



# 7 ENVIRONMENTALLY SUSTAINABLE WATER MANAGEMENT IN THE ASIA PACIFIC

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Stuart Bunn, Mark Kennard and  
Sue Jackson

## Introduction

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Balancing water needs for human use and for the protection of freshwater ecosystems is one of society's great challenges. Freshwater is not distributed uniformly across the globe nor often in relation to patterns of human settlement, and overuse and pollution further diminish available water supplies. As a consequence, much of the world's population is exposed to a high level of threat to water security—as are freshwater ecosystems.<sup>1</sup>

The Asia-Pacific region is a global hot spot for water insecurity: 1.7 billion people currently lack access to basic sanitation and approximately 80% of wastewater is discharged into rivers, lakes, and the sea with little or no primary treatment. It is estimated that up to 3.4 billion people could be living in water-stressed areas by 2050 given projected increases in water demand for food production, domestic supply, manufacturing, and electricity production.<sup>2</sup> There is little doubt that water will become a constraint on economic growth in a number of countries unless significant effort is directed toward improved water management.

The Asia-Pacific region also sustains outstanding freshwater biodiversity and a high societal dependence on environmental services (e.g. fisheries) that healthy rivers and wetlands provide. Freshwater ecosystems are home to extraordinary biodiversity, but almost one in three freshwater species is threatened with extinction world-wide,<sup>3</sup> and populations of freshwater vertebrate species have fallen at more than twice the rate of those on land or in the oceans.<sup>4</sup> South and South East Asia are by far the most threatened regions.

Many human populations in the Asia Pacific rely on rivers and wetlands for a large part of their diet and subsistence. In these areas, rice is the major source of carbohydrate but fish is the major, if not only, source of animal protein and a major source of minerals.<sup>5</sup> Consumption of freshwater fish is particularly important for the physical development of children, and not only often represents a cheaper source of animal protein but also a preferred part of local and traditional recipes. Technologies required in freshwater fisheries are relatively low in cost and therefore widely available to millions of people, including to women and children who frequently harvest small, but nutritionally important quantities from the river and wetlands near to their homes. In Asian countries, fish make up a larger proportion of household expenditures in low income households.<sup>6</sup>

## The path to environmentally sustainable water management

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The prospect of sustaining current rates of development and improving livelihoods in the Asia Pacific clearly depends on the precious natural resources provided by healthy aquatic ecosystems. However, decades of neglect have degraded the environment and its natural resources as governments across the region have prioritised rapid economic growth over environmental objectives. Asia's leaders are now looking to green their economies as part of their commitment to the 2030 Agenda for Sustainable Development.

Meeting the Sustainable Development Goal (SDG) targets<sup>7</sup> to protect and restore water-related ecosystems (SDG6.6; 15.1) and reducing land-based pollution (SDG6.3) poses a major challenge in the Asia-Pacific region (see Figure 1). However, there is concern that these will be insufficient to reduce rates of freshwater biodiversity loss without commitment to additional priority actions. These include the rapid

implementation of environmental flows, reducing exploitation of freshwater species and the mining of riverbed materials, controlling invasive species, and safeguarding river connectivity.<sup>8</sup> There is an excellent opportunity to review the SDG targets and other indicators relevant to this challenge and identify practical steps for implementation at the Conference of the Parties (COP 15) to the Convention on Biological Diversity, to be held in China in 2020.

Figure 1: Sustainable Development Goals



**SDG 6.3:** By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

**SDG 6.6:** By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.



**SDG 15.1:** By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.

Source: United Nations.<sup>9</sup>



Stuart Burnn | Griffith University

# Priority environmental water challenges for the Asia Pacific

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In a recent review, we assessed four priority environmental water challenges for the Asia-Pacific region (see 'Four Key environmental water quantity and quality challenges in the Asia Pacific'),<sup>10</sup> using indicators from a recent global river threat assessment and the Asian Water Development Outlook. These indicators, together with published information on threats to river health and freshwater biodiversity in the region, were used to assess information and capacity needs to address each of these dimensions of environmental water management.

