Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

HTT005-05 Room:202 Time:May 25 15:15-15:30

Hydrologic Response to Land use Change and its Impact on Coastal Ecosystem of Fiji

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Healthy coral reefs are a vital part of the coastal ecosystem and support a huge amount of sea life and fulfill a variety of human needs, like subsistence, fisheries, tourism and shoreline protection. These fragile coral reef ecosystems are rapidly deteriorating with intense anthropogenic perturbations in the river basins of northwest Viti Levu, Fiji, due to large terrigenous material run-off loads from the steeply-sloping watersheds. The cropland expansion has vastly altered the structure of natural watersheds and their ecosystems through accelerated conversion of forest land and marginal land to agriculture or urban area. Therefore, it is crucial to ascertain the temporal and spatial change pattern of coral cover and asses the environment factors, which directly/indirectly influence the reef ecosystem. This study focuses to find out intense and sustained environment pressures generated by anthropogenic activities and land use change on the coastal ecosystem using remote sensing and GIS. In this research benthic cover is analyzed temporally (1992-2007) and spatially to find out the impacts of terrestrial runoff from 14 adjoining agriculture dominated watersheds in the coastal area. To accomplish this task, an integrated modeling framework with land use change has been constructed to simulate the transport of runoff, sediment yield and nutrient pollution using ArcView interface based SWAT (Soil and Water Assessment Tool) model. The benthic cover change analysis using Landsat TM/ETM+ shows that coral cover reduced by 33.5% from 1992 to 2007 while the algae and seagrass cover increased by 139.3% and 70.6% respectively due to the fine sediments and nutrients carried by eroding sediments from the sugarcane fields. The land use change analysis indicates that maximum agriculture expansion is in small watersheds of the study area. Results reveals that during 1992-2007, forest land (27.04%) and shrubland/grassland (20.96%) was replaced by agriculture (46%) and barren land (2%) in small watershed (area 12.10 km2). Therefore, the hydrological response impact from these watersheds cannot be ignored as soil loss and nutrient loss are high, especially during the heavy rainfall event. In addition, Landsat data interpretations (1992-2007) for coral reef ecosystem also infer that there is an enormous increase in the degraded reef areas (59.39 %) around these coastal watersheds.

Keywords: Coral reefs, runoff, sediments, nutrients, remote sensing, SWAT