in Hawai'i would come from small-scale, unique projects that would likely include plants and other wildlife that can be found nowhere else on Earth and that are the foundation for the cultural practices of an ancient and thriving indigenous culture.

GOVERNANCE + INSTITUTIONAL FUNCTIONS

The unifying purpose and design of the potential PES approach will determine which public institutions and private entities must be involved and which ones would add additional capacity or be able to tap into and leverage existing resources. As discussed in Part I, the institutional functions that are needed for any PES approach are:

- Supporting project development (e.g., scientific research and project planning);
- Collecting and managing financial resources;
- Managing participation in the PES, access to information, and conflict resolution (e.g., capacity

building, stakeholder dialogues, facilitation of negotiations, etc.);

- Monitoring compliance (e.g., contractual obligations, management of public funds);
- Enforcing laws, regulations, and contracts; and
- Coordination of the whole PES program across institutions and levels of government

The following table identifies existing Hawai'i public institutions and private entities that have existing mandates or missions that may align with the necessary institutional functions for a PES program. Potential alignment with a particular function is reflected with a checkmark. Depending on the actual design and implementation needs of a PES program, however, these mandates or missions may not be broad enough to cover all the necessary functions for a PES program. In that case, the mandates or missions of existing institutions would need to be expanded or new institutions or private entities may need to be created to fully serve certain functions. The institutions and entities are listed below based on potential mission or skillset alignment, not based on budget availability or expressed willingness to serve the role.

In addition to these general institutions and entities, there are also government-funded PES programs currently active in Hawai'i that rely in-part or entirely on federal and/or state funding. Generally, the government funding determines the goals and restrictions of these PES programs, which affects which landowners or land managers can qualify to participate. As a result, the existing PES programs may not have the ability to reach all the ecosystem services priority areas or all the potential sellers or buyers of ecosystem services in Hawai'i. These programs provide, however, experience and expertise that could be tapped, expanded, and leveraged for a broader PES approach. A table of Government-Funded PES Programs in Hawai'i follows the Hawai'i Institutions or Entities + Current or Potential Functions table.

Hawai'i Institutions or Entities + Current or Potential Functions

Entity	Mission	Jurisdiction	Project Types	Project Development	Managing Finances	Managing Participation	Compliance	Enforcement	Coordination
Agricultural Leadership Foundation of Hawai'i	Trains new farmers to become Hawai'i's future agricultural leaders. Offers specialized training and education from renowned industry representatives to prepare for a career as effective leaders for agriculture in each perspective business, industry, and community	Statewide (Private)	Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
County of Hawai'i – Department of Research and Development (Hawai'i – DRD)	Provides grant awards to non-profit organizations for initiatives that improve the quality of life for the people of Hawai'i County through responsible and sustainable economic, societal, and environmental practices in agricultural research that is innovative or urgent in nature, marketing and promotion of products and the collections and dissemination of information	County of Hawai'i (Public)	Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
Hawai'i Association of Conservation Districts (HACD)	Helps farmers to create the conservation plans they need in order to farm.	Statewide (Public)	Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
Hawai'i Association of Watershed Partnerships (HAWP)	Comprised of 11 island-based Watershed Partnerships ²⁴⁴ that work collaboratively with more than 71 public and private partners on 6 islands to protect over 2.2 million acres of vital forested watershed lands.	Statewide (Private)	Forest Enhancement, Forest Restoration, Afforestation, Agroforestry	✓		✓			✓
Hawai'i Department of Agriculture (HDOA)	To develop and promote agriculture as a significant and respected driver of Hawai'i's economy.	Statewide (Public)	Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓	✓	✓	✓		✓
HDOA – Agricultural Loan Division (HDOA/ALD)	To help promote agricultural and aquacultural development of the State by providing credit at reasonable rates and terms to qualifying individuals or entities	Statewide (Public)	Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health		✓		✓		
Hawai'i Invasive Species Council (HISC)	Established to provide policy level direction, coordination, and planning among state departments, federal agencies, and international and local initiatives for the control and eradication of harmful invasive species infestations throughout the State and prevent the introduction of other invasive species that may be potentially harmful.	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓		✓			✓
Hawai'i Invasive Species Committees (ISCs)	Island-based, grassroots partnerships of government agencies, private businesses and non-profit organizations working together to control or eradicate the worst pest species that threaten each island.	Island-Specific (Public-Private)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓		✓			✓

Entity	Mission	Jurisdiction	Project Types	Project Development	Managing Finances	Managing Participation	Compliance	Enforcement	Coordination
Hawai'i Department of Land and Natural Resources – Division of Aquatic Resources (DLNR/DAR)	To manage, conserve, and restore the state's unique aquatic resources and ecosystems for present and future generations.	Statewide (Public)	Aquatic Services	✓			✓		
Hawai'i Department of Land and Natural Resources – Division of Boating and Ocean Recreation (DLNR/DOBOR)	Provides facilities and support for recreational boating and ocean-based recreation activities. Manages, operates, regulates, and maintains 15 independent boat ramps, 2 deep draft harbors, 4 landings, 8 offshore moorings, 4 public shorelines, 20 small boat harbors, and 4 wharfs. Also develops and implements rules to promote boating safety and reduce conflicts between various recreational user groups, handles vessel registration, and investigates boating accidents. Supported by user fees, registration fees, marine fuel taxes, and boating property rental income.	Statewide (Public)	Aquatic Services	✓		✓	✓		
Hawai'i Department of Land and Natural Resources – Division of Conservation and Resources Enforcement (DLNR/DOCARE)	To enforce the rules and regulations related to fishing, hunting, boating, and ocean recreation, as well as the activities on Forest Reserve lands, lands and waters within the Conservation District, state shores, Na Ala Hele trails, and in parks, wildlife sanctuaries, Marine Life Conservation Districts, and Natural Area Reserves. Also administers the Hawai'i Hunter Education Program	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Aquatic Services					✓	
Hawai'i Department of Land and Natural Resources – Division of Forestry and Wildlife (DLNR/DOFAW)	To responsibly manage and protect watersheds, native ecosystems, and cultural resources and provide outdoor recreation and sustainable forest products opportunities, while facilitating partnerships, community involvement and education	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Rangeland BMPs, Soil Health	✓	✓	✓	✓		✓
Hawai'i Department of Land and Natural Resources – Division of State Parks (DLNR/DSP)	To provide opportunities and facilities for unorganized outdoor park recreation activities to preserve and make available for appreciation and study places of historical, scenic, and natural significance	Statewide (Public)	Forest Enhancement, Forest Restoration, Wetlands, Soil Health	✓					
Hawai'i Department of Land and Natural Resources – Land Division (DLNR/LD)	To manage state-owned lands in ways that will promote the social, environmental, and economic well-being of Hawai'i's people. Also to ensure that these lands are used in accordance with the goals, policies, and plans of the state.	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Rangeland BMPs, Soil Health		✓	✓			

