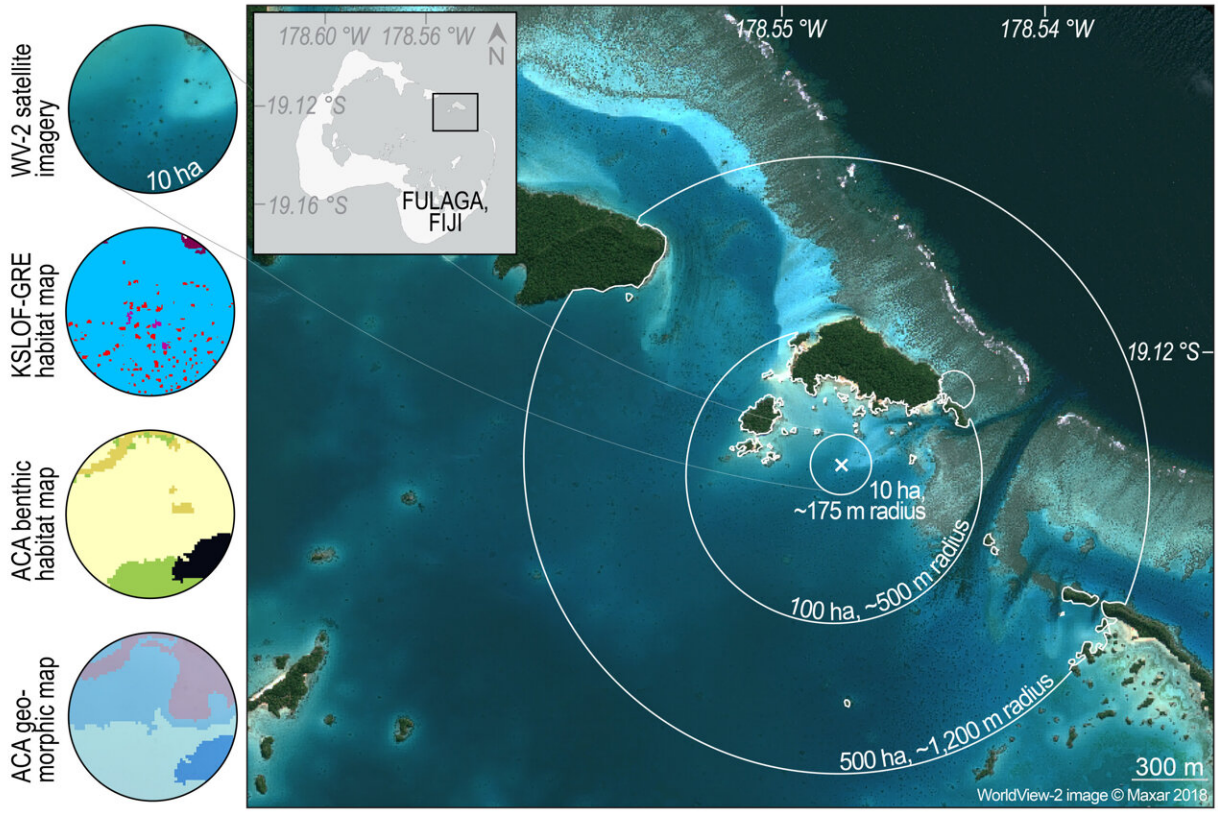
Researchers use satellites to analyze global reef biodiversity

February 10 2024



Generating dynamic habitat windows in the Fulaga Atoll (Fiji). In this example, habitat windows encompassed 10, 100 and 500 ha centered on a dive station (white "x"). These windows were generated using our dynamic window algorithm that detected and morphed around terrestrial habitats. The 10 ha insets on the left portray the satellite imagery and the three satellite map types within that area: the Khaled bin Sultan Living Oceans Foundation Global Reef Expedition ("KSLOF- GRE") habitat maps, and the Allen Coral Atlas ("ACA") benthic and geomorphic maps. Note that the 10 ha window contained no

