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APR 2 5 2023

RESOLUTION 33, 2023

ADOPTING A CLALLAM COUNTY CLIMATE ACTION PLAN

THE BOARD OF CLALLAM COUNTY COMMISSIONERS finds as follows:

1. In 2008, at the direction of the County Administrator, a Climate Advisory Group comprised of employee volunteers met to discuss County practices that could positively affect the environment and reduce the County's carbon footprint and to develop recommendations to the Board of Commissioners.

2. The Climate Advisory Group developed a Climate Action Plan which was presented to and formally adopted by the Board of Commissioners in April 2009.

3. County employees subsequently implemented many of the suggestions and strategies outlined in the Climate Action Plan, helping to reduce the County's carbon footprint.

4. In 2018 under Resolution 62-2018 the Clallam County Board of Commissioners reaffirmed the County's commitment to climate action and resolved to re-establish the Climate Advisory Committee.

5. Starting in October 2021, the Climate Advisory Committee met over the following 15 months to develop the draft Clallam County Climate Action Plan (CAP) in consultation with Cascadia Consulting Group.

6. In addition to the financial support the Commissioners designated to fund the greenhouse gas emissions inventory portion of the plan, the North Olympic Development Council provided funding for Cascadia to assist with the development of strategies and recommendations aligned with the Greenhouse Gas inventory data.

NOW, THEREFORE, BE IT RESOLVED by the Board of Clallam County Commissioners in consideration of the above findings of fact:

1. The Board of Commissioners approve of the attached Clallam County Climate Action Plan and will encourage its implementation across all County departments.

PASSED AND ADOPTED this 25th day of April 2023

CLERK OF THE BOARD CLALLAM COUNTY COMMISSIONERS PORT ANGELES, WA

ATTEST:

Loni Gores, MMC, Clerk of the Board

BOARD OF CLALLAM COUNTY COMMISSIONERS

Mark Ozias, Chair

Randall L Johnson

Randy Johnson

Mike French

CLALLAM COUNTY

CLIMATE ACTION PLAN

EXECUTIVE SUMMARY

Beginning in 2022, Clallam County undertook a significant climate action initiative to develop a Climate Action Plan (CAP) to mitigate greenhouse gas (GHG) emissions from County government operations. The impacts of climate change are already being observed in Clallam County, including warmer maximum temperatures, rising sea levels along coastlines, and increased extreme weather events including drought and flooding.

This CAP sets the **foundation** for future climate action by outlining key strategies and actions across many focus areas that the County and its community can implement to reduce greenhouse gas (GHG) emissions and increase capacity for adapting to the impacts of climate change. This plan **prioritizes actions that can be implemented in the next five years** as the County takes steps toward meaningful climate action.

Climate Action Planning Process

The CAP was developed in an iterative process that included multiple rounds of discussion and refinement from the County's "**Climate Advisory Committee**" (CAC), an assemblage of County employees across various departments whose expertise and County insight helped to create a CAP that is tailored to Clallam County.

In addition to monthly meetings with the CAC, the CAP development process also included:

- An initial **review of County plans and policies** including the County's Parks Master Plan, Solid Waste Management Plan, and Shoreline Master Plan.
- 2019 communitywide and municipal **GHG inventories.**
- A **forecast** of Clallam County's future GHG emissions under different scenarios including a "no action" future, and a scenario that forecasts the impacts of state and federal climate action legislation.
- An **action-by-action analysis** process to determine benefits that could be provided to the community.

Greenhouse Gas Emissions

To understand Clallam County's GHG emissions, two types of inventories were prepared:

- A **geographic** inventory accounts for the emissions produced from activities that occur within a geographic or political boundaries of a community or local government.
- A **consumption-based** emissions inventory accounts for the emissions related to a community's carbon footprint, including beyond geographic boundaries, which includes the production, transportation, use, and disposal of goods and services consumed by the community.

These inventories establish a **baseline estimate** that can be used to measure progress into the future and illustrate priority areas for emissions reduction.

Geographic Emissions Inventories

As part of the CAP development process, two geographic inventories were completed:

A **communitywide GHG inventory** which includes all emissions that occur within Clallam County's geographic boundaries from residents, businesses, visitors, and industrial facilities.

A **government operations** inventory which includes GHG emissions produced by Clallam County's municipal operations, such as emissions from County fleet vehicles or energy used to power municipal facilities.

The results of the communitywide GHG inventory indicate that Clallam County's residents, businesses, employees, and visitors produced **459,517 metrics tons of carbon dioxide equivalent ($MTCO_2e$)** in 2019, approximately **6 $MTCO_2e$ per capita**. Figure 1 shows total emissions by sector:

- The **transportation** sector contributed the largest share of total emissions (73%).
- Emissions sources within the "Other" category consist of **industrial process emissions** (10%), **refrigerants** (9%), and **solid waste** (1%).
- **Energy** contributed 5% of total emissions and **agriculture** contributed 2% of emissions.

Figure 1. 2019 Communitywide Emissions by Sector (%)

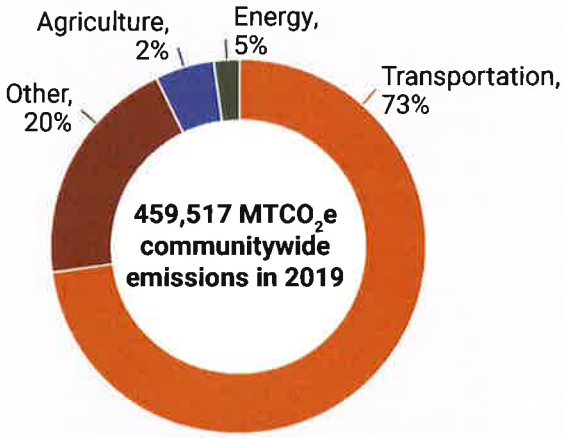
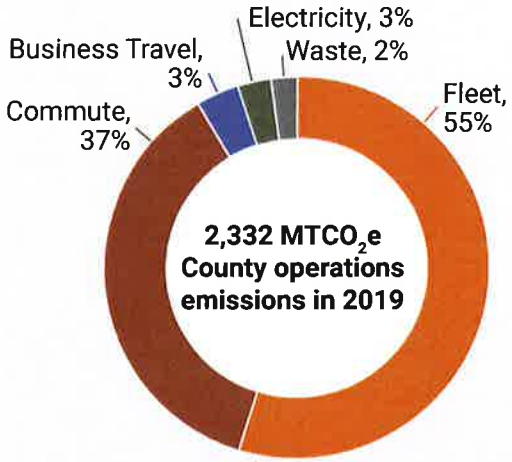


Figure 2. 2019 County Operations Emissions ($MTCO_2e$)



The results of the government operations emissions inventory show that the County produced **2,332 $MTCO_2e$** in 2019 (Figure 2), equivalent to approximately **5 $MTCO_2e$ per County employee**.

The vast majority (**95%**) of emissions produced by government operations are from transportation (County fleet vehicles, employee commute, business travel).

Consumption-Based Emissions Inventory

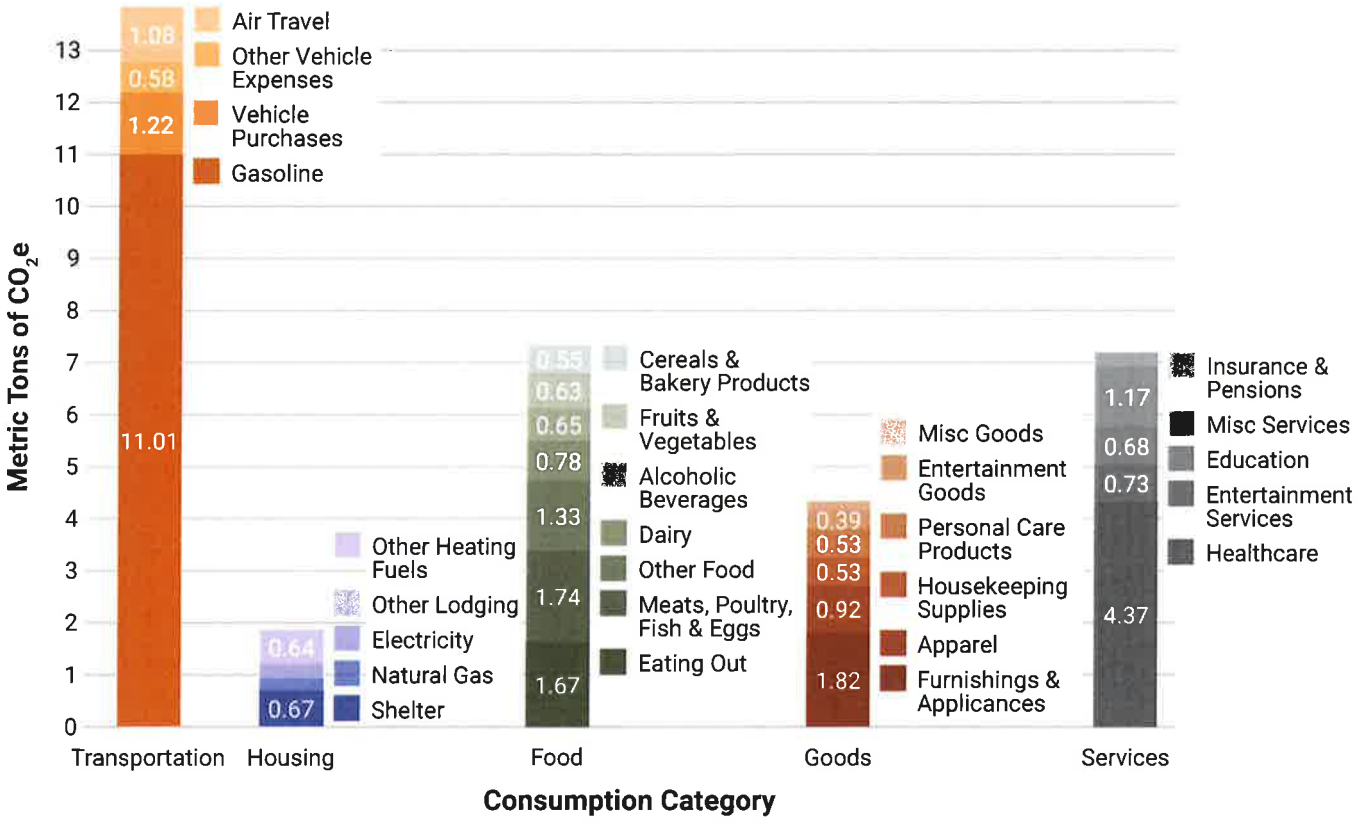
The consumption-based emissions inventory (CBEI) estimated that Clallam County's residents produced approximately **1.2 million $MTCO_2e$** in 2019. This means that on average, each household produced roughly 35 MTCO2e per year, or approximately **15 $MTCO_2e$ per person**.

The CBEI includes five categories: transportation, housing, food, goods, and services.

Figure 3 shows average emissions by source, per household. **Transportation** was the largest emissions category, followed by **food and services**. Overall, **gasoline** was the single largest source of emissions in 2019, followed by **healthcare**.[1]

CBEIs provide the community with insight on how to reduce their personal or household level emissions. The primary focus of this CAP is to outline actions that Clallam County can take to reduce GHG emissions in its facilities and operations going forward. Although the process for developing these strategies and recommendations has not yet included broad community engagement, it is the intention of the Commissioners to undertake a public engagement process for feedback on the approaches outlined in the plan.

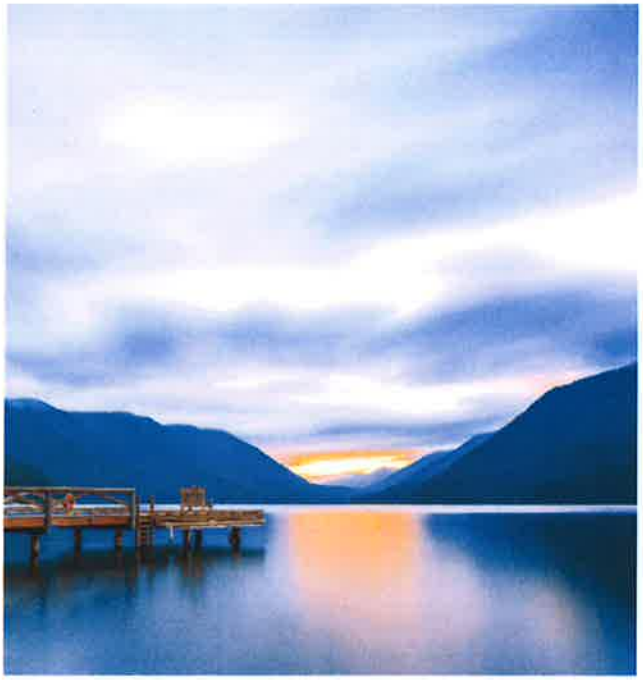
Figure 3. 2019 Consumption-Based Emissions ($MTCO_2e$/household)



1 Healthcare emissions include emissions from hospitals, doctor and dentist offices, and other medical facilities; pharmaceutical manufacturing; medical equipment; etc.

Goals, Strategies, and Actions

The goals, strategies, and actions presented below are a strategic mix of County- and community-focused initiatives and actions designed to reduce governmental and communitywide emissions. Developed with guidance from the County Climate Action Committee (CAC), these strategies and actions work to protect and maintain local natural resources and ecosystems, public health and safety, and economic vitality. Actions were prioritized if **highly impactful**, **easily implementable**, and/or **cost-efficient**.



To ensure longevity and success of the CAP, two main takeaways rose to the top during the CAP development process. First, the need for centralized management, monitoring, and implementation of actions and goals outlined in this plan to ensure focused progress and verifiable results. Secondly, the importance of implementing e-government solutions that could significantly impact emissions and the way Clallam government operates.

Focus Areas


Energy & Built Environment


Consumption & Solid Waste


Transportation


Land Use


Natural Environment

Energy & Built Environment

Goal: Decrease and mitigate emissions through clean energy and energy efficiency in the built environment.

Strategy	Action Name
Install and incentivize energy-efficient upgrades and retrofits	**1.1:** Install energy efficiency retrofits at County facilities **1.2:** Incentivize energy efficient retrofits and upgrades for residential and commercial buildings
Use cleaner energy-sources and increase resiliency of energy systems	**1.3:** Invest in community energy projects

EXECUTIVE SUMMARY

Consumption & Solid Waste

Goal: Reduce organic waste stream by half by 2030 through waste diversion and sustainable consumption.

Strategy	Action Name
Increase waste diversion to reuse, repair, and support edible food rescue	**2.1:** Expand food waste diversion and education programs **2.2:** Increase waste diversion in County Operations
Promote green purchasing and sustainable consumption	**2.3:** Expand on County sustainable purchasing policies and reduce paper waste in County Operations

Transportation

Goal: Increase transportation options, incentivize non-motorized transportation options, facilitate and plan for electrification of vehicles.

Strategy	Action Name
Reduce single-occupant vehicle miles traveled and support non-motorized transportation options	**3.1:** Create a County employee commute reduction program **3.2:** Develop a non-motorized transportation plan
Promote green purchasing and sustainable consumption	**3.3:** County fleet electrification and idle reduction **3.4:** Prepare for EV infrastructure and use

Land Use

Goal: Implement policies for sustainable, smart development that reduces urban sprawl, strengthens food systems, and increases conservation.

Strategy	Action Name
Invest in and support local food systems	**4.1:** Support existing gardening programs **4.2:** Invest in Clallam County's agricultural sector

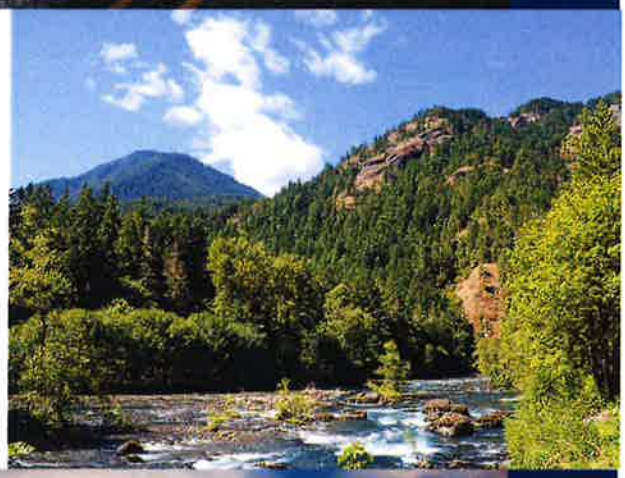
Natural Environment

Goal: Conserve and protect the environmental attributes and critical areas of Clallam County that contribute to the quality of life for all.

Strategy	Action Name
Protect natural resources and conserve water through policies and programs	**5.1:** Increase tree planting **5.2:** Increase native plant landscaping

CLALLAM COUNTY

CLIMATE ACTION PLAN



2023

TABLE OF CONTENTS

TABLE OF FIGURES

ACKNOWLEDGEMENTS

The following individuals served on the CAC at the time of this Plan's development, and provided valuable insight, without which this planning process would not have been possible.

CAC Member	Department
Angi Klahn	Accountant, Auditor's Office
Cathy Lear	Habitat Biologist, Community Development
Christina Epperson	GIS Analyst, Information Technology
Clea Rome (CAC Liaison)	Director, WSU Clallam County Extension
Diane Harvey	Special Assistant to Sheriff's Office Command Staff, Sheriff's Department
Don Crawford	Director, Parks, Fair, & Facilities
Eli Owens	Environmental Health Specialist, Health and Human Services
Elizabeth Stanley	Chief Civil Attorney, Prosecuting Attorney's Office
Jesse Goodman	Engineer, Public Works
Katherine Connors	Planner II, Community Development
Mark Doten	Director, Information Technology
Melanie Greer	4-H Coordinator, WSU Extension
Rich Meier	Clallam County Board of Commissioners

In addition to the CAC members, many external entities participated in this planning process in a variety of ways, including providing data for the communitywide GHG inventory, participating in the North Olympic Development Council's (NODC) planning processes, vetting and revising actions, and reviewing draft documents.

Prepared by:

CASCADIA CONSULTING GROUP

CLALLAM COUNTY

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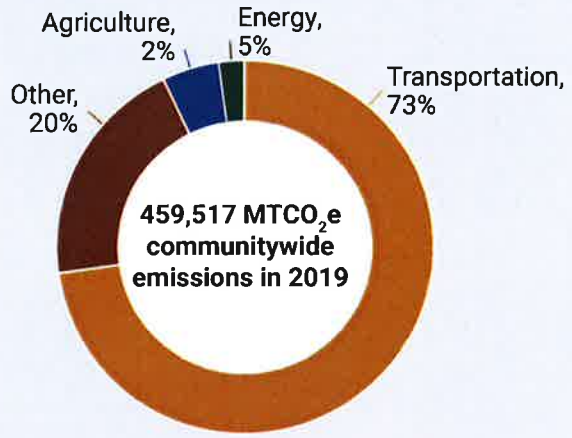

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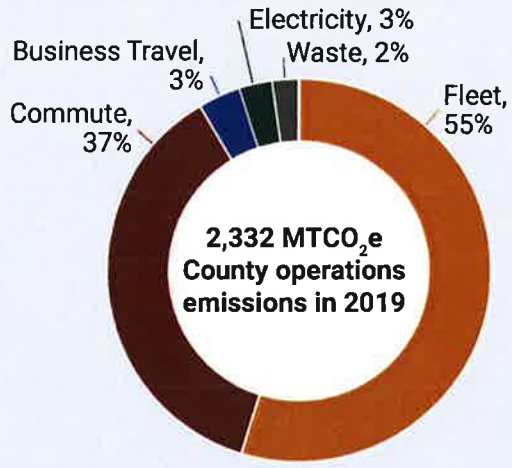

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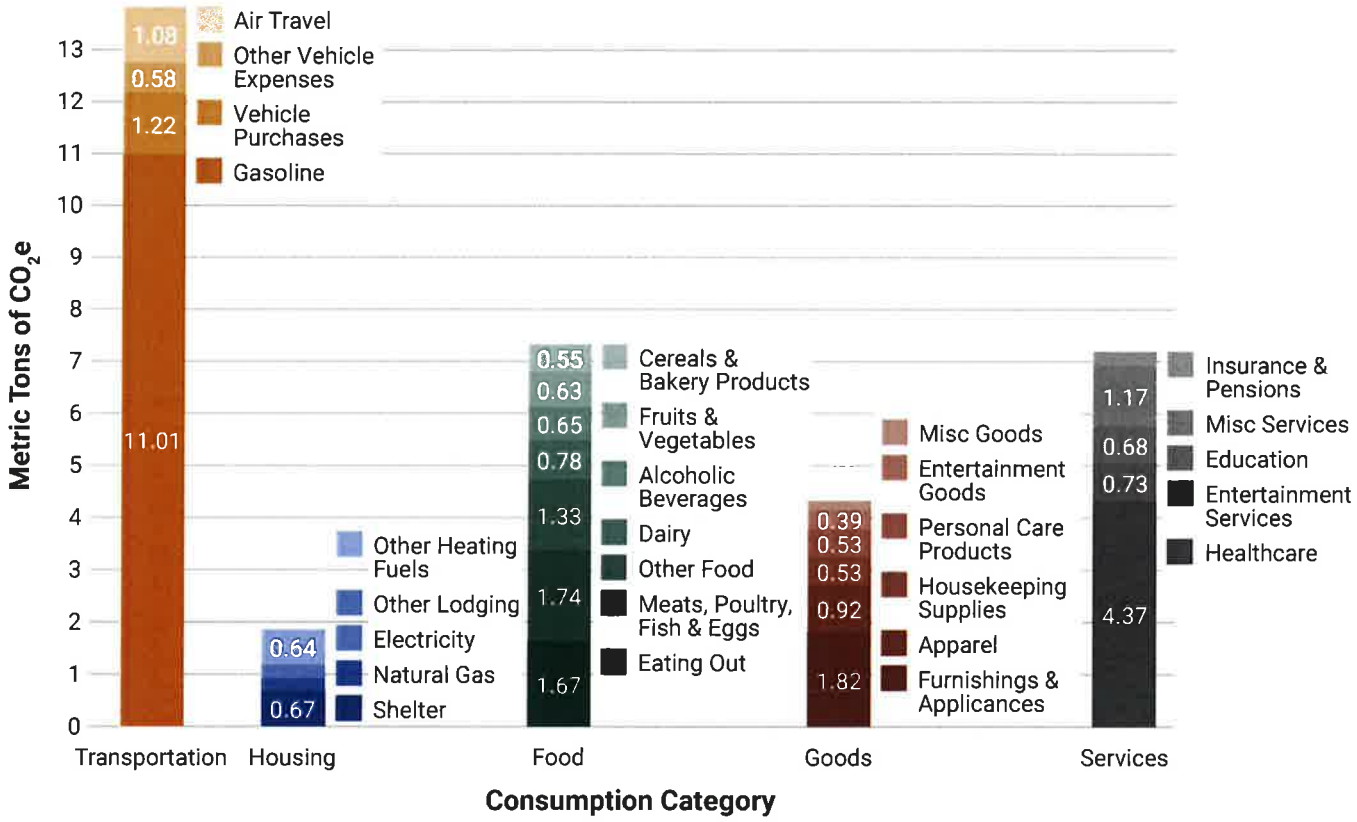

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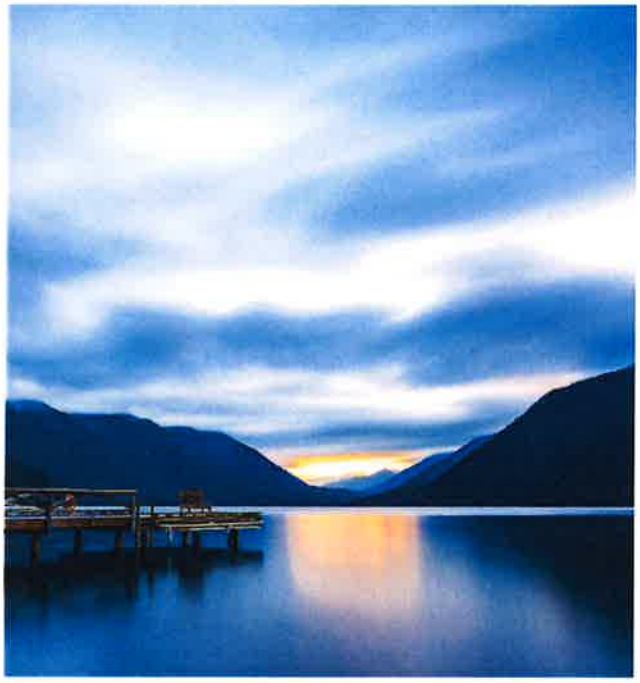

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[1] The primary focus of this CAP is to outline actions that Clallam County can take to reduce GHG emissions in its facilities and operations going forward. As such, this plan has not yet been shared and vetted with the larger community. It is the intention of the Commissioners to engage the public on this plan and future planning efforts to ensure communitywide actions are well supported and actionable. Engaging the community on their priorities and concerns will be a critical early step in ensuring the CAP is implemented equitably and does not create unintended consequences.

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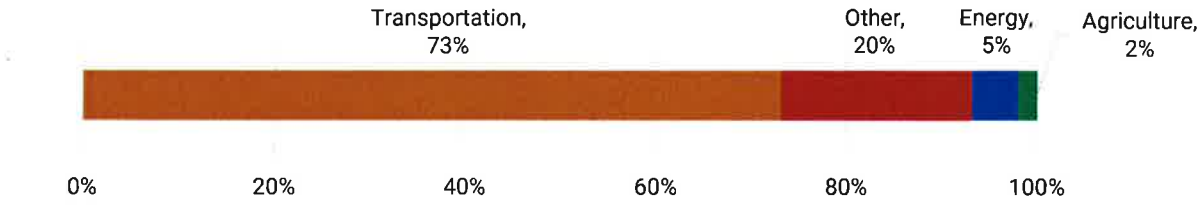

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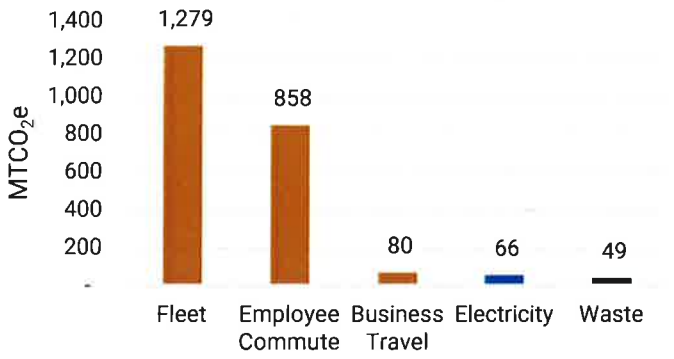

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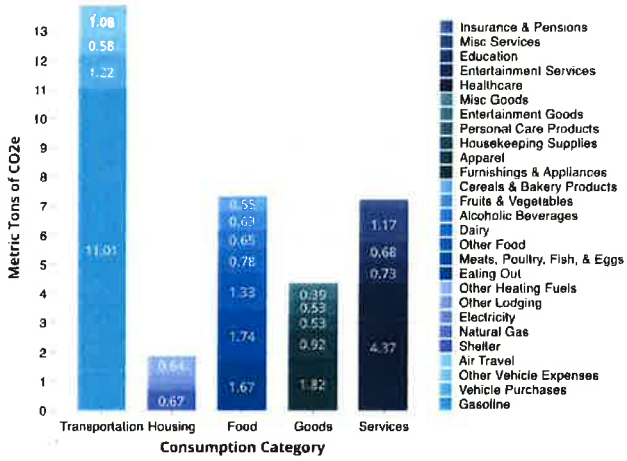

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	Focus Area	# of Strategies	# of Actions
	Energy & Built Environment	2	3
	Consumption & Solid Waste	2	3
	Transportation	2	4
	Land Use	1	2
	Natural Environment	1	2

Energy & Built Environment

Goal: *Decrease and mitigate emissions through clean energy and energy efficiency in the built environment.*

Strategy	Action Name
Install and incentivize energy-efficient upgrades and retrofits	1.1: Install energy efficiency retrofits at County facilities 1.2: Incentivize energy efficient retrofits and upgrades for residential and commercial buildings
Use cleaner energy-sources and increase resiliency of energy systems.	1.3: Invest in community energy projects

[3] The strategies and actions in this CAP were developed with funding from the North Olympic Development Council (NODC). In 2022, NODC provided consultant support to Clallam County to help guide the development of strategies in alignment with other local governments' climate action efforts, in addition to participation in NODC regional climate initiatives for collective action in the Olympic Peninsula.

Consumption & Solid Waste

Goal: *Reduce organic waste stream by half by 2030 through waste diversion and sustainable consumption.*

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Strategy	Action Name
Reduce single-occupant vehicle miles travelled and support non-motorized transportation options	3.1: Create a County employee commute reduction program 3.2: Develop a non-motorized transportation plan
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Land Use

Goal*: Implement policies for sustainable, smart development that reduces urban sprawl, strengthens food systems, and increases conservation.*

Strategy	Action Name
Invest in and support local food systems	4.1: Support existing gardening programs 4.2: Invest in Clallam County's agricultural sector

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Protect natural resources and conserve water through policies and programs	5.1: Increase tree planting 5.2: Increase native plant landscaping

ACRONYMS AND KEY TERMS

Carbon sequestration	The process of capturing and storing atmospheric carbon dioxide in soils, oceans, vegetation, and geologic formations. Because carbon sequestration removes emissions from the atmosphere rather than reducing the total emissions generated by a community, it should not be considered a direct emissions reduction. Instead, it can be considered as a method used to help achieve carbon neutrality. It is best practice to report GHG removals from sequestration processes separately to ensure transparency and meaningful and accurate reporting of progress made toward a community's GHG reduction and carbon neutrality goals.
Climate Action Plan (CAP)	A comprehensive roadmap developed by an entity that outlines specific strategies and actions that it will take to reduce greenhouse gas emissions and adapt to climate change impacts.
Climate change	The long-term change in global and regional climate patterns due to increased levels of atmospheric carbon dioxide and other greenhouse gases produced by human activities such as using fossil fuels like coal, oil, and gas.
Climate resilience	The ability of a community to prepare for, respond to, and recover from climate emergencies and impacts. Improving climate resilience is essential to the health and wellbeing of residents.
E-government	E-government focuses on information and communication technology (ITC) utilized and involves the digitization of procedures, documents, information, and services to improve governance through the deployment of modern technology.
Electric vehicles (EVs)	Vehicles that derive all or part of their power from electricity. – Plug-In Hybrid Electric Vehicles (PHEVs): Vehicles that run by using a combination of plug-in electricity and internal combustion. – Battery Electric Vehicles (BEVs): Vehicles that run completely on electricity using a battery that can be recharged by being plugged into the electric grid.
Electrification	The transition away from using natural gas and other fossil fuels to electricity (preferably generated from renewable energy sources like solar and wind) to power homes and vehicles.
Greenhouse gases (GHGs)	A heat-trapping gas that warms the atmosphere. The primary greenhouse gases of concern are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases.
Heat pump	An energy-efficient alternative to furnaces and air conditioners that uses electricity to move heat around rather than generating it, resulting in space heating and cooling.

Metric ton of carbon dioxide equivalent ($MTCO_2e$)	A common unit of measurement that represents an amount of a greenhouse gas whose impact on climate change has been standardized to that of one unit of carbon dioxide (CO_2), based on the global warming potential (GWP) of the gas.
Mixed-use development	Development that consists of a mix of uses such as residential, retail, commercial, office, government, and entertainment in the same building or in close proximity.
Net zero	The balance of greenhouse gas emissions produced through human activities and emissions removed from the atmosphere from processes such as carbon sequestration to offset emissions.
North Olympic Development Council (NODC)	A collaborative of member governments, community organizations, tribes and businesses on the North Olympic Peninsula aiming to advance economic, environmental and quality of life initiatives in the region.
Transit-oriented development	Walkable, pedestrian-oriented, and densely compacted mixed-use (commercial, residential, entertainment) development centered around or located near public transit stations.
Vehicle miles traveled (VMT)	A metric used in transportation planning to measure the cumulative miles traveled by all vehicles in a geographic region over a given time period.