Entity	Mission	Jurisdiction	Project Types	Project Development	Managing Finances	Managing Participation	Compliance	Enforcement	Coordination
Hawai'i Department of Land and Natural Resources – Office of Conservation and Coastal Lands (DLNR/OCCL)	Oversees approximately 2 million acres of private and public lands that lie within the State Land Use Conservation District and the beach and marine lands out to the seaward extent of the State's jurisdiction. Lead agency for maintaining public access to and along Hawai'i's shorelines.	Statewide (Public)	Forest Restoration, Wetlands, Agriculture BMPs, Aquatic Services, Silviculture, Rangeland BMPs, Soil Health	✓		✓			✓
Hawai'i Forest Stewardship Advisory Committee (FSAC)	To advise DLNR/DOFAW on all project proposals and management plans for the Forest Stewardship Program. Comprised of representatives of federal and state agencies, professional foresters, resource consultants, conservation organizations, non-profit and land trust organizations, and private landowners. ²⁴⁵	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation	✓		✓			
Hawai'i Island Game Management Advisory Commission	To advise County, State, and Federal agencies on matters related to the preservation of subsistence hunting and fishing, and protecting traditional and cultural gathering rights.	Hawai'i Island (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓		✓			
Hawai'i Department of Hawaiian Home Lands (DHHL)	To serve native Hawaiian beneficiaries and manage the extensive land trust comprised of Hawaiian home lands for homesteads. The land trust consists of over 200,000 acres on the islands of Hawai'i, Maui, Moloka'i, Lāna'i, O'ahu, and Kaua'i.	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health		✓	✓	✓		
Hawai'i Department of Business, Economic Development, and Tourism (DBEDT)	To achieve a Hawai'i economy that embraces innovation and is globally competitive, dynamic and productive, providing opportunities for all Hawai'i's citizens. Serves as the center for economic and statistical data, business development opportunities, energy and conservation information, and foreign trade advantages.	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓	✓	✓			✓
Hawaiian Islands Land Trust (HILT)	To protect the lands that sustain Hawai'i for current and future generations. Committed to working with private landowners, community groups, community leaders, and government partners to protect Hawai'i's precious lands.	Statewide (Private)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Rangeland BMPs,	✓	✓	✓			✓

Entity	Mission	Jurisdiction	Project Types	Project Development	Managing Finances	Managing Participation	Compliance	Enforcement	Coordination
Hawai'i Tourism Authority (HTA)	Hawai'i's lead agency for tourism. Charged with: 1) Setting tourism policy and direction with the goal of contributing to the ongoing, sustainable growth of Hawai'i's economy; 2) Developing and implementing the State's tourism marketing plan and efforts; 3) Managing programs and activities that sustain a healthy visitor industry; 4) Developing and implementing the Hawai'i Tourism Strategic Plan; and 5) Coordinating tourism-related research, planning, promotional and outreach activities with the public and private sectors	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓	✓	✓	✓		✓
Hawai'i Ecotourism Association	Volunteer-nonprofit focused on protecting Hawai'i's unique, natural environment and host culture through the promotion of responsible travel and educational programs, relating to sustainable tourism for residents, businesses, and visitors	Statewide (Private)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓		✓	✓		
Kamehameha Schools (KS)	To fulfill Ke Ali'i Pauahi's desire to create educational opportunities in perpetuity to improve the capability and well-being of people of Hawaiian ancestry. It is the policy of KS to manage their lands and resources to optimize the balance of educational, cultural, economic, environmental, and community returns and steward resources in an ethical, prudent, and culturally appropriate manner	Statewide (Private)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓	✓	✓	✓		
National Park Service (NPS)	Preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations	Federal (Public)	Forest Enhancement, Wetlands	✓	✓		✓		
National Oceanic and Atmospheric Administration: National Ocean Service (NOAA/ NOS)	Provides science-based solutions through collaborative partnerships to address evolving economic, environmental, and social pressures on our ocean and coasts	Federal (Public)	Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
National Tropical Botanical Garden (NTBG)	To enrich life through discovery, scientific research, conservation, and education by perpetuating the survival of plants, ecosystems, and cultural knowledge of tropical regions	Statewide and Florida (Private)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands	✓		✓			
The Nature Conservancy Hawai'i (TNC Hawai'i)	In Hawai'i, to bring active, protective management to representative, viable, native ecological systems and species of the Hawaiian Archipelago, and to thereby sustain the greatest possible complement of native Hawaiian biodiversity into the future	Statewide (Private)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands	✓	✓		✓		✓

Entity	Mission	Jurisdiction	Project Types	Project Development	Managing Finances	Managing Participation	Compliance	Enforcement	Coordination
Office of Hawaiian Affairs (OHA)	To malama (protect) Hawai'i's people and environmental resources and OHA's assets, toward ensuring the perpetuation of the culture, the enhancement of lifestyle and the protection of entitlements of Native Hawaiians, while enabling the building of a strong and healthy Hawaiian people and nation, recognized nationally and internationally.	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓	✓				
Pacific Islands Climate Change Cooperative (PICCC)	Provides a range of services and tools to help managers in Hawai'i, the Mariana Islands, American Samoa, and other Pacific Island groups make informed decisions for conservation of natural and cultural resources including climate models at the archipelagic and island scales, ecological response models, and implementation and monitoring strategies for island species, resources, and communities.	US-Affiliated Pacific Islands (Public-Private)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
Pacific Islands Climate Science Center (PI CSC)	Network of 8 Climate Science Centers created by the U.S. Department of the Interior to provide natural resource managers and cultural stewards in federal, state, and local agencies access to the best science available on climate change and other landscape-scale stressors that are impacting the nation's natural and cultural resources.	Pacific Islands (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
Trust for Public Land (TPL)	In Hawai'i, to work with local communities and public agencies to conserve the best of Hawai'i.	Statewide (Private)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Rangeland BMPs, Soil Health	✓	✓				
University of Hawai'i at Manoa: Center for Conservation Research and Training (UHM/CCRT)	To create the premier multi-agency, trans-disciplinary research and education center in the Pacific Asia Region whose mission is to develop a new paradigm for addressing ecosystem and human health issues within a socio-ecological systems framework that includes the spiritual values of traditional cultures	Pacific Asia Region (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
The Economic Research Organization at the University of Hawai'i (UHERO)	To conduct rigorous, independent economic research on issues that are both central to Hawai'i and globally relevant.	Statewide (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					

