

Water, Health, and Economy: an Integrated Ecosystem Services Approach to Sustainable Development in Urbanizing Deltas



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International Student Taskforce Research Approach

In late August 2011 an international group of interdisciplinary graduate students was assembled to create an integrated framework approach for sustainable development and planning in urbanizing delta regions throughout the world. This project is being accomplished in 3 major steps:

- 1) **Reviewing** sustainable development approaches to “wicked” problems (i.e. those with complex interdependencies) that in an effort to solve may reveal or create other problems,
- 2) **Integration** of team knowledge and different sustainable development frameworks to create one cohesive approach, and
- 3) **Application** of this generic sustainable development approach to a case study delta in Indonesia.

International University & Student Taskforce

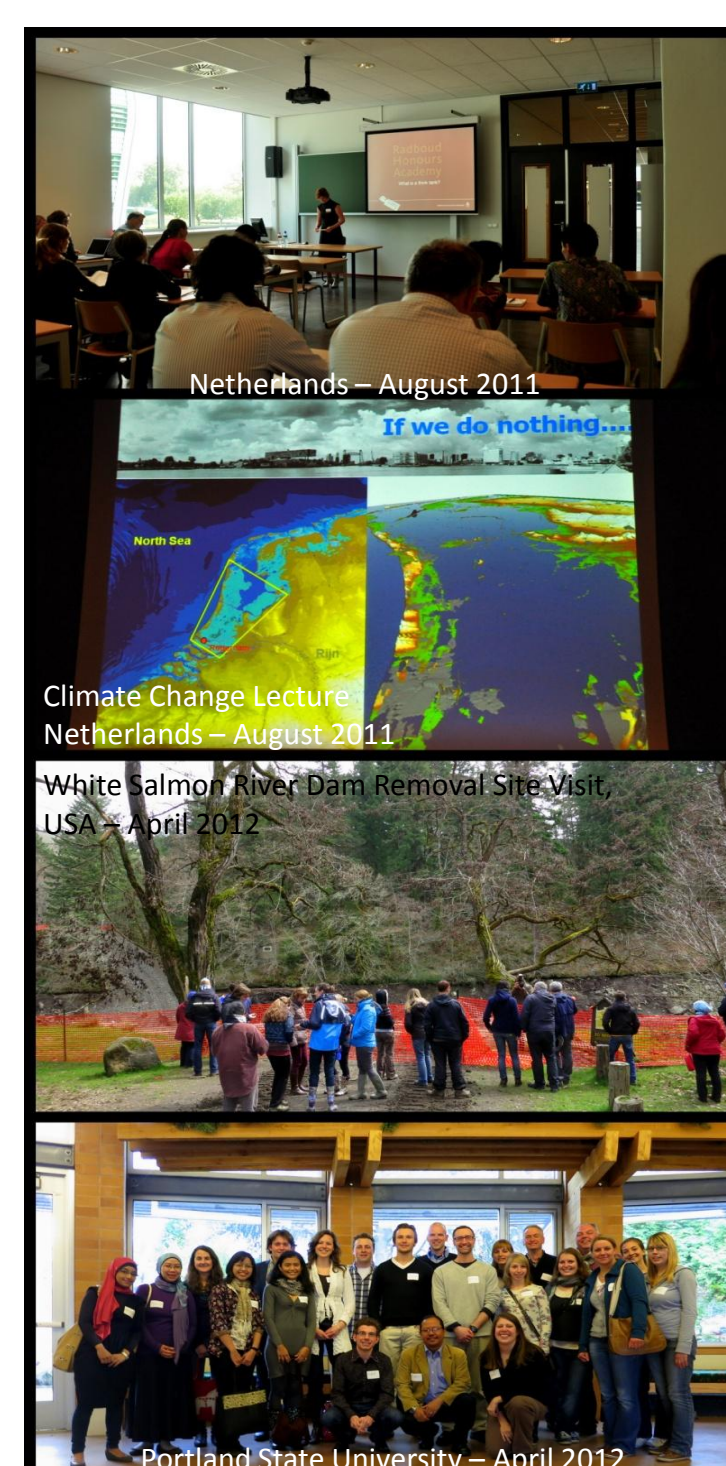
The primary sponsor and facilitator of this international student taskforce is Radboud Honours Academy (Radboud University Nijmegen, Netherlands) in partnership with Portland State University (PSU) and the PSU IGERT program (Portland, Oregon), along with 4 other universities including: Blekinge Tekniska Högskola in Sweden, University of Duisburg-Essen in Germany, Padjadjaran University Bandung in Indonesia, and Institute Technology Bandung in Indonesia. This project is proceeding in collaboration with the Delta Alliance, an international knowledge-driven network organization with the mission of improving the resilience of the world’s deltas.