INTRODUCTION

Clallam County has developed the following Climate Action Plan (CAP) to mitigate greenhouse gas (GHG) emissions from County government operations. The impacts of climate change are already being observed in Clallam County, including warmer maximum temperatures, rising sea levels along coastlines, and increased extreme weather events including drought and flooding.

This CAP **sets the foundation for future climate action** across a variety of areas including transportation, buildings, and land use. The CAP focuses on actions with the most greenhouse gas (GHG) emissions reduction potential while also prioritizing actions that will increase the county's climate resilience.

Background

The County's climate action work began in 2008 with the creation of a group of volunteer County employees serving on the County's **"Climate Advisory Committee" (CAC)**.

The County adopted its first CAP via Resolution 35 on April 21, 2009 which included suggested goals to support the reduction of the County's governmental GHG emissions.

The 2022 CAP significantly expands the inventory scope to include:

- 2019 communitywide emissions and forecast
- 2019 County operations emissions
- 2019 consumption related emissions
- Detailed strategies and implementation plan for reducing GHG emissions

Guiding Principles

This CAP was guided by one of the County's 2022/2023 mission statement objectives[4]: *"maximizing and enhancing our environmental resources for sustainability and legacy expectations."* The Plan builds on Clallam County's previous work, including:

- Multiple climate resolutions from the Board of County Commissioners (BOCC)
- 5-year Capital Improvement Plan
- Park And Recreation Master Plan
- Solid Waste Management Plan
- Stormwater Management (CCC Title 27.14)
- Shoreline Master Program (CCC Title 35)
- Critical Areas Code (CCC Title 27.12)
- County Comprehensive Plan

[4] Board of County Commissioners | Clallam County, WA (clallamcountywa.gov)

Climate Action Planning Process

The climate action planning process included both quantitative and qualitative analyses, a review of relevant County policies and programs, identifying potential strategies and actions, and vetting them with the CAC and other County staff to ensure that the final CAP is tailored to Clallam County and provides a foundation for climate action.

This CAP includes the results of the 2019 GHG inventories as well as strategies and actions designed to reduce governmental and communitywide emissions. The CAP development process is outlined in Figure 4 below.

Figure 4. CAP Development Process

Future Considerations

The primary focus of this CAP is to outline actions that Clallam County can take to reduce GHG emissions in its facilities and operations going forward. As such, this plan has not yet been shared and vetted with the larger community. It is the intention of the Commissioners to engage the public on this plan and future planning efforts to ensure communitywide actions are well supported and actionable. Engaging the community on their priorities and concerns will be a critical early step in ensuring the CAP is implemented equitably and does not create unintended consequences.

Additionally, this CAP prioritizes strategies and actions for implementation within the next five years. Additional analysis will be needed for longer-term planning.

CAP Organization

The CAP is organized into the following sections:

- **2019 Greenhouse Gas Emissions Inventories.** Summary of geographic and consumption-based inventories.
- **Strategies and Actions.** Summary of the strategies and actions intended to achieve the County's near-term climate action goals.
- **Implementation Plan**. Implementation planning details and key considerations for CAP strategies and actions including expected emissions impact, cost, and timeline, lead department, known funding sources, potential implementation partners, and equity considerations.

2019 GREENHOUSE GAS EMISSIONS INVENTORIES

Clallam County completed two types of greenhouse gas inventories as a part of this CAP:

- **Geographic inventory** which includes emissions produced or removed by activities occurring within a geographic or political boundary.
- **Consumption-based inventory** which includes emissions generated from the community's consumption of products and services (including the production, transportation, and disposal of these products).

Geographic Greenhouse Gas Inventory

Clallam County completed geographic communitywide and municipal operations inventories for Inventory Year 2019:

- **Geographic GHG Inventory**: accounting of GHGs emitted into and removed from the atmosphere over a period of time within a geographic or political boundary.
    - **Communitywide GHG Inventory**: includes all emissions that originate/occur within Clallam County's boundaries (e.g., residential, commercial, industrial, etc.).
    - **Government Operations GHG Inventory**: includes only emissions that are generated by Clallam County's municipal operations.

These inventories established a **baseline estimate** of Clallam County's community and government operations GHG emissions. The County's emissions can be **tracked and monitored** into the future using this baseline as a comparison point and **foundation for setting emissions reduction targets**. GHG inventories also help **identify the County's largest emissions sources** and point to where emissions reduction actions will be most impactful.

While geographic inventories are beneficial tools for understanding emissions produced within a defined boundary, they do not include "upstream" emissions related to the consumption of goods and services. See "Consumption-Based Emissions Inventory" chapter for details on these emissions.

Protocols

The 2019 geographic inventories were completed using the following protocols:

- **Communitywide Inventory**: Global Protocol for Community-Scale GHG Emissions (GPC). Where sufficient calculation methodology was unavailable in the GPC, the calculation methods follow guidance from the U.S. Community Protocol (USCP).
- **Government Operations Inventory:** The government operations inventory follows the local Government Operations Protocol (LGOP), version 1.1.

Inventory Calculation Tools

The 2019 Communitywide and Government Operations geographic GHG inventories were prepared in Microsoft Excel in accordance with the protocols listed above using the best available data sources and calculation methods.

The external tools below were used to calculate emissions from off-road transportation and forestry as they offered more precise emissions estimates, tools, data, and/or calculators:

- **Off-Road Transportation** | EPA MOVES Model
  EPA's Motor Vehicle Emission Simulator (MOVES NONROAD) estimates emissions for off-road vehicles and equipment at the county level by GHG, equipment type, and fuel type.
- **Forestry** | Global Forest Watch Analysis
  Global Forest Watch's (GFW) analysis tool uses the United States Department of Agriculture Forest Service's National Land Cover Database to provide an estimate of tree carbon sequestration and emissions produced from tree cover loss.

Descriptions of the data sources and external calculators used for each of Clallam County's emissions sources are provided in "Appendix A. Sources."

Communitywide Greenhouse Gas Inventory

The communitywide inventory quantifies communitywide emissions occurring within county's geographic boundaries from activities like transportation, energy consumption, and waste generation.

The following sections outline the methodology and results of the 2019 Clallam County communitywide GHG inventory. Note that communitywide inventories encompass emissions from County operations (except for operations located outside of county); refer to "County Operations Greenhouse Gas Inventory" for details on those emissions.

BOUNDARIES AND SCOPE

The communitywide inventory includes the following emissions sources with associated inventory protocol references and notations on calculation tools:

Sector	Base Emissions Sources	Inventory Protocol Ref.
Transportation	On-road transportation	• GPC 7.3 • USCP TR.1, TR.2
	Aviation	• GPC 7.6
	Marine vessels	• GPC 7.5 • USCP TR.7
	Off-road vehicles and equipment **	• GPC 7.7 • USCP TR.8

Sector	Base Emissions Sources	Inventory Protocol Ref.
Built Environment	Electricity consumption (residential, commercial, and industrial)	• GPC 6.1 • USCP BE.1, BE.2
	T&D losses (electricity)	• GPC 6.6 • USCP BE.4
	Fuel oil consumption (residential, commercial, and industrial)	• GPC 6.3 • BE.1
	Propane consumption (residential)	• GPC 6.3 • BE.1
Solid Waste	Community-generated solid waste	• GPC 7.3 • USCP SW.4
Agriculture & Forestry	Livestock	• GPC 10.1-10.4 • USCP A.1, A.2
	Soil management	• GPC 10.11-10.12
	Forest carbon sequestration and emissions from tree cover loss **	• Global Forest Watch
Process & Fugitive Emissions	Refrigerants	• GPC 9.4 • USCP BE.7
	Industrial process emissions	• GPC 9.4 • USCP BE.8.1

** ***Calculation tools:***
- *Off-Road Vehicles*: EPA MOVES tool
- *Forest Carbon Sequestration*: Global Forest Watch tool

Refer to "Appendix A. Sources" for information regarding data limitations and detailed assumptions used in the absence of more precise, local data.

INVENTORY RESULTS AND ANALYSIS

In 2019 Clallam County's residents, businesses, employees, and visitors produced **459,517** metric tons of carbon dioxide equivalent ($MTCO_2e$), as shown in Figure 5.
Figure 6 shows emissions broken out by specific activity sources.

- The community's total emissions are about **6 $MTCO_2e$** per capita (Clallam County's 2019 population was 76,010).
- The largest emissions sources in 2019 were on-road and off-road transportation (**57%** and **13%** respectively), industrial processes (**10%**), and refrigerants (**9%**).
- Compared to other jurisdictions in Washington, Clallam County's **emissions from its built environment are relatively low**, largely due to the County's use of 98% renewable electricity, minimal use of fuels such as propane and fuel oil, and no use of natural gas.

Figure 5. Total 2019 Communitywide GHG Emissions by Source.

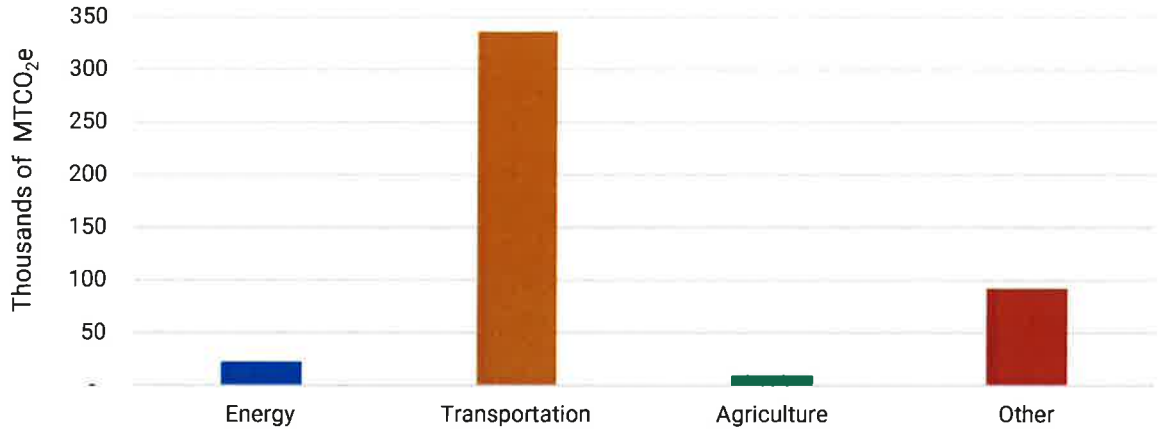
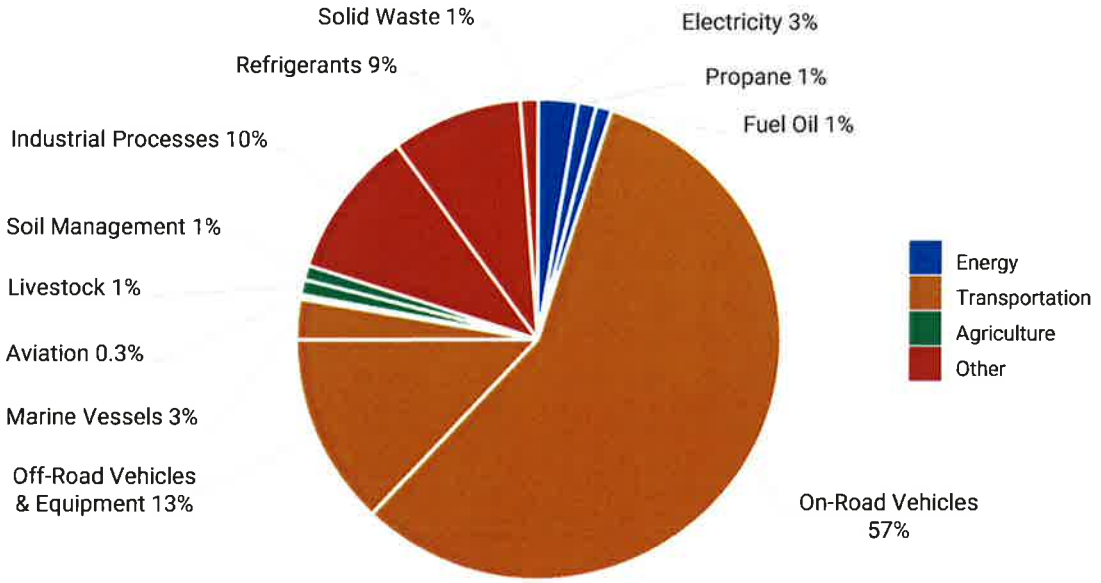


Figure 6. 2019 Communitywide GHG Emissions by Source (%)



Transportation | 335,847 $MTCO_2e$ | 73% of total emissions

- Transportation emissions accounted for **over 70%** of total communitywide emissions.
- On-road vehicle emissions represent **78%** of transportation emissions, while off-road, marine, and aviation emissions represented the remaining **22%**.

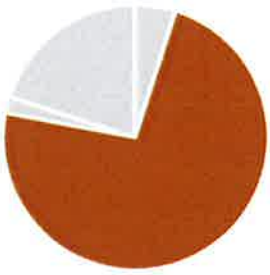
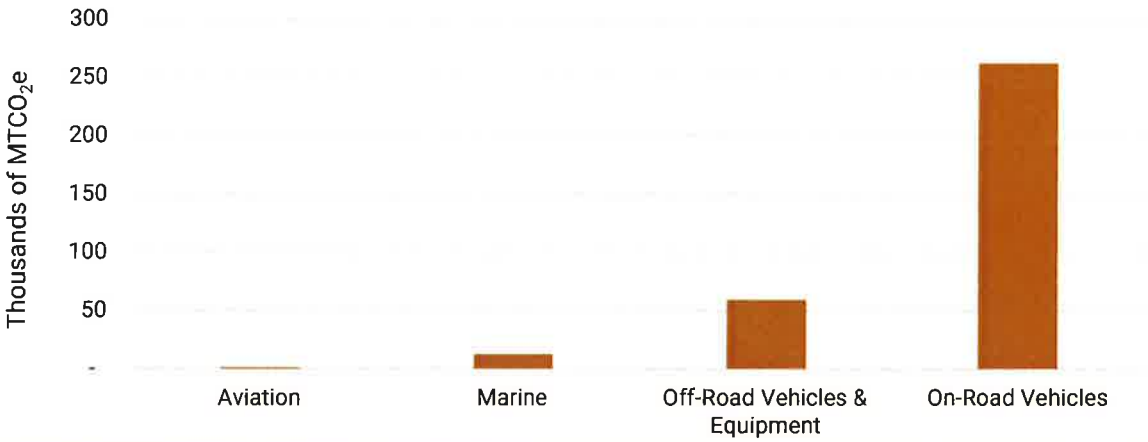


Figure 7. 2019 Community Transportation Emissions (thousand $MTCO_2e$)



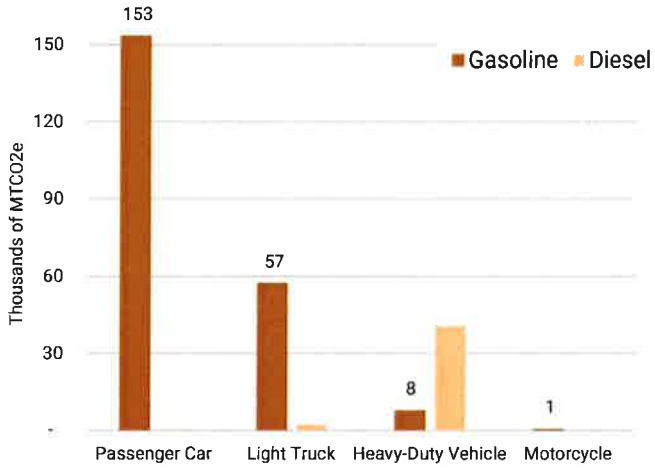
On-Road | 262,668 $MTCO_2e$ | 78% of transportation emissions | 57% of total emissions

On-road transportation emissions include emissions from gasoline and diesel-powered motorcycles, passenger vehicles, and light- and heavy-duty trucks within the boundaries of Clallam County.

On-road transportation emissions were calculated using County-specific data from the Washington State Department of Transportation's (WSDOT) Highway Performance Monitoring System (HPMS) and using national average vehicle fuel efficiencies.

Most on-road emissions (**59%**) are from passenger vehicles, followed by light trucks (**23%**). **83%** of emissions are from gasoline vehicles and **17%** from diesel.

Figure 8. On-Road Emissions by Vehicle Type (thousand $MTCO_2e$)



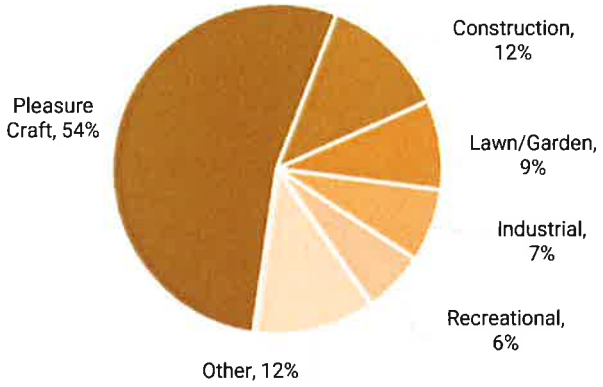
Off-road | 59,299 $MTCO_2e$ | 18% of transportation emissions | 13% of total emissions

Off-road transportation emissions were calculated using the EPA MOVES model (NONROAD module), which provides county level modeling data for off-road vehicles and equipment.

Off-road vehicle and equipment types include:

- Pleasure crafts (54%)
- Construction (12%)
- Lawn/garden (9%)
- Industrial (7%)
- Recreational (6%)
- Other (12%)
  - Commercial (4.3%)
  - Logging (4.5%)
  - Agriculture (2.7%)
  - Airport support (0.5%)

Figure 9. Emissions by Off-Road Vehicle Type (%)



As shown in Figure 9, pleasure crafts make up more than half of off-road emissions (**54%**), with the next largest sector being construction (**12%**). Lawn/Garden, Industrial, and Recreational vehicles make up **6-9%** each, and other vehicle categories (Agriculture, Commercial, Logging, Airport Support, Oil Field, and Railroad) emit a total of **12%** of off-road emissions.

MOVES calculates emissions by fuel type: liquefied petroleum gas (LPG), diesel, compressed natural gas (CNG), and gasoline. **97%** of off-road emissions are from gasoline (**54%**) and diesel (**42%**).

Marine Vessels | 12,551 $MTCO_2e$ | 4% of transportation emissions | 2.7% of total emissions

Marine emissions come from oceangoing vessels hoteling and maneuvering when departing from or returning to the Port of Port Angeles and from Black Ball Ferry operations.

- **54%** of marine emissions are from the Port of Port Angeles
  - 2019 emissions were estimated using the most recent data (2016) from the latest Puget Sound Maritime Air Emissions Inventory report (February 2018).
  - Total 2016 emissions were divided by total 2016 vessel movements to estimate "emissions per vessel movement." This rate was multiplied by 2019 vessel movements to estimate 2019 emissions.
- **46%** of marine emissions are from Black Ball Ferry
  - 2019 emissions from ferries were estimated using total fuel consumed by Black Ball Ferry.

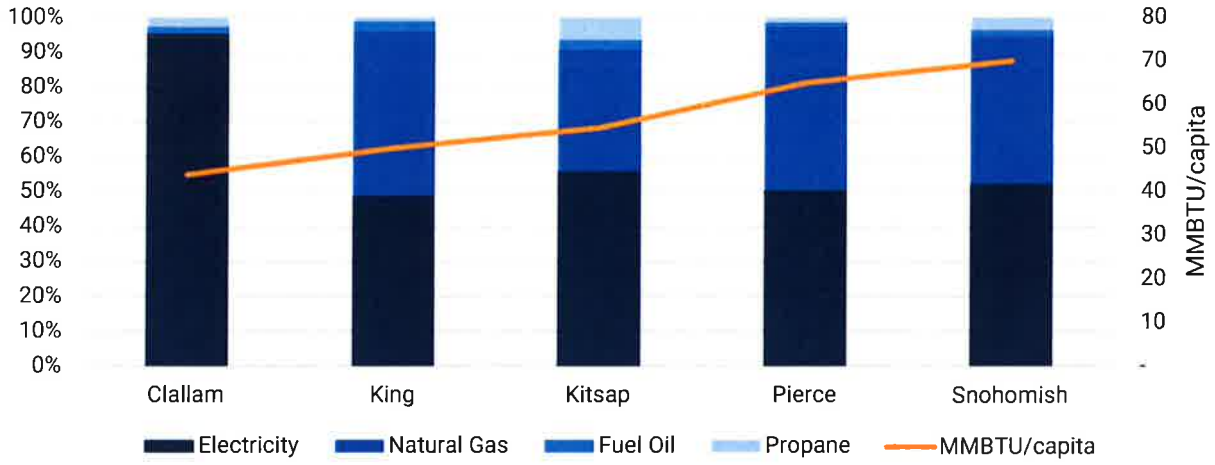
Aviation | 1,328 $MTCO_2e$ | 0.4% of transportation emissions | 0.3% of total emissions

Clallam County's aviation emissions come from fuel consumed by aircrafts at the Port of Port Angeles. **70%** of emissions are from consumption of jet kerosene (Jet A) and the remaining **30%** are from aviation gasoline.

Energy | 22,461 $MTCO_2e$ | 5% of total emissions

- Energy emissions accounted for **5%** of communitywide emissions.
- **95%** of total energy consumption is from electricity, followed by propane (**3%**) and fuel oil (**2%**), with no natural gas consumption.
- The county's proportion of total energy consumption from electricity is high compared to King, Kitsap, Snohomish, and Pierce counties as shown in Figure 10.
- Clallam County's total energy consumption in 2019 was **44 MMBTU/per capita**. This indicator is 14-59% lower than the total per capita energy consumption in King, Kitsap, Pierce, and Snohomish counties, shown in Figure 10.
- The magnitude of difference in total per capita energy consumption in Clallam County compared to the counties referenced above is attributed primarily to differences in the makeup of commercial and industrial sectors among these counties.
    - Residential energy consumption per capita in Clallam County in 2019 was **4-11%** lower than the per capita consumption in King, Kitsap, Pierce, and Snohomish counties.
    - Commercial energy consumption per capita in Clallam County in 2019 was **29-126%** lower than the per capita consumption in King, Kitsap, Pierce, and Snohomish counties.
    - Industrial energy consumption per capita in Clallam County in 2019 was about 2x as high as in Kitsap County, but was **200%+** lower than the per capita consumption in King, Pierce, and Snohomish counties.

Figure 10. Energy by County (% of all energy needs) and Total MMBTU/capita by County

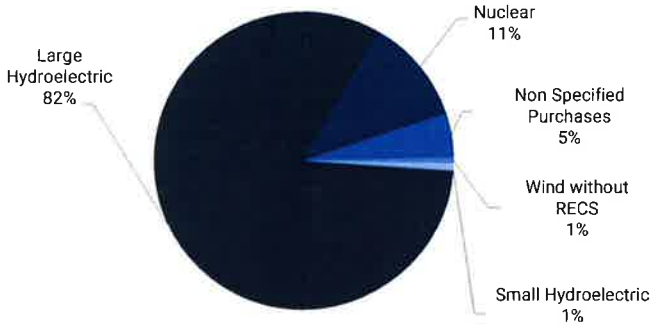


Electricity | 12,059 MTCO2e | 54% of Energy emissions | 2.6% of total emissions

Clallam Public Utility District and the City of Port Angeles provide Clallam County's electricity. All of these distributors source their electricity from Bonneville Power Administration (BPA), which supplies nearly carbon-neutral electricity through a fuel mix of hydroelectric, wind, and nuclear power. Figure 11 presents BPA's 2019 fuel mix.

Residential electricity consumption accounted for **63%** of emissions, followed by commercial (**33%**) and industrial (**4%**).

Figure 11. Bonneville Power Administration's 2019 Fuel Mix



Propane | 5,592 MTCO$_2$e | 25% of Energy emissions | 1.2% of total emissions

Clallam County's propane emissions were calculated by scaling residential propane consumption in Washington to Clallam County using census population data.

Despite accounting for only **3% of total energy consumption**, emissions from propane result in **25% of total energy emissions** due to its high emissions factor (i.e., the amount of emissions produced per unit of energy consumed).

Due to lack of data availability, only residential propane use was calculated in the 2019 inventory.

Fuel Oil | 4,810 MTCO$_2$e | 21% of Energy emissions | 1% of total emissions

Emissions from residential fuel oil use were calculated by downscaling the statewide number of households who use fuel oil to Clallam County using census data.

Commercial and industrial fuel oil emissions were calculated by scaling statewide commercial and industrial fuel oil consumption data to Clallam County based on number of employees.

Similar to propane, fuel oil makes up only **2% of energy consumption** but contributes **21% of energy emissions** due to its high emissions factor. 50% of fuel oil emissions are from usage in residential buildings, while the commercial and industrial sectors emitted 37% and 13% respectively.

Agriculture | 9,133 $MTCO_2e$ | 2% of total emissions

- Agricultural emissions stem from **soil management** practices (51%) and **livestock management** (49%), which total approximately 2% of total communitywide GHG emissions.

Livestock | 4,665 $MTCO_2e$ | 51% of Agriculture emissions | 1% of total emissions

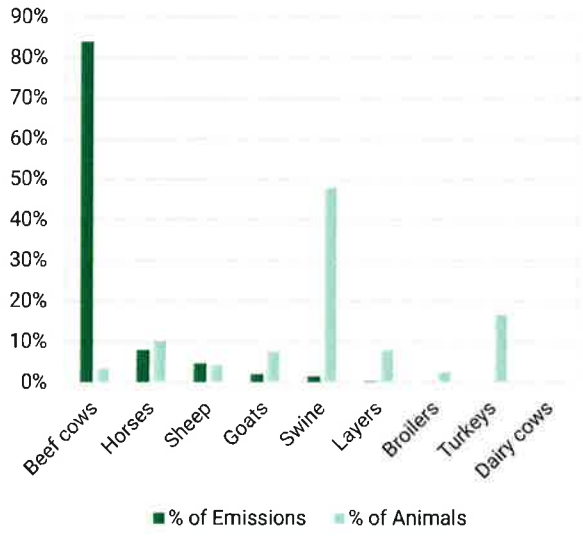
Emissions from livestock stem from two processes:

- **Enteric fermentation (94%)**
- **Manure management (6%)**

Enteric fermentation refers to livestock digestive processes which result in methane and nitrous oxide emissions.

As shown in Figure 12, the majority of livestock emissions come from beef cows (**84%**), which release more methane than other farm animals. **98%** of total livestock emissions come from beef cows[5], horses, goats, sheep, and swine. The remaining **2%** of livestock emissions are attributed to poultry[6].

Figure 12. Total Livestock (%) and Portion of Emissions by Livestock Type (%)



[5] The 2017 WA Census of Agriculture did not differentiate between cattle types, so it was assumed that emissions from cattle within Clallam County resulted from beef cows.

[6] Layers are egg-laying chickens and broilers are chickens raised for meat.

The emissions related to livestock are calculated using County level animal counts[7], as reported in the WA Census of Agriculture. Because this census is only released once every five years, 2019 livestock emissions were calculated using the 2017 Census.

Soil Management | 4,469 $MTCO_2e$ | 49% of Agriculture emissions | 1% of total emissions

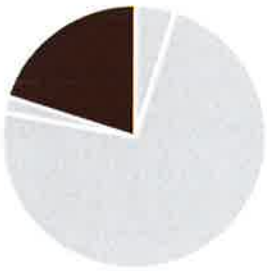
Soil management emissions represent direct and indirect emissions associated with the total number of acres of cropland in Clallam County, calculated using WA Census of Agriculture data.

- **Direct processes** include nitrification (conversion of ammonia to nitrate) and denitrification (conversion of nitrate to nitrogen gas) that naturally occur within soil and produce N_2O.
- **Indirect emissions** result from processes such as:
  - *Volatilization*: the conversion of liquid to gas
  - *Atmosphere deposition*: the process where liquids and gases in the atmosphere move to Earth's surface
  - *Surface leaching*: where fertilizer dissolves into water instead of soil
  - *Fertilizer run-off*: where fertilizer is not fully dissolved into soil and is washed off of the cropland by precipitation or other water sources.

Because the Census of Agriculture is only released once every five years, 2019 soil management emissions were calculated on the 2017 Census.

Other Emissions | 92,077 $MTCO_2e$ | 20% of total emissions

- "Other" emissions sources make up a total of **20%** of 2019 community emissions.
- The largest emissions source in this category is EPA-reported **industrial process emissions** (50%), followed by **refrigerants** (44%), and **solid waste** (6%).
- **Interfor US, Inc.** emitted 91% of EPA-reported industrial process emissions in Clallam County; **McKinley Paper Co.** emitted 9%.



Industrial Processes | 45,930 $MTCO_2e$ | 50% of Other emissions | 10% of total emissions

Washington facilities that have an air operating permit must submit their GHG emissions data to the Department of Ecology (Ecology) or local clean air agencies. Ecology collects emissions data through the Washington Emissions Inventory Reporting System (WEIRS).

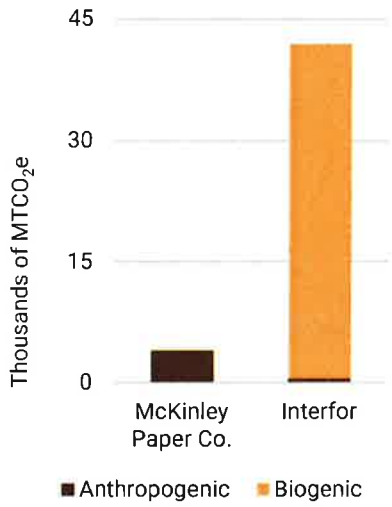
Two industrial facilities in Clallam County report to Ecology under **mandatory emissions reporting** requirements, both located in **Port Angeles**:

- **Interfor** is a sawmill that generates 91% of total EPA-reported industrial process emissions. Interfor is one of the world's largest forest products companies.[8]
- **McKinley Paper Co.** is a paper mill that generates 9% of total EPA-reported industrial process emissions. McKinley is part of Bio Pappel, the largest manufacturer of paper and paper products in Mexico and Latin America.[9]

89% of Clallam County's reported industrial process emissions are biogenic emissions, meaning that they are derived from organic matter, rather than from fossil fuel consumption (anthropogenic emissions). **Over 98% of Interfor's emissions are biogenic** and result from combustion of wood byproduct. This leftover material is used as fuel to produce steam. Note these emissions do not include the emissions resulting from tree cover loss; tree cover loss is discussed in the "Land Use" section below.

To provide a comprehensive picture of emissions in Clallam County, this inventory includes biogenic emissions in its net total. For the purpose of planning for mitigation strategies and actions, the **County may choose to exclude biogenic emissions** from this inventory total. The removal of biogenic emissions from this source would reduce the emissions contribution of Industrial Processes from 10% to 1% of Clallam County's total emissions.

Figure 13. 2019 Biogenic vs. Anthropogenic Industrial Process Emissions



Refrigerants | 40,432 $MTCO_2e$ | 44% of Other emissions | 8.8% of total emissions

Refrigerant emissions are created from the release of hydrofluorocarbons (HFCs), greenhouse gases that mainly used as a coolant in air conditioning and refrigeration equipment.

Refrigerant emissions in this inventory were estimated by downscaling national-level refrigerant emission data from the Environmental Protection Agency (EPA) to the local level using population data.

[8] Interfor | Quality Lumber | Moving Ahead in Bold Directions

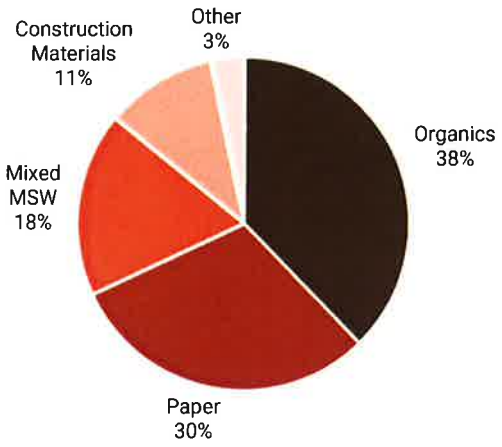
[9] ABOUT | McKinley Packaging

Solid Waste | 5,715 $MTCO_2e$ | 6% of Other emissions | 1.2% of total emissions

Emissions from the **generation and disposal of solid waste** were estimated by multiplying tons of county generated waste (as reported in the County's Solid Waste Management Plan) by material-specific emissions factors, derived from the EPA WARM v15 model.

