

Renewable Energy Ecology: Applications for New York State



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Preview

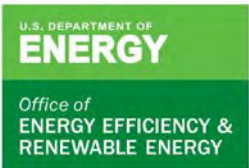
Matching renewable energy and conservation targets for a sustainable future

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Solar Futures STUDY

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CONSERVING AND RESTORING AMERICA THE BEAUTIFUL

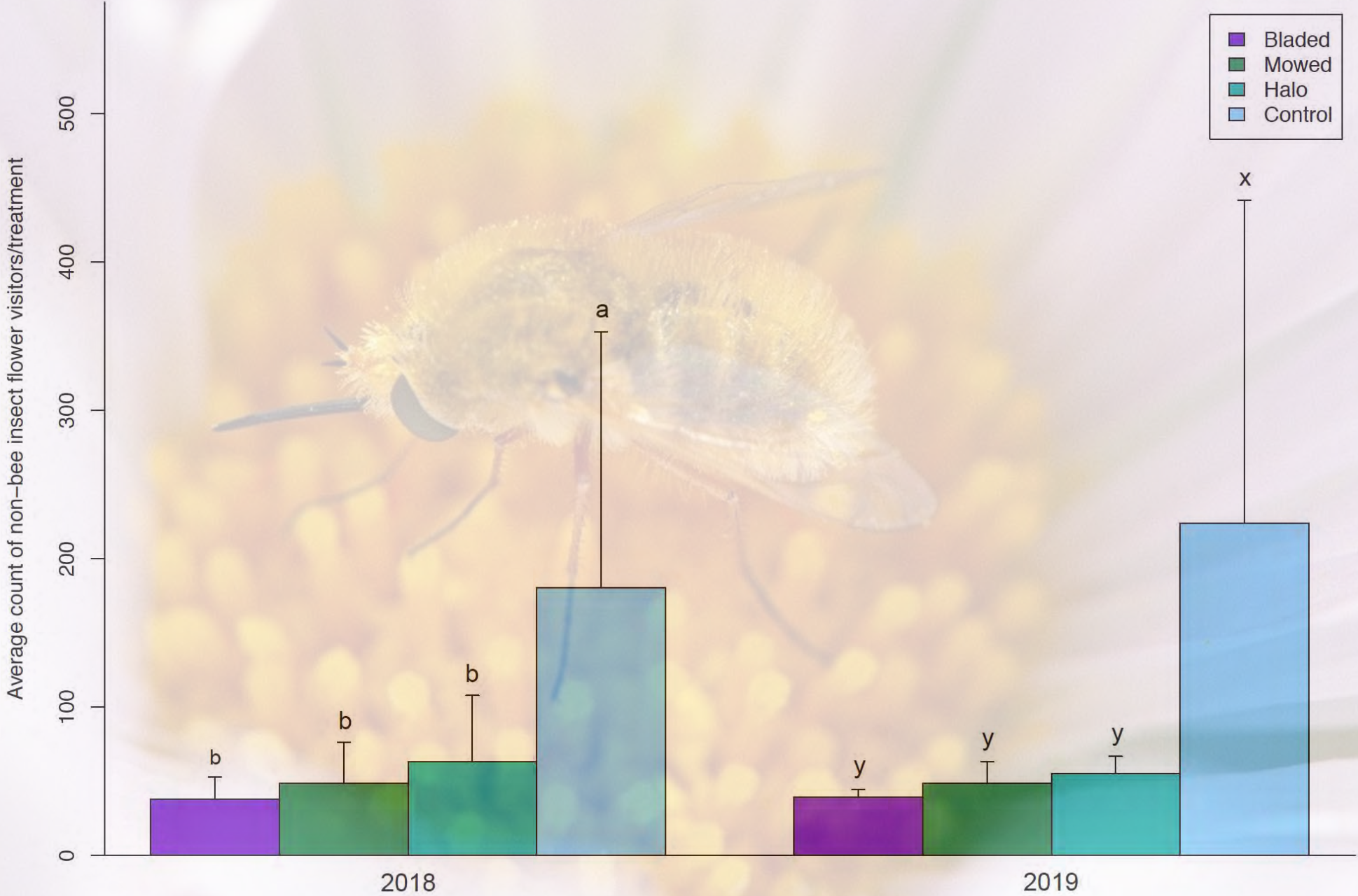
2021

A preliminary report to the National Climate Task Force recommending a ten-year, locally led campaign to conserve and restore the lands and waters upon which we all depend, and that bind us together as Americans.

