CONCEPTUAL CHALLENGES IN TRANSDISCIPLINARY STUDIES OF COASTAL ZONE MANAGEMENT

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The coastal zone, however defined, is the critical active transitional interface between terrestrial catchment and marine biophysical systems. Broadly, the coastal zone represents the interface point of very different systems and integrates a broad range of socioeconomic and biophysical components into a transdisciplinary management context.

Cultural context

For humans as terrestrial creatures life on land is normal. Coastal environments with freshwater flows and alluvial soils are attractive places and for most of the time benign.

The land

We take for granted the elaborate life support systems needed to maintain moist cells in a harsh environment. Our world is largely a two dimensional surface - the top few meters of the Earth's surface, with unidirectional linkage of water flow down catchments. The third dimension overlying the surface sustains no permanent life but can support migrating or wind driven species, pollen, seeds and spores. Many sites and ecological communities are tightly defined by soil type and effectively isolated by their catchment or artesian water regime and may have high levels of high endemism. Equally, soil types and water regime define or limit the purposes for which land may be used although to a considerable extent what occurs on one soil type has little influence on another nearby. Geodetically defined boundaries, fences and gates give meaning and an appearance of permanence to property – good fences make good neighbours.

The Sea

Against that terrestrial normality and the marine environment is culturally strange, "infinite", "inexhaustible", often threatening but a source of resources for the bold and energetic. Our cultural and governance concepts evolved taking the productivity of nearshore waters for granted - "plenty more fish in the sea". The concept of human activity affecting the seas beyond local impacts was absurd so we took for granted the capacity of the sea to remediate the wastes of terrestrial life - "just a drop in the ocean" or "the solution to pollution is dilution". We modify land and watercourses and build structures in areas that are vulnerable to the extremes. We imply a degenerate marine environment when we talk of "reclaiming" land by mechanically alienating marine habitat.

The coastal zone is, therefore, jurisdictionally complex and characterised by issues where the interrelationships of benefits, costs, responsibilities and consequences of environmental risk management are complex, challenging and poorly understood.

Fences, jurisdictions and sectors

When we come to management of marine and coastal areas the relevance of geodetic boundaries defined in relation to the land or seabed surface, the permanence of property and the functionality of fences is brought into question. We know this from the geological record of ice age sea level dynamics, from historic and legendary accounts subsiding coastlines and of great storms. . But in the time scales and priorities of human decisions in political and financial cycles securities it is possible to set aside the longer term risk and treat the shorter term consequences as emergencies.

The shifting boundaries and transboundary impacts of marine systems on terrestrial system create wicked problems. They call into question the utility of governance systems based on separation of jurisdictions, property, functions and sectoral management with very limited cross-sectoral accountability. In most coastal systems there is a separation on marine and terrestrial functions. On the seaward side internal waters and the old 3 nautical mile territorial sea are under state/territory jurisdiction and agency management. Beyond that marine matters are under Commonwealth jurisdiction but with many functions carried out by states/territories. On the landward side local government within state/territory jurisdiction. All of these are complicated by the costs of managing the expected impacts of climate change and continuing coastal population growth (see Table 1).

Table 1. Example of complex issues involved in managing the coastal zone.

- The squeeze of local government.
- The enduring challenges of providing capital and maintenance services – roads, rates, rubbish, water cycle, urban infrastructure.
- Ratepayer and state/territory government resistance to increases to pay for service.
- Books balanced by green field new development or intensive re-development that increase the ongoing demands for levels of service.
- Dealing with risk, values and vulnerabilities. Beachfront and near beach properties attractive, valuable but vulnerable. But acknowledging the vulnerability affects the value.
- The biophysical science. To what extent can it define needs, constraints and opportunities for policy options?
- Some precise local studies needed to refine local understandings but overall the long term outlook is reasonably clear, but the short and medium term.

