



**Monocacy National Battlefield  
Climate Action Plan  
November 2013**

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## Introduction

### MONOCACY NATIONAL BATTLEFIELD

Monocacy National Battlefield covers 1,647 acres of farmland, forest and riverbank near Frederick, Maryland. Six historic properties comprise the park, including the Baker Farm, Best Farm, Gambrill Tract, Lewis Farm, Thomas Farm and Worthington Farm. As a Civil War battlefield, the park is rich with some of America's greatest history; there are 52 historic structures at the park as well as a wide variety of archeological sites and historic landscapes. Visitors come to the park to wander over seven miles of scenic trails, to learn about the Battle of Monocacy and to enjoy the natural and cultural resources the park has to offer.



Source: National Park Service

Over time, as the Frederick area developed, Monocacy National Battlefield became a natural and historical sanctuary. While many habitats outside the boundaries of the park have changed or been replaced by development, the park provides a home to over 500 species of plants and over 150 species of animals. The park offers protection for the creeks, fields, forests, historic structures and terrestrial and aquatic life within its boundaries.

### MONOCACY NATIONAL BATTLEFIELD CLIMATE ACTION COMMITMENT

As the steward of the nation's most valued public lands, the National Park Service (NPS) has an obligation and an opportunity to be a leader in protecting the environment. As a participant in the Climate Friendly Parks (CFP) program, Monocacy National Battlefield belongs to a network of parks that are at the forefront of sustainability planning. By developing a greenhouse gas (GHG) emissions inventory, setting an emissions reduction target, developing this climate action plan and committing to educate park staff and the public about climate change and mitigation efforts, the park is leading by example. In doing so, the park commits to reducing GHG emissions from park operations by 8 percent below FY 2008 levels, by 2016 through the following actions:

1. Prioritize facility improvements that will reduce park energy use.
2. Pursue and prioritize strategic replacement of heating, ventilation and air conditioning (HVAC) systems and heat pumps in appropriate rooms and buildings throughout the park.
3. Replace all heat pumps that are more than ten years old and no longer efficient.
4. Develop renewable energy sources where appropriate, such as photovoltaic systems for locations that use the most energy.
5. Reduce mobile fuel use by upgrading park fleet, mowers and infrastructure.
6. Collaborate with farmers and other park partners on opportunities for reducing emissions.
7. Develop strategies for greener meetings.
8. Educate park staff on ways to save energy and reduce transportation-related emissions.

9. Educate visitors about climate change risks and impacts and the actions that they can take to help reduce emissions at home and while visiting the park.

The Monocacy National Battlefield climate action plan serves to support and enhance existing initiatives, such as the park’s Resource Stewardship Strategy, the park’s environmental management system (EMS) and the National Capital Region (NCR) EMS. The park’s EMS is a comprehensive management system that addresses all environmental programs at the park and provides the context for actions that reduce park emissions. The NCR EMS addresses the energy- and climate-related goals for all parks in the region and assists the park in maintaining compliance with Executive Order (EO) 13423: Strengthening Federal Environmental, Energy, and Transportation Management, and EO 13514: Federal Leadership in Environmental, Energy, and Economic Performance.

The goals in this climate action plan will be incorporated into the park’s EMS. Additionally, the climate action plan supports the park’s long-term planning efforts. It should be noted that the purpose of this climate action plan is to reduce park GHG emissions, and it is not intended to address park adaptation to climate change impacts.

## THE CHALLENGE OF CLIMATE CHANGE

The atmosphere has a natural supply of gases that trap heat and keep the temperature of the Earth warm enough for life to survive. Such gases are known as greenhouse gases (GHGs). However, GHGs released as a result of human activities—including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O)—have disturbed this balance. These gases, primarily resulting from the burning of fossil fuels (e.g., industrial manufacturing, energy production and vehicles), can stay in the atmosphere for at least 50 years, but some can remain for many centuries. The accumulation of GHGs in the atmosphere faster than natural processes can remove them is causing an overall warming of the planet, commonly referred to as “global warming.” The term “climate change” describes the variable consequences of global warming over time.