Entity	Mission	Jurisdiction	Project Types	Project Development	Managing Finances	Managing Participation	Compliance	Enforcement	Coordination
UHM: College of Tropical Agriculture and Human Resources (UHM/CTAHR)	To create and deliver knowledge that supports and strengthens families, agricultural and food systems, and the natural environment.	Statewide (Public)	Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓		✓			
U.S. Department of Agriculture: Farm Service Agency (USDA/FSA)	To equitably serve all farmers, ranchers, and agricultural partners through the delivery of effective, efficient agricultural programs for all Americans.	Federal (Public)	Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓	✓	✓			✓
USDA: Forest Service Pacific Southwest Research Station – Institute of Pacific Islands Forestry (USDA/PSW)	Through research, education, and demonstration, provide scientific and technical information needed to restore, protect, and sustain forests of the Pacific for purposes of conservation and utilization	Pacific Region (Public)	Forest Enhancement, Forest Restoration, Afforestation	✓					
USDA: Natural Resources Conservation Service (USDA/NRCS)	Works in partnership with private land owners and managers to protect, enhance, and preserve soil, water, air, plant and animals using sound science and professional expertise	Federal (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓	✓	✓	✓		✓
U.S. Fish and Wildlife Service: Ecological Services (USFWS/ES)	Working with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people.	Federal (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
U.S. Geological Survey: Pacific Island Ecosystems Research Center (USGS/PIERC)	To conduct and interpret scientific research to provide understanding and technologies needed to support and implement sound management and conservation of our Nation's biological resources occurring in Hawai'i and other Pacific island locations.	Pacific Region (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓					
U.S. Environmental Protection Agency (USEPA)	To protect human health and the environment	Federal (Public)	Forest Enhancement, Forest Restoration, Afforestation, Wetlands, Agroforestry, Silviculture, Agriculture BMPs, Aquatic Services, Rangeland BMPs, Soil Health	✓				✓	
U.S. Army Corps of Engineers (USACE)	With environmental sustainability as a guiding principle, works to strengthen the United States' security by building and maintaining America's infrastructure and providing military facilities where U.S. service members train, work, and live.	Federal (Public)	Wetlands, Aquatic Services, Agriculture BMPs	✓					

Government-Funded PES Programs in Hawai'i

Program	Purpose	Landowner Benefit	Ecosystem Services	Eligible Participants	Implementing Entities	Funding Sources	Capacity
Agricultural Conservation Easement Program – Wetland Reserve Easements	Uses wetland reserve easements and wetland reserve enhancement partnership agreements to help eligible conservation partners leverage local resources to voluntarily protect, restore, and enhance critical wetlands on agricultural lands.	Funds	Habitat for fish and wildlife; improved water quality; flooding reduction; groundwater recharge; biodiversity protection	American Indian tribes, state and local governments, and non-governmental organizations that hold farmed or converted wetland that can be successfully and cost-effectively restored	USDA/NRCS	2014 Farm Bill	\$15 million available nationwide; ~\$300,000/yr ave. in Hawai'i ²⁴⁶
Forest Legacy Program	To provide interested landowners with alternatives to selling their land for development in order to cover costs associated with increased taxes, management of the land, etc. by selling the land or a conservation easement on the property to a government organization.	Funds; Reduced taxes	Freshwater, Biodiversity, Carbon Dioxide Removal	Private forest landowners that prepare a multiple resource management plan as part of the conservation easement acquisition.	DLNR/DOFAW; USDA/FS	Federal government provides up to 75% of project costs with at least 25% coming from private, State, or local sources; USDA/FS Forest Legacy Program provides administrative support	Varies by year.
Hawai'i Conservation Reserve Enhancement Program (Hawai'i CREP)	Use 15-year contracts that provide program participants with financial incentives to voluntarily convert degraded lands to native trees, shrubs, and grasses	Funds	Freshwater, Biodiversity, Carbon Dioxide Removal	Landowners or lessees with land that is physically and legally capable of being agriculturally productive	USDA/FSA; USDA/NRCS; DLNR/DOFAW; HDOA; HAWP; UHM	USDA; DLNR/DOFAW	Target of 15,000 acres of agricultural land in counties of Hawai'i, Maui, Honolulu, and Kaua'i; From 2010-2012, ~\$337,000 in state funds matched by ~\$1.7M in federal USDA funds and ~\$1.4M in private funds
Hawai'i Forest Stewardship Program	To assist non-industrial private forest landowners to more actively manage their forest and related resources, and to increase the economic and environmental benefits of these lands.	Funds	Freshwater, Biodiversity, Carbon Dioxide Removal	Individuals, joint owners, private groups, associations, lease or license holders, or corporations that own or have a minimum lease for a minimum of 10 years on at least 5 contiguous acres of forested or formerly forested land and intend to actively manage at least 5 acres to enhance forest resource values for both private and public benefit. Contract terms can range from 3 to 30 years.	DLNR/DOFAW; FSAC; USDA/FS	Forest Stewardship Fund (HRS § 195F-4) – receives % of annual Conveyance Tax revenues deposited into the Natural Area Reserve Fund ²⁴⁷ ; also funds from sale of forest products from the State of Hawai'i Forest Reserve System lands	~\$3.9M distributed in state funds to 36 different projects from 1990 to 2013; ²⁴⁸ Generally, projects requesting more than \$75,000 per year have not been approved

Program	Purpose	Landowner Benefit	Ecosystem Services	Eligible Participants	Implementing Entities	Funding Sources	Capacity
Kaulunani Urban & Community Forestry Program	To improve the health and viability of trees in Hawai'i communities through educational programs, financial support through cost-share grants, technical training, Arbor Day promotions, and public-private partnerships	Matching grants; Technical Assistance	Freshwater, Biodiversity, Carbon Dioxide Removal	Nonprofit groups, schools, community organizations, parks, museums, arboretums, etc.s	DLNR/DOFAW; USDA/FS; C&C Honolulu; Outdoor Circle; UH; Smart Trees Pacific	State; USDA/FS-Private Forestry Branch	\$2.6 million to 376 organizations statewide since 1991; matched with \$7 million in cash and in-kind contributions
Legacy Land Conservation Program	Provide grants to community organizations and government agencies that strive to purchase and protect land including important natural lands, open space, agricultural lands, cultural and historic sites, and scenic areas.	Funds	Freshwater; Biodiversity; Carbon Dioxide Removal	Community organizations and government agencies that can provide 25% of total transaction costs	DLNR	Land Conservation Fund	~\$14.5 million at the end of FY 2016 ²⁴⁹
Natural Area Partnership Program	To provide state funds on a 2-for-1 basis with private funds for the management of private lands of the highest natural area quality and that are permanently dedicated to conservation	Funds	Freshwater; Biodiversity; Carbon Dioxide Removal	Private landowners with lands and waters with intact native Hawaiian ecosystems, essential habitat for endangered species, and areas within the protective subzone of the Conservation District	DLNR/DOFAW	DOFAW program funding	300,000 acres enrolled
Safe Harbor Agreement Program	To encourage private landowners to voluntarily manage their lands to the benefit of endangered, threatened, proposed, and candidate species with assurances that future property-use limitations would not be required as a result of these conservation efforts	Cost-reduction; Risk management; Technical Assistance	Biodiversity	Private landowners with protected species on their property	DLNR/DOFAW; USFWS; USNOAA	DOFAW program funding	No limit
Watershed Partnerships Program	Provides technical and financial support to implement watershed management plans	Funds; Technical Assistance	Freshwater; Biodiversity; Carbon Dioxide Removal	Public and private landowners committed to the common value of protecting forested watersheds for water recharge and other ecosystem services through collaborative management	DLNR/DOFAW	DOFAW program funding	No limit
Environmental Quality Incentives Program (EQIP)	Provide financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air, and related natural resources on agricultural land and non-industrial private forestland.	Financial assistance payments for specific conservation practices	Freshwater; Biodiversity; Carbon Dioxide Removal	Owners of land in agricultural or forest production or persons who are engaged in livestock, agricultural or forest production on eligible land and that have a natural resource concern on that land. Must have adjusted gross income (AGI) of less than \$900,000, unless a federally recognized Native American Tribe or Alaska Native corporation	USDA/NRCS	Federal Farm Bill	~\$10 million to Hawai'i and the Pacific; payments cannot exceed \$450,000 for all EQIP contracts entered into during the 2014 to 2018 period; Organic Initiative contracts are limited to \$20,000 per fiscal year and \$80,000 during any 6-year period.

