Dengue Risk in the Zambezi Drainage of Mozambique

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GEOG 582

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Introduction

- Dengue vector borne viral illness
- Case fatality rate 1-5% depending on medical care
- 4 serotypes: DEN-1, 2, 3, 4
- Dengue Hemorrhagic Fever: subsequent infections up to 40% mortality

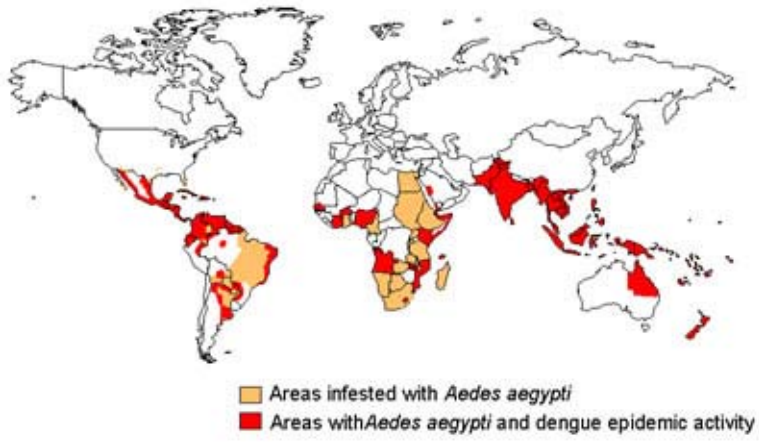
Introduction

- Vector is *Aedes* mosquitoes usually *A. aegypti*
- Large increase in tropical urban centers
- Found on Mexican-Texan border
- *Aedes* well adapted to human settlements
- Breeding sites in artificial water sources

Introduction

- Dengue prototypical geographic disease
- Limited to *Aedes* distribution
- Specific ecological requirements
- Highest risk is urban areas in tropical zones