According to the Intergovernmental Panel on Climate Change, the leading international scientific organization for the assessment of climate change, “continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.”<sup>1</sup> Signs of climate change can be seen in the heat waves experienced across the country, altered precipitation patterns and changes in ecosystems. Climate change will likely result in further sea level rise and will affect all aspects of the water cycle, including snow cover, mountain glaciers, timing of spring runoff, precipitation patterns, water temperature, ocean currents and upwelling, salinity levels of inland coastal waters and aquatic life. Climate change is also expected to affect human health, alter crop production, modify animal habitats and change many other features of our natural and managed environments.

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<sup>1</sup> Intergovernmental Panel on Climate Change, Climate Change: 2007: Synthesis Report, page 45, [www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\\_syr.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf).

## MONOCACY NATIONAL BATTLEFIELD AND CLIMATE CHANGE

Climate change presents significant risks and challenges to the NPS. In the western Maryland area, climate model scenarios suggest an increase in the frequency of extreme temperature and precipitation events.<sup>2</sup> Changes in precipitation and temperature will affect the current ecological, cultural-historical and recreational features of the park. These changes in the environment will directly impact the ability for the park to preserve and manage the battlefield. The following potential climate change impacts were considered at the workshop while the park staff brainstormed actions to reduce GHG emissions:

- Changes in growing seasons, which will affect vegetation.
- Increased opportunity for invasive species establishment in changing ecosystems.
- Changes to natural resources resulting in unpredictable management needs.
- Changes in visitation due to changes in seasonal patterns.

By measuring and reducing GHG emissions from park-related activities, Monocacy National Battlefield intends to minimize its contribution to climate change and the resulting detrimental impacts. Park progress and green initiatives to reduce GHGs will be communicated to the public.

## INVENTORY PROCESS

Monocacy National Battlefield completed a GHG emissions inventory for FY2008 with data from park operations using the Climate Leadership in Parks (CLIP) tool. The CLIP tool was initially developed by the NPS CFP program, in association with the U.S. Environmental Protection Agency, to account for GHG emissions specific to national parks. The tool is designed to:

- Convert energy and resource use data into metric tons of carbon dioxide (CO<sub>2</sub>) equivalent (MtCO<sub>2</sub>e), which is a single unit that standardizes carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O) and methane (CH<sub>4</sub>).
- Educate park employees about the sources of GHGs and the emissions inventory process.
- Assist with identifying strategies for each park to reduce emissions.
- Enable park personnel to track current and future progress toward emissions reduction goals.

Park activities such as fuel and electricity use, refrigeration and sending solid waste to the landfill for treatment all produce different types of GHGs. Since not all GHGs affect climate change to the same degree, it is necessary to convert each GHG to a common unit in order to compare them in the park inventory. The CLIP tool automatically converts the park's data into MtCO<sub>2</sub>e. MtCO<sub>2</sub>e is used as a common measure for GHG emissions accounting so that the emissions of different greenhouse gases can be compared. The conversion to MtCO<sub>2</sub>e is based on the potential of a specific GHG to contribute to the greenhouse effect, or its global warming potential (GWP), relative to the potential of CO<sub>2</sub>, which is given the GWP of 1. The GWP of CH<sub>4</sub> is 21, meaning that an equivalent amount of

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<sup>2</sup> Gonzalez, Patrick. "Climate Change Trends for Resource Planning at Catoctin Mountain Park." National Park Service, June 25, 2012.

CH<sub>4</sub> has 21 times the potential of CO<sub>2</sub> to cause global warming. The output of the CLIP tool is the park's emissions profile, which was used to prioritize GHG emission reduction strategies.

Monocacy National Battlefield staff gathered annual usage data, such as electricity and gallons of fuel used, as well as data regarding visitor travel within park boundaries. Staff provided employee commuting data and this information was included in the inventory as well.

Data categories include stationary combustion, mobile combustion (e.g., the park's vehicle fleet and mowers), purchased electricity, solid waste, refrigeration, wastewater, farming and employee commuting. These categories can be divided into direct and indirect GHG emissions. Scope 1 emissions are direct emissions from sources owned and operated by the park. This includes emissions produced when fuel is burned within park boundaries (e.g., wood) or when fueling a park vehicle, and it includes "fugitive" emissions released from refrigeration sources. Scope 2 emissions are indirect GHG emissions resulting from the consumption of purchased electricity. Scope 3 emissions are all other indirect emissions, such as emissions from visitor transportation within the park, employee commuting, offsite wastewater treatment, emissions from livestock (documented as "other" emissions in the Monocacy GHG inventory) and offsite waste disposal.

