Renewable Energy Ecology: Applications for New York State

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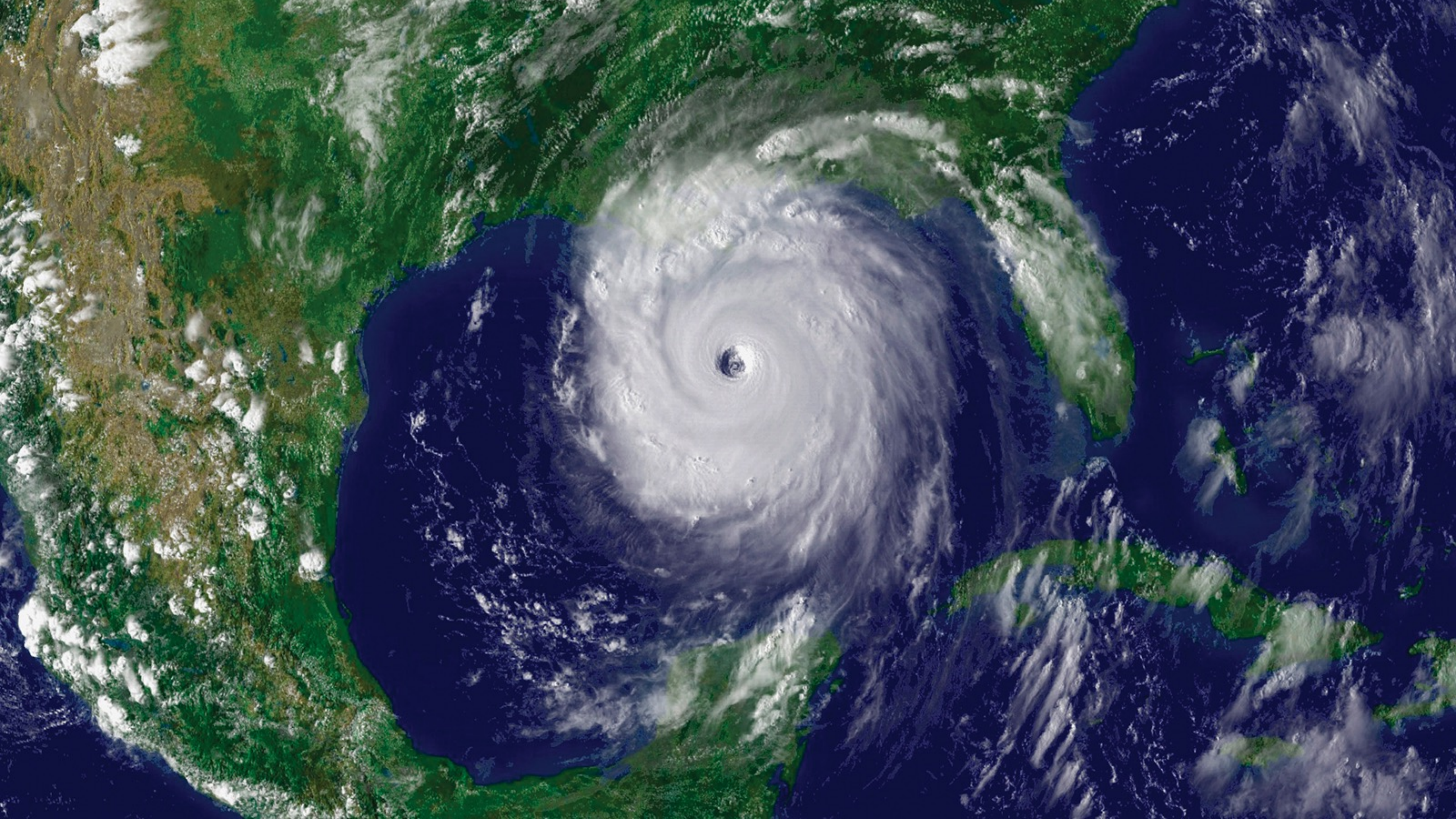