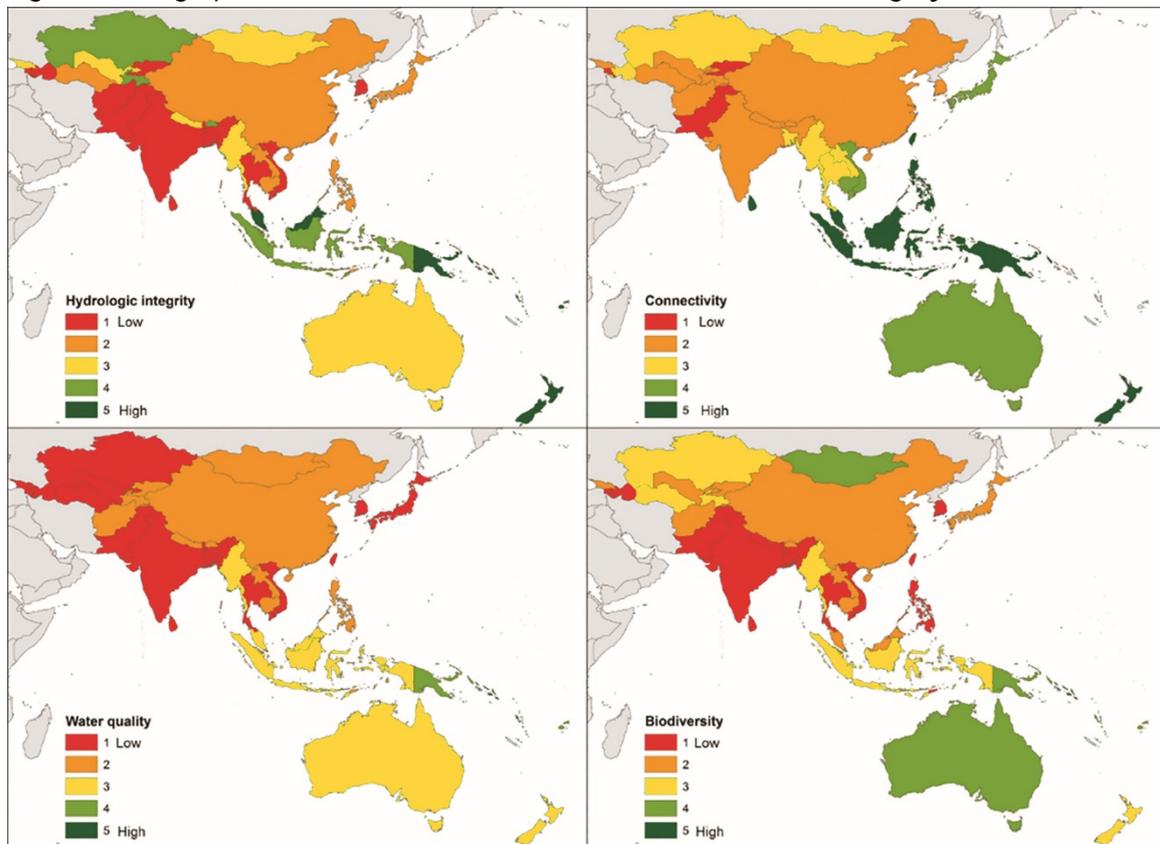
## Four key environmental water quantity and quality challenges in the Asia Pacific

1. **Environmental flows:**<sup>11</sup> The provision of water for the environment is a key action to meet SDG targets 6.6 and 15.1. The flow needs for floodplain and coastal wetlands, which are often of great significance for fisheries and international agreements for migratory waterbirds, are of particular importance in the region.
2. **Fragmentation and connectivity:** Dams and other in-channel barriers have a major impact on migratory aquatic species, including important fisheries species, while levees reduce floodplain subsidies that sustain the high aquatic production in many lowland rivers.<sup>12</sup> Dams also trap sediment and are associated with shrinking deltas,<sup>13</sup> and the loss of important river-wetland connections.
3. **Water pollution and river health:** Addressing water pollution (SDG 6.3) is essential to protecting aquatic ecosystems and freshwater biodiversity (SDG 6.6 and 15.1) and is a key action to make drinking water safe (SDG 6.1). Point source pollution from industry and urban sources is a significant problem in many developing countries in the region. In addition, many countries are also dealing with similar land-based pollution problems to those in Australia and improving catchment resilience in the face of increasing extreme weather events is a key challenge.
4. **Biodiversity and conservation planning:** The region is known for its high freshwater biodiversity,<sup>14</sup> and includes significant floodplain wetlands and lakes for migratory waterbirds. New approaches are needed to guide future water infrastructure investment, to minimise risks to freshwater biodiversity, fisheries production and other flow-dependent values such as cultural heritage.

