Quantifying the ecosystem services of glaciers highlights their importance to humankind

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Iceland's Skaftafells glacier has retreated significantly in the last two decades. Credit: Creative Commons/Dominico Covertini

As the world's glaciers disappear, one group of scientists is seeking to

understand their impact on humans before they are gone. By applying the ecosystem services framework to glaciers, the authors of an August 2021 paper published in *Ecosystem Services* hope to drive home the important role that glaciers play for humans.

Ecosystems services is a framework that examines the many ways that humans benefit from nature. Such services are well defined for many of the planet's ecosystems, like forests and grasslands, but until now a comprehensive assessment applying the framework to glaciers had not been completed. "The reason we wanted to focus on glaciers is that we recognize that we benefit from glaciers in many ways." Lead author David Cook, a postdoc in the Environment and Natural Resources Program at University of Iceland said in an interview with GlacierHub. "The ecosystem services perspective is quite useful in that regard."

The literature review conducted by Cook's team emphasizes the many ways in which glaciers benefit humans, some of which may not be immediately apparent. "A lot of the ecosystem services literature focuses on ecosystems that have more immediate or obvious benefits," said Cook. "For example, forests or coastal ecosystems. I think that the benefits of those ecosystems are maybe more familiar to human beings."

The benefits detailed in the paper include freshwater for drinking, glacial runoff that supports hydropower, carbon sequestration, water temperature regulation and water purification. As climate change works on glacial ecosystems, humans may see a temporary uptick in the useful aspects of glaciers, albeit briefly. "Hydropower production [from meltwater] is expected to increase until 2050 or 2060, but after that, as glaciers continue to retreat and meltwater rates are not as high as they are going to be in the next few decades, then we see more of a problem," said Cook.

Cook is quick to point out that in order to benefit from the resources that

glaciers provide, societies must actively work to foster their productivity. "Many people think of ecosystem services as just free gifts of nature that just arrive and are enjoyed by human beings, and that's not really the case," explained Cook. "For most ecosystem services there needs to be mobilization of capital—human capital, built capital, financial capital—all of this needs to come together."

The benefits of glaciers are not limited to the physical and biological. The study also describes the ways in which glaciers are important to humans culturally. It focuses on glacial recreation and tourism and the opportunity that glaciers provide for climate and environmental education as well as the spiritual and symbolic significance of glaciers around the world.

In addition to the services that glaciers can provide, there are also a suite of risks, or disservices, that come with glaciated regions in the era of climate change. In particular, the research focuses on the risk that glacial lake outburst floods, which occur when a surplus of glacial meltwater causes a glacial lake to breach a dam, close to communities in glaciated areas.

Cook hopes that his team's review of glacial ecosystem services will help inform decisions and planning for a warming future. "The paper talks about the need for enhanced disaster preparedness; it could be used to help research institutes to identify and quantify precisely climate change related risks in terms of glacier melt, glacier retreat," said Cook. "This implies that there is going to need to be involvement from both the private and public sector."

Cook's team isn't the only one paying attention to the state of the earth's glaciers. The recently released IPCC report, Working Group I of the Sixth Assessment Report, detailed the disastrous situation that climate change poses for glaciers. For Cook in Iceland, the effects of climate

change are at his front door. In his nine years there the scientist has witnessed glaciers rapidly retreating. He has watched glacial lagoons grow and the walk from a parking area to a glacial hike get longer and longer. The trends Cook is observing in Iceland are happening across the planet as nearly all of the Earth's glaciers are retreating. "In a few decades Iceland will not so much be the land of ice," he said.

More information: David Cook et al, Co-production processes underpinning the ecosystem services of glaciers and adaptive management in the era of climate change, *Ecosystem Services* (2021). DOI: 10.1016/j.ecoser.2021.101342