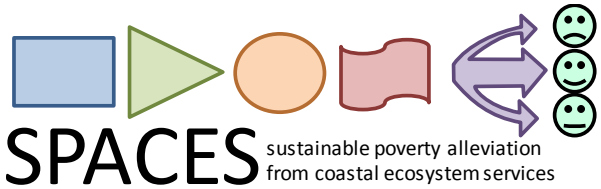

Sustainable poverty alleviation from coastal ecosystem services (SPACES): Investigating elasticities, feedbacks and tradeoffs

Project details

Underlying rationale

The Millennium Ecosystem Assessment highlighted the role of ecosystem services (ES) for human welfare (MA 2005), The poor's wellbeing is in particular often reliant on ecosystems, for example for their food, physical security or livelihoods (Duraiappah 2004, Bizikova 2011). Whilst the concept of wellbeing has become increasingly central to research and policy on ES, and sustainability generally (IISD 2011, Duraiappah et al 2012), significant gaps still remain in understanding of how ecosystems actually contribute to wellbeing, and thus poverty alleviation (Butler and Oluoch-Kosura 2006, Carpenter et al. 2006, 2009). The relationship between ecosystems and human wellbeing is thus neither direct nor simple. For example despite the linkages inferred by the ecosystem service concept, improvements in wellbeing sometimes accompany degradation of ecosystems. This so-called 'environmentalists' paradox' (Raudsepp-Hearne et al 2010) suggests a variable 'elasticity' within some ecosystem services, such that ecosystems and wellbeing are only loosely coupled. Understanding this elasticity is important, as it suggests that wellbeing benefits from ecosystem services, and their contribution to poverty alleviation, may be enhanced or undermined by interventions or evolving contexts.

Approach

SPACES has a three-pronged approach focussing on

1. *Understanding the complex and elastic relationship between ecosystem and wellbeing outcomes* (ES – WB chains);

We will unpack and empirically examine ecosystem wellbeing relationships using a novel conceptual model of ecosystem-wellbeing relationships. We will empirically test this framework for different ES in different contexts, giving attention to the elements that link ecosystem processes to human wellbeing, determinants of elasticity in this linkage, and how they are shaped by a range of ecological, social, political and economic factors. This aims to identify potential levers for improving ES contribution to poverty alleviation.

2. *Identifying feedbacks and the implications of these for social-ecological system trajectories*

We will draw on a range of data, and models including partner and stakeholder expert knowledge to produce site-based, holistic and dynamic understanding of the way in which

relationships between social, economic, ecological and institutional factors generate system feedbacks that can prevent or enable change.

3. *Highlighting and dealing with trade-offs*.

By examining the linkages between multiple ecosystem services that benefit different people in different ways, we aim to explicitly elucidate critical trade-offs that may not be apparent from linear or narrowly-focussed analysis, but that must be understood if interventions are to achieve long-term sustainable poverty alleviation.

Conceptual framework

Our empirical research is guided by a conceptualisation of each ecosystem service as a chain of six connected elements that determine how people's wellbeing is affected by ecosystem change (Figure 1 a-f). The links between each element are affected by five *'multipliers'* (i-v) and thus determine elasticity. We specifically define each element and multiplier for the purposes of studying the poverty alleviation potential of ecosystem services:

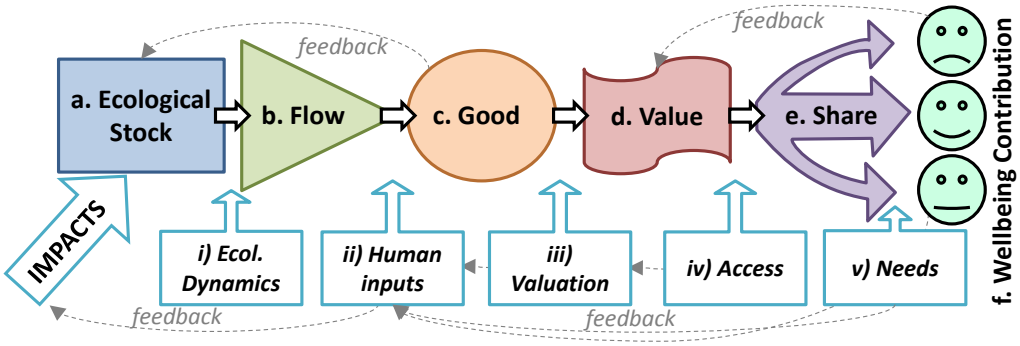

Fig 1. Conceptual framework showing an ecosystem service as a chain of elements (a-f) linked by 'multipliers' (i-iv), that determine elasticity between ecological change and wellbeing. See text for definitions

We **define 'Stocks' (a)** as the condition, volume or diversity of the natural ecosystems underpinning the service, analogous to 'natural capital', and 'supporting services'. Stocks are affected by impacts at different scales, that may be related to other parts of the chain (e.g. exploitation of the good) creating feedback, or external to the chain such as climate change. **'Flow' (b)** is the biophysical processes that is potentially useful for humans, analogous to Mace et al's (2012) 'final service'. Flow is generated from the Stock according to **Ecological Dynamics (i)**. Stocks and flows are frequently and problematically confused (Vira and Adams 2009) when in fact they have a complex and multifaceted relationship between them (Mace et al 2012). **Good (c)** (sensu Mace et al 2012) is the result of humans utilising or capturing flow. Goods result from the interaction of biophysical flows and **Human Inputs (ii)** such as labour, capital, and presence of people benefit from them. Societal process of **Valuation (iii),** such as the nature of markets or cultural norms about palatable food, determine the aggregate **Value (d)** of a good, which reflects its aggregate potential contribution to wellbeing (rather than individually held values). Value will be defined for each ES depending on how the poor potentially benefit. For example, for traded ES that produce cash benefits, market prices indicate value in terms of potential earnings from that good. For ES that are directly 'consumed' by the poor, value can be indicated by non-economic metrics, such as the nutritional quality of food or the number of families protected by a regulating service.

Stocks, flows, goods and value (a-d) are aggregate quantities with no consideration of the identity of beneficiaries. The chain is then explicitly disaggregated with the recognition of different **Access (iv)** of individuals or groups which determines their **Share** (e) of the

aggregate value. Access is includes a range of institutions, laws, norms and structures (such as class, gender, ethnicity) that determine access (Leach et al 1999, Coulthard 2011, Ribot and Peluso 2003:153). The final element in the chain is the **Wellbeing contribution (f),** which reflects how an ES *translates* into *wellbeing outcomes* based on individual **Needs** (v) and the degree to which these are met by their share of ES value. The term 'Needs' is used here to include both objectively measurable basic needs, as well as people's values, aspirations and goals that determine what they need to subjectively enjoy a satisfactory quality of life. We will draw on the framework of Gough and McGregor (2007) to assessing ES contribution to both of these dimensions of wellbeing.

Interaction between elements in the ES chain create feedbacks. For example harvest of goods (c) has direct impacts on ecosystem stock (a), while access (v) at an aggregate scale determines the human inputs (ii) the volume of goods and services produced (f). The linear arrangement aims to clarify data collection and maintain focus on the connection and elasticities between ES and wellbeing. Having teased apart the linkages between ES elements, we will then consider how multiple chains are connected and embedded within particular social ecological systems. This broadens our focus to holistic, system-level processes, including multiple, interdependent ES with synergies and tradeoffs, feedbacks and the effect of the governance context (see section on 'system analysis').

Study sites and context

Research will be carried out in four areas, two each in Kenya and Mozambique, which include both mangrove and coral reef ecosystems. In Kenya these are Vanga, (including Vanga town and Shimoni), and Mombasa (including Mwache Creek and Bamburi Beach). Mozambique sites are Olumbe and Pemba City (Cabo Delgado District).