Most countries across Asia show high levels of flow alteration (i.e. their rivers have low hydrologic integrity; see Figure 2). Dams have not only significantly altered flow regimes and disrupted connectivity in many rivers, but also reduced sediment delivery to the sea. Delta shrinkage has been reported for several large rivers, including the Yellow, Zhujiang (Pearl River) and Yangtze in China, the Chao Phraya (Thailand) and the Mekong (Viet Nam).<sup>15</sup>

The proposed boom in hydropower development in the Himalayan region<sup>16</sup> will mean that impacts from flow alteration and fragmentation are likely to increase. There are already emerging issues with dams and loss of connectivity in the Mekong.<sup>17</sup> Up to 50% of the annual fisheries yield in the Mekong basin could be compromised if uncontrolled development continues.<sup>18</sup> Replacing this lost food base may lead to further degradation of the river environment already stressed by external pressures and it may intensify poverty.<sup>19</sup> Many fish species of commercial and subsistence importance in the Ayeyarwady Basin, Myanmar, are also migratory and face similar threats from water resource development.<sup>20</sup>

Figure 2. Geographic variation in indicators of environmental water integrity



Source: Bunn, Kennard and Jackson 2019.

The United Nation’s Food and Agricultural Organization’s (FAO) recent assessment of the state of the world’s fisheries noted that water management plans often ignore the needs of these fisheries and that ‘demands on freshwater systems from hydropower, irrigation and industry feature more prominently in policy discussions, especially in developing regions where people’s dependence on fisheries is greatest’.<sup>21</sup> Although dams can generate renewable energy and jobs, and may contribute to better flood control in the wet season and a greater water supply in the dry season, river regulation and fragmentation represents a particular risk to inland fisheries, making this an important consideration in dam assessments.

The gendered impact of flow alteration from hydro-electricity programs is also a noted feature of the socio-ecological changes underway in South Asia, particularly the Himalayas. The benefits of energy projects are skewed in favour of urban populations over the rural communities in which women labour in agriculture. Women in India bear an unequal burden within their rural communities when irrigation and household water, land, and forest resources are reduced due to hydropower, and from climate and land intensification-induced changes such as erosion.<sup>22</sup> Hydro schemes are contributing to environmental degradation that, when combined with low returns from agriculture, drives migration of rural men and youth to urban areas. This migration is adding to urban energy demand and adding to rural women's work.

In addition to flow alteration and loss of connectivity, poor water quality is a major threat across Asia and overall river health is poor and declining in many countries. Over-abstraction, pollution, mining and structural modifications of the river corridor, as well as a loss of connectivity with floodplains, have changed the character and function of rivers in China to the extent that many are no longer ecologically or physically recognisable.<sup>23</sup> About 80% of the major rivers in China have become too polluted to sustain commercial fisheries, and fishes have been eliminated from at least 5% of the total river length.<sup>24</sup> Water pollution is also a major threat to human health and is associated with a high incidence of liver and stomach cancers, the leading causes of cancer mortality in rural China.<sup>25</sup>