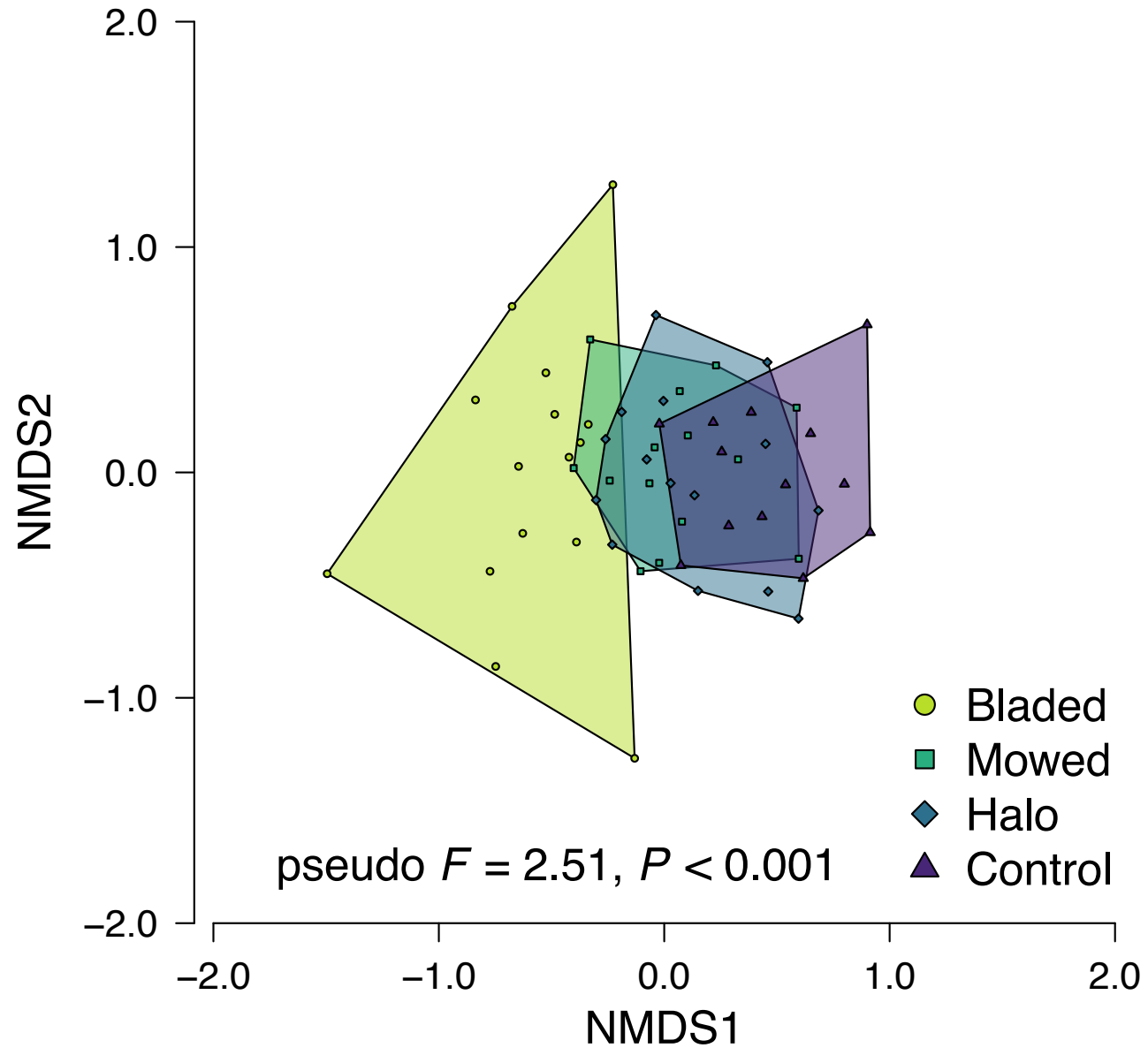




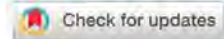
All non-bee insect flower visitors



Ant (Formicidae) Community Composition