The distribution of material types was approximated using the 2015-2016 Washington Statewide Waste Characterization Study's "West WGA" waste analysis.

Figure 14. Emissions by Waste Type (%)



Tree Cover

The way that lands are managed (e.g., forest conservation, agricultural practices) affect the exchange of GHGs between the atmosphere and land and can result in emissions or removals of carbon dioxide. Different land use types have differing levels of carbon stocks (stores of carbon) so changes across land use types result in differing levels of emissions and removals.

While these fluxes are an important consideration in climate action planning, tree carbon sequestration and emissions from tree cover loss were not included in the county's inventory totals based on the following considerations:

- **Inventory comparability**:
  - Emissions and removals from forestry are a **relatively new area** for inclusion in GHG inventories as these emissions have historically been challenging to measure accurately/efficiently.
  - Given the expanse of forested land in Clallam County, if emissions from tree cover loss were included in inventory totals they **would make up 84% of Clallam County's GHG emissions**.
  - Inclusion of these emissions would **increase the inventory total sixfold** and as such, make it difficult to meaningfully compare per capita emissions with jurisdictions that have not included this emissions source.
- **Geopolitical boundaries**:
  - Much of the forested land within the **County's geographic boundaries do not align with the County's political jurisdiction**; for example, Olympic National Forest (federal), WA Department of Natural Resources (DNR), and tribal lands all

fall within the County's geographic boundary but outside of their political control.[10]

- As the **County has little to no influence over how these lands are managed,** including these lands in the County's inventory is not meaningful for climate action development and implementation.

While these emissions were not included in inventory totals, they were calculated to inform climate action planning. Forestry related emissions were calculated using **Global Forest Watch's (GFW) land use change tool**. This tool uses several datasets including the GLAD (Global Land Analysis & Discovery) lab at the University of Maryland, NASA, the U.S. Geological Service, and the World Resource Institute to create an interactive dashboard which allows users to view estimated emissions resulting from land use changes (Figure 15).

Tree Cover Loss Emissions and Tree Carbon Sequestration Overview

Based on the GFW analysis described above:

- **Carbon sinks** sequestered (removed from the atmosphere) 5.03 million $MTCO_2e$ from the atmosphere in 2019 (Figure 16). Refer to "Carbon Sequestration" section below for details.
- **Tree cover loss** emitted 2.36 million MTCO2e in 2019 (Figure 18). Refer to "Tree Cover Loss" section below for details.
    - Tree cover gain and loss in Clallam County are shown in Figure 17 and Figure 18 (respectively), providing a geographic visual of the areas of Clallam County in which land use changes are occurring.

Emissions from tree cover loss and tree carbon sequestration are calculated and reported separately. Because carbon sequestration does not directly reduce the total amount of emissions generated by a community, emissions reductions from sequestration processes should be reported separately from GHG emissions (i.e., **GHG emissions from tree loss and tree carbon sequestration should not be netted in inventory total**).

[10] In future analyses, the County could develop a shapefile in a GIS platform that excludes the areas within the county's geographic boundary over which the County has no jurisdiction. This shapefile could then be uploaded into Global Forest Watch (GFW) or another emissions calculator that uses spatial analysis to zero in on only the forested lands the County has influence over.

Figure 15. Image of the Global Forest Watch dashboard for Clallam County.

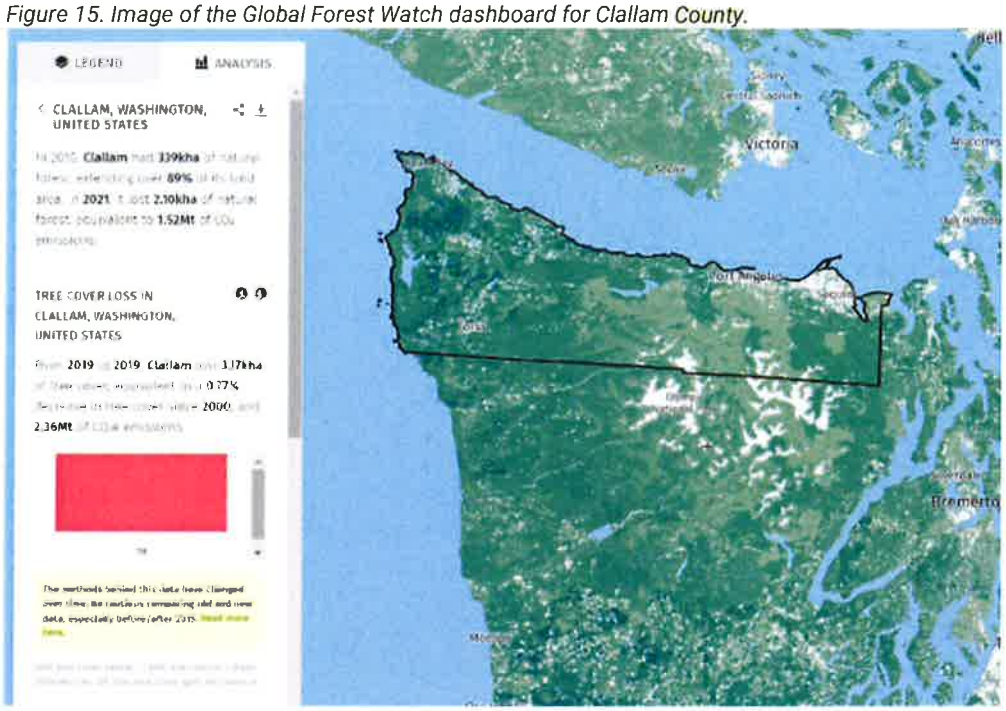


Figure 16. Average carbon sequestration rates in Clallam County, 2001-2021

*Figure 17. Tree Cover **Gain** in Clallam County, 2001-2012 (data only available through 2012)*

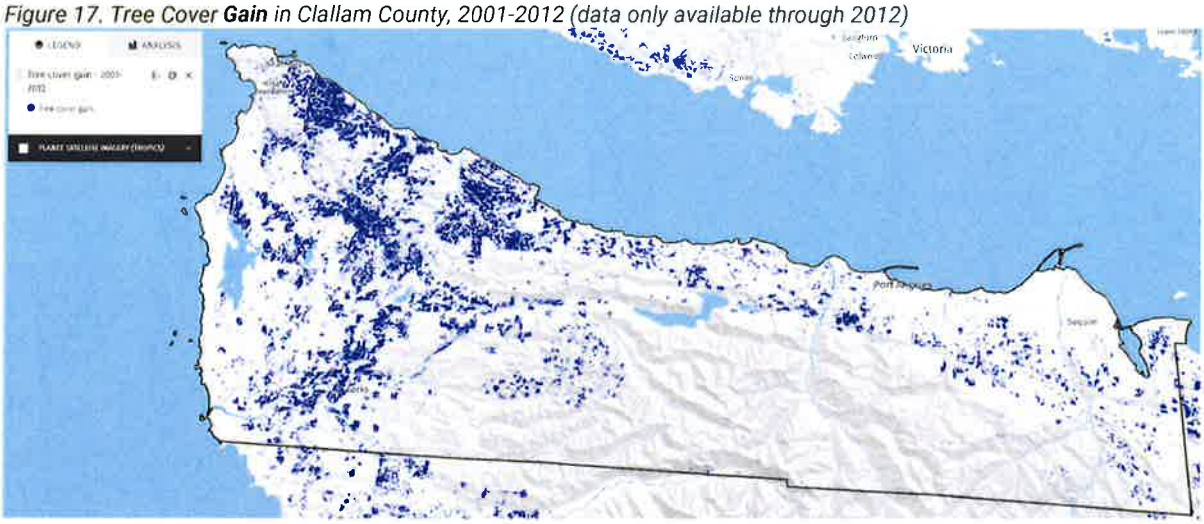
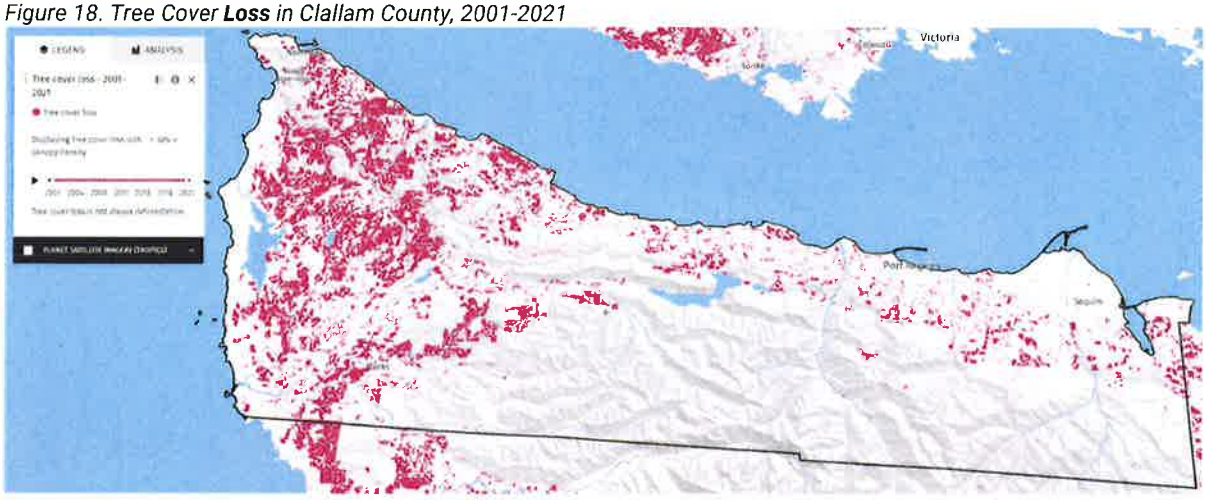


*Figure 18. Tree Cover **Loss** in Clallam County, 2001-2021*

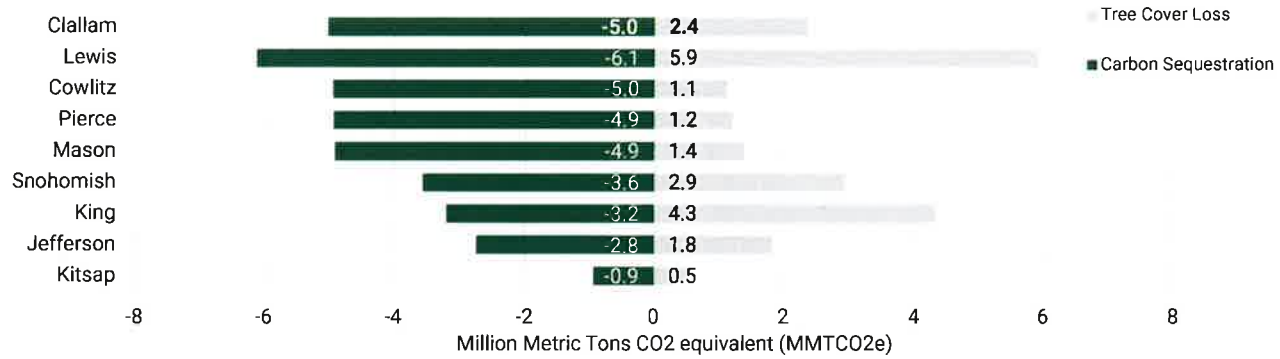


County Comparison

To contextualize Clallam County's tree cover loss emissions, GFW analysis results were compared across eight other Washington counties: Lewis, King, Jefferson, Snohomish, Pierce, Cowlitz, Mason, and Kitsap counties (Figure 19).

- Clallam County's tree cover **sequestered the second largest amount** of CO_2 of these counties. Refer to "Carbon Sequestration" section below for details.
- Clallam County's land management practices **generated the third largest amount of emissions**. Refer to "Tree Cover Loss" section below for details.

Figure 19. Emissions from Tree Cover Loss and Carbon Sequestration by County ($MMTCO_2e$).



Relationship to Consumption-Based GHG Emissions

While Clallam County has significant forested land which sequesters CO_2, cutting down trees for lumber or paper production produces GHG emissions. These tree cover loss emissions are related to the county's geographic GHG inventory as the activity occurs within the county's boundary.

When measuring GHG emissions from a consumption-based perspective, however, these emissions are attributed proportionately to the consumers of these lumber and paper products, regardless of where the tree cover loss occurred. Refer to Consumption Based Emissions Inventory section below for details on Clallam County's consumption based GHG emissions profile.

Carbon Sequestration | -5,030,000 $MTCO_2e$

GHG emissions sequestered by trees as a passive process are stored within trees as a carbon sink and are temporarily prevented from being emitted into the atmosphere. In 2019, Clallam County's **tree cover sequestered an estimated 5.03 million metric tons of CO_2e** – approximately **4.5 metric tons per acre of land** in Clallam County. When compared to eight other counties in Washington State, Clallam County's tree cover sequestered the largest amount of carbon per acre, shown in Figure 21.

Figure 20. Emissions from Carbon Sequestration by County ($MTCO_2e$ per acre)

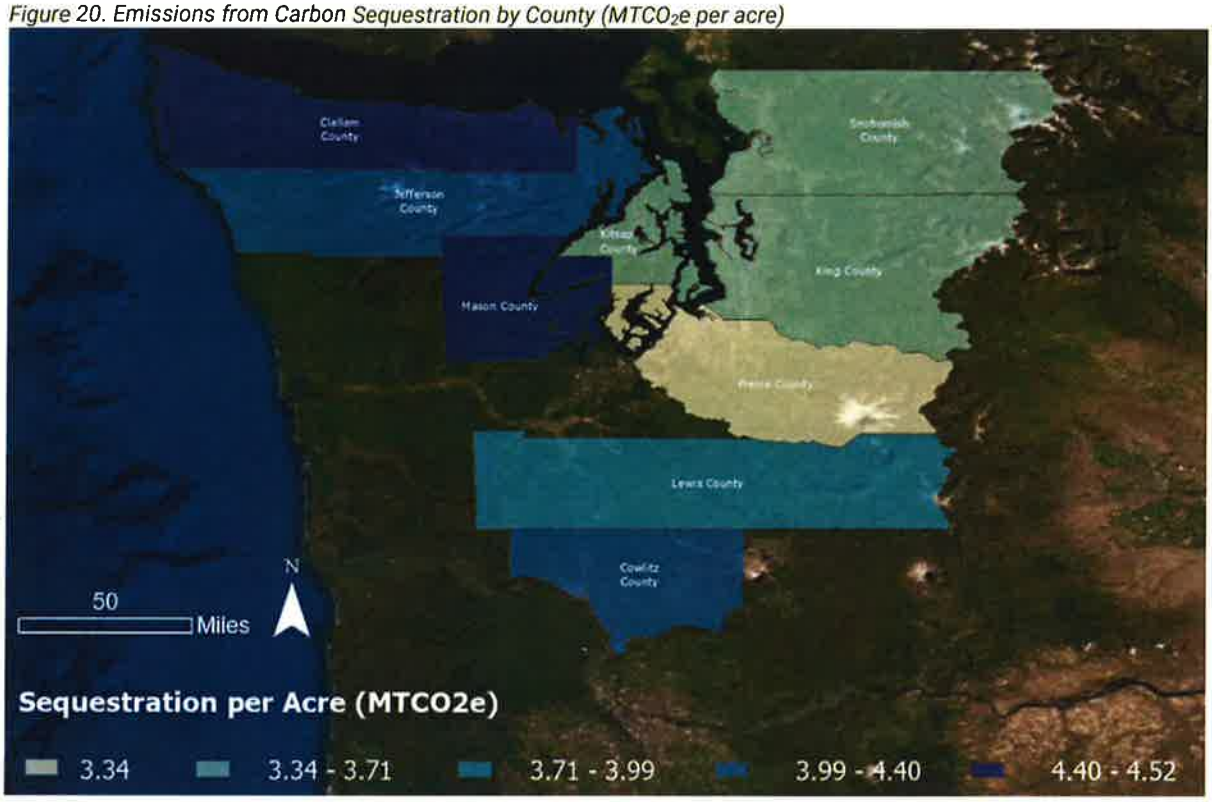
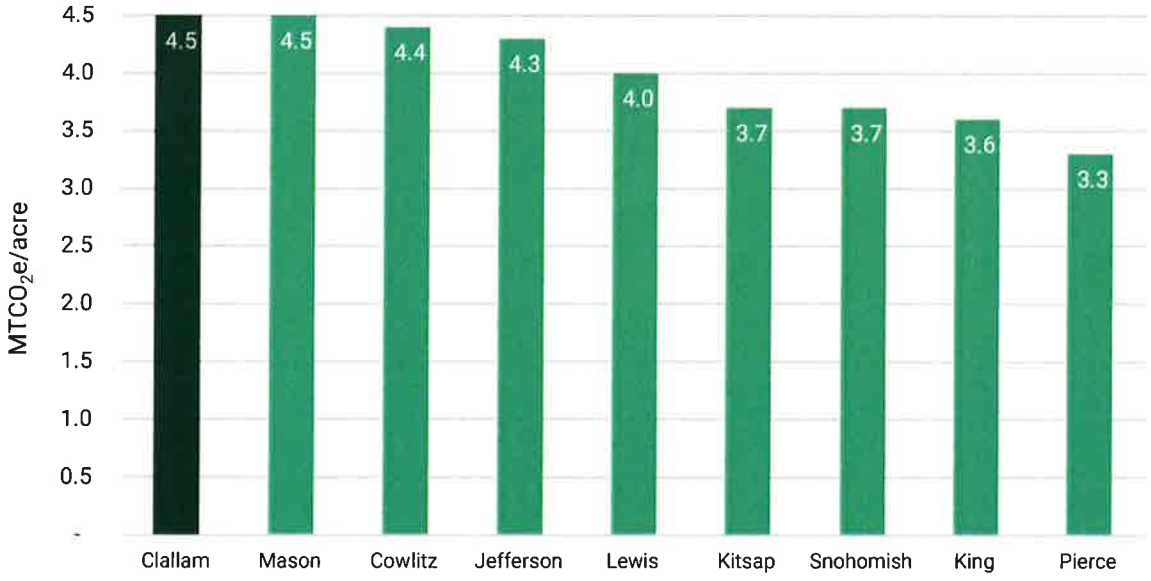


Figure 21. Tree carbon sequestration per acre of land (MTCO2e/acre)



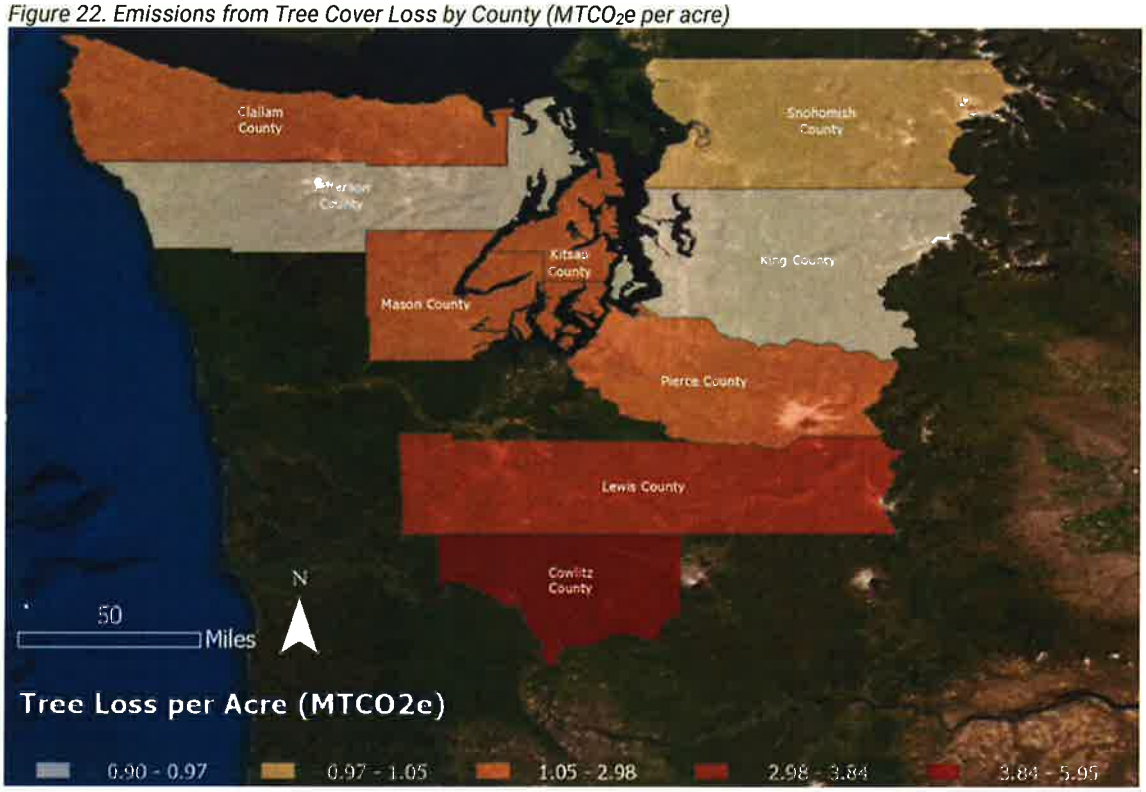
Tree Cover Loss | 2,360,000 $MTCO_2e$

Tree cover loss emissions resulted from the **loss of 3.17 kilo hectares (kha) of tree cover**. Reasons for tree loss could include deforestation, fire, and/or logging.

The GFW tool reflects gross instead of net loss because "*in sustainably managed forests, the "loss" will eventually show up as a "gain," as young trees get large enough to achieve canopy closure*" [Global Forest Watch]. For this analysis, **tree cover is defined by the GFW tool as vegetation greater than 5 meters in height.**[11] As a result, although County regulations require replanting activity to replace tree cover loss, the tree cover gain will not appear in this analysis until reaching five meters in height.

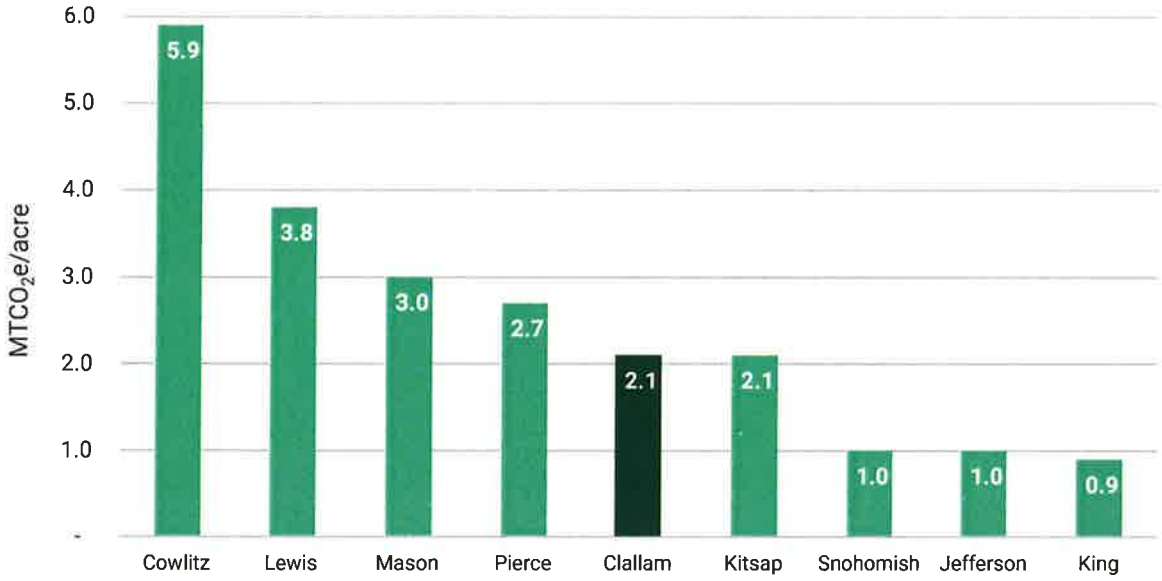
Tree cover loss resulted in an estimated **2.36 million $MTCO_2e$**; approximately **2.1 $MTCO_2e$ per acre of land**. When compared to the eight counties shown in Figure 23, Clallam County's emissions from tree cover loss were slightly below average.

Figure 22. Emissions from Tree Cover Loss by County ($MTCO_2e$ per acre)



[11] Interactive World Forest Map & Tree Cover Change Data | GFW (globalforestwatch.org)

Figure 23. Tree cover loss emissions per acre of land (MTCO2e/acre)



County Operations Greenhouse Gas Inventory

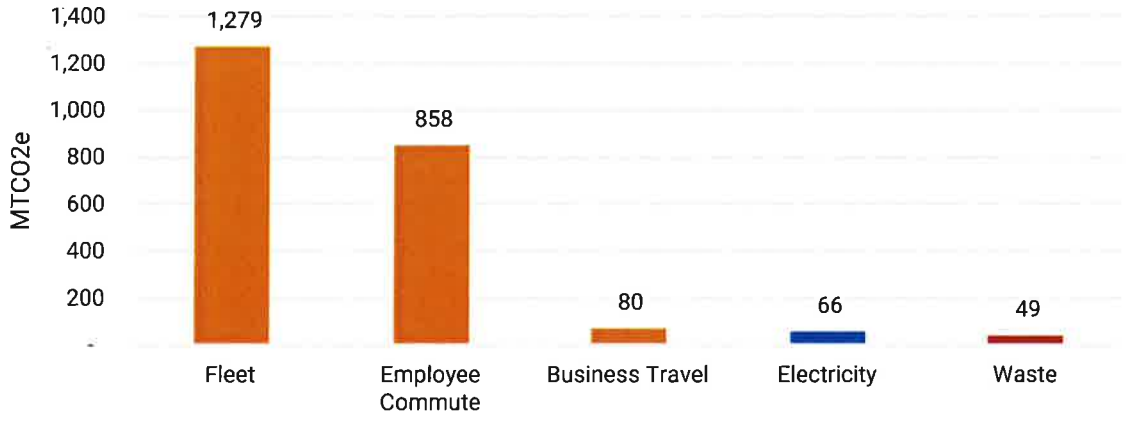
The County Operations GHG inventory includes the sources below for the County's governmental operations only.

Emissions Sources	Inventory Protocol Ref.
Energy use in (1) municipally owned and/or operated buildings and facilities; and (2) streetlights and traffic signals	LGOP 6.2.1
County's vehicle fleet and fuel-consuming equipment	LGOP 7.1.1.1
Employee commute and business travel	LGOP 12.2.1
Solid waste generation	LGOP 9.3.1-3

INVENTORY RESULTS AND ANALYSIS

County operations produced **2,332** $MTCO_2e$ in 2019, as shown in Figure 24. The **largest source of GHG emissions (95%) is from transportation**. The County's transportation emissions results from usage of fleet vehicles, business travel, and employee commute choices. Remaining emissions are from **energy** consumption and **solid waste** generation, accounting for 3% and 2% of County emissions respectively.

Figure 24. Total 2019 County Operations GHG Emissions by Emissions Source (MTCO2e).



GHG emissions can be categorized into three "scopes," related to the extent of control over the emissions source:

- **Scope 1**. Direct emissions from sources from stationary and mobile combustion such as County owned vehicles such as the County's fleet.
- **Scope 2**. Indirect emissions that result from the purchase of electricity, steam, or other heating and cooling sources.

- **Scope 3**. Indirect emissions resulting from activities the jurisdiction has minimal influence over such as employee commuting and business travel.

As such, the County has more direct influence and control over emissions from its own fleet vehicles as compared to emissions from employee commuting and business travel. This dynamic should be considered in climate action planning to prioritize the areas where the County has the most operational control.

Vehicles

- Transportation emissions account for **95% of 2019 County operations emissions**.
- **Fleet emissions** represent 58% of transportation emissions, split nearly evenly between gasoline and diesel vehicles.
- 98% of fleet emissions can be attributed to **on-road vehicles** while only 2% result from **off-road vehicles**.
- **Employee commute** makes up 39% of transportation emissions. Commute emissions are about 5 $MTCO_2e$ per employee (the County had 464 employees in 2019).
- **Business travel** represents the remaining 3% of transportation emissions.

Fleet Vehicles | 1,279 $MTCO_2e$ | 58% of transportation emissions | 55% of total emissions

Fleet transportation emissions include emissions from gasoline and diesel-powered vehicles (passenger, light-duty, and heavy-duty) owned by Clallam County.

- 52% of fleet emissions are from **gasoline** vehicles, while are from **diesel** vehicles (Figure 25).
- Only 2% of fleet emissions were from **off-road vehicles and equipment**.

Figure 25. Fleet Emissions by Fuel and Type (%)

Employee Commute | 858 $MTCO_2e$ | 39% of transportation emissions | 37% of total emissions

Employee commute emissions were calculated based on an **internal survey** conducted by County staff, surveying staff's average commute length, method, and frequency. In 2019, the County had 464 employees, however only 173 participated in the commute survey and many only responded to specific questions. Due to a lack of full participation and a lack of more complete data, this **sample may not be representative of all County staff**.

79% of employees surveyed commuted to work using their personal vehicle, while approximate 10% work from home, and the remaining 11% indicated that their commute types include: carpool, public transportation, walking, biking, riding a motorcycle, or another commute method.

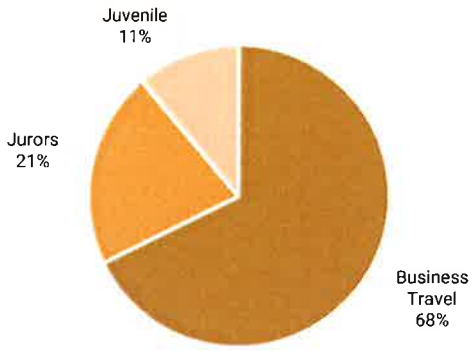
99% of employee commute emissions are from single occupancy vehicles, while 1% are a result of carpooling and motorcycle usage. For this inventory, using public transportation to ride to work was considered an insignificant source of emissions.

Business Travel | 54 $MTCO_2e$ | 3% of transportation emissions | 3% of total emissions

In 2019, business travel emissions associated with County emissions resulted from activities including:

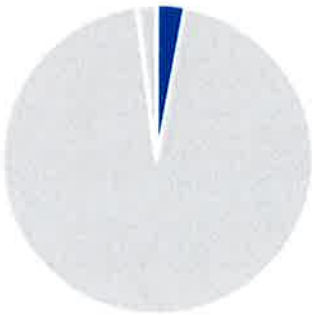
- **County employee business travel (68%)**
  Includes travelling between sites, attending conferences, etc. Does not include employee commute to and from their regular place of work.
- **Juror travel (21%)**
  Community members selected to serve on a jury travel between their place of residence and the courthouse. This travel is attributed to the County because jurors are required to travel.
- **Juvenile service volunteer travel (11%)**
  Community members within Clallam County may volunteer for the County's Child Advocate Program to serve youth in dependency. Emissions related to travel while volunteering are attributed to the County.

Figure 26. Emissions by Business Travel type (%)



Energy| 66 MTCO2e | 3% of total emissions

- 2019 electricity use produced **66 $MTCO_2e$**, approximately 3% of all 2019 County GHG emissions.
- County facilities do not use stationary fuels such as natural gas, propane, or fuel oil, meaning that **100% of the County's energy consumption is from electricity**.



The County's electricity is provided by Clallam Public Utility District, the City of Port Angeles, and Jefferson PUD. Each of these distributors source their electricity from Bonneville Power Administration (BPA), a utility that supplies nearly carbon-neutral electricity through a fuel mix of hydroelectric, wind, and nuclear power.

Solid Waste

- Solid Waste emissions make **2%** of 2019 County Operations emissions.
- Total waste tonnage for the County was calculated using solid waste invoicing information and waste pickup frequency.
- Emissions from the **generation and disposal of solid waste** were estimated using an emission factor derived from the EPA WARM v15 model.