## Park Emissions Profile

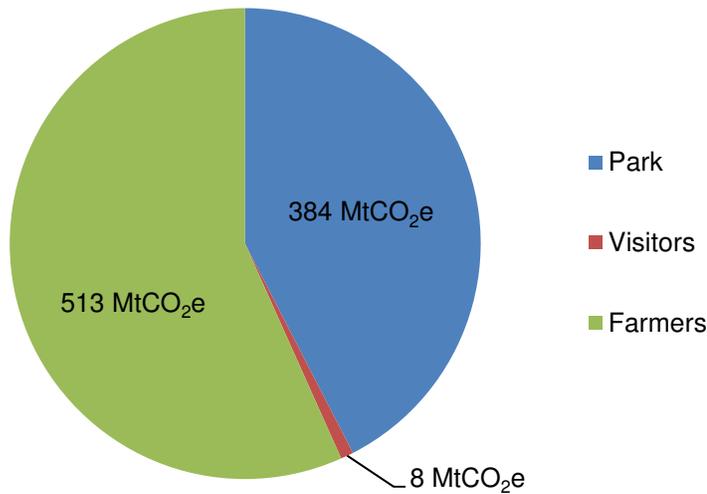
The Monocacy National Battlefield GHG inventory for FY 2008 includes emissions from park operations, visitors and farmers leasing park lands. There are no concession operations at the park. Sources of emissions from park operations include purchased electricity, mobile combustion (i.e., park-owned vehicles and equipment), wastewater treatment, solid waste disposal, refrigerant use and employee commuting. Fertilizer is used at the park, but data on fertilizer use was not available for FY 2008; it will be included in future inventories. Visitor emissions are estimated based on annual visitation numbers for visitor vehicle transportation. Farming is a permitted activity that results in emissions from livestock (e.g., methane produced by cows through enteric processes) and mobile fuel combustion for tractors and other farm equipment. A summary of the inventory is detailed below.

### MONOCACY NATIONAL BATTLEFIELD GHG INVENTORY – FY 2008

Total GHG emissions from park operations, visitors and farmers for FY 2008 amounted to 905 MtCO<sub>2</sub>e. For comparison, a typical single-family home in the U.S. produces 12 MtCO<sub>2</sub>e per year.<sup>3</sup> Thus, the combined FY 2008 emissions from park operations, visitor activities and farm activities within the park were roughly equivalent to the emissions from the energy use of 75 households. Farming practices contributed the greatest percentage of the total emissions from Monocacy National Battlefield, producing approximately 513 MtCO<sub>2</sub>e (57 percent of total emissions). Park operations produced 384 MtCO<sub>2</sub>e (42 percent of total emissions), and visitor emissions produced 8 MtCO<sub>2</sub>e (less than one percent of total emissions), which is attributed to mobile combustion from visitor transportation. The greatest source of emissions from park operations alone was electricity consumption, resulting in 271 MtCO<sub>2</sub>e. See Figure 1 showing the total park GHG emissions profile for FY 2008.

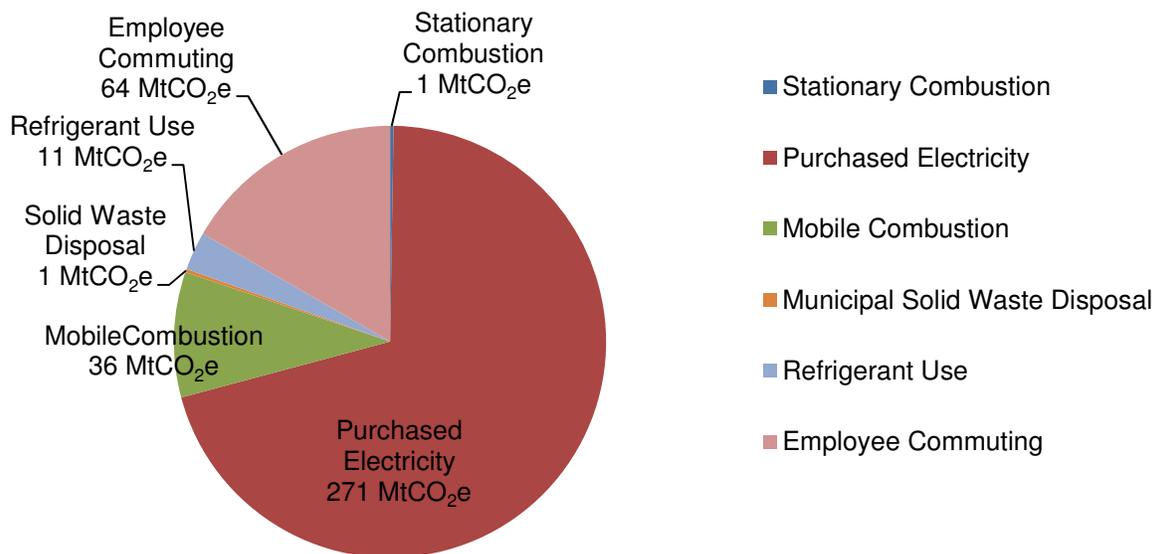
<sup>3</sup>U.S. Environmental Protection Agency. "Greenhouse Gases Equivalencies Calculators." Clean Energy Resources. EPA, 2011. Web. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