World Distribution of Dengue - 2005

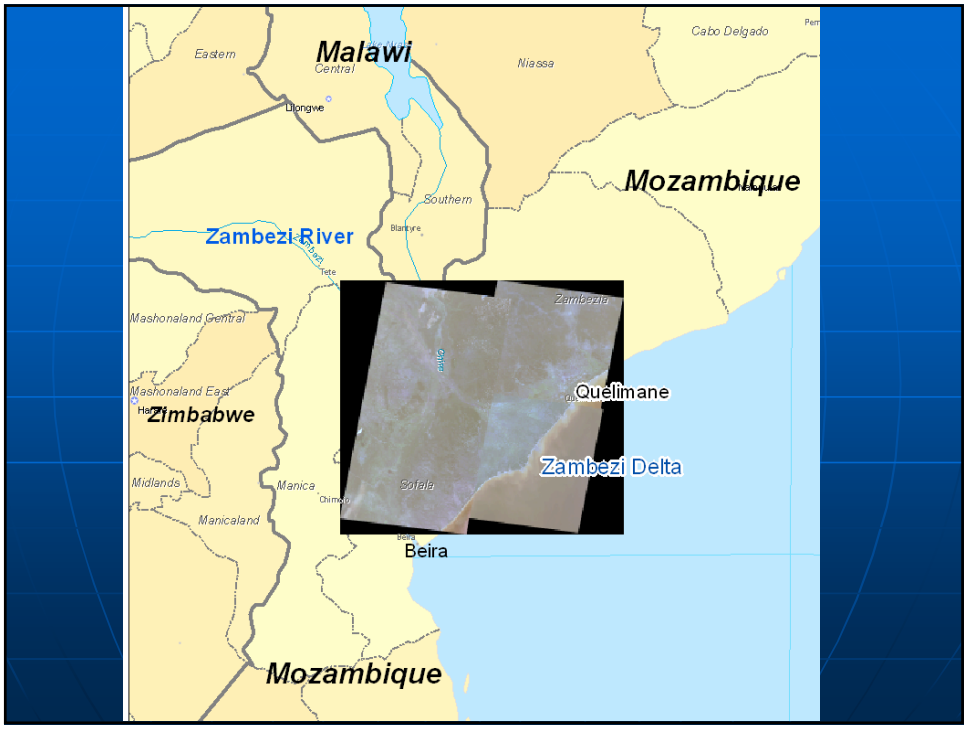


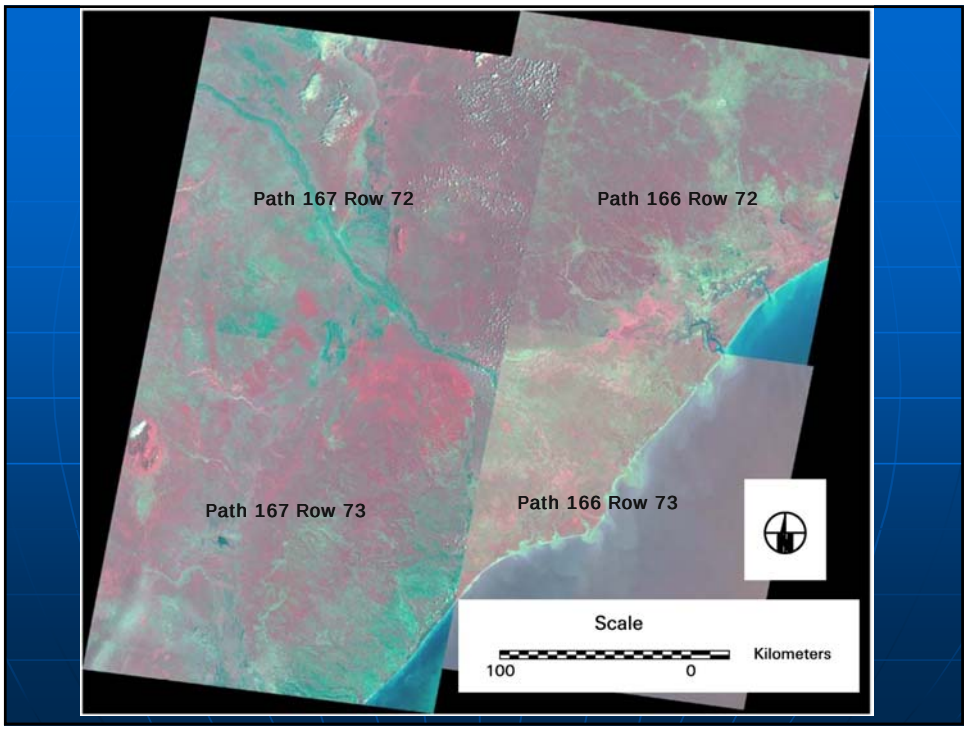
Research Objectives

- Study high risk area in southern Africa (Mozambique)
- Construct dengue ecological risk map (not doable at this point)
- Determine urban & agricultural land use from Landsat ETM+ images

Methods

- Downloaded 4 Landsat TM+ images for target area from 2000
- Included Zambezi Drainage area
- Thermal IR resampled at 28.5 m pixel size
- Panchromatic band separated
- Principal Component Analysis on remaining 7 bands


Malawi
Central
Eastern
Niassa
Cabo Delgado
Lilongwe
Mozambique
Southern
Zambezi River
Blantyre
Tete
Zambezia
Mashonaland Central
Mashonaland East
Harare
Zimbabwe
Quelimane
Zambezi Delta
Midlands
Manica
Sofala
Chimoio
Manicaland
Beira
Mozambique


Path 167 Row 72
Path 166 Row 72
Path 167 Row 73
Path 166 Row 73
Scale
100
0
Kilometers

Methods: Classification

- ISODATA unsupervised classification on first 3 PCA components
- Signatures assigned to:
  - Urban
  - Agricultural
  - Water
  - Forest
  - Mixed Forest/Savannah
  - Savannah