Consumption-Based Emissions Inventory

While geographic GHG inventories represent the emissions over which local governments typically have the most influence, consumption-based emissions inventories (CBEI) recognize that a **community's carbon footprint extends beyond its jurisdictional borders**.

Typically, consumption-based emissions from the **production, transportation, use, and disposal of goods and services consumed by a community** are significantly higher than geographic emissions because they account for these additional sources.

In 2019, the average Clallam County household was responsible for roughly 35 $MTCO_2e$ (Figure 27), or about 15 $MTCO_2e$ per person. With 33,022 households in the county, this is a total of roughly **1.2 million $MTCO_2e$**.

Consumption-based emissions include five categories: **transportation, housing, food, goods, and services**.

- **Transportation** was the single largest category of emissions, followed by **food and services**.
- **Gasoline** was the single largest source of emissions overall, among all sub-categories.

Figure 27 provides an overview of the county's average per-household emissions. Differences in household size, spending, housing, travel, and other discretionary and non-discretionary factors affect individual household's emissions. Refer to *Appendix B. Consumption-Based Inventory Report* for full inventory results.

Figure 27. Average household consumption-based emissions by category (MTCO2e).

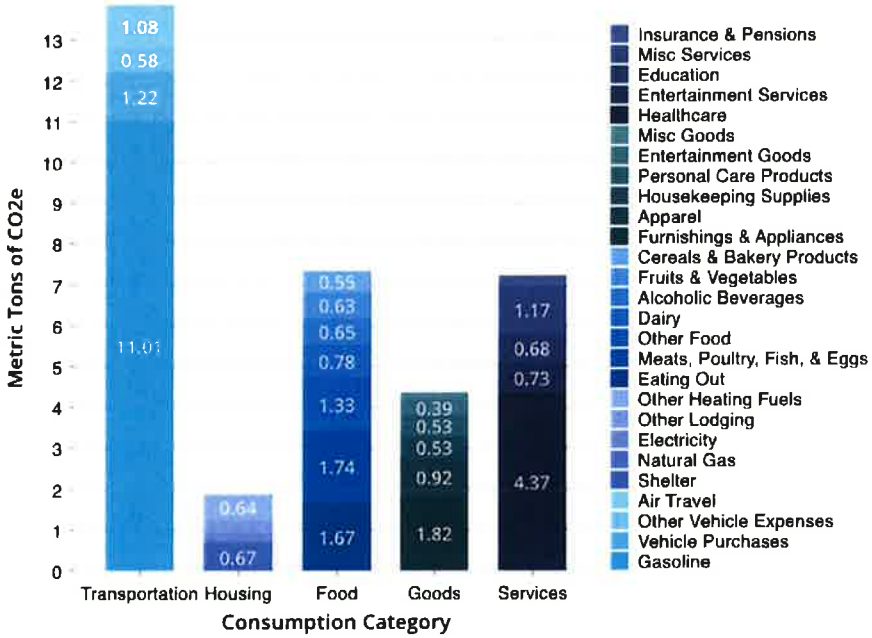
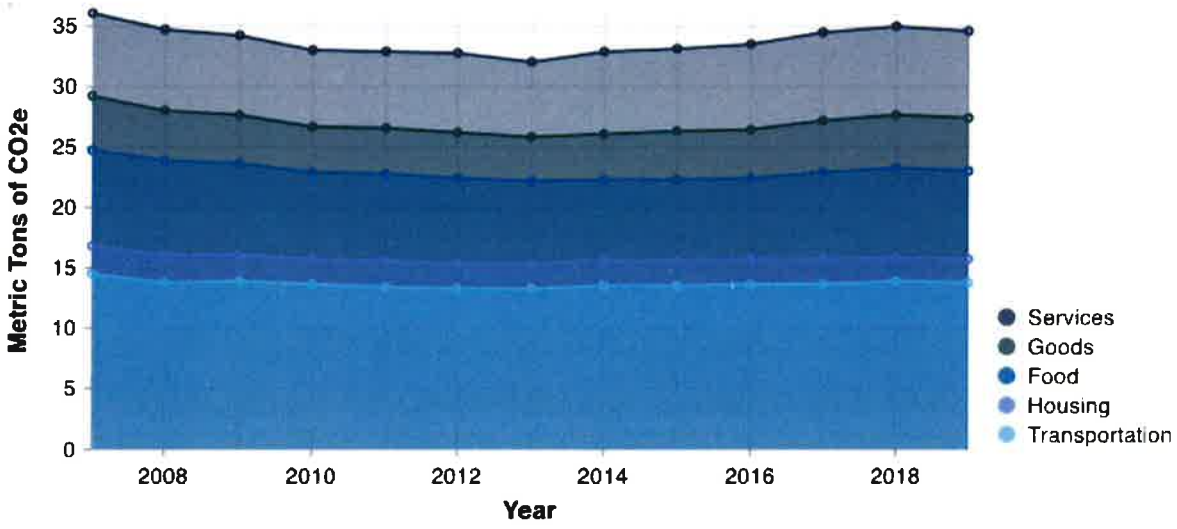


Figure 28 shows Clallam County's **per household emissions decreased 4% from 2007 to 2019**, approximately 1.4 MTCO2e per household. Over the same time period, **national consumption-based emissions declined by over 12%**, largely due to the use of cleaner electricity and vehicles. Clallam County's emissions trends have not been as significant as the national average likely due to the County's historic and continued use of clean power from BPA.

Figure 28. Historical CBEI trends (2007-2019)



Consumption based emissions inventories are a beneficial tool to help a community **identify priority areas for emissions reduction on an individual or per household level**. For example, the largest source of 2019 consumption-based emissions in Clallam County was from gasoline consumption. Examples of strategies that households can employ to reduce their emissions from gasoline usage include transitioning to a hybrid or electric vehicle or choosing alternative transportation methods where possible, such as taking public transit, walking, biking, or scootering.

Emissions Forecast

While GHG inventories provide a current snapshot of the county's emissions, the wedge analysis below (Figure 29) illustrates how emissions are projected to change into the future.

- **"No action" scenario**: The black dotted line represents projected growth in emissions in the absence of federal, state, or local climate action. In this scenario, emissions are projected to grow 7.5% from 2019 to 2050. Population projections were used to forecast emissions growth.
- **Federal and state policies**: The orange, blue, and maroon wedges represent the emissions reduction expected from the adopted federal and state climate policies below. Collectively, these policies are expected to reduce emissions 26% from 2019 to 2050.
    - Federal Vehicle Regulations: Corporate Average Fuel Economy (CAFE) standards are fleet-wide averages that must be achieved by each automaker for its car and

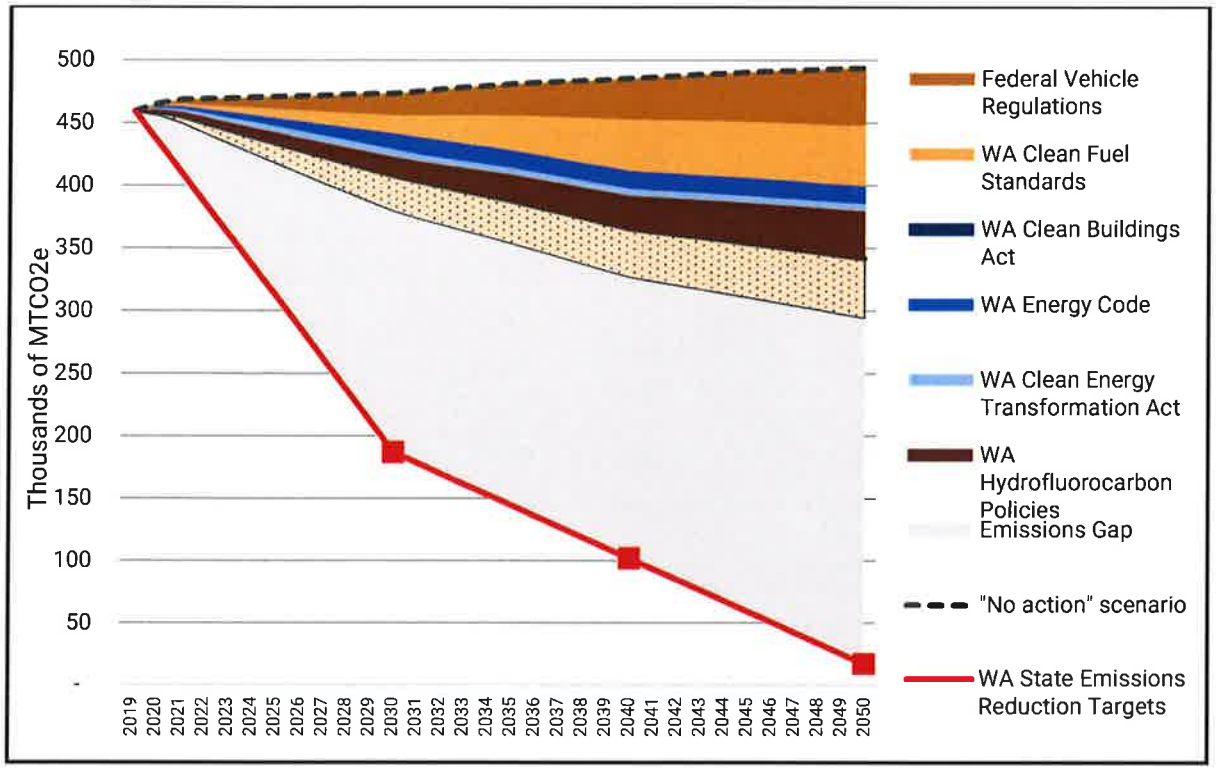
try fleet, regulated by the Department of Transportation's National Highway Traffic and Safety Administration (NHTSA).

- WA Clean Fuel Standards: Requires a 20% reduction in the carbon intensity of transportation fuels by 2038, compared to a 2017 baseline level. may be achieved through cleaner fuels or by purchasing clean fuel credits from cleaner producers such as those providing electricity as fuel. Boats, trains, aircraft, and military vehicles & equipment are excluded.
- WA Clean Buildings Act: Requires all new and existing commercial buildings over 50,000 square feet to reduce their energy use intensity by 15%, compared to the 2009-2018 average.
- WA Energy Code: Requires residential and nonresidential construction permitted under the 2031 state energy code to achieve a 70% reduction in annual net energy consumption (compared to a 2006 baseline).
- WA Clean Energy Transformation Act: Applies to all electric utilities serving retail customers in Washington and sets specific milestones: By 2025, utilities must eliminate coal-fired electricity from their state portfolios; By 2030, utilities must be greenhouse gas neutral, with flexibility to use limited amounts of electricity from natural gas if it is offset by other actions; By 2045, utilities must supply Washington customers with electricity that is 100% renewable or non-emitting, with no provision for offsets.
- WA Hydrofluorocarbon (HFC) Policies: HB 1112 requires that new equipment be manufactured without HFCs or using refrigerants with a lower global warming potential (GWP) in a phased approach through 2024. HB 1050 applies Clean Air Act provisions for ozone depleting substances to HFCs and extends restrictions on higher GWP HFCs to new equipment.

- **WA State Emissions Reduction Targets**: The red line in the graph below represents the state of Washington's emissions reduction targets (using a 1990 emissions baseline):
  - 45% reduction by 2030
  - 70% reduction by 2040
  - 95% reduction by 2050 (+ net zero emissions)[12]
- **Emissions Gap**: The grey wedge represents the remaining amount of emissions that would need to be reduced through regional and local action to achieve WA State Emissions Reduction Targets.

[12] Net zero emissions means that emissions produced and emissions sequestered from the atmosphere net to zero. In the context of emissions reduction targets, 95% of the state's emissions must be reduced while the remaining 5% of emissions could be addressed through carbon offsetting or sequestration to achieve net zero.

Figure 29. Forecasted communitywide geographic emissions and reductions through 2050.

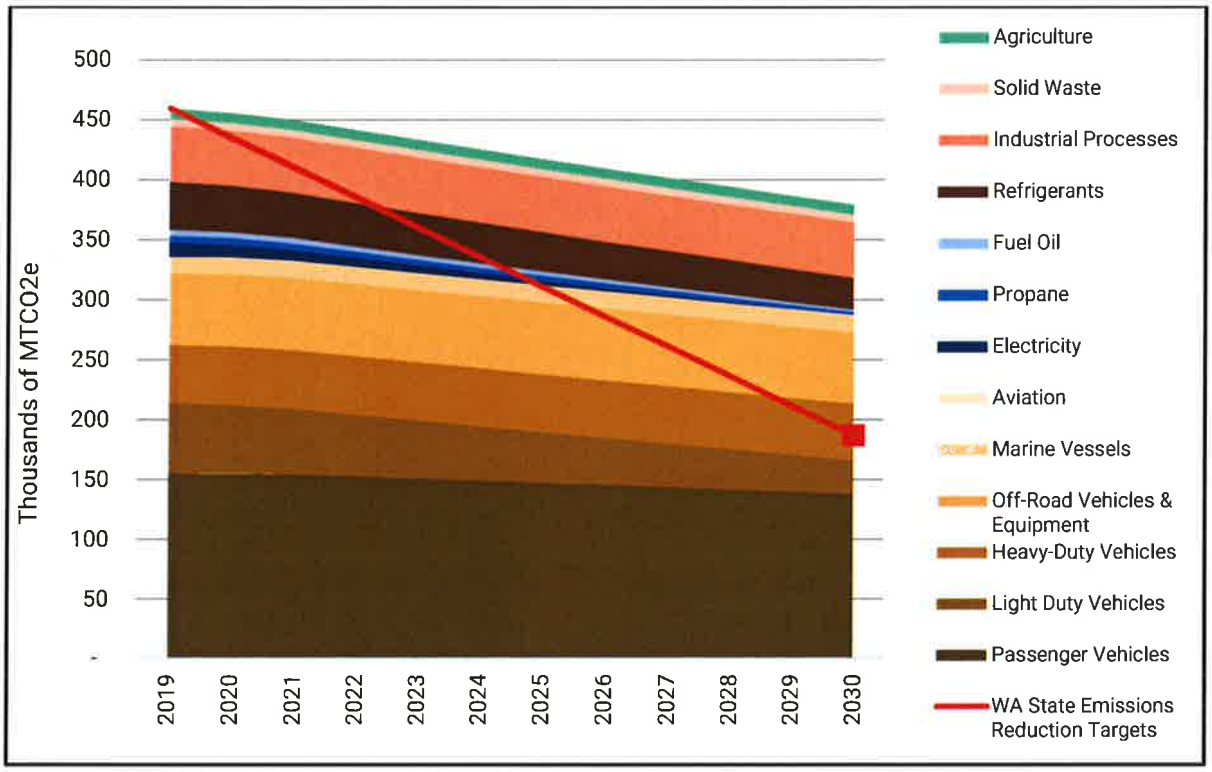


Emissions to address through local action

While the chart above represents total emissions and reductions in the long term (through 2050), the graph below (Figure 30) represents the individual sources of emissions projected in the short term (through 2030).

These emissions sources are the primary focus of the strategies and actions within this CAP. **On- and off-road vehicles make up 75% percent of total projected 2030 emissions** (58% and 17% respectively). As such, Clallam County should continue to focus efforts on high-impact transportation actions, such as promoting the transition to electric vehicles and equipment, and various e-government approaches that reduce commuter traffic.

Figure 30. Forecasted communitywide geographic emissions through 2030.



STRATEGIES AND ACTIONS

Introduction

Clallam County's emissions inventories and forecasts are in alignment with recent studies by the Intergovernmental Panel on Climate Change (IPCC), showing that greenhouse gas (GHG) **emissions will continue to increase if we do not take action** to limit the impacts of climate change. Clallam County has already experienced climate change impacts such as record-breaking **heatwaves, drought, flooding from heavy storms, and severely compromised air quality from wildfire smoke**.

Through this CAP, Clallam County sets the foundation for the County and the community to **reduce emissions and build a resilient, sustainable future**. The following focus areas, goals, strategies, and actions are a strategic mix of County- and community-focused initiatives and actions designed to reduce governmental and communitywide emissions.[13]

Guided by the County Climate Action Committee (CAC)[14], these strategies and actions work to **protect and maintain local natural resources and ecosystems, public health and safety, disaster resilience and economic vitality**.

Actions were prioritized if **highly impactful, easily implementable**, and/or **cost-efficient**. The strategy and action development process was guided by and rooted in Clallam County priorities and values through the CAC.

Planning Process

The strategy and action development process is outlined in the figure below in coordination with NODC efforts. Development was iterative, revisiting action language, strategies, and goals at each stage of the process, described in detail in the sections that follow.

[13] The strategies and actions in this CAP were developed with funding from the North Olympic Development Council (NODC). In 2022, NODC provided consultant support to Clallam County to help guide the development of strategies in alignment with other local governments' climate action efforts, in addition to participation in NODC regional climate initiatives for collective action in the Olympic Peninsula.

[14] The CAC consists of County staff representing a variety of departments. Each committee member attended seven monthly CAC meetings related to this project, as well as met outside of monthly committee meetings for further discussion.

Policy Scan

The strategy and action development process started with a policy scan of **key policy and planning documents** from Clallam County, plans and polices of regional jurisdictions, Tribes, and other relevant agencies and comparable counties within the state. The goal of this review was to identify:

- Sustainability plans, programs, policies, and actions already in place
- Types of actions that have already been proposed
- Actions being implemented by cities within the County
- Policy context, particularly for transportation, land use, and buildings

The policy scan culminated in an initial list of potential actions, primarily **focused on mitigation with adaptation as a high priority co-benefit**. The CAC narrowed this list based on the strategic priorities outlined above (impact, feasibility, and cost) as well as actions that can be implemented within the next five years.

Initial strategy and action development was also informed by findings from the **government operations** and **communitywide** GHG inventories.

To see all documents reviewed during the policy scan, and other existing key state and regional policies please see Appendix D.

Multi-Criteria analysis (MCA)

The initial list of actions was further vetted through a multi-criteria analysis (MCA). The MCA assigns *qualitative* numerical scores to each action for each criterion (see table below) to arrive at an overall priority score. Each criterion is scored on a 1 (low) to 5 (high) scale and criteria were weighted equally. Any action that scored below a 3 (neutral) on the equity criterion was refined to raise the score to a 3 or higher.

Actions that were eliminated during this prioritization process are included in Appendix C for future consideration. Full MCA criteria definitions and MCA Priority Score breakdowns are included in Appendix E.

Criterion	Definition/Sub criteria
Emissions Impact 	What is the scope and likelihood that the action will reduce GHG emissions? By when? Can impact be measured and tracked?
Cost 	What is the cost to the community and County?
Feasibility 	Are there regulatory, political, or technological constraints related to action implementation? Is the action adaptable to new technologies?
Equity 	Does the action reduce vulnerability for all populations? Is it fair? Are benefits distributed equitably across the community? Do they redress historic inequities?
Co-benefits 	Does the action support 1) climate resiliency, 2) economic development, and 3) conservation (i.e., energy & water)?

Strategies and Actions

Guided by GHG inventory results and CAC discussions, Clallam County developed the following goals, focus areas, strategies, and actions to meet emissions reductions and CAP goals.

This plan serves as a roadmap, to be adaptively managed, for how Clallam County will work to reduce GHG emissions over the next 5 years.

In order for Clallam County to ensure that the following strategies and actions outlined to meet Climate Action Plan's goals and target metrics, **the County should first expand staff capacity by establishing a full-time Sustainability Officer.** The Sustainability Office will implement coordinated sustainability projects across Clallam County departments and ensure that new projects consider CAP goals from the outset.

The Sustainability Officer's duties would include:

- Identify opportunities and secure funding to **integrate more climate action and analysis into other County planning efforts** (e.g., Comprehensive Plan) as a way to align strategies and priorities for shared funding
- Support departments with **grant writing** for climate-related opportunities
- Work with department liaisons to ensure **accountability** of policies/actions related to existing policies and CAP goals
- Recommend **new and updated policies** that promote sustainability
- Create a **systematic way to assess the GHG emissions** associated with major county actions/policies/plans and consider the cost of those emissions during the decision-making process
- Oversee **centralized procurement** process
- **Seek funds** for projects such as studies that focus on developing industries around local re-use
- Develop, manage, and preform **sustainability outreach** and programs

Focus Areas and Legend

Five key focus areas emerged based on Clallam County priorities, the extent of the County's control, and the primary sources of GHG emissions. The goals developed for each focus area align with other County plans and existing efforts.

Each focus area section provides an overview of the topic's relevance and importance to the plan, followed by tables listing the climate strategies and actions within the focus area. Each action has an ID number, scope, action short name, and action description.

	Focus Area	Goal
	**Energy & Built Environment**	Decrease and mitigate emissions through clean energy and energy efficiency in the built environment.
	**Consumption & Solid Waste**	Reduce organic waste stream by half by 2030 through waste diversion and sustainable consumption.
	**Transportation**	Increase transportation options, incentivize non-motorized transportation options, facilitate, and plan for electrification of vehicles.
	**Land Use**	Implement policies for sustainable, smart development that reduces urban sprawl, strengthens food systems, and increase conservation.
	**Natural Environment**	Conserve and protect the environmental attributes and critical areas of Clallam County that contribute to the quality of life for all.

Community
The action designed for the entire Clallam County community.

County
The action is intended for County operations and internal processes only.

Strategies and Actions by Focus Area

ENERGY & BUILT ENVIRONMENT

GOAL: Decrease and mitigate emissions through clean energy and energy efficiency in the built environment.

Energy consumption contributes only **5%** of total community-wide emissions. This percentage is lower than most jurisdictions in Washington because the county does not use natural gas and electricity comes primarily from hydropower and other renewable sources. The actions below focus on maximizing energy efficiency in buildings and bolstering grid resiliency.

Strategy: Install and incentivize energy-efficient upgrades and retrofits			
#	**Scope**	**Action Name**	**Action Description**
1.1		Install energy efficiency retrofits at County facilities	Conduct energy audits for all County facilities. Install energy-efficient upgrades and retrofits for existing County facilities informed by the energy audit. Examples include: • Install energy-efficient lighting and automatic light sensors. This includes retrofitting light fixtures and/or replacing bulbs with LEDs. • Install energy-efficient heat pumps in all buildings. • Install occupancy sensors in all County buildings. • Develop and implement weatherization program for County facilities. • Install or improve building insulation (energy efficient windows) in County facilities. • Install new energy efficient cooking appliances. • Install photovoltaic panels on existing buildings and for stand-alone lighting and on county owned property where appropriate and productive. • Repair the solar water heaters on the Clallam County Courthouse that are not currently operative, or replace with more efficient models.
1.2		Incentivize energy efficient retrofits and upgrades for	Work in collaboration with partners to incentivize energy-efficient improvements and retrofits for residential and commercial buildings in the County. Including:

		residential and commercial buildings	• Help connect citizens to information and rebates available for energy-saving updates. • Incentivize residents to switch heating sources from wood-burning stoves and propane to high-efficiency electrical heaters and other less carbon intensive sources. • Partner with Clallam PUD to expand low-income Energy Assistance programs. • Set up a fund or grant to assist in payment for energy efficient upgrades for residential properties.
Strategy: Use cleaner energy-sources and increase resiliency of energy systems.			
#	**Scope**	**Action Name**	**Action Description**
1.3		Invest in community energy projects	As part of community development and promoting energy resiliency, assess potential capital projects that develop community energy projects (e.g., local microgrids, local solar projects) to ensure there is energy supply redundancy, especially within County facilities, critical facilities such as hospitals, schools and airports or neighborhoods vulnerable to power loss due to natural events.

CONSUMPTION & SOLID WASTE

GOAL: Reduce organic waste stream by half by 2030 through waste diversion and sustainable consumption.

The generation and disposal of solid waste accounted for 1% of total community-wide emissions. Most of these emissions are from organics (38%) and paper (30%). As noted in the Consumption-Based Emissions Inventory section above, there is also a large carbon footprint associated with the upstream activities related to consumption of goods and services.

The actions below focus on reducing organic waste through food waste diversion and composting as well as sustainable consumption practices. The following strategies and actions are in alignment with existing goals and efforts outlined the 2021 Solid Waste Management Plan.

Strategy: Increase waste diversion to reuse, repair, and support edible food rescue.

#	Scope	Action Name	Action Description
2.1		Expand food waste diversion and education programs	Expand existing food waste diversion and composting programs for large food producing commercial businesses (e.g., hotels, restaurants, caterers, cafeterias, etc.), and residential homes. Programs could include: • Commercial food donation programs. • Expand compost pickup services and on-site composting throughout the County for commercial users. • Identify end-use applications for compost. • Support and expand existing food waste and yard waste diversion program for residential households and encourage backyard composting. • Support existing waste prevention program and educational resources for waste, recycling and composting. • Fund existing master Composter and Recycler programming for waste reduction.

2.2		Increase waste diversion in County Operations	• Recycling and composting will be made available at all County-owned facilities including the Courthouse, 3rd Street Building, Juvenile Services Building, and all County-owned Campgrounds. • Develop and implement a centralized procurement policy. • Sustainability Officer will create a centralized location for surplus office supplies that can be accessed by all county departments.
Strategy: Promote green purchasing and sustainable consumption			
2.3		Expand on County sustainable purchasing policies and reduce paper waste in County Operations	• Expand on current County sustainable purchasing policies and guidelines that prioritizes local, recycled content, and other sustainability considerations. • Develop department-specific strategies to reduce paper consumption by up to 15%. • Duty of Sustainability Officer to implement.

TRANSPORTATION

GOAL: Increase transportation options, incentivize non-motorized transportation options, facilitate and plan for electrification of vehicles.

Transportation contributes the largest share of communitywide emissions (73%), attributed in large part to the rural, spread out geography of Clallam County compared to more condensed urban settings. Major sources of emissions within this sector are on-road vehicles (78% of transportation emissions) and off-road vehicles (18% of transportation emissions).

The actions below focus on reducing single-occupant vehicle miles driven, encouraging rideshare and non-motorized transportation options where feasible, and installing infrastructure for the transition to electric vehicles. Additionally, Clallam County will be prioritizing actions that maintain an **e-government** and work-from-home model for County employees who are able to encourage less employee vehicle miles travelled.

Strategy: Reduce single-occupant vehicle miles travelled and support non-motorized transportation options			
#	**Scope**	**Action Name**	**Action Description**
3.1		Create a County employee commute reduction program	Create and implement a vehicle trip reduction policy that incorporates: • Codified e-government operations. • Formalized teleconferencing/telecommuting and hybrid work schedule policy. • Video and/or web conferencing abilities in all major County facilities. • Strengthen County incentives for carpooling, transit ridership, biking/walking, and commute trip reduction among County employees.
3.2		Develop a non-motorized transportation plan	Expand on the development of non-motorized transportation options and infrastructure to support biking, walking, and other means of non-motorized transportation by: • Develop of a non-motorized transportation master plan for Clallam County. • Updating the Comprehensive Plan to expand upon elements for non-motorized transportation such as bicycle infrastructure and pedestrian networks, with a focus within the Urban Growth Areas for non-motorized connections to business, retail, and transit connections. The development of feeder trails into the Olympic Discovery Trail should be expanded upon.

			• Expand funding for the Transportation Improvement Plan for the development of non-motorized transportation as outlined within the Comprehensive Plan. • Where feasible, include safety and accessibility enhancements at busy interchanges and other busy streets. • Continue working with the Peninsula Regional Transportation Planning Organization to expand on their Regional Transportation Plan. • Implement a process by which non-motorized infrastructure is considered at the outset of every Roads Department project.
Strategy: Build infrastructure for and transition to electric vehicles			
3.3		County fleet electrification and idle reduction	• Expand EV charging stations available at County facilities for use by County fleet and County employee vehicles. • Electrify or switch to hybrid County fleet vehicles where feasible, establish a reduced idling policy for all County vehicles, and monitor fleet emissions yearly. • Identify County operations that could be accomplished without a vehicle or with a less carbon-intense fuel source.
3.4		Prepare for EV infrastructure and use	Work with Peninsula Regional Transportation Planning Organization (PRTPO) to develop strategies and expand infrastructure to increase use of electric vehicles. This includes: • Developing and implementing an EV infrastructure plan. • Encourage EV network expansion by helping connect citizens to information and rebates. • Recommend installing EV parking and charging infrastructure in homes. • Revise parking standards code to: ○ Include incentives to support bicycle storage (i.e., racks) and ride share amenities. ○ Include incentives for EV parking spot adoption within commercial/industrial projects. ○ Discontinue use of parking minimums (ex. 1 space required for every 200 square ft of retail).

LAND USE

GOAL: Implement policies for sustainable, smart development that reduces urban sprawl, strengthens food systems, and increases conservation.

Emissions from livestock and soil management contribute 2% of communitywide emissions. The actions below focus on strengthening local food systems and encouraging sustainable agricultural and gardening practices in Clallam County through expanding programs and investments.

Strategy: Invest in and support local food systems

#	Scope	Action Name	Action Description
4.1		Support existing gardening programs	Fund continued Master Gardener program to educate community on climate related topics including soil building, integrated pest management, and vegetable gardening.
4.2		Invest in the agricultural sector of Clallam County	Support strategies to protect productive agricultural lands and expand food production in Clallam County by: • Investing county dollars in education, marketing and promotion resources for the agricultural sector. • Strengthening codes to encourage retention of agricultural lands instead of conversion to residential, commercial, and industrial development. • Providing continued support for programs that work with farms to help make their businesses more sustainable and increase land access for beginning farmers. • Supporting and expanding Conservation Futures for the protection of farmland and open space.

NATURAL ENVIRONMENT

GOAL: Conserve and protect the environmental attributes and critical areas of Clallam County that contribute to the quality of life for all.

Clallam is a highly forested county. If emissions from tree cover loss were included in the communitywide GHG inventory, they would make up 84% of Clallam County's total emissions. Remaining tree cover sequesters more than double the amount of carbon emitted by tree cover loss. The following actions are designed to preserve the county's carbon sinks and other natural resources.

Strategy: Protect natural resources and conserve water through policies and programs

#	Scope	Action Name	Action Description
5.1		Increase tree planting	Increase tree planting requirements and incentives for all public and private projects, including transportation projects that incorporate the use of trees.
5.2		Increase native plant landscaping	• Evaluate and update current County irrigation and landscaping policies to maximize efficiencies and water conservation on County grounds. • Expand on current native plant landscaping policy in Landscaping Code.

IMPLEMENTATION PLAN

This CAP is a strategic and coordinated plan, that relies on all of Clallam County, both County departments, as well as Clallam County residents and communities, to collectively work towards reducing GHG emissions and creating a resilient and sustainable future. The following section provides a framework for implementing the strategies and actions in this CAP.

The first step of CAP implementation will be creating, and subsequently hiring, a **Sustainability Officer position** at the County to build internal capacity. Pending existing County staff and departmental capacity and County budget, this position could be expanded to include an additional position for a Sustainability Procurement Officer.

Equity

CAP implementation will center equity by considering:

- **Disproportionate impacts**
  - Are there ways that an action could be implemented that would generate burdens (including costs), directly or indirectly, to communities of color, low-income, or elderly populations?
  - If yes, how can we mitigate these impacts and ensure that the implementation is equitable?
- **Shared benefits**
  - Are the benefits of implementation equally shared?
  - Are there ways to target an action or strategy's benefits to address historical or current disparities?
- **Access to participation and technical knowledge**
  - Are there barriers for individuals and communities to participate in climate action due to time, language, financial resources, or technology?
  - Are there resources and trainings that need to be provided so that all can participate with a shared understanding of more technical topics?

Community engagement

Implementing the CAP and making progress towards GHG reduction goals will depend on engagement with County Staff, partners, and the greater Clallam County communities.

The primary focus of this CAP is to outline actions that Clallam County can take to reduce GHG emissions in its facilities and operations going forward. As such, this plan has not yet been shared and vetted with the larger community. It is the intention of the Commissioners to engage the public on this plan and future planning efforts to ensure communitywide actions are well supported and actionable. **Engaging the community on their priorities and concerns will be a critical early step in ensuring the CAP is implemented equitably and does not create unintended consequences.**

Oversight & Accountability

In order for Clallam County to ensure that CAP is implemented, **the County should first expand staff capacity by establishing a full-time Sustainability Officer.** The Sustainability Office will implement coordinated sustainability projects across Clallam County departments and ensure that new projects consider CAP goals from the outset.

