

Limnologists Warn of Impacts of an Interoceanic Canal Across Lake Nicaragua

China's Hong Kong Nicaragua Canal Development Investment Company (HKND) recently began construction of a canal linking the Pacific and Atlantic oceans through Nicaragua. The "Interoceanic Canal" route will include a 105-km swath across Lake Nicaragua, also known as Lake Cocibolca (see map). The approximately 500-m-wide and 30-m-deep channel will require the removal of around 1.2 billion tons of sediment from the lake bottom.



In November 2014, the Academy of Sciences of Nicaragua invited the InterAmerican Network of Academies of Science (IANAS) and the International Council for Science - Regional Office for Latin American and the Caribbean (ICSU-LAC) to co-sponsor a workshop to identify the potential environmental and social impacts of the canal (www.cienciasdenicaragua.org). The workshop participants concluded that the channel through the lake would severely affect the ecology of the system mainly due to sediment resuspension and disposal during the construction phase, as well as from navigation through the lake. Resuspension will add nutrients and contaminants in this shallow (mean depth 13.2 m) and naturally polymictic lake, leading to an increased risk in of eutrophication, hypoxia, and degraded fisheries.

Lake Nicaragua has the second largest surface area of tropical lakes in the Americas and is presently an important source of drinking water and subsistence fisheries, as well as a hotspot of cultural and biological diversity (Huete-Pérez, et al. 2013, Meyer and Huete-Perez 2014). Currently, Lake Nicaragua has good water quality, and it is borderline mesotrophic-eutrophic according to chlorophyll and phosphorus levels (CIRA/UNAN, 2014). The lake also has oxygen concentrations that are near saturation throughout the water column (Vammen et al. 2006). Lake Nicaragua is located within 30 km of the Pacific Ocean, but it discharges to the Caribbean Sea and contains several euryhaline fish such as tarpon and sawfish. The canal construction and operation would compromise Lake Nicaragua for providing high-quality drinking water and

irrigation, and for maintaining biodiversity. These adverse impacts could also be amplified in the future by increased periods of drought due to climate change.

Many thousands of people will be displaced along the Canal route due to expropriations of their family lands because most people in rural areas do not have adequate property deeds. Likewise, opening a corridor through several natural reserves and indigenous areas will increase pressure on already threatened natural areas and tribal homelands.

The HKND has commissioned an Environmental Impact Study by the British firm Environmental Resources Management (ERM) on the long-term environmental, social and economic consequences of this project. Neither the HKND nor ERM has released any of the details of this assessment, although work on the canal has already begun (Meyer and Huete-Perez 2014). The economic viability of Interoceanic Canal is also questionable due to competition from the soon to be expanded Panama Canal and the opening of alternative maritime routes through the North Pole as arctic ice melts. Because the potential economic value of the lake and biodiversity along the canal route has also not been evaluated, a full accounting of costs and benefits of the project is lacking.

Well-established international best practices require that environmental assessments be completed, vetted, and published before work begins. The government's actions are leading to an atmosphere of mistrust, confrontation and repression. We call on the Nicaraguan government to halt the project until these studies are completed and publicly debated.

1. Vammen, Katherine, Nicaraguan Research Center for Water Resources of the National Autonomous University of Nicaragua
2. Huete-Pérez, Jorge A., Universidad Centroamericana, Managua, Nicaragua
3. Brett, Michael T, University of Washington, Seattle, WA, USA
4. Covich, Alan P, University of Georgia, Athens, GA, USA
5. Alvarez, Pedro J.J., Rice University, Houston, TX, USA
6. Ghadouani, Anas, University of Western Australia, Perth, Australia
7. Arhonditsis, George B., University of Toronto, ON, Canada
8. Arts, Michael T., Ryerson University, Toronto, ON, Canada
9. Vincent, Warwick F., Université Laval, QC, Canada
10. Jeppesen, Erik, Aarhus University, Denmark
11. Kankaala, Paula, University of Eastern Finland, Joensuu, Finland
12. Meyer, Axel, University of Konstanz, Germany
13. Zohary, Tamar, Israel Oceanographic & Limnological Research, Israel
14. Zambrano, Luis, UNAM, Mexico City, Mexico
15. Brönmark, Christer, Lund University, Lund, Sweden
16. Johnson, Richard K., Swedish University of Agricultural Sciences, Uppsala, Sweden
17. Moss, Brian, University of Liverpool, UK
18. Anderson, Elizabeth P., Florida International University, Miami, FL, USA
19. Capps, Krista, University of Maine, Orno, ME, USA
20. Chandra, Sudeep, University of Nevada, Reno, NV, USA
21. Chapra, Steven C., Tufts University, Medford, MA, USA
22. Connelly, Scott, University of Georgia, GA, USA
23. Crowl, Todd A., Florida International University, Miami, FL, USA