**FIGURE 1: FY 2008 MONOCACY NATIONAL BATTLEFIELD TOTAL GHG EMISSIONS – 905 MtCO<sub>2</sub>e**

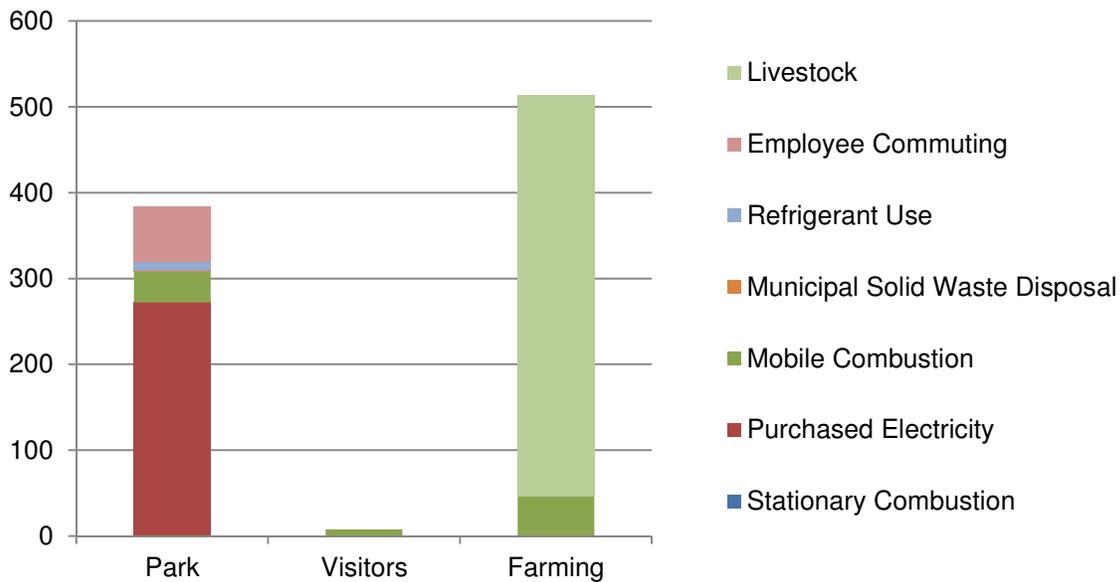


In order to target emissions reduction efforts, the park assessed park operations emissions by source. At 271 MtCO<sub>2</sub>e (71 percent of total park operations emissions), purchased electricity is by far the largest contributor of GHG emissions from park operations. Employee commuting contributed 64 MtCO<sub>2</sub>e (17 percent of total park operations emissions), making it the second largest contributor. Out of the remaining sources of emissions from park operations, mobile combustion contributed 36 MtCO<sub>2</sub>e (9 percent), refrigerant use (e.g., refrigerators, freezers, and air conditioning) contributed 11 MtCO<sub>2</sub>e (2 percent), stationary combustion contributed 1 MtCO<sub>2</sub>e (less than 1 percent), waste disposal contributed 1 MtCO<sub>2</sub>e (less than 1 percent), and wastewater treatment contributed less than 1 MtCO<sub>2</sub>e. See Figure 2 for a breakdown of all park operations emissions (without visitors or leasing farmers) sources and Figure 3 for total contribution by all sources for FY 2008.

