



Yosemite National Park  
November 2006

# CLIMATE FRIENDLY PARKS

## YOSEMITE NATIONAL PARK ACTION PLAN



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 the accomplishments of Yosemite National Park staff who participated in the joint NPS and EPA Climate Friendly Parks (CFP) Workshop on April 4<sup>th</sup> and 5<sup>th</sup>, 2006. In conjunction with its Environmental Management System (EMS) planning, Yosemite National Park developed the following commitments to reduce greenhouse gases and criteria air pollutants through the climate friendly management of park operations and increased outreach and education efforts.

## Yosemite NP Becomes A Climate Friendly Partner

By holding a Climate Friendly Parks workshop; conducting a baseline emission inventory; developing a Climate Action Plan; and committing to educate park staff, visitors, and community members about climate change, Yosemite NP has become one of seven US parks to become distinguished as a Climate Friendly Partner. As a Climate Friendly Partner, Yosemite NP serves as a model for climate friendly behavior within the Park Service.

Yosemite NP now has the opportunity to follow through with the climate change initiatives it has committed to and become further recognized as a Climate Friendly Park. This action plan lays out the framework for actions Yosemite will take to meet this goal. In addition to implementing the actions described in this Action Plan, Yosemite NP will:

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

THE CLIMATE FRIENDLY PARKS PROGRAM is funded through an interagency agreement between the U.S. Environmental Protection Agency and the National Park Service. The program encourages and enables national parks—and, in the future, entities such as state and local parks, refuges, schools and universities, zoos and aquariums and science museums—to develop both short- and long-term comprehensive strategies to reduce their greenhouse gas and criteria air pollutant emissions. Furthermore, the program entails a commitment on the part of the participating park to educate the public about what actions the park is taking to mitigate its greenhouse gas and criteria air pollutant emissions.

# The Challenge of Climate Change

Climate change presents significant risks and challenges to the National Park Service. For example, 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 natural identity and unique resources of national parks such as Yosemite.

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 20<sup>th</sup> century all occurred in the last 15 years. The single leading cause of this warming is the buildup of greenhouse gases in the atmosphere—primarily carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O)—which trap heat that otherwise would be released into space.

The continued addition of CO<sub>2</sub> and other greenhouse gases 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 likely. Rising global temperatures will further raise sea level and affect all aspects of the water cycle, including snow cover, mountain glaciers, timing of spring runoff, water temperature and aquatic life. Climate change is also expected to affect human health, alter crop production, animal habitats, and many other features of our natural and managed environments.



*Yosemite NP waterfall during snowmelt*

## Goals and Objectives

The objective of the Yosemite NP Climate Action Plan is to identify actions that the Park can undertake to reduce greenhouse gas emissions and thus address climate change. This Plan presents Yosemite NP's emissions reduction targets and associated reduction strategies designed to achieve the Park's 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 Yosemite NP's emissions reduction targets.

Yosemite NP aims to:

- 1. Reduce non-fire management-related greenhouse gas emissions to 10 percent below 2005 levels by the year 2010 by implementing emission mitigation actions identified by the park.**

In order to meet or surpass these goals, this Plan first presents the current emission inventory for Yosemite NP and then proposes strategies for achieving the desired reduction targets. Specifically, the plan recommends three main strategies:

- Strategy 1:** Reduce fuel use and greenhouse gas emissions from Park facilities and operations.
- Strategy 2:** Increase climate change outreach and education efforts.
- Strategy 3:** Perform subsequent emission inventories to evaluate progress and inform the park and public in developing future emission mitigation actions.

# Greenhouse Gas and Criteria Air Pollutant Emissions Inventory at Yosemite National Park

Greenhouse gases include CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O, among others. Human activities (e.g. fuel combustion and waste generation) lead to increased concentrations of these gases in the atmosphere. Criteria air pollutants, which lead to numerous air quality and public health problems, include sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), volatile organic compounds (VOCs), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), and carbon monoxide (CO).<sup>1</sup> While greenhouse gases contribute to climate change on a global scale, the impacts of criteria air pollutants are often local and regional in nature.

