

## “Ridge to Reef” Management Approaches: Addressing Interactions in Samoa’s Coastal Zone

John E. Hay, University of the South Pacific  
Samuel Wedderburn, The World Bank

Samoa is a small, independent island country in the southwest Pacific, comprised of four inhabited islands and six smaller, uninhabited islands. All are of volcanic origin. Samoa has a total land area of around 2,900 km<sup>2</sup>. Samoa’s two main islands, Upolu and Savai’i, are characterised by rugged and mountainous topography. Around 46% of Upolu and 70% of Savai’i’s total land area is covered by forest. Approximately 80% of the 403 km coastline is ‘sensitive’ or ‘highly sensitive’ to erosion, flooding or landslips.

Between 70 and 80% of Samoa’s 180,000 population live on or near the coast. Most of the important physical and social infrastructure is also located along the coast. Over 50% of Samoa’s population lives in the Apia urban area and northwest Upolu, an area of only 311 km<sup>2</sup>, or 11% of the total land area. Samoa’s economy has traditionally depended on development aid, family remittances from overseas, agriculture and fishing. Only around 12% of Samoa’s total population is engaged in formal paid employment. Two-thirds of Samoa’s potential labour force is involved in subsistence village agriculture, a dominant sector in the Samoan economy.

There are many factors contributing to strong interactions between upland and coastal areas. Samoa experiences high rainfall, both annually (annual rainfall is about 3,000mm, with about 75% of the precipitation occurring between November and February) and as intense rainstorms, including tropical cyclones. A daily rainfall of 400mm has a 50 year return period. The steep topography results in rapid runoff. Over 80% of the land and other natural resources of Samoa are under customary ownership and management. Family lands typically run in strips from the coast into the mountains. This system of land tenure facilitates the increasing movement of people away from the coastal villages to build family dwellings in the inland garden plots.



Source: Central Intelligence Agency  
Samoa: [https://www.cia.gov/library/publications/the-world-factbook/maps/maptemplate\\_ws.html](https://www.cia.gov/library/publications/the-world-factbook/maps/maptemplate_ws.html)  
World: [https://www.cia.gov/library/publications/the-world-factbook/maps/ws\\_large\\_locator\\_template.html](https://www.cia.gov/library/publications/the-world-factbook/maps/ws_large_locator_template.html)

Factors driving this movement include coastal villages becoming increasingly crowded - the population growth rate is around 1% annually - and growing realization of coastal risks (Table 1). Rising seas, more damaging storm surges, coastal deforestation and sand mining are resulting in a significant loss of land along the coast, with rates of retreat as high as 5m per year for unprotected shorelines.



*Erosion threatening traditional tourist accommodation.*

*Credit: John Hay*

Samoa experienced a disastrous tsunami in September 2009, resulting in 155 deaths, with close to 50% being children under the age of ten. The number of fatalities was more than five times the total number of deaths caused by cyclones from 1990 to 2010. The tsunami resulted in the complete destruction of several coastal villages, and destruction



Event	Return period	Asset damage	Loss of GDP	Total GDP	Loss as % of GDP	Notes
	Years	US\$ million, 2005 prices	US\$ million, 2005 prices	US\$ million, 2005 prices		
Cyclone Ofa	25	166	15	161	113%	Buildings & infrastructure
Cyclone Val	100	388	36	163	260%	30% agricultural assets
Cyclone Heta	10	1	4	236	2%	Limited damage
Tsunami 2009	50	54	50	277	38%	Buildings, infrastructure & tourism

*Economic Damage Caused by Recent Natural Disasters in Samoa*

*Source: World Bank estimates*

of 20% of hotel tourist room capacity. At least 5000 people were directly affected. Of the 850 households affected about 502 homes were completely destroyed while 360 suffered severe but reparable damage. Community buildings such as churches, seven schools and two health centres were also affected, with many declared structurally unsound and unfit for use. The tsunami recovery plan, which is founded on the “build back better” principle, is estimated to cost just over US\$100 million, shared between the public sector and donor assistance.