CellPress
Gold Standard for the Global Goals
1 ton of CO_2 offset
One Earth

Preview

Matching renewable energy and conservation targets for a sustainable future

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U.S. DEPARTMENT OF ENERGY
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

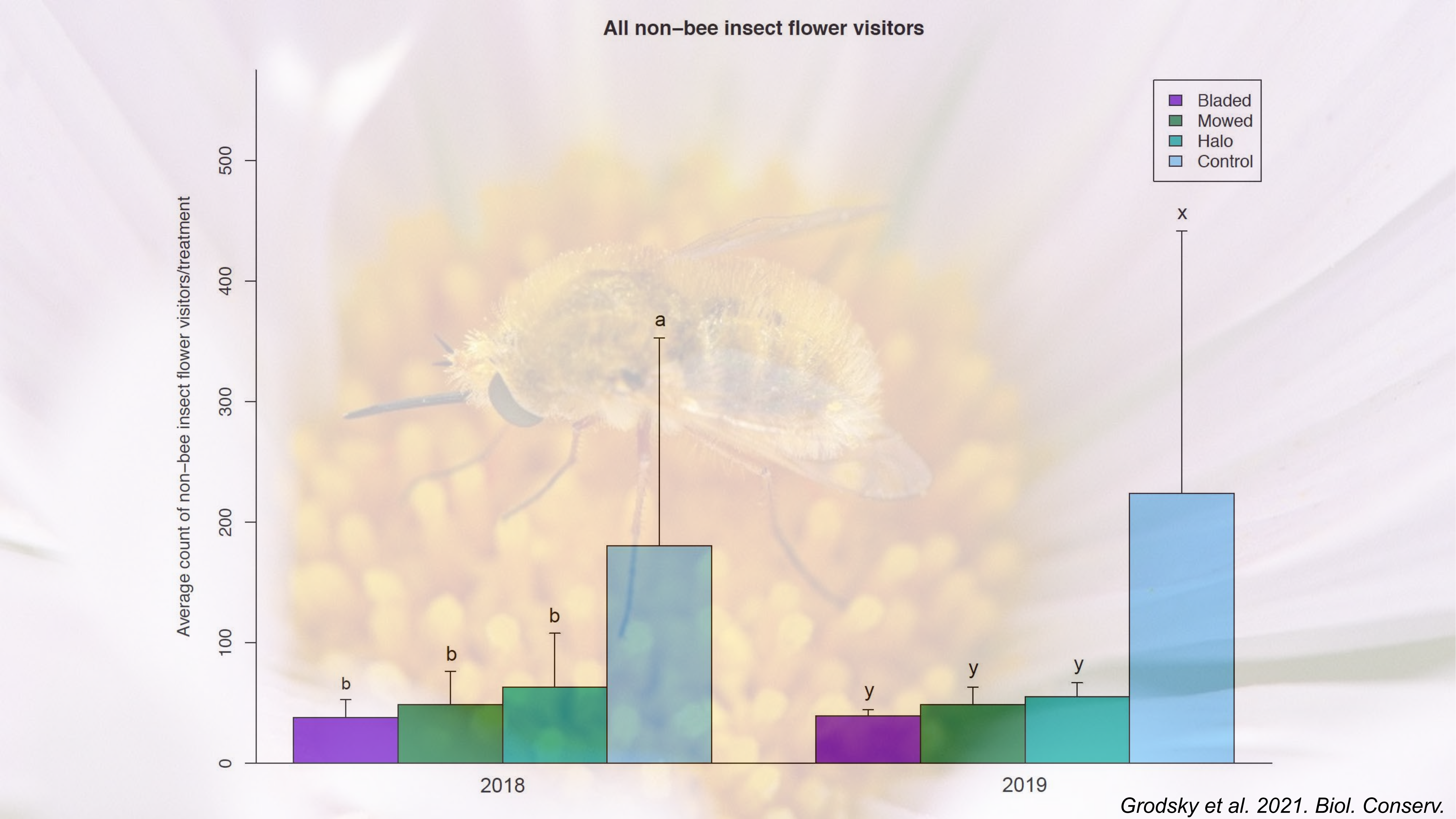