In addition, it is recommended that the **CAC be a permanent committee** to ensure that climate action is ongoing and continuous priority in County operations. The CAC will work with the Sustainability Officer to track CAP progress and implementation. The CAC's key duties will include:

- Convening monthly **committee meetings.**
- Continuing to **identify top emissions reduction priorities and opportunities** for County climate leadership in coordination with the Sustainability Office.
- **Exploring partnership opportunities** with other government agencies and departments and community organizations and coalitions.
- Assisting the Sustainability Officer with **tracking implementation progress.**

Monitoring & Evaluation

The CAP is designed to be a roadmap that will evolve based on implementation and community engagement.

- The Sustainability Officer will **work with identified Implementation Leads** to coordinate action implementation, and track progress.
- The CAC and Sustainability Officer will monitor progress and prepare **annual progress reports**.
- If annual progress reports indicate that Clallam County is not on track to meet goals, the CAC and County Council will p**rovide direction to strengthen or add additional actions as necessary**.
- This direction will be informed by the **latest climate science, best practices**, and allocated **budgets and staffing**.

The next planned CAP update will be in 5 years (2028). The Sustainability Officer will lead the next CAP update, guided by the CAC and Clallam County Council.

Implementation Matrix Criteria

The Implementation Matrix outlines the following key details for each CAP action:

Emissions Impact	Cost	Timeline	Potential Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
Relative measure of the action's potential to reduce emissions.	Estimate of how much the action will cost the County to implement.	The timeframe for starting to implement an action.	Potential funding sources including County budgets, federal relief programs, state and federal grants, and incentive programs. These are potential funding sources and have not yet been promised, committed, or awarded.	County department responsible for overseeing implementation. Existing staff capacity and departmental budgets may need to be re-evaluated regularly to ensure sufficient resources for implementation.	Identified regional partners to support implementation. "Regional Tribal Partners" is used throughout to refer to the Jamestown S'Klallam, Makah, Quileute, and Hoh Tribes.	Additional factors the County will consider when implementing the action and/or notes.

ICON LEGEND

Emissions Impact	Cost	Implementation Timeline
 **Low** potential to reduce emissions	 **Low** cost, from no cost to less than $100K	 **Short-term** = 1 – 2 years - Foundational steps. - Actions that may require substantial time or resources, so it is important to start as soon as possible. - Actions that align with or could support other County plans, projects, or updates and should be implemented concurrently.
 **Moderate** potential to reduce emissions	 **Moderate** cost, from $100K to $1 million	 **Medium-term** = 2 – 3 years - Actions that might require additional resources to implement or cannot occur until foundational actions are implemented.
 **High** potential to reduce emissions	 **High** cost, from $1 million to $10 million or greater	 **Long-term** = 4 – 5 years - Actions that are not as time sensitive as shorter-term actions. - Actions that require substantial infrastructure and resources or build upon foundational short and midterm actions.

Implementation Details

ENERGY & BUILT ENVIRONMENT

Strategy: Install and incentivize energy-efficient upgrades and retrofits

#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
1.1	**Install energy efficiency retrofits at County facilities**				Energy Efficiency and Conservation Block Grant Program – Bipartisan Infrastructure Law 2021 Building Codes Implementation for Efficiency and Resilience WA Department of Commerce Solar Plus Storage (buildings owned by local govt)	Parks, Fair and Facilities, Parks, Fair, and Facilities Sustainability Officer	Clallam County PUD City of Port Angeles	Develop RFP for contractor to conduct energy audit
1.2	**Incentivize energy efficient retrofits and**				Energy Efficiency and Conservation Block Grant Program –	Community Development – Building Division	Clallam County PUD Regional Tribal Partners	Tailor outreach to engage low-income residents, renters, and other demographics typically

#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
	upgrades for residential and commercial buildings				Bipartisan Infrastructure Law 2021 Ecology: Wood stove education & enforcement grants	Olympic Region Clean Air Agency	Olympic Region Clean Air Agency	underrepresented in energy programs.
Strategy: Use cleaner energy-sources and increase resiliency of energy systems.								
#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
1.3	**Invest in community energy projects**				Energy Improvement in Rural or Remote Areas DOE Grid Resilience and Innovation Partnerships (GRIP) Program WA Department of Commerce Solar Plus Storage (buildings owned by local govt)	Parks, Fair, and Facilities Sheriff's Office – Emergency Management Community Development – Planning Division	Clallam County PUD Regional Tribal Partners	Ensure there is community support for these investments through community outreach Through community partnerships ensure that there is assistance for low- and mid-income households for transitioning to clean energy Community Development to encourage the development of these items through updates to the Comprehensive Plan.

CONSUMPTION & SOLID WASTE

Strategy: Increase waste diversion to reuse, repair, and support edible food rescue.

#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
2.1	**Expand food waste diversion and education programs**				Ecology: Waste Reduction and Recycling Education Grants EPA: Solid Waste Infrastructure for Recycling Grant Program	WSU Extension Parks, Fair, and Facilities HHS – Environmental Health	Solid Waste Advisory Committee (SWAC) WA State Ecology Local food banks and community-based organizations Cities Private Businesses Chamber of Commerce City of Port Angeles	Work together with existing efforts from the County's 2021 Solid Waste Management Plan Update Implement Organics Waste Reduction Plan for Clallam County (in development currently- completion Spring 2023)
2.2	**Increase waste diversion in County Operations**				EPA: Solid Waste Infrastructure for Recycling Grant Program DOE Local Solid Waste Financial	Sustainability Officer	WSU Extension Waste Reduction Zero Waste Washington	Work together with existing efforts from the County's 2021 Solid Waste Management Plan Update

#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
					Assistance (LSWIFA)			
Strategy: Promote green purchasing and sustainable consumption								
#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
2.3	**Expand on County sustainable purchasing policies and reduce paper waste in County Operations**					Sustainability Officer Attorney's Office	Solid Waste Advisory Committee (SWAC) WSU Extension	Consider resources from: West Coast Climate & Materials Management's Climate Friendly Purchasing Toolkit, USDN Sustainable Procurement Guide, Carbon Leadership Forum.

TRANSPORTATION

#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
Strategy: Reduce single-occupant vehicle miles travelled and support non-motorized transportation options.								
3.1	**Create a County employee commute reduction program**				WSDOT: Transportation Demand Management Grants	Sustainability Officer Human Resources – to update employee policies Department Heads IT Department (e-government)	Clallam Transit	Clallam County is a rural county, many rideshare or transit options might not be as accessible Helpful tips and guidance from WSDOT: Commute Trip Reduction program
3.2	**Develop a non-motorized transportation plan**				Buses and Bus Facilities Program Capital Investment Grants Program Formula Grants for Rural Areas WSDOT: Grant Programs	Public Works – Roads Division Community Development - Planning	Peninsula Regional Transportation Planning Organization Regional Tribal Partners	Coordinate with internal existing efforts from the Comprehensive Plan Public safety component should be of importance.
Strategy: Build infrastructure for and transition to electric vehicles.								

#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
3.3	**County fleet electrification and idle reduction**				Charging and fueling Infrastructure Discretionary Grant Program WSDOT: Zero-emission vehicle grants DOE GRIP grants	Facilities Public Works Sustainability officer	Peninsula Regional Transportation Planning Organization (PRTPO) Facilities	Identify which fleet vehicles would be prioritized for transition to electric first Identify this a core strategy in the plan according to GHG emissions reduction data
3.4	**Prepare for EV infrastructure and use**				Charging and fueling Infrastructure Discretionary Grant Program Grants for Energy Efficiency and Renewable Energy Improvements at Public School Facilities Infrastructure for Rebuilding America (INFRA) Grants	Sustainability Officer Public Works – Roads Division Regional Tribal Partners Community Development - Planning & Building Division	Peninsula Regional Transportation Planning Organization (PRTPO)	Work with partners to identify top sites for charging stations Coordinate with cities within the County for their EV infrastructure efforts Voluntary EV network expansion for residential development will get County to capacity as people switch to EVs over time.

LAND USE

Strategy: Invest in and support local food systems								
#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
4.1	**Support existing gardening programs**					WSU Extension	Clallam Conservation District Parks, Fair, and Facilities	Opportunity to leverage with actions in Natural Environment focus area
4.2	**Invest in the agricultural sector of Clallam County**				National Coastal Wetlands Conservation Grant Program WSDA: Food Assistance Resiliency Grants WSDA: Farm To School Purchasing Grants USDA grants Flood Mitigation Assistance (FMA) Grant	Community Development Division – Planning WSU Extension	Conservation Futures Program Advisory Board (CFPAB) Parks, Fair, and Facilities Conservation District NODC	

NATURAL ENVIRONMENT

Strategy: Protect natural resources and conserve water through policies and programs

#	Action Name	GHG Impact	Cost	Timeline	Known Funding Sources	Lead Implementor	Partnership Opportunities	Implementation Considerations
5.1	**Increase tree planting**					Parks, Fair & Facilities Community Development – Planning Public Works – Utilities & Roads Division	Clallam Conservation District Parks, Fair, and Facilities WSU Extension City of Port Angeles Street Tree program	Work with Parks for where more trees could be needed in public spaces
5.2	**Increase native plant landscaping**					Community Development Division – Planning Parks, Fair & Facilities	Clallam Conservation District: Annual Native Plant Sale WSU Extension Master Gardener program	Work with Parks for their current landscaping policies

APPENDIX A. SOURCES

Geographic Inventories

Acronyms

- **ACS:** American Community Survey
- **EIA:** Energy Information Administration
- **EPA:** Environmental Protection Agency
- **ESD:** Employment Security Department
- **GPC:** Global Protocol for Community-Scale Greenhouse Gas Inventories
- **MOVES:** Motor Vehicle Emission Simulator
- **PUD:** Public Utility District
- **USCP:** U.S. Community Protocol
- **WEIRS:** Washington Emissions Inventory Reporting System
- **WSDOT:** Washington State Department of Transportation

Communitywide

Key: Emissions from this source were calculated manually | Emissions from this source were calculated with an external tool

Sector	Emissions Sources	Inventory Protocol Ref.	Data Source	Notes/Limitations
Transportation	On-road transportation	• GPC 7.3 • USCP TR.1, TR.2	• WSDOT Highway Performance Monitoring System • EPA default vehicle breakdown	

Sector	Emissions Sources	Inventory Protocol Ref.	Data Source	Notes/Limitations
			• and fuel efficiency	
	Aviation	• GPC 7.6	• Port of Port Angeles	
	Marine Vessels	• GPC 7.5 • USCP TR.7	• Port of Port Angeles • Puget Sound Maritime Air Emissions Inventory	• Used most recent data (2016) from the latest Puget Sound Maritime Air Emissions Inventory report (February 2018).
	Ferries	• GPC 7.5 • USCP TR.7	• Black Ball Ferry	
	Off-road vehicles and equipment	• GPC 7.7 • USCP TR.8	• EPA "MOVES" tool	
Built Environment	Electricity (residential, commercial, and industrial)	• GPC 6.1 • USCP BE.1, BE.2	• Clallam PUD • Port Angeles	• Includes electricity used for potable water conveyance and wastewater treatment, as required by protocols
	T&D losses (electricity)	• GPC 6.6 • USCP BE.4	• Clallam PUD • Port Angeles	
	Fuel Oil (residential, commercial, and industrial)	• GPC 6.3 • BE.1	• EIA Fuel Sales by End Use • ACS House Heating Fuel estimates • ESD Covered Employment	• Used regional data and scaled down to Clallam County
	Propane (residential)	• GPC 6.3	• EIA Fuel Sales by End Use	• Used regional data and scaled down to Clallam County

Sector	Emissions Sources	Inventory Protocol Ref.	Data Source	Notes/Limitations
		• BE.1	• ACS House Heating Fuel estimates	• Commercial and industrial propane data was unavailable, so this source was excluded from the 2019 inventory.
Solid Waste	Community-Generated Waste	• GPC 7.3 • USCP SW.4	• Clallam County Solid Waste Management Plan	
Agriculture & Forestry	Livestock	• GPC 10.1-10.4 • USCP A.1, A.2	• 2017 Washington Agriculture Census	• Census only conducted every 5 years; relied on 2017 data
	Soil Management	• GPC 10.11-10.12	• 2017 Washington Agriculture Census	• Census only conducted every 5 years; relied on 2017 data
	Forest carbon sequestration	• Global Forest Watch	• Global Forest Watch	•
Process & Fugitive Emissions	Refrigerants	• GPC 9.4 • USCP BE.7	• Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2019	• Used national data and scaled down to Clallam County

Sector	Emissions Sources	Inventory Protocol Ref.	Data Source	Notes/Limitations
	Industrial process emissions	• GPC 9.4 • USCP BE.8.1	• Washington Department of Ecology WEIRS	• Only captures industries that are required to report emissions to Ecology

County Operations

Sector	Emissions Sources	Inventory Protocol Ref.	Data Source	Notes/Limitations
Transportation	Fleet	• LGOP 7.1.1.1	•	
	Employee Commute	• LGOP 12.2.1	• Commute survey	• Not all employees responded to the commute survey provided which may result in a less representative sample of employee commutes.
	Business Travel	• LGOP 12.2.1	• Auditor's Office	
Built Environment	Electricity	• LGOP 6.2.1	• Clallam PUD • Port Angeles • Jefferson PUD	• Includes electricity used for potable water conveyance and wastewater treatment, as required by protocols
	T&D losses (electricity)	• LGOP 6.2.1	• Clallam PUD • Port Angeles • Jefferson PUD	
Solid Waste	County-Generated Waste	• LGOP 9.3.1-3	• Solid & Hazardous Waste department	• Amount of solid waste generated was estimated based on dumpster volume and pickup frequency due to lack of more granular data

APPENDIX B. CONSUMPTION-BASED INVENTORY REPORT

Introduction

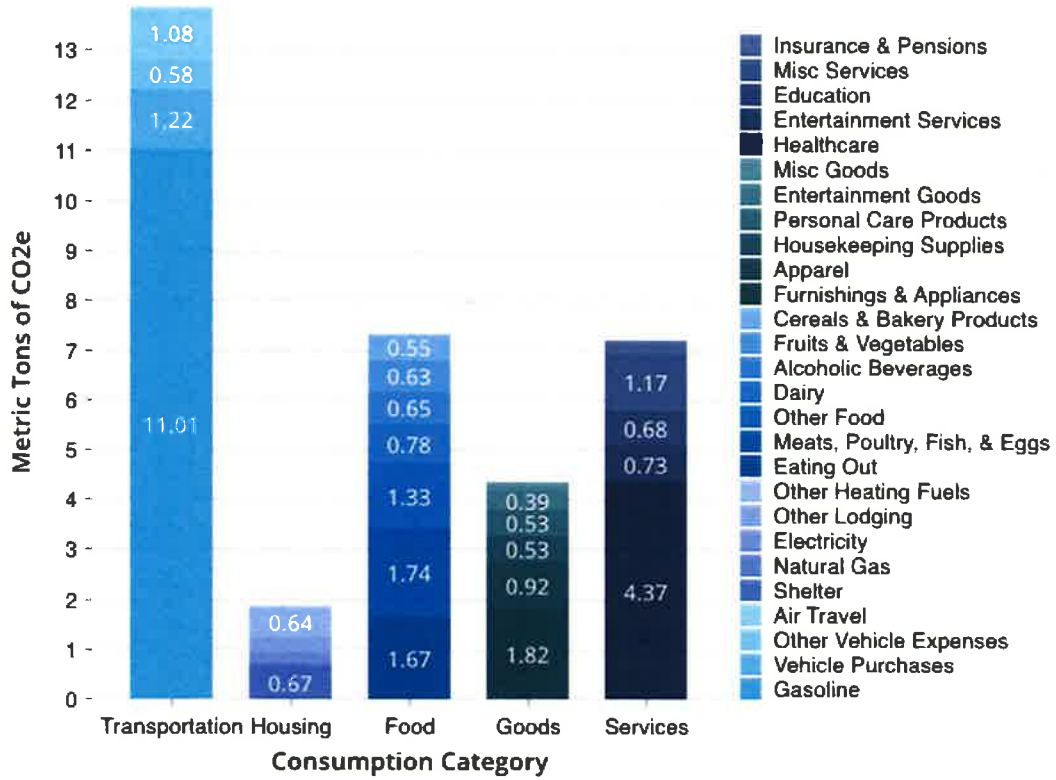
A consumption-based emissions inventory (or "CBEI") is an estimate of the greenhouse gas emissions associated with the activity of all residents of a geographic area. It's equivalent to a personal household carbon footprint estimate, except calculated for all households in a jurisdiction. Consumption-based emissions are modeled based on local variables such as income and vehicle ownership, and on scientific studies that tie these variables to changes in consumption-based emissions.

In Clallam County in 2019, the typical household was responsible for roughly 35 metric tons of CO_2e annually ($MTCO_2e$), or about 15 $MTCO_2e$ per person. With 33,022 households in the county, this is a total of roughly 1.2 million $MTCO_2e$ for 2019 attributable to residents of Clallam County.

These emissions are broken out into five areas: transportation, housing, food, goods, and services. Transportation was the single largest category of emissions, followed by food and services. Gasoline was the single largest source of emissions overall, among all sub-categories.

The bar chart below provides an overview of the county's average per-household emissions. The actual emissions of any particular household, however, could vary significantly from this average. Differences in household size, spending, housing, travel, and other discretionary and non-discretionary factors will affect any individual household's emissions.

Figure 31. Clallam County consumption-based inventory.



Consumption-Based versus Geographic Emissions

A CBEI is different from the more standard greenhouse gas inventory typically assembled by cities. Those inventories are focused on the emissions generated within the city boundary (scope 1). While they also include some emissions that occur outside the city border as a direct result of activity within the city (such as electricity emissions, scope 2; and waste landfilled outside the city, scope 3), they are primarily focused on the emissions occurring directly from actions taking place in the city. This includes energy,

transportation, and waste disposal; and it may also include local industrial and agricultural emissions that occur in the city boundary as well.

In contrast, CBEIs consider emissions that may occur anywhere in the world, as long as they are directly or indirectly a result of the activities of the residents of the city.

Geographic and consumption-based approaches are complementary and partially overlapping. Both will look at resident's local, direct emissions (e.g. from driving or home heating). A geographic inventory will also consider the direct emissions from local businesses and visitors. However, geographic inventories neglect the emissions associated with goods and services manufactured outside but purchased and used in the city, as well as the emissions associated with food production that occurs outside city limits.

Meanwhile, a consumption-based emissions inventory will look only at the emissions associated with resident's activities and purchases, but it looks at all of those emissions regardless of where they may occur. As a result, consumption-based inventories only consider local emissions from businesses to the extent that their goods and services are consumed by local residents. Visitor activities are attributed to the visitor's home cities, not the city in which they visit.

Consumption-based emissions may occur anywhere in the world. CBEIs are essentially inventories of emissions viewed through the lens of local household's typical consumption.

Consumption-Based Emissions Approach

Because consumption-based emissions can occur anywhere in the world, it's virtually impossible to measure them directly. Instead, these consumption-based emissions are estimated, using a model based on national survey data and adjusted for local conditions.

The model used for this CBEI takes into consideration six key household characteristics: household size, household income, vehicle ownership, home size, educational attainment, and home ownership[15].

[15] In addition, supplemental models for household energy use and vehicle miles traveled incorporate additional variables such as local climate, energy prices, home type, and geographic region, for the energy model; and time to work, commute mode, density, and family status for the vehicle miles traveled model. For a full list of variables used in each model, see Appendix A. Methodology.

These variables are selected because they are demonstrated to have clear, direct effects on consumption. For instance, larger homes generally take more energy to heat or cool, while more people per household also means more food consumed per household. These variables are also available nationwide through US Census data, allowing for detailed local analysis at a range of geographic scales.

The table below compares the values of these household characteristics in Clallam County with those of the US average in 2019:

Table 1. Household characteristics, Clallam County vs United States.

Household Characteristic	Clallam County	US
Average Income	$69,587	$88,783
Vehicle Ownership	2	1.82
Household Size	2.31	2.61
Home Size (rooms)	6.4	6.57
Home Ownership	71%	64%
Educational Attainment (college degree)	31%	35%

The emissions profile for Clallam County is based on a "typical" household in 2019, using the average household characteristics for Clallam County as shown above. Most actual households in the county differ in one or more ways; and households with different characteristics are expected to have different emissions profiles.

Major Categories Overview

Among all categories, transportation, food, and services are the largest overall categories, accounting for 40%, 21%, and 21% of emissions, respectively. Together, these account for over 82% of total emissions. Within sub-categories, gasoline, healthcare, and furnishings & appliances are the top three, accounting for 32%, 13%, and 5% of total emissions, respectively - a combined 50%.

Transportation

The transportation category includes gasoline usage, vehicle purchases & maintenance, and air travel. For an average household in Clallam County, transportation accounts for 13.9 $MTCO_2e$ per year, per household. Much of this comes from gasoline, which accounts for 11 $MTCO_2e$, or 79% of the total transportation emissions.

Housing

Household energy use, home construction and maintenance ("shelter"), and water usage make up the Housing category. Overall, a typical household has 1.9 $MTCO_2e$ resulting from housing, with the largest single category being shelter. Shelter produced 0.7 $MTCO_2e$, or 35% of the total housing emissions.

Food

The Food category includes all food consumed by residents of Clallam County, broken down by meat, dairy, fruits & vegetables, and other foods consumed at home, as well as eating out. Food accounts for 7.4 $MTCO_2e$, and the single largest sub-category is meat, poultry, fish, and eggs at 1.7 $MTCO_2e$, or 24% of total food emissions.

Goods

Goods includes all physical items purchased by the household (excluding items in other categories). Goods includes things like furniture, personal electronics, clothing, toys, and books. These goods account for 4.3 $MTCO_2e$ per household per year. Of these goods, furnishings & appliances is the single largest source, making up 1.8 $MTCO_2e$, or 42%, of total goods.

Services

Services includes the emissions associated with things like healthcare, education, insurance & finance, and entertainment experiences like concerts and museums. Services account for 7.2 $MTCO_2e$ per household, and the single largest category is healthcare at 4.4 $MTCO_2e$, or 61%.

Historical Trends

Since 2007, per household CO_2e emissions have decreased by 4%, or 1.4 $MTCO_2e$ per household, as shown in Figure 32. Historical CBEI trends

Figure 32. Historical CBEI trends

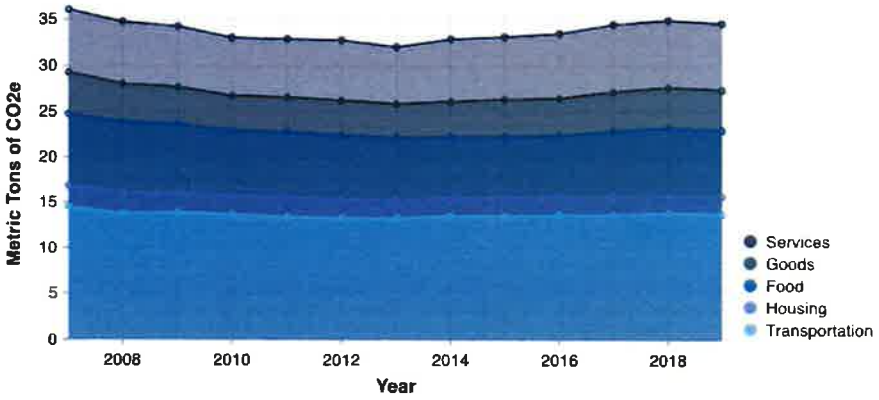


Table 2, below, compares emissions in 2007 and in 2019 on a per household basis (unless otherwise stated). Most categories have seen an overall decline, with housing emissions seeing the largest decline, of more than 20%, while emissions from services have increased by over 5%.

Table 2. Clallam County Changes in Emissions Over Time (2007-2019)

Emissions Category	Clallam County (2007)	Clallam County (2019)	% Change
Transportation Emissions	14.6	13.9	-5.2%
Housing Emissions	2.3	1.9	-20.6%
Food Emissions	7.9	7.4	-7.8%
Goods Emissions	4.5	4.3	-3%
Services Emissions	6.8	7.2	5.3%
Total Emissions	36	35	-4.1%
Total Per Capita Emissions	16	15	-6.9%

At the national level, consumption-based emissions have declined by more than 12%. The electricity grid has been getting cleaner, vehicle fuel economy has been improving, and industries have generally been figuring out how to produce more with less emissions.

In Clallam, these reductions have been less pronounced. This is in large part because the county has been running on clean power for decades, thanks to Clallam PUD's purchases of electricity via the Bonneville Power Administration. In addition, over 80% of homes use electricity for heating, and natural gas is not available in the county.

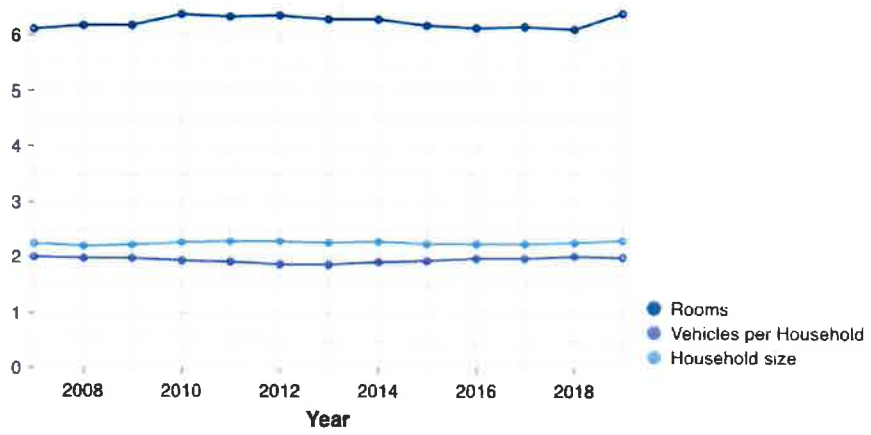
Effectively, the county already achieved the low-hanging emission reductions decades ago that the rest of the country is now only beginning to adopt. The challenge facing the county today is how to reduce emissions beyond building energy usage.

Transportation emissions have declined largely due to improving vehicle fuel economy. In 2019, the average vehicle fuel economy for vehicles registered in Clallam County was 20.2 miles per gallon. While historic fuel economy data was not available, the national average fuel economy has improved by roughly 5% since 2007, and Clallam's has likely followed a similar trajectory. Vehicle miles traveled and vehicle ownership remain largely unchanged. Emissions from air travel have also declined, largely due to the national trend of improving fuel economy in aircraft.

Other consumption-based emissions have shifted slightly due to changes in household characteristics. Since 2007, income has not changed significantly: while nominal household incomes have increased by over $14,000, after adjusting for inflation, this is a change of only 2%. However, the share of households with a college degree has grown substantially, from 23% to 31%. Home sizes have also seen a slight upward trend, going from an average of 6.12 rooms to 6.40. Higher educational attainment is typically correlated with more spending on services and less on goods.

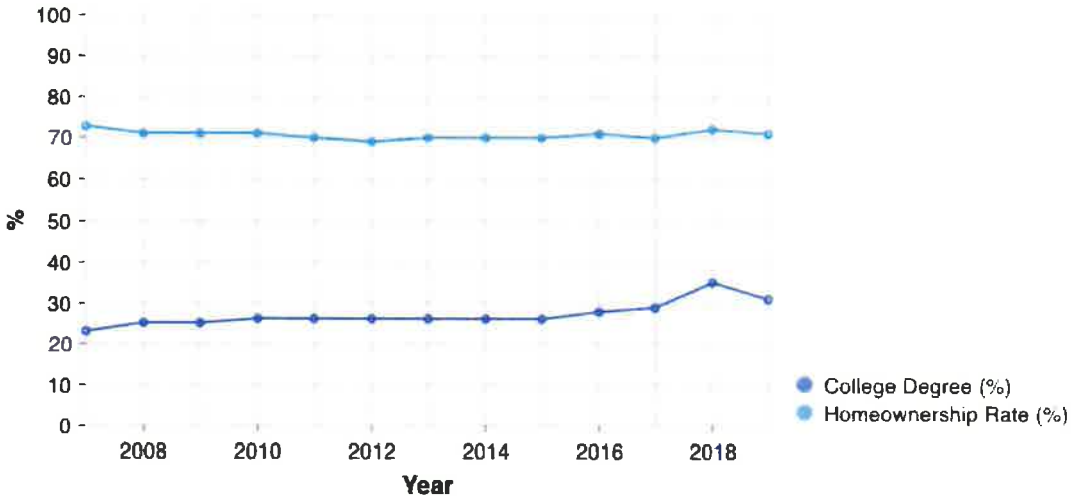
The charts below highlight the changes in these characteristics over time.

Figure 33. Rooms, vehicles per household, and household size trends over time.



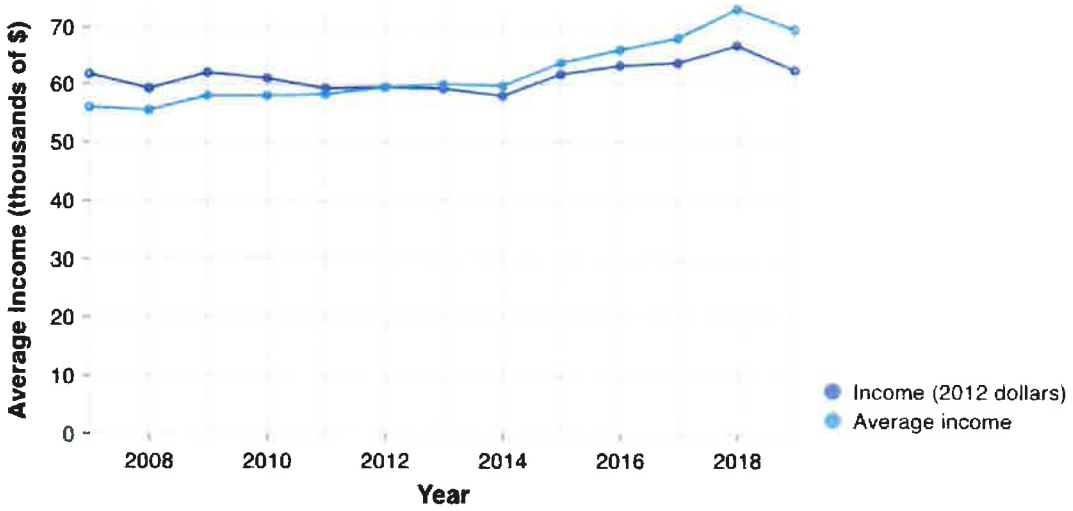
Since 2007, rooms per household have increased slightly (from 6.12 to 6.4, about 4.6%), while vehicles per household and household size have remained largely constant.

Figure 34. Percent with college degree and homeownership rate trends.



The share of households with a college degree has increased substantially, from 23% to 31%, while the home ownership rate has decreased slightly.

Figure 35. Income over time.



Inflation-adjusted income has not changed substantially. Since 2007, income has not changed significantly: while nominal household incomes have increased by over $14,000, after adjusting for inflation, this is a change of only 2%.

Changes in educational attainment and home size have led to increases in the consumption of services and goods. However, emissions from goods has still declined overall due to national reductions in carbon intensity of production.

Category Breakdown

Some key categories and sub-categories are of particular interest. These are detailed below.

Transportation

GASOLINE

Gasoline consumption is the #1 source of emissions in Clallam County, responsible for about 11 $MTCO_2e$ per household. Vehicle ownership is a primary driver of gasoline consumption, due to resultant driving activity.

Nationwide, the US average is 1.82 vehicles per household. A typical vehicle is driven over 11,000 miles per year, and so the average American household drives roughly 20,514 miles per year.

Meanwhile, Clallam County households have an average of 2 vehicles per household, and drive an estimated 20,241 miles per year. This works out to about 10,121 miles per vehicle, or 90% of average.

