

Guest Editorial

Evaluating ecosystem services in Antarctica - why are we falling behind?

Ecosystem services describe the many benefits provided by healthy functioning ecosystems, including food provision, climate regulation and recreational benefits. An assessment and understanding of ecosystem services has directed effective conservation and/or management in many areas across the globe. Policymakers are starting to embrace ecosystem services studies that focus on the Southern Ocean, but equivalent studies for Antarctic terrestrial environments are still largely absent. Why is this when the ecosystem services provided to humans by the Antarctic terrestrial environment are clear? For example, the role of Antarctic ice masses on global regulation services are massive while also locally driving changes in downstream ice-free areas (Milner *et al.* 2017). Moreover, Antarctic researchers use Antarctica as a pristine natural laboratory to deliver research advances and the tourism industry is sustained by the cultural ecosystem services that make Antarctica such an astounding tourism destination. By utilising these services, parts of Antarctica are becoming increasingly busy and Antarctic values are under increasing pressure. This makes the application of ecosystem services assessment frameworks to inform the use of existing environmental management tools by the Antarctic Treaty Parties all the more urgent.

The latest Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services report (IPBES 2019) highlighted the changes in land use, pollution and warming that are affecting the Polar Regions, while emphasizing the role of ecosystem services in underpinning Biodiversity Conservation Targets. The report warned of global trade-offs between the many ways' nature benefits people, including for example, the production of food and other commodities over regulation of air and water quality, climate regulation and habitat provision. Notably, the Antarctic region was only mentioned once with a reference to the risks associated with future seabed mining. Lack of consideration of the Antarctic may be due to the limited number of studies explored ecosystem services in Antarctica: only two have been undertaken, which focus on Southern Ocean fishing (Grant *et al.* 2013) and on payment for recreational activities (Verbansky 2018). In contrast, studies on various Ecosystem Services at the Arctic region are much more frequent (Malinauskaite *et al.* 2019). Strikingly, none of the global IPBES assessments and projections include the Antarctic continent despite it being a major provider of globally essential ecosystem services.

One explanation for the lack of ecosystem services studies for terrestrial Antarctica might relate to the unique governance arrangements of the Antarctic Treaty area. Use of established mechanisms to consider environmental issues mean there may be an initial reluctance to embrace the new terminology and concepts presented by ecosystem services assessments. However, similarities exist between the values described by the Antarctic Treaty System and established ecosystem services classifications. For example, scientific, historical, aesthetic and wilderness values are all core 'cultural' ecosystem services. Helpfully, spatial ecosystem services assessments can be particularly effective in managing trade-offs between different cultural ecosystem services. A second and more practical reason for slow implementation of ecosystem services studies may be the limited geospatial resources available to create high-resolution maps needed for the assessments. However, spatial information is becoming increasingly accessible, and terrestrial biodiversity data is being systematically compiled and centralized, making this less of an issue. A third reason is that undertaking ecosystem services assessments needs financial support and the identification of strong 'champions' to clearly communicate its importance to funders. In Antarctic marine ecosystems, the financial value of supporting services, including fisheries, may be sufficient to justify the expense. In contrast, the range of beneficiaries of ecosystem services in terrestrial Antarctica have been less vocal in recognizing them explicitly, making allocation of funds to support ecosystem services assessments less of a priority for national funding bodies. However, given the pace of change in Antarctica, with an increase in distribution and diversity of national operator and tourism industry activities, can we afford further delay?

Some progress in identifying locations that deliver ecosystem services has been made, albeit as a secondary benefit of the existing work of the Committee for Environmental Protection. For example, the system of Site Guidelines for Visitors show locations where some features of recreational value are present (e.g. rookeries and rich vegetation), and the list of Historic Sites and Monuments (HSMs) and 72 Antarctic Specially Protected Area (ASPAs) management plans describe features of outstanding historic, conservation or scientific value. However, Site Guidelines, ASPAs and HSMs focus on spatially restricted areas for a limited range of ecosystem services connected with specific Antarctic

Treaty values. The strength of ecosystem services assessments is that they go one step further by identifying synergies and potential trade-offs between different legitimate activities at broader spatial scales.

Ecosystem services assessment frameworks provide robust and widely applicable mapping tools to help manage Antarctic values and to integrate the region into global assessments and projections. If we fail to use these tools, how can we understand and communicate Antarctica's essential contribution to the well-being of everyone on planet Earth?

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