PART IV: CONCLUSIONS + RECOMMENDATIONS

STEP 1: IDENTIFY THE UNIFYING PROBLEM + PURPOSE

Hawai'i's private sector, as well as leaders from its diverse communities, need to join Hawai'i's public sector in identifying the unifying problem and purpose that will guide the PES approach design. A truly unifying problem will be one that reflects a shared sense of threat to ecosystem services that are commonly valued and provide benefits to a diversity of people in Hawai'i. The problem that resonates with the greatest number and diversity of Hawai'i businesses and residents will be one capable of generating the political and social will necessary to address it through a PES approach.

As discussed in Part III, Hawai'i has policies and target-setting initiatives that have, among other things, created a statewide commitment to sustainability. There is a lot to build on from initiatives like the Aloha+ Challenge, Promise to Pae 'Āina, and the Sustainable Hawai'i Initiative, such as clear alignment around the need to increase local food production and protect Hawai'i's priority watersheds. Building on these initiatives, PES could provide a mechanism for Hawai'i's public, private, and civil society partners to work together to implement agreed-upon sustainability and climate priorities. A need still exists, however, for a clear message that speaks directly to Hawai'i's private businesses, private citizens, and visitors in a way that generates enthusiasm and unified support to pay for the ecosystem services that benefit all the people in Hawai'i.

Considering the existing target setting initiatives that are in place, a unifying problem and purpose for a PES approach may be one that builds on the goals of doubling local food production by 2020 and protecting 30% of priority watersheds by 2030. Both of these goals are reflected in more than one Hawai'i initiative and will require coordinated efforts from both public and private landowners to achieve. Without coordinated effort and communication, these goals could be perceived as in conflict with each other. Identifying a problem that unifies and aligns these goals could guide the design of a PES approach that will make progress toward both goals in a way that responds to the needs and interests of both the public and private sectors.

STEP 2: CREATE A COMMON AGENDA FOR SHARED ACTION

A unifying purpose will help identify what success will look like for the PES approach and the people and places that must be involved to achieve that success. This can help create a common agenda or roadmap for a diverse set of

stakeholders that may only participate in a small part of the overall PES approach.

An example of this would be the new approach designed to meet wastewater temperature regulations in Oregon's Tualatin Basin watershed. In that approach, rural landowners planted native trees and shrubs near streams on their own properties to help cool water that ran into the Tualatin River. In cities within the same watershed, volunteers worked with city authorities to plant trees near streams on public property that also ran into the Tualatin River. Each individual planting effort was small on its own, but coordinated together and deployed for a single purpose, these efforts resulted in 500,000 trees being strategically planted over five years to provide the shade necessary to cool 50 million gallons of wastewater effluent released each day by the basin's wastewater plants. This approach also avoided the need to invest more than \$100 million in new technology at the plants, the cost of which would have been passed on to the Tualatin Basin ratepayers.

Having a common agenda can help different stakeholders see how their participation in a specific effort or specific PES tool will contribute to a larger collective approach for a common purpose that they all value.

STEP 3: LEVERAGE EXISTING FUNDING + CAPACITY SUPPORT PROGRAMS

Part III of this analysis details the many resources and capacities that are in place in Hawai'i. These resources could be leveraged for greater impact, but they must be aligned. These resources are currently deployed to serve separate mandates and priorities. The real opportunity presented by a PES approach, is the ability to align existing public resources, determine where the capacity and funding gaps exist, and engage the private sector to make strategic investments that maximize impact and leverage public funds, political will, and broad social engagement.

In Hawai'i, federal and state agencies currently fund programs that pay qualifying landowners to protect forested lands, protect wetlands, or convert degraded lands to native habitat. Public-private partnerships, such as the Hawai'i Watershed Partnerships and the Hawai'i Invasive Species Committees, offer technical expertise and experience working effectively across property boundaries. State agencies with economic mandates recognize the critical role of Hawai'i's natural resources, such as the Hawai'i Tourism Authority and Hawai'i's Department of Business, Economic Development, and Tourism. Strong nonprofit organizations, such as The Nature Conservancy, the Trust for Public Land, and Hawaiian Islands Land Trust, work with Hawai'i landowners to secure unique natural resources. And importantly, leaders of locally owned Hawai'i businesses, such as those in the Sustainability Business Forum, have been looking for opportunities to secure the long-term health of Hawai'i's natural resources and the economy that relies on them.

A PES approach offers an opportunity to harness all of these strengths and assets in a collective effort.

agreements between landowners and ecosystem service beneficiaries would be the lowest hanging fruit tool.

STEP 4: EVALUATE THE ROLE FOR NEW PES TOOLS

The actual strength or weakness of any particular PES tool will not be apparent until the unifying problem and purpose and common agenda have been identified and the existing resources have been evaluated for potential leverage and gaps. That being said, a few high-level observations can be made about the varied advantages of different PES tools that are not currently in use in Hawai'i or are being used at a very small scale.

PES Tools with Potential to Capture New Revenue Sources (Greatest Economic Impact)

The PES tools with the potential to tap into new revenue sources for Hawai'i would include carbon offset credits (in voluntary and in compliance markets, like California's carbon emissions cap-and-trade program and the developing carbon emissions program for international aviation), biodiversity offsets, in lieu fees, and tourism activities that directly support ecosystem services (e.g. tree planting voluntourism, reservation tools with options to offset carbon emissions with local nonprofits, etc.). These tools have the potential to tap into revenue streams that exist or are developing and would provide buyers to which Hawai'i does not currently have access.

Potential to Support Multiple Ecosystem Services (Greatest Ecosystem Impact)

The PES tools with the greatest potential to support multiple ecosystem services would be forest-based projects, because of the frequent overlap of existing native forests and areas of recharge for groundwater aquifers. Forest-based projects that are used to generate carbon offset credits, improve water supply, temperature, or quality, or secure the habitat of native species would provide benefits for all three ecosystem services of interest to this analysis (i.e. freshwater, biodiversity, and carbon dioxide removal). Native forests may not have the highest rate of carbon dioxide removal, but they will likely provide more benefits for freshwater and biodiversity security than other project types with higher carbon dioxide removal rates.

Policy Change Required in Hawai'i (Lowest Hanging Fruit)

The PES tool that would require the least amount of policy change to implement in Hawai'i would be private agreements between landowners and ecosystem service beneficiaries (such as those currently used in the government-funded PES programs, such as Hawai'i CREP and Hawai'i Forest Stewardship). Private agreements funded from private sources would not be restricted or limited by the goals and priorities of government funding and would not be reliant on legislative appropriations at the federal or state levels of government. For this reason, private

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26 Porras, *Monitoring PES*, *supra* note 17.

