

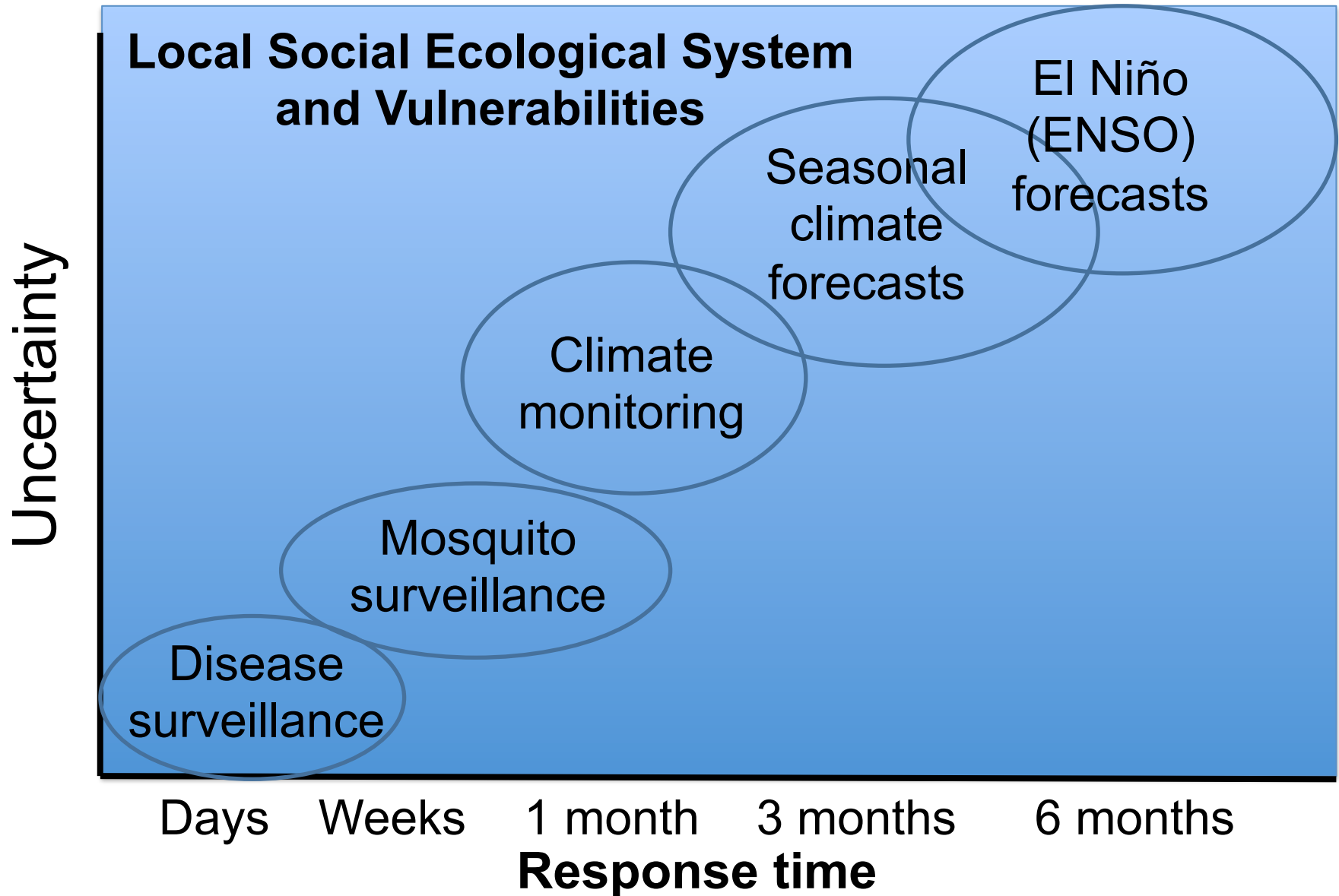
Lessons from the field: Local research and surveillance of climate sensitive diseases in coastal Ecuador



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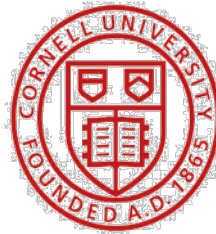


Epidemic Early Warning System Data





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Strengthening climate-health surveillance and research capacities in Ecuador

Aim: Create a long-term research platform for climate-sensitive diseases and other priority areas, e.g., other pathogens, clinical trials, vector control interventions.

Approach:

- Strong institutional partners and a team of people who facilitate this kind of research.
- A social-ecological systems approach to study design and analysis.
- Strengthening virus-vector-climate surveillance systems (diverse data streams) and ongoing training and capacity building
- Integration of data through spatiotemporal modeling.

Outcome:

- Generate the evidence base for the effects of climate on health
- Identify and test effective public health responses and interventions.

Machala, Provincia El Oro