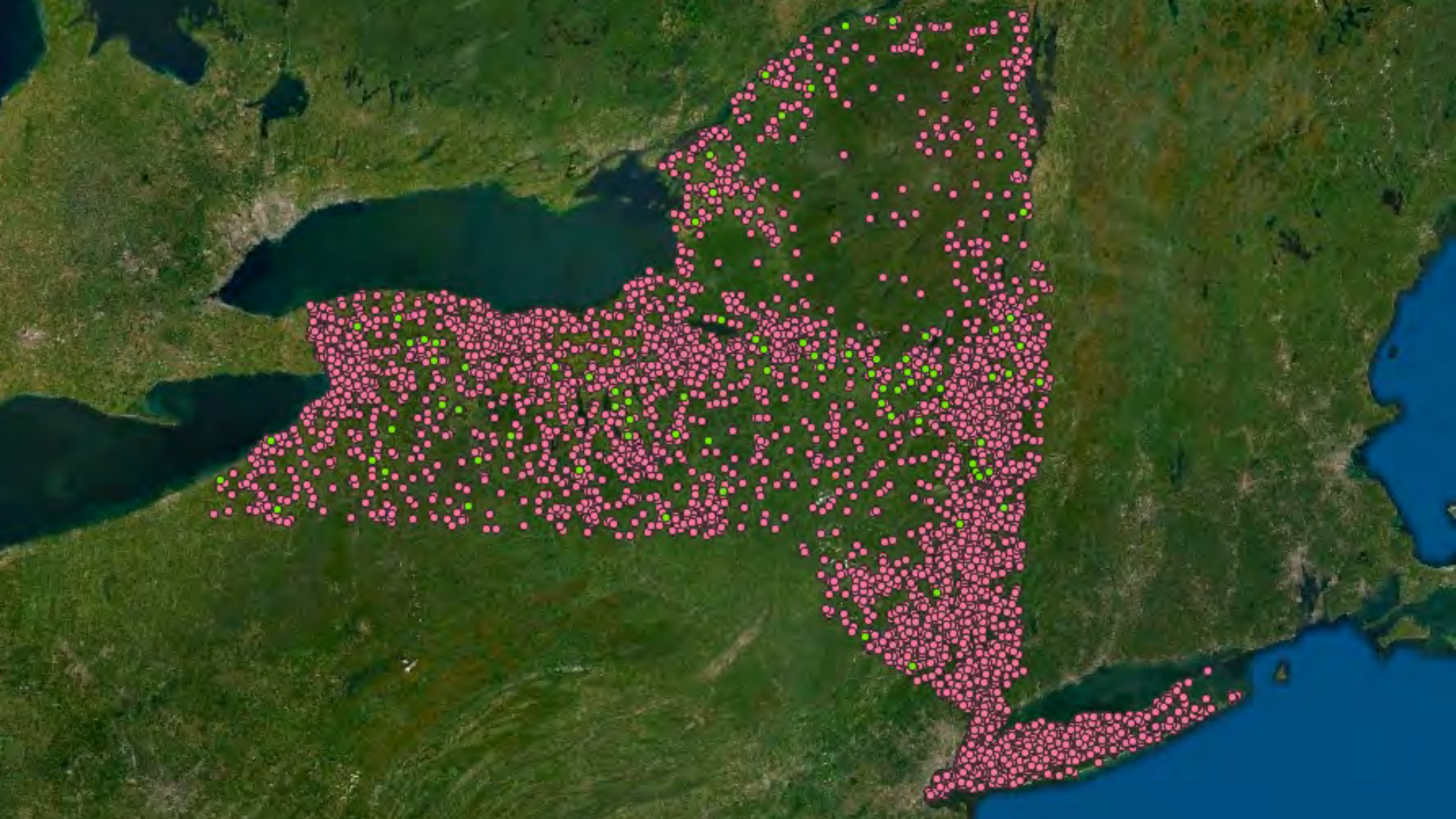
Reduced ecosystem services of desert plants from ground-mounted solar energy development