The international taskforce is composed of 25 international graduate students from 6 different universities located in 5 different countries. The students represent a range of disciplinary backgrounds including: Environmental Science, Biology, Civil Engineering, Engineering Technology Management, Water Management, Urban Studies and Planning, Economics and Business, Anthropology, Behavioral Sciences, Criminal Law, Psychology, Cognitive Neuroscience, Medical Biology, and Strategic Leadership Towards Sustainability.

International Student Taskforce Process

Students gathered for a week-long workshop (August 2011) at Radboud University in Nijmegen, the Netherlands, where they were exposed to a range of water-related sustainable development issues. After the workshop, students continued to collaborate through the integration process via teleconferences, email, and web-based discussion board. In early April 2012 the international team gathered for a second week-long workshop at PSU in Portland, Oregon to finish the integration process. With the guidance of the Indonesian students, the taskforce theoretically applied the approach to a case study delta in Indonesia to identify possible issues and develop recommendations for future framework application. This process produced a generic sustainability framework document focused on illuminating and addressing the “wicked” complex problems and sustainable development issues faced in growing delta regions.



Water, Health, Economy Wicked Problems in Deltas

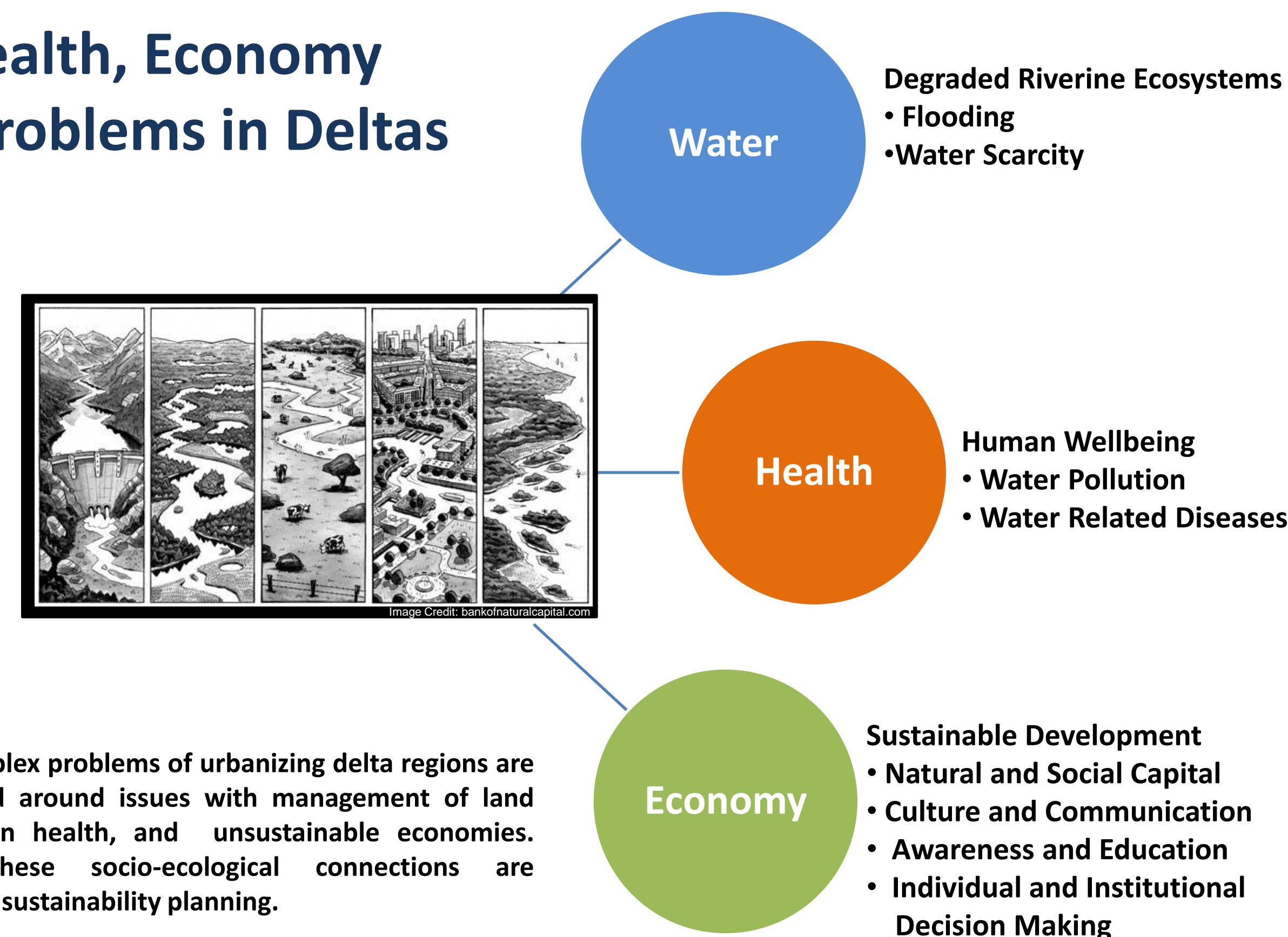


Figure 1: The complex problems of urbanizing delta regions are primarily centered around issues with management of land and water, human health, and unsustainable economies. Understanding these socio-ecological connections are essential to future sustainability planning.

Sustainable Framework Integration: Framework for Strategic Sustainable Development (FSSD) + Ecosystem Services (ES)

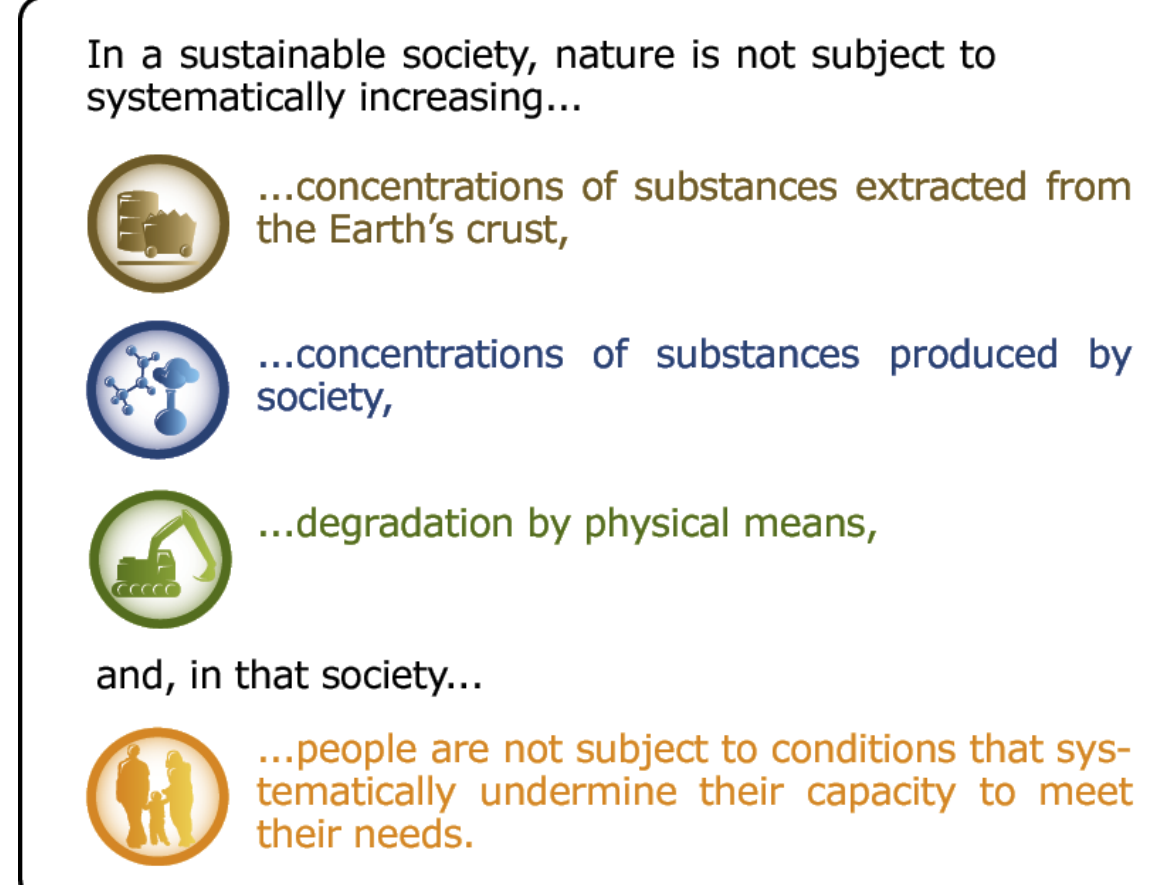


Figure 2: The FSSD 4 Principles of Sustainability. Source: <http://www.naturalstep.org/>

