



Assessment of coastal erosion and quantification of land loss on Western Pacific atolls during the last 50 years

Danko Taborosi (1), Mojca Zega (1,3), and John W. Jenson (2)

(1) Island Research & Education Initiative, PO Box PS 303, Palikir, Pohnpei, FM 96941, Federated States of Micronesia, (2) Water and Environmental Research Institute of the Western Pacific, University of Guam, Mangilao, Guam 96923, USA, (3) Institute of the Republic of Slovenia for Nature Conservation, Regional Unit Nova Gorica, Delphinova 16, 5000 Nova Gorica, Slovenia

The majority of islands in the tropical western Pacific are coral atolls. Most are inhabited by indigenous Micronesian populations. Local people have over the millennia developed coping strategies and response mechanisms to difficult natural conditions, including typhoons, erosion, giant swells, and flooding, as well as ensuing famines and epidemics. However, since 1990s residents of atolls in the region have been appealing for help. They indicate that their islands are being rapidly eroded along coastlines, land areas are becoming smaller, and taro patches and other vegetation are being damaged.

Such concerns were corroborated by one sweeping assessment by South Pacific Applied Geoscience Commission in 1998, as well as various isolated field observations since. Evidence of recent coastal erosion is found locally on many islands, both on windward and leeward sides and ocean and lagoon facing shores. Examples include retreating modern beaches, exhumed beachrock, scouring and undercutting of vegetation, overhanging scarps, etc. In addition, a considerable number of uninhabited islets have been completely obliterated by storms in the recent past; unusually high tides and swells have swept over large populated islands, destroying homes and harming agriculture; and at least one atoll has been abandoned due to irrecoverable typhoon damage.

Those problems have received much worldwide media coverage, in which they are generally presented as "sinking" of islands due to global climate change and accompanying sea level rise. In reality, modern atolls are now known to be artifacts of the Pacific mid-Holocene High-Stand, and no first-hand data are available from Pacific islands to discern what proportion of observed erosional phenomena are 1) due to local natural and anthropogenic coastal processes as opposed to global and regional changes, and 2) caused by continuous natural dynamics as opposed to episodic extreme events. It is clear that some islands are faring better than others, and that land is not always eroding but in some cases accreting. We are currently engaged in a systematic survey of islands across the region in order to differentiate local problems from wide-ranging phenomena and gain insight into the temporal and geospatial "big picture." The direct aim is to comprehensively and more precisely assess coastal erosion and quantify changes in land area of different islands over the past 50 years.

The project consists of fieldwork and GIS analyses, and it is the first to employ such methods to evaluate shoreline transformation in the western Pacific. We visit each island, interview local people regarding recent land changes and events, and carry out site investigations and mapping. Each inhabited island is circumambulated on foot, and beach slopes and scarps are measured, sediments examined, human activities and vegetation damage noted, etc. More importantly, the entire coast of each island is mapped using MobileMapper PRO portable units capable of generating GIS shapefiles in the field. Created coverages include the actual shoreline, sandy banks, vegetated areas, coastal engineering, control points, etc. Data collected on the ground is imported into ArcGIS and rectified using remote sensing imagery. It is then compared to all available historical maps, notably US Army Corps of Engineers 1960s topographic charts, which were previously assembled, digitized, and georeferenced for the purposes of this project. Any discrepancies in island outline and land area would have occurred over the past half a century. Due to the vastness of western Pacific region and logistical obstacles to working on remote islands, data are accumulated gradually. Ultimately, this island-by-island approach will allow documentation of

historical and regional erosion patterns, contribute to understanding of local and global components of recent coastal changes, and deliver recommendations for environmental management and emergency avoidance on atolls and other oceanic low islands.