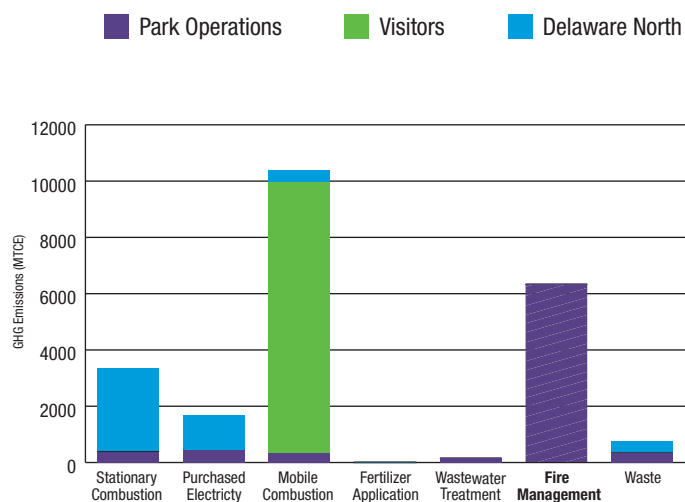
The 2005 greenhouse gas and criteria air pollutant inventory completed for Yosemite NP was developed by the Park using the Climate Leadership in Parks (CLIP) tool. This Excel-based tool allowed Yosemite NP to use data on park activities (e.g., fuel consumption, electricity consumption, waste disposal) to estimate the Park's greenhouse gas and criteria air pollutant emissions.

## Greenhouse Gas Emissions

In 2005, Yosemite NP's greenhouse gas emissions totaled 22,683 metric tons of carbon equivalent (MTCE) of which 16,352 MTCE

**Figure 1**

*Yosemite National Park's 2005 Greenhouse Gas Emissions by Source and Park Emitting Entity*

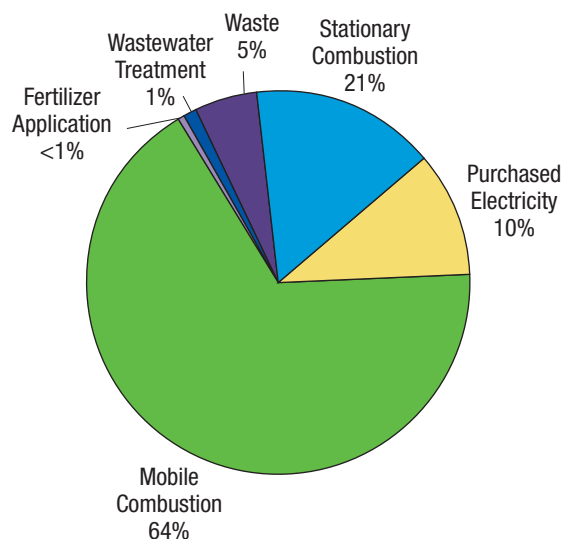


were due to non-fire management-related activities. As Figure 1 demonstrates, these emissions were estimated for stationary combustion, purchased electricity, mobile source combustion, wastewater treatment, solid waste management, fertilization application, and fire management sources.

While fire management produces the majority of Yosemite NP's criteria air pollutant emissions and a significant percentage of the Park's greenhouse gas emissions, fire management emissions are the result of ecologically responsible actions undertaken by the park. Through mimicking natural burns, prescribed burning helps to maintain forests in their natural state by preventing the buildup of biomass that, left unchecked, would ultimately result in larger, more destructive fires. Larger natural burns would release emissions similar in quantity and type to those associated with prescribed burns. In the interest of performing a more targeted inventory that addresses and seeks to reduce emission sources that do not replicate natural events, the park should set aside fire-management-related emissions and focus on emissions associated with the geologic carbon cycle, waste and synthetic materials.

**Figure 2**

*Sources of Yosemite National Park's 2005 Non-Fire Management-Related Greenhouse Gas Emissions by Percent of Total Greenhouse Gas Emissions*



<sup>1</sup> Criteria air pollutants were calculated for Yosemite NP and are presented in the inventory section of this document due to their co-benefit relation with greenhouse gases. However, it is important to realize that criteria air pollutants do not contribute directly to climate change.

