An interdisciplinary study of typhoid fever in Central Division, Republic of Fiji

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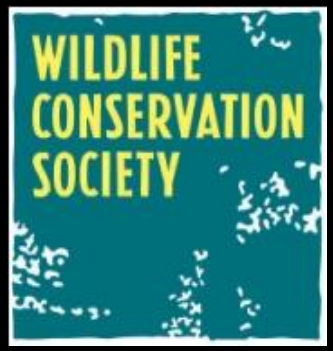
Shaping Fiji's Health


WILDLIFE
CONSERVATION
SOCIETY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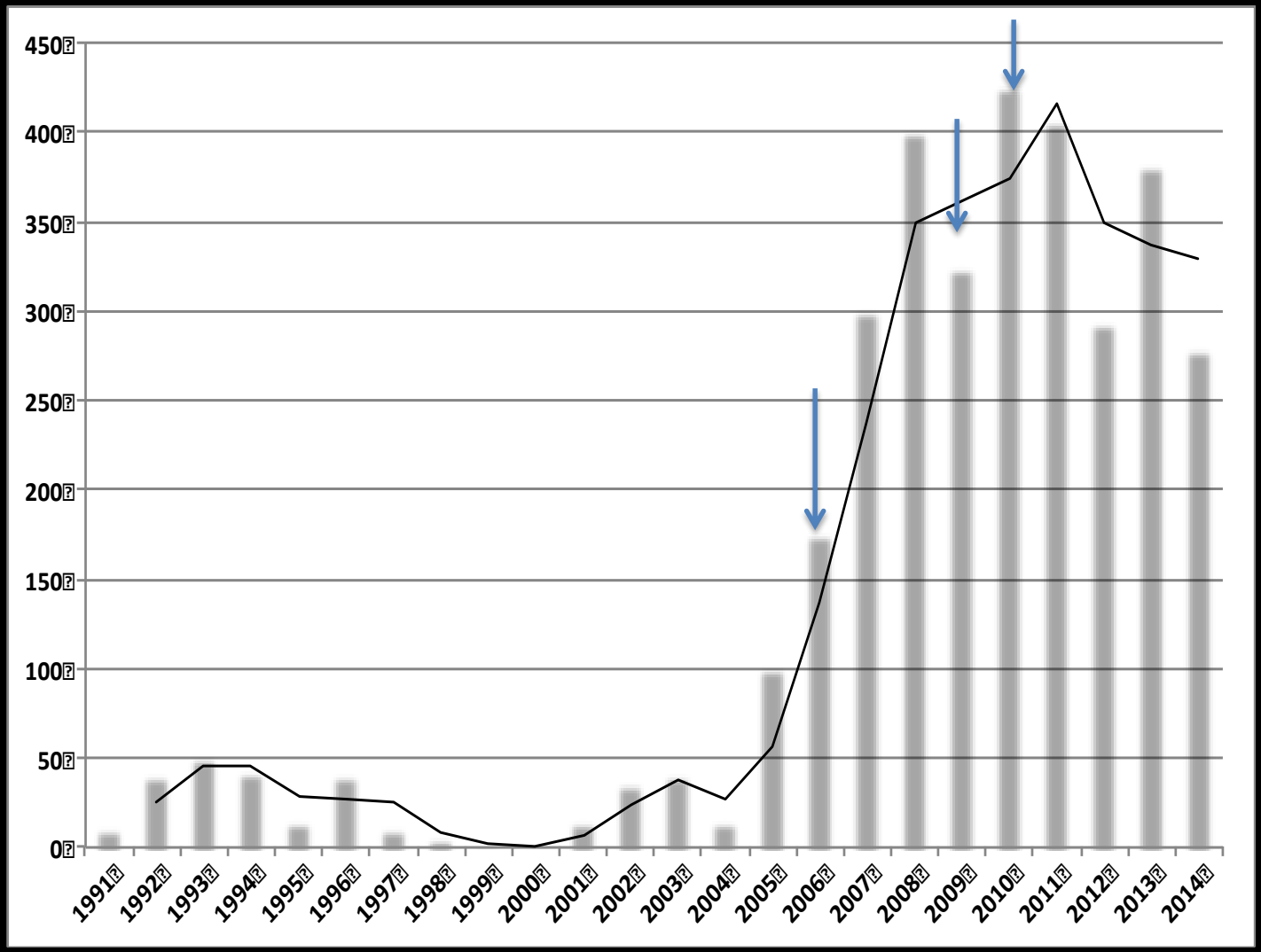
Outline

- The study framework
- Where are the cases – GIS
- Case /control
- Environmental investigations
- Molecular detection -rPCR

Salmonella Typhi bloodstream infections detected by passive surveillance, Fiji, 1991 -2014