The FSSD (also known as The Natural Step) is an analytical and planning tool for engaging stakeholders in a sustainable planning decision making process. This strategic planning framework supports the development of actions that are aligned with sustainability as defined by the 4 sustainability principles (Figure 2). These principles allow one to assess whether an action/strategy will be sustainable or not. The FSSD provides a robust decision making process, with an explicit guiding definition of sustainability; however, it and does not provide metrics for issues like ecosystem vitality, or other factors involving economic, social, environmental, or cultural sustainability impacts.

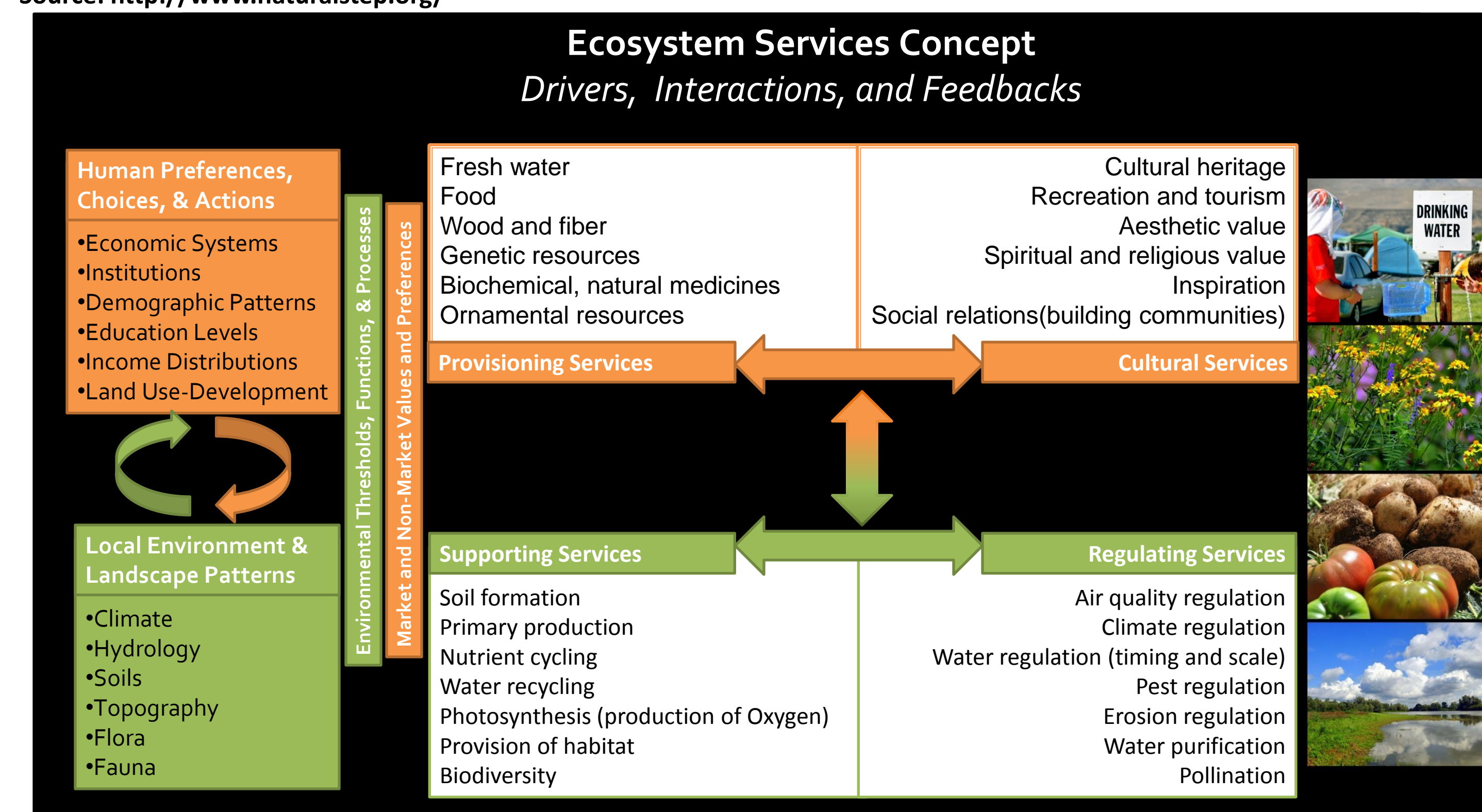
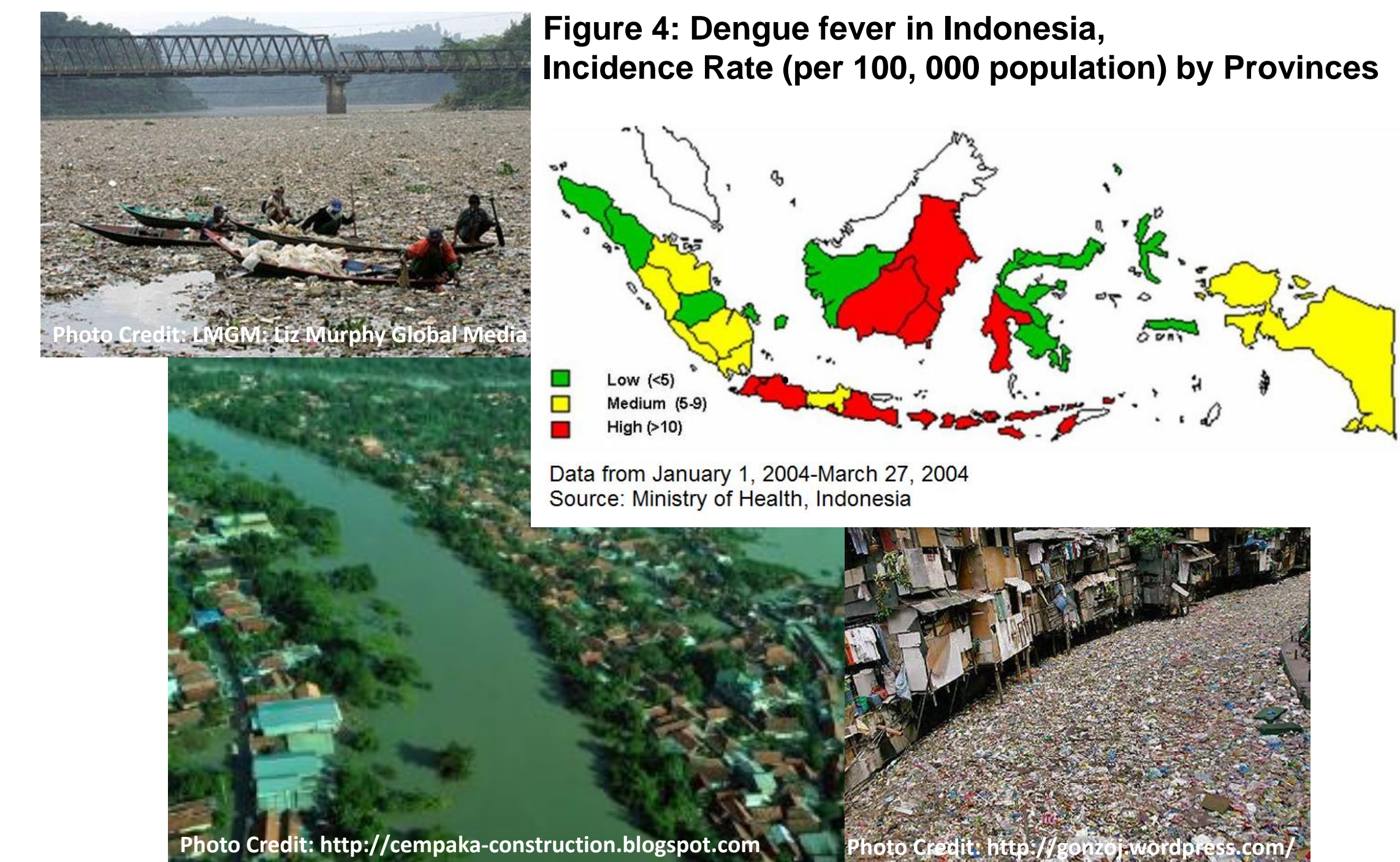


Figure 3: The ecosystem services concept shown coupled with the biophysical and socio-economic drivers (interactions & feedbacks) of environmental change (thresholds, processes, functions) and ecosystem service demand and valuation. Figure concepts adapted from the Millennium Ecosystem Assessment (2005) and Carpenter et al. (2009).