Solar Futures STUDY

Conserving and Restoring America the Beautiful

2021

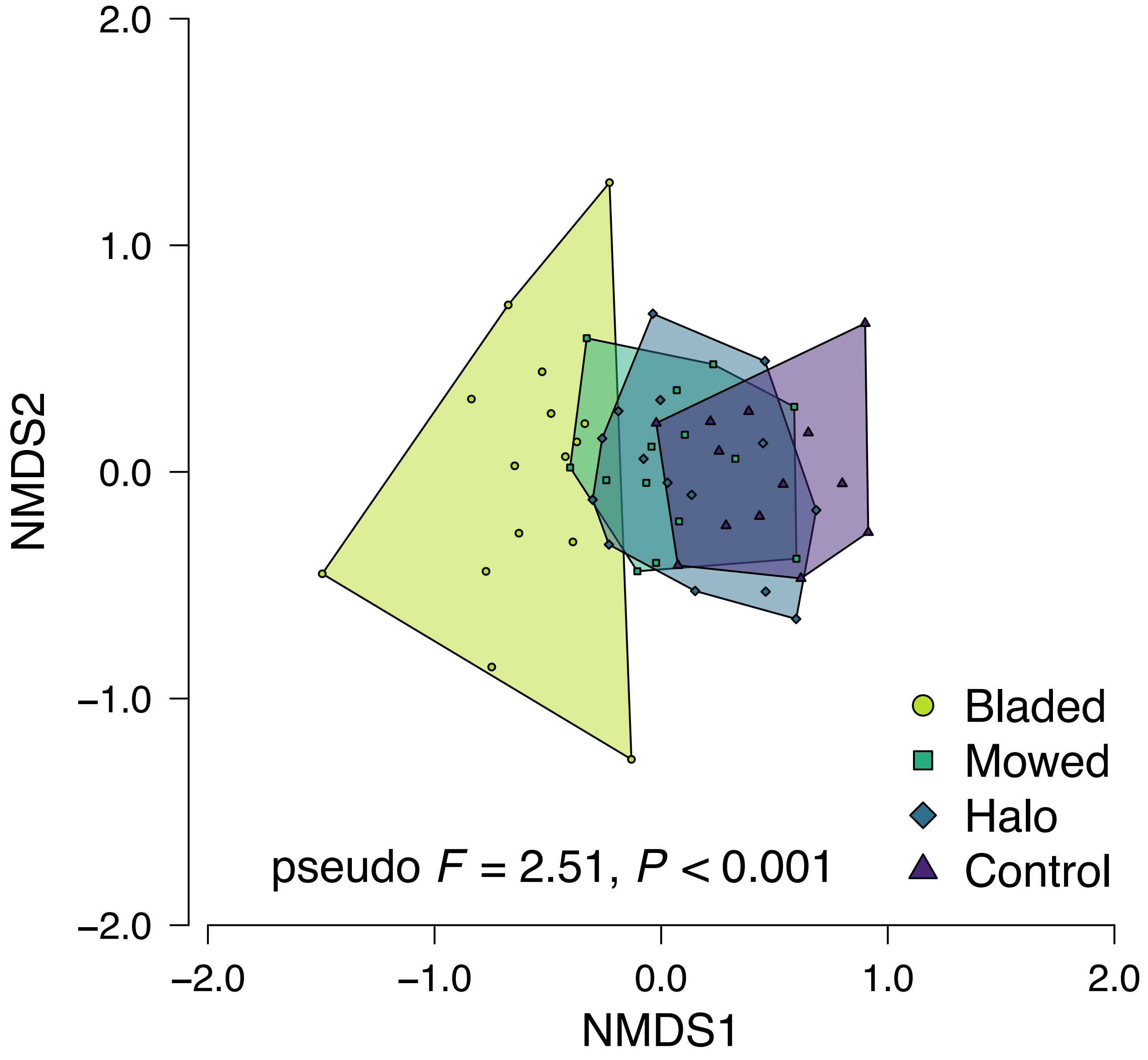
A preliminary report to the National Climate Task Force recommending a ten-year, locally led campaign to conserve and restore the lands and waters upon which we all depend, and that bind us together as Americans.