Steven M. Grodsky ¹✉ and Rebecca R. Hernandez ^{1,2}



Species	Provisioning Services			Regulating Services				Habitat Services		Cultural Services						ES-based Value	Ethnic Group Use ^a	Ethnic Group Value			
Crassulean acid metabolism (CAM)																	ES-based Value = 85; ES-based value per species = 9.44±2.70				
<i>Coryphantha chlorantha</i> ^b										●	●					2	3, 9, 14, 15				
<i>Cylindropuntia acanthocarpa</i>	●	●	●			●	●		●	●	●	●		●		12	1, 2, 5-7, 11, 16				
<i>Cylindropuntia echinocarpa</i>	●	●	●			●	●		●	●	●	●		●		12	1, 2, 5-7, 10, 11, 14, 16				
<i>Cylindropuntia ramosissima</i>	●	●	●			●	●		●	●	●	●		●		12	1, 2, 5-7, 11, 13, 16				
<i>Echinocactus polycephalus</i>			●			●			●		●			●		6	2, 10, 14				
<i>Echinocereus engelmannii</i>		●				●	●		●		●			●		7	3, 5, 6, 10, 12-15				
<i>Ferocactus cylindraceus</i>	●				●		●		●							7	11				
<i>Opuntia basilaris</i>	●	●	●	●		●	●		●	●		●		●		12	1-4, 10, 11, 14, 15				
<i>Yucca schidigera</i>	●	●	●	●	●	●	●		●	●	●	●		●		15	2, 3, 10, 14				