24. Dodds, Walter K., Kansas State University, Manhattan, KS, USA
25. Finlay, Jacques, University of Minnesota, Minneapolis, MN, USA
26. Flecker, Alexander S., Cornell University, Ithaca, NY, USA
27. Grimm, Nancy B., Arizona State University, Tempe, AZ, USA
28. Hairston, Nelson G., Jr., Cornell University, Ithaca, NY, USA.
29. Holtgrieve, Gordon W., University of Washington, Seattle, WA, USA
30. Jones John R., University of Missouri, Columbia, MO, USA
31. Kling, George W., University of Michigan, MI, USA
32. McKnight, Diane M., University of Colorado, Boulder, CO, USA
33. Monismith, Stephen G., Stanford University, Stanford, CA, USA
34. Paerl, Hans W., University of North Carolina, Morehead City, NC, USA
35. Pease, Allison, Texas Tech University, Lubbock, TX, USA
36. Power, Mary E., University of California, Berkeley, Berkeley, CA, USA
37. Pringle, Catherine M., University of Georgia, Athens, GA, USA
38. Ramirez, Alonso, University of Puerto Rico, Rio Piedras, PR, USA
39. Rejmankova, Eliska, University of California- Davis, Davis, CA, USA
40. Rittmann, Bruce, Arizona State University, Tempe, AZ, USA
41. Rosemond, Amy, University of Georgia, Athens, GA, USA
42. Rudstam, Lars, Cornell University, Ithaca, NY, USA
43. Schelske, Clair, University of Florida, Gainesville, FL, USA
44. Schindler, Daniel E., University of Washington, Seattle, WA, USA
45. Schnoor, Jerry, University of Iowa, Iowa City, IA, USA
46. Smith, Val H., University of Kansas, Lawrence, KS, USA
47. Soranno, Patricia A., Michigan State University, MI, USA
48. Stanford, Jack A., University of Montana, Missoula, MT, USA
49. Thorp, James H., University of Kansas, Lawrence, KS, USA
50. Urquhart, Gerald R., Michigan State University, East Lansing, MI, USA
51. Vadeboncoeur, Yvonne, Wright State University, OH, USA
52. Vandermeer, John H., University of Michigan, Ann Arbor, MI, USA
53. Vander Zanden, M. Jake, University of Wisconsin-Madison, WI, USA
54. Wallace, J. Bruce, University of Georgia, Athens, GA, USA
55. Wenger, Seth, University of Georgia, Athens, GA, USA
56. Wurtsbaugh, Wayne A., Utah State University, Logan, UT, USA

References

Centro para la Investigación en Recursos Acuáticos de la Universidad Nacional Autónoma de Nicaragua (CIRA/UNAN), Report on Monitoring of Water Quality of Lake Cocibolca of July, August 2014. In preparation.

Huete-Pérez, J.A., J.G. Tundisi, and P.J.J. Alvarez. (2013). Will Nicaragua's interoceanic canal result in an environmental catastrophe for Central America? *Environmental Science and Technology*, 47 (23): 13217-13219.

Meyer, A., and J.A. Huete-Perez. (2014). Conservation: Nicaragua Canal could wreak environmental ruin. *Nature*, 506: 287-289.

Vammen, K., J.P. Tercero, and S.M. Guillén. (2006). Evaluación del Proceso de Eutrofización del Lago Cocibolca, Nicaragua y sus Causas en la Cuenca. *Eutrofización en América del Sur, Consecuencias y Tecnologías de Gerencia y Control, Instituto Internacional de Ecología, Interacademic Panel on International Issues*, 35-58.