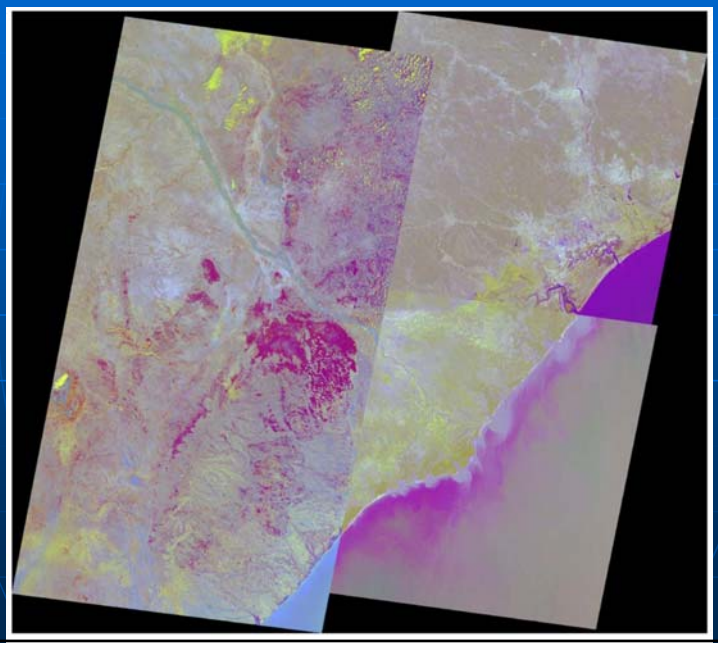
Methods: Classification

- Used:
  - TM+ Bands 4, 3, 2 false color image
  - NDVI
  - Texture
  - Google Maps
  - ESRI World Map
- Highest risk area = Urban + Agriculture areas
- Validation with panchromatic band

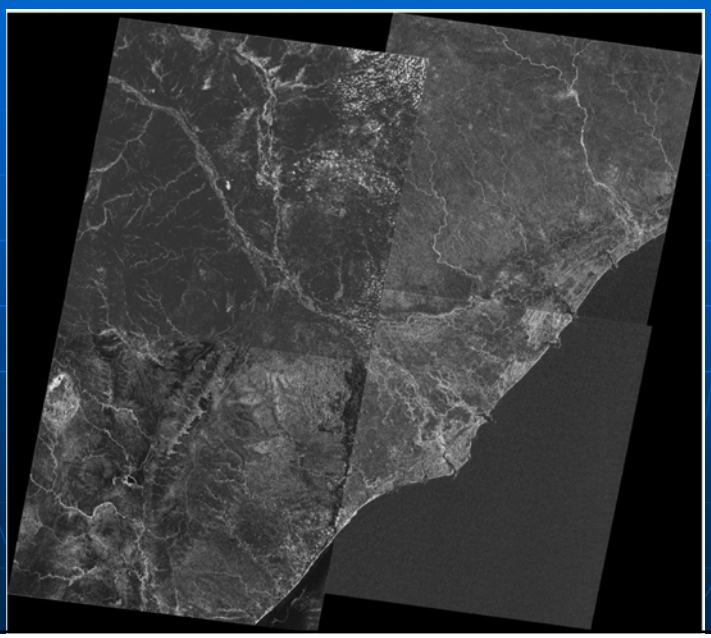
PCA Results: Eigenvalues

	166_072	166_073	167_072	167_073
PC 1	8048.566	6428.685	13468.73	12687.63
PC 2	285.829	1031.974	543.1793	370.2719
PC 3	113.4487	63.68643	171.8924	219.1071
PC 4	21.64382	30.5838	131.6386	64.0132
PC 5	5.203467	5.407538	7.616446	6.844
PC 6	3.770449	2.916707	5.980097	6.671634
PC 7	1.533788	1.777841	3.173872	2.973574