Google Earth
Image Landsat / Copernicus



Grodsky et al. 2021. Biol. Conserv.

Ant (Formicidae) Community Composition



Grodsky et al. Ecosphere. *Accepted.*


nature sustainability

ARTICLES

https://doi.org/10.1038/s41893-020-0574-x

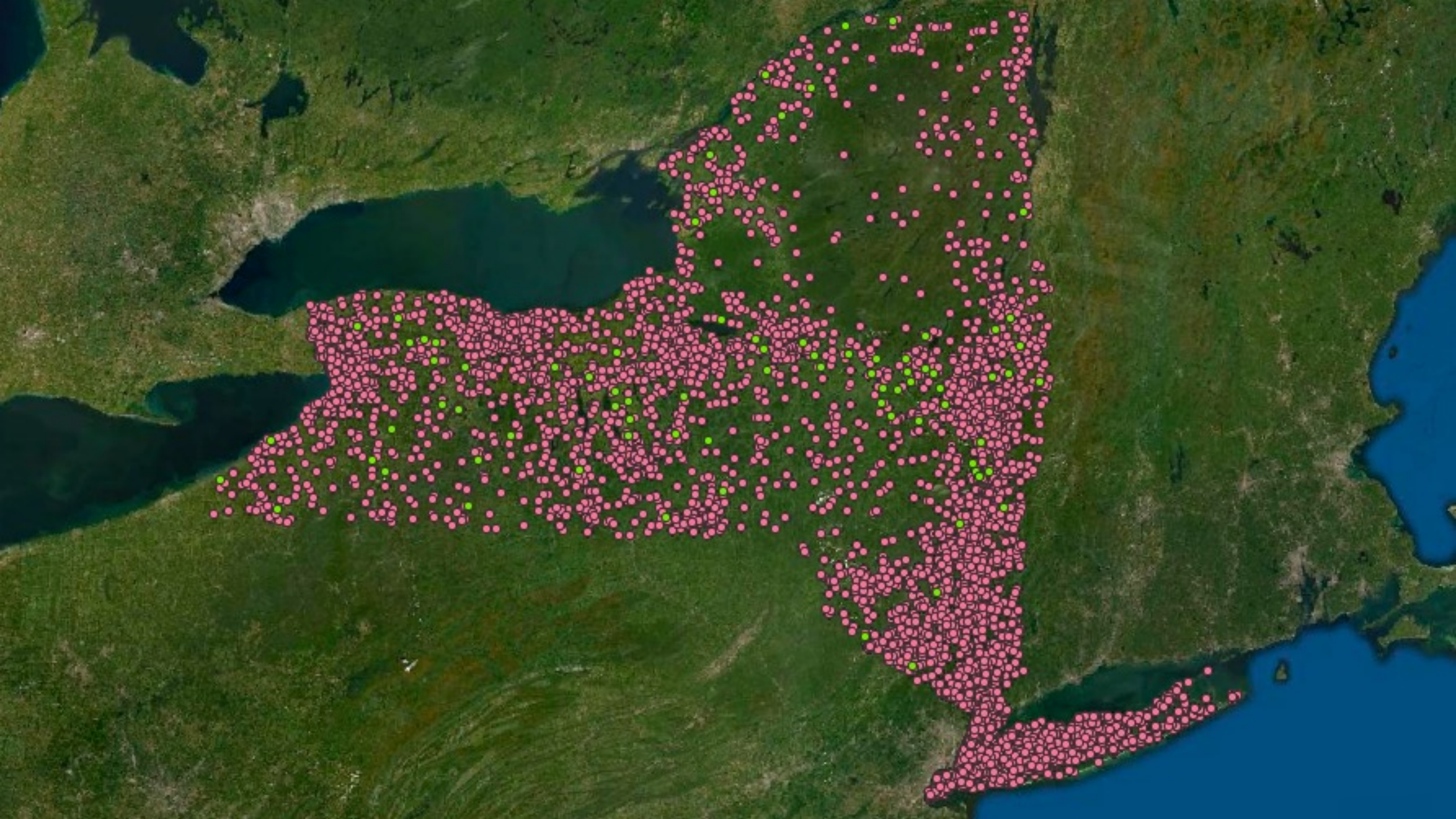
Check for updates

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

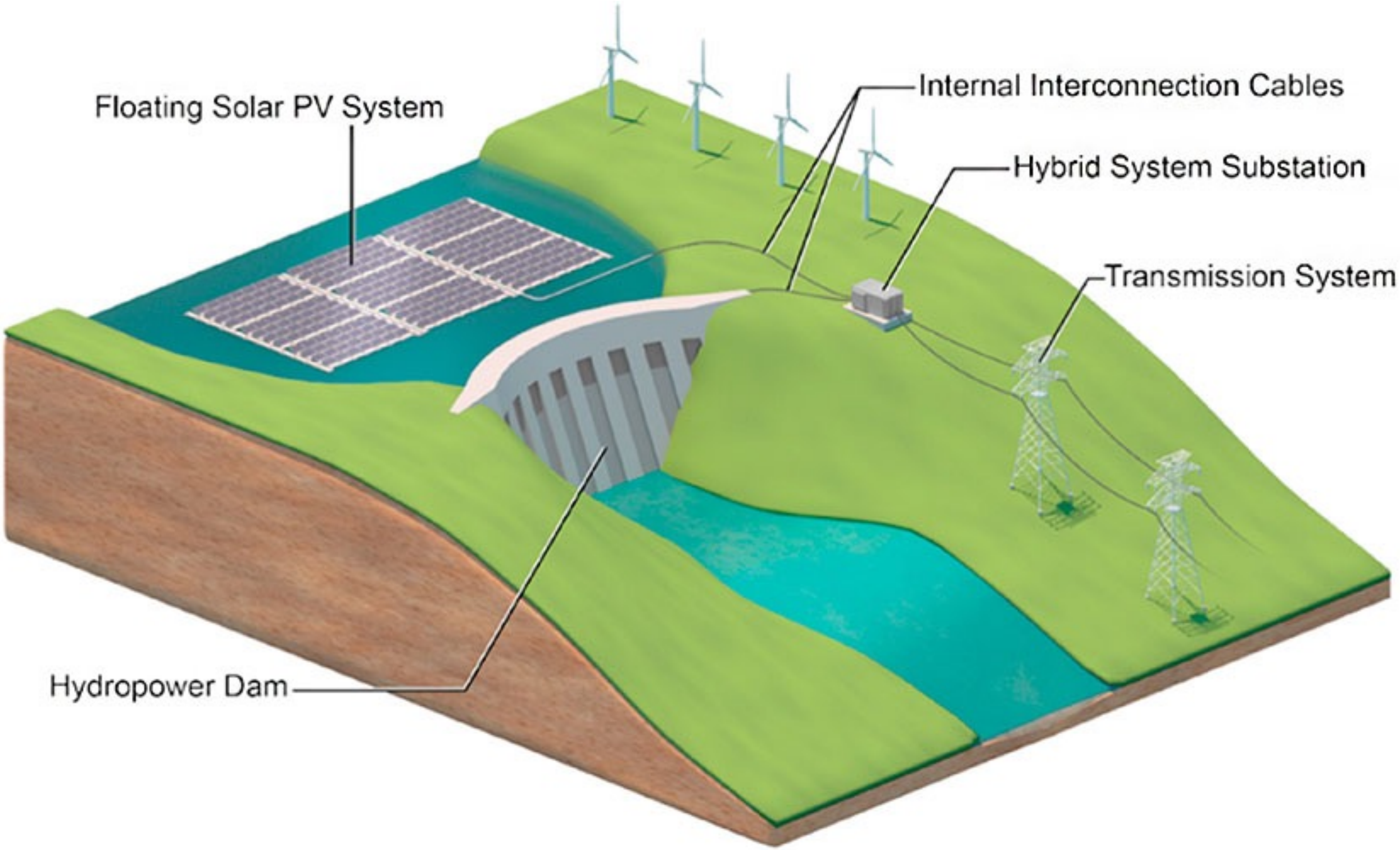
Steven M. Grodsky[1] ✉ and Rebecca R. Hernandez[1,2]

