



Hawaii Volcanoes National Park
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CLIMATE FRIENDLY PARKS



Produced by the NPS Environmental Leadership Program, with technical assistance from EPA's Office of Air and Radiation/Office of Atmospheric Programs Climate Change Division/Program Integration Branch and NPS's Natural Resources Stewardship and Science Division.

This document reports commitments to reduce greenhouse gases (GHGs) and criteria air pollutants (CAPs) through the climate friendly management of park operations and increased education and outreach efforts. Developed using the Climate Friendly Park's CLIP (Climate Leadership In Parks) Tool, this Action Plan serves a guide for meeting concrete emission reduction targets through climate friendly behavior within the Park.

Hawaii Volcanoes National Park Becomes a Climate Friendly Park

As a participant in the Climate Friendly Parks program, Hawaii Volcanoes National Park (HAVO) belongs to a network of parks that are putting climate friendly behavior at the forefront of sustainability planning in national parks. By conducting an emissions inventory, setting an emissions reduction target, developing this Action Plan, and committing to educate park staff, visitors, and community members about climate change, Hawaii Volcanoes National Park is serving as a model for climate friendly behavior within the park service.

Hawaii Volcanoes National Park (NP) has set a greenhouse gas (GHG) emission reduction goal. This Action Plan lays out the measures the park will take to meet this goal. In addition to implementing these measures, Hawaii Volcanoes NP will:

- Perform subsequent emission inventories to monitor progress.
- Identify additional actions to reduce GHG emissions and inform the public on climate change.
- Include additional actions to reduce GHG emissions in future Action Plans.



Lava flows at Hawaii Volcanoes National Park

photo credit: Brad Lewis

The Challenge of Climate Change

Climate change presents significant risks and challenges to the National Park Service. For example, as a result of climate change, Glacier NP faces losing all of its famed glaciers within the next several decades and Yosemite NP risks major changes to its alpine ecosystems. Climate change threatens the identity and unique resources of our national parks.

Scientists cannot predict the severity of climate change or its impacts with certainty. However, the current warming trend suggests that the problem is real and should be taken seriously. Average global temperatures on the Earth's surface have increased about 1.1°F since the late 19th century, and the 10 warmest years of the 20th century all occurred in the last 15 years. The single leading cause of this warming is the buildup of GHGs in the atmosphere—primarily carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O)—which trap heat that otherwise would be released into space.

The continued addition of CO₂ and other GHGs to the atmosphere will raise the Earth's average temperature more rapidly in the next century; a global average warming of 4-7°F by the year 2100 is considered likely¹. Rising global temperatures will further raise sea level and affect all aspects of the water cycle, including snow cover, mountain glaciers, spring runoff, water temperature, and aquatic life. Climate change is also expected to affect human health, crop production, animal habitats, and many other features of our natural and managed environments.

Goals and Objectives

The objective of this Action Plan is to identify actions that Hawaii Volcanoes NP can undertake to reduce GHG emissions and thus address climate change. This Plan presents the park's emission reduction targets and associated reduction strategies designed to achieve the the park's emission reduction goals.

While the Plan does not provide detailed instructions on how to carry out each of the proposed measures, it provides the essential framework needed to meet Hawaii Volcanoes NP's emission reduction targets. The Plan presents an opportunity for the park to devote resources for climate action through a mandate from the park's superintendent. This mandate gives park staff the resources and authority to pursue the mitigation strategies contained in this Plan.

Hawaii Volcanoes NP aims to:

Reduce GHG emissions from Hawaii Volcanoes NP operations to 12.5 percent below 2006 levels by the year 2012 by implementing emission mitigation actions identified by the Park.

In order to meet or surpass this goal, the park will implement strategies proposed in this Plan that build from the park's current and future emissions inventories. Specifically, the plan recommends three main strategies:

Strategy 1: Reduce fuel use and GHG emissions from park facilities and operations.

Strategy 2: Increase climate change outreach and education efforts.

Strategy 3: Develop management strategies to adapt to climate change.

Greenhouse Gas and Criteria Air Pollutant Emissions Inventory at Hawaii Volcanoes National Park

Naturally occurring greenhouse gases include CO₂, CH₄, N₂O, and water vapor. Human activities (e.g., fuel combustion and waste generation) lead to increased concentrations of these gases (except water vapor) in the atmosphere. Criteria air pollutants, which lead to numerous air quality and public health problems, include sulfur dioxide (SO₂), nitrogen oxides (NO_x), volatile organic compounds (VOCs), particulate matter (PM₁₀ and PM_{2.5}), and carbon monoxide (CO)². While GHGs contribute to climate change on a global scale, the impacts of criteria air pollutants are often local and regional in nature.