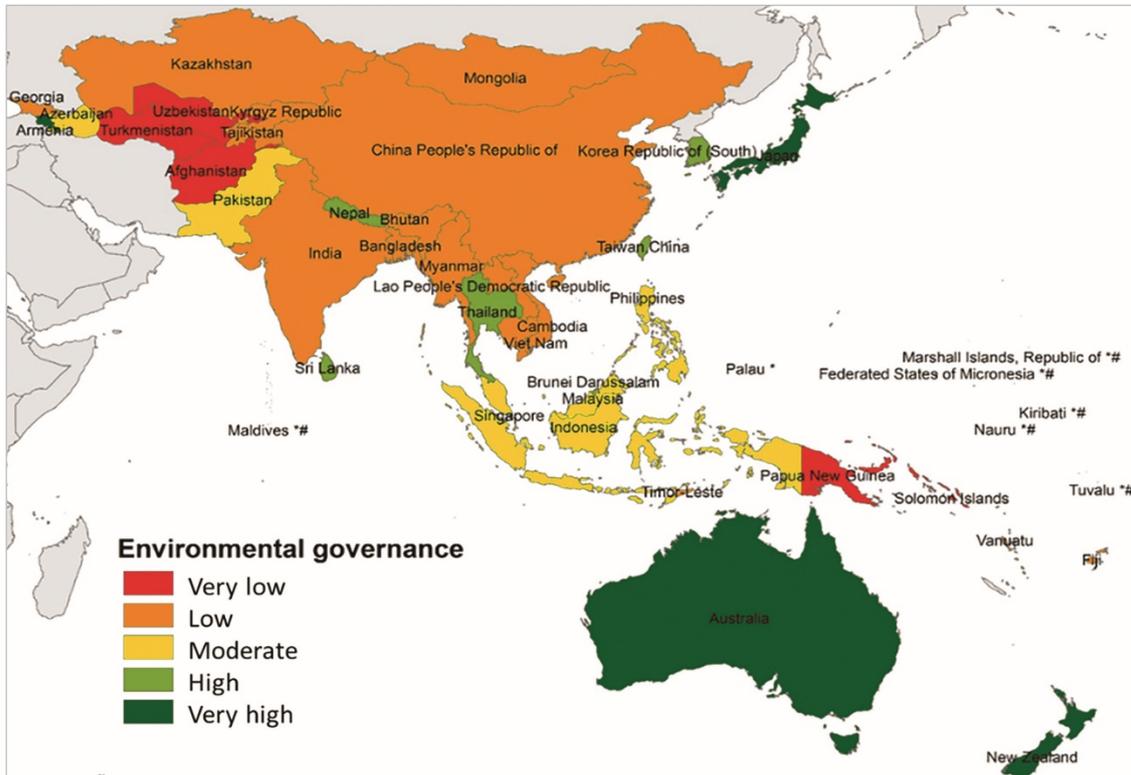
Forest land conversion to agriculture and other uses, and deforestation by legal and illegal logging have caused serious erosion and sedimentation problems and pollution in the downstream portions of catchments in Indonesia.<sup>26</sup> These threats are then exacerbated by population pressures as people move into new areas.

Data on river health and threats for many island countries is incomplete. Generally, the risks to the environment are relatively low; however, deforestation and associated water quality changes represent a significant threat to freshwater fish diversity and downstream coastal areas (e.g. Fiji).<sup>27</sup> Deforestation of catchments in volcanically young and rugged high islands has led to massive soil erosion and impacts upon wetlands.<sup>28</sup> Conversion of tropical rainforest to oil palm plantations is also an emerging issue, in countries like Papua New Guinea.<sup>29</sup> Water quality impacts from mining on freshwater fisheries have also been recorded.<sup>30</sup>

# Capacity to address these challenges

The *Yale Environmental Performance Index*<sup>31</sup> provides a coarse measure of the level of each nation state's institutional capacity and willingness to reduce and prevent environmental degradation (see Figure 3).

Figure 3. Map of geographic variation in environmental governance



Source: Bunn, Kennard and Jackson 2019.

With the exception of a few countries like Sri Lanka, Nepal, Thailand and Singapore, environmental governance is ranked low to very low across Asia (see Figure 3). Many countries have policies related to different water uses and in most there is a national water policy that refers to integrated water resource management (IWRM) and addressing environmental concerns. However, none has a well-defined policy for providing flows to maintain the ecological integrity of rivers and associated aquatic ecosystems.<sup>32</sup> At best, some countries (e.g. Nepal) recognise downstream water requirements as a water right and recommend that minimum flow requirements be established.

