



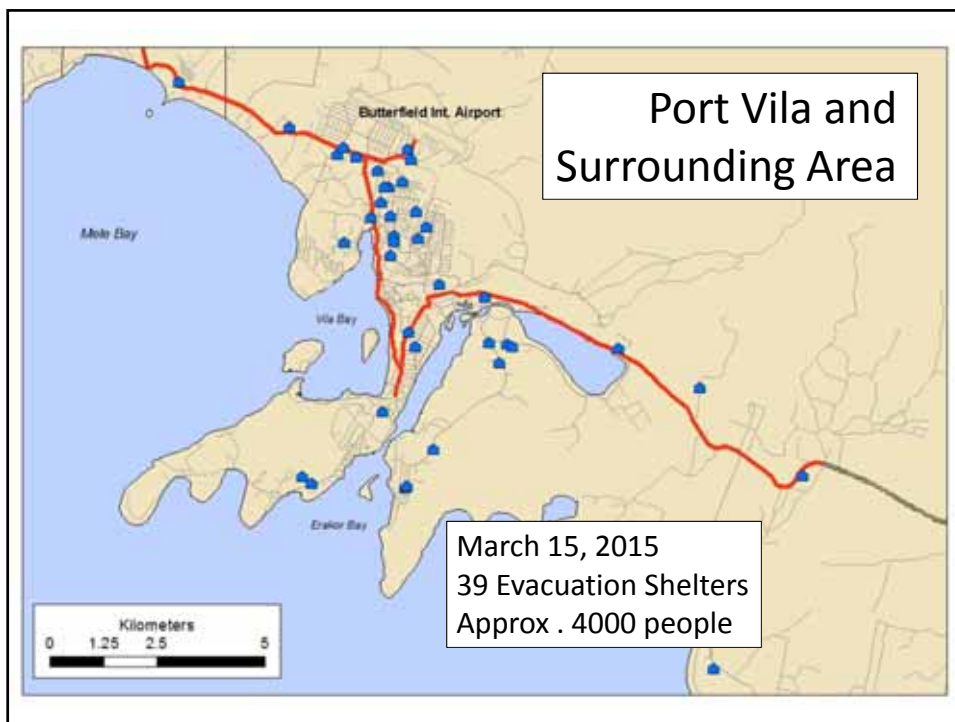
Spatial Accessibility of Evacuation Shelters in Port Vila, Vanuatu

Dr. John Lowry

School of Geography, Earth Science & Environment
Faculty of Science, Technology & Environment
The University of the South Pacific

Overview

- Evacuation Shelters in Port Vila, March 2015
- Spatial Accessibility (Supply-Demand) Models
 - Thiessen Polygons
 - Street Network Service Areas
 - Two-Step Floating Catchment Area (2SFCA)
 - Enhanced 2SFCA
- Population Assessment & Questionnaires
- Conclusion



Spatial Accessibility

- **Spatial accessibility**—availability of evacuation shelter given geographic constraints of distance (time)
- **Availability** determined by **Supply** vs. **Demand**
 - Supply: Capacity of shelters
 - Demand: Population in need of shelters
 - Spatial: Travel distance/time

Measuring Capacity (Supply)

- Evacuation Shelter Capacity
 - Area from digitized building footprints
 - Assumed 70% of building footprint is usable
 - 3.5m² per person *



* International Federation of Red Cross and Red Crescent Societies

Measuring Population (Demand)

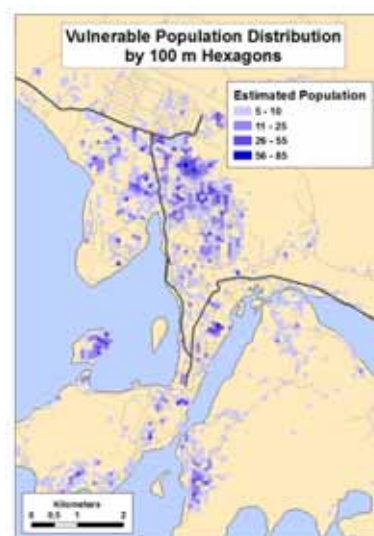
- PCRAFI* database of buildings
 - Residential
 - Single story timber frame, traditional, uninhabitable or poor construction



