Consultation document signalling new horizons for

Future Earth – Coasts

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Cover: Fisher families in Mamallapuram, India. Photo: Ellen-Barbe Goldberg.
Page 5: Delegates of the 2011 LOICZ Open Science Conference, Yantai, China. Photo: Marcus Lange.
Vision

The Future Earth - Coasts' vision is to support transformation to a sustainable and resilient future for society and nature on the coast, by facilitating innovative, integrated and impactful science.
Future Earth – Coasts

Future Earth – Coasts stems from 20 years of Land-Ocean Interactions in the Coastal Zone (LOICZ), an international programme that functioned as a facilitator of collaborative, interdisciplinary and sustainability oriented research on the world’s coasts conducted under the auspices of the International Geosphere Biosphere Program (IGBP) and the the International Human Dimensions Programme (IHDP).

Future Earth – Coasts is part of a wider global initiative called Future Earth. This initiative is sponsored by a consortium of international scientific and development organizations and will bring together many programs operated formerly by IGBP, DIVERSITAS, the IHDP and the World Climate Research Programme. The main objective of Future Earth is to develop the knowledge for responding effectively to the risks and opportunities of global environmental change and supporting transformation towards global sustainability in the coming decades. Future Earth will mobilize thousands of scientists while strengthening partnerships with policy-makers and other stakeholders to provide sustainability options and solutions in the wake of Rio+20. Future Earth – Coasts is setting out to become one of 30 global environmental change projects under the Future Earth umbrella.

1. Why are coasts important?
• Coasts around the world are cherished as places of enormous ecological, cultural, social

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1 Future Earth is sponsored by the Science and Technology Alliance for Global Sustainability comprising the International Council for Science (ICSU), the International Social Science Council (ISSC), the Belmont Forum of funding agencies, the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the United Nations University (UNU), and the World Meteorological Organization as an observer.
and economic significance sustaining about 50% of the world’s population in a narrow interface between land and sea. They are the ‘laboratory’ in which we will need to experiment with new ways of living in the Anthropocene. There exists a need to learn from the past and secure resilience and adaptive pathways that transition out of business as usual towards sustainability; the coast is where this global endeavor will be won or lost.

- Coastal zones are the front-line of the struggle for global sustainability. Arguably the most transformed and imperilled social-ecological system on earth, coasts are characterised by pervasive unsustainable practices.
- The Low Elevation Coastal Zone (LECZ) constitutes 2% of the world’s land area but contains 10% of world’s population (600 million) and 13% of world’s urban population (360 million) based on year 2000 estimates.
- About 65% of the world’s cities with populations of over 5 million are located in the LECZ.
- The global population exposed to the 1-in-100 year extreme sea level (i.e. the sea level that has a 1% chance of being exceeded every year) has increased by 95% from 1970 to 2010 with about 270 million people and 13 trillion US$ worth of assets being exposed to the 1-in-100 year extreme sea level in 2010.
- About 44-48% of global economic activity is generated in the coastal zone. Major economic activities in the coastal zone include business and finance, industry, transportation and communication, energy production, shipping, fisheries, and tourism.
- The coast contains unique and sensitive ecosystems of great natural and economic value and is home to numerous endangered species.
- Human and natural systems in the coastal zone are threatened by human activities, natural hazards, and climate change.

2. Setting the agenda for Future Earth – Coasts
Future Earth – Coasts aims to deliver a new ten-year global programme of research to harness the knowledge required to address the risks and opportunities arising from global coastal change. The views expressed by all stakeholders with
Our APPROACH to developing the Science Plan for Future Earth – Coasts between now and December 2015 is to:

1. Chart a new landscape for science and technology that will help society anticipate and adapt to global coastal change.
2. Distinguish Future Earth – Coasts as a global leader in producing policy-relevant tools and information needed for sustainable ecosystems and human development on our World’s coasts.
3. Deliver a transformational approach to engaging stakeholders in the design and guidance of science planning at the global and regional levels around the world.