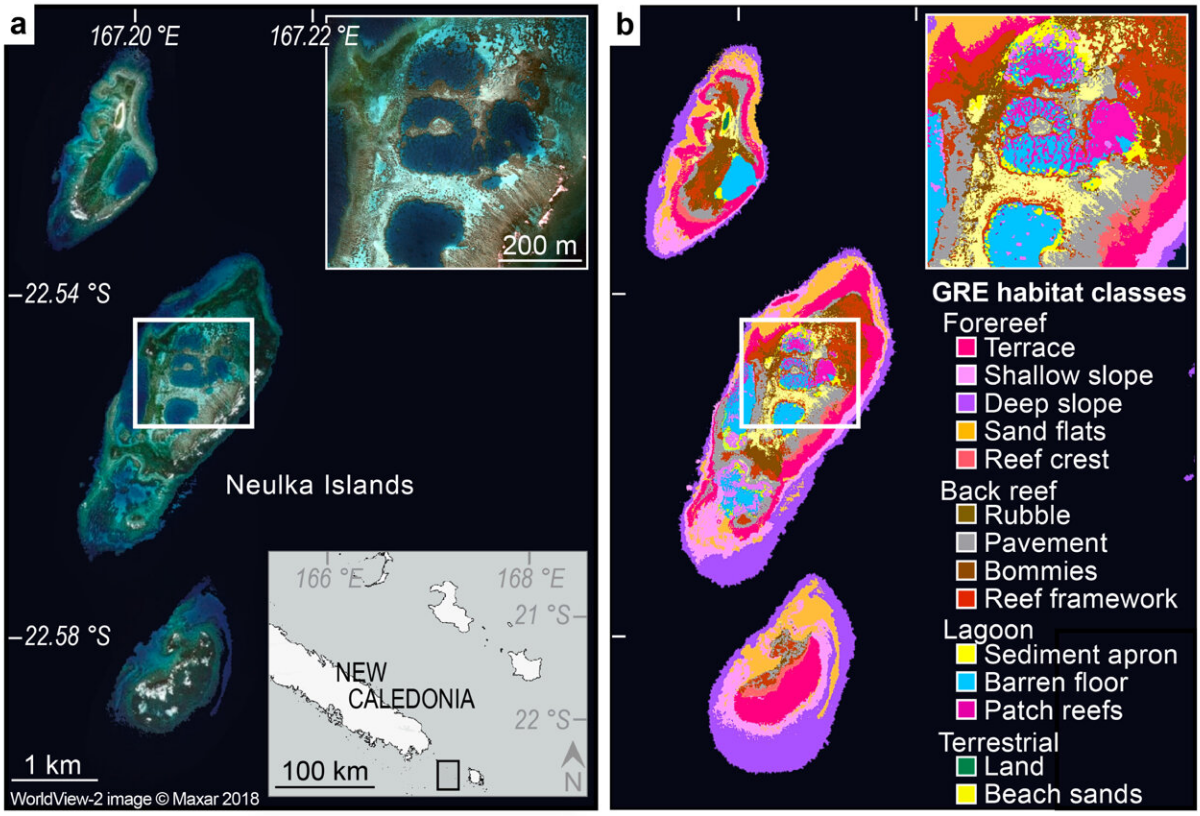
obstacles, and was therefore circular, whereas the 100 and 500 ha windows deviated from circles because they morphed around terrestrial obstacles while maintaining their specified areas. Credit: Bakker, et.al.

Researchers used Earth-orbiting satellites to map coral reef biodiversity at a global scale to show that areas of high habitat diversity also have high species diversity. This new satellite mapping technique can help guide future efforts to identify and protect highly biodiverse reefs, according to the University of Miami Rosenstiel School of Marine, Atmospheric, and Earth Science research team that conducted the study.

"As remote sensing technology becomes more advanced, and we continue to use satellite imagery to map ecological habitats, we must understand the biological and ecological meaning of these products," said Sam Purkis, Professor and Chair of the Department of Marine Geosciences at the Rosenstiel School and the senior author of the study. "We showed that these maps can be used as a proxy for biodiversity, and therefore they can be used to guide ecosystem protection and restoration."

The conventional approach of conducting SCUBA-diver surveys to measure the biodiversity of coral reefs is both time consuming and expensive. Therefore, the research team set out to find a new method utilizing remote sensing to produce habitat maps at a global scale.

