



Solar Panels vs Trees

Considerations for Locating Solar Installations

Key Points

- Increased levels of carbon dioxide in the atmosphere have had negative effects across the globe, which will only worsen if we do not take action against climate change.
- The transition to renewable energy is a critical step on the path to phasing out fossil fuel burning because energy is generated with lower emissions.
- Renewable energy requires large amounts of space, and many communities turn to undeveloped green space, raising the question: is it better for the climate to remove forests to install solar panels, or to leave trees standing?
- When considering forest removal to install solar panels, decision-makers should consider all of the costs and benefits of this choice, including carbon storage by trees as well as energy generation emissions. Solar panel placement should prioritize leaving forests standing to maximize climate benefits.



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The Drastic Effects of Climate Change

Since the late 19th century, the average global temperature has increased by approximately 1.2 degrees Celsius, a change primarily caused by greater carbon dioxide emissions. This increase in temperature has had a range of consequences, including thinning ice sheets, increasing average sea levels, and more frequent and severe extreme weather.¹ The United Nations' 2016 Intergovernmental Panel on Climate Change (IPCC) report stated that global emissions need to be reduced by 45% from 2010 levels by 2030 to avoid catastrophic impacts to natural systems and people across the globe.² Climate change is not an event of the future; it is happening now, and it will only get worse as long as greenhouse gasses in the atmosphere continue to increase. However, it is not too late to take action.

The Switch to Renewable Energy

One way to mitigate climate change is to use renewable energy, as it produces lower emissions than fossil fuel burning.³ With great public support for renewable energy, especially solar power, and ever-increasing energy demand, there is a growing trend toward increasing numbers of large, ground-mounted solar installations. In many locations, the path of least resistance involves sacrificing public forest land because it is available for use and the land-use conversion is relatively low-cost.⁴ In Massachusetts alone, 2,500 acres of forest have been cut down for solar panels in the last 10-15 years.⁵ This raises the question: when is replacing forest with solar panels beneficial to the climate?

Getting the Math Right

When deciding whether to maintain forests or install solar panels in their place, decision-makers often do not consider all the benefits of trees. In addition to carbon sequestration, trees contribute to clean air and water, locally produced food and wood products, shade, and biodiversity. The ability of trees and forests to absorb air pollution prevents more than 670,000 accounts of respiratory symptoms and more than 850 deaths nationally each year.⁶ Globally, trees and forests also annually remove about one third of fossil fuel emissions, and roadside trees reduce nearby indoor air pollution by more than 50%.⁷ Trees help purify our drinking water, acting as a filter to remove pollutants so that it arrives at lakes, rivers, and streams in cleaner condition.⁸ Lastly, trees support biodiversity because they provide valuable ecosystem services, such as food, shelter, and water.⁹



In making the decision to install solar panels in place of trees, it is essential to consider all of the benefits of trees and the carbon footprint of both trees and solar panels. Trees contain a tremendous amount of embodied carbon—carbon that they have stored throughout their lifetime. Any time a tree is cut down, an organism is removed that has spent its entire life sequestering carbon. In contrast, producing and shipping solar panels generates carbon emissions. Only after the panels are installed do they begin reducing overall emissions, whereas trees sequester carbon continuously. The accurate carbon footprint of trees includes how much carbon is currently held in the trees plus the amount of carbon the trees would continue to sequester over time if they remained standing. The carbon footprint of solar panels includes the emissions that go into the production and disposal of the panels and the carbon emissions that they will offset once installed.

To make these calculations, decision-makers can use the Land Emissions and Removal Navigator (LEARN) tool to determine the past and future carbon sequestration of trees in a given forest. This tool uses satellite imagery from across the country and allows individuals to calculate the total amount of carbon stored in forests based on the average

sequestration of each species of tree (e.g. maple, beech, oak) and the type of forest (e.g. deciduous, coniferous).

It is crucial that decision-makers consider all the benefits of trees as well as the carbon footprint of the trees and panels when making the decision to install solar panels in place of forests. However, instead of choosing one or the other, decision-makers can maximize climate and other ecosystem service benefits by installing the panels in areas that do not interfere with the sequestration of trees, so both forests and solar panels can contribute to mitigating carbon emissions.