## Criteria Air Pollutant Emissions *continued from page 3*

**Table 1**

*Yosemite National Park's Criteria Air Pollutant Emissions by Gas and Source (reported in lbs)*

	SO <sub>2</sub>	NO <sub>x</sub>	VOCs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO
Stationary Sources	3,945	92,154	10,943	2,422	NA	457
Mobile Sources	NA	271,335	114,646	NA	659	1,414,644
Area Sources	351,823	1,141,894	0	3,677,525	3,120,573	36,113,219
<b>Total Criteria Air Pollutant Emissions</b>	<b>355,768</b>	<b>1,505,383</b>	<b>125,589</b>	<b>3,679,947</b>	<b>3,121,232</b>	<b>37,528,320</b>

Park-based emissions are the result of many activities, including park operations, visitor travel, and concessions operations. Yosemite NP's primary concessionaire, the Delaware North Company (DNC) accounted for the greatest amount of purchased electricity and stationary source emissions (furnaces and fuel tanks), while visitor miles driven accounted for the greatest amount of transportation-generated greenhouse gas emissions. Park operations were responsible for the majority of fire-management-related emissions.

As figure 2 shows, mobile source combustion represents Yosemite NP's most significant source of non-fire management related greenhouse gas emissions (64 percent), a function of the 82 million miles traveled in the park by visitors annually. The other major non-fire-management-related emissions were produced from stationary combustion (21 percent), purchased electricity (10 percent) waste

(5 percent), wastewater treatment (1 percent) and fertilizer application (less than 1 percent).

### Criteria Air Pollutant Emissions

Sources of criteria air pollutant emissions included stationary sources (e.g., furnaces and fuel tanks), mobile sources, and area sources (e.g., fire-use management). All three park units (park operations, visitors, and DNC) contributed to these emissions.

Table 1 presents the results of Yosemite NP's criteria air pollutant emission inventory. Area sources, namely fire management, are responsible for the vast majority of criteria air pollutant emissions. In fact, with the exception of volatile organic compounds, area sources were responsible for the majority of all other criteria air pollutants measured.<sup>2</sup>

Reducing greenhouse gas emissions has many local benefits other than protecting our climate. One example of these **co-benefits** is improved ambient air quality. The Yosemite Valley tends to trap local air pollutants such as particulates and create concentrated levels of criteria air pollutants. The same activities that generate greenhouse gases also generate criteria air pollutants. Therefore, by addressing these activities, greenhouse gas and criteria air pollutant emissions can be addressed simultaneously.



*Sunset at Halfdome*

<sup>2</sup> For mitigation purposes, criteria air pollutants that result from fire-management-related activities should, like greenhouse gases, be treated differently than those resulting from stationary and mobile sources; the processes that produce them both mimic natural occurrences and are considered ecologically responsible.

# How Yosemite National Park Is Responding to Climate Change

The following actions were developed by Park staff during Yosemite NP's CFP Workshop in order to address these two areas and meet the Park's climate change mitigation goals. Workshop attendees decided that the objectives and targets would be undertaken by Yosemite NP employees and overseen by the Park's Yosemite Environmental System (YES) team.

## Strategy 1: Reduce Fuel Use and Greenhouse Gas Emissions From Park Facilities and Operations

### Transportation Management

As the inventory results indicate, 64 percent of non-fire management-related greenhouse gas emissions within Yosemite NP are produced by mobile sources. This large contribution is caused mainly by the estimated one million vehicles that enter the Park annually. Consequently, Yosemite NP has decided to expand the use of alternative fuels, enable and promote alternative modes of transportation, and improve effective use of the park fleet.

#### Expand use of alternative fuels

In an effort to increase the use of lower greenhouse-gas-emitting alternative fuels and alternatively fueled vehicles, Yosemite NP will write a position paper on alternative vehicular fuel sources, with a focus on the use of biodiesel. This document will address such topics as availability, costs, effectiveness, benefits to the environment, impacts on vehicles, and potential funding sources. The paper will serve as a guide to set specific goals for alternative fuel use in the Park.

