



A NATION DIVIDED

Some scientists see Nicaragua's plans for a Grand Canal as a boon for an ailing land; others predict ecological catastrophe

By **Lizzie Wade**, in Managua

When the Nicaraguan government vowed in 2012 to revive a long-dormant idea to carve a canal through the heart of the country, Jorge Huete-Pérez expected a national debate on the project's merits. More than three times as long and twice as deep as

the recently enlarged Panama Canal, the \$40 billion Grand Canal linking the Atlantic and Pacific oceans would be the largest civil earthmoving project in history, with a social and environmental footprint to match. But in June 2013, when Nicaragua's government asked its National Assembly to grant a 50-year concession for the canal to the Chinese firm Hong Kong Nicaragua Ca-

nal Development (HKND) Group, approval took just 2 days.

Now, after the release of a massive impact assessment of the project commissioned by HKND, and just months before the company says it will break ground, the debate has begun in earnest. Huete-Pérez, a molecular biologist at Central American University (UCA) here, is firmly on one side. The canal, he

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Lake Nicaragua, Central America's largest source of freshwater, is a flashpoint in plans for an interoceanic canal.

of biologists, some take a sunnier view. Deforestation and pollution are already ravaging Nicaragua's environment, they note, and they applaud HKND's plans to replant forests near the canal to halt erosion and control runoff. They also view the project as a possible boon to science: a chance to collect a windfall of environmental data through HKND-funded studies in a country too impoverished to support much fieldwork. "We should provide help and support, so that the [impact] study is as complete as possible and the canal's impact on the environment is as minor as possible," says Ricardo Rueda, a botanist at the National Autonomous University of Nicaragua (UNAN), León.

The scientific debate is unlikely to dissuade President Daniel Ortega's Sandinista government from pursuing a megaproject that it claims is vital to the nation's future. Nicaragua is the second poorest country in the Americas, after Haiti, and "we don't have many development opportunities," says Manuel Coronel Kautz, president of the Nicaraguan canal authority.

Nicaragua stands to gain a 1% stake in the canal each year, which means that after a half-century of operation it will have accumulated a controlling stake. In the meantime, the canal law states that HKND will pay the Nicaraguan government up to \$10 million a year

for 10 years. "We want to transform the economic lives of Nicaraguans—that's what makes us revolutionaries," says Coronel, a long-time Sandinista. "And there is no other option that makes as big of an impact."

Far from posing a further threat to Nicaragua's dwindling forests and wetlands, asserts engineer Bill Wild, HKND's chief project adviser, the canal will benefit conservation by bringing economic development. "I personally believe that the only thing that will save Nicaragua's environment is the canal," Wild says. "There is nothing else."

FOUR CENTURIES AGO, Spain dreamt of what Nicaragua is bent on doing today. Tired of schlepping gold and silver across Panama on foot and by mule from mines in western South America to ships in the Atlantic, the empire began eyeing Nicaragua as an alternative route. Although wider than both Costa Rica and Panama, Nicaragua offered a hydrological advantage. The navigable San Juan River allowed large ships to sail

from the Atlantic 200 kilometers inland to Lake Nicaragua. Crossing the lake's roughly 100-kilometer span left a mere 20 kilometers to the Pacific coast. But when an engineer surveyed the potential canal route, he found that ships would need to be raised and lowered more than 30 meters as they traversed the Nicaraguan terrain: too great an elevation to overcome with 17th century technology. Other countries thought to pick up where Spain left off, but time and again their plans fell through.

Hoping to succeed where empires stumbled is HKND's founder, a Chinese magnate named Wang Jing. His plans, too, face skepticism because of the project's costs and scale. "Practically every week there's a reason to believe the canal is going to happen and another reason to believe it won't," says Edmundo Jarquín, an opposition politician here. HKND says it plans to finance the project by attracting investors on the open market. But he says that "if the canal is built, it won't be for financial reasons." Instead, Jarquín says, it would be part of a larger "geopolitical vision" backed by the Chinese government. If Beijing doesn't step up to fund the canal's construction, the project could

collapse, says R. Evan Ellis, an expert on Chinese-Latin American relations at the U.S. Army War College Strategic Studies Institute in Carlisle, Pennsylvania. An economic feasibility study HKND commissioned has not been made public.

Since securing the preliminary concession, HKND has been investigating possible canal routes, including the one Spain considered. After determining that commandeering the San Juan River would be too destructive—and would surely anger Costa Rica, which shares the river as a border—HKND settled on a route running from Brito through Lake Nicaragua to the mouth of the Punta Gorda River (see map, p. 222).

