

## Population and Environment Case Studies: Local Approaches to a Global Challenge

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It is apparent that we now live in a new epoch, the [Anthropocene](#) (IGBP, 2001), in which Earth's environment and climate is mainly controlled by human activity. Environmental damage is accelerating on a global scale. As the world's population increases, improving standards of living without destroying or degrading the natural environment becomes a challenge. Water shortages, sea-level rise, air pollution and degradation of coastline afflict many areas all over the world.

The larger the population, the more complex the environmental problems become (Fig. 1). The challenge is to build synergies between members of separate disciplines and between scientists, policymakers and the public within and between nations that can accomplish collaboratively what none are capable of doing alone for global climate change. A number of case studies in the coastal zone, based on population density gradients, from [Palau](#), Maryland Coastal Bays, [Moreton Bay](#) in Australia and [Chesapeake Bay](#) to [Pearl River](#) in China will be reviewed to understand the population dynamics, environment issues, and management services. Importantly, through this case study discussion, we can learn from different perspectives between nations and the mistakes in terms of the environment and quality of living.

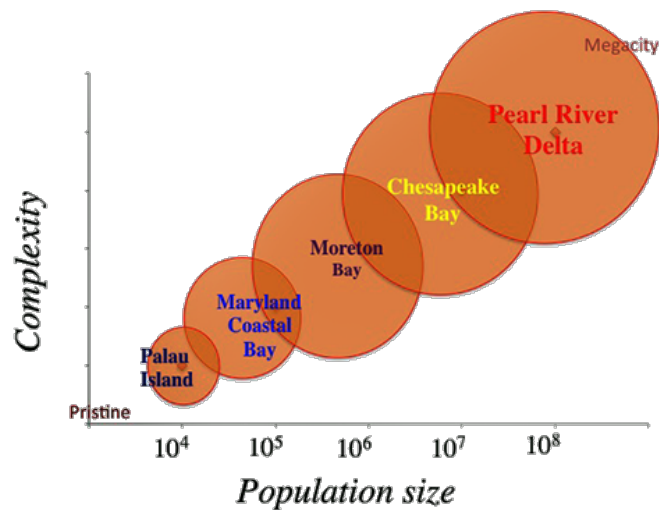


Fig.1. The relationship between population size between complexity among case studies.

Palau is not letting the overwhelming climate change impacts slow them down. The Pacific country of Palau (with a population of only 21,000) has made significant environmental inroads to a pristine ecosystem protection and a sustainable tourism-based economy. They are looking for ways to increase the resilience of their diverse mangroves, seagrasses and coral reefs to promote high-end ecotourism and manage development to protect its unique ecosystem. However, managing conflicts between conservation, tourism and traditional practices are inevitable in Palau. For example, how do we push to develop education awareness of ecological processes and sustainable development to the public? How do we overcome the knowledge gap, culture differences and language barriers before educating local people about global climate change? How do we spread awareness of the environmental problems when it brings people into closer contact with nature via ecotourism? It is obvious that Palau needs international support and lessons from different experiences and perspectives for management, monitoring and research. A comparison between regions (such as tropical versus temperate environments) is necessary, but it should be careful not to extrapolate too much. Culture bias on nutrient pollution

and marine impacts on different systems must be taken into account when making environmental decisions.

The Maryland coastal bay, [Chincoteague Bay](#) lagoon system is a wave-dominated environment. The changes impacting water quality, land use and the ecosystem have been associated with intensification of anthropogenic stressors (Fertig et al. 2013) Non-linear ecosystem level changes are due to the complexity of the phenomena occurring in this system. Therefore, management of coastal ecosystems requires a strong interaction between managers and researchers (Dennison 2008). Problem-oriented research is an effective way to examine the sustainable use of coastal zones, and targeting proper species that can affect human health directly is also important for implementing research. The aim of research is to translate it into meaningful information for the decision-making process or its evaluation.