Clallam is predominantly a low-density suburban/rural community with heavy automobile dependency. A typical percentage of people drive alone to work (77%); however, county residents enjoy shorter-than-average commute times (about 20 minutes, versus national average of 27.6). Reduced commute times, along with smaller household sizes and below-average incomes, are the major drivers of overall lower per-household VMT in the county.

Examples of Individual Strategies for Reducing Gasoline Consumption

For households that aim to reduce their emissions from automobile usage, switching their primary commute vehicle to an electric vehicle is a common strategy. Depending on where they live, some households can purchase electric bicycles (e-bikes) to substitute for automobiles. E-bikes are bicycles that include an electric motor to assist pedaling, and can typically reach speeds of 20-28 mph. Some models include large cargo carriers capable of carrying kids, groceries, or even furniture. Between e-bikes, public transit, and the availability of car-sharing, rentals, or taxis (including Uber and Lyft), some households can achieve further reductions, or even eliminate their automobile use altogether. In Clallam County, about 5% of households owned 0 vehicles.

AIR TRAVEL

For many individual households, air travel is a significant portion of emissions. However, for Clallam County overall, air travel is only a small part of the county's consumption-based emissions, coming in at 1.1 $MTCO_2e$ per household on average (3.1% of total emissions). This varies significantly between households, however, largely due to income: air travel is a luxury for most Americans, and only the wealthiest households do substantial flying.

According to Gallup survey data, between 1999 and 2015, 48-60% of the US population did not fly in any given year. More recent data from Statista.com suggests that in 2019, 41% of the US had never traveled by air, and another 28% flew only about once per year.

Air travel in a mostly full aircraft is more fuel-efficient than driving alone, but the high-altitude pollution released is uniquely damaging to the environment and can make flying worse than driving. Most modern aircraft get roughly 70-100 miles per gallon per passenger seat; in comparison, the average fuel economy for new vehicles nationwide was 25.4 miles per gallon in 2020. However, due to additional climate forcing from high-altitude particulate matter, as well as lifecycle production of aviation fuels, air travel's overall emissions are roughly double what would be expected on a per gallon basis alone - making it more like driving a 35-50 mpg car. As a result, air travel may be more fuel-efficient than driving alone in an average vehicle, but usually not for two individuals traveling together.

Air travel also often results in significant emissions due to the long distances traveled. A two-person, one-vehicle household may only drive 10,000 miles per year, but could easily fly 24,000 person-miles with just two cross-country (3,000-mile) trips per year (3,000 miles each way on a two-way trip = 6,000 miles round trip per person, for two people = 12,000 miles round trip, twice = 24,000 miles).

Examples of Individual Strategies for Reducing Air Travel

Households that aim to reduce their air travel emissions typically avoid flying, take long-distance buses, or take Amtrak instead when available.

Housing

HEATING & ELECTRICITY

Clallam County's electricity emissions derive from Clallam PUD data showing an average electricity usage of 16,464 kWh per household and a utility-specific average emission factor of 21 grams per kWh.

Roughly 85% of households in Clallam County use electricity for heating. After electricity, wood is the next largest heating fuel, at roughly 10%. The use of fossil fuels for home heating is insignificant in the county, but there are still a few homes which could convert to electric to see further emission reductions.

Examples of Individual Strategies for Reducing Electricity Emissions

With 100% clean power already in use in Clallam, the only strategy available for households to reduce their electricity emissions are to invest in energy efficiency improvements.

Because most homes use electricity for heating, investing in insulation and weatherization can result in significant reductions in energy use. Households can also replace old lightbulbs with LEDs and ensure new appliances are EnergySTAR-certified, and use a

smart thermostat to ensure heating and air conditioning only run when needed. Lastly, replacing outdated resistive electric appliances with heat pump furnaces and hot water heaters can lead to further electricity savings.

Water

The average household in Clallam County uses an estimated 54,864 gallons per year. With an emission factor of roughly 0.5 grams CO_2e per gallon, the average household has roughly 0.03 $MTCO_2e$ of emissions associated with their water use.

80% of emissions associated with water in Clallam County occur in wastewater treatment; and within wastewater treatment, an estimated 80% of emissions occur as a result of methane leakage. Overall, water is a negligible contributor to household consumption-based emissions.

Food

Globally, roughly 24% of greenhouse gas emissions are a result of agriculture, forestry, and other land use changes, with the majority of these emissions resulting from agriculture. In the US, agriculture resulted in roughly 623 million metric tons of greenhouse gas emissions in 2019, or about 10% of national emissions (according to the US EPA's most recent national inventory).

Emissions from agriculture are driven primarily by two sources. In the US, most agricultural emissions derive from nitrous oxide (N_2O), a greenhouse gas that is released from the breakdown of nitrogen-based fertilizers. N_2O accounts for roughly 55% of the US' agriculture greenhouse gas emissions.

The second-largest source of agricultural emissions is methane (CH_4), a potent greenhouse gas which is produced by certain animals like cows, sheep, and goats. These animals rely on microbes to break down the grass and other plants they eat, in a process known as enteric (intestinal) fermentation. This digestive fermentation produces methane as a byproduct (much in the same way that beer fermentation produces CO_2 as a byproduct). Methane from digestion is nearly 30% of the US GHG emissions from agriculture. The decomposition of animal manure (also into methane) contributes another 12% of agriculture emissions. Nitrous oxide and methane combined account for 97% of emissions directly associated with agriculture.

The consumption-based inventory includes these direct nitrous oxide and methane emissions from agriculture, emissions from fixed capital investments in agricultural equipment and facilities, as well as emissions associated with transport and sale of food. In the consumption-based inventory, direct emissions from agriculture are the vast majority of the emissions associate with food - generally around 67-80% of food emissions come directly from food production. For most foods, transportation comprises about 5% of the emissions, while wholesale and retail make up another 5-15%. Fixed capital investments (e.g. buildings and equipment) is estimated at typically around 13% of total emissions.

While nitrogen fertilizer is the single largest source of emissions nationally, meat & dairy are often the largest sources of at-home food emissions for households. In Clallam County, meat, poultry, fish, eggs, and dairy combined account for about 2.5 $MTCO_2e$, while fruits & vegetables, cereals, and other foods account for another 2.5 $MTCO_2e$.

Despite being only a small fraction of overall calories, meat, dairy, and other animal products have an outsized impact on the typical household's emissions associated with food. This is because the emissions associated with meat consumption not only includes the direct methane emissions from the animals - it also includes the nitrous oxide emissions from growing all of the crops to feed those animals.

It takes a lot of feed crop - mostly corn - to produce one calorie of meat. In the case of beef, it can be as many as 33 calories of feed per calorie of beef. As a result, a quarter pound of beef (284 calories) could require over 9,000 calories of corn to produce.

Further compounding these food emissions is the fact that an estimated 30-40% of food goes to waste. Emissions from the production of wasted food is included in the overall emissions associated with food, driving up the emissions of all food consumption. While some of this loss occurs in production, storage, or transport, households are often also a significant source of food waste. According to the United Nations, US households purchase more calories per capita than any other country - nearly 3,800 calories per person per day in 2018. This includes all purchased food, whether consumed or otherwise.

Eating out also contributes a substantial portion of food emissions. For the typical Clallam County household, eating out is associated with roughly 1.7 $MTCO_2e$ per year. However, this includes not only all the food consumed while eating out, but also the operational emissions from restaurants, including emissions from cooking, transportation, and construction of the building. In comparison, household emissions from cooking, transportation, and construction are allocated to the transportation and housing sectors. Overall, eating out is likely similar emissions per calorie as food prepared at home; however, restaurants across the US often also serve much larger portions than are typically consumed at home, which can lead to further food waste or excess.

Examples of Individual Strategies for Reducing Food Emissions

Households that aim to reduce emissions from food have two primary strategies they can use. First, avoiding food waste and only buying as much food as the household needs is one of the easiest - and most cost-effective - ways to avoid food emissions. Second, replacing meat and dairy with plant-based meat substitutes can lead to further emissions reductions. Buying organic and locally grown food does not typically have much impact on emissions, but can provide other social and economic benefits. In Clallam County, local pasture-raised animals play important economic and ecological roles, helping to maintain soil quality and manage vegetation. However, the research on overall greenhouse gas impacts from pasture-raised beef is mixed: while there are benefits from soil health and reduced fertilizer use, pasture-raised animals also tend to live longer and weigh less before slaughter, resulting in more emissions per pound or calorie of meat.

Goods & Services

Goods and services include all physical goods purchased for household use (including furniture, clothing, electronics, personal care products, and other various household furnishings), as well as services used by residents (including healthcare, entertainment, education, personal care services, financial services, and others).

Goods and services often have lower emissions per dollar than food or energy. Households with higher incomes tend to spend more money (as well as a greater fraction of their income) on these various goods and services. Households with an adult who has a college degree tend to have higher income, and as a result tend to spend more on entertainment services, financial services, personal care products & services, and education. Homeowners also tend to spend more on home furnishings and equipment.

The largest sources of emissions from goods comes from household furnishings and equipment (including miscellaneous household equipment, furniture, and appliances), as well as apparel (clothing). Healthcare dominates emissions from services, accounting for 4.4 $MTCO_2e$ in Clallam County. Nationally, healthcare makes up roughly 12% US emissions; in Clallam County, healthcare emissions are also about 12% of the typical household's carbon footprint. Healthcare emissions include emissions from hospitals and other medical facilities, pharmaceutical manufacturing, medical equipment, and more.

Other major categories of emissions include entertainment services (mostly fees & admissions to museums, concerts, etc.), education, financial services like insurance & pensions, and miscellaneous services (including personal care, household operations, etc.).

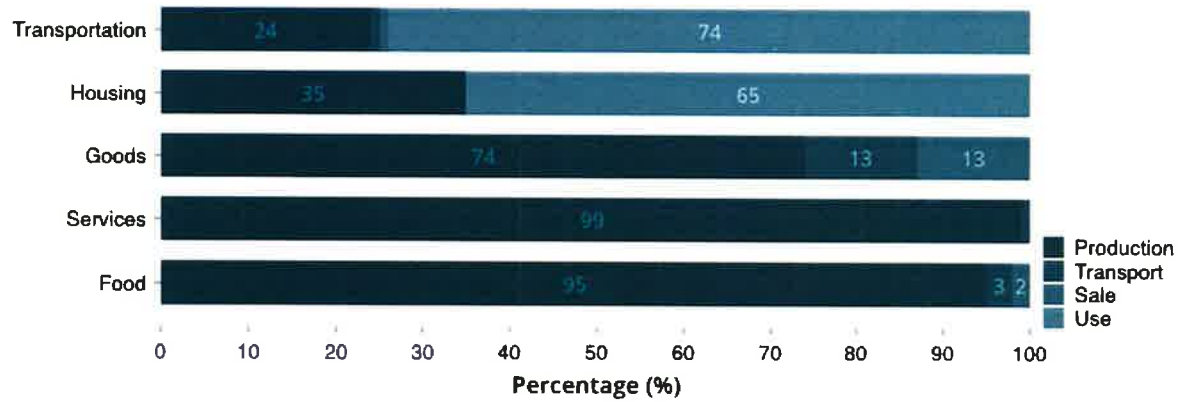
Emissions Breakdown by Supply Chain Stage

Consumption-based emissions occur at many points in the supply chain. Emissions are generated in production, during transport (by rail, sea, road, or air), in wholesale and retail, and use. In some cases, disposal also generates emissions; however, disposal also sometimes results in storing carbon that would otherwise be re-emitted. The chart below shows the share of emissions associated with production, transport, sale, and use for each overarching category of goods. (Because disposal emissions are sometimes negative, they are not included on this chart).

Household Emissions Breakdown by Supply Chain Stage - US Average

Below, Figure 36 shows what percentage of emissions are associated with each life-cycle phase (production, transport, sale, and use), for each category of consumption.

Figure 36. Household emissions breakdown by supply chain stage - US average.



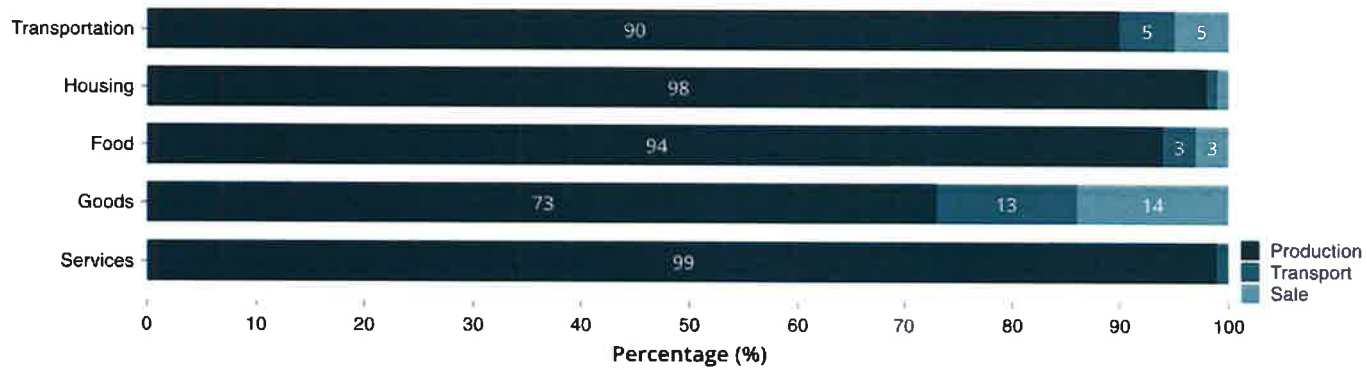
Overall, emissions from transportation and housing are dominated by "use phase" emissions - the burning of fossil fuels (such as gasoline or the methane in natural gas) for transportation or home heating energy. This "use phase" - primarily gasoline combustion - makes up nearly 74% of household transportation emissions. For housing emissions, "use phase" emissions (electricity and home heating fuels) make up 65%.

For food, goods, and services, however, use- phase emissions are practically zero. These categories have some transport and sale emissions, but are overwhelmingly dominated by production emissions. The chart below shows the pre-consumer (production, transport, and sale) breakdown of emissions by category.

Pre-Consumer Emissions Breakdown - US Average

Below, Figure 37 shows what percentage of emissions are associated with each life-cycle phase prior to use (production, transport, and sale), for each category of consumption. These are the emissions associated with the production of goods and services prior to households acquiring them.

Figure 37. Pre-consumer emissions breakdown - US average.



Pre-consumer emissions associated with Transportation (that is, prior to a consumer using a vehicle) are predominantly from production (90%). Roughly 50% of these emissions are associated with the production of fuel (oil extraction & refining); the remaining 50% are from the production of vehicles and vehicle parts. Most of the transport emissions in this section derive from the transport of used vehicles, while sales emissions mostly derive from the sale of gasoline and other transportation fuels.

For Housing, over 99% of pre-consumer emissions occur in production. This is dominated by the production of natural gas and the construction of homes, apartments, and other lodging (including hotels). The small portion of these emissions attributable to transport and sale are entirely due to the transport and sale of fossil fuels (and wood) used for home heating.

For Goods, only about 72% of emissions come from production. About 13% of emissions from goods comes from transportation, and 14% comes from retail. Transport emissions from goods disproportionately occur from truck travel, which make up over 90% of the total goods transport emissions (12% of goods total emissions). Similarly, over 90% of the emissions associated with the sale of goods comes from retail (13% of goods total emissions).

Like Housing, pre-consumer emissions from Services are overwhelmingly (99%+) from production. Services is primarily made up of activities like healthcare, education, entertainment, and various financial services; most of these involve little to no retail or transportation to provide these services.

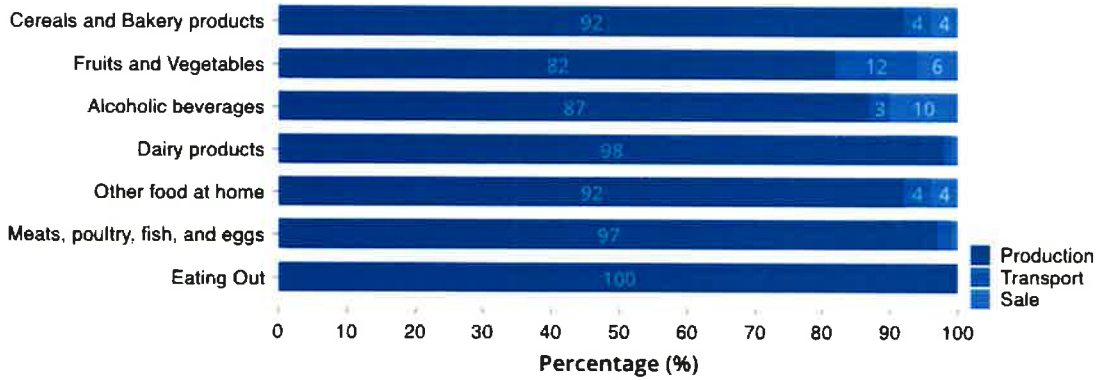
Lastly, for Food, roughly 95% of emissions occur in production. As discussed in the Food category breakdown, food emissions primarily come from application of nitrogen fertilizers and enteric fermentation (methane released from digestion by cows and other

livestock). These emissions significantly outweigh the emissions associated with transportation or sale of food. The following chart provides a detailed breakdown by sub-category within Food.

Pre-Consumer Food Emissions Breakdown - US Average

Below, Figure 38 shows what percentage of emissions are associated with production, transport, and sale, for each category of food.

Figure 38. Pre-consumer food emissions breakdown - US average.



For all food sub-categories, over 80% of emissions come from production. For fruits and vegetables, and alcoholic beverages, production emissions account for roughly 83% and 87% of pre-consumer emissions, respectively. Cereals and bakery products, as well as miscellaneous household food, have roughly 92% of their emissions from production. Meanwhile, meat and dairy products have over 97% of their emissions from production, while eating out has 99% of its emissions from production. Within all food sub-categories, transportation emissions are overwhelmingly dominated by truck transport.

As discussed previously, meat and dairy products have significantly higher emissions (on either a per calorie or per dollar basis) than other foods. These extra emissions are virtually entirely in the production phase, which is why production is a higher-than-average share of emissions for meat and dairy.

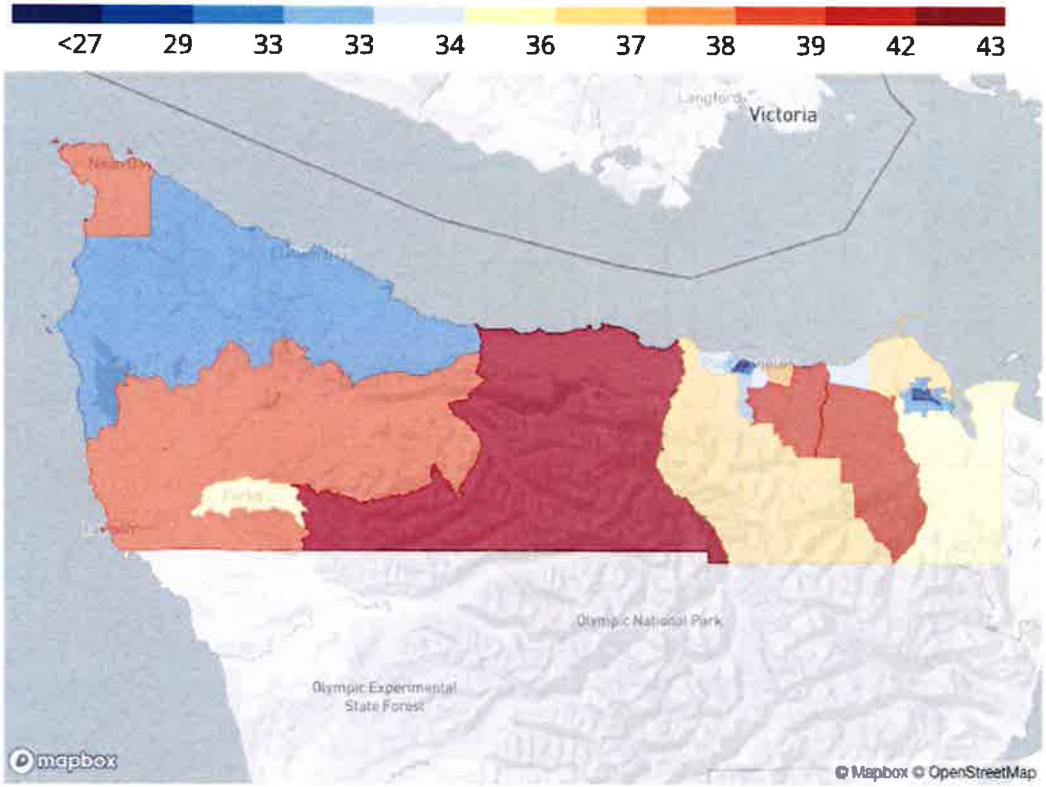
Meanwhile, even fruits and vegetables have predominantly production-phase emissions because the transport of food is relatively efficient, even over longer distances. As a result, fruits and vegetables from local farmer's markets are not necessarily lower emissions than those at large supermarkets. Because farmers typically bring relatively small quantities to the farmer's market, the

transport may be much less efficient, which could result in a higher overall footprint than food that may have been grown further away but transported more efficiently.

Neighborhood Variation

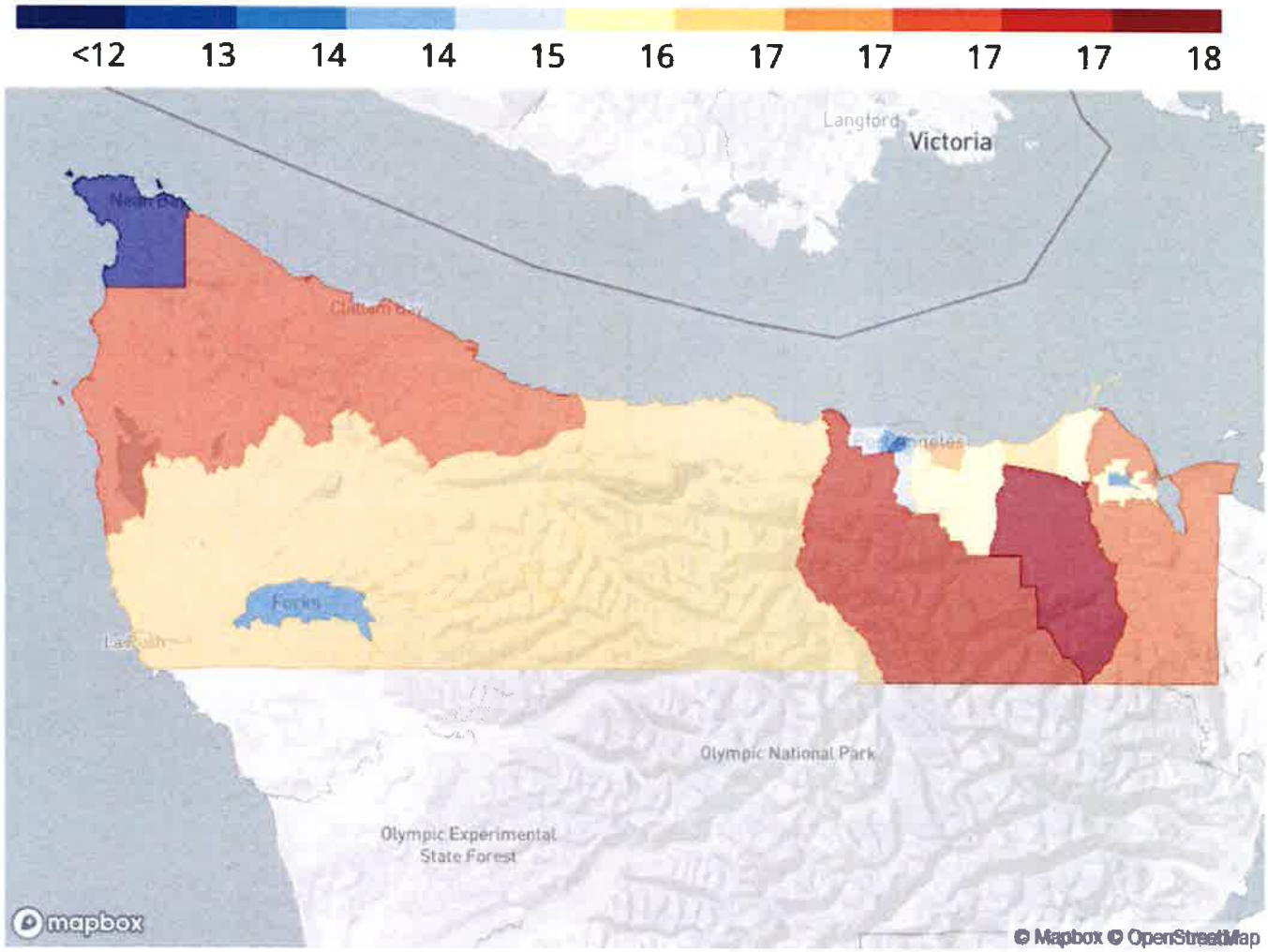
Among the 21 neighborhoods (census tracts) within the county, there is substantial variation in both emissions and the key driving demographic variables. The highest-emitting neighborhood has per-household emissions of 43 tons, while households in the lowest-emitting neighborhood have emissions of 27 tons - roughly a 1.6-fold difference.

Figure 39. Consumption-based emissions map ($MTCO_2e$ per household).



On a per-capita basis, these differences are similarly pronounced. Clallam County's highest per-capita neighborhoods have emissions of 18 tons per person, while the lowest per-capita neighborhoods have emissions around 13 tons, about a 1.4x difference.

Figure 40. Consumption-based emissions map ($MTCO_2e$ per person).



The variation in emissions between neighborhoods is driven by a wide range of factors. In many locations, historical – or current – local land use planning has a significant influence on the consumption-based emissions. Local jurisdictions adopt plans and regulations specifying what kinds of buildings can be built, under what conditions, and to what criteria. This has significant effects on where people choose to live, and what kind of lifestyles can be accommodated, with consequences for consumption-based emissions.

The following maps show how the six core household characteristics – income, home size, household size, home ownership, vehicle ownership, and education – vary across the county, with subsequent implications for consumption-based emissions.