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																			
Coryphantha chlorantha[b]											●	●					2	3, 9, 14, 15	
Cylindropuntia acanthocarpa	●	●	●			●	●		●	●	●	●	●	●		●	12	1, 2, 5-7, 11, 16	
Cylindropuntia echinocarpa	●	●	●			●	●		●	●	●	●	●	●		●	12	1, 2, 5-7,10, 11, 14, 16	
Cylindropuntia ramosissima	●	●	●			●	●		●	●	●	●	●	●		●	12	1, 2, 5-7, 11,13, 16	
Echinocactus polycephalus			●			●				●	●		●			●	6	2, 10, 14	
Echinocereus engelmannii		●				●		●		●	●		●			●	7	3, 5, 6, 10, 12-15	
Ferocactus cylindraceus	●				●		●	●		●	●						7	11	
Opuntia basilaris	●	●	●	●		●	●	●		●	●	●		●		●	12	1-4, 10, 11, 14, 15	
Yucca schidigera	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	15	2, 3, 10, 14	

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





Lee et al. 2020 – *Renewable Energy*

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 Netherlands[1]. Land-scarce nations such as Japan and South Korea might have to devote 5% of their land to solar farms[2].

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

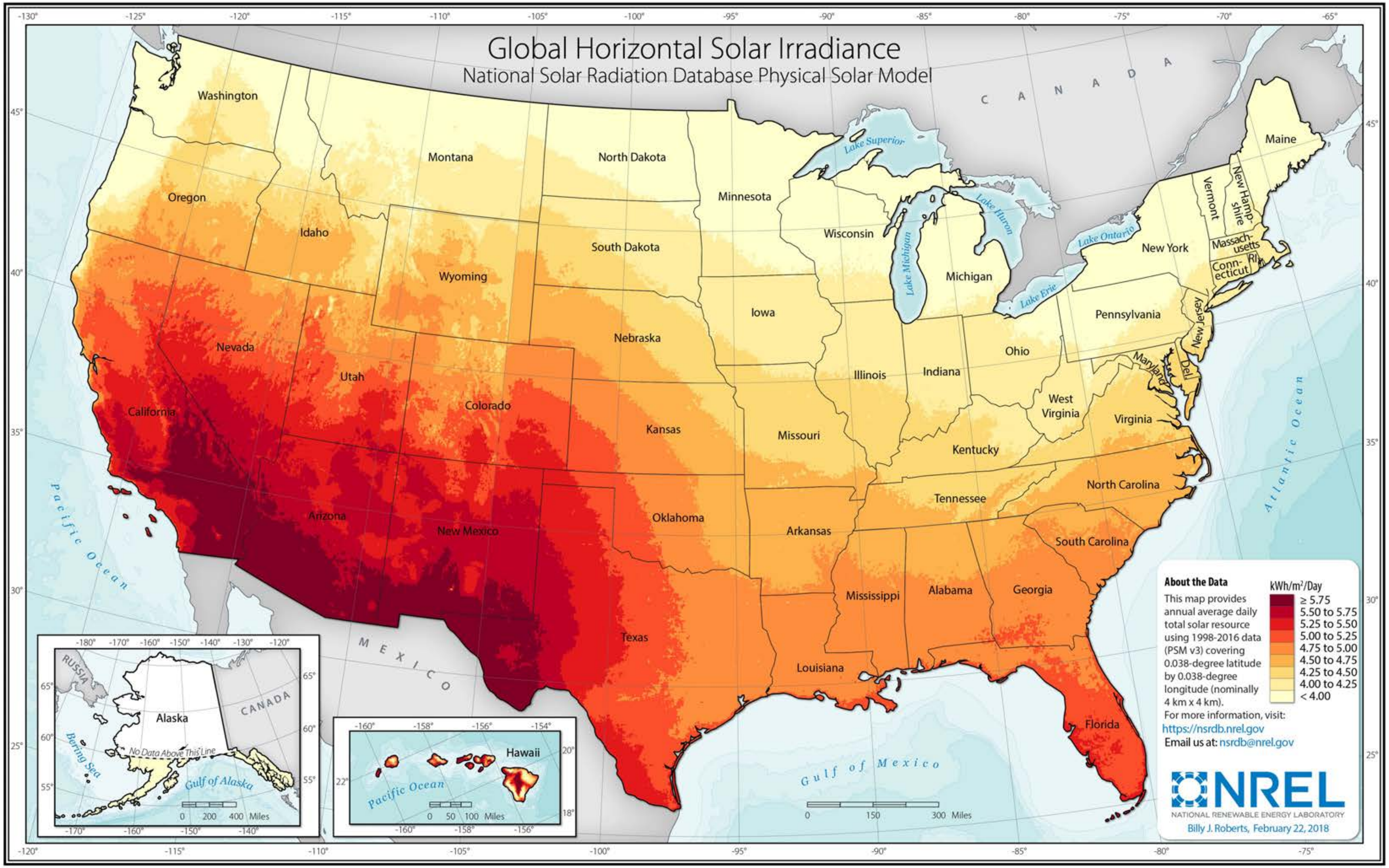
Solar power is space-intensive, requiring at least 20 times more area than conventional fossil-fuel plants to produce one gigawatt (GW) of electricity[3]. Several environments have been proposed as locations for extensive installations, each with pros and cons.