*Damage from the 2009 tsunami. Credit: Helen Henry*

Unregulated clearance of native forests occurs as a result of shifting cultivation and expansion of family plantations, leading to soil erosion and the loss of other environmental assets and services. Approximately one third of the country's forests were cleared between 1977 and 1990, the clearance rate of 3% per year being one of the highest in the world. Deforestation impacts adversely on wood supply, water supplies, biological diversity and on livelihoods.

In 2000 Samoa commenced an initiative designed to reduce the vulnerability of Samoa's coastal communities and infrastructure to natural hazards within the wider context of

development planning, including land use and disaster risk reduction. An important first step was preparation of a Coastal Infrastructure Management (CIM) Strategy. It recognises that, for all communities, agencies and other stakeholders to be resilient, they must be adaptive, responsive and quick to recover. The Strategy approaches the management and use of land and other resources through a partnership between government and villages, while also highlighting the importance of education, awareness, monitoring and evaluation. Since its adoption by Cabinet in 2001, the Strategy has become well entrenched in a wide range of planning and management frameworks. It is now a foundation document for most of the agencies and stakeholders active in coastal management in Samoa.

Consistent with the Strategy, by 2007 all the 41 districts of Samoa had Coastal Infrastructure Management (CIM) Plans, covering 283 villages. Over 7000 people were directly consulted to reach agreement between the Government and communities on various solutions to address coastal erosion, flooding and landslides. The CIM Plans are not statutory instruments. However, each Plan was formally signed by village representatives and by the Chief Executive Officer and by the Minister of Natural Resources and Environment, signifying the Government's commitment to the Plans. The Plans themselves include both “hard” and “soft” interventions, with the former being dominant. For example, of the 1720 interventions to be undertaken at village level, 280 involve replanting and riparian management.

To date the Plans have not been implemented in a comprehensive manner, principally due to a lack of funding – just village level physical works were recently costed at over USD 16 million. However, the UNDP-supported Sustainable Community Development Programme is piloting CIM Plan implementation in four of the 41 districts.

The National CIM Strategy was updated in 2011 as part of renewed efforts to implement the CIM Plans in light of growing concerns about risks to coastal communities and infrastructure. The Strategy now ensures a “whole of catchment”

approach. In the small island context relevant to Samoa this is usually described as a “ridge to reef” approach and is now recognised as being fundamental to integrated resource and hazard management in Samoa. Importantly, the updated Strategy now considers the full range of hazards for communities and infrastructure in order to address such issues as inland flooding and watershed management, particularly in light of their affect on village safety, water quality and coastal infrastructure. The updated Strategy also provides a clear linkage between land use policy and planning, and emergency management and hazard reduction.