Figure 41 Clallam Average Household Income Map

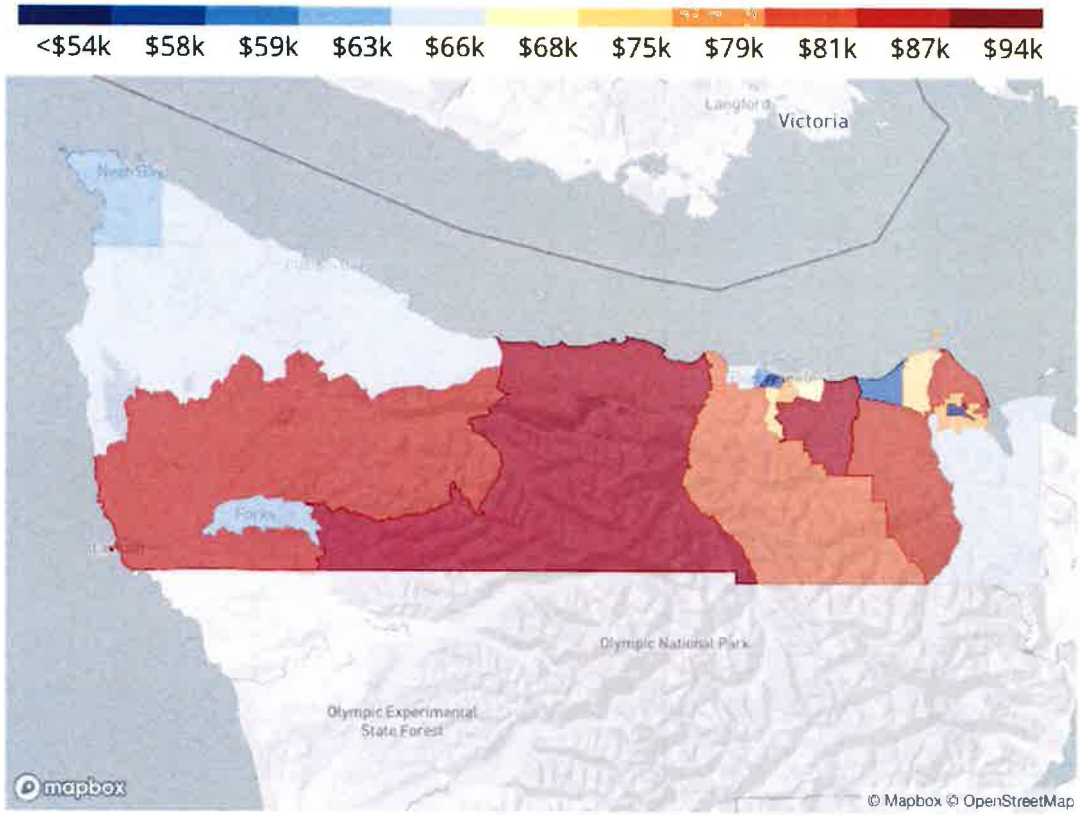


Figure 42 Clallam Household Size Map

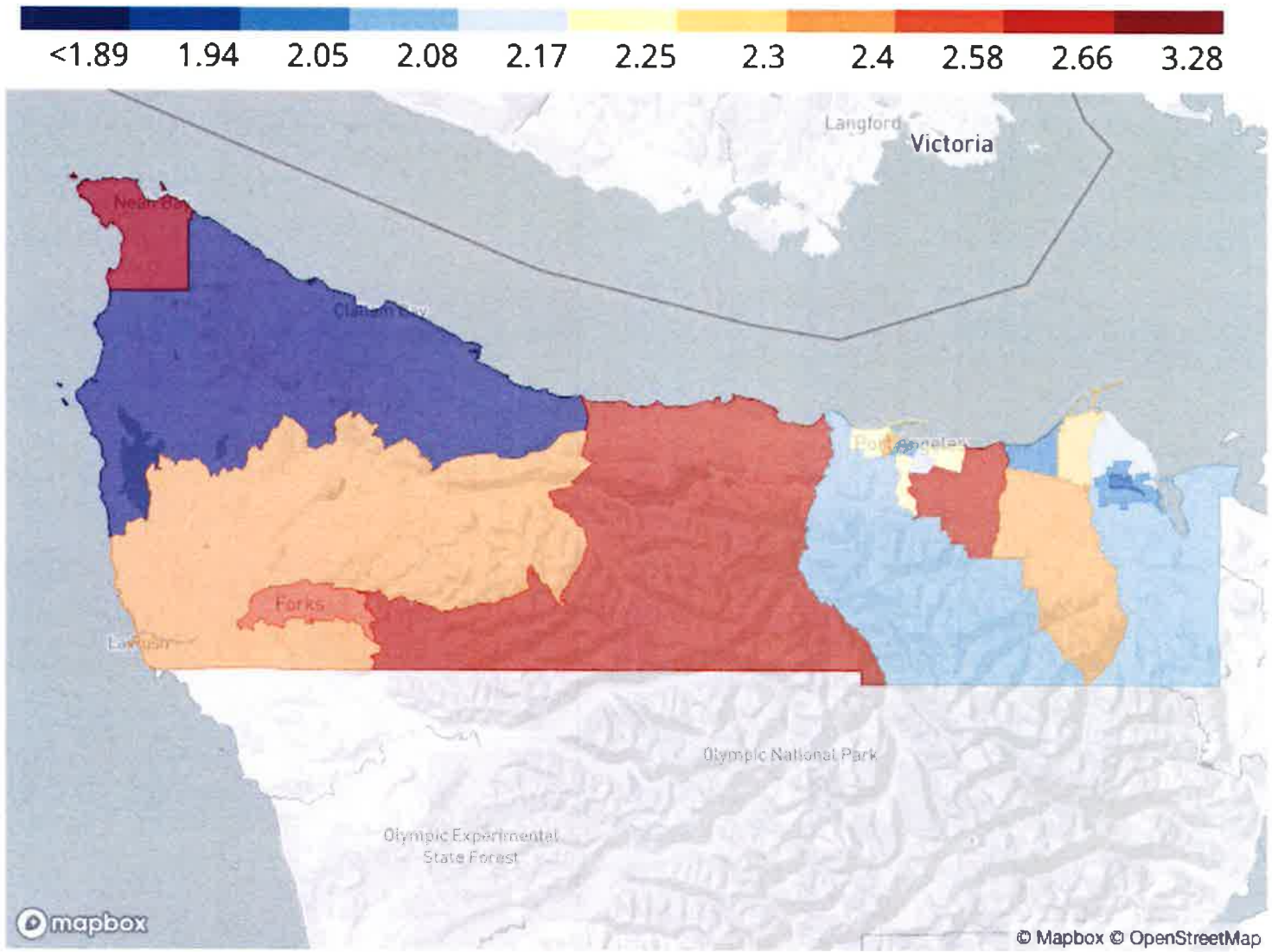


Figure 43 Vehicle Ownership Map

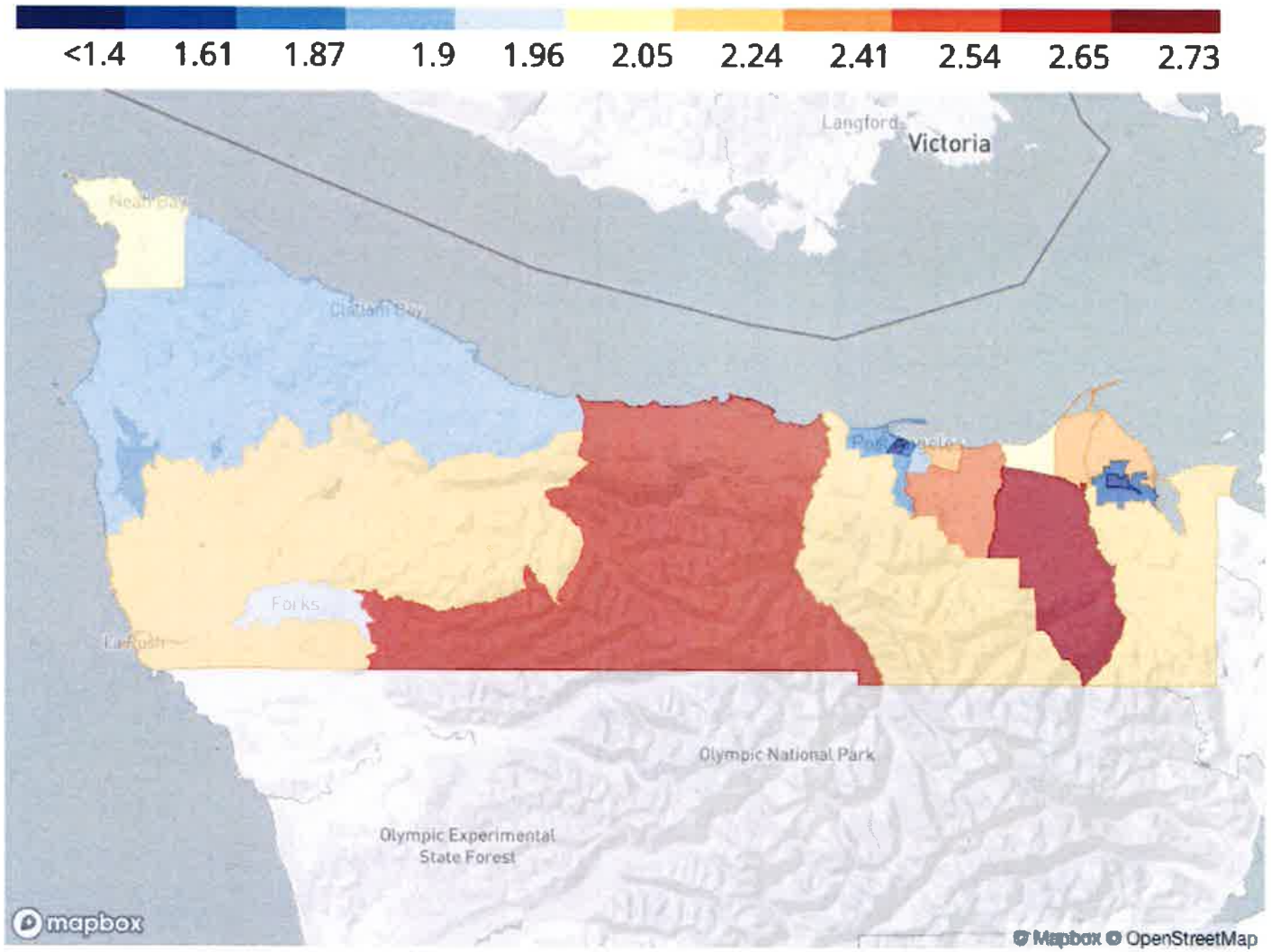


Figure 44 Clallam Rooms per Household Map

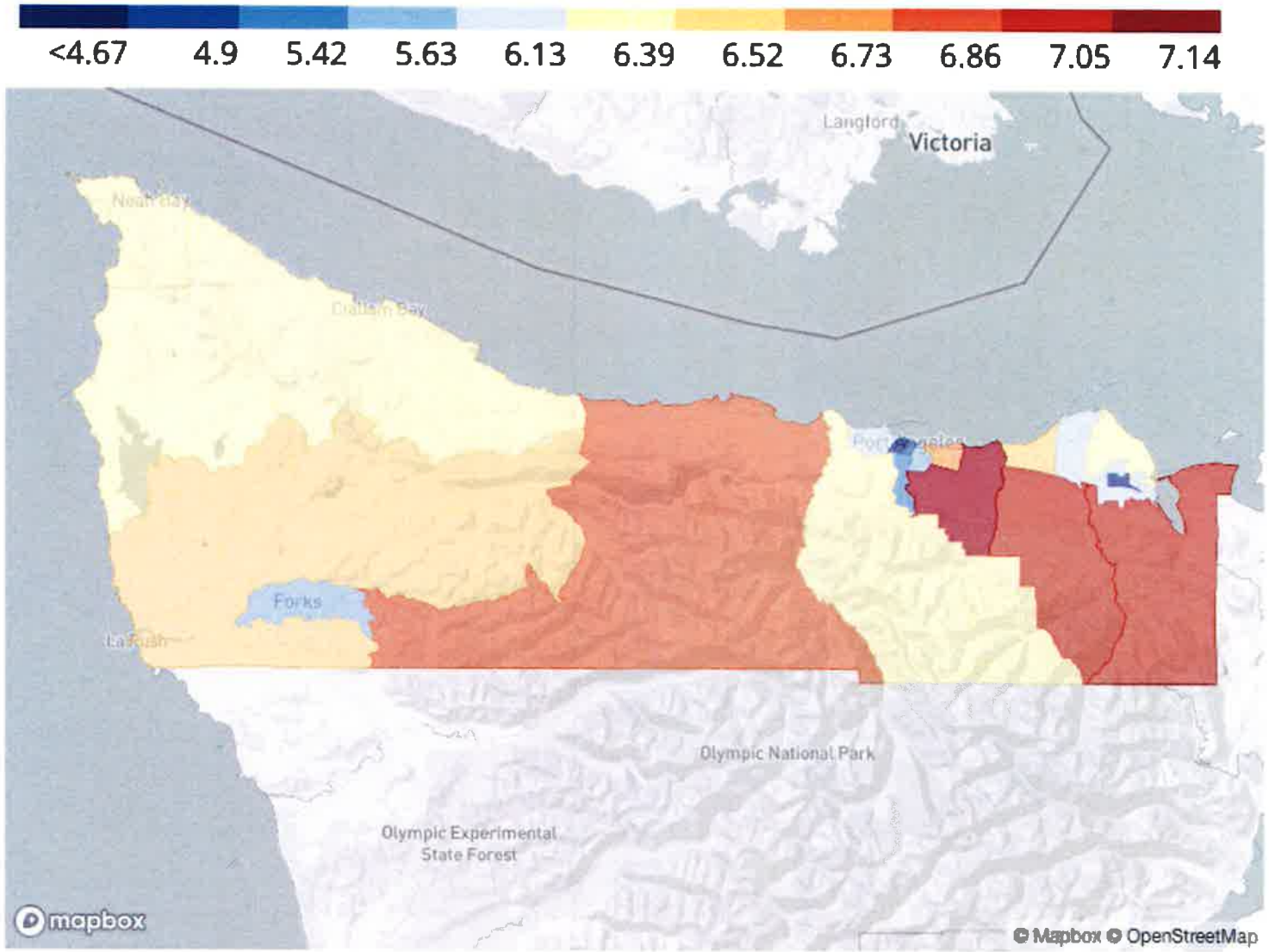


Figure 45 Clallam Home Ownership Map

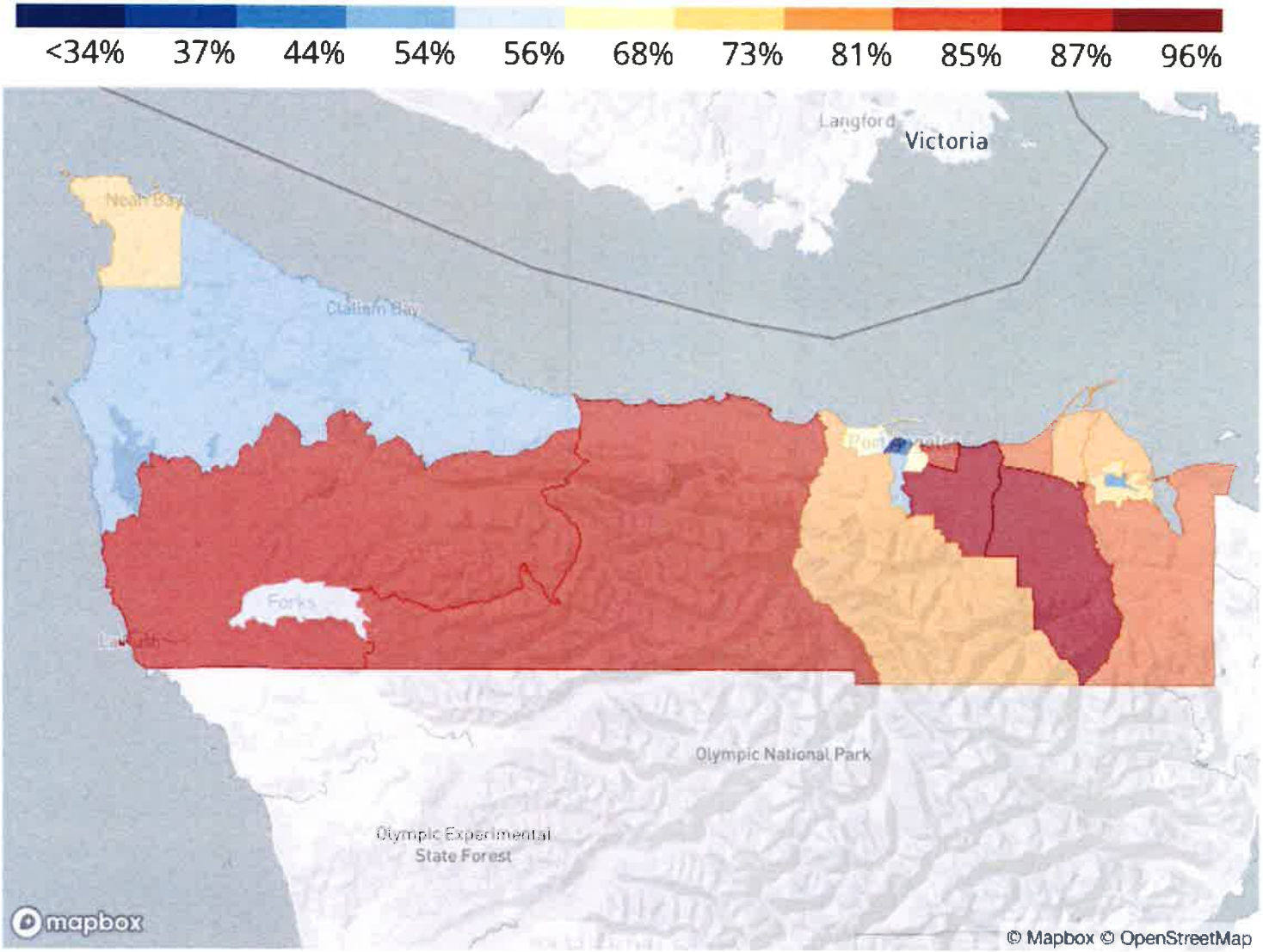
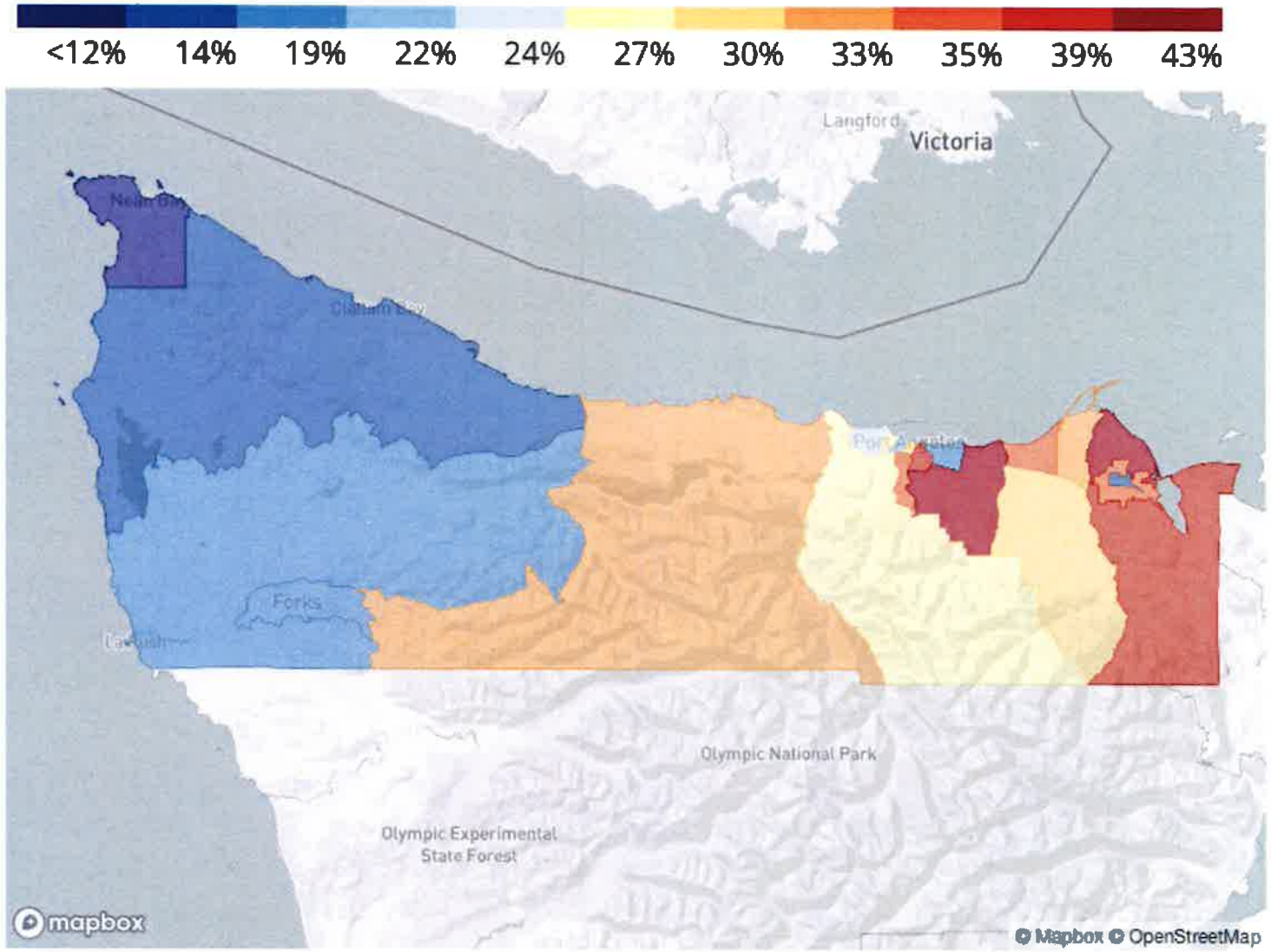


Figure 46 Clallam College Degree Attainment Map



As shown in these maps, parts of Clallam – especially in the northwestern part of the county, and in the towns of Port Angeles, Sequim, and Forks – tend to be lower income and less educated. Lower income households typically also live in smaller homes due to their being more affordable, and are more likely to be renters. Meanwhile, Clallam's wealthiest residents live in the central areas of the county, just outside Port Angeles and Sequim.

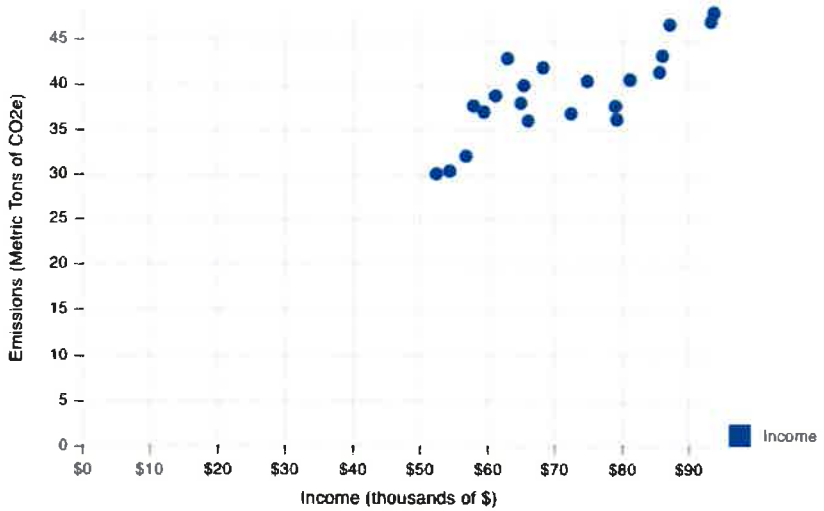
Clallam's historical patterns of development have likely played a role. Older homes in and near the towns tend to be smaller, while postwar suburban developments and farmland subdivisions further out have catered primarily towards wealthier and larger households.

Smaller homes, closer together often means urban areas are more walkable or bikeable and have more public transit options available, reducing vehicle usage and ownership. Smaller homes also means households tend to be smaller, while multi-unit dwellings mean more energy efficiency for heating and cooling.

In contrast, suburban neighborhoods tend to have among the highest emissions per household. Suburban land use plans often encourage large, detached, single-family homes, with spacious yards and setbacks. Larger detached homes take more energy to heat or cool, and the extra space (and lack of nearby destinations) generally results in greater automobile usage. Larger homes also tend to be more expensive, making these suburban neighborhoods exclusive to wealthier households. Households that are drawn to suburban homes are also often looking to use the space to raise families, meaning larger household sizes.

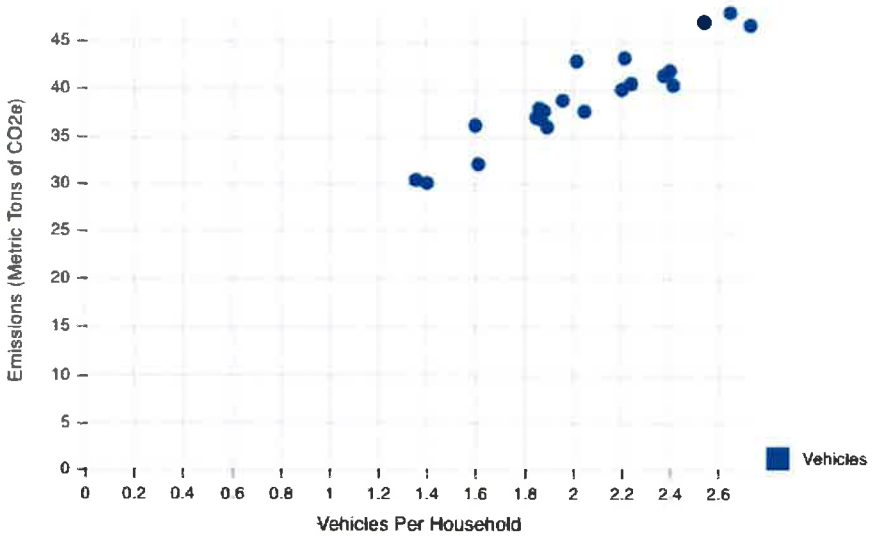
The following charts provide some examples of how these neighborhood demographics correlate with per household emissions across the county. Each scatterplot shows census tracts in the county, with a demographic variable – such as income, vehicles per household, rooms per household, and home ownership rate – on the horizontal axis, while average per-household emissions for each tract are tracked on the vertical axis.

Figure 47. Household income vs emissions.



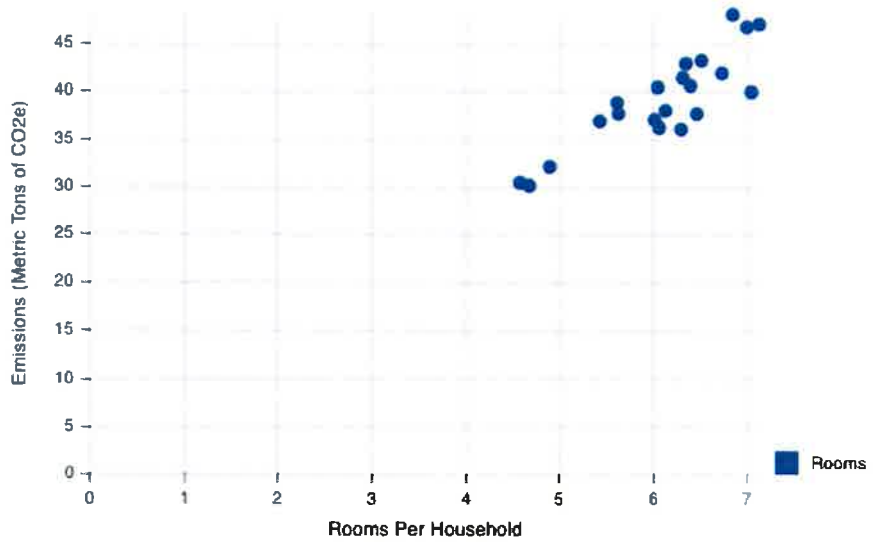
Higher incomes strongly correspond to greater consumption emissions. However, even at a given income level, different neighborhoods have different household emissions. At the very highest incomes, neighborhoods tend to be clustered at the upper end of emissions, but middle-income (for the county) has a wider range of variation. Middle-income households often have the choice of either living in suburban, car-dependent communities or more walkable urban cores; those that live in areas with lower dependency on automobiles - as shown in the next chart - can have much lower emissions.

Figure 48. Vehicle ownership vs emissions.



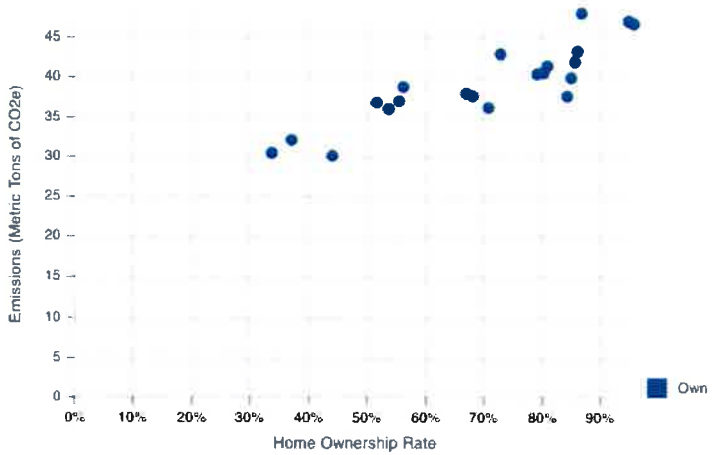
Greater vehicle ownership strongly corresponds to greater emissions, in large part due to the increased driving associated with the extra vehicle(s). Greater vehicle ownership is likely also correlated with household size.

Figure 49. Rooms vs emissions.



More rooms per home strongly corresponds to greater emissions - homes with more rooms take more energy to heat or cool, and have more space to accommodate more purchases of furniture and other household goods.

Figure 50. Home ownership vs emissions.



Greater home ownership strongly corresponds to greater emissions. This is partly because home ownership correlates with income and household size, but it is also because home ownership on its own leads to more consumption of goods that are higher emissions - for instance, furniture and miscellaneous housewares.

Conclusion & Next Steps

Across Clallam County, consumption-based household emissions range from 27 to 43 tons per household, with an average of 35 tons per household, or 15 tons per person. Geographic variation is driven by differences in income, household size, home size, vehicle ownership, education, and home ownership. Many of these geographic differences reflect historical choices in local land use decisions.

Table 3 below compares consumption-based emissions in Clallam with King, Pierce, Kitsap, and Snohomish Counties in the neighboring Puget Sound region, as well as the US average. These Puget Sound counties are selected for comparison due to their geographic proximity and having recently completed consumption-based emissions inventories of their own using an identical methodology, allowing for an apples-to-apples comparison.

Unless otherwise stated, all emissions are on a per-household basis and for the calendar year 2019.

Table 3. Regional CBEI comparison.

Category	Clallam	King	Pierce	Kitsap	Snohomish	US AVG
Transportation Emissions	13.9	14.2	15.6	15.6	16.2	10.8
Housing Emissions	2	6.0	9.2	9.5	3.5	9.5
Food Emissions	7.4	8.4	8.0	8.1	8.4	9.5
Goods Emissions	4.3	5.0	4.7	4.7	4.9	9.5
Services Emissions	7.2	7.9	7.9	7.5	7.9	5.9
Total Emissions	35	42	45	45	41	45
Total Per Capita Emissions	15	17	17	19	15	17

Clallam County's total countywide consumption-based emissions of roughly 1.2 million $MTCO_2e$ are roughly 60% smaller than the geographic inventory of 2.8 million $MTCO_2e$ occurring within County limits (when accounting for logging). Because of its significant industrial (ie logging) activity, Clallam is a net importer of emissions from a consumption-based standpoint: households elsewhere in the world consume goods and services, for which the emissions occur geographically in Clallam. This is in contrast to many other counties in the US with either heavier residential or service-based sectors, where the consumption-based inventory might be several times larger than the geographic inventory.

Table 4, below, shows aggregate consumption-based emissions by county (per household emissions times the total number of households) for each category and in total, in thousands of $MTCO_2e$, for 2019.

Table 4. Aggregate Consumption-Based Emissions ('000s of $MTCO_2e$)

Category	Clallam	King	Pierce	Kitsap	Snohomish
Transportation Emissions	459	12,890	5,205	1,677	4,857
Housing Emissions	66	5,447	3,070	1,021	1,050
Food Emissions	244	7,625	2,669	81	2,519

Goods Emissions	142	4,539	1,568	505	1,469
Services Emissions	238	7,171	2,636	806	2,369
Aggregate Emissions	1,156	38,126	15,016	4,839	12,293

Clallam's use of zero-emissions electricity and no natural gas set it ahead of other counties in terms of already-achieved emission reductions, including those in the Puget Sound region. Because Clallam has a smaller population than other counties in the Puget Sound region (just over 33,000 households in Clallam, vs 108,000 to 908,000 households for Puget Sound counties), aggregate consumption-based emissions in Clallam are also smaller than in those other counties.

Clallam County's largest categories of consumption-based emissions include gasoline usage, healthcare, furnishings & appliances, meat, and eating out. However, some of these categories – especially healthcare and eating out – are likely smaller than estimated, because local providers do not have emissions associated with their use of electricity and do not use natural gas. These emissions estimates are based on national average emission factors associated with expenditures at these types of businesses, but because of Clallam's unique circumstances, future CBEIs should seek to quantify the indirect benefits of the county's use of clean energy.

Transportation emissions remain the single largest overall category of consumption-based emissions in Clallam County, with significant opportunities for further reductions. Table 5 provides a detailed breakdown of the emissions associated with each sub-category of transportation; all values are on a per-household basis unless otherwise stated.

Table 5. Detailed Transportation Emissions Breakdown

Category	Clallam	King	Pierce	Kitsap	Snohomish
Air Travel	1.1	1.9	1.4	1.4	1.6
Other Vehicle Expenses	0.6	0.7	0.7	0.7	0.8
Vehicle Purchases	1.2	1.5	1.2	1.3	1.3
Gasoline	11.0	10.1	12.3	12.1	12.5
Total Transportation Emissions per Household	13.9	14.2	15.6	15.6	16.2
Total Transportation Emissions per Capita	6.0	5.8	5.9	6.4	6.0

Category	Clallam	King	Pierce	Kitsap	Snohomish
Total Aggregate Transportation Emissions	459,000	7,171,000	2,636,000	806,000	2,369,000

Compared with the Puget Sound region counties, Clallam residents have similar levels of driving and gasoline usage, but lower air travel emissions, resulting in overall slightly lower transportation emissions per household (though comparable or average on a per capita basis, due to Clallam's smaller household sizes).

Clallam's best opportunity for reducing consumption-based emissions align with some of its top strategies for reducing local direct GHG emissions: transitioning to zero-emission vehicles and, where feasible, supporting alternative modes of transit such as biking, walking, and buses.

While Clallam has successfully maintained its lower-income communities through 2019, changes in home prices since the pandemic and other economic shifts may be jeopardizing lower-income households' ability to stay in and afford Clallam. To help ensure lower-income households can remain in Clallam, and to expand opportunities for higher-income households to enjoy Clallam's low-emission lifestyles, Clallam (and its constituent communities) should explore permitting and encouraging the construction of smaller homes and more rental units, particularly in the lower-vehicle-ownership cores of its constituent communities, and discourage the development of larger auto-dependent single-family subdivisions except as needed to meet housing demand.

Clallam could also explore policies to encourage a dietary shift away from imported red meat, focusing on locally raised meat and/or reductions in meat consumption generally, along with strategies to reduce food waste, can help bring down food emissions. Lastly, because of Clallam's clean energy and lack of natural gas, it is well-positioned to support the growth of local zero-emission industries. These zero-emission industries can help meet local and global demand for goods and services, without causing any additional emissions, helping to move up the date by which we can achieve a zero-emission world.

Appendix 1: Methodology

EcoDataLab CBEI Modeling Approach

The consumption-based emissions inventory (CBEI) is not a direct measurement of individual resident's consumption or behavior. Instead, EcoDataLab uses a model (a series of complex calculations) to estimate consumption and emissions, using a combination of real-world consumption or emissions data where available, along with predictions based upon household characteristics, as well as regional and national averages.

This model is based upon an approach first developed by the CoolClimate Network at the University of California, Berkeley, and published extensively in multiple scientific journals.

The overall model has a number of sub-models, but each one follows the same general formula:

1) Select a survey

We select a nation-wide survey, conducted by the US federal government, that focuses on an important element of the inventory. The US sub-models are built using the Consumer Expenditures Survey (CEX), the National Household Travel Survey (NHTS), and the Residential Energy Consumption Survey (RECS).

These surveys are used to build the full suite of models. CEX provides data used to model all categories of consumption except for gasoline and home energy use. NHTS provides data for the vehicle miles traveled model (which translates into gasoline usage), and RECS provides data for the home energy use models (including electricity, natural gas, and other heating fuels).

2) Identify key household characteristics

Next, we look at the household characteristics available from the survey, and identify data for which we can get nationwide data from the US census and other data sources. These data include variables like household size, income, vehicle ownership, etc. We also include geography, climate, and other relevant data where applicable.

3) Build a predictive model

Using the nation-wide survey and selected household and geographic characteristics, we run a computer program that identifies how strongly each of those household characteristics correlates with the survey results. This technique is called multiple linear regression, and is a type of machine learning - the computer sees many input data (the household and geographic characteristics)

and learns how to predict what the outcome will be (the survey result). The computer then gives us an equation that takes each of those household and geographic characteristics and produces an estimated result.

A single linear regression might take this form:

$$y = mx + b$$

where y is the survey result (dependent variable), x is the household and geographic characteristics (independent variable), m is the computer's predicted correlation between x and y (slope), and b is a fixed value that adjusts for any underlying base discrepancy between x and y when x is equal to 0 (intercept).