Although Lake Nicaragua was once considered a boon to a canal, it now presents a daunting engineering challenge. The lake's average depth—13 meters—is far too shallow for supertankers and cargo ships. To create the necessary 30-meter-deep channel, HKND must carve 17 meters into the lakebed. ERM estimates that would require removing 715 million cubic meters of sediment: "the largest wet excavation ever," Vammen says.

She worries about what it might stir up. In the single sediment core from Lake Nicaragua analyzed for the impact study,

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Jorge Huete-Pérez, Central American University

says, "is going to be an environmental disaster of enormous dimensions."

Huete-Pérez had already published editorials in *Nature* and *Science* (23 January 2015, p. 355) decrying the project's downsides, including the possible salinization of Lake Nicaragua—Central America's largest source of freshwater—and the forced relocation of indigenous communities in the eastern part of the country. He views the 11,000-page impact assessment, conducted by Environmental Resources Management (ERM), a consulting firm headquartered in London, as inadequate. Many others expressed similar qualms at a meeting of Nicaraguan and international scientists that Huete-Pérez organized in November 2015 to review the assessment. "It's irresponsible" to commit to building the canal with so little data, says Katherine Vammen, a water expert at UCA. "There are just too many left-open doubts."

But among Nicaragua's small community

ERM found relatively high concentrations of heavy metals and other pollutants, including mercury, arsenic, and pesticides, possibly from rice paddies along the lake's eastern shore. Dredging could release the contaminants into the water, making it unsafe to drink or use for irrigation. Lake sediments also likely contain nutrients such as phosphorus and nitrogen; stirring those up could fuel algae blooms, poison fish, and destabilize the ecosystem.

The channel itself could transform the lake, if saltwater were to leak through the locks that will raise and lower ships. Not only would such an intrusion make the water undrinkable, it could bring invasive marine species and harm the plankton and invertebrates that form the base of the lake's food web. "The lake is a place where so much could be lost," says panelist Gerald Urquhart, a tropical ecologist at Michigan State University in East Lansing.

Others raise a direr scenario. "There is

a serious risk of [volcanic] eruptions" near Lake Nicaragua, says Sergio Espinosa, a Nicaraguan geoscientist based in Vancouver, Canada, who consults on seismic risks and participated in the academy panel. "Eruptions cause landslides, and landslides cause lake tsunamis." If a catastrophe destroyed the locks, Lake Nicaragua might drain down the channel to the Pacific. How HKND and the government plan for such low-probability but high-risk events could "make or break the canal," says panelist Julio Miranda, a Nicaraguan structural engineer with CH2M HILL in San Jose, California.

Over the long term, the canal's ecological toll would run coast to coast. The canal could dump sediment into both oceans, harming coral reefs, says Jorge Cortés Núñez, a marine biologist at the University of Costa Rica, San José. And the planned route would sever the Mesoamerican Biological Corridor, a string of protected areas and buffer zones from southern Mexico to

Panama intended to safeguard habitat for jaguars and other large mammals.

Although HKND has not started digging, the mere prospect of the Grand Canal has ignited social unrest in Nicaragua. The canal will run through indigenous lands, and the last village where the Rama language is spoken will have to be relocated to make room for it, according to ERM's report. And the concession law gives HKND the right to expropriate land anywhere in Nicaragua, not just along the canal route. "We're on a state of alert," says Manuel Abines Jiménez, a community leader from the town of Jicaró who attended the academy panel and has protested against the canal. "We won't go easily."

According to Urquhart, who does fieldwork in Nicaragua's rural east, other farmers are already fleeing to avoid the prospect of being violently relocated to less desirable land. He says some have moved into the Indio Maíz Biological Reserve, the largest continuous area of rainforest north of the Amazon. The government has claimed that the canal would keep people out of Indio Maíz by serving as a barrier on its northern border.

In its impact study, ERM "rightly described the social and environmental issues as serious," Urquhart says. However, he says, the report's "great optimism that these impacts can be mitigated" is not matched by a mitigation strategy. Other scientists say the assessment is based on too little data. For example, Vammen says, little is known about Lake Nicaragua's bathymetry and the composition of its sediments, leaving a major question mark about the safety and feasibility of dredging. "Those are really essential things you need to know if you're going to build a canal," she says.

Nor did the report fully weigh the risks of a catastrophic failure, Miranda says. The study used Chinese building codes to evaluate the canal's safety, he says, rather than develop new standards that would ensure the "one-of-a-kind project" remains "operational before, during, and after a quake."

Huete-Pérez argues that ERM's impact study, paid for by HKND, is tainted and has called on the government to fund a new study—ideally one that would evaluate the canal against other possible development projects. But Wild defends the report, noting that ERM was paid in advance: "They wrote whatever report they wanted with us not owing them a cent," he says. In the meantime, the academy panel has recommended that construction be put on hold while independent scientists fill gaps in ERM's report. Nicaragua, the panel contends, needs more data and analyses to accurately weigh the canal's risks and benefits.