2.1 Charting a new landscape for scientific

endeavour to address critical global coastal change problems

In accordance with the structure of the emerging global sustainability science, the new landscape for our scientific endeavour is reflected in three inter-related key themes:

Theme 1 - DYNAMIC COASTS
Theme 2 - HUMAN DEVELOPMENT AND THE COAST
Theme 3 - PATHWAYS TO GLOBAL COASTAL SUSTAINABILITY

DYNAMIC COASTS: Recognizing that the world’s coasts are ever-changing, despite a widespread hope for stability and predictability, it is imperative to build capacity to measure, comprehend, and adapt to coastal change and to recognize potential thresholds in the coastal system. This entails an understanding of the physical, chemical, and biological processes and fluxes that define coastal dynamics, and the role of human activities in these changes. We need to know comprehensively how coastal social-ecological systems operate, how they generate goods and services for human use, and the implications of human-driven degradation of the system within a wide range of scales and processes. At the global scale, for example, climate change, ocean acidification, and sea level rise are already affecting critical life-support services of the world’s coasts. Examples of climate-sensitive coastal service-providers include coral reefs, the world’s largest natural coastal defence protection structures and major incubators of biological productivity, and high-latitude sea ice, which plays a vital role in shoreline protection and subsistence access to marine food resources.

HUMAN DEVELOPMENT AND THE COAST: The overall objective within this theme is to
improve understanding of the consequences of human activity on coastal systems and how human systems can be sustained without adversely affecting the resilience of and services provided by coastal ecosystems. An important element of sustainability science is a framework within which essential elements of and constraints to sustainable development can be analyzed. It is likely that sustainable development will be difficult if not impossible for some areas of the earth; some coastal systems, deltas for example, already appear to be operating at or near threshold levels in terms of human use and habitability. It is critical that human development issues be considered in future coastal development planning. Alternative models for global development and our coasts are needed so that human ingenuity and technological innovation in areas such as marine renewable energy, managed coastal retreat, and sustainable fishing techniques can be harnessed to minimize the consequences of overexploitation.

PATHWAYS TO GLOBAL COASTAL SUSTAINABILITY: Transformative change is necessary to transition towards safer, more resilient and sustainable pathways that enhance global coastal sustainability. Realising such change necessitates critical reflection on prevailing practices, institutional structures and processes, including consideration of the interconnected ethical, cultural, political, social, economic, institutional, technological and behavioural dimensions of coastal development. There is a compelling need for new approaches to research and wider knowledge building that transcend disciplinary boundaries and the barriers between science, policy and practice. In this, research needs to delve into the root causes and drivers of individual, group and societal choices that foster unsustainable outcomes and maladaptive practices in the coastal realm, and deepen understanding about the limits, barriers and opportunities to transitioning towards coastal sustainability in the face of change, turbulence and surprise.

2.2. Distinguishing Future Earth – Coasts as an international leader in producing policy-relevant tools and information needed for sustainable ecosystems and human development on our world’s coasts.

Certain territories are subject to rapid and fundamental global change effects. Along much of the earth’s coasts, a warming climate and sea-level rise are already negatively affecting natural ecosystems and human communities. The impacts of global change such as these are intensely felt by small-island States, along Arctic coasts, at river mouth deltas, and in urbanised coastal zones. The LOICZ project previously recognised the need to focus attention on these hotspots of coastal vulnerability and to produce policy relevant tools and information such as seminal assessments of coastal seas as net sources or sinks of atmospheric CO2, river discharge to the oceans, and guidelines for coastal resources assessment and biogeochemical modelling.

Future Earth – Coasts provides an opportunity to build on the legacy of LOICZ by inculcating existing products (such as coastal typologies, the LOICZ Biogeochemical Budgets Model, and governance baseline assessment methods), in the development of new knowledge of the following four hotspots for coastal research: -

1. River Mouth Systems: River mouth systems such as deltas and estuaries generate high levels of economic value for humanity. They are at risk from a loss of fresh water and sediments associated with dams, seawater intrusion into
ground water, ground water extraction, climate change, acidification of estuaries and intensifying anthropogenic activity which increases the fluxes of nutrients and contaminants with as yet largely unknown effects and ecosystem and human health.

2. Small Islands: Small islands are vulnerable to global climate change impacts including extreme events, sea-level rise and the threat of consequent seawater inundation, population pressure and issues of diminished ecological diversity e.g. in coral reefs, and mangroves. Island communities require transformational approaches to deal with a decreasing and degrading terrestrial and marine resource base. Small island issues can, in many ways be regarded as the early examples at a smaller spatial scale of challenges such as freshwater scarcity and degraded ecosystems that the economy depends on that will have to be dealt with along global coasts.

3. Urbanised Coastal Zones: Urbanisation and climate change are arguably the two most significant pressures shaping human well-being and ecological integrity today, with a concentration of issues often found in coastal megacities. Global assessment of science on coastal urbanisation and environmental change will help to better define the cutting edge of integrated research and identify critical gaps in knowledge.

4. Arctic Coasts: As the ice disappears and permafrost melts, altered hydrological and sediment cycles impact on the traditional lifestyles of Arctic communities. Vulnerable Arctic communities require research to identify factors affecting their resilience and to design adaptation strategies for global change impacts.