In multiple linear regression, the equation takes on a more complex form:

$$y = m_1x_1 + m_2x_2 + m_3x_3 + ... + b$$

where in this case, each x (x_1, x_2, x_3, etc.) is a different household or geographic characteristic, with its own unique correlation (m_1, m_2, m_3, etc.) that together add up to make the overall result. The number of x variables depends on the sub-model and available data. All EcoDataLab sub-models use at least six variables (...x_6), with some using a dozen or more to get the most accurate prediction possible.

In addition, many of the values we are considering do not scale linearly. Instead, the models often look more like this:

$$\ln(y) = m_1x_1 + m_2*\ln(x_2) + m_3x_3 + ... + b$$

where the survey result might actually be scaled as a natural log (ln) variable, and some of the household and geographic characteristics are also calculated using its natural log (or sometimes both its ordinary and natural log values). This generally occurs in cases where there are nonlinear effects from household characteristics, and smaller values have different implications than larger values. For example, a household of 2 is typically two adults, whereas a household of 3 typically includes a child, which can significantly change consumption patterns. Similarly, consumption patterns based on income change significantly once basic needs are met and "luxury goods" start being consumed.

4) Run the model using local data

With these multiple linear regression models built (see above), we then collect over 200 points of local data - mostly census and climate data, from federal sources including the US Census Bureau, the National Oceanic and Atmospheric Administration (NOAA), but also things like energy prices, inflation rates, fuel economy, and emission factors from sources including the Energy Information Agency (EIA), the Bureau of Labor Statistics (BLS), the Department of Energy, and the Environmental Protection Agency (EPA). Those values are transformed to fit the required inputs to the model, and then the model is run with that local data as the independent (x) variables in the model.

In some census tracts, local data is a poor fit for the models. Because the models are trained on a limited set of survey data, local outlier values produce unreasonable results.

For instance, prisons, universities, and military bases can result in unrealistic estimates of things like household size, while vacation destinations (beach or resort towns) can result in unrealistic estimates of rooms per household. We correct significant outliers to be more realistic estimates of local conditions for typical households in these instances. Extremely wealthy communities (average household incomes well in excess of $300,000/yr) are also an outlier and are adjusted downwards; much of the luxury spending at these higher income levels is very low-emission due to spending money on intangibles like brand value (ie luxury clothing and cars have similar emissions as non-luxury goods, but cost significantly more due to the brand, and so adjusting highest-income households downwards preserves the accuracy of the emissions estimates).

5) Make final adjustments to consumption estimates

While the multiple linear regression model helps us estimate consumption, the model doesn't perfectly resemble reality. We adjust for these discrepancies by comparing the model's predicted results with real-world data wherever available, and scaling the model outputs accordingly where real-world data isn't available.

To achieve this, we compare the model results with the actual results for the most granular level of data available. This can be national-level data (in the case of surveys), state-level data (in the case of transportation), or locality-level data (in the case of energy or water consumption). For cases where real-world data is available at the geographic scale of interest, we use the real-world data in place of the modeled data; otherwise, we run the model at a geographic level at which data is available and use that to create a scaling factor, which we use to correct the locally modeled data. For example, the standard approach to energy modeling is to compare modeled state-level energy use with real-world state-level energy data, and then use that scaling factor to adjust a city or county's modeled energy use.

6) Calculate emissions

After calculating consumption using the models, we then calculate emissions. Most consumption emissions are calculated using the US EPA's USEEIO Model, which bridges the gap between consumption (dollars) and emissions ($MTCO_2e$). This model includes data on emissions by sector and supply chain stage, allowing us to differentiating between emissions associated with production, transport, wholesale, and retail, for all US emissions. Emissions associated with fixed capital investments (e.g. buildings & infrastructure construction, excluding residential construction) are also incorporated across all sectors.

For electricity emissions, we use EIA's eGrid emission factors, detailed at the zip code level and then scaled to any geography. For all other direct consumption of fuels (natural gas / methane, gasoline, etc.), we use the latest IPCC GWP values and best available academic literature to estimate life-cycle emissions. This includes fugitive and non-CO_2 GHG emissions, as well as any radiative forcing effects from other emissions (such as particulate matter or contrails).

When working with local jurisdictions, we always replace these national or grid average emission factors with the best available local data. We contact state agencies to procure detailed vehicle registration data, which we combine with US DOE fuel economy data to get the most granular and accurate estimate for fuel economy of local residents' vehicles. We work with local jurisdictions to identify local utilities and their geographic coverage, and their local emission factors for electricity, water & wastewater, or methane leakage rates.

Model Input Variables

The consumption models use the following six variables: household size, average income, vehicle ownership, home ownership, share of households respondents with a bachelor's degree or higher (educational attainment), and number of rooms (home size).

The vehicle miles traveled model uses household size, average income, vehicle ownership, home ownership, and educational attainment, along with commute time to work, drive alone to work, number of homes per square mile, number of employed people per square mile, employed people per household, family status, children per household, youth per household, adults per household, and Census region. The race of households (white, Hispanic or Latino, or neither) also proved to be statistically significant and was included.

The home energy models use household size, average income, home ownership, and home size as well as detached home status, heating and cooling degree days, statewide average price of electricity, statewide average price of natural gas, and census division.

Appendix 2: Government Emissions

In the consumption-based inventory, government agencies are considered final demand the same way households are, and so government emissions are not attributed directly to households. These emissions are not insignificant – based on GDP data and the same USEEIO emission factors discussed in Appendix A, federal, state, and local governments across the US had emissions totaling over 660 million $MTCO_2e$. Of this total, roughly 69% came from state & local governments, with the remaining 31% from the federal government split between defense (24%) and non-defense sectors (7%).

Like households, government emissions include transportation, buildings, food, and procurement of goods & services. Transportation emissions include the use of government vehicles, aircraft, trains and buses, police and firefighting vehicles, ambulances, and more. (Because public transit is heavily subsidized in the US and associated emissions are not directly related to consumer spending, these emissions are allocated to government instead).

Government emissions from buildings include natural gas used for heating and water heating, as well as electricity use associated with the operation of the building. Government buildings include agency or department offices, legislatures, public colleges and universities, local schools, ports and airports, courts and prisons, post offices, military bases, some museums, research laboratories, libraries, water treatment plants, some hospitals, and more.

Embodied emissions from construction, including infrastructure, are also included. Roads, highways, and bridges all have large emissions associated with their construction. Governments also build and maintain local water supplies and resources, as well as some railway and public transit infrastructure, with additional emissions associated. Lastly, other purchases of food, goods and supplies, and services all have emissions associated with them as well.

Government consumption, and associated emissions, are not linked to particular household characteristics or activities in readily traceable ways. While some government activities can be linked to certain households – such as direct cash transfers for unemployment insurance or social security; and healthcare coverage through Medicare, Medicaid, or veteran's benefits – other government activities, like infrastructure construction and maintenance, national defense and public safety (police & fire), R&D spending, and parks maintenance cannot be readily and systematically assigned to households based on any discernable characteristics.

As a result, these emissions can only be effectively allocated to households on a flat average basis. If these emissions were allocated to households, it would be an average of 5.5 $MTCO_2e$ per household. For Clallam County, this would work out to an additional 182,000 $MTCO_2e$ countywide. These "hidden" emissions are not otherwise captured in the consumption-based emissions inventory, but still contribute to overall emissions nationally and globally.

Government agencies often have their own internal plans for reducing their emissions, with strategies that include switching to 100% renewable energy, purchasing electric vehicles, and retrofitting buildings to eliminate natural gas usage.

APPENDIX C. ACTIONS FOR FUTURE CONSIDERATION

Scope	Action Short Name	Action Description	Source	Reasoning
County	Support Local Utilities in efforts to negotiate the 2028 BPA renewal agreement	The current Bonneville power franchise agreement with the County's local utilities expires in 2028. It is expected that this will be a twenty-year agreement. The County, together with other stakeholders (Port of Port Angeles, State and Federal Representatives, the Tribes, NODC, EDC) should assist our local utilities in their negotiation efforts with BPA concerning the 2028 power supply contracts. Issues that will need to be addressed include: • The new regulatory requirements regarding clean energy acquisition and reduction of greenhouse gas emissions; • Achieving adaptable contract terms to respond to changing externalities in the environment, irrigation rate mitigation, and having sufficient and affordable energy for economic development. • These new BPA contracts also need to ensure renewable, resilient, and low-GHG emission sources that protects healthy habitat for salmon and other aquatic species.	Public Power Post-2028 Concept Paper, NRU; 2019 Resiliency Plan: Recommendations Addressing Climate Change for City of Port Angeles	Already in the process of this negotiation

Scope	Action Short Name	Action Description	Source	Reasoning
County	Begin planning for larger transit connections	Begin researching and planning for opportunities to implement a high speed commuter transit option (bus with dedicated travel lanes, light rail, etc.) between communities such as Jefferson and Kitsap counties.	Clallam County CAC	Longer term action outside timeframe for this plan
Community	New green building requirements	Enact new building electric requirements and codes, continue to promote the County's green building program to phase out fossil fuels. Examples could include: • Provide resources and incentives to meet green buildings standards for new residential and commercial development. • Department of Community Development will create a pre-approved set of plans for a LEED Certified home. Pre-approved plans will be available for purchase through DCD and cost of plans will include cost of basic inspection fees. • Incentives for weatherization. • Incentivize electric heating/cooling and electric water heat pumps in all new builds or renovations. • Incentivize new buildings be solar ready (where feasible) and EV charging ready (consider including buildings undergoing deep retrofits as this is another good time to make changes). The County should lead by example by updating County building codes and requirements to meet	Clallam County; Modeled after DCD's Basic Living Unit preapproved plan program	County already has very stringent building codes and meets IBC code standards through WA State requirements.

Scope	Action Short Name	Action Description	Source	Reasoning
		green building standards for all new County facilities and development. • Build all new County buildings and develop sites to at least a LEED Silver criterion for energy, water and waste conservation strategies (e.g. Architecture 2030, LBC certification). • Climate-smart permitting: Incorporate future climate change scenarios when calculating level of service for permitting county facilities and services. • Require electric heating/cooling and electric water heat pumps in all new builds or renovations. • Require new buildings be solar ready (where feasible). And EV charging ready (consider including buildings undergoing deep retrofits as this is another good time to make changes).		
County	Food Preservation	Upgrade county-owned commercial kitchen facility (fairgrounds) for use by community groups for community-processing and preservation events to capture excess food and increase resiliency against climate-related supply chain issues.	Clallam County CAC	Going to pursue in another way, does not need to be included in the CAP as no direct emissions reduction connection; more of a resiliency action
County	Expand County staff capacity	Fund a full-time waste reduction coordinator whose duties include: Educating community on zero waste strategies such as sustainable consumption, reuse opportunities, recycling, and	Clallam County CAC	Already received funding for this position through WSU Extension

Scope	Action Short Name	Action Description	Source	Reasoning
		composting assisting with internal waste reduction systems.		
Community	Continue to partner with Clallam Transit	Continue to partner and support Clallam Transit to identify barriers to using transit, expand transit use, and ensure routes are convenient for travelers/commuters, safe, and accessible, and increase ridership.	Clallam Transit's Comprehensive Operational Analysis; Olympic National Park Action Plan	Already partnering and supporting Clallam Transit
County	Advocate for the Conversion Forestry Ordinance	Advocate and support the current Conversion Forestry Ordinance that is currently in progress that would incentivize cutting less than 33% or 66% of the trees on the property (versus clear cutting). These new options would be considered a "Conversion Option Harvest Plan" (COHP), and would minimize grading and limit clearing of the understory in addition to retaining trees on the property.	Clallam County CAC	Successful! Already been codified into County law.
County	Incentivize maintenance of land	Increase incentives for the maintenance or restoration of areas within agricultural zoned property, such as wetlands and ponds, that function as carbon sinks, promote water storage, and provide other ecosystem services.	Whatcom County CAP; Port Townsend / Jefferson County Climate Action Plan	Already a very regulated area and already doing
County	County agricultural policies and processes	Revise the Comprehensive plan, and other County plans, to remove barriers to agricultural activities and incorporate strategies for protecting productive agricultural lands and expanding food production in Clallam County.	Clallam County CAC; Whatcom County CAP; Port Townsend / Jefferson County Climate Action Plan	Combined with other land use action

Scope	Action Short Name	Action Description	Source	Reasoning
Community	Invest in the agricultural sector of Clallam County	Double demand of locally produced food in Clallam County by 2030 by investing county dollars in education, marketing and promotion resources for the agricultural sector for Eat Local First.	Clallam County CAC	Need more action oriented language, revised into another action
Community	Support sustainable farming resources	Provide continued support for programs that work with farms to help make their businesses more sustainable, increase land access and succession planning for farms, vegetable variety trials, soil management, etc.	WSU Extension; Conservation District; NODC; Port Townsend / Jefferson County Climate Action Plan	Revised and combined into one action
County	Expand land use policies	Expand land use zoning standards and codes to promote transit-oriented development and mixed-use development to reduce urban sprawl. Updated codes could include: • Provide incentives to build within walkable distances to existing transit, school, employment, community facilities, businesses, and other supporting services (relevant for LAMRIDs and explore in denser neighborhoods). • Exclude residential development in riparian corridors, floodplains, and on shoreline areas subject to storm surge. In addition, preserve rural and commercial forest lands and agricultural lands. • Revise zoning codes to reduce development potential in high value working lands and	2019 Port Angeles Housing Action Plan; Whatcom County CAP	Already in place

Scope	Action Short Name	Action Description	Source	Reasoning
		ecosystem areas, including the critical areas and climate impact zones. • Require climate impact vulnerability assessments and projected GHG emissions and mitigation in the planning of large new residential, commercial or industrial developments.		
Community	Support and expand Conservation Futures	Support and expand Conservation Futures for the protection of farmland and open space.	Clallam County CAC	Combined with another action
County	Update water conservation programs and policies	Increase regional capacity for water storage through regulations, capital projects, and outreach/education: • Incentivize and allow regulated rainwater harvesting. • Create regulations that require water efficient appliances (washers, dishwashers, toilets, etc.) • Enhance stormwater retention in upstream areas where appropriate and feasible. • Develop code and infrastructure for reclaimed water system. • Partner with Clallam PUD for outreach and education to expand water conservation actions for residential, commercial, and agricultural water users.	Cascadia Consulting; Quileute Climate Plan	Outside scope of the County, falls within Clallam County PUD

Scope	Action Short Name	Action Description	Source	Reasoning
		• Evaluate/adapt agricultural drainage management to increase storage and promote subirrigation. • Encourage rainwater harvesting to provide water supply for buildings and agriculture.		

APPENDIX D: POLICY SCAN DETAILS

The following documents were reviewed for Clallam CAP development.

EXISTING KEY STATE & REGIONAL POLICIES

There are existing key state policies that set the stage for other regional and Clallam County policies. Listed below are key state policies that are already in effect and relevant to Clallam County's CAP.

Policy/Program	Description	Effective Date
General		
WA Climate Commitment Act	Places an economy-wide cap on carbon to meet state GHG reduction targets & be consistent with best available science. Policy still under development.	Jan 2023
WA HEAL Act	Defines & embeds environmental justice (EJ) in state law. Includes state agency requirements for EJ in engagement, budgeting, funding, and strategic planning.	2021
WA HFC Superpollutants Act	Requires phasing out of HFC Superpollutants in new equipment, using climate friendly alternatives in compliance with the Act's 2020-2024 phasing timeline.	Jan 2020
WA low-GWP refrigerants (HB 1050)	Establishes a maximum global warming potential (GWP) threshold (150) for HPCs used in stationary air conditioning, stationary refrigeration, and ice rinks.	Jul 2021
Buildings & Energy		
WA Clean Energy Transformation Act (CETA)	Requires a phase-out of coal by 2025, carbon-neutral electricity sales by 2030, and 100% clean energy by 2045.	2019
WA Building/Energy Code (RCW 19.27A.160)	Requires permitted residential and nonresidential construction under the 2031 state energy code must achieve a 70% reduction in annual net energy consumption compared to the 2006 state energy code.	Dec 2012
WA Clean Buildings Act (HB 1257)	Establishes a state energy performance standard and other measures for new and existing large buildings over 50,000 sq ft with an early-adopter incentive program.	2021 (voluntary) 2026 (mandatory)
Transportation & Land Use		

Policy/Program	Description	Effective Date
Federal Fuel Economy Standards	Reduces fuel consumption by raising fuel efficiency standards in passenger cars and light trucks.	Latest standards apply to 2024-2026 vehicles
WA Clean Fuel Standard	Reduces overall carbon intensity of fuels through use of cleaner fuels or purchasing clean fuel credits.	Jan 2023
WA EV readiness (HB 1287)	Extended the Clean Building Act's requirement for EV readiness to new single-family construction.	Jul 2024
WA Clean Cars 2030	Passed as part of "Move Ahead WA," sets a date of 2030 for all new cars registered in the state to be electric. Also commits state funding to EV investment/infrastructure.	Proposed in 2022; not yet adopted
WA Commute Trip Reduction	Requires implementation of transportation demand management (TDM) programs for certain employers to reduce work trips.	2006
Solid Waste & Consumption		
WA Plastic Pollution Reduction Policy SB 5022	Requires 1) single-use foodware be provided only upon request; and 2) minimum levels of recycled content in plastic beverage containers, trash bags, etc.	Phased in between 2022-2024
WA Organic Waste Goals (HB 1799/SB 5731 in 2022 legislative session)	Under development. Would establish a statewide goal for the landfill disposal of organic materials at a level representing 75% reduction by 2030, relative to 2015, and a goal of 20% reduction in volume of edible food disposed (relative to 2015) to be recovered for human consumption by 2025.	Under development (proposed date of Jan 2024)
Natural Systems & Water		
Shoreline Management Act	Supports local land use decision-making and shoreline planning, including access, hazard mitigation, economic uses, and salmon recovery.	1971

The list of documents reviewed in the policy scan identified by Clallam County included:

Clallam County	Relevant and/or Neighboring Jurisdictions
• Clallam County Climate Action Plan • 2018 BOCC Resolution • 2021 GHG Reduction Policy • Clallam County Hazard Mitigation Plan: 2019 Update • Clallam County Parks Master Plan • 2021 Solid Waste Management Plan • Shoreline Master Program • County Comprehensive Plan	• 2019 Resiliency Plan: Recommendations Addressing Climate Change for City of Port Angeles • 2019 Port Angeles Housing Action Plan • Elwha-Dungeness Watershed Plan • Whatcom County CAP • Sustainable Sequim • Quileute Tribe Climate Plan • Jamestown S'Klallam Tribe Adaptation Report • Olympic National Park Action Plan • Olympic National Forest Adapting to Climate Change • Port Townsend and Jefferson County CAP • City of Issaquah CAP • City of Seattle Papercuts Memo

APPENDIX E: MULTI-CRITERIA ANALYSIS

Cascadia led a qualitative multi-criteria analysis (MCA) of actions from Clallam County's strategy and action list. The MCA assigns qualitative numerical scores to each evaluated action and criterion to arrive at an overall priority score for each action.

This appendix includes an overview of the MCA approach, definitions, and results as conducted in July and August 2022 with the then current list of strategies and actions. It includes:

- An overview of the evaluation steps for the multi-criteria analysis.
- Detailed descriptions of the evaluation criteria, including sub-criteria definitions and criteria weights.

MCA Evaluation Steps

The MCA evaluation steps are as follows:

1. To arrive at a priority score, each criterion is clearly defined and assigned a weight. Clallam County decided on weightings based on relative priorities as indicated by Clallam County's Climate Advisory Committee (CAC).
2. Cascadia developed qualitative score matrices to allow for a consistent, objective ranking process. Cascadia then assigned scores for each action based on the criteria definitions and professional judgement drawing from peer county case studies, knowledge of Count context, engagement results, and consultant experience. Each criterion is evaluated on a 1 (low) to 5 (high) scale.

Evaluation Criteria

Summary

The following criteria will be used to evaluate the actions to be included in Clallam County's Climate Action Plan. Each criterion is evaluated on a 1 (low) to 5 (high) scale.

Criterion		Weight	Definition/Sub-criteria
GHG Emissions Reduction Impact		20%	What is the scope and likelihood that the action will reduce GHG emissions? By when? Can impact be measured and tracked?

Criterion		Weight	Definition/Sub-criteria
Cost		20%	What is the cost to the community and county?
Feasibility		20%	What is the County's level of control over implementation?
Equity		20%	Does the action reduce vulnerability for all populations? Is it fair?
			Are benefits distributed equitably across the community? Do they redress historic inequities?
Co-benefits		20%	Does the action support 1) climate resiliency, 2) economic development, and 3) conservation (i.e., energy & water)?

IMPACT

This criterion evaluates impact according to the lever of the action (voluntary/indirect programs, regulatory action, etc.), how directly the action addresses emissions, whether the action is focused on the County's highest-emissions sources, the timeline and ability to scale the impact, and the ease of measuring and tracking the impact.

Impact	
1	**No emissions reductions** – Action is not intended to/does not reduce GHG emissions or increase sequestration.
2	**Low** – voluntary/indirect action (e.g., education/outreach, planning, assessments) that indirectly reduce emissions; regulatory/direct strategies that address a very small emissions source; limited scope/ability to scale (i.e., low or very low impact/reductions/sequestration).
3	**Moderate** – voluntary/indirect programs that directly reduce emissions with financial incentives; voluntary/indirect programs without financial incentives but with relatively high reduction potential (addresses large source of emissions); regulatory/infrastructure projects with low/medium or indirect emissions reduction potential (i.e., moderate impact/reductions/sequestration).

Impact	
4	**High** – regulatory/infrastructure projects that directly reduce emissions; strong voluntary/indirect programs with financial incentives and/or addressing a top emission source; limited scope/reach or with broad scope/reach that will be realized after 2030 (i.e., high impact/reductions/sequestration).
5	**Very high** – regulatory/infrastructure projects that directly reduce emissions and that will be realized by 2030; broad reach/scope (i.e., very high impact/reductions/sequestration).

COST

The cost criterion focuses on financial costs to the County.

Cost	
1	**High to very high** – MAJOR INFRASTRUCTURE/capital improvement project; generally >$10 million; and/or SIGNIFICANT costs across the ENTIRE community
2	**High** – MODERATE INFRASTRUCTURE projects and large programs; generally $1-10 million; and/or SIGNIFICANT costs to SOME in the community
3	**Moderate** – SMALL INFRASTRUCTURE projects and LARGER PLANS, policies, and small programs; $100K-1 million; and/or MODERATE costs across the community
4	**Low** – SIMPLE policy changes, studies, and small plans; <$100K; and/or MINIMAL costs across the community
5	**Very low** – planning strategy or MINIMAL TO NO COUNTY GOVERNMENT INVESTMENT; County government may already be working on it; and/or will NOT present any additional costs to the community; may save money.

FEASIBILITY

The feasibility criteria assess the degree of County control over an action's strategy success and the likely regulatory, political, and technological constraints to implementation, as well as anticipated cost to the County, and community support.

- Community support focuses on support from community partners and stakeholders such as the business, environmental, social justice, and other community perspectives.

- Political constraints include the level of County Council support and direction, County staff support and capacity, the regulatory role and level of support of county cities, the level of support from local Tribes, alignment or reinforcement of other County, and regional policies, plans, programs, and initiatives (including opportunities for shared implementation), whether funding or other needed resources from state and federal entities is easily acquired, and whether the outcome of a legislative process may affect the feasibility of a strategy.

Feasibility	
1	**Very high barriers** – action currently UNVIABLE given current regulations, politics, community support, and/or technologies and anticipated opportunity windows. If encountered, challenges are VERY DIFFICULT or IMPOSSIBLE to overcome and/or unable to adapt to new technologies. Not identified in any existing County and/or regional plan (e.g., NODC).
2	**High barriers** – action LIKELY to encounter challenges given current regulations, politics, community support, and/or technologies and anticipated opportunity windows. If encountered, challenges are DIFFICULT to overcome and/or difficult to adapt to new technologies. Identified in existing Clallam County and/or regional plan but has been identified as having high barriers.
3	**Moderate barriers** – action MAY encounter challenges given current regulations, politics, community support, and/or technologies and anticipated opportunity windows. If encountered, challenges are MODERATELY DIFFICULT to overcome and/or moderately difficult to adapt to new technologies. Identified in an existing Clallam County and/or regional plan, but no action yet.
4	**Low barriers** – action UNLIKELY to encounter challenges given current regulations, politics, community support, and/or technologies and anticipated opportunity windows. If encountered, some or most challenges are RELATIVELY EASY to overcome and/or are relatively easy to adapt to new technologies. Related to an existing Clallam County and/or regional plan (e.g., NODC, e.g., "expand on something from a plan").
5	**Very low barriers** – MINIMAL to NO challenges anticipated given current regulations, politics, community support, and/or technologies and anticipated opportunity windows. If encountered, most challenges are EASILY overcome and/or easily adaptive to new technologies. Identified in existing Clallam County and/or regional plan (e.g., NODC).

EQUITY

The equity criterion focuses on how costs and benefits are distributed among community members and communities that face historic inequities. Per instructions from the Clallam County CAC, any actions that receive an MCA score of 1 – 2 in this criteria category will either be removed from the list of actions and/or undergo significant revisions advance equity and move the MCA score up to 3 to 5.

Equity	
1	**Very low** – ALL benefits and costs are perpetuating historic inequities.
2	**Low** – SOME benefits and costs are perpetuating historic inequities.
3	**Moderate/neutral** – action DOES NOT distribute benefits and costs in the community in a way that perpetuates historic inequities.
4	**High** – MANY or MOST benefits are accruing to the sectors of the community that face historic inequities; other sectors of the community accrue benefits as well.
5	**Very high** – MOST or ALL benefits are accruing to the sectors of the community that face historic inequities; other sectors of the community accrue benefits as well.

CO-BENEFITS

Many actions will have benefits beyond greenhouse gas emissions reduction. Based on County input and community priorities, the selected co-benefits for consideration in the MCA are climate resiliency, economic development, and conservation.

- **Climate resiliency:** This criterion also evaluates to whether the action is focused on the County's greatest climate risks and vulnerabilities, how broadly the action would affect the community, and scalability and timeline.
- **Economic development:** This criterion evaluations an action's ability to contribute positively to local businesses, job creation, and municipal revenue.
- **Conservation:** This criterion evaluates an action's ability to reduce energy or water consumption.

Co-benefits			
	Climate Resiliency	**Economic Development**	**Conservation**
1	**Addresses a very minor need** – very low climate risk for County/community or may be a voluntary action that indirectly enhances resilience. May have limited ability to scale.	**Very low –** significant negative impacts on local businesses, job creation, and/or municipal revenue.	**Very low –** no impact or very low impact on energy or water conservation.

Co-benefits			
	Climate Resiliency	**Economic Development**	**Conservation**
2	**Addresses a minor need** – low climate vulnerability for County/community (transportation, emergency services) or a higher climate risk but with indirect action; may be a voluntary action with ability to scale.	**Low –** some negative impacts on local businesses, job creation, and/or municipal revenue.	**Low –** low impact on energy or water conservation.
3	**Addresses a moderate need** – average/moderate climate vulnerability for County/community (parks and open space, storm drains); may address high climate risk/vulnerability but through a voluntary or indirect programs, possibly with incentives.	**Moderate/neutral –** does not benefit or burden local businesses, job creation, and/or municipal revenue.	**Moderate/neutral –** average/moderate impact on energy or water conservation.
4	**Addresses a higher-than-average need** – high climate risk for County/community (air quality, heat-related illnesses, flooding; indirect risks to overburdened communities). May have a long timeframe or limited reach.	**High –** supports priority local businesses, job creation, and/or municipal revenue.	**High –** high impact on energy or water conservation.
5	**Addresses a very major need** – very high climate risk(s) for County/community (air quality, heat-related illnesses, flooding; direct risks to overburdened communities); risks may be addressed through regulatory action. Will be realized by 2030 and will have broad reach across the community.	**Very high –** directly advances opportunities for local businesses, job creation, and/or municipal revenue.	**Very high –** very high impact on energy or water conservation.

MCA Priority Scores Breakdown

With the above outlined weights and definitions for criteria, Cascadia Consulting conducted the MCA. Each criteria received a score and rational (1 = low, 5 = high). Since all criteria were weighted equally at 20% the MCA Priority Score was derived by multiplying each criterion score by .20 to represent 20% of the total priority score. If any action scored less than 3 in the Equity criteria, that action was either omitted or revised to account for equity concerns. To calculate the score for co-benefits, the average score across the three co-benefits was used to represent the overall co-benefits criterion score. These adjusted criteria scores for each action were summed to arrive at a final priority score for every action, scored out of 5 points.

Please note: Cascadia Consulting conducted the MCA in August 2022, and since then, strategies and actions underwent additional rounds of revisions after the MCA Priority Score was assigned.

Priority Score Equation: Priority score was calculated using the following equation Priority Score = (GHG Impact x 0.2) + (Cost x 0.2) + (Feasibility x 0.2) + (Equity x 0.2) + (((Climate Resilience + Economic Development + Conservation)/3) x 0.2)

Energy & Built Environment

#	Action Short Name	GHG Emissions Impact	Cost	Feasibility	Equity	Co-benefits			MCA Priority Score
						Climate Resiliency	Economic Development	Conservation	
Strategy: Install and incentivize energy-efficient upgrades and retrofits									
1.1	Install energy efficiency retrofits	4	3	5	3	4	3	5	**3.80**
1.2	Incentivize energy efficient retrofits and upgrades	3	4	3	4	5	3	4	**3.60**
Strategy: Use cleaner energy-sources and increase resiliency of energy systems.									
1.3	Invest in community energy projects	2	4	4	3	4	4	3	**3.33**

Consumption & Disposal

#	Action Short Name	GHG Emissions Impact	Cost	Feasibility	Equity	Co-benefits			MCA Priority Score
						Climate Resiliency	Economic Development	Conservation	
Strategy: Increase waste diversion to reuse, repair, and support edible food rescue									
2.1	Expand food waste diversion and education programs	2	3	5	4	5	5	4	**3.73**
2.2	Increase Waste Diversion in County Operations	2	4	5	3	3	3	4	**3.47**
Strategy: Promote green business practices and sustainable consumption									
2.3	Sustainable purchasing and consumption in County Operations	2	4	4	4	3	3	4	**3.47**

Transportation

#	Action Short Name	GHG Emissions Impact	Cost	Feasibility	Equity	Co-benefits			MCA Priority Score
						Climate Resiliency	Economic Development	Conservation	
Strategy: Reduce single-occupant vehicle miles travelled and support non-motorized transportation options									
3.1	County employee commute reduction	3	4	5	3	4	3	3	**3.67**
3.2	Expand on non-motorized transportation plan	4	2	2	3	5	3	3	**2.93**
Strategy: Build infrastructure for and transition to electric vehicles									
3.3	County fleet electrification and idle reduction	4	2	3	3	3	3	3	**3.00**
3.4	Prepare for EV infrastructure and use	3	2	3	4	3	4	3	**3.07**

Land Use

#	Action Short Name	GHG Emissions Impact	Cost	Feasibility	Equity	Co-benefits			MCA Priority Score
						Climate Resiliency	Economic Development	Conservation	
Strategy: Invest in and support local food systems									
4.1	Support existing gardening programs	1	4	5	4	4	3	3	**3.47**

#	Action Short Name	GHG Emissions Impact	Cost	Feasibility	Equity	Co-benefits			MCA Priority Score
						Climate Resiliency	Economic Development	Conservation	
4.2	Invest in the agricultural sector of Clallam County	1	4	5	3	5	4	3	**3.20**

Water & Natural Environment

#	Action Short Name	GHG Emissions Impact	Cost	Feasibility	Equity	Co-benefits			MCA Priority Score
						Climate Resiliency	Economic Development	Conservation	
Strategy: Protect natural resources and conserve water through policies and programs									
5.1	Increase tree planting	4	4	4	3	5	3	3	**3.73**
5.2	Native plant landscaping	1	3	5	3	3	3	4	**3.07**