In southwestern Madagascar, Indigenous communities have long employed inventive methods to safeguard their food resources. (Garth Cripps)

Science & Technology

# What Madagascar Fishing Communities Can Teach Us about Climate Survival

Indigenous groups of the island nation have survived centuries of environmental tumult. What is their secret? And could it be useful in times of global warming? Columbia researchers aim to find out.

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**Beneath a roof festooned with bunting,** schoolchildren watched saucer-eyed as three young men performed acrobatic dance moves inspired by martial arts. Older women wrapped in brightly colored skirts clustered in the back of the wooden pavilion. The crowd clapped along with the music, enthralled by the display.

Onlookers would be forgiven for thinking that this gathering in the remote fishing village of Andavadoaka, Madagascar, was a village custom or tribal ceremony passed down through the ages. But in fact this was something entirely new: a community workshop organized by Columbia social scientists hoping to bond with the Malagasy people whose culture they are studying.

The event, which took place this past summer, would prove unexpectedly fruitful. As the crowd watched and sometimes joined in with the dance, the performers' sweeping arm and leg movements reawakened their long-dormant memories of

traditional dance ceremonies witnessed decades earlier. Speaking later to lead researcher Kristina Douglass, an associate professor at Columbia Climate School, the village elders described their memories in detail. They recalled how, after attending similar ceremonies in their youth, they climbed into outrigger canoes called *lakanas* and sailed among the surrounding coral reefs, seagrass beds, and mangroves, fishing for octopus, grouper, snapper, lobster, and finfish. One man described how they obeyed rules meant to ensure they did not overfish one of their favorite sources of food, the octopus. For example, if no octopuses were spotted in the water, they would resist the temptation to break apart their coral dens to retrieve them. Better to go hungry once, the elder said, than jeopardize the livelihoods of future generations. “He said that people back then were so respectful of the sea creatures, they thought of them almost as relatives,” says Douglass, an archaeologist and climate scientist who studies how people have interacted with the natural environment throughout history.



Kristina Douglass (left) and local historian Manantsoa Kely in Madagascar’s Mikea Forest. (Garth Cripps)

Today, fishing practices in Madagascar, a Texas-sized island nation off the coast of East Africa, have evolved with the arrival of industrial fishing fleets and mining interests and the growth of its population. Fishermen and fisherwomen are routinely smashing open octopuses' dens. This causes significant damage to coral reefs — which are also being ravaged by global warming — threatening not only the sustainability of octopus populations but the villagers' long-term subsistence.

After her conversation with the elders, Douglass wondered: might it be possible to resurrect the old rules and instill them in a younger generation? Perhaps, if combined with new government policies to protect the reefs, the readoption of traditional practices could help the octopus populations recover. Douglass, who uses they/them or she/her pronouns, made a mental note to discuss the idea further with the villagers.

That joyful gathering and the insights it inspired encapsulate much of what is unique about the Morombe Archaeological Project (MAP), which Douglass has led since 2011. Based in the Velondriake marine protected area, a region containing thirty-five Indigenous fishing, farming, foraging, and herding communities along Madagascar's southwestern coast, the initiative studies the history of the Malagasy people's stewardship practices for clues about how the communities might yet again adapt to a rapidly changing environment. Often this research involves collecting and analyzing archaeological, paleoclimatic, and biological data — to determine, say, how ancient people's food-harvesting practices shifted in accordance with changing climatic conditions and the abundance or dearth of particular fish, animal, or plant species. But Douglass and their colleagues are also collecting oral histories to record the Malagasy people's own knowledge of traditional sustainability practices, many of which have never been formally documented. And all of this work is done in close partnership with the Malagasy people in accordance with the principles of "coproduction," an emerging model of fieldwork that holds that the subjects of scientific research ought to have a voice in how it is conducted and ought ultimately to benefit from it.

Douglass, who is widely recognized as a pioneer of archaeological coproduction, involves Malagasy people in decisions about nearly every aspect of MAP's work — from the framing of research questions and methodology to the way the team's findings are publicly disseminated. The Columbia project today employs fifteen full-time Malagasy research associates, some of whom have had limited schooling but who possess unparalleled knowledge of local history and food-production practices.

