

Is Singapore losing its heritage through redevelopment of buildings and loss of its coastline? It is time to develop a more robust way to assess heritage and ecosystems, to prevent their destruction.

# Assessing the value of mangrove swamps

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**T**HE coastline generally associated with Singapore is one of harbours, ships, artificial beaches and concrete seawalls, all contributing to – and a product of – economic activity. But hidden among the cranes and refineries is a different coastal Singapore, a coast teeming with life.

This is a coastline fringed by intertidal mangrove forests and subtidal seagrass meadows, a coast that is home to crocodiles, dolphins, otters, and some of the most biodiverse coral reefs in the world.

However, Singapore's coastal ecosystems have declined rapidly with urbanisation. While data varies, the country may have lost almost 90 per cent of its mangroves since the 1950s due to land reclamation in the north and south-west. Other coastal ecosystems continue to decline, with recent research suggesting that over 40 per cent of intertidal coral reefs and almost 38 per cent of mudflats and sandflats have been lost in only the last 20 years.

If threatened ecosystems are to be conserved, it may become necessary to show their value to society, in comparison to other alternative land uses. It is simple to show the economic value of a reclaimed shoreline or a harbour terminal, but how much is the country's hidden natural coastline worth, and how do we, and should we, put a value on nature?

Increasingly, conservationists, and some businesses and policymakers are pitching their tent on the paradigm of "ecosystem services" as a way of increasing awareness of the importance of ecosystems, and potentially as a way of quantifying their value – economic, or otherwise.

"Ecosystem services" refer to the roles and benefits that ecosystems provide to humans. This is potentially an attractive concept as it can allow ecosystem value to become part of the decision-making process, and widens the scope of conservation to appeal to people and donors who may not otherwise consider themselves environmentalists.

This new approach is controversial, as valuing ecosystems for their benefits to humans puts people front and centre in our view and perception of the environment. It represents a paradigm shift away from traditional protectionist conservation approaches, where ecosystems are protected for their inherent intrinsic or existence value.

Ecosystem services come in all shapes and sizes. The Millennium Ecosystem Assessment – a ground-breaking international report released in 2005 – was commissioned by the United Nations to understand the impact of environmental change on human well-being. This report was one of the most high-profile attempts to describe the wide range of ecosystem services that human populations rely on.

One way in which ecosystems benefit people is through "provisioning services", where people can physically extract products from an ecosystem, such as fish and other foods, building materials, minerals and medicinal resources. These are direct, tangible and physical ecosystem services, which can be easily understood and monetised.

Other ecosystem services "regulate" or "support" the environment, and can include processes by which ecosystems purify water, trap pollutants, produce nutrients and regulate local climates.

For example, carbon sequestration (the removal of carbon dioxide from the atmosphere) is an ecosystem service that is currently high on the international agenda in international climate negotiations.

In Singapore, seagrass meadows and mangrove forests use up atmospheric carbon dioxide for photosynthesis, so can offset a proportion of the country's carbon dioxide emissions and thus offset our contribution to global climate change. However, these ecosystem services are largely invisible and less tangible.

The way ecosystems benefit people through "cultural services" is perhaps the most abstract, but may be the most important in Singapore's context. Cultural services include the use of ecosystems for recreation and education. Tens of thousands of people visit the mangroves at Sungei Buloh Wetland Reserve every year, which has recently expanded in area and has constructed new visitor facilities.

Other cultural services are much more abstract and intangible, and include spiritual, aesthetic, and "sense of place" services.

Current research shows that the types of cultural services valued in Singapore are changing; in the 1950s, communities valued mangroves for intrapersonal reasons such as spiritual and religious value, especially for kampung communities that had a strong personal link to the coast. However, today people in Singapore have become more dislocated from their coastline, and place more value in interpersonal services such as recreation and education.

Despite their importance, Singapore's remaining fragments of hidden coastline face an uncertain future. The Urban Redevelopment Authority's 2013 Land Use Plan and the 2014 Master Plan suggest further land reclamation – expansion that is needed to maintain economic production and house a growing population in a land-challenged Singapore.

This begs the question of how ecosystem services can be used to balance socioeconomic demands with environmental concerns. Yet, we already implicitly use the ecosystem-service approach in land use planning, with Singapore's Garden City concept driven by an acknowledgement of the importance of natural and managed green spaces in improving livability in a densely populated nation, through recreation and aesthetic value.

Exploring the potential of ecosystem services such as climate regulation, coastal protection and carbon sequestration may provide decision-makers with the evidence to make informed management decisions that incorporate and utilise the varied benefits of the country's hidden coastline, to ensure a sustainable Singapore in the future.

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