Finding New Locations for Solar Panels

We can enjoy the benefits of both solar panels and forests in our communities if we take care to locate everything in its rightful place. Solar panels provide the maximum benefit in locations where they do not significantly impact the capacity of the land to contribute to climate mitigation. Ideal places for the panels are large, relatively flat areas, like old fields, rooftops, or hard surfaces, like concrete and asphalt.¹⁰ The potential for installing solar panels in these areas across our state is excellent; existing rooftops in Massachusetts can support up to 22.5 gigawatts of solar capacity, meeting 47% of the total electrical demand of the state.¹¹ If we install solar panels in these preferred sites while also allowing trees to sequester carbon, we will maximize energy demand and our climate benefits.

Time to Take Action

In order to install large arrays of solar panels while benefiting from carbon-storing forests, it is crucial to support better protections for forests so that their removal is no longer a consideration. Mapping tools, such as the Cape Cod Commission's Solar Screening Tool, can help decision-makers identify preferred locations for solar panels in their communities.¹²

Solar panels are most beneficial when installed in locations that maximize emissions reductions and do not counteract other climate solutions. One Massachusetts town where citizens are open to installing solar panels in these ideal locations is Wareham, MA. While attempting to find a balance between conservation and respecting the rights of landowners, town administrator Derek Sullivan remarked that the town would consider writing a bylaw that incentivizes installing solar panels on roofs or existing parking lots, as opposed to cutting down trees.¹³

Even though solar panels are extremely valuable for reducing our emissions from energy production, trees are also crucial to our environment—not only for their carbon sequestration, but also for their many ecosystem services. Solar panels should not be installed in place of trees, since both climate solutions together are necessary for carbon mitigation. Instead, decision-makers can help maximize climate benefits by encouraging the installation of solar panels in areas that are not contributing to carbon mitigation, like parking lots or rooftops. It is essential to have robust, science-based policies to guide solar implementation and ensure that we make the best decisions to maintain a sustainable future.

This policy brief was developed by Spring Forward Climate Education in collaboration with Woodwell Climate Research Center. Spring Forward is a youth-led climate education organization that aims to empower students to become conscious global citizens. It has taught over 150 workshops and reached over 2,000 students since its founding in March 2020. Woodwell Climate Research Center conducts science for solutions at the nexus of climate, people, and nature, and partners with leaders and communities for just, meaningful impact to address the climate crisis.



