

# Our waste our way: a spatial study of household waste management in Betio, Tarawa, Kiribati

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## 1.0 INTRODUCTION

There is an increasing concern over solid waste disposal on the islands of Kiribati in the Pacific Ocean. This is especially true on South Tarawa, which is the urban centre of Kiribati (Carden, 2003). The trend over the last few decades (see Figure 1) has been for people from the rural islands of Kiribati to migrate to South Tarawa for educational and employment opportunities (Secretariat of the South Pacific, 2012). An effect of the increased urbanisation is that the people residing on South Tarawa have changed from traditional subsistence living to a more “westernised” lifestyle. As a result, the demand on imported goods together with their high level of packaging has greatly increased the volume of solid waste produced in South Tarawa. The inability to manage this waste effectively has been identified as a major outcome of this increased waste generation rate (Carden, 2003).

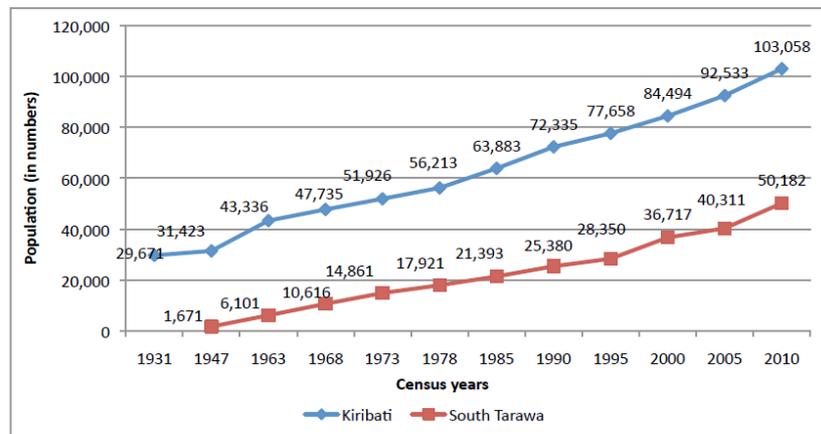


Figure 1: Population trends for Kiribati and South Tarawa for the period 1931 – 2010 (Secretariat of the South Pacific, 2012).

Betio is one of the main towns of South Tarawa with a population of 15,755 in 2010 and a land area of 1.7 square kilometres (National Statistics Office, 2010). It is overcrowded and littering in common areas such as beaches can be readily seen (see Figure 2). In Betio, the task of collecting and disposing of household waste is carried out primarily by the Betio Town Council (BTC). In addition, New Zealand has funded a project called the ‘Green-bag household project’, which started in March 2012, to end in-organic waste littering and other disposal practices over terrestrial and marine ecosystems to produce a cleaner and healthier environment. (Bwatee, 2013). One of its objectives is to get the public to put their waste into green bags that are then collected at scheduled intervals. The Green-bag truck collects the green bags, which should contain only inorganic household waste, once a week.



*Figure 2: Example of household waste dumped on a beach near Betio.  
Photo taken by K.B. Teburea on 10 April 2013.*

The aim of this study is to encourage the people of Kiribati, especially those residing on Tarawa, to assist in maintaining a clean environment by effectively managing their household waste. A thorough analysis of all of the factors resulting in improved waste management is beyond the scope of this study. Therefore, this study focuses on the use of geospatial analysis techniques to predict whether changes to the way in which the BTC manages solid waste collection in Betio will lead to improved solid waste handling. This involves determining how the system is currently managed, finding out what influences the choices local residents make regarding their household waste and coming up with alternative management techniques together with key performance indicators to assess the expected outcomes of these proposed techniques. It is expected that improvements to management of household waste will potentially extend the life and usability of landfills in Kiribati (Leney, 2006). Learning ways to manage household waste can be a preliminary stage for young and adult residents in keeping their environment clean for future generations.

## **2.0 METHODS**

The following steps are undertaken in this study:

- a. Collection of data on the current waste management system in Betio including the location of current collection sites, informal dumping sites and the attitudes of the residents towards the management of their household waste;
- b. Creation of a fully connected network of Betio, prior to travelling salesman and location-allocation stages of analysis (e.g. Yeh and Chow, 1997), to analyse the current collection system and determine feasible alternatives in terms of more efficient collection routes and definition of more optimal waste collection points; and
- c. Synthesis of resident behaviours and attitudes with the geospatial model outcomes to predict changes in waste management outcomes resulting from alternative collection systems.

### **2.1 Collection of field data**

Spatial and questionnaire data were collected during a period of fieldwork undertaken from 2 – 14 April, 2013. Once ethical approval had been obtained, data was collected from randomly selected household residents on Betio, who agreed to participate in the research. The number of participants was 200, aged 20 and upwards. Household residents were given one questionnaire per household covering topics such as type of household, the nature of waste disposed, storage, possible use of and disposal of waste, attitudes towards waste collection and disposal, problems encountered in waste collection and disposal, suggestions for improved disposal and collection, and awareness of waste policy and management. The questions were given in two languages (Kiribati and English). Location of their household waste sites was also collected using a Trimble Nomad GPS handheld receiver. The spatial and questionnaire data were linked via a common reference number for the household. The

spatial data collected was complemented by a contextual dataset consisting of roads, buildings and coastline. Semi-structured interviews with relevant people working at the Betio Town Council were also conducted as part of the research study. An overview of Betio that roughly indicates the spatial extent of the area covered in the fieldwork is shown in Figure 3.



Figure 3: Islet of Betio (Source: SOPAC).

## 2.2 Travelling salesman and location-allocation modelling

Network routing and location-allocation modelling will be applied to the data collected during the fieldwork, which has been modified to derive a fully connected road network with waste dumping nodes or points attached to them. Network routing will be used to calculate the shortest route on the network that can collect rubbish from all nodes – this is therefore a travelling salesman problem. Location-allocation modelling will establish the placement of new nodes, given the population distribution and the mapped locations of informal dumping (see Longley et al, 2011 for more information on these techniques).

## 2.3 Data synthesis

The outputs from the questionnaires will be used to inform the location-allocation model and construct a number of scenarios. These outputs include, but are not limited to, participants' views on whether the rubbish is being collected regularly enough and what interval it should be collected at, the manner in which residents currently informally dispose of their household waste, particularly when the council truck does not collect the rubbish from assigned areas, and what sort of containers the residents place their household rubbish in for collection. Analysis of the questionnaire outputs will also indicate the number of participants who are aware of the policy or awareness regarding waste management, as this these data can inform the government of the best options (such as radio and newspaper advertisements, door knocking, etc.) for increasing community or individual awareness of waste disposal, as well as aid in the enforcement of waste disposal policies.

## 3.0 SUMMARY

Addressing the problem of informal waste disposal on Betio, Kiribati Islands, the current state of household waste management, policies for waste containment and enforcement and household waste management issues (collected by questionnaire and interview) were analysed, along with the mapped locations of household waste dumping sites, before the suggestion of practical alternatives for waste disposal, collection and management on a household and island-wide scale.

More specifically, this project will generate a set of data and output maps, derived from spatial analysis, on locations of informal dumping sites as well as recommendations for locations of centralized dumping nodes, and the optimal route on the road network visiting them all. This can be used in future decision support on Betio household waste management decisions. The project has also generated a resource of opinions held by Betio inhabitants about household waste management on Betio, which may be valuable in future decision making.

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