Coastal land areas are increasingly vulnerable to impacts and incursions of seawater as a consequence of expected effects of climate change (Climate Commission 2011). Despite the noise, the expectation of a rise in sea level of at least 1 meter by 2100 is supported by solid, validated, science. Seawater is 800 times as dense as air. It can flatten fences and walls and can carry large volumes of materials from sediments to wreckage and change coastlines. Is chemistry, particularly its salinity, can seriously affect the ecology and productivity of soil and freshwater regimes. The consequences are predictable, the risk is increasing.

The expected consequences of sea level rise and increased frequency and intensity of severe storm events increase the importance and urgency of managing human activities and impacts in and affecting the coastal zone. At the practical level, challenges facing the future of the world's urban metropolitan areas, particular those located in coastal areas, are enormous. In Australia, increases in rainfall periods, coastal erosion and liability issues associated with the protection of private and public assets have proven to be a complex issue. Recent coastal erosion in many parts of the New South Wales state and the

massive flooding in Queensland have affected the liveability of societies by affecting their transport infrastructure, electricity supply, food delivery, among others, causing disruption of people's life and loss of public and private assets. At all policy levels from federal to local, governments, decision-makers and citizens are of great need of adaptation and mitigation strategies that will support them to better prepare for impacts of climate change.

Managing the coast and, consequently, sea level rise is about managing people's behaviors, expectations, responses and actions. There is no question that, to succeed, we will have to adapt and prepare to respond to predictable and possible climate related events that will affect our livelihoods. Better and smart infrastructure and other essential services are critical priorities for growing coastal nations such as Australia. Management strategies such as those addressing temporary or permanent coastal protection will be essential to support adaptation measures for local communities, natural environment and economic assets. Preparing to manage these risks and to take decisions to invest in protection or retreat', has become a key topic and challenge to decision-makers and coastal communities. We may be able to manage what people do to slow and stabilise sea levels and how we respond to it. The problem is social understanding, acceptance and response.

The challenge is transdisciplinary and conceptual given the fact that same words might possess different meanings according to different disciplines. As institutional and social barriers, conceptual barriers such as inept analogies, metaphors and models used by academics and professionals constitute key reasons for lack of collaboration between scientists and practitioners (Lawrence 2010). Within the current planning scenario in which incorporation of sea level benchmarks in coastal risk assessment has become a major priority, conceptual challenges such as 'liability' and acting in 'good faith' are being questioned. Even the concept of whether we should refer to 'coastal zone' or 'coastal area' has not yet reached a consensus due to implied meanings associated both words (Kay and Alder 2005). Discussion has focused on the fact that 'zone' might relate to geographically defined planning zones that become dominant part of the coastal management process. Such approach might not be appropriate for developing countries which usually equate coastal zone with land-use or marine park zoning. Scientific definitions based on, for example, measurement of the coast which can include catchment-related or marine-related physical processes affect the boundary zone between the sea and the land are considered on the core reasons for the variation in coastal definitions (Harvey and Caton 2003).

At the policy level, scientific definitions based on processes are not usually practical for management purposes so political definitions are designed to fit its own purposes for defining the coast (Harvey and Caton 2003). For example, at the Commonwealth government's level, coastal zone is defined as 'The boundaries of the coastal zone extend as far inland and as far seaward as necessary to achieve the policy objectives, with a primary focus on land/sea interface (Commonwealth of Australia 1992, p.2). At the State level, this definition varies substantially across States. In New South Wales Coastal Policy 1997, the coast is defined as: 1) 1 km coastal strip landward of the open coast high water mark, 2) a distance of 1 km around all bays, estuaries, coastal lakes, islands and tidal waters of coastal rivers, excluding the Greater Metropolitan Region, and the urban areas of Newcastle, Central Coast and Sydney. In Western Australia, the Government Position Paper 1983 defines coast as 'coast waters to a depth of 30 m, reefs, estuaries, tidal rivers and land which is presently subject to coastal processes such as mobile sand dunes, areas inundated by storm surge and vegetated foreshore areas exposed to onshore winds.' Again, in both States the coast is defined according to its biophysical components not explicitly addressing the management context which is framed by people's concepts,

values and behavior.