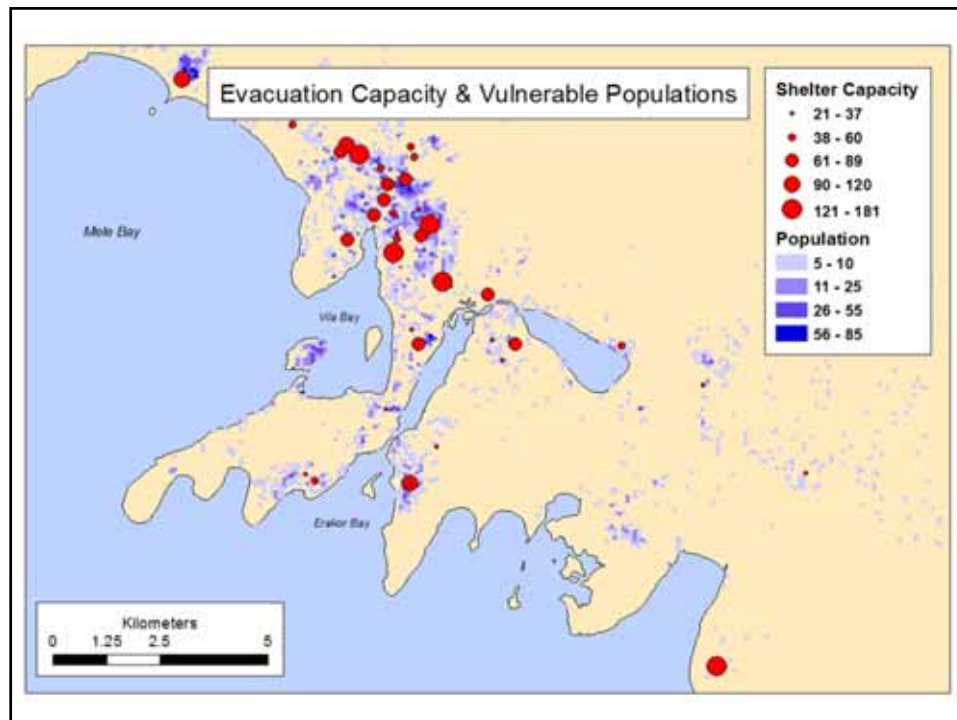
* Pacific Catastrophe Risk Assessment and Financing Initiative (<http://pcrafi.spc.int>)

Measuring Population (Demand)

- Lattice of **hexagons**
- Each attributed with **number of buildings**
- Population per hexagon estimated **based on 5 people/house***

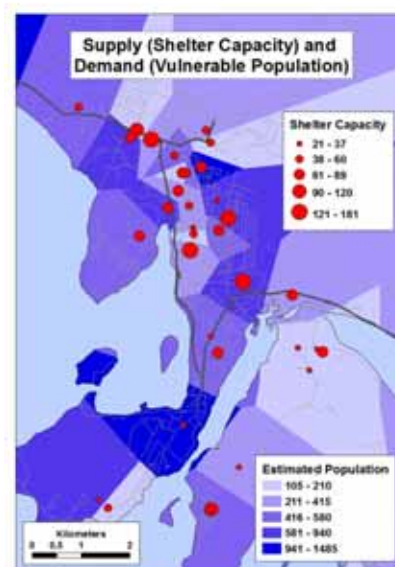


* Determined based on Enumeration Area data from 2009 Census

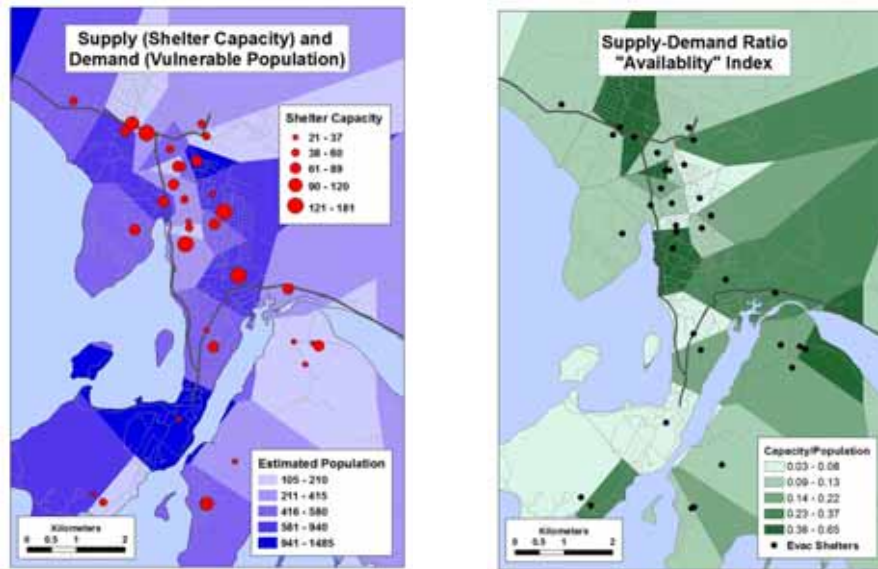


Thiessen Polygons as Catchments

- Thiessen polygons defined by shelters
- **Sum population** for each polygon
- Index is **ratio of capacity/population**
- Larger ratio = greater accessibility