27 *Id.*; Allie Goldstein & Gloria Gonzalez, *Turning over a New Leaf: State of the Forest Carbon Markets 2014* (2014).

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32 For example, there were concerns that PES programs in China, Norway, Finland, Costa Rica, and Mexico did not initially target lands with high conservation value. Though several of these programs have modified their programs to start to address these concerns. Other local PES schemes, such as those in Ecuador, El Salvador, Honduras, and Nicaragua, actively target ecologically critical lands for participation. Porras, *Monitoring PES*, *supra* note 17.

33 *Id.*

34 In lieu fees are fees that a regulated entity pays into a compensation fund program, as a substitute for creating a project or purchasing funds from a project that will offset a negative ecosystem impact caused by the regulated entity. Genevieve Bennett, et al. *An Atlas of Ecosystem Markets in the United States* (2016).

35 Examples of user fees are water supply fees and wastewater fees. C'Amato, *supra* note 21.

36 Braybrook & Barrera, *supra* note 13. Examples of these kind of private agreements can be found in France (Vittel), Switzerland (Henniez), and Germany (Bionade). C'Amato, *supra* note 21.

37 Braybrook & Barrera, *supra* note 13.

38 Soil is a natural source of emissions for greenhouse gases, but is equally a sink for greenhouse gases, except for nitrous oxide. Managing soil in a sustainable way can lead to balanced greenhouse gas cycling. Nicholas B. Comerford, et al. *Assessment and Evaluation of Soil Ecosystem Services, Soil Horizons*, 2013.

Effective manure management can significantly reduce emissions from animal waste, and replacing synthetic fertilizers can reduce CO₂ emissions from agricultural production by half. Soil conservation measures such as conservation tillage and no-till cultivation also conserves soil carbon. Alison G. Power, Ecosystem services and agriculture: tradeoffs and synergies, *Philosophical Transactions of The Royal Society B*, 2010.

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40 North Carolina has three successful avoided forest conversion projects, the Noles North and Noles South Forest Conservation Projects and the Pungo River Forest Conservation Project, that together have conserved 1,730 acres of forest in the tidewater region. Christine Yankel, Carbon for Conservation: Avoided Conversion of Our Forests, The Climate Trust (Oct. 14, 2014), <https://climatetrust.org/carbon-for-conservation-avoided-conversion-of-our-forests/>.

41 Program offers financial incentives for creating new nature reserves that provide habitats for threatened species or protect areas of great natural beauty.

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44 Verified Carbon Standard, VM0033 Methodology for Tidal Wetland and Seagrass Restoration, Version 1.0, 2015.

45 Studies have estimated that wetland restoration can generate soil carbon sequestration at a rate that ranges from 1.5 to 6.5 tCO₂e per hectare per year. Alison J. Eagle, et al., Greenhouse Gas Mitigation Potential of Agricultural Land Management in the United States: A Synthesis of Literature, Institute for Environmental Policy Solutions, 2012. Variability in wetland types leads to significant variability in soil carbon changes among sites.

46 Bennett, *supra* note 34.

47 The Association for Temperate Agroforestry (AFTA) defines agroforestry as an intensive land management system that optimizes the benefits from biological interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock. Eagle, *supra* note 45.

48 Agroforestry's soil carbon sequestration potential on cropland can vary from 0.8 to 6.9 tCO₂ per hectare per year, depending on the specific practice, individual site characteristics, and time frame. *Id.*

49 "By February 2010, the Costa Rica national program covered nearly 730,000 hectares of forest and had planted nearly 3 million trees in agroforestry plantations. Porras, *Monitoring PES*, *supra* note 17.

50 The conditional land tenure scheme in Sumberjaya, Indonesia increased the protected forest from 7% to 70% and has participation from 6,400 farmers that use practices, such as multi-storied coffee gardens. *Id.*

51 *Id.*

52 The Sloping Lands Conversion Programme resulted in 28 million hectares of forest plantations planted in 6 years. The Cropland to Forest Programme converted 8.8 million hectares of crops to plantations. *Id.*

53 Setting cropland aside for unharvested perennial vegetation can provide multiple environmental benefits, including soil carbon sequestration, provision of wildlife habitat, erosion prevention, water quality protection, and aesthetics. These set-asides can take the form of herbaceous buffers (grass strips) within a field or along a riparian area or consist of larger tracts of land. The physical potential of set-aside areas to sequester carbon depends on their size, vegetation, former land use, and structure. Eagle, *supra* note 45.

54 Short-rotation woody crops (SRWCs) are tree plantings on agricultural or otherwise nonforested land with rotation lengths of less than 30 years. As a mitigation activity, SRWCs may be more attractive to farmers than longer-term forestry options, because of the short rotation of the crops. SRWCs are estimated to sequester soil carbon at an average rate of 2.5 tCO₂e hectare per year. On cropland, SRWCs could also generate substantial reductions in fertilizer and fuel use. *Id.*

55 For example, water boards in the Netherlands paid landowners to plant buffer strips between ditches and crops reducing drift of pesticides into the ditch water by 90%. C'Amato, *supra* note 21.

56 Of all agricultural land management activities suggested for greenhouse gas mitigation, conservation tillage has been the most widely applied and studied with the majority of research focused on no-till management. Conservation tillage can take various forms, ranging in the levels of soil disturbance. Eagle, *supra* note 45.

57 For example, a local waste water plant in Sweden paid mussel farmers to remove nutrients from coastal waters. Payments were based on the content of the nitrogen and phosphorous in the mussels harvested. One hundred percent of the nitrogen emissions from the waste water treatment plant were removed, exceeding the plant's targets with about 3,500 tons of blue mussels being used per year. C'Amato, *supra* note 21.

58 Reducing stocking rates on overgrazed land, avoiding grazing during drought conditions, improving the timing of grazing and frequency. Eagle, *supra* note 45.

59 Improved grazing management has potential soil carbon sequestration rates ranging from 0.6 to 1.3 tCO₂e per hectare per year. *Id.*

60 In the northern Everglades, ranchers are receiving payments through the Florida Ranchlands Environmental Services Project for ecosystem services related to water storage and nutrient retention. In Texas, private landowners are paid to implement management and conservation practices benefiting the endangered Golden-cheeked Warbler on their property as an offset for impacts from US Army maneuvers at the adjacent Fort Hood military base. In the Willamette Basin in Oregon, landowners sell four types of ecosystem service credits: wetlands, salmon habitat, upland prairie habitat, and water temperature regulation to utilities and corporations. Joshua H. Goldstein, et al., Beef and Beyond: Paying for Ecosystem Services on Western US Rangelands, *Rangelands* 33.5, 2011.