**FIGURE 2: FY 2008 MONOCACY NATIONAL BATTLEFIELD OPERATIONS GHG EMISSIONS – 384 MtCO<sub>2</sub>e**



**FIGURE 3: FY 2008 MONOCACY NATIONAL BATTLEFIELD GHG EMISSIONS BY SOURCE – MtCO<sub>2</sub>e**



## Strategies for Reducing Emissions

Monocacy National Battlefield staff developed GHG reduction strategies and actions during the park’s CFP workshop held on April 2 and 3, 2013, at the National Conservation Training Center in Shepherdstown, West Virginia. These strategies focus on reducing energy consumption, reducing transportation emissions, addressing water and source reduction and increasing climate change education efforts. Park staff identified a number of strategies to reduce emissions based on emission reduction potential, cost-effectiveness, feasibility, co-benefits and local impact.

### STRATEGY 1: REDUCE GHG EMISSIONS FROM PARK ENERGY USE BY 10 PERCENT BELOW FY 2008 LEVELS BY 2016

The largest contributor of GHGs from park operations is purchased electricity, which produced 271 MtCO<sub>2</sub>e in FY 2008. Because of this, Monocacy National Battlefield will focus on actions to reduce electricity consumption as a top priority. In addition to reducing overall GHG emissions, reducing electricity consumption will provide the park with reduced costs and increased operational efficiency.

#### PROGRESS AS OF APRIL 2013:

- Changed 95 percent of the lighting at the visitor center to light-emitting diode (LED) bulbs, including:
  - Installing flat-panel lighting in office areas;
  - Eliminating some of the existing lighting;
  - Replacing track lighting with LED bulbs;
  - Replacing halogen 50 watt bulbs with LED bulbs;
  - Replacing T8 fluorescent bulbs with LED bulbs; and
  - Reducing the number of bulbs and ballasts in exhibit light boxes;
  - Using T5 energy efficient bulbs, where fluorescent bulbs must be used for exhibits.

- Changed parking lot lighting to LED bulbs with variable wattage.
- Replaced fluorescent lighting in administrative offices with LED bulbs.
- Removed oil furnace and window AC units from seasonal quarters, and replaced them with a two ton, 16-SEER energy efficient heat pump.
- Installed light dimmers in appropriate spaces.
- Installed instant hot-water heaters.
- Reduced the size of the hot-water tank at the maintenance shop.
- Installed a geothermal heat pump for the HVAC system.
- Installed energy-efficient ceiling fans in the visitor center.
- Installed a solar exhaust fan in the visitor center.
- Installed low-flow faucets and motion sensors in the visitor center restrooms.
- Added insulation to the attic of the seasonal housing building.

#### MONOCACY NATIONAL BATTLEFIELD COMMITS TO THE FOLLOWING ACTIONS IN ORDER TO REDUCE PARK ENERGY USE:

1. Reduce energy use in buildings through the following actions:
  - Replace old heat pumps with more efficient units.
  - Complete lighting retrofit to LED bulbs.
  - Upgrade or replace the HVAC system at the visitor center.
  - Prioritize projects based on the greatest potential for energy efficiency benefits.
  - Consider repurposing the use of historic structures to reduce electricity demand; research and consider efficiency opportunities for historic structures.
  - Install occupancy sensors in appropriate spaces, such as meeting rooms and restrooms.
  - Evaluate opportunities to purchase green energy (e.g., renewable energy credits).
2. Prioritize park structures to target for energy improvements.
  - Replace windows in seasonal housing.
  - Consider opportunities to reduce energy use through better caulking and insulation.
  - Consider installing energy-saving window films.
3. Provide education to staff on no-cost energy-saving activities, such as: turning off computers and lights, turning down the thermostat and powering down computers and printers on nights and weekends.
4. Reach out to farmers to educate them on the CFP process and to share ideas and opportunities to reduce their energy use.
5. Purchase and install solar energy equipment.
  - Install solar photovoltaic panels for park tenants.
  - Use solar energy for vehicle charging stations.
  - Identify funding for solar photovoltaic projects at the visitor center and maintenance facility.

## STRATEGY 2: REDUCE GHG EMISSIONS FROM TRANSPORTATION BY 6 PERCENT BELOW FY 2008 LEVELS BY 2016

Transportation, or mobile combustion, produced 36 MtCO<sub>2</sub>e in FY 2008, and employee commuting produced 64 MtCO<sub>2</sub>e in FY 2008. Taking actions to reduce transportation-related emissions and helping staff reduce their emissions from commuting will support the park in lowering its GHG emissions. In addition, the park identified opportunities to reduce visitor transportation emissions, which resulted in 8 MtCO<sub>2</sub>e in FY 2008. Park actions should focus on reducing emissions from fuel use in vehicles and in landscaping equipment such as mowers.