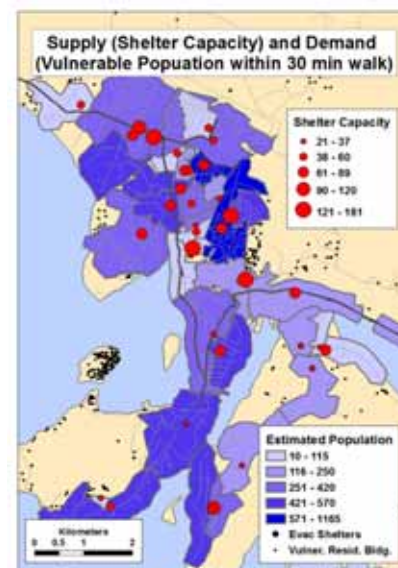


Thiessen Polygons as Catchments

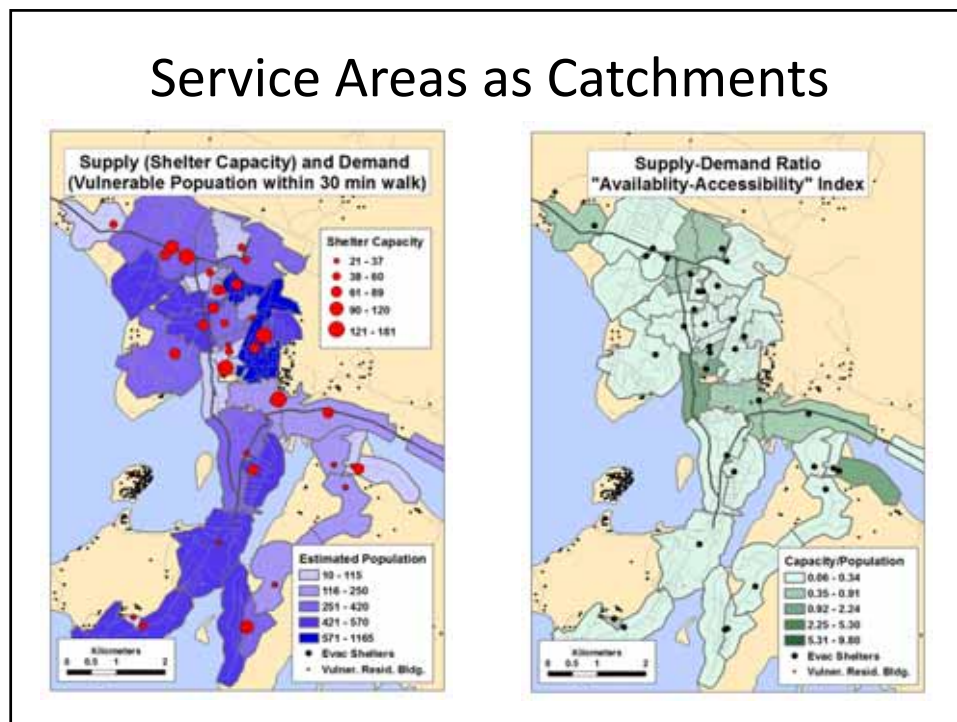


Service Areas as Catchments

- **Service areas** from street network
- **Walking distance** at 3 km/hr
- **Non-overlapping** polygons
- Index is **ratio of capacity/population**
- Larger ratio = greater accessibility

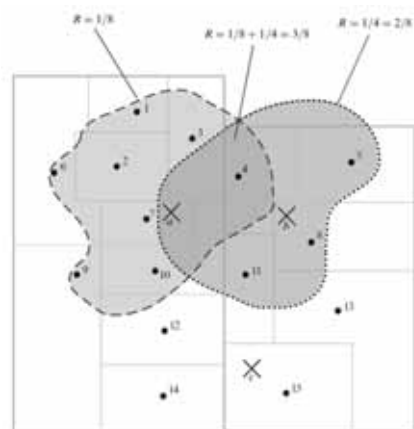


Service Areas as Catchments



Two-Step Floating Catchment Area

- **Step 1:** For each *Evac Shelter* compute **Shelter/Pop ratio** within catchment
- **Step 2:** For *each Pop location* within catchment and **sum Shelter/Pop Ratios**
- **Effect:** Greater access for populations within multiple catchments



Lou & Wang (2003) Measures of spatial accessibility to health care in a GIS environment. *Env. & Planning B*.