- 61 San Miguel County in Colorado has launched a multi-year pilot Soil Health PES program that will measure soil productivity, water retention, and carbon sequestration on several private crop and pasture lands in southwestern Colorado. *Payment for Ecosystem Services*, San Miguel County, <https://www.sanmiguelcountycogov/430/Payment-for-Ecosystem-Services> (last visited Oct. 12, 2017). The results of this pilot will help develop a protocol for a potential PES program.
- 62 The University of California Cooperative Extension and UC Berkeley researchers are currently exploring the potential for a PES program for rangeland owners in Sonoma and Marin Counties. Reid Johnsen & Stephanie Larson, *Conservation Easement Payment Structures: Lump Sums, Annuities, and Payments for Ecosystem Services, Outstanding in the Field: Views from Forth Coast Rangeland*, Apr. 20, 2017.
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- 64 Porras, *Monitoring PES*, *supra* note 17. It is important to note, however, that depending on the location there are sometimes trade-offs between ecosystem services, such as between watershed services and carbon sequestration, where a carbon project promotes large-scale reforestation with a fast-growing, single exotic species that may potentially reduce the available water in already water-strained environments. *Id.*
- 65 Bennett, *supra* note 34.
- 66 *Id.*
- 67 Braybrook & Barrera, *supra* note 13. Behavioral economics based on multi-stakeholder, multi-criteria analysis and hydrological studies are sometimes used to provide a better assessment of the non-financial values and costs for ecosystem services. Porras, *Monitoring PES*, *supra* note 17.
- 68 Porras, *Monitoring PES*, *supra* note 17.
- 69 Braybrook & Barrera, *supra* note 13.
- 70 *Id.*
- 71 Porras, *20 Years of PES*, *supra* note 11.
- 72 *Id.*
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- 79 *Id.*; Porras, *Monitoring PES*, *supra* note 17.
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- 107 *Id.*; Bruce Finley, *Denver Water tree-thinning effort to protect watershed, prevent fires is expanded to private property*, The Denver Post, Feb. 27, 2017.
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- 131 *Rain Follows the Forest*, *supra* note 4. Priority I and II areas based on climatic conditions (elevation, moisture zones including fog and rainfall levels), as well as land cover types that provide higher recharge and fog capture. These are native forest areas that are assumed to be under threat to be converted to alien forests (especially in wetter areas) or grasslands, if not managed. Conversion would generally result in loss of recharge function, soil retention, and an increase in runoff. Priority III areas are non-native forests or grasslands within fog zones, where reforesting these areas with natives would generally result in higher groundwater recharge, particularly due to potential fog interception. *Id.*
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151 *Id.*

152 A "covered source" is defined as: 1) any major source; 2) any source subject to a standard of performance for new stationary sources; 3) any source subject to an emissions standard for hazardous air pollutants; 4) any source subject to the rules for the prevention of significant deterioration of air quality; and 5) any source in a source category designated by the department director. A "major source" is a stationary source, or any group of stationary sources that are located on one or more contiguous properties, and are under common control, belonging to a single major industrial grouping and that emits or has the potential to emit hazardous air pollutants in the aggregate of 10-20 tons per year or more depending on the pollutant, 100 tons per year or more of any regulated air pollutant. A "stationary source" is any piece of equipment or any activity at a building, structure, facility, or installation that emits or may emit any air pollutant. Haw. Rev. Stat. § 342B-1.

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154 Haw. Rev. Stat. §§ 141-2.6 to 2.7; Haw. Admin. Rules ch. 4-170.

155 Department of Taxation, State of Hawai'i, Annual Report 2015-2016 (2016).

156 Commercial marine fishing license fees have recently been revised and may reduce this amount.

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158 *Id.* The sale of non-resident licenses shows a persistent increase annually.

159 The boards of water supply are semi-autonomous agencies that manage the municipal water resources and distribution systems at the county level (i.e. Board of Water Supply (BWS) for City and County of Honolulu; Department of Water Supply for the County of Hawai'i; Department of Water Supply for Maui County; Department of Water for Kauai County).

160 20% of gross revenues from ceded lands is allocated to Office of Hawaiian Affairs. *SCORP*, *supra* note 121.

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164 Although legislation from 2015 authorized the counties to charge these user fees, it does not appear that the counties have exercised this authority yet. (H.B. 1325, H.D.1, S.D. 1, 28th Leg., Reg. Sess. (2015).

165 At one time, a portion of TAT funds was dedicated State Parks and the Na Ala Hele program. *SCORP*, *supra* note 121. These figures reflect the recently approved increase to the Counties as part of the 2017 Special Session Bill relating to Transportation Financing (S.B. 1)

166 *Hawai'i Tourism*, *supra* note 9.

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169 Telephone interview with Philipp LaHaela Walter, State Resource & Survey Forester, Division of Forestry & Wildlife, State of Hawai'i (May 25, 2017).

170 *Id.*

171 Dep't of Agriculture, State of Haw., Report to the Twenty-Ninth Legislature, 2017 Regular Session, State of Hawai'i: Report on the State's Progress Toward Meeting the Milestones and Objectives of the Energy Feedstock Program (2016).

172 *Id.*

173 Dep't of Land & Natural Res., State of Haw., Report to the Twenty-Ninth Legislature, State of Hawai'i, 2017 Regular Session: Relating to the Land Conservation Fund and The Legacy Land Conservation Program (2016) [hereinafter *LCF & LLCP*]. Approximately half of this land is owned by private landowners. Conry, *supra* note 126.

174 Depending on the island and location, this can include pigs, goats, sheep, deer, and/or wild cattle. Fence installation, ungulate removal, fence replacement, and fence maintenance costs are part of this activity. *Rain Follows the Forest*, *supra* note 4.

175 Invasive weeds can increase fire risk, consume more water than old-growth forest, and significantly reduce carbon storage. DLNR/DOFAW estimates indicate that weed control is the most costly activity. *Id.*

176 These include rats, slugs, plant diseases, and insect predators. *Id.*

177 These services have been calculated for the island of O'ahu's Ko'olau forests alone to have a net present value of between \$7.4 and \$14 billion. Approximately half of that amount is attributed to the forest's contribution to ground and surface water quality and quantity. *Id.*

178 Historically, Hawai'i had an estimated 59,000 acres of wetlands. It has lost 12 percent of its original acreage or 6,200 acres. The remaining wetlands cover less than three percent of Hawai'i's statewide surface area. Ass'n of State Wetland Managers, Hawai'i State Wetland Program Summary, https://www.aswm.org/pdf_lib/state_summaries/hawaii_state_wetland_program_summary_083115.pdf (last visited Oct. 13, 2017). Coastal wetland losses have been greatest on O'ahu, where wetlands have been drained and filled for resort, industrial, and residential development. U.S. Geological Survey, National Water Summary on Wetland Resources, https://water.usgs.gov/nwsum/WSP2425/state_highlights_summary.html (last visited Oct. 13, 2017). There are also areas where crops are cultivated in wetlands, the largest number of wetland crop acres are located on Kaua'i (322 acres), followed by Maui (164 acres) and Hawai'i Island (142 acres). Dep't of Econ. Dev. & Tourism, State of Haw., Agricultural Land Use Maps State of Hawai'i, http://files.hawaii.gov/dbedt/op/gis/maps/alum_stats.pdf (last visited Oct. 13, 2017) [hereinafter *ALUM*].