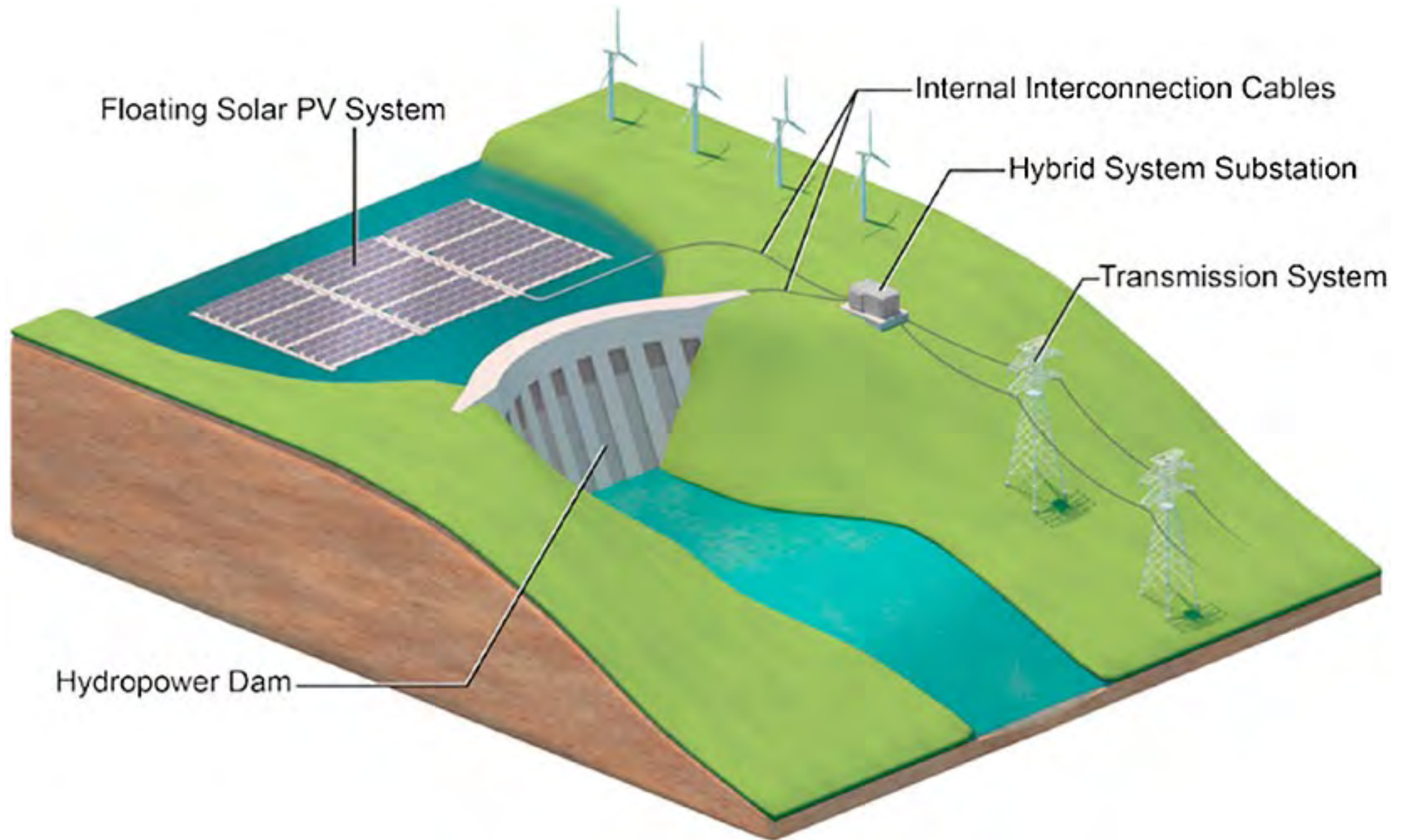
^aNative American ethnic groups: ¹Apache, ²Cahuilla, ³Chemehuevi (Nümü), ⁴Hia C-ed O'odham, ⁵Hohokam, ⁶Hopi, ⁷Maricopa, ⁸Mayo, ⁹Navajo, ¹⁰Paiute, ¹¹Pima, ¹²Pueblo, ¹³Seri, ¹⁴Shoshone, ¹⁵Southern Paiute, ¹⁶Tohono O'odham, ¹⁷Ute, ¹⁸Zuni.











Comment

Floating solar power: evaluate trade-offs

Rafael M. Almeida, Rafael Schmitt, Steven M. Grodsky, Alexander S. Flecker, Carla P. Gomes, Lu Zhao, Haohui Liu, Nathan Barros, Rafael Kelman & Peter B. McIntyre

Covering 10% of the world's hydropower reservoirs with 'floatovoltaics' would install as much electrical capacity as is currently available for fossil-fuel power plants. But the environmental and social impacts must be assessed.

Solar panels need to be deployed over vast areas worldwide to decarbonize electricity. By 2050, the United States might need up to 61,000 square kilometres of solar panels – an area larger than the Netherlands¹. Land-scarce nations such as Japan and South Korea might have to devote 5% of their land to solar farms².

The question of where to put these panels isn't trivial. There is fierce competition for land that is also needed for food production and biodiversity conservation. One emerging solution is to deploy floating solar panels ('floatovoltaics') on reservoirs.

The idea of floatovoltaics holds much promise, and there has been a rapid rise in installation and investments. But there are still many unknowns about the technology's environmental impacts, along with its social, technical and economic dimensions.

These knowledge gaps need to be filled as soon as possible to avoid overpromising on the benefits of this approach, or having its roll-out derailed by unforeseen roadblocks.

Location, location

Solar power is space-intensive, requiring at least 20 times more area than conventional fossil-fuel plants to produce one gigawatt (GW) of electricity³. Several environments have been proposed as locations for extensive

installations, each with pros and cons.

