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From conflicts to wise practice agreement and national strategy: cooperative learning and coastal stewardship in estuarine floodplain management, Tweed River, eastern Australia

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Abstract

Appropriate information, participatory processes and wise practice agreements are key elements in reducing conflicts over the use and management of coastal resources. In this work we describe the evolution of a cooperative learning approach to coastal floodplain management, incorporating these elements. Government-encouraged drainage of coastal floodplains in eastern Australia caused accelerated oxidation of acid sulfate soils and export of diffuse acidic drainage into streams. Major impacts on infrastructure, ecology, fisheries and aquaculture resulted. In the Tweed River estuary, in 1987, all gilled organisms were killed by acid discharge from floodplain canelands. This generated major conflicts between fishers, environmentalists and sugarcane producers. The cooperative learning partnership that evolved, involving cane farmers, local government, and researchers, has produced better strategies for managing sulfidic estuarine areas and mitigating impacts on downstream ecosystems. These underpinned mandatory best practice management guidelines for the NSW sugar industry. Increases in productivity and decreases in acid discharge have resulted. Fish kills on the Tweed and elsewhere also generated broader, parallel whole-of-government approaches that led to Australia's national strategy for managing coastal acid sulfate soils and the rapid adoption of information and strategies across Australia.

Keywords: Coastal floodplain management; Acid sulfate soils; Cooperative learning; Wise practice agreements; Acidic discharge; Diffuse source pollution

1. Introduction

1.1. Global challenges of coastal zone management

The annual value of the world's coastal goods and ecosystem services has been estimated to be about US$24 trillion, compared with a global gross domestic product of around US$18 trillion [1]. While the former figure is questionable, coastal ecosystems are both immensely valuable and valued by communities. Coastal regions and estuaries are distinctive because they involve so many different sectors of society that claim right of access and use of resources. This often results in lengthy, expensive and counterproductive conflicts [2].

Despite their importance, coastal areas continue to degrade through both natural and human-induced changes [3]. Of the human pressures, cropping and grazing and mega cities in coastal catchments have the largest impacts [4]. Increased diffuse source discharges of nitrogen, carbon and sediment, as

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a result of changes in coastal land and water regimes, are major concerns [5]. Studies of nutrient processes in near shore areas suggest that population density and percentage of land under crops in coastal catchments provide useful proxy measures of coastal disturbance [6]. Trigger values for identifying regions of highly disturbed coastal catchments have been set at densities as low as 60 persons/km^2 and 10% of catchment cleared [3,6].

Although examples of localised coastal improvement exist, sustainable resource use and maintaining coastal systems functions remain vital global tasks. Some of the key challenges include [5]: improving the availability and accessibility of resource and environmental information; fostering participatory approaches to coastal zone management; developing wise use options and agreements (best management practices); ensuring that planning and management cope with change; and developing policies that take into account risks and vulnerability.

1.2. Information, participation and coastal stewardship

Some, concerned by continued environmental degradation, believe that it is not possible to wait while the knowledge gaps in complex, coastal ecosystems are researched. Instead, action learning or adaptive management has been proposed as a practical response to the difficulties of managing complex situations [7,8]. It is argued that, in an adaptive process, mistakes due to incorrect information can be easily identified through rigorous monitoring and be corrected. Adaptive management, however, assumes linear processes where the consequences of erroneous actions can be reversed readily. Systems such as estuaries, however, appear to behave in a non-linear, hysteretic manner, exhibiting dramatic collapses that are not easily reversed [9].

Information on coastal ecosystem functions is patchy, even in intensively managed areas [10]. The general paucity of data is also evident in Australia. Relatively little research has been undertaken on the processes, consequences of environmental change or impacts of human activities in coastal eastern Australia, despite the concentration of population there [11]. The psychology of change management suggests change is more readily embraced when the underlying reasons for change are understood [12]. Appropriate, reliable information, communicated in a relevant way, is an important catalyst for change. The challenge is to collect and transmit that information in ways that are trusted by conflicting sectors.

Experience indicates that the first step in resolving conflict is to describe its nature and cause [2]. The next step is identifying and bringing together all stakeholders in a participatory manner, to try and build consensus and reach compromise agreements [13]. To reach agreement, there needs to be a process or mechanism in which the conflicting parties have confidence, and where they are able to address and resolve conflicts. Independent, impartial, outside parties, such as universities have been found to be very useful in developing higher quality agreements [2]. Problems in the management of coastal resources in eastern Australia have flowed from the plethora of top-down, conflicting visions and disparate goals between protection, rehabilitation, economic development and regional employment growth, as well as the inheritance of past legislation and administrative goals [11]. Governments are frequently reluctant to embark on participatory processes, as they are very time-consuming, and often use them as a last resort in solving conflicts.

Coastal stewardship has been proposed as one way of reducing conflicts by promoting ownership and pride in a country's heritage. It involves voluntary compliance, strong commitment and willing participation in the sustainable use of coastal resources and the development of wise practices [14]. The challenges in coastal stewardship are to inform, educate, motivate and empower communities to become managers and custodians of their environment. There are concerns, however, that without strong underpinning regulations, voluntary compliance agreements contain no effective mechanisms to address persistent breaches.

In this paper we examine the use of information, participation, and coastal stewardship in resolving serious conflicts over coastal floodplain management, stemming from fish kills, and in developing wise practice agreements for coastal floodplains in eastern Australia. We describe a cooperative learning partnership that has evolved over the last 15 years, which included local government, cane farmers and their industry, and academic institutions. This approach has successfully addressed some of the important challenges outlined above. We also describe the parallel institutional changes at the State level that flowed from the fish kills and eventually led to the production of a national strategy for the management of coastal acid sulfate soils and the rapid adoption of information and strategies across Australia. We first outline issues concerned with coastal zone development in Australia.

2. Coastal zone development in eastern Australia

About 80% of Australians live in the coastal zone, and about 66% of these are concentrated around large urban centres on estuaries and inlets. In the period 1971 to 1991 the population of the non-metropolitan coastal zone grew by 95%, from 2.1 to 4.1 million people, compared with a 32% growth for all of Australia. About 25–30% of the coast is subject to increasing development, most of this concentrated in the south eastern section of the country. In South Australia, more than half the land is cleared in 86% of estuaries. In Victoria the figure is 60% and in New South Wales 37% [15].

There are clear indications that coastal developments are changing the coastal, estuarine and marine ecology. For example, the dramatic decline in Australia's seagrass beds, up to 85% in some areas, due to nutrient outputs in the south east and sediment loads in the north east, is but one indicator of land-based impacts [15]. Given their fundamental importance in the marine food chain, disappearing seagrasses and their slow rate of recovery are major concerns.

2.1. Floodplain development

Eastern coastal floodplains in Australia were the first areas developed for agriculture following European settlement, due to their favourable temperatures, plentiful soil water and young, fertile soils [16]. Their plentiful soil water was associated with