#### Did You Know?

Replacing one incandescent light bulb with an energy-saving compact fluorescent bulb means 1,000 pounds less carbon dioxide is emitted to the atmosphere and \$67 dollars is saved on energy costs over the bulb's lifetime. (*U.S. Environmental Protection Agency and Alliance to Save Energy*)



*Participants at Yosemite NP's CFP Workshop*

#### Enable and promote alternative modes of transportation

In April of 2005, Yosemite NP, in cooperation with the Department of Transportation, purchased a fleet of 18 hybrid shuttle buses. This was an important first step towards significantly reducing visitor vehicle miles traveled (VMT) while providing a visible example of climate friendly technology. In a continued effort to decrease the number of visitor vehicle miles traveled, Yosemite NP will actively encourage the use and expansion of public transit and alternative transportation within the park.

#### Improve effective use of Park fleet

Improving vehicle efficiency and reducing the number of VMT by park employees is another significant way to reduce Park emissions and serve as an example for visitors. Yosemite NP will engage in a number of actions such as offering staff teleworking opportunities, developing staff carpooling, and ensuring efficient fleet vehicle purchases.

### Energy Use Management

In 2005, 31 percent of Yosemite NP's non-fire management-related greenhouse gas emissions came from energy use, namely purchased electricity and stationary combustion sources. In order to reduce related greenhouse gas emissions, Yosemite NP plans to implement actions that improve energy efficiency, promote energy conservation, and promote alternative energy sources. These actions will not only help to achieve measurable greenhouse gas reductions, but will also save the park money.

## Strategy 1 continued from page 5

### Utilize alternative energy

Yosemite NP has already taken significant steps away from reliance on conventional greenhouse-gas-emitting power sources. For example, Yosemite NP currently maintains 13 permanent photovoltaic systems, along with a fuel cell generator that supplies 30 percent of the electricity needs of the Administration Building and provides power for the THINK vehicle charging station. Yosemite NP will continue to look for ways to develop alternative energy solutions that address the Park's power needs, including, investigating the potential for off-grid power at Wawona Point and Crane Flat.

### Increase lighting efficiency

Developing an energy-efficient lighting initiative is one of the easiest and most rewarding climate friendly actions a national park can choose. Improving lighting efficiency can reduce greenhouse gas emissions significantly, while at the same time saving money in electricity costs. Yosemite NP will investigate the best available energy efficient lighting options, including induction lighting, motion sensors, and compact fluorescents.

### Promote energy-efficient facility construction and green design

Yosemite NP realizes that its facilities can serve as visible examples of energy efficiency and green design. Yosemite NP will ensure that future construction considers energy efficiency and incorporates Energy Star's environmentally friendly standards with the long-term goal of requiring all major projects be Leadership in Energy and Environmental Design (LEED) compliant (silver rating or better).

### Optimize energy use

Conservation is the least expensive way to reduce energy consumption and reduce greenhouse gas emissions. Yosemite NP will develop a program that promotes energy conservation among park staff and visitors. This initiative will be guided by the existing Energy Conservation Plan.

#### Did You Know?

- Steel made from recycled steel uses only 39% of the energy needed to make virgin steel.
- Paper made from recycled paper uses only 26-45% of the energy needed to make virgin paper.
- Aluminum made from recycled aluminum uses 5% of the energy needed to make virgin aluminum.

#### Did You Know?

Over 1/3 of the waste generated at Yosemite NP comes from food.

### Waste Management

The connection between waste and greenhouse gas emissions may not be obvious. However, waste management—in the form of source reduction and solid waste reduction—can dramatically reduce greenhouse gas emissions. The less we consume in terms of products and packaging, the less energy is used and fewer tons of greenhouse gases are emitted. Additionally, reducing the amount of waste sent to landfills reduces CH<sub>4</sub> emissions caused by decomposition. Waste sent to landfills is the largest source of human-generated CH<sub>4</sub> emissions in the United States.

Diverting the park's waste stream through increased recycling efforts and waste-management procedures will reduce the amount of waste sent to landfills. In an effort to reduce waste-related greenhouse gas emissions, Yosemite NP will develop an incentive program for waste reduction, improve solid waste hauling efficiency, and develop a green procurement plan.

#### Develop an incentive program for waste reduction

Visitors are responsible for most of the solid waste generation in the park. Much of this waste could be diverted or recycled with the right incentives. Yosemite NP will develop incentive programs to encourage waste reduction, including identifying feasible ways to recycle propane bottles that need to be processed as hazardous waste, and composting organic food waste.

