

Transforming nature

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This past June I took a diversion from one of my usual dog-walking routes to explore two small nature reserves, Kingman and Heritage Islands. The islands lie next to each other in the Anacostia River 4 km due east of the US Capitol in Washington, DC.

From the bank, the islands resemble the undeveloped shores of the Potomac River downstream of Washington. Trees grow almost to the water's edge. Snowy egrets and blue herons stand vigilantly amid the reeds and lily pads. But when my Airedale terrier, Echo, and I walked around the islands, I noticed something strange. Though covered in vegetation, the ground in places was unnaturally lumpy.

I discovered the cause of the unusual terrain when I googled the islands. In precolonial times the Anacostia ran swift and clear through forested land. Soon after European settlers arrived in the region, they chopped down trees and planted crops. Soil from the fields washed into the river and formed mudflats downstream. By the end of the 19th century, the silt was augmented with raw sewage, and the marsh had become a breeding ground for malaria-carrying mosquitoes.

The US Army Corps of Engineers proposed a solution: excavate two channels in the riverbed and build artificial islands from the dredgings. Forcing the river water past the islands would, it was hoped, keep the current strong enough to carry the silt away. The plan, which was completed in 1916, worked. The larger island was named after Brigadier General Dan Christie Kingman, who led the corps of engineers at the time.

The story of Kingman and Heritage Islands reminded me how quickly and profoundly humans can affect their environ-

ment. One of the starkest examples of such an alteration is the Aral Sea, which lies in a desert between Kazakhstan and Uzbekistan. Without human intervention, the Aral would have remained the world's fourth largest lake, its high rate of evaporation balanced by the influx of water from two rivers that

originate in the snow-covered mountains of Kyrgyzstan and Afghanistan. But in the 1940s, Soviet planners embarked on a series of mammoth projects called the Great Plan for the Transformation of Nature. For the Aral, the plan entailed constructing canals to divert water from the lake's sources and irrigate crops, notably cotton. By the 1960s irrigation was so extensive that most of the water that would have reached the Aral was devoted to agriculture or lost to evaporation and leakage from the badly built canals.

Predictably, the Aral shrank. Once as large as West Virginia, the lake is now a tenth of its original size. In its place is a toxic salt flat. Absent the sea's moderating influence on the local climate, daily and seasonal temperature ranges have widened by up to 3°C. Salty dust blown off the exposed lake bed reaches the mountains, where it promotes the melting of snow and ice. The rivers that feed the Aral Sea will flow more vigorously for a while and then more weakly, further accelerating the lake's desiccation.

How changes in land use affect weather and climate is the topic of the feature article by Roger Pielke Sr, Rezaul Mahmood, and Clive McAlpine, which begins on page 40. The authors contend that human alteration of the land surface must be considered alongside carbon dioxide, soot, and other anthropogenic forcings when addressing the causes of and response to climate change.

Land use not only influences a region's climate, it also affects a region's vulnerability to climate change. In a 2015 paper, geographer Elena Lioubimtseva reviewed the environmental health of the Aral Sea basin.¹ The myriad feedbacks on global, regional, and local scales, together with shared political jurisdiction, will make restoring the Aral Sea and its shores especially challenging, she concluded. But as the modest example of the Anacostia demonstrates, some changes are reversible. And at least on the Kazakh side of the lake, reclamation projects are already having an impact.

Reference

1. E. Lioubimtseva, *Environ. Earth Sci.* **73**, 719 (2015).

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