In addition, community elders representing five ancestral clans in Velondriake sit on a MAP board of advisers. “Real knowledge coproduction requires that there be equal power within a team and that everybody involved have agency in shaping the direction of the work,” says Douglass. “What it looks like is hugely diverse. It doesn’t look the way we expect science to look.”

In the Malagasy language, “Velondriake” means “to live with the sea,” and the people in this region have long survived on what they catch, grow, hunt, and gather. Their lives have never been easy, as the region’s climate is notoriously unpredictable; the summer wet season may bring four inches of rain or five feet. But over thousands of years, the people of Velondriake have developed successful adaptations, including a seminomadic lifestyle that enables them to respond to the pull of a booming fishing ground or the push of a poor tuber harvest. As Douglass noted in a 2021 paper, the intergenerational transfer of group knowledge, mainly through a form of storytelling called *tapasiry* (which loosely translates as “tales of proper conduct”), enabled local inhabitants to coax abundance out of landscapes that outsiders regarded as barren.



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However, numerous global forces, from industrial fishing trawlers to anthropogenic climate change, have begun to erode those adaptive advantages. Massive foreign fishing vessels, many from Asia seeking tuna and shrimp, are sweeping up countless other marine species in their huge nets and straining Madagascar's fisheries. The country's valuable stock of sea cucumbers, a delicacy that China ravenously imports, has collapsed. Meanwhile, global warming, in addition to devastating the nation's coral reefs, is intensifying tropical cyclones and making semiarid landscapes even drier and less fertile. "People are under tremendous pressure," says Douglass. "There's a lot of hunger."

Globalization is also disrupting the transmission of ancestral knowledge. Younger villagers, drawn to social media and the temptations of TikTok videos, are often deaf to the stories of their grandparents. This has prompted widespread concern that sustainability practices that once proved critical in coping with environmental shocks may soon disappear forever. At the request of village elders, Douglass and their colleagues are developing educational materials to teach local youths about their own community's history and foraging traditions. Leading that effort is François Lahiniriko, who was born in Andavadoaka and now serves as a MAP assistant coordinator and a field-team manager. Before he met Douglass as a college student and joined one of their archaeological digs in 2012, Lahiniriko hadn't deeply considered his homeland's history. Now he is enamored with the way archaeology enlivens his surroundings — for instance, by unlocking the subtle stories in his country's ubiquitous pottery — and is determined to share his sense of wonder with others. "Ceramic analysis is a particular thing that I love," he says. "Each decoration can tell where that object comes from."

Douglass's perspective on the issues of inclusivity and coproduction was shaped by their own upbringing. Born in the West African nation of Togo, they were adopted by an American man and a Dutch-Indonesian woman who worked in international health and development. Douglass spent much of their childhood in Madagascar, surrounded by Western expats who, Douglass said, would often pontificate about how the island's once "pristine" environment had been destroyed by human activity. In this telling, the destructive people were always the Malagasy — Black people who needed to be taught how to protect their environment, despite having survived here long before Europeans colonized it. "You see it all over the colonial and postcolonial world, similar narratives about what local and Indigenous communities do to the environment," says Douglass, who would go on to earn a bachelor's degree in

classical archaeology at Dartmouth and a PhD in anthropology at Yale. “So that bitter seed was planted pretty early.”



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While at Yale, Douglass was inspired to return to Madagascar and undertake an in-depth investigation of the island’s ecological history. Specifically, Douglass sought to determine if any archaeological evidence existed to support the popular idea that Madagascar’s first human inhabitants had wiped out Madagascar’s fabulous bygone megafauna — including pygmy hippopotamuses, giant elephant birds, and man-sized lemurs — shortly after having arrived from East Africa and Indonesia, ostensibly some 1,500 years ago. But Douglass didn’t uncover any piles of ancient bones indicative of mass-butchering sites. That pushed the young archaeologist to launch MAP and to expand the search, but a more exhaustive survey found only limited evidence of megafauna consumption — nothing to suggest overhunting. “I thought, well, this is really interesting. Let’s then focus on what everyday life was like here,” says Douglass.