#### Improve solid waste hauling efficiency

Yosemite NP recognizes the need to develop partnerships and engage in planning efforts in order to reduce the large quantity of waste generated by the Park. By developing waste-management partnerships between the Park, the County, and DNC, the Park can reduce hauling overlap and foster creative waste reduction solutions.

#### Further develop a green procurement plan

By furthering Yosemite NP's efforts to purchase environmentally preferred products and services, the Park can reduce the amount of waste sent to landfill, which in turn reduces landfill greenhouse gas emissions. Green purchasing can also reduce emissions from products such as solvents. In an effort to replace conventional purchasing practices with green ones, Yosemite NP will develop green purchasing guidelines in the form of a green procurement plan.

## STRATEGY 2: Increase Climate Change Outreach and Education

Climate change is a complex issue that is poorly understood by the public. A better understanding of the problem and the benefits of reducing greenhouse gas emissions can motivate staff, visitors, and community members to incorporate climate friendly actions into their own lives. Yosemite 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 Yosemite NP 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, Yosemite NP will reduce Park emissions and provide visitors with the tools and resources they need to reduce greenhouse gas emissions at home and in their own communities.

#### **Incorporate climate change into park staff trainings**

In an effort to provide Yosemite NP staff with the knowledge and tools to educate visitors, the Park will include climate change messages into spring DNC and park service interpretive trainings, hold a resource-management lecture on the topic of climate change, and include a succinct climate change message at all employee and division meetings.

### Visitors

Understanding climate change and its consequences is essential to initiating individual behavioral change. Yosemite 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 Yosemite NP-specific materials, highlighting what the park is currently doing about climate change, and encouraging visitors to reduce emissions, Yosemite 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. Yosemite NP encourages staff to include messages about climate change in their visitor talks as well as monthly climate change presentations by Yosemite Institute for



*Yosemite Valley after the rain*

student groups. The Park also plans to include climate change and sustainability as a topic at an upcoming Quarterly Gateway Partner meeting, and include sustainability and climate change as topics at a monthly Open House.

#### **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 greenhouse gas emissions. While Yosemite NP will use existing climate change interpretive resources, the Park will promote the development of climate change materials specific to impacts in Yosemite. These resources will include an interpretive kiosk focusing on the latest climate change science and including climate change in the rotating YOSE exhibit in the Visitor Center.

#### **Highlight what the park is doing to address climate change**

Yosemite NP has already taken many climate friendly actions. In an effort to lead by example and demonstrate climate friendly behavior for the public, Yosemite NP will increase outreach and education efforts related to sharing the successes it has already achieved. These actions include creating climate change information on park shuttle busses literature and signage, creating signs describing energy-efficiency of buildings and developing information on green material use at the park.

## **Strategy 2** continued from page 7

### **Encourage Visitors to reduce greenhouse gas emissions**

Perhaps the greatest potential for your national park to help reduce greenhouse gas is to increase visitors' awareness of how they can reduce their personal greenhouse gas emissions. Yosemite NP will provide visitors with tools to help address their personal emissions, including the *Do Your Part!* program.

### **Local Community**

The communities that surround Yosemite NP play a significant role in supporting the parks greenhouse gas reduction goals. As such, when appropriate, Yosemite 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. Yosemite NP staff will use their knowledge of climate change resources to help local communities engage in climate friendly actions.

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

### **Encourage climate change awareness in the community**

Yosemite NP 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 including climate change as a topic at monthly open house events and reaching out to Gateway schools.

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## **Conclusion**

Yosemite NP has a unique opportunity to serve as a model for 3.5 million visitors annually. This report summarizes the operational actions that Yosemite NP has committed to in response to this important challenge. Specifically, the Park has realized the potential it has to serve as an educator and model for citizens. By seriously addressing greenhouse gas emissions within the Park and sharing its successes with visitors, Yosemite 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 Yosemite NP staff and approved by the Park's Yosemite Environmental

System team will significantly reduce the Park's greenhouse gas and criteria air pollutant emissions 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. Yosemite NP's Climate Action Plan thus provides an effective way to meet EMS goals.

Yosemite NP faces an uncertain future due to the possible effects of climate change. However, by seriously addressing climate change impacts and reducing emissions, Yosemite NP 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 toward moving Yosemite NP to the forefront of Climate Friendly Parks.