Hydropower threatens Andes–Amazon link

Framework study warns of environmental impact of widespread dam construction.

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Dams in the Amazon basin, such as Brazil's Tucuruí dam in Pará state, must be carefully planned to avoid disrupting the flow of nutrients from headwaters in the Andes.

Out of some 151 dams proposed for the Amazon river system, more than half will sever the connectivity between the Amazon lowlands and headwaters in the Andes mountains, according to the latest study. The unimpeded flow of the river over the past 10 million years is thought to have fuelled the extraordinary biodiversity of the Amazon ecosystem[1].

The finding follows decisions to prioritize hydropower development in the countries that share the Amazon tributaries, including Bolivia, Columbia, Peru, Brazil and Ecuador. As many as 48 dams that produce at least two megawatts of power each are already in place, and there are plans to triple that number by 2030. Peru, especially, is aggressively pursuing hydropower in cooperation with Brazil.

The study, published in the journal *PLoS ONE*[2], is the first to evaluate the impact of all proposed dams on the six Amazon river basins across five countries, together with associated projects to construct road and power lines. Previous impact assessments focused only on individual projects and country-level impacts.

This kind of analysis “has been needed for a long time to take a comprehensive view of the Amazon basin”, says Robert Naiman, a river ecologist at the University of Washington in Seattle.

Dam data

The study began in 2010 when Matt Finer, a staff ecologist at Save America’s Forests in Washington DC, and his colleague Clinton Jenkins, of North Carolina State University in Raleigh, acquired data on the locations of proposed dams from government ministries in all five nations. The information included their power-generation capacities and their requirements for roads and electric grids.

Finer and Jenkins plotted the locations of the dams using maps from a global river database called HydroSHEDS, and developed five criteria that could be applied across national boundaries to assess the ecological impact. They looked at whether a new dam would fragment the river, and decided that there would be no impact if the proposed dam is within 25 kilometres of an existing large dam that has already altered the river.

The other criteria consider whether the dams would be the first disruption of the connectivity between the Andes and the Amazon; whether the dams would need new roads and power lines; and whether there could be miscellaneous environmental impacts, such as flooding of land or blocks to migrating fish. A ‘yes’ to any of these would signify a negative ecological impact.

Using this framework, the study finds that 47% of the proposed dams are high impact, having at least three negative effects. About 20% are low impact, with little or no ecological effect.

And 80% of the projects are situated at least 3 kilometres away from the nearest roads or main power lines, meaning that forests would have to be cleared to enable construction of this infrastructure.

“From an ecological perspective, having that many dams in the headwaters is going to change the Amazon for several hundreds, if not thousands, of kilometres downstream,” says Naiman.

John Matthews, an ecologist at Conservation International in Arlington, Virginia, says that the framework could be adapted to reflect changes to climate, using the HydroSHEDS database together with other models. “A lot of this added investment in the upper Amazon is going to be sensitive to climate change,” he says. “There’s been indirect evidence that flows have been impacted, and that has

impacted the quantity of hydropower in the Andes."

"It is important not to view all dams as bad or all dams as good," says Finer. Instead, the goal is to show governments the need for strategic planning so that hydropower is developed as a network across the entire basin, rather than as a series of isolated, opportunistic projects, he says.

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References

1. McClain, M. E. & Naiman, R. J. *BioScience* **58**, 325–338 (2008).
2. Finer, M. & Jenkins, C. N. *PLoS ONE* http://dx.plos.org/10.1371/journal.pone.0035126 (2012).