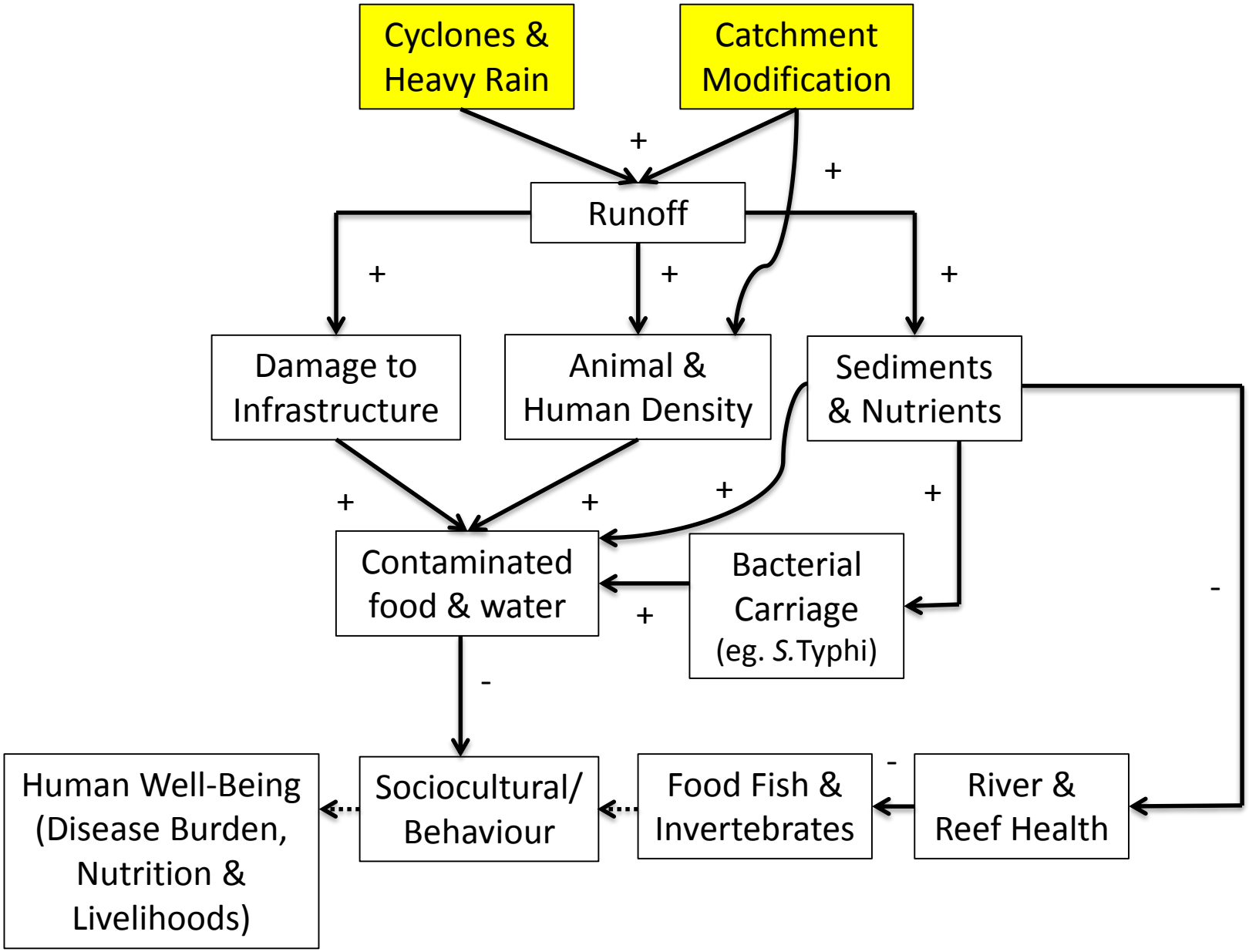


Adapted from Kool et al. 2010


Digicel

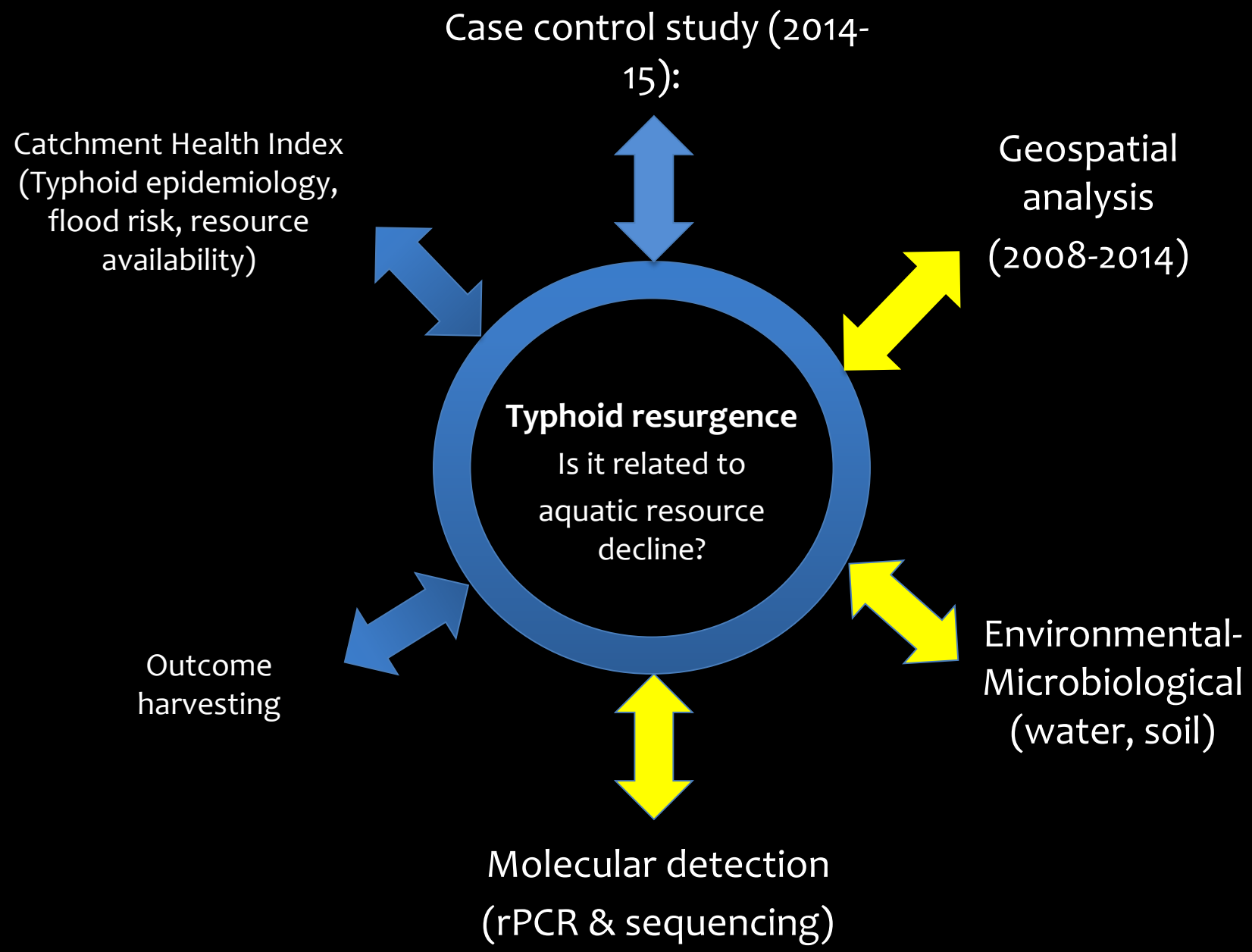
Primary threats to natural systems

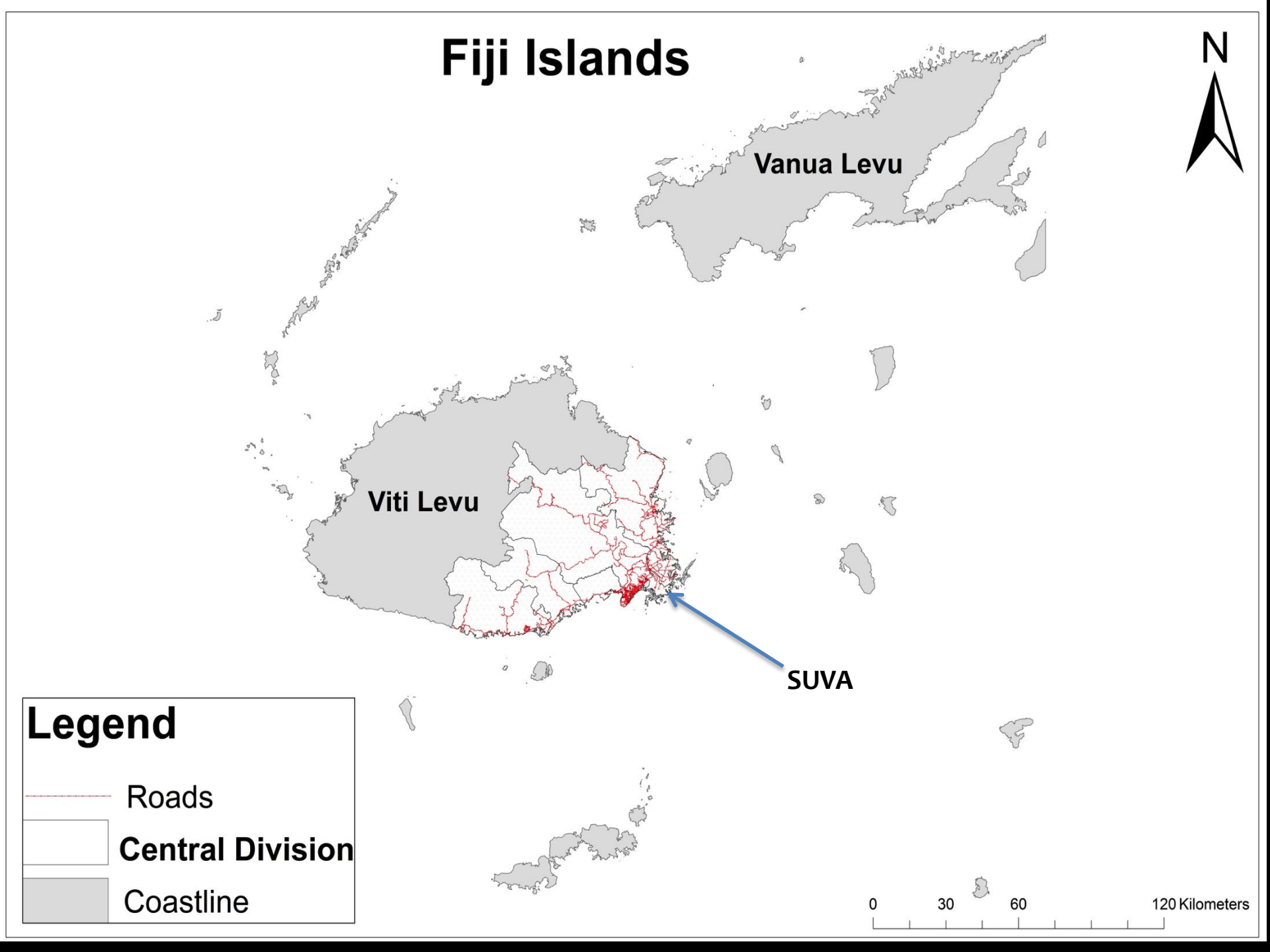