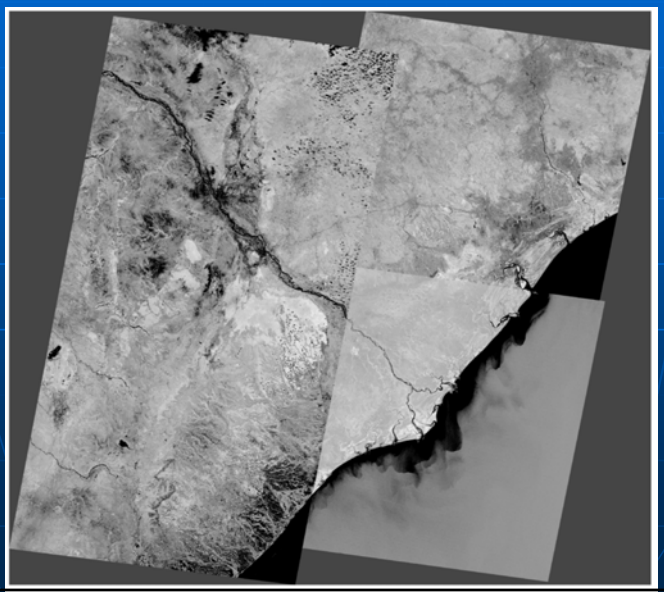
First 3 PCA Components



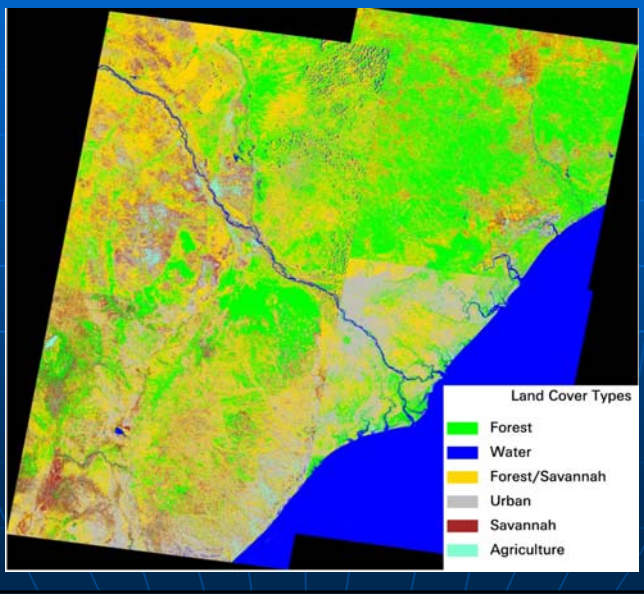
Texture Analysis Mosaic



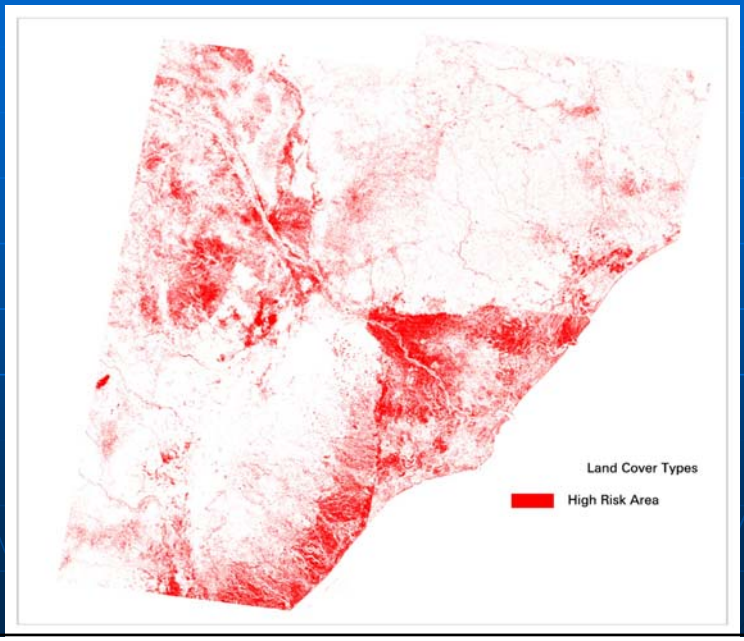
NDVI Mosaic

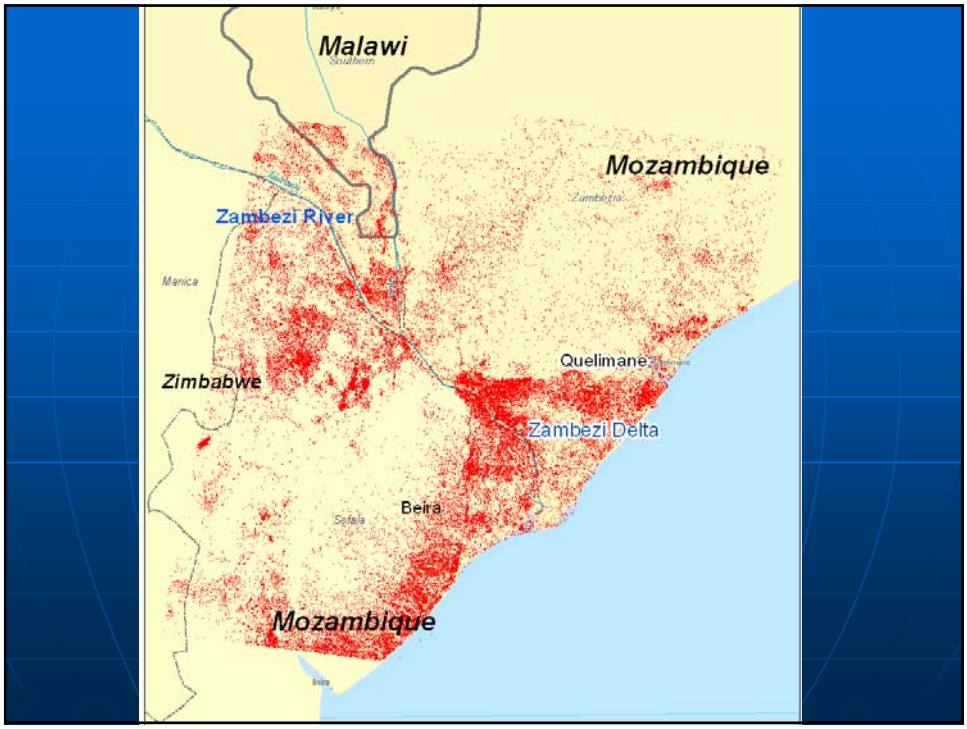


Final Land Cover Type Mosaic

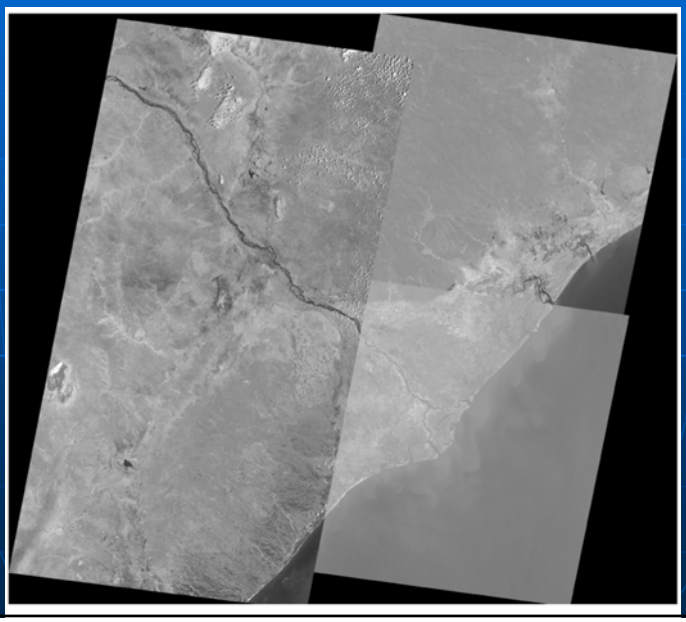


High Risk Areas





Panchromatic Mosaic



Error Matrix

	Urban	Agriculture	Water	Forest	Mixed Forest/ Savannah	Savannah	Total
Urban	10	1	3	0	0	0	14
Agriculture	2	7	1	1	0	0	11
Water	1	0	10	0	0	0	11
Forest	0	0	0	20	1	2	23
Mixed Forest/ Savannah	0	0	0	2	12	4	18
Savannah	0	0	0	2	1	20	23
Total	13	8	14	25	14	26	100

% Correct = 78%, Kappa = 0.73, 95% CI 0.64 – 0.83

Conclusions

- Difficult to get good data in developing world
- Need to do field work
- Need to do ecological studies of *Aedes* distribution
- Need to survey for dengue cases
- Trivia question: what animal kills the most humans in Africa?

Questions?