A core challenge in transdisciplinary discussion is that the use of specific words or language can have very different contextual meanings between and even within disciplines. Examples include: governance, integration, conservation, zoning, protected area, vision, goal and objective. For example governance may refer to substantially different operational contexts ranging from the formal processes of constitutional government and law; through the operational context of business commerce and operational management; to a range of formal, semi formal or informal processes of communities or groups within civil society. The "correct" use for one discipline or context may quite different from that in another. A profession or discipline tends to have accepted, internally understood terminologies and acronyms that are not necessarily understood, or may even have different meanings for "outsiders" (Figure 1).

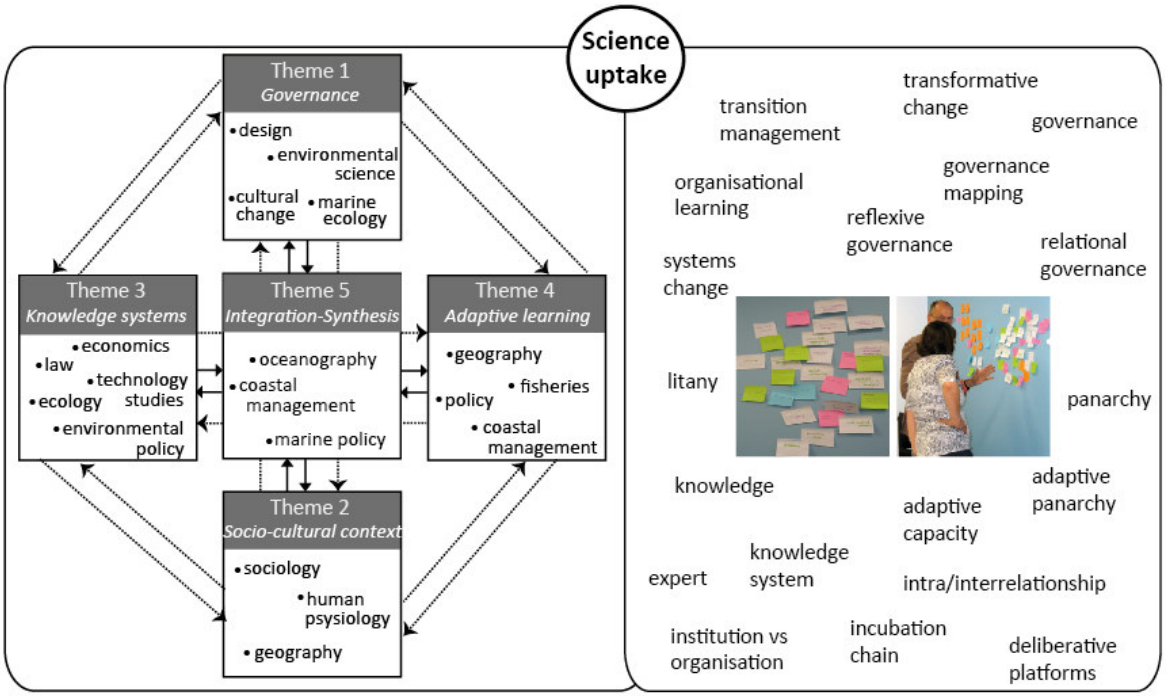

Figure1. Diversity of professions/disciplines (left quadrant) that integrates the Coastal Collaboration Cluster initiative[1]. Example of contested terminologies (right quadrant) identified during an integration workshop conducted with Cluster academics on February 2011 in Wollongong (NSW).

The challenge for effective integration is to achieve a framework for mutual understanding and clear expression of meanings between disciplinary groups and communities seeking to share information in coastal planning and management.

[1] The Coastal Collaboration Cluster is a major three-year research program aiming to develop approaches to better connect science with the needs of governments, communities and industries to meet coastal challenges. The Cluster unites diverse research capabilities across seven universities (Curtin University of Technology, Deakin University, Flinders University, the University of Adelaide, University of the Sunshine Coast, University of Tasmania, University of Wollongong) and CSIRO. The Cluster is composed of five governance, socio-cultural context, knowledge systems, and adaptive learning. The various themes will be integrated by a keystone Theme: integration, analysis and synthesis.

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