Chapter 6
Geomatics in Urban Expansion Mapping for Sustainable Urban, Warehouse, and Logistics Planning

Nelly Rose Gham
Papua New Guinea University of Technology, Papua New Guinea

Sujoy Kumar Jana
http://orcid.org/0000-0003-0901-5316
Papua New Guinea University of Technology, Papua New Guinea

Tingneyuc Sekac
http://orcid.org/0000-0001-5972-7149
Papua New Guinea University of Technology, Papua New Guinea

Bikash Ranjan Moharana
http://orcid.org/0000-0001-8208-6191
Papua New Guinea University of Technology, Papua New Guinea

ABSTRACT

Alotau, the capital town of Milne Bay Province, is experiencing rapid urbanization, leading to significant pressure on its limited land resources and demanding improved planning strategies. The urban expansion from 2005 to 2025 was analysed using Geographic Information Systems (GIS), remote sensing techniques and land use land cover (LULC) maps, and found a significant improvement in urbanization i.e.,

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~148%. The expansion was predominantly confined to low-elevation, low-gradient terrain, resulting in the conversion of vegetated and barren land covers, and was strongly regulated by topographic constraints. The LULC maps with high classification accuracy (> 85%), providing reliable, data-driven evidence of Alotau's growth patterns. These findings offer critical insights for town planners and policy makers, underscoring the urgent need for strategic and sustainable urban planning to guide Alotau's future development via. manufacturing firms, logistics planning etc., in a manner that is both resilient and environmentally conscious.

1 INTRODUCTION

Urban planning is a complex and multifaceted field that requires careful consideration of various factors, including demographic trends, infrastructure development, transportation systems, and environmental sustainability (Cheshmehzangi, 2025; Adesina et al., 2024; Sekac et al., 2017). Geospatial analysis, using Geographic Information Systems (GIS), has become an essential tool in urban planning, enabling policymakers and planners to make informed decisions based on spatially referenced data. In this article, we will explore the world of geospatial analysis for urban planning, delving into GIS techniques, tools, and applications for informed decision-making (Prabha et al., 2025; Mansourihanis et al., 2025; Anucharn et al., 2025; Andrew et al., 2023; Poi et al., 2018).

Alotau's town itself grew by 3.570 km^2 in 2011 (PNG NSO), yet more than half of the expansion lacks zoning records. Alotau, the capital town of Milne Bay Province is situated on the coastal area of the forested foothills that extends from the Owen Stanley Range in an eastward direction. The town has a population of 11,857 (2011 census). The town serves as a commercial and administrative hub, attracting the people from the rural areas seeking economic opportunities. The town has been experiencing rapid changes in terms of urbanization in the recent years. As more people move into town and the development of infrastructures increases, changes in the land use and settlement patterns are becoming more obvious. Alotau's urbanization mirrors Papua New Guinea's broader challenges such as unplanned growth, coastal squeeze, and terrain limited expansion (UN-Habitat, 2020). Most of the town's suitable land for urbanization is being occupied, making it to expand into the nearby communities. This study fills a critical gap because while prior PNG research focused on Port Moresby and Lae, Alotau's unique topography and tourism driven economy demand localized analysis. This town is a recipient of urban expansion due to the increase in infrastructures in the town itself and expanding into the nearby communities. The expansion is accompanied by various problems including unstructured planning, the increase in settlements and overcrowding.

Multi-Wavelength Spectrophotometric Analysis: Determination of Sitagliptin and Metformin in Tablets

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