Douglass and colleagues went on to publish a series of studies, based on animal-fossil remains stretching back 1,400 years, that revealed that Malagasy communities developed creative means of managing natural resources — migrating frequently,

diversifying their diets, and cooperating with neighboring clans to preserve fauna and flora. “It’s very counter to this notion of the tragedy of the commons: that wherever people are, they will be blanket consumers of everything that exists,” says Douglass.

In 2019, Douglass conducted a systematic review of radiocarbon dates from all archaeological materials ever collected in Madagascar, finding compelling evidence that humans first arrived on the island not 1,500 but rather 11,000 years ago. Additional research is still needed to determine if those initial settlers put down permanent roots and are the ancestors of today’s inhabitants, but Douglass’s findings raise the possibility that ancient Malagasy people coexisted with megafauna like pygmy hippopotamuses for thousands of years before the creatures died out. “It’s conceivable that a wave of extinctions that occurred between 1,500 and 1,000 years ago resulted from the emergence of global trade networks and the arrival of newer settlers who brought more modern agricultural methods, which were ecologically disruptive,” says Douglass.



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Columbia University took notice of Douglass's research and in 2022 appointed them an associate professor of climate, the first faculty hire for the new Columbia Climate School. Douglass now runs MAP out of the Olo Be Taloha Lab at Columbia's Lamont-Doherty Earth Observatory in Palisades, New York. (Olo Be Taloha means "elders of the past" in Malagasy.) Douglass says they were drawn to the climate school because of its emphasis on finding real-world solutions to climate threats and promoting social and racial justice.

Today, MAP includes more than thirty-five research projects aimed at understanding Madagascar's settlement history and how human activity has been shaped by, and has in turn shaped, the natural environment. Some efforts are aimed at understanding how ancient Malagasy people managed specific resources, like elephant birds, whose populations they appear to have valued and protected for their eggs, as well as some 250 fish species. The MAP team is also devising innovative ways to prompt elders' recollections of past stewardship practices. For example, Douglass and their colleagues are teaching Malagasy elders to scuba dive in order to help them recall details of traditional fishing techniques. The researchers have also shot drone footage of remote landscapes where elders once worked and shown them the footage using virtual-reality headsets. "This experimental oral-

history work is designed to use sensorial experiences to trigger memories," says Douglass.

Douglass's team is now undertaking one of its most ambitious projects to date: a survey of current land-use and food-production practices in dozens of villages throughout southwestern Madagascar. The researchers hope to learn what local community members consider the most sustainable fishing, farming, and herding practices and then relay the findings to government agencies and NGOs that oversee conservation efforts there. Douglass says there is reason to suspect that environmental regulations that have been instituted in some parts of Madagascar are ineffective, and possibly even harmful, because they inadvertently constrain Indigenous people's traditional practices. For example, government regulators have banned or strictly limited human activity in some parts of the country. Douglass says that while this modern conservation strategy makes sense in certain settings, it may not be suitable for places where Indigenous people have a long history of successfully managing and protecting the natural environment. "The movements of Malagasy communities in and out of particular grasslands, woodlands, and coastal regions are integral to how these ecosystems have evolved to function, and so restricting people's mobility may be detrimental both to them and to the ecosystems," Douglass says.

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Ultimately, the Columbia team's research could have implications far beyond Madagascar. The researchers recently started similar studies in Nigeria and other sub-Saharan African nations, and they hope to eventually build a global network of subsistence communities to promote knowledge exchange. "We want to help these communities share their most successful sustainability strategies, as well as insights about how to effectively convey the importance of their traditional practices to institutional decision-makers at all levels, from the UN to local government bodies," Douglass says. "Indigenous people have deep knowledge about adaptations that have worked for them in the past, and their voices should be heard."

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