2.3 Delivering a transformational approach to engaging stakeholders at the global and regional levels around the world:

A defining characteristic of Future Earth – Coasts, is the genuine desire to develop a ‘social contract’ with key stakeholders who have a vested interest in coastal issues at the global and regional levels. It is envisioned that this social contract will enable
scientists to work with key stakeholders to secure trust and secure the legitimacy required to pursue policy relevant research, whilst providing decision takers with an opportunity to participate in and steer the course of a forward looking, major international frontier research initiative.

This social contract will be enabled through the development of a transformative knowledge network with three highly interconnected components:

1. The engine for Future Earth - Coasts will be a Scientific Steering Committee (SSC) consisting of 15 world class coastal experts, selected to drive an ambitious framework for research and assessment at the global and regional levels, and to function as an exemplar for trans-disciplinary research in practice.

2. An embedded and empowered network of Regional Nodes (RNs) will shape, coordinate and promote Future Earth - Coasts science in North America (Louisiana), South Asia (Chennai, India), Southeast Asia (Singapore), East Asia (Yantai, China), South Europe (Portugal), and Latin America (Brazil). Operating guidelines will be defined and new nodes will be added to provide better global coverage of coastal issues.

3. At the same time, structures for Stakeholder Advisory Councils (SACs) will be developed. Stakeholders will be drawn from representative groups across government, industry, academia, funding bodies and civil society at global and regional levels.

Unlocking the potential of the Triple Helix between SSC, RNs and SACs demands innovative research and practices that ‘think outside of the box’ – with new modalities of trans-disciplinary, policy oriented research to complement the more traditional disciplinary approaches. The new modalities that will characterise the next generation of global coastal science will be centred on the principles of co-design and co-production of knowledge:

**Co-design** of research refers to the planning of research agendas, to the establishment of what questions will be addressed. Co-design and scale are linked in an important way. The challenge for Future Earth – Coasts is to balance stakeholder interest, usually expressed at the local and regional levels, with the need to create more effective inputs into the development of relevant research at the global level, to better deal with the biophysical and human dimensions of the Anthropocene. Examples of research questions that may arise from a co-design of research with stakeholders are:

- How do river catchment activities such as damming and deforestation affect mass, nutrient, energy and sediment fluxes to coasts?
- What are the major indicators for the sustainability of different types of coastal social-ecological physical systems (e.g. deltas, small islands, megacities, mangrove or reef coasts) globally?
- What are the mal-adaptations, unsustainable behaviours, social norms, habits, attitudes, etc., that are affecting coasts globally and what are the barriers to doing things more sustainably?
- How can indigenous/traditional ecological and other forms of non-academic knowledge help in sustainable and wise use of coastal resources?
- How will coastal human communities
and economic sectors be affected by sea level rise, ocean acidification, eutrophication, and other biophysical changes in the marine realm?

- What are the indicators that help us measure the impacts of human and biophysical influences on coasts?

- What are the tipping points in the vulnerability of hotspots such as deltas, arctic coasts, islands and megacities on the coast?

**Co-production** of knowledge relates to the principles and processes according to which research questions and agendas are addressed. In Future Earth - Coasts this will mean that Regional Nodes develop as platforms for agenda-setting which involve the fullest possible range of regional coastal stakeholders. Inter-node networking and effective linking to global expertise (in the SSC) are then to co-produce global trans-disciplinary coastal research.

### 3. Next Steps

This Signpost document signals the development of a robust, iterative and long-term engagement process, involving funding bodies, practitioners, policy makers, scientists, NGOs and industry groups, to shape the Future Earth – Coast Agenda from 2016 to 2026. The next steps will involve a process design activity to identify key stakeholders that can help to:

1. Define and prioritise key research questions to validate and identify the need for key science outputs such as global assessments and tools for regional decision making (co-design).

2. Build capacity to enhance the implementation and progress of research activities by leveraging different forms of relevant non-academic knowledge (including tacit knowledge; direct system user knowledge, management knowledge and others) and by monitoring milestones, relevancy and innovation (co-production).

Key milestones to be delivered between now and 2016 will be:


3. Memorandum of Agreement and transition into Future Earth.

4. First inter-node workshop, India, December 2014 – (Human influences and interactions in biogeochemical cycles of coastal and shelf waters).

5. Publication of Future Earth – Coasts Agenda, by December 2015.

For further information on how to be a part of our vision to support transformation to a sustainable and resilient future for society and nature on the coast, by facilitating innovative, integrated and impactful science, contact: loicz.ipo@loicz.org or see www.loicz.org

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