Conceptual model of mechanisms determining health in high island river basins



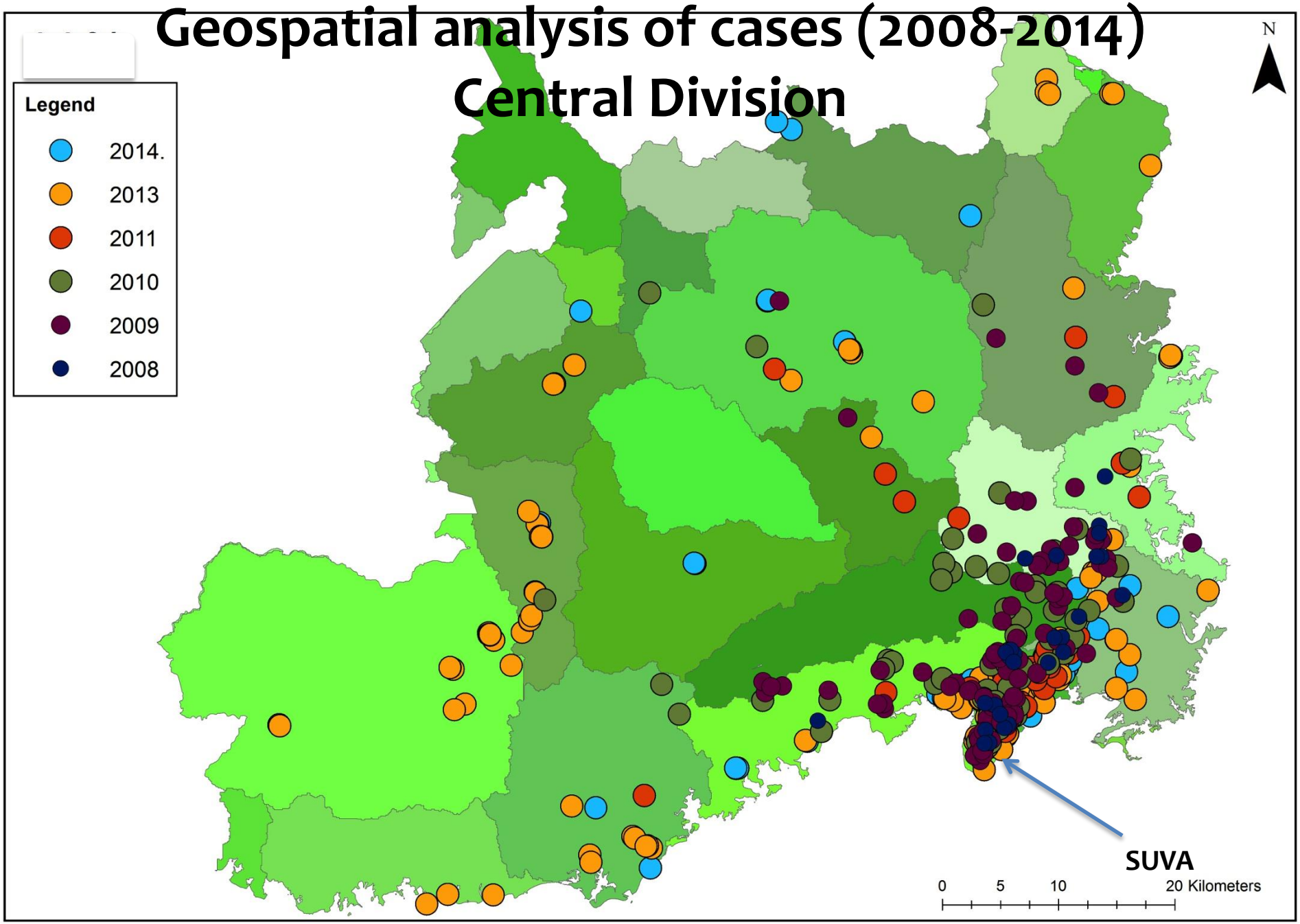
Jenkins & Jupiter (2015) Wetlands Hum Health, in press