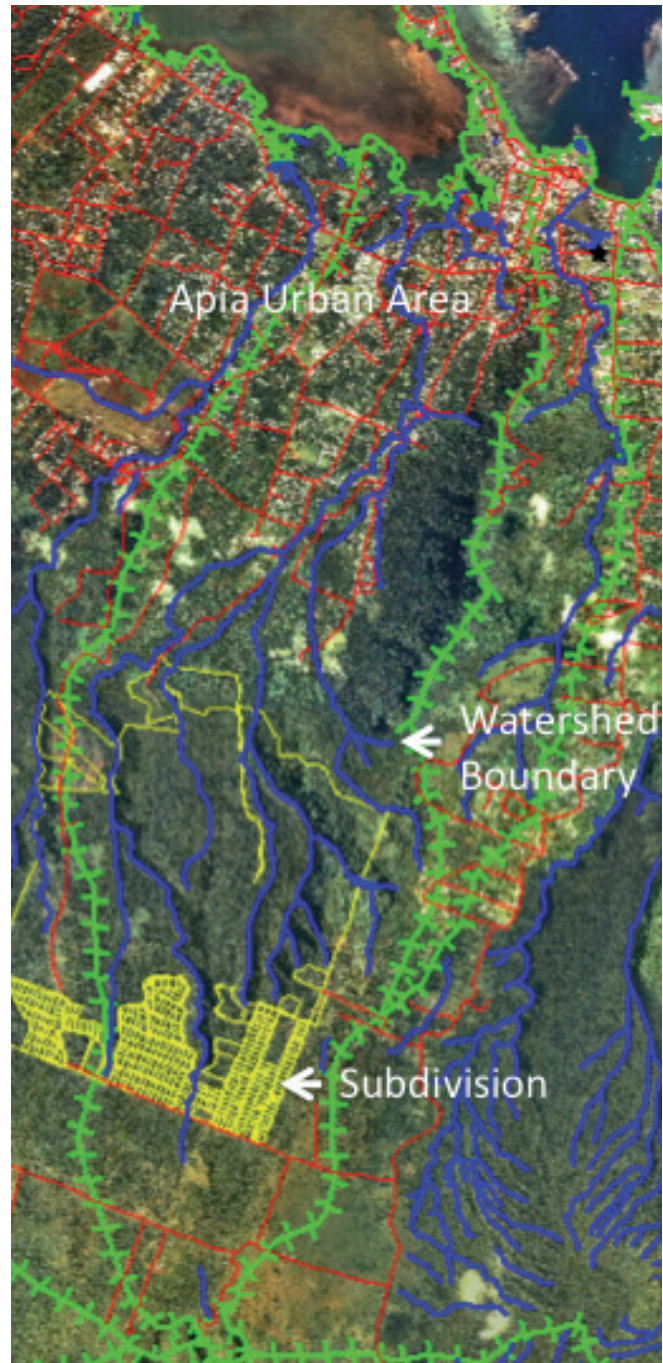
The strengthening of the National CIM Strategy reflects the growing recognition that development in the upper catchment can have serious adverse consequences for Samoa’s coastal communities. For example, the following photos show that development in the watershed above Apia is occurring at a rapid rate despite this being the principle source of potable water for over 50% of Samoa’s population.



*New home on ridge overlooking Apia (lower right of subdivision in image to left). Credit: John Hay*



*Typical vegetation cover in the upper catchment. Credit: John Hay*



*The watershed which supplies Apia and surrounding areas with potable water, including the plan to subdivide the upper catchment. Credit: Adapted from map provided by MNRE, Samoa*

While revised regulations for environmental impact assessment (EIA) were approved by Cabinet under the Planning and Urban Management Act (2004) they did not become operative until mid 2007. It is hoped that they will prevent such actions as quarrying of rock to be used in coastal reclamations. Both the quarrying and the reclamation works increase hazard risks, as the following photographs show.



*The watershed which supplies Apia and surrounding areas with potable water, including the plan to subdivide the upper catchment. Credit: Adapted from map provided by MNRE, Samoa*



*Both buildings and people on the reclaimed land have high exposure to coastal hazards. Credit: John Hay*



*Rock quarry which provided material for coastal reclamation in 1997. The quarry has modified the flow of surface and ground water. In the wet season the quarry fills with water. When the impounded waters overflow there is serious flooding in neighbouring villages. In addition, two children have drowned in the flooded quarry. Credit: John Hay*