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 more[4]. Solar-energy developments in the Mojave Desert in the US southwest have reduced the cover of cacti that are culturally important to resident Native Americans[5]. 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 production[6]. 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 ones[7]. Arrays shield the surface from the sun and might reduce evaporation, retaining water for hydropower, drinking and irrigation[8]. 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 high[9].

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 plants[10]. 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
kWh/m²/Day
≥ 5.75
5.50 to 5.75
5.25 to 5.50
5.00 to 5.25
4.75 to 5.00
4.50 to 4.75
4.25 to 4.50
4.00 to 4.25
< 4.00
NREL
NATIONAL RENEWABLE ENERGY LABORATORY
Billy J. Roberts, February 22, 2018
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Oregon
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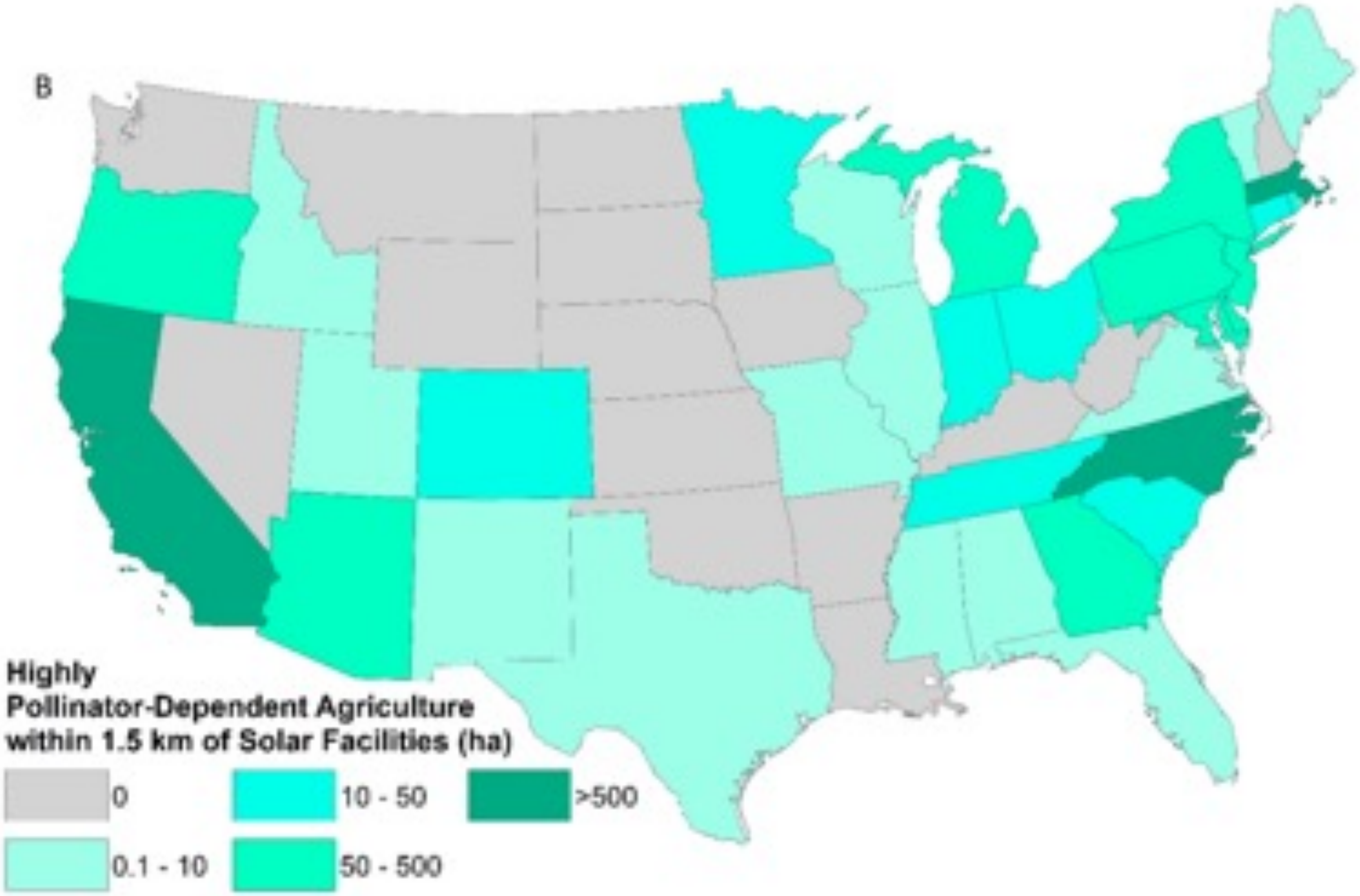
Montana
Wyoming
Utah
Arizona
Colorado
New Mexico
North Dakota
South Dakota
Nebraska
Kansas
Oklahoma
Texas
Minnesota
Iowa
Missouri
Arkansas
Louisiana
Wisconsin
Illinois
Michigan
Indiana
Ohio
Kentucky
Tennessee
Mississippi
Alabama
Georgia
Florida
South Carolina
North Carolina
Virginia
West Virginia
Pennsylvania
New York
Maryland
Del.
New Jersey
Conn-ecticut
RI
Massach-usetts
Vermont
New Hamp-shire
Maine
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
CANADA
MEXICO
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
Alaska
RUSSIA
Bering Sea
Gulf of Alaska
No Data Above This Line
Hawaii
0 150 300 Miles
0 200 400 Miles
0 50 100 Miles



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

National Pollinator-Solar Energy Monitoring and Research Network

Improve, standardize, and validate monitoring methods for pollinators, including indicator species of economic value and threatened and endangered species, at solar facilities

Inform strategies to reduce adverse effects of solar energy development on pollinators while maximizing co-benefits

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

Empirical Information | Best Management Practices | Management Plans | Peer-Reviewed Publications | Online Resources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