179 More specifically, wetlands "provide habitat for thousands of species of aquatic and terrestrial plants and animals. A recent study found that in Hawai'i, 222 federally listed threatened or endangered plants and animals use wetland ecosystems for all or part of their range. Wetlands provide ecological services to Hawai'i's human population by absorbing floodwaters from rain events, storm surge, and tsunami. This ability to control floods can alleviate property damage and loss and save lives. Wetlands also absorb excess nutrients, sediment, and other pollutants before they reach rivers, lakes, and oceans protecting nearshore marine environment." *SCORP*, *supra* note 121. Additionally, wetlands "play an important role in Hawai'i's recreational and commercial fishing industry. While only a small percent of Pacific island marine life are estuarine-dependent, several of these species are critically important to Hawai'i's economy, such as the 'ama'ama (mullet), awa (milkfish), 'opae (shrimp), and the nehu, a tropical anchovy used as live bait in the pole-and-line skipjack tuna fishery. Wetlands also

provide, directly or through the food chain, prey organisms for reef and open coastal fishery resources." *Id.* "Wetlands clean surface runoff physically and chemically and slow pulses of freshwater and sediment during times of heavy rain. The water quality functions of wetlands help protect sensitive coral reef habitat from pollutants, fluctuations in salinity, and sediment loads, and help to keep Hawai'i's waters clear and inviting for everyone who loves beach recreation." *Id.*

180 This figure is based on a 2015 baseline report and includes 22,864 acres of commercial forestry and 651 acres of aquaculture. Jeffrey Melrose, Ryan Perroy, & Sylvana Cares, *Statewide Agricultural Land Use Baseline 2015* (2016). As of that baseline, sugar remained the largest crop in Hawai'i with 38,810 acres, virtually all of which was associated with HC&S operations on Maui. In early 2016, HC&S announced plans to end its sugar operations on Maui. Next to sugar, the seed industry is the second largest agricultural land user in the state at 23,720 acres spread across Kaua'i, O'ahu, Moloka'i, and Maui. *Id.* In terms of field crops, the largest number of acres are located on Hawai'i Island (7,157 acres), followed by O'ahu (3,093 acres) and Maui (2,222 acres). *ALUM*, *supra* note 179.

181 This represents the acres of land in use for animal husbandry. The largest number of acres are located on Hawai'i Island (820,696 acres), followed by Maui (146,312 acres) and Moloka'i (92,660 acres). *Id.*

182 States within the United States, like Hawai'i, may not be eligible for all of the international funding opportunities that may be available to PES programs in countries that qualify as developing countries. For example, Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a program of the United Nations Framework Convention on Climate Change (UNFCCC), which aims to financially reward countries for lowering forest-related emissions. Fehse, *supra* note 78. REDD+ projects are located in developing countries. Once the purpose and likely design of a Hawai'i PES program are identified, potential international funding opportunities could be explored more effectively.

183 Dep't of Agriculture, State of Hawai'i, Report to the Twenty-Eight Legislature, 2016 Regular Session, State of Hawai'i: Annual Report on the Agricultural Development and Food Security Special Fund, Act 73 SLH 2010 (2016).

184 Haw. Rev. Stat. § 141-9.

185 Tax Research & Planning Office, State of Haw., Tax Credits Claimed by Hawai'i Taxpayers, Tax Year 2014 (2016).

186 *Id.*

187 Although this fund has been around since 1964, it is currently set to expire in September 2018 unless it is permanently reauthorized. Rachel Schadegg, House bill reintroduced to permanently reauthorize LWCF, The Wildlife Society (Jan. 24, 2017), <http://wildlife.org/house-bill-reintroduced-to-permanently-reauthorize-lwcf/>.

188 Since 1965, more than \$18 billion of LWCF's funding has been diverted into general revenues for other, unintended purposes. *SCORP*, *supra* note 121.

189 Schadegg, *supra* note 188.

190 State apportionments are based on population and need. *SCORP*, *supra* note 121.

191 Nat'l Ocean Serv., Nat'l Oceanic & Atmospheric Admin., NOAA designates 29th National Estuarine Research Reserve <https://oceanservice.noaa.gov/news/jan17/new-hawaii-reserve.html> (last visited Oct. 13, 2017).

192 *SCORP*, *supra* note 121.

193 Marcus Peng & Kirsten L.L. Oleson, *Beach Recreationalists' Willingness to Pay and Economic Implications of Coastal Water Quality Problems in Hawai'i*, 136 *Ecological Econ.* 41 (2017).

194 "We Are Still In" Declaration, *Open letter to the international community and parties to the Paris Agreement from U.S. state, local, and business leaders*, <https://www.wearestillin.com/we-are-still-declaration> (last visited Oct. 13, 2017).

195 *Kaulukukui Interview*, *supra* note 138.

196 *Id.*; Climate Action Reserve, Forest Project Protocol, <http://www.climateactionreserve.org/how/protocols/forest/> (last visited Oct. 13, 2017).

197 ICAO, *What is CORSIA and how does it work?*, https://www.icao.int/environmental-protection/Pages/A39_CORSIA_FAQ2.aspx (last visited Oct. 13, 2017).

198 *Id.* As of August 2017, 72 countries, representing 87.7% of international aviation activity, have volunteered to participate in the pilot and first phases of CORSIA.

199 *Id.*

200 Includes transpacific and inter-island air carriers. *Data Book*, *supra* note 117 at Table 18.31.

201 *SCORP*, *supra* note 121. This figure does not likely capture all the noncommercial marine fishers that are not required to register or purchase permits or licenses from the State and are not easily trackable or quantified.

202 Federal and Hawai'i law will require that license fees are spent on activities that benefit the person paying the fees, so fishing license fees would need to be used for marine (rather than terrestrial) conservation activities that benefit fishers.

203 Reflects registered members of the American Institute of Architects (AIA) Honolulu chapter. AIA Honolulu, Architect Members, <http://www.aiahonolulu.org/search/custom.asp?id=1669> (last visited Oct. 13, 2017).

204 Any mechanically propelled boat (including those with auxiliary engines) and any boat powered solely by sail if over eight feet in length. *Data Book*, *supra* note 117 at Table 18.47.

205 *Id.*

206 The largest number are located in Honolulu County. *Id.* at Table 18.23.

207 Building Industry Association-Hawai'i, 2017 Membership Directory, available at: https://chambermaster.blob.core.windows.net/userfiles/UserFiles/chambers/9314/CMS/Spotlight/2017BIADirectory_LR.pdf (hereinafter *BIA-Hawai'i*).

208 *Data Book*, *supra* note 117 at Table 21.28.

209 These tour operators are allowed to use certain trails and access roads deemed appropriate for commercial use. Authorized vendors reserve slots for a particular day on a particular trail and pay a per patron fee according to a per unit system based on the impact of the mode of transport has on the trail (i.e. hike (\$5); mountain bike or horse (\$7); motorcycle (\$10); 4-wheel drive (\$25-\$100)). *SCORP*, *supra* note 121.