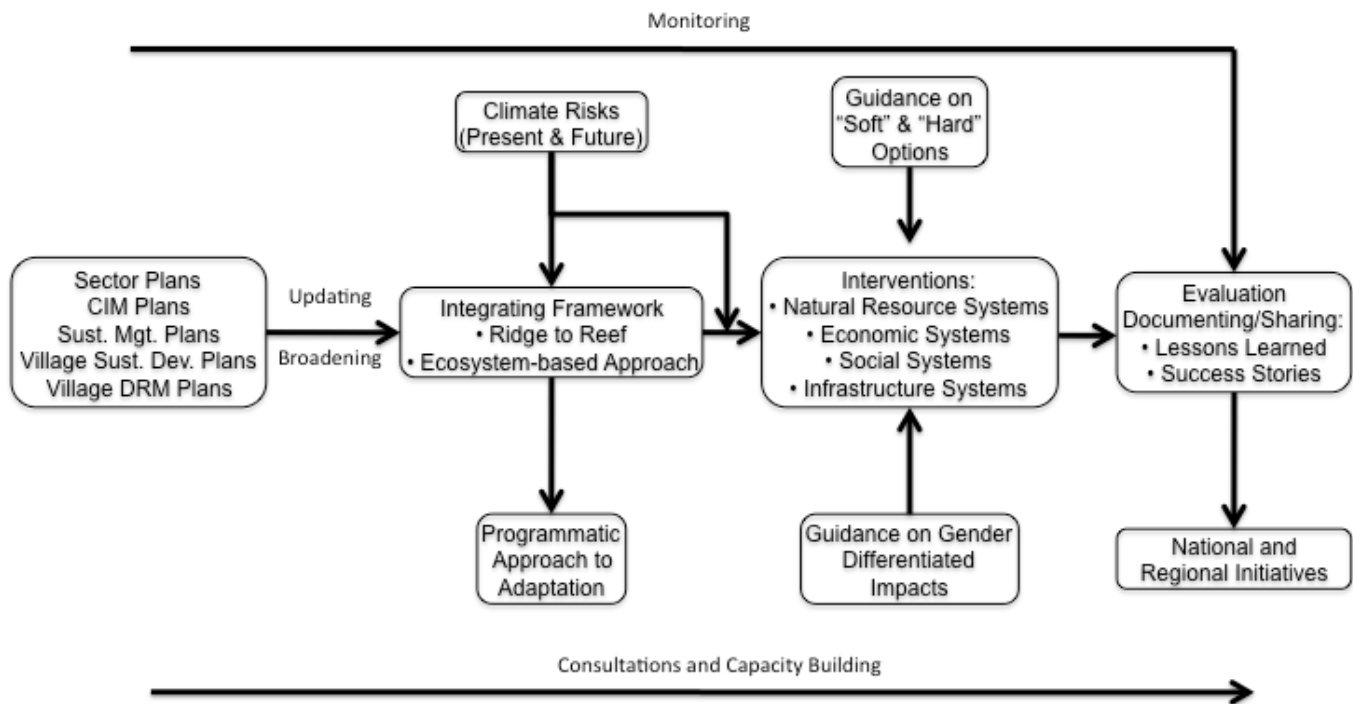


*Reclamation is continuing, despite the destruction of mangroves and other coastal vegetation. Credit: John Hay*

The CIM Plans themselves are also being reviewed and revised, taking into account other existing planning frameworks such as Village Disaster Risk Management Plans, Catchment Management Plans and Sustainable Management Plans. The Sustainable Management Plans are required under the Planning and Urban Management Act, but have not yet been developed due to the constraints customary ownership of land place on physical planning processes. Preparation of a village planning guide is being considered. This would assist villages to discharge their planning functions in a manner consistent with the CIM Plan requirements. It would also support an interim approach to introducing a more considered use of land at village level, in advance of the planned introduction of the

Sustainable Management Plans, as a replacement of the CIM Plans. An Apia Urban Area Plan is also under consideration. Physical planning is possible in Apia as much of the land is not in customary ownership.

Even more recently, implementation of the CIM Plans has come even closer to realization. Samoa's Climate Resilience Investment Plan calls for 16 CIM Plans to be implemented as part of Samoa's Pilot Programme for Climate Resilience. This also includes "climate proofing" the 30km of road between Apia and the international airport. The road runs through eight of the districts covered by the 16 CIM Plans, allowing for a highly integrated approach to enhancing the resilience of both the coastal and inland areas (see figure). The global Pilot Programme for Climate Resilience is now funding these activities. It forms part of the Strategic Climate Fund, and was established under the Multi-donor Climate Investment Fund.



*Integrated approach to enhancing the resilience of coastal and inland areas in Samoa (Source: After Climate Resilience Investment Programme for Samoa, 2011).*

A project funded by the Adaptation Fund and implemented by UNDP is likely to support implementation of the CIM Plans for the remaining 25 districts. Both the PPCR and Adaptation Fund projects will be implemented in an integrated manner. All the CIM Plans will be reviewed and revised to ensure they are consistent with the revised National CIM Strategy, including adoption of a “ridge to reef” approach and the preference to use of ecosystem-based rather than “hard” interventions wherever possible and appropriate. Implementation will also emphasise risk reduction through an integrated approach to managing both disaster and climate-related risks in order to increase resilience. This will be especially the case in the districts most seriously affected by the recent tsunami, but will also be a priority in the other districts covered by the two projects.