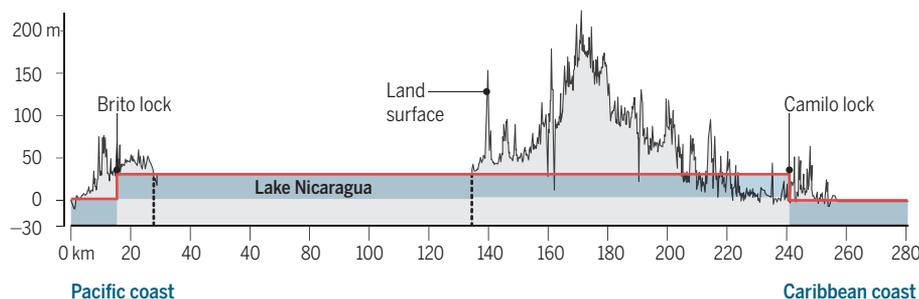
"We do share the scientists' frustration with the lack of data in some critical areas,"

The biggest dig

World powers have long dreamed of carving a shipping canal through Nicaragua. Critics assail HKND's preferred route, which would bisect Central America's largest lake.



Profile of the canal





Canal opponents fear the project will wreak havoc on Nicaragua's environment and lead to forced relocations of farmers and indigenous communities.

says ERM partner David Blaha, who led the impact study. ERM's report lists nine studies, including a complete bathymetric survey of Lake Nicaragua and a study of seismic risks, that should be carried out before construction begins. Such studies should be done after HKND completes its final design, says the canal authority's Coronel. For example, he says, "it's not until the lock designs are finished that we can analyze the specific geology of the exact place where [they are] going to be." Wild anticipates the canal's final design will be completed around the end of this year. Well before then, he says, the company plans to break ground on the Pacific port.

JEFFREY MCCRARY used to share Huete-Pérez's feelings about the canal. When ERM asked McCrary to survey freshwater fish species along the canal route as part of the impact study, the biologist, who has lived in Nicaragua for 3 decades and now works for the Nicaraguan Foundation for Integral Community Development here, remembers thinking, "I'm going to give you the best reasons not to do the canal." But as he traveled around the eastern portion of the country, he was struck by the lawlessness and environmental destruction he saw. Slash-and-burn agriculture and cattle ranching had devastated the Punta Gorda watershed and was threatening the Indio Maíz reserve, he says. "This is a really

doomed place," he recalls thinking. Now, he wonders, "what in the world are we going to do if we don't get a canal?"

For McCrary and other converts, the Grand Canal's main selling point is reforestation. "Between 2002 and 2012, half of [Nicaragua's] forest cover was lost," heightening erosion and runoff, says Norving Torres, director of the Friends of the Upper San Juan River Foundation here. "The amount of clearing is

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Bill Wild, HKND

a disaster for water management," Wild adds. If HKND doesn't put a stop to the erosion, he says, "we're going to be dredging all that stuff [out of the canal] forever." As a result, the company plans to reforest the Punta Gorda River catchment, an area covering roughly 20,000 hectares.

Wild says HKND has tweaked the canal's route in response to ERM's concerns. The original location for the Pacific port, he says, would have "completely wiped out" a mangrove lagoon and destroyed the mouth of the Brito River. "So we moved it," Wild says. The firm also moved the Atlantic port to skirt

Indio Maíz. And it shifted where the canal would connect to the eastern shore of Lake Nicaragua to avoid El Tule, a town that has been roiled by protests against relocation. "We've made a lot of changes," Wild says. "We will react positively wherever we can to honest and objective criticism."

McCrary, for one, is ready to work on HKND's terms. "I guess my strategic tack is, if there's going to be a canal in Nicaragua, I want to be sure it gets done right," he says. He's "disappointed" that Huete-Pérez and other canal opponents have shut themselves out of that conversation by adopting a confrontational stance, he says. Rueda, the UNAN botanist, agrees. Nicaraguan scientists, he says, should be "looking for ways to help so that more and more is known" about the country's natural resources and the best ways to protect them during canal construction.

Driving along the shore of Lake Nicaragua, Vammen points out drainage ditches that funnel raw sewage from the city of Granada into the lake. "No one ever said the whole area was pristine," she says. But Vammen and like-minded scientists reject the idea of anointing the canal as Nicaragua's savior. And Huete-Pérez bristles at the suggestion that cooperation is the only path forward. "It's always easier to take the side of the powerful," he says. "It requires more courage to align yourself with the powerless." ■