The Moreton Bay system in Australia is known for seagrasses, mangroves and coral diversity. The bay is special in that wildlife is close to city skyline. The health of the bay had worsened over the past year due to the growing population along the coastlines. A significant component of nitrogen pollution from sewage discharge leads to marine eutrophication (Costanzo et al. 2001). Scientists researching water quality issues have developed an ecosystem health index for assessing the health of Moreton Bay. Functional zones based on habitats are also well defined to process effectiveness assessment. On the other hand, the scientists working in Moreton Bay have had good support from politicians, which has enhanced the communication with the public. The [Queensland](#) government and mayor are big advocates of the idea that the more people hear the problems, the more they get behind the actions. Currently, they yield good result: the receiving sewage discharge used to be seven times higher than the water quality standards in Queensland; however, it is currently only about two times the standard.

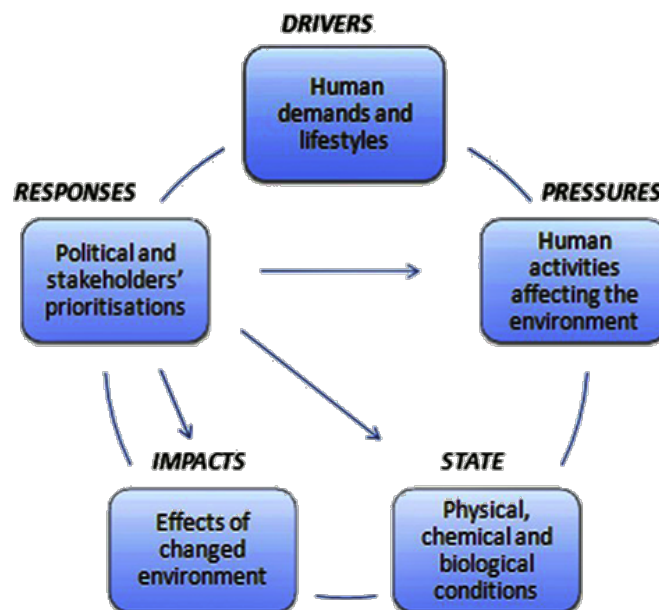


Fig. 2. The drivers-pressures-state-impacts-responses (DPSIR) framework scheme. Figure from Sekovski et al 2011.

The [drivers-pressures-state-impacts-responses](#) (DPSIR; Fig. 2) framework provides a standard framework for site assessment and evaluation on the effect of human activity on environment. The framework has been applied to study the complex interactions in Chesapeake Bay and China's megacity around Pearl River. The rapid rate of population growth around Chesapeake Bay watershed has changed the land use and expanded urban areas. Harmful algal blooms, declines in oyster population, land erosion and invasive species have become major environmental issues here. Although the Chesapeake Bay is extremely well studied; effective communication between

science and management is required to bridge the barriers to integration (Boesch 2006). While the Chesapeake Bay is extensively managed with multiply branches; the community involvement and partnership are commonly separated. People do not feel a sense of ownership for the bay.

Population growth in China is formidable. The economic imbalances within the country itself result in a huge and constant influx of migrants to the coastal megacity (defined as a city with more than 10 million people in search of better jobs and quality of living). China's Pearl River Delta region has overtaken Tokyo as world's largest megacity. Large population pressures on resources cause devastating effects on natural environments and human health. As megacities grow, the boundaries expand. It is difficult to manage efficiently when cities reach unprecedented scales and complexity beyond population models. Although the urbanization rate of this coastal megacity has been slowing down, there are a number of uncertainties in terms of nutrient contaminants and future climate change.

Governments around the world are moving to integrate their efforts to address complex environmental issues, such as the [Kyoto Protocol](#). However, there are many challenges we must face in order to make this possible, and to working together across-boundaries can range from technological applications, such as data to culture bias in science and organization. Science may have good networking through peer review, but integrative management is not easy to conduct.

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