Interdisciplinary research elements

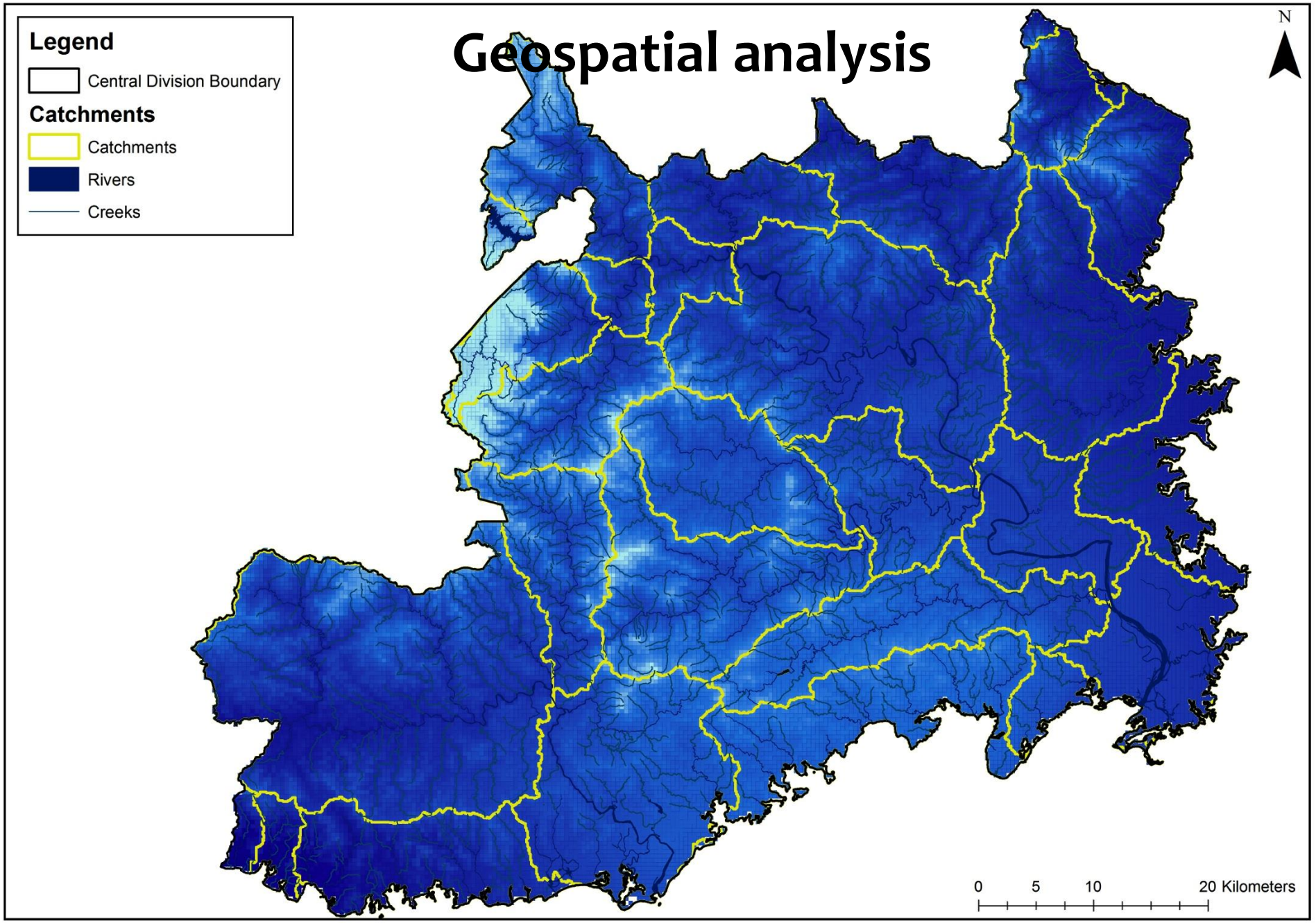


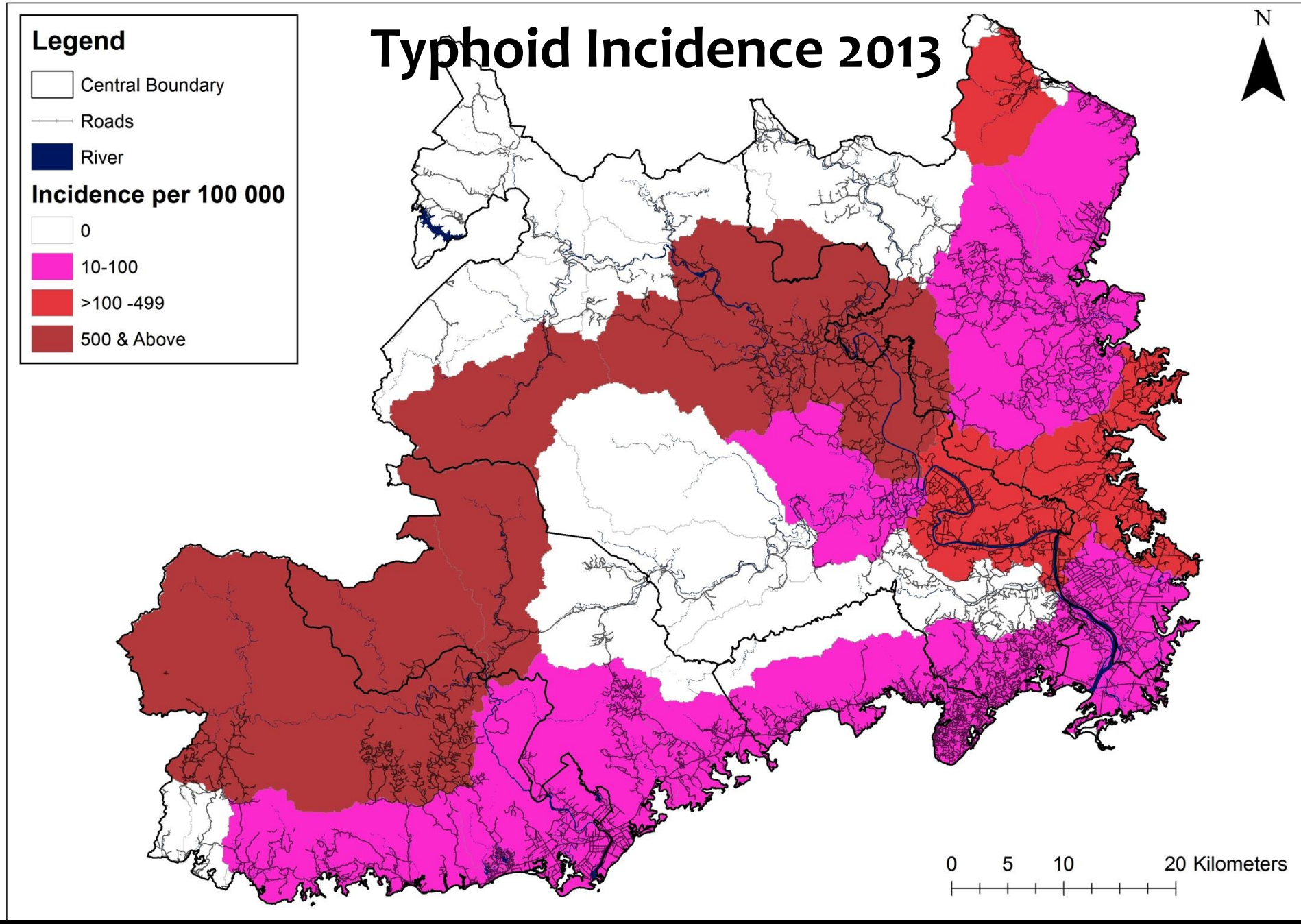

Fiji Islands
N
Vanua Levu
Viti Levu
SUVA
Legend
Roads
Central Division
Coastline
0
30
60
120 Kilometers