### PROGRESS AS OF APRIL 2013:

- Acquired two hybrid vehicles.
- Acquired a zero-turn mower.

## MONOCACY NATIONAL BATTLEFIELD COMMITS TO THE FOLLOWING ACTIONS TO REDUCE PARK EMISSIONS FROM TRANSPORTATION:

1. Reduce emissions from the park fleet through the following actions:
  - Upgrade fleet with higher efficiency vehicles.
  - Encourage staff to use the most efficient vehicle for the job.
2. Encourage teleworking or alternate work schedules, when possible.
3. Reduce idling from buses.
  - Educate bus drivers about CFP process.
  - Educate bus drivers about the importance of turning off the buses.
4. Reduce emissions from visitor transportation by considering the following actions:
  - Consider opportunities to increase connectivity of trails, to help reduce driving between locations.
  - Research opportunities for a transit bus stop at the visitor center.
  - Evaluate other transportation options such as bike sharing and bike tours.
  - Educate visitors before they come to the park via the park Web site about reducing idling and other emission reducing actions.

## STRATEGY 3: INCREASE STAFF AWARENESS OF RECYCLING AND WASTE REDUCTION

The disposal of solid waste produced a total of 1 MtCO<sub>2</sub>e in FY 2008. Although this is a relatively small contributor to the overall emissions, there are opportunities to reduce GHG emissions associated with this activity through education and awareness. The park will educate staff about the opportunities to reduce solid waste and how these actions can save on disposal fees and staff time.

### PROGRESS AS OF APRIL 2013:

- Operated as a trash-free park since 2002.
- Implemented an internal recycling program that includes glass, plastic, paper, cardboard, batteries, electronics, and light bulbs.
- Implemented a program to recycle toner and print cartridges used for park operations.

## MONOCACY NATIONAL BATTLEFIELD COMMITS TO THE FOLLOWING ACTIONS TO REDUCE PARK EMISSIONS FROM SOLID WASTE DISPOSAL:

1. Replace hand dryers with higher efficiency models to eliminate the waste from paper towels.
2. Educate staff on opportunities for reducing waste.
3. Reach out to the group that has adopted a section of MD-355 to encourage them to recycle the waste that they pick up.
4. Separate recyclables from the visitor waste that is picked up in the park.
5. Install a water refill station to reduce the use of disposable water bottles.

## STRATEGY 4: INCREASE CLIMATE CHANGE EDUCATION AND OUTREACH

Over 28,850 people visited Monocacy National Battlefield in FY 2008. The park can contribute to greater overall GHG emissions reductions by educating its visitors on actions they can take to reduce emissions. There are also opportunities to educate park staff and members of the surrounding community.

## MONOCACY NATIONAL BATTLEFIELD COMMITS TO THE FOLLOWING ACTIONS TO INCREASE CLIMATE CHANGE EDUCATION AND OUTREACH FOR PARK STAFF, VISITORS, AND THE LOCAL COMMUNITY.

1. Communicate sustainability messages at all employee meetings.
2. Remind staff about double-sided printing.
3. Reuse scrap paper.
4. Include signage around the park regarding the savings from implementing CFP actions, with concrete examples of the benefits (e.g., “this project allowed us to heat the building for a month”, “this project saved us XX kWh and XX\$ annually”).
5. Research historic climate and land use data from a significant period in the park’s history, and compare that information to the current climate and land use to highlight the differences; include this information in interpretive programs.
6. Incorporate environmental stewardship materials from the Alice Ferguson Foundation into visitor climate change education, and explain the relevance of mitigating climate change and environmental stewardship.
7. Incorporate climate change messages into existing interpretive programs.

## Conclusion

Monocacy National Battlefield has a unique opportunity to educate both national and international visitors and set an example for reducing GHG emissions in the National Capital Region and Service-wide. By addressing emissions in a targeted, prioritized manner, the park can efficiently and effectively reduce its GHG emissions. Additionally, by sharing these strategies with park visitors and partners, Monocacy National Battlefield will promote an awareness of climate change and encourage visitors and staff to take action to reduce GHG emissions on a broader scale.