210 Highest concentration of commercial hiking trail operators is on O'ahu. The highest concentration of commercial 4-Wheel Drive tour operators and commercial equestrian tour operators is on Kaua'i. *Id.*

211 *Data Book*, *supra* note 117 at Table 23.35.

212 Departures in FY 2016. *Id.* at Table 18.51.

213 This includes eighteen of Hawaiian Electric Company's plants and fossil fuel-based independent power producers, as well as eight of Kaua'i Island Utility Cooperative's facilities. Hawaiian Electric Company, Inc., Power Facts, <https://www.hawaiianelectric.com/about-us/power-facts/> (last visited Oct. 13, 2017); Kaua'i Island Utility Cooperative, Energy Information, <http://website.kiuc.coop/content/energy-information> (last visited Oct. 13, 2017).

214 Largest number are in the City and County of Honolulu. *Data Book*, *supra* note 117 at Table 17.17.

215 As reported by the Hawai'i State Golf Association, a nonprofit organization described as dedicated to the integrity and traditions of the game of golf in Hawai'i. Hawai'i State Golf Association, Course Listing, <http://www.hawaiistategolf.org/Default.aspx?p=DynamicModule&pageid=309547&ssid=198036&vfn=1> (last visited Oct. 13, 2017).

216 Higher numbers of residents on Kaua'i report playing golf. *SCORP*, *supra* note 121.

217 *BIA-Hawai'i*, *supra* note 208.

218 This represents sightseeing tour operators in Hawai'i that are members of the nonprofit Helicopter Association International, which has a mission described as providing its members with services that directly benefit their operations, and to advance the international helicopter community by providing programs that enhance safety, encourage professionalism and economic viability while promoting the unique contributions vertical flight offers society. Helicopter Association International, Search Membership Directory, <https://www.rotor.org/Membership/SearchMembershipDirectory.aspx> (last visited Oct. 13, 2017).

219 This definition of "hotel" includes hotels, apartment hotels, bed-and-breakfasts, hostels, individual vacation units and timeshares. Properties with both condo and hotel units are included with the condominiums. *Data Book*, *supra* note 117 at Table 23.35. The largest number of accommodation type are the hotel rooms that are over \$500 per unit (17,609 units statewide). *Id.* at Table

- 2338.
- 220 Highest number are located on Maui (484) followed by Hawai'i (473), Kaua'i (337), and O'ahu (281). *Id.* at Table 23.35.
- 221 *SCORP*, *supra* note 121.
- 222 Among residents, hunting is more popular among Hawai'i Island and Kaua'i residents. *Id.*
- 223 As reflected in the Building Industry Association (BIA) of Hawai'i 2016 Membership Directory. The BIA is a not-for-profit trade organization chartered in 1955, affiliated with the National Association of Home Builders. The BIA of Hawai'i describes itself as the voice of the construction industry with the mission of promoting its members through advocacy and education, and providing community outreach programs to enhance the quality of life for the people of Hawai'i. *BIA-Hawai'i*, *supra* note 208.
- 224 Honolulu Marathon, National Football League's Pro Bowl, Ironman Triathlon, Sony Open, Moloka'i Hoe, Vans Triple Crown of Surfing, Maui Invitational, and the Hawaiian International Billfish Tournament. *SCORP*, *supra* note 121.
- 225 Marine Corps Base Hawai'i, Wheeler Army Airfield, Schofield Army Barracks, Fort Shafter Army Base, Barbers Point Coast Guard Air Station, Bellows Air Force Station, Kahuku Training Area, Makua Training Area, and Joint Base Pearl Harbor-Hickam. *SCORP*, *supra* note 121.
- 226 *Data Book*, *supra* note 117 at Table 23.43.
- 227 Kitesurfing and windsurfing is more active on Maui. *SCORP*, *supra* note 121.
- 228 Includes brokers and salesman with active real estate licenses. *Data Book*, *supra* note 117 at Table 21.30. Role of real estate agents could be to include options for potential voluntary ES purchases to their clients.
- 229 *BIA-Hawai'i*, *supra* note 208.
- 230 *SCORP*, *supra* note 121.
- 231 *Data Book*, *supra* note 117 at Table 23.29.
- 232 The number of visitors to Hawai'i is forecast to increase to nearly 10 million annual arrivals in 2040. *SCORP*, *supra* note 121.
- 233 O'ahu receives the largest number of visitors with 63% of the state's total. *Id.*
- 234 *Id.*
- 235 Braybrook & Barrera, *supra* note 13; C'Amato, *supra* note 21.
- 236 Hawai'i Community Foundation, *Hawai'i Fresh Water Initiative: A Blueprint for Action: Water Security for an Uncertain Future 2016-2018*, available at: <https://www.hawaiicommunityfoundation.org/learning/a-blueprint-for-action-water-security-for-an-uncertain-future-2016-2018> (last visited Oct. 13, 2017).
- 237 Catrina, Rorke, *Whitehouse-Schatz carbon tax moves in right direction, but falls far short*, R Street, <http://www.rstreet.org/2017/07/28/whitehouse-schatz-carbon-tax-moves-in-right-direction-but-falls-far-short/> (July 28, 2017); S.1639 - American Opportunity Carbon Fee Act, 115th Cong. (2017-2018), available at: <https://www.congress.gov/bill/115th-congress/senate-bill/1639> (last visited Oct. 13, 2017).
- 238 Rorke, *supra* note 238.
- 239 Climate Leadership Council, *Mission*, <https://www.clcouncil.org/mission/> (last visited Oct. 13, 2017).
- 240 *Id.*
- 241 PFM Group Consulting LLC, State of Hawai'i Tax Review Commission: Study of the Hawai'i Tax System (Draft Aug. 7, 2017), available at: https://www.tfhawaii.org/wordpress/wp-content/uploads/2017/10/Hawaii_Draft-Report_080717.pdf.
- 242 Kelley Hamrick & Melissa Gallant, *Unlocking Potential: State of the Voluntary Carbon Markets 2017* (May 2017).
- 243 *Id.*
- 244 These watershed partnerships are voluntary alliances of public and private landowners and managers. The forested areas managed through these watershed partnerships supply almost all of the hundreds of millions of gallons of fresh water needed in Hawai'i every year. Working across ownership boundaries, these partnerships leverage State efforts, pool funding, and provide a diverse range of local jobs. *Rain Follows the Forest*, *supra* note 4.
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- 246 Natural Res. Conservation Serv., U.S. Dep't of Agriculture, *NRCS Conservation Programs: Agricultural Conservation Easement Program (ACEP)*, https://www.nrcs.usda.gov/Internet/NRCS_RCA/reports/srpt_cp_acep.html (last visited Oct. 13, 2017).
- 247 Div. Forestry & Wildlife, State of Hawai'i, *Report to the Twenty-Seventh Legislature, Regular Session of 2014, Relating to the Forest Stewardship Program* (Nov. 2013).
- 248 *Id.*
- 249 *LCF & LLCP*, *supra* note 174.

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