Geospatial analysis of cases (2008-2014) Central Division

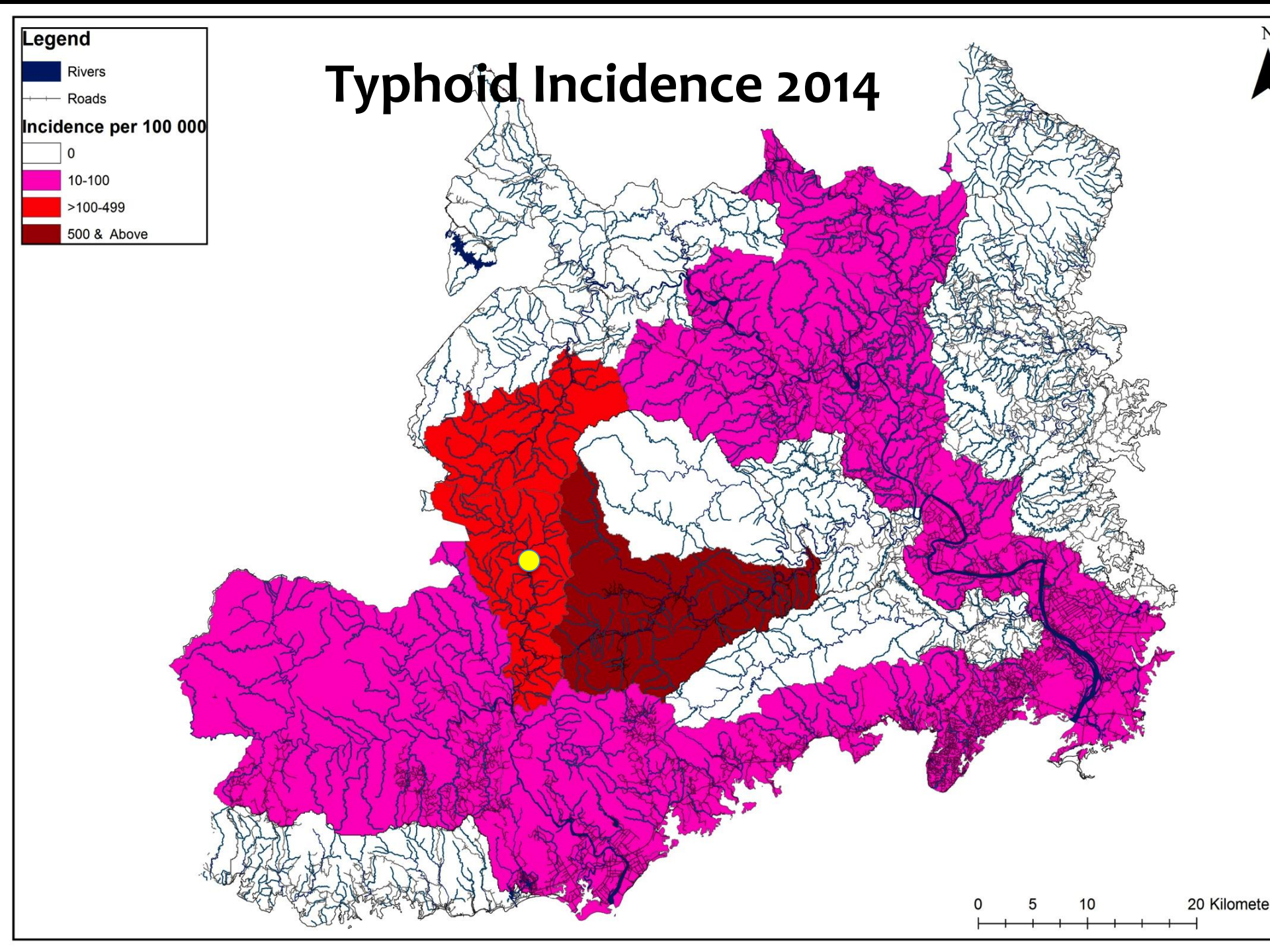


Geospatial analysis

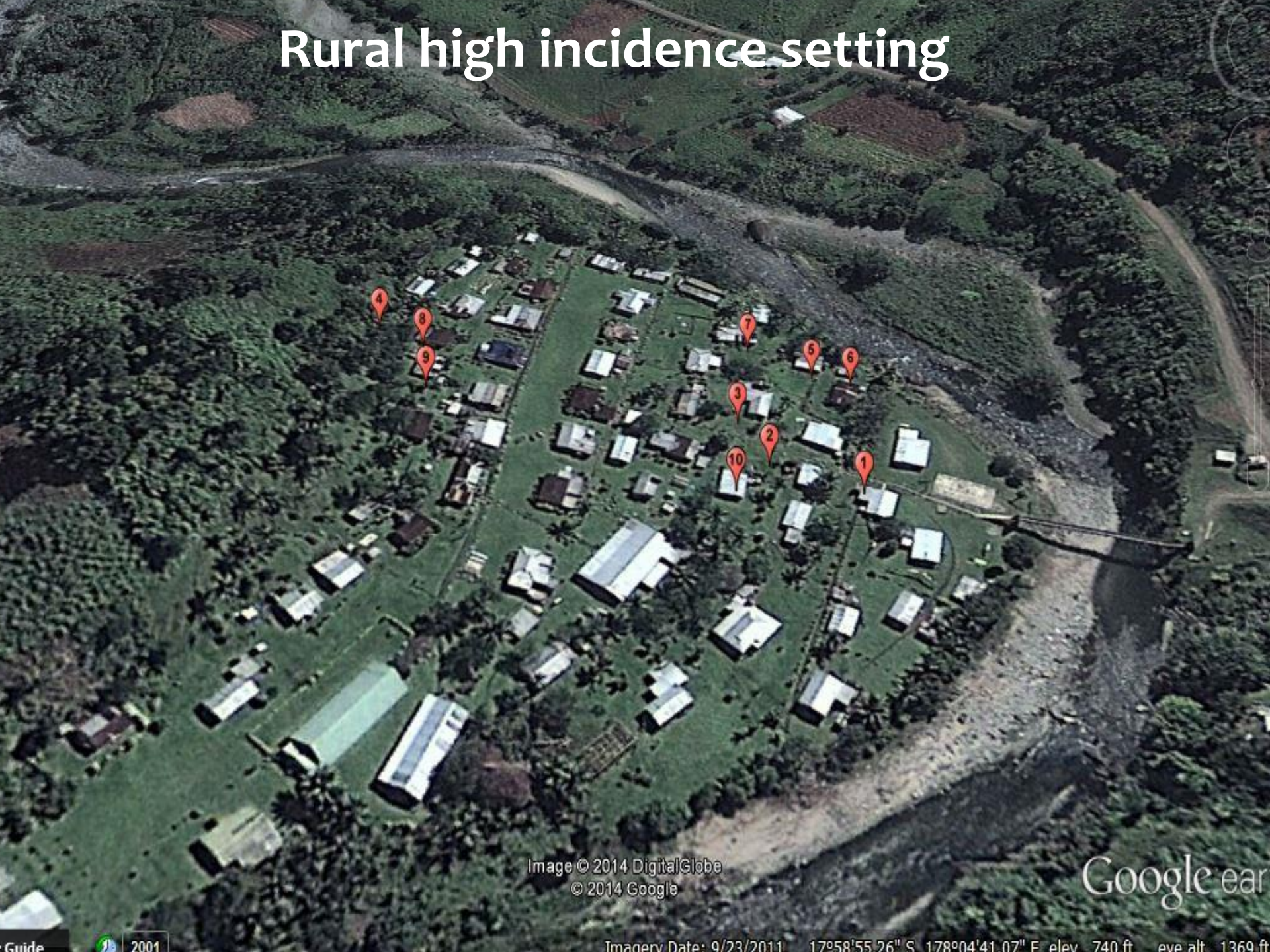



Typhoid Incidence 2013
Legend
Central Boundary
Roads
River
Incidence per 100 000
0
10-100
>100 -499
500 & Above
N
0
5
10
20 Kilometers