Deserts have ample sunshine and don't have much competition for land use. But even here, there are trade-offs. For example, modelling indicates that in the Sahara, the dark colour of large swathes of solar panels would alter local temperatures and global airflow patterns in ways that could cause droughts in the Amazon, sea-ice loss in the Arctic and more⁴. Solar-energy developments in the Mojave Desert in the US southwest have reduced the cover of cacti that are culturally important to resident Native Americans⁵. And logistically, it can be hard to get energy from remote desert regions to where it is needed.

Agricultural fields are another promising possibility, but researchers are only starting to understand how pairing solar panels with crops in 'agrivoltaic' systems will affect food production⁶. Rooftops, car parks and highways are also good options, but are limited in scale.

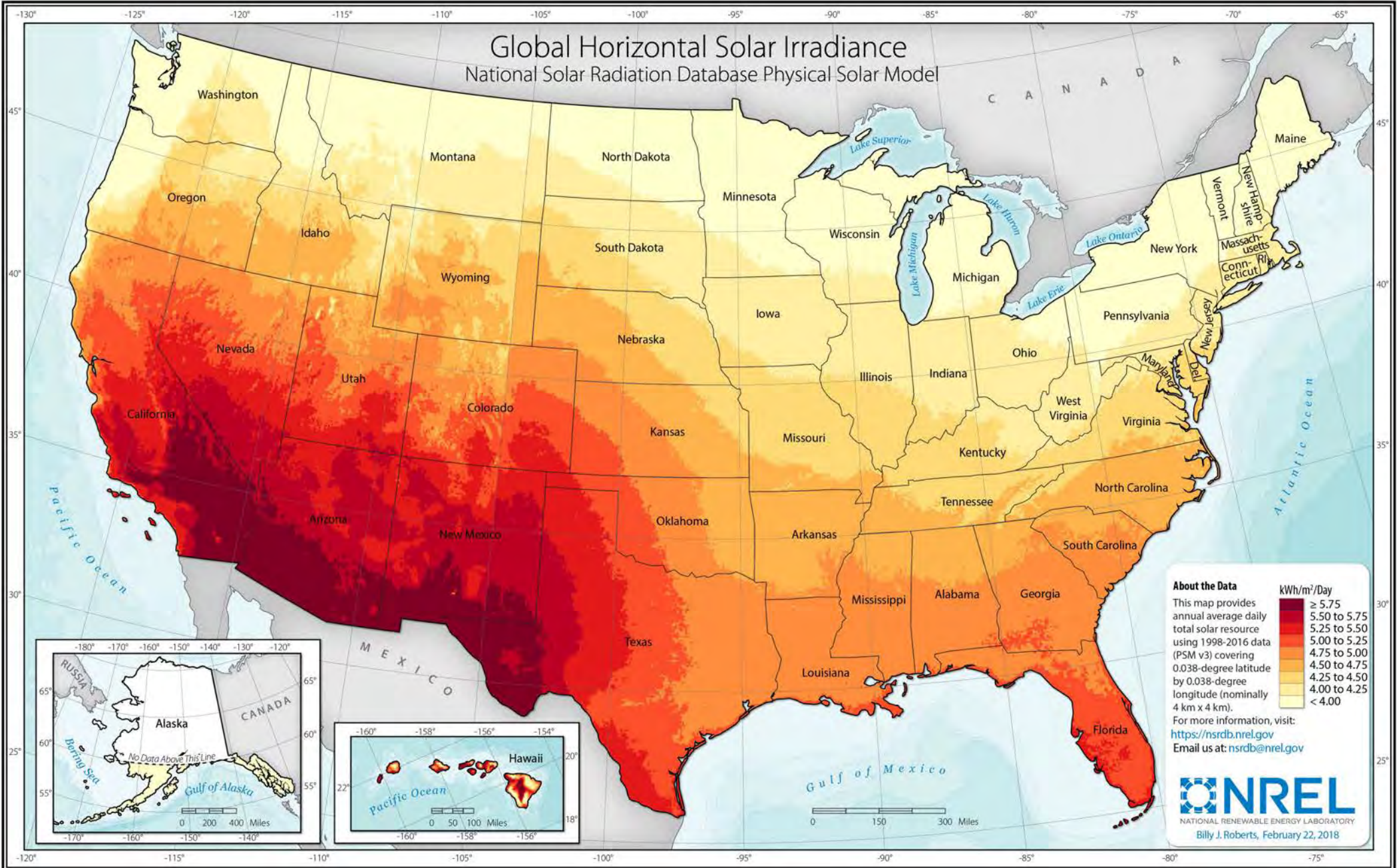
Placing solar arrays on reservoirs could have many advantages. The arrays are simply conventional solar panels installed on floats that are anchored through mooring lines. Proximity to water tends to keep them cool, making floating panels about 5% more efficient than land-based ones⁷. Arrays shield the surface from the sun and might reduce evaporation, retaining water for hydropower, drinking and irrigation⁸. Hydropower reservoirs already have the grid infrastructure for conveying electricity to consumers, reducing transmission costs. Pairing solar with pumped-storage hydropower could address the twin challenges of providing energy when sunlight is weak and storing it as potential energy in reservoirs when solar-power production is high⁹.