Greenhouse Gas Emissions

GHG emissions result from the consumption of fossil fuels for energy (e.g., boilers, electricity generation) and transportation purposes, the decomposition of waste, and the volatilization or release of various other sources (e.g., fertilizers and refrigerants).

In 2006, Hawaii Volcanoes NP's GHG emissions totaled 5,971 metric tons of carbon equivalent (MTCE). As Figure 1 and Table 1 demonstrate, the largest source of Hawaii Volcanoes NP's emissions is Mobile Combustion—totaling 4,372 MTCE.

¹ IPCC 2007. Climate Change 2007: The Physical Science Basis. Intergovernmental Panel on Climate Change, Geneva Switzerland. Available online at <http://ipcc-wg1.ucar.edu/wg1/wg1-report.html>

² Criteria air pollutants were calculated and are presented in the inventory section of this document due to their co-benefit relation with GHGs. However, it is important to realize that criteria air pollutants do not contribute directly to climate change.

Figure 1
Hawaii Volcanoes National Park's 2006 GHG Emissions by Sector

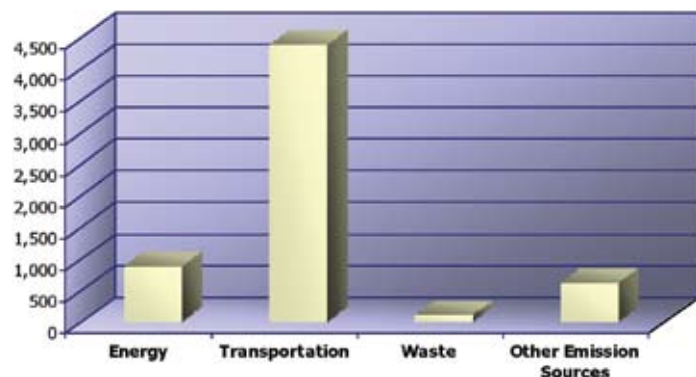


Table 1
Hawaii Volcanoes National Park's 2006 GHG Emissions by Sector and Source¹

	Emissions (MTCE)	% of Total
Energy	882	15%
Stationary Combustion	75	1%
Purchased Electricity	806	13%
Transportation	4,372	73%
Mobile Combustion	4,372	73%
Waste	109	2%
Solid Waste Disposal	109	2%
Other Emission Sources	609	10%
Refrigeration	2	0%
Livestock Management ²	607	10%
Total Emissions	5,971	

Totals may not sum due to rounding
 1 – Emission totals include park operations, Kilauea Military Camp, Volcano House and USGS.
 2 - Livestock management emissions include manure management and enteric fermentation from a park cattle population.

Did You Know?
 The same activities that generate GHGs often also generate CAPs. Therefore, addressing activities that generate GHGs also often has the added, or co-, benefit of reducing CAPs.

Criteria Air Pollutants

CAP sources include stationary sources (e.g., boilers), mobile sources, and area sources (e.g., campfires, solvent use). In 2006, Hawaii Volcanoes NP produced 1,767,453 lbs of CO, 0 lbs of SO₂, 233,649 lbs of NO_x, 309,807 lbs of VOCs, 1,737 lbs of PM_{2.5}, and 3 lbs of PM₁₀ (Figure 2). As Table 2 demonstrates, at 1,767,453 lbs, CO is the most emitted CAP, largely from Mobile Sources (1,767,438 lbs).