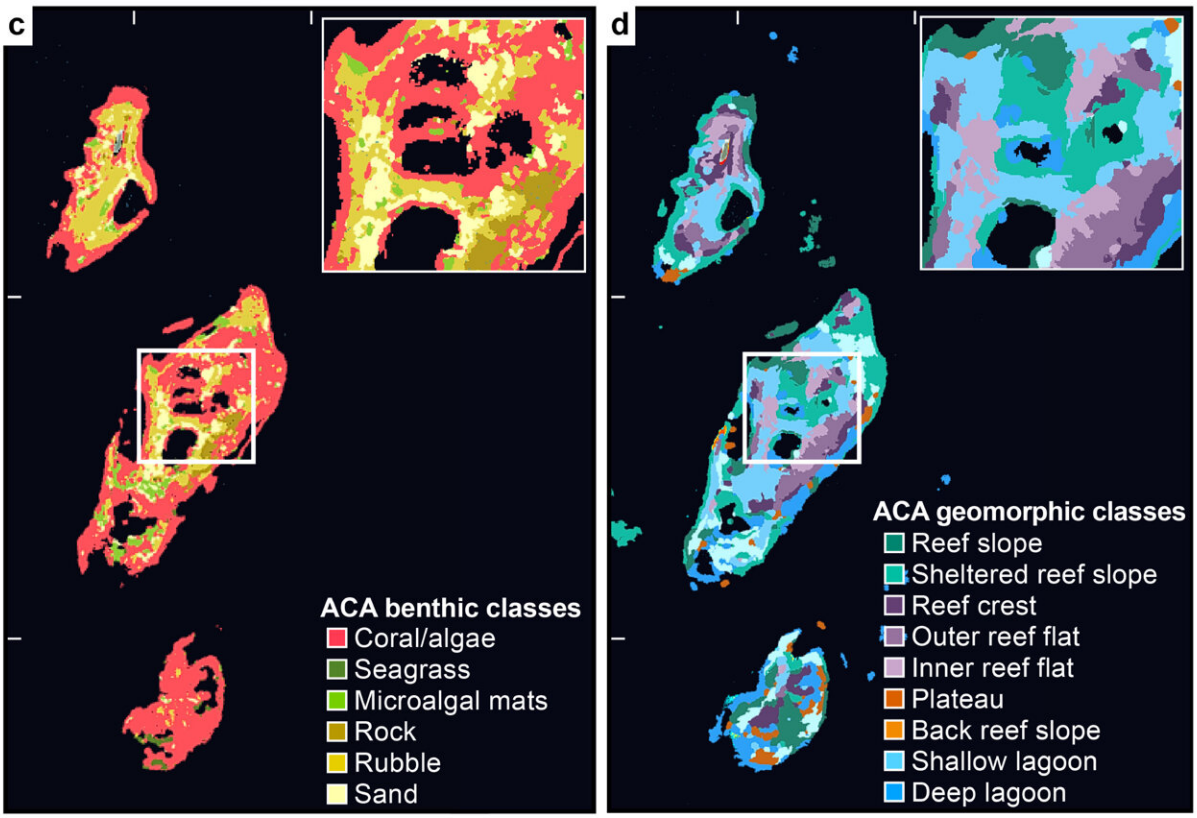
To conduct the study, they extracted the diver-measured diversity of reef fish and of coral species in the global dataset of SCUBA diver surveys from the Khaled bin Sultan Living Oceans Foundation (KSLOF) Global Reef Expedition across the Pacific, Atlantic, and Indian Oceans. KSLOF maps cover approximately one quarter of Earth's shallow-water tropical coral reefs. Purkis serves as the chief scientist for the foundation.



Satellite imagery of the Neulka Islands (New Caledonia), along with the three types of satellite-derived habitat maps considered in our study. (a) True-color image from Maxar WorldView-2. The Khaled bin Sultan Living Oceans Foundation Global Reef Expedition ("GRE") benthic habitat maps for the Neulka Islands at 4×4 m resolution (b) contain 14 of the total 37 Indo-Pacific classes. Credit: Bakker, et.al.

The scientists then used these maps to audit the complexity of the patterning of seabed habitats, which, they showed, to be correlated with the species diversity of the organisms which inhabited them. This relationship held across the Atlantic, Pacific, and Indian Oceans, and, the scientists advocate, can therefore be used as a proxy for reef biodiversity.

"We show how the biodiversity of these ecosystems can instead be retrieved from satellite maps of the seabed," said Anna Bakker, a Ph.D. student in the Rosenstiel School's Department of Marine Geosciences and lead author of the study. "This discovery offers the opportunity of assessing reef biodiversity, at global scale, from orbit."



The Allen Coral Atlas ("ACA") offers two map types at 5×5 m resolution—benthic (c) and geomorphic (d). The full six ACA benthic classes are shown, while nine out of 12 geomorphic classes are present at this site. Credit: Bakker, et.al.

The results from this study can aid in marine spatial planning and the designation of marine protected areas to protect reefs with high

biodiversity, according to the researchers.

The study, titled "Remotely sensed habitat diversity predicts species diversity on coral reefs," was published in the journal *Remote Sensing of Environment*. The study's authors also include: Arthur Gleason from the University of Miami's Department of Physics, Alexandra Dempsey from the Khaled bin Sultan Living Oceans Foundation, and Helen Fox and Rebecca Green from the Coral Reef Alliance.

More information: Anna C. Bakker et al, Remotely sensed habitat diversity predicts species diversity on coral reefs, *Remote Sensing of Environment* (2024). DOI: 10.1016/j.rse.2024.113990

Provided by Rosenstiel School of Marine, Atmospheric, and Earth Science