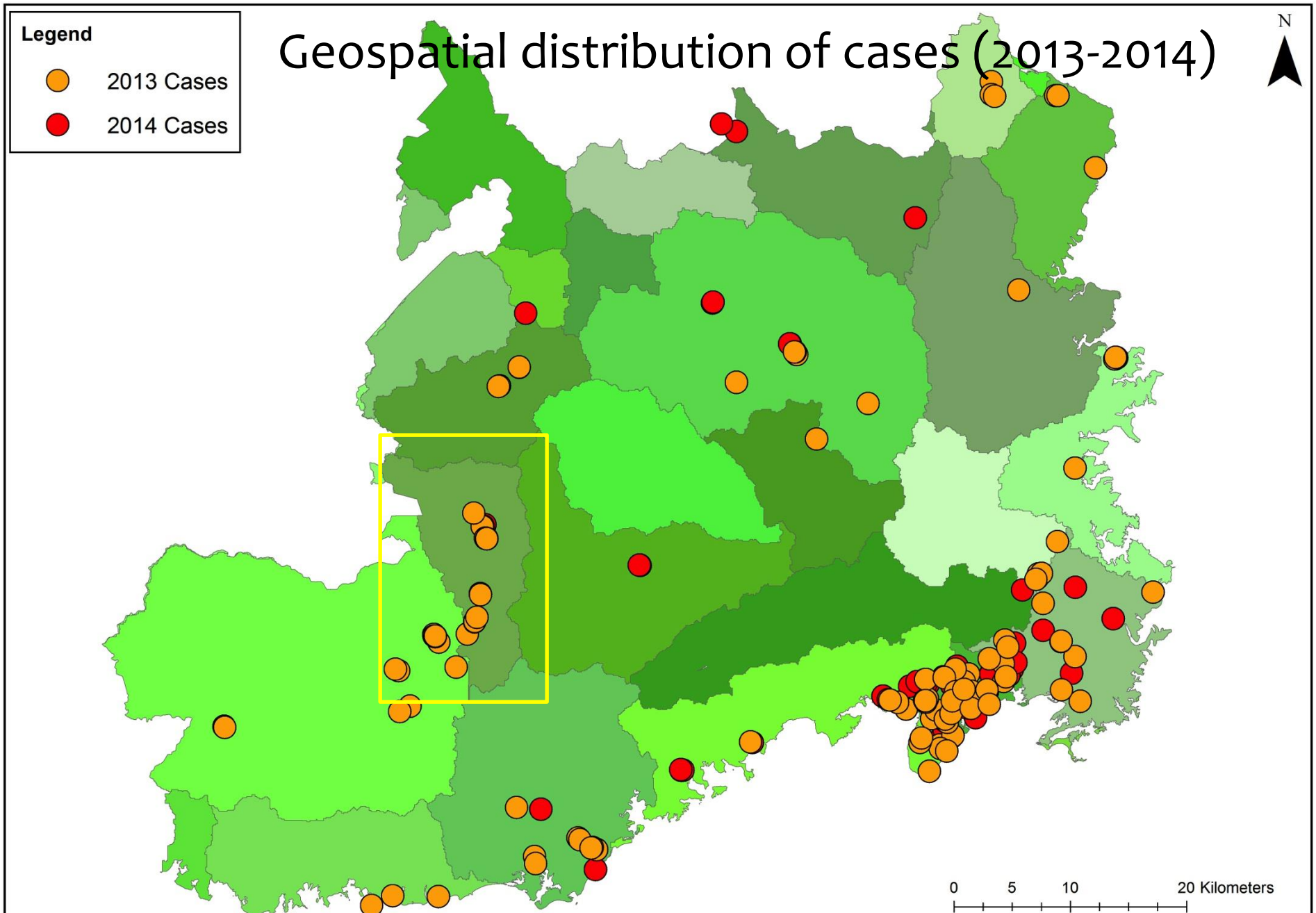
Typhoid Incidence 2014

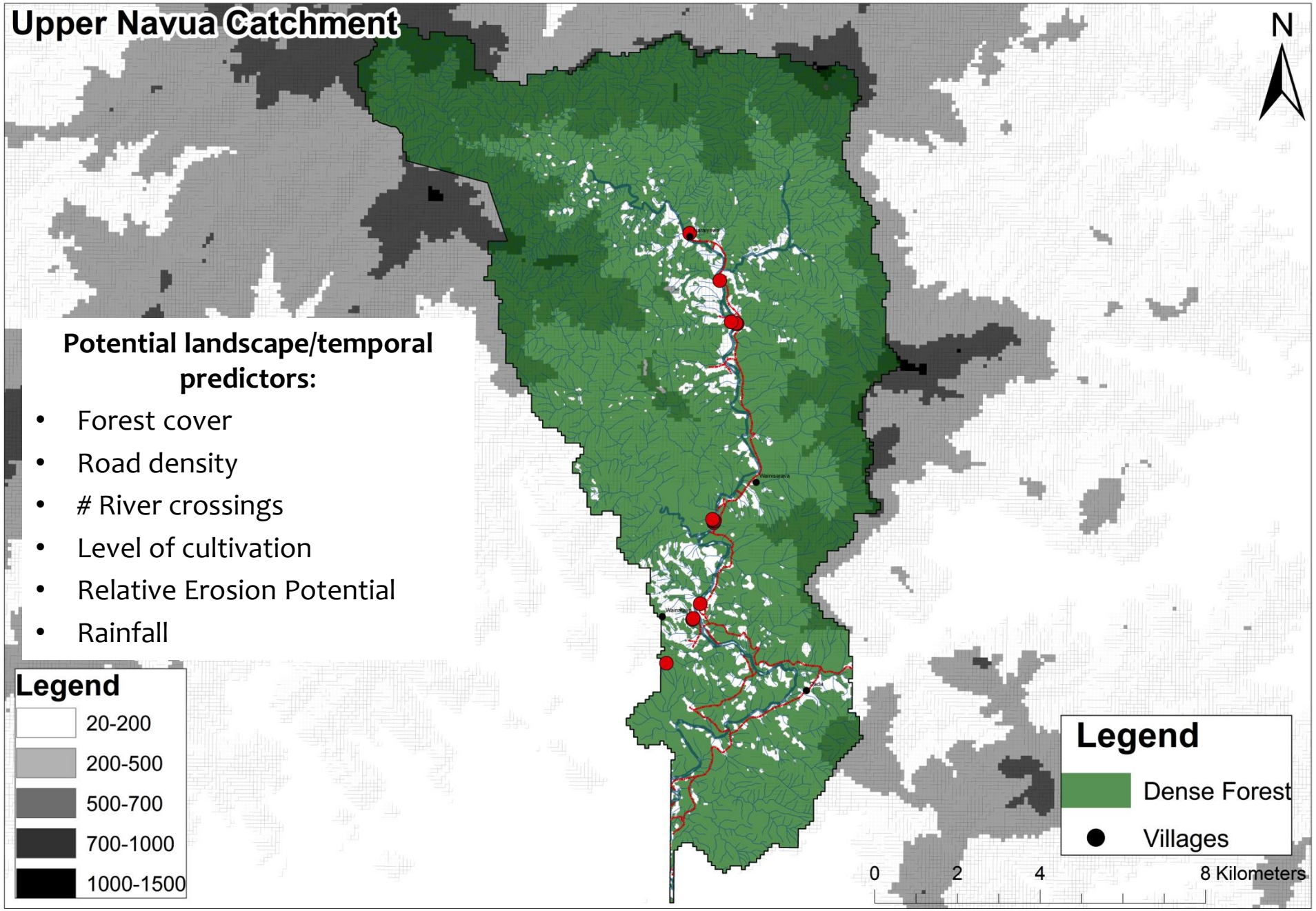


Rural high incidence setting



Urban high incidence setting

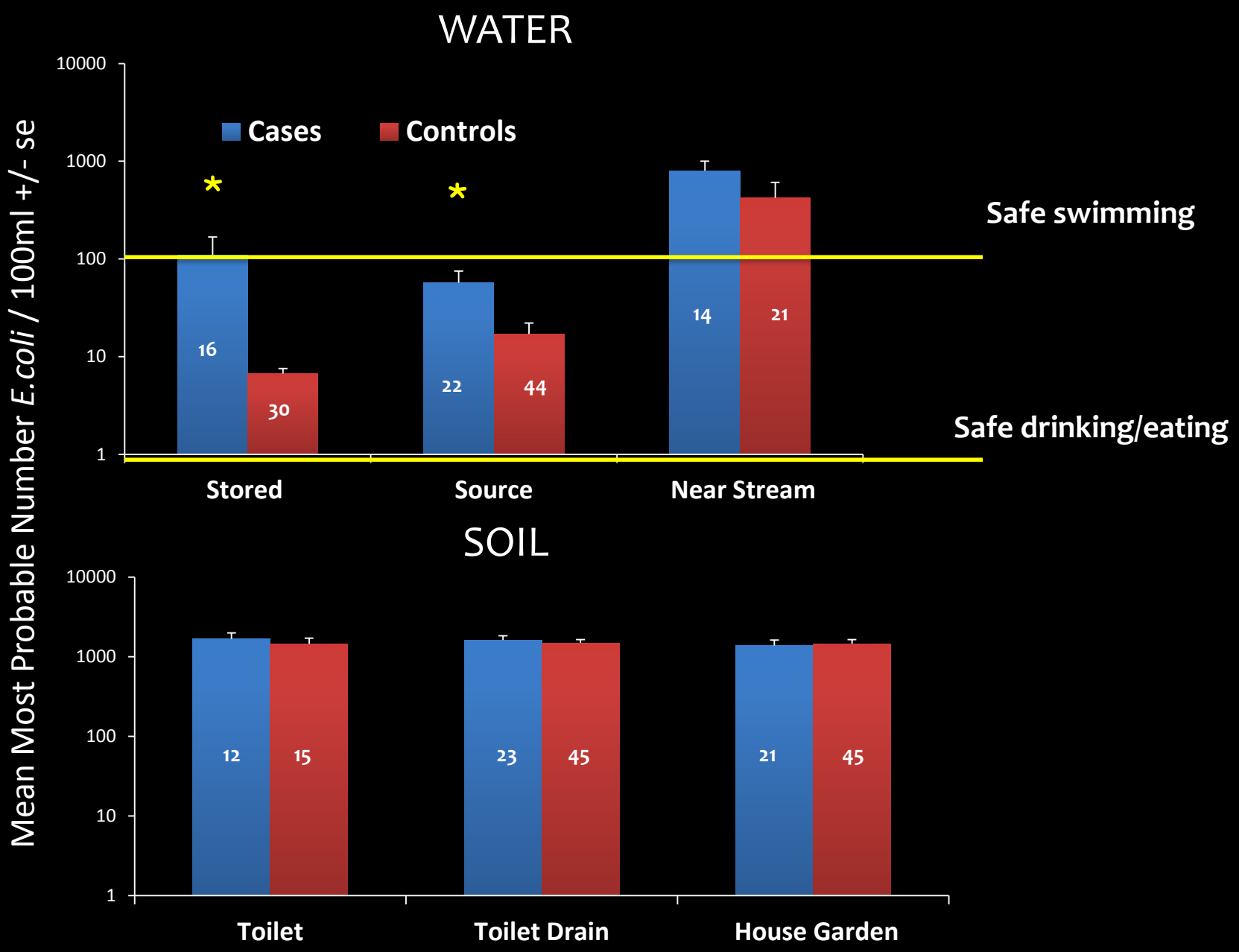

Legend
2013 Cases
2014 Cases
Geospatial distribution of cases (2013-2014)
N
0
5
10
20 Kilometers


Upper Navua Catchment
N
Potential landscape/temporal predictors:
• Forest cover
• Road density
• # River crossings
• Level of cultivation
• Relative Erosion Potential
• Rainfall
Legend
20-200
200-500
500-700
700-1000
1000-1500
Legend
Dense Forest
Villages
0
2
4
8 Kilometers

Environmental sampling

- Water – stored, source, nearby stream
- Soil – toilet, toilet drain, household garden
- On site – Temp, pH, conductivity, DO
- Lab process – Total Coliforms, *E.coli*
- Filtered (0.4 microns) – stored for PCR
- Filtrate – Nitrates, Phosphates, Ammonia