Two-Step Floating Catchment Area

- **Origin-Destination Matrix** using street network
- **Compute Shelter/Pop ratio (R)** for ea. Shelter
- **Sum (R)** for each hexagon = 2SFCA Index



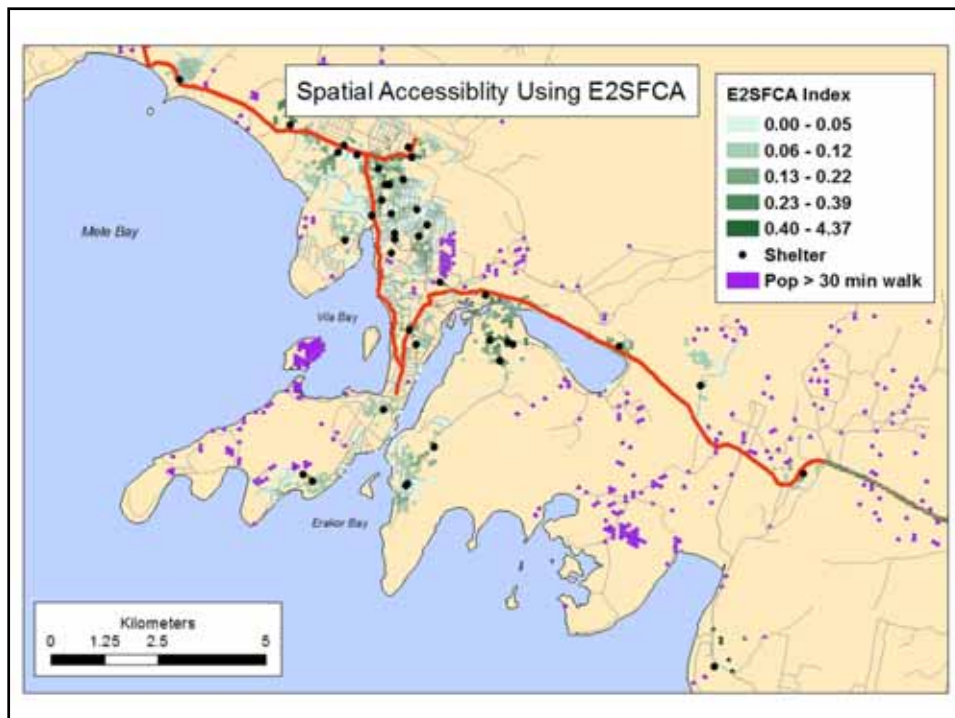
Two-Step Floating Catchment Area

- 2SFCA Index
- **Larger = Greater** Spatial Accessibility
- Above 1 means **more capacity than demand**
- Does **not** take into consideration **distance decay**

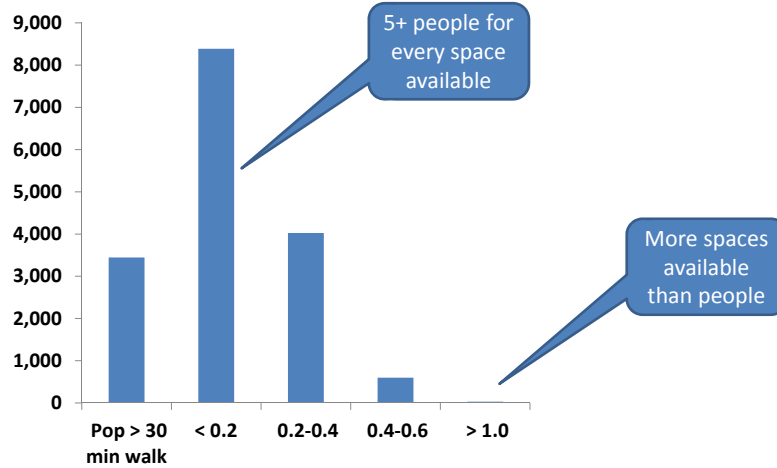


Enhanced 2SFCA

- 2SFCA Index with **distance decay**
- Each hexagon ratio **weighted** by inverse of distance (time)



Estimated Population in S2FCA Classes



What happened in March 2015?

- **Alternatives** to Evacuation Shelters
- NDMO provided some **transport**
- **Questionnaire Survey** July 2015
 - Most shelters **over-crowded**
 - Most people **walked**
 - Stayed **approx. 2 days**



Future Work-Utility of Research

- **Two modes** of transport—Walking & Carrier
- **Validate population** estimates with Census
- Compare with **Occupancy data (NDMO)**
- Compare with **Questionnaire “Story”**
- For NDMO in Vanuatu (and Pacific)
 - Encourage **capacity estimates** for Shelters
 - **Other recommendations** from Questionnaires

**Tankiu Tumas! Questions or
Comments?**