These sites are highly relevant investigating how changing governance arrangements, market integration, environmental and demographic change affect elasticities, feedbacks and tradeoffs.. Both countries have high national poverty rates (approx. 55%), with 57% of the Kenyan coastal population classified as very poor (Kenya State of the Coast 2007). Furthermore, both countries are moving towards decentralized governance structures. In Kenya a new constitution was promulgated in 2010 shifting governance from a centralized system to a devolved system where power is vested in the counties. This affects management of natural resources since decisions will now be made and actions implemented at the county level, closer to resources and the people dependent on them. Similarly, in Mozambique national policies and legal frameworks encourage decentralized management of natural resources, including mechanisms for community engagement in management of fisheries and related resources. Examples represent the establishment of Community Fisheries Councils (CCPs) (Moz) and Beach Management Units (BMUs) (Ken), as well as forestry associations (CFAs). While devolution of power has begun and policy-level support exists, the governance arrangements, i.e. the rules, regulations and responsibilities of different actors in resource management, are not yet finalized making the timing of this project opportune for linking our research to impact partners and ongoing processes.

Furthermore, in the last 50 years modern equipment and new fishing methods, including nylon lines and shark nets, have been introduced in the region leading to an unprecedented increase in the quantity and value of fish sold (Wamukota et al in review). The last few decades have also seen increasing market integration for fisheries products. For example, in Kenya, octopus and Kingfish, which are both locally consumed goods, are increasing sold to tourist establishments, and for export markets, with local prices of octopus increasing rapidly as a result (Wamukota et al in review). This shows the importance of studying the interaction between such larger scale process as market globalization and flow of benefits from ES to

poor people at local scales. In Mozambique export markets are increasingly reaching remote fishing communities through small- to medium scale traders (MASMA Migration Project). Other economic development is also likely to affect elasticities and feedbacks to create novel tradeoffs. For example, Pemba, one of our Mozambique sites, is emerging as the hub for oil exploration off the Mozambican coast, with two refineries planned in lands currently occupied by local communities. This development is already affecting the structure of the local economy and prices of local commodities.

Finally, demographic change can affect how people value and interact with their natural resources, thus affecting the ES-wellbeing relationships under investigation. Kenya and Mozambique follow the general trend for Sub-Saharan nations, with rapid rates of population growth in recent decades, and effects on demographic age structure (UNEP 2006). But Vanga (Ken) and Olumbe (Moz) are both located close to national borders and are experiencing significant cross-border migration, which translate into new and at times contested claims to natural resources, locally increasing pressure on resources, and complex tradeoffs between environmental stewardship, resource extraction, and local and migrant users (MASMA Migrant Project).

The sites included also represent examples of urban (Bamburi, Pemba) versus rural (Vanga, Olumbe) settings within each country. This will allow us to examine if patterns of elasticities differ across urban and rural contexts. Furthermore, sites have been chosen to represent presence of tourism establishments (Bamburi and Shimoni in Kenya, Olumbe in Mozambique) to allow examination of how this particular ecosystem service affects distribution of shares and wellbeing of poorer population segments.

Project team

SPACES is a collaboration between the researchers from the following institutions:

- Stockholm Resilience Centre
- Exeter University
- Eduardo Mondlane University
- Kenya Marine and Fisheries Research Institute (KMFRI)
- Northumbria University
- Wildlife Conservation Society (WCS), Kenya
- The University of British Columbia (UBC), Fisheries Centre
- Stanford University
- University of East Anglia
- World Conservation Monitoring Centre (UNEP-WCMC), Cambridge University
- Centre for Coastal and Marine Environment, Mozambique Ministry for Coordination of Environmental Affairs
- Kenya Forestry Research Institute
- Universidade Lurio, Pemba, Mozambique

Project partners inclue:

- James Cook University
- Kenya Coastal Development Project
- Western Indian Ocean Marine Sc
- Universidade Lúrio
- Kenya Marine and Fisheries Institute

- Fisheries Department (FID)
- International Council for Science
- Ministerio das Pescas
- CCP Ruela, IDPPE
- United Nations Development Programme
- Stanford University
- Bamburi beach
- United Nations Environment Programme