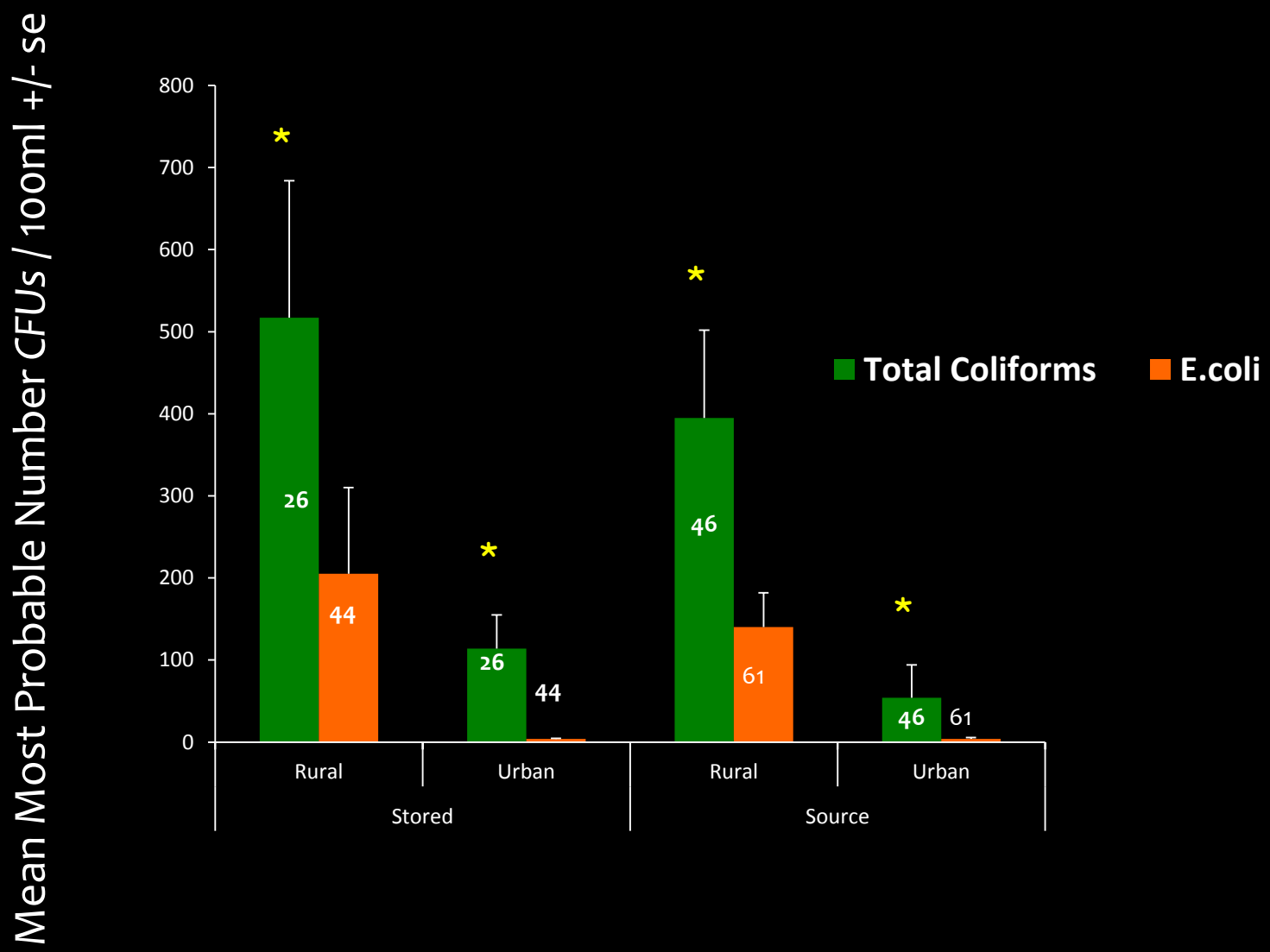
Mean Most Probable Number of *Escherichia coli* in water & soil of cases & controls



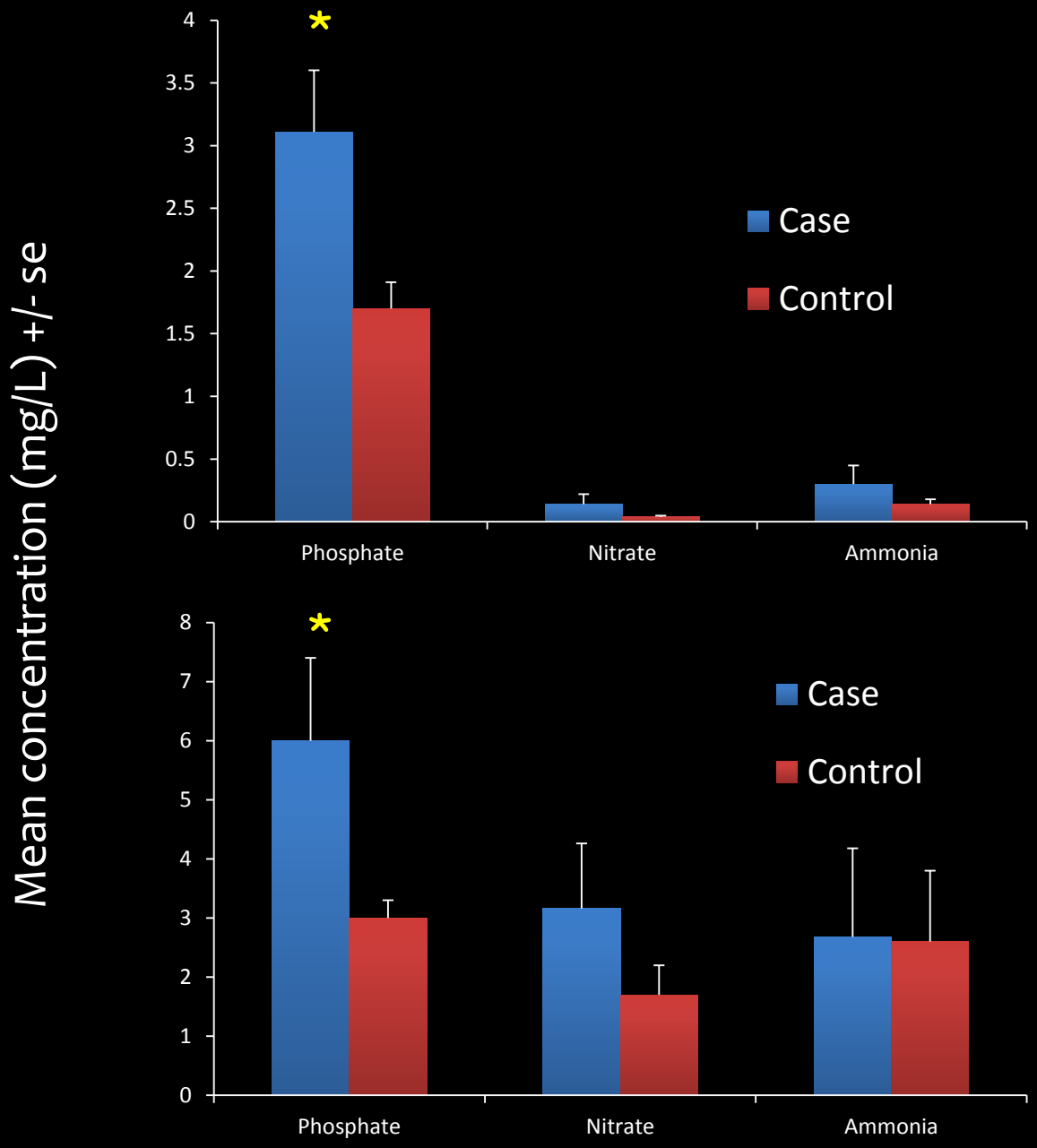
RURAL

URBAN

Total Coliforms and *Escherichia coli in* Rural vs Urban Drinking Water



Mean concentration of nutrients in water & soil of cases & controls



Molecular detection

- rPCR on water & soil samples
- Assay works in soil… a first?
- 5 positives from 50 samples – all case houses

Muddy water below
house entrance

Conclusions

- In endemic, high-incidence, flood prone settings environmental sources of exposure are likely
- Localized behaviors, household environments or river basin settings may enhance risk of typhoid
- Focus on natural and built infrastructure + vaccination
- Pacific Islands as model systems for typhoid control and elimination?

Said Lao Tsu, 2,500 years ago.

“Thirty spokes share the wheel’s hub;

It is the center hole that

makes it useful.”


THANK YOU
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