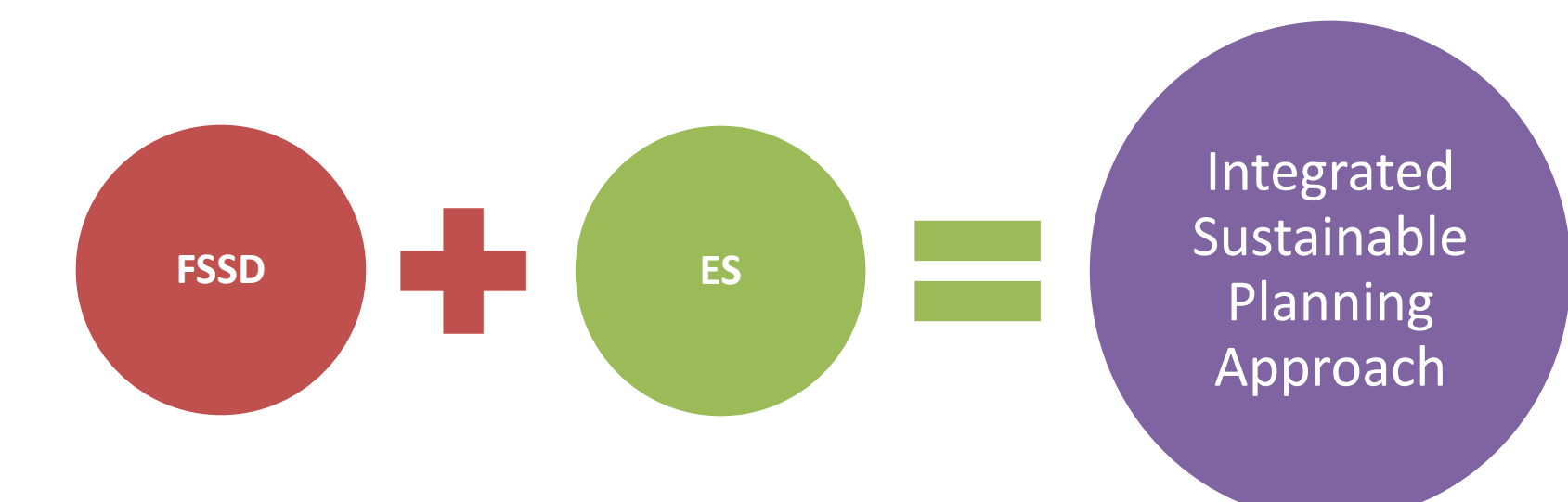
ES is a conceptual framework that provides a cross-disciplinary language to describe the essential services provided to humans by ecosystems. These services include direct services such as food, fiber, and water, as well as indirectly employed services such as nutrient cycling, water filtration, and climate regulation (Figure 3). The ES framework can provide a holistic summary of ecosystem service trade-offs and aid in the operationalization of the FSSD's sustainability principles for more comprehensive sustainable development decision making. Combining the ecological and system-orientation of ES with the well-developed decision-making and planning process of the FSSD results in a powerful tool that can be applied to the multidimensional problems facing urban river deltas worldwide.

Application: Indonesian Case Study Citarum River Delta



The Citarum River Delta, 269 km long and draining an area of 6.080 km², is one of the largest rivers in Java Island. It originates from Mt. Wayang (1700 m) and flows through the middle of the western part of the island before flowing out into the Java Sea. Water pollution in the form of domestic sewage, industrial effluents, agricultural runoff, and solid waste polluting surface and groundwater are all serious issues in this Indonesian Delta. In addition to pollution, water related diseases such as Dengue Fever are also a serious threat to community well-being and individual health in this region (Figure 4). These water quality and health issues are wicked problems that require a multidimensional social, economic and ecological approach for development of sustainable solutions.

Conclusions-Recommendations



Health issues, and especially waterborne diseases, play a large role in urban delta regions. It should be understood that human health issues are closely interwoven with other complex problems, and diseases are often caused or spread as a result of other processes. To create true sustainable development in urban delta regions, measures must be taken to protect sensitive ecosystems from urban pressures. The ES concept can be a useful way of analyzing and addressing these important characteristics of deltas. Therefore, it is recommended that an integrated approach be taken; ES can be used as operational language within FSSD, increasing the understanding of the immense importance of delta ecosystems for human inhabitants. ES can also be used to demonstrate to policy makers the potential benefits of a sustainable development projects that preserve ecosystems and the services they provide. This integrated approach will be taken in October 2012 on the ground in Indonesia with the cooperation of students and stakeholders to create a sustainable plan for reducing waterborne disease outbreaks in the Citarum Delta.

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