Floatovoltaics might also reduce the carbon intensity – emissions per unit of energy produced – of some hydropower operations. Many hydropower plants are as low-carbon as other renewables. But for some projects, so much methane – a potent greenhouse gas – is released from decaying submerged plant matter that they can emit as much carbon per unit energy as do fossil-fuel power plants¹⁰. For some



Global Horizontal Solar Irradiance

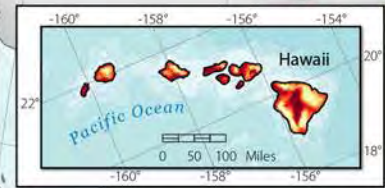
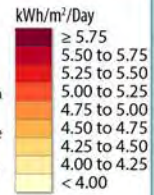
National Solar Radiation Database Physical Solar Model



About the Data

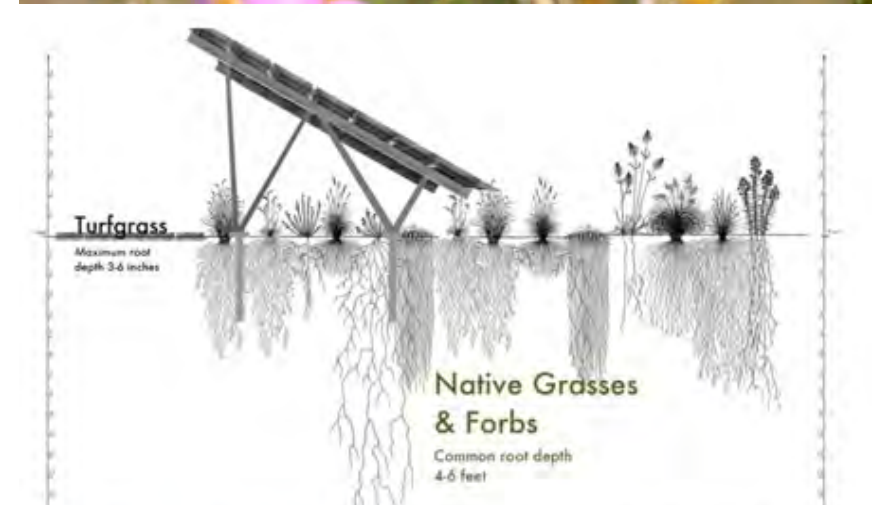
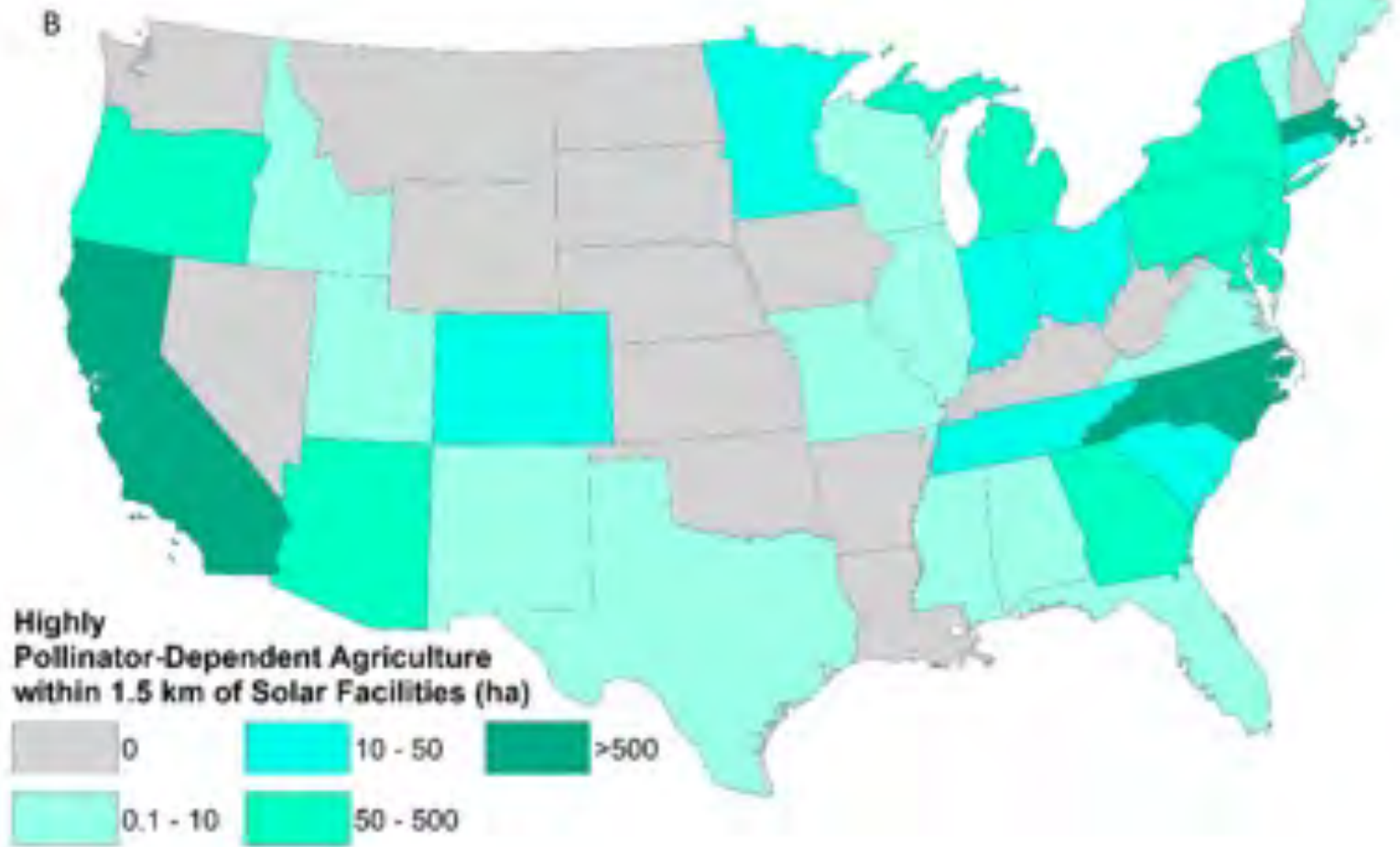
This map provides annual average daily total solar resource using 1998-2016 data (PSM v3) covering 0.038-degree latitude by 0.038-degree longitude (nominally 4 km x 4 km).

For more information, visit: <https://nsrdb.nrel.gov>
 Email us at: nsrdb@nrel.gov



NREL
 NATIONAL RENEWABLE ENERGY LABORATORY
 Billy J. Roberts, February 22, 2018





Walston et al. 2018. *Environ. Sci. Tech.*



National Pollinator-Solar Energy Monitoring and Research Network

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Provide a wealth of data and information available to stakeholders via an online platform



Generate research capacity, information, and outreach products for underserved communities interested in conservation at solar facilities





Sustainable Energy Future



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