CITATIONS

- 1 "Climate Change: How Do We Know?" NASA: *Global Climate Change*, edited by Holley Shaftel et al., NASA's Jet Propulsion Laboratory, climate.nasa.gov/evidence. Accessed 16 Dec. 2021.
- 2 "Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments." IPCC, 8 Oct. 2016, www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/#:~:text=Global%20net%20human%2Dcaused%20emissions,removing%20CO2%20from%20the%20air. Accessed 8 May 2022.
- 3 "Local Renewable Energy Benefits and Resources." United States Environmental Protection Agency, www.epa.gov/statelocalenergy/local-renewable-energy-benefits-and-resources. Accessed 25 Mar. 2022.
- 4 Kennedy, Brian, and Allison Spencer. "Most Americans support expanding solar and wind energy, but Republican support has dropped." Pew Research Center, www.pewresearch.org/fact-tank/2021/06/08/most-americans-support-expanding-solar-and-wind-energy-but-republican-support-has-dropped. Accessed 4 May 2022.
- 5 LaMoult, Craig. "Some Massachusetts Forestland Is Being Clear-cut to Put up Solar Farms." GBH [Boston], 26 Apr. 2019. WGBH, www.wgbh.org/news/local-news/2019/04/26/some-massachusetts-forestland-is-being-clear-cut-to-put-up-solar-farms. Accessed 17 Feb. 2022.
- 6 Ricci, E.H., J. Collins, J. Clarke, P. Dolci, and L. de la Parra. 2020. *Losing Ground: Nature's Value in a Changing Climate*. Massachusetts Audubon Society, Inc., Lincoln, Massachusetts, 33 pp.
- 7 "Tree Facts." Arbor Day Foundation, [www.arborday.org/trees/treefacts/#:~:text=Trees%20absorb%20carbon%20dioxide%20\(CO,2%20car%20driven%2026%2C000%20miles](https://www.arborday.org/trees/treefacts/#:~:text=Trees%20absorb%20carbon%20dioxide%20(CO,2%20car%20driven%2026%2C000%20miles). Accessed 4 May 2022.
- 8 Healthy Forests for Clean Water. North Carolina Forest Service, ncforestservice.gov/publications/UF0115.pdf. Accessed 4 May 2022.
- 9 "Benefits for Wildlife." National Wildlife Foundation, www.nwf.org/Trees-for-Wildlife/Wildlife-Benefits#:~:text=Trees%20support%20the%20lives%20of,delicious%20fruits%20and%20foraging%20opportunities. Accessed 4 May 2022.
- 10 Walker, Wayne, Dr. Personal interview with the author. 3 Feb. 2022.
- 11 Ricci, E.H., J. Collins, J. Clarke, P. Dolci, and L. de la Parra. 2020. *Losing Ground: Nature's Value in a Changing Climate*. Massachusetts Audubon Society, Inc., Lincoln, Massachusetts, 33 pp.
- 12 "Solar Screening Tool." Cape Cod Commission, www.capecodcommission.org/our-work/solar-screening-tool/. Accessed 17 Feb. 2022.
- 13 Shelford, Chloe. "Committee to Craft New Solar Bylaw." *Wareham Week Today*, 21 Sept. 2021, wareham.theweektoday.com/article/committee-craft-new-solar-bylaw/54914. Accessed 17 Feb. 2022.

FURTHER READING

- "Climate Change: How Do We Know?" NASA: *Global Climate Change*, edited by Holley Shaftel et al., NASA's Jet Propulsion Laboratory, climate.nasa.gov/evidence. Accessed 16 Dec. 2021.
- LaMoult, Craig. "Some Massachusetts Forestland Is Being Clear-cut to Put up Solar Farms." GBH [Boston], 26 Apr. 2019. WGBH, www.wgbh.org/news/local-news/2019/04/26/some-massachusetts-forestland-is-being-clear-cut-to-put-up-solar-farms. Accessed 17 Feb. 2022.
- Ricci, E.H., J. Collins, J. Clarke, P. Dolci, and L. de la Parra. 2020. *Losing Ground: Nature's Value in a Changing Climate*. Massachusetts Audubon Society, Inc., Lincoln, Massachusetts, 33 pp.
- Ruiz, Sarah, editor. "Success or Failure? Woodwell Scientists Deem COP26 a Mixed Bag." Woodwell Climate Research Center, 18 Nov. 2021, www.woodwellclimate.org/how-successful-was-cop26. Accessed 16 Dec. 2021.
- Shelford, Chloe. "Committee to Craft New Solar Bylaw." *Wareham Week Today*, 21 Sept. 2021, wareham.theweektoday.com/article/committee-craft-new-solar-bylaw/54914. Accessed 17 Feb. 2022.
- . "Vote on Controversial Solar Farm Delayed." *Wareham Week Today*, 9 Mar. 2021, wareham.theweektoday.com/article/vote-controversial-solar-farm-delayed/52090. Accessed 21 Feb. 2022.
- "Solar Screening Tool." Cape Cod Commission, www.capecodcommission.org/our-work/solar-screening-tool. Accessed 17 Feb. 2022.
- "Temperatures." Climate Action Tracker, climateactiontracker.org/global/temperatures. Accessed 16 Dec. 2021.
- Zuckoff, Eve. "Proposed Solar Farm on Falmouth Golf Course Faces Town Meeting Votes." CAI, 6 Apr. 2021. CAI, www.capeandislands.org/local-news/2021-04-06/proposed-solar-farm-on-falmouth-golf-course-faces-town-meeting-votes. Accessed 17 Feb. 2022.