Environmental flows have yet to be main-streamed into water resources planning, development and management decision making in many countries. In India, the government has not developed a clear policy or technical guidelines or operational procedures for conducting reconnaissance level or comprehensive environmental flow assessments or to support their implementation or enforce compliance.<sup>33</sup> The few detailed studies of environmental flows to date in India have concentrated on the upper reaches of the River Ganga.<sup>34</sup> Socio-cultural factors are growing in importance in environmental flows work in India.<sup>35</sup>

Myanmar has recently undertaken the Ayeyarwady State of the Basin Assessment (SOBA), which included an ecohydrology assessment to characterise the status and trends of key aspects of the Basin's flow regime that are likely to be of importance to biodiversity and fisheries and explored the associated risks from water infrastructure (e.g., through the loss of connectivity due to in-stream barriers or the impoundment of key habitats).<sup>36</sup>

China has recently implemented an ecological redline policy (ERP) to tackle environmental degradation and secure ecosystem services for the future.<sup>37</sup> Since 2005, there has been increased interest in river restoration, especially in urban areas. The objectives vary with location—in the north of the country, where water resources are scarce, most projects have focused on environmental flows and restoring aquatic habitat, in the south the focus is more on improving water quality and river health.



A number of government directives are now in place to facilitate this investment—including the release of new guidelines for river restoration planning in 2015 by the Ministry of Water Resources. In 2015, the Chinese State Council issued the ‘Water Pollution Prevention and Control Action Plan’ (“Water Ten Plan”). This includes objectives to reduce the percentage of badly polluted water bodies so that over 70% of water in 7 key rivers becomes suitable for drinking supply and recreation (Grade III) or better, and to reduce groundwater over extraction and pollution.<sup>38</sup>

There is generally insufficient baseline data on freshwater quality to evaluate the impacts of developments or land use practices in many of the Pacific Islands, and little data available on the physical, chemical and biological processes in island watersheds, including soil erosion, loss of biodiversity and land clearance. Few Pacific Islands have specific legislation that centrally addresses wetland issues.<sup>39</sup> Although there are some laws relevant to various wetland issues from the perspective of various individual government sectors, their enforcement is either limited or not coordinated across government or industry.

## Conclusion

Nowhere else in the world is there a greater need for investment to address environmental water issues than the Asia-Pacific region, and especially South East Asia. The region represents the confluence of outstanding freshwater biodiversity, high societal dependence on environmental services that healthy rivers and wetlands provide, and a high level of threat to these values that is rapidly intensifying.

Australia has a strong international reputation in environmental water planning and policy, underpinned by a solid foundation of hydroecological science. Australian researchers have also played a significant role in the development of practical guidelines for river rehabilitation, and the development and implementation of innovative tools for monitoring and reporting on river ecosystem health. There is clearly international interest in these approaches to address environmental water quality and quantity challenges. Growing concerns about the environmental and social costs of water pollution and over-allocation will undoubtedly stimulate further demand for Australian expertise over the coming decade and open up new opportunities for private-sector investment in on-ground implementation of nature-based solutions.

There is a compelling need to build capacity and provide tools for environmental flow management in South East Asia and address issues of fragmentation and loss of connectivity, especially in the larger transboundary river systems with important fisheries (e.g. Mekong, Ayeyarwady, Salween). While there is adequate hydrological information for many of these systems, basic knowledge on fish ecology and fisheries, river ecology, sediment transport and on human uses and values of aquatic resources is very limited within the scientific community.<sup>40</sup> Such information will be essential to underpin the consultancy-based processes deployed by international banks and others.

China is South East Asia's most important upstream riparian country, sharing over a hundred rivers and lakes with 18 downstream countries.<sup>41</sup> Building capacity and developing tools for effective environmental water management in China may also lead to improved outcomes in the broader region, through information sharing and improved management of transboundary rivers.<sup>42</sup>

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