Figure 2
Hawaii Volcanoes National Park's 2006 CAPs by Sector

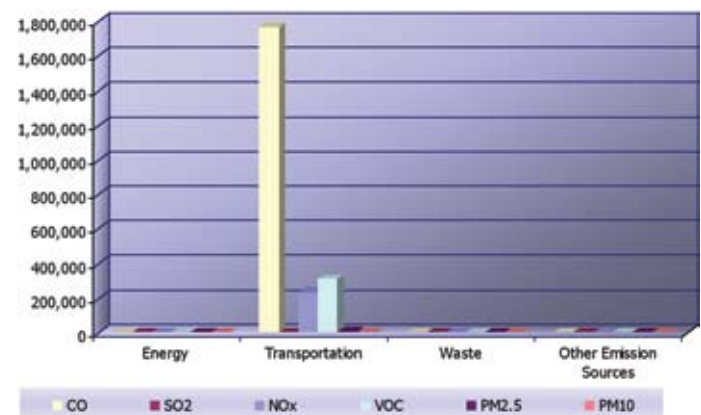


Table 2
Hawaii Volcanoes National Park's 2006 CAPs by Sector and Source

	CO (lbs)	SO ₂ (lbs)	NO _x (lbs)	VOC (lbs)	PM _{2.5} (lbs)	PM ₁₀ (lbs)
Energy	15	0	110	0	0	3
Boilers, Heaters, and Generators	15	0	110	0	0	3
Transportation	1,767,438	0	233,540	309,659	1,737	0
Mobile Sources	1,767,438	0	233,540	309,659	1,737	0
Waste*	NE	NE	NE	NE	NE	NE
Other Emission Sources	0	0	0	148	0	0
Area Sources	0	0	0	148	0	0
Total Emissions	1,767,453	0	233,649	309,807	1,737	3

* CAP emissions were not calculated for Waste.

Hawaii Volcanoes National Park Responds To Climate Change

Hawaii Volcanoes NP staff developed the following actions during the park's CFP Workshop on February 21st and 22nd, 2007 in order to meet the park's climate change mitigation goals.

STRATEGY 1:

Reduce Fuel Use And Greenhouse Gas Emissions From Park Facilities And Operations

Transportation management

Emission Reduction Goal:

Reduce Transportation Emissions by 12.5% below 2006 levels by 2012.

Reducing vehicle miles traveled, improving vehicle efficiency, and using alternative fuels can significantly reduce Hawaii Volcanoes NP's emissions. As the inventory results indicate, 73 percent of the park's GHG emissions are a result of mobile combustion. In addition, mobile combustion produces 1,767,438 lbs of CO, 233,540 lbs of NO_x, and 309,659 lbs of VOCs. The following strategies were developed to meet the the park's transportation emission reduction goal:

Reduce Visitor Vehicles Miles Traveled (VMT)

- Implement a safe biking program to reduce visitor vehicle miles traveled.
- Develop a marketing campaign to increase bus ridership from Kilauea-Kona.
- Provide two hydrogen shuttle buses to drive visitors around Crater Rim Drive and down Chain of Craters Road.

Reduce fuel consumption among non-road equipment

- Reduce lawn maintenance and associated fuel consumption by 15 percent.

Replace existing park, concessionaire, and other vehicles with alternative fuel vehicles and hybrids.

- Replace 100 percent of park gasoline cars with gasoline cars that use the most fuel-efficient technologies.
- Investigate best available technology for patrol cars.
- Investigate biodiesel for park vehicles.
- Replace fuels used by all diesel trucks with B20 (biodiesel).

Work with partners to improve efficiency of transportation systems

- Work with tour bus companies to establish a set of criteria for tour bus permits (e.g., maintenance, idling, alternative fuels). Develop a standards and recognition program for those buses that meet the criteria established.
- Organize a transportation workshop with Hawaii Department of Transportation.
- Work with the state to provide incentives for alternative fuel in tour buses.

Energy Use Management

Emission Reduction Goal:

Reduce Energy Use Emissions by 12.5% below 2006 levels by 2012.

Improving energy efficiency and implementing alternative energy sources reduces park-based fuel use, lowers GHG emissions, decreases electricity consumption, and offers monetary benefits for the park. As the inventory results indicate, 15 percent of the park's GHG emissions result from energy consumption. In addition, energy consumption produces 15 lbs of CO, and 110 lbs of NO_x. The following strategies were developed to meet the park's energy use emission reduction goal:

Install energy efficient light fixtures.

- Increase energy efficiency among all lighting fixtures by replacing current bulbs and fixtures with energy efficient models. Upgrades will affect 10 percent of lighting bulbs and fixtures as 90 percent have already been upgraded.
- Reduce electricity consumption by installing controlled-lighting devices (e.g., motion sensors, smart-power strips).
- Reduce energy consumption in the workplace by encouraging working at home among individuals where possible and implementing an energy-minded space-management plan for working space.

Purchase electricity from a renewable energy provider.

- Produce or purchase approximately 15 percent of electricity needs through renewable energy means.

Develop park policy that promotes energy efficiency and energy conservation

- Institute a building rental management agreement to include energy efficiencies in concert with the park.
- Encourage working at home for individuals who are able to (flexi-place plan). Implement an energy-minded space-management plan (share space).
- Assess utility rate charges for rental buildings and invest potential savings in emission reduction efforts.
- Assess incorporating emission reduction efforts into annual efficiency improvements by concessionaires.
- Integrate LEED Gold certification into planning for new Ranger Office and ensure continued commissioning.

Waste Management:

Emission Reduction Goal:

Reduce Waste emissions by 35% below 2006 levels by 2012 through waste diversion.

The connection between waste and GHG emissions may not be obvious. However, waste management—in the form of source reduction and solid waste reduction—can dramatically reduce GHG emissions. The less we consume in terms of products and packaging, the less energy is used and fewer GHGs are emitted. Additionally, reducing the amount of waste sent to landfills reduces CH₄ emissions cause by decomposition.

Diverting or reducing the park's waste stream through increased recycling efforts and waste management procedures will reduce the amount of waste sent to landfills, which are the largest human-generated source of CH₄ emissions in the United States. Hawaii Volcanoes NP activities emitted 109 MTCE from waste management in 2006. The following strategies were developed to meet the park's waste emission reduction goal:

Manage waste through source reduction, composting, recycling, and combustion

- Develop a set of guidelines to incorporate waste prevention strategies into standard park practices (e.g., water coolers, double-sided printing, reusing garbage bags, separating food waste).
- Investigate opportunities to reuse or recycle used pallets.
- Reduce own packaging (cleaning containers) and encourage concessionaires to reduce packaging on retail materials (e.g., flashlights at lava tubes).

- Utilize cooperative procurement—lab chemicals, natural resource management (pesticides, herbicides).
- Install more recycling bins and work with the concessionaires to locate recycling bins in appropriate areas.
- Reduce quantity of containers in non-visitor areas to reduce waste pickup.
- Partner with concessions to consolidate volume and reduce trips for collection.
- Contract waste removal with existing waste hauler.
- Require concessionaires to track waste generation.
- Require concessionaires to compost 100 percent of food waste on site.
- Require concessionaires to purchase 50 percent of food locally.
- Work with concessionaires to institute bio-based materials.
- Integrate LEED Gold certification into planning for new Ranger Office and ensure continued commissioning.
- Establish relationship with local partner to donate extra materials.

Reduce the amount of wastewater sent to wastewater treatment plants

- Partner with county to compost wastewater sludge by 2010.
- Investigate opportunities to reduce wastewater generation, considering increase in visitation.
- Install motion sensors on all faucets.
- Replace all urinals with waterless urinals.

STRATEGY 2: Increase Climate Change Education And Outreach

Emission Reduction Goals:

- **Have 50% of park staff participating in Do Your Part! Program by 2008**
- **Have 10% of HAVO visitors reduce their household emissions by 10% annually by 2012 using the Do Your Part! Program.**

Climate change is a complex issue that is poorly understood by the public. A better understanding of the problem and the benefits of reducing GHG emissions can motivate staff, visitors, and community

members to incorporate climate friendly actions into their own lives. Hawaii Volcanoes NP recognizes that the greatest potential impact the park can have on mitigating climate change is through public education. Thus, the park sees public education as an end goal of any climate initiative. From increasing the efficiency of public transportation to developing a green purchasing program, the actions the park takes to address climate change serve as opportunities for increasing the public's awareness of climate change.

Park Staff

Developing a climate change education program for park staff is vital to increasing awareness about climate change among park visitors. By incorporating climate change education into staff-development programs and creating new opportunities for staff to learn about climate change, Hawaii Volcanoes NP will reduce park emissions and provide visitors with the tools and resources they need to reduce GHG emissions at home and in their own communities.

Incorporate climate change into park staff trainings

In an effort to provide Hawaii Volcanoes National Park staff with the knowledge and tools to educate visitors, the park will:

- Incorporate material from HAVO's Climate Friendly Workshop PowerPoint presentations in staff trainings.
- Develop mandatory climate change training for all staff.
- Promote the Do Your Part! Program among park staff.

Visitors

Understanding climate change and its consequences is essential to initiating individual behavioral change. Hawaii Volcanoes NP realizes that it has a unique opportunity to educate the public in a setting free from the distractions of daily life. By using existing materials, developing park-specific materials, highlighting what the park is currently doing about climate change, and encouraging visitors to reduce emissions, Hawaii Volcanoes NP can play an important role in educating the public about climate change.

Incorporate Climate Change awareness into visitor education

Park interpretive staff have the opportunity to introduce the issue of climate change to many visitors. Hawaii Volcanoes NP encourages staff to include messages about climate change in their visitor talks. The park will:

- Introduce climate change messages into the Junior Ranger program.
- Include climate change messages in interpretive talks.

Develop Park specific interpretive materials for visitors

Educating visitors about the tangible effects of climate change is a powerful way to encourage visitors to reduce GHG emissions. The park will use existing climate change interpretive resources, and promote the development of climate change materials specific to impacts in Hawaii Volcanoes NP. The park will:

- Develop a page on the HAVO website dedicated to climate change that will be linked to the Do Your Part Program.
- Partner with local, state, and national partners to develop island specific and relevant interpretation materials.
- Include climate friendly messaging on appropriate park signage.
- Include climate friendly actions messaging on the visitor's television channel.
- Work with COR to make sure next RFP requires concessions to be environmentally friendly and to educate visitors about those actions (e.g., display signage, classes, etc.).

Highlight what the park is doing to address climate change

Hawaii Volcanoes National Park has already taken many climate friendly actions. In an effort to lead by example and demonstrate climate friendly behavior for the public, the park will increase education and outreach efforts related to sharing the successes it has already achieved. The park will:

- Develop signage and messaging for climate friendly park features so that visitors are aware of the actions the park has taken.

Encourage Visitors to reduce greenhouse gas emissions

Perhaps the greatest potential for your national park to help reduce GHGs is to increase visitors' awareness of how they can reduce their personal GHG emissions. Hawaii Volcanoes National Park will provide visitors with tools to help address their personal emissions, including the Do Your Part! Program.

- Promote the Do Your Part! Program among park visitors.

Did You Know?

The **Do Your Part!** Program provides easy actions people can take every month to reduce emissions in their everyday lives.

Local Community

The communities that surround Hawaii Volcanoes NP play a significant role in supporting the parks GHG reduction goals. As such, when appropriate, Hawaii Volcanoes NP staff will assist local communities with incorporating climate change messages into community events and find partners to promote climate change education at those events. Park staff will use their knowledge of climate change resources to help local communities engage in climate friendly actions.

Encourage climate change awareness in the community

Hawaii Volcanoes National Park realizes that climate change does not adhere to geographic or political boundaries. In an effort to reach out to the community, the park will engage in strategies such as:

- Develop a climate friendly recognition program for tour bus companies and surrounding hotels and restaurants.
- Partner with the Art center to hold classes on how to transform property to native species or rock gardens.

STRATEGY 3:

Develop Climate Change Adaptation

National park staff face many challenges, from managing ecosystems and visitors to balancing budgets and public interests. As regional climates change, national parks will need to adapt their current management strategies to address new, existing, and changing stressors. The better understandings park staff possess about current stressors, potential stressors, and adaptive management strategies, the better equipped they will be to plan for, and adapt to, the possible futures created by a changing climate. With this in mind, The park will:

- Hold a joint NPS/Kupuna meeting to begin thinking about long-term changes and how to apply cultural management practices to park management plan.
- Document the sites in the park that are at highest risk to effects of climate change.
- Develop landscape management strategies to deal with increased fragmentation of ecosystems to have some areas protected for species.

- Plan sites for captive release and restoration for rare species.
- Increased monitoring for corals, habitat, disease, species loss from disease.
- Improve overall disaster response plans including partnerships with civil defense and county agencies.
- Start to use scenarios of multi-hazard cumulative events.
- Develop and enforce a policy of no fires during droughts.

Conclusion

Hawaii Volcanoes NP has a unique opportunity to serve as a model for over one million visitors annually. This report summarizes the operational actions the park commits to undertake to affect climate change. Specifically, the park realizes its ability to educate the public and serve as a valuable model for citizens. By seriously addressing GHG emissions within the park and sharing its successes with visitors, Hawaii Volcanoes NP will help mitigate climate change far beyond the park's boundaries.

This Action Plan also serves as an important enhancement mechanism for the park's established Environmental Management System (EMS). Realistic environmental commitments created by Hawaii Volcanoes NP staff and approved by the park's Superintendent will significantly reduce the park's GHG emissions and CAPs in the coming years. The mitigation actions included in this plan have been developed in order to be directly transferable to the park's EMS. Hawaii Volcanoes NP's Action Plan thus provides an effective way to meet EMS goals.

The National Park Service faces an uncertain future due to the possible effects of climate change. However, by seriously addressing climate change impacts and reducing emissions, Hawaii Volcanoes National Park will reduce its contribution to the problem while setting an example for its visitors. The strategies presented in this Action Plan present an aggressive first step towards moving Hawaii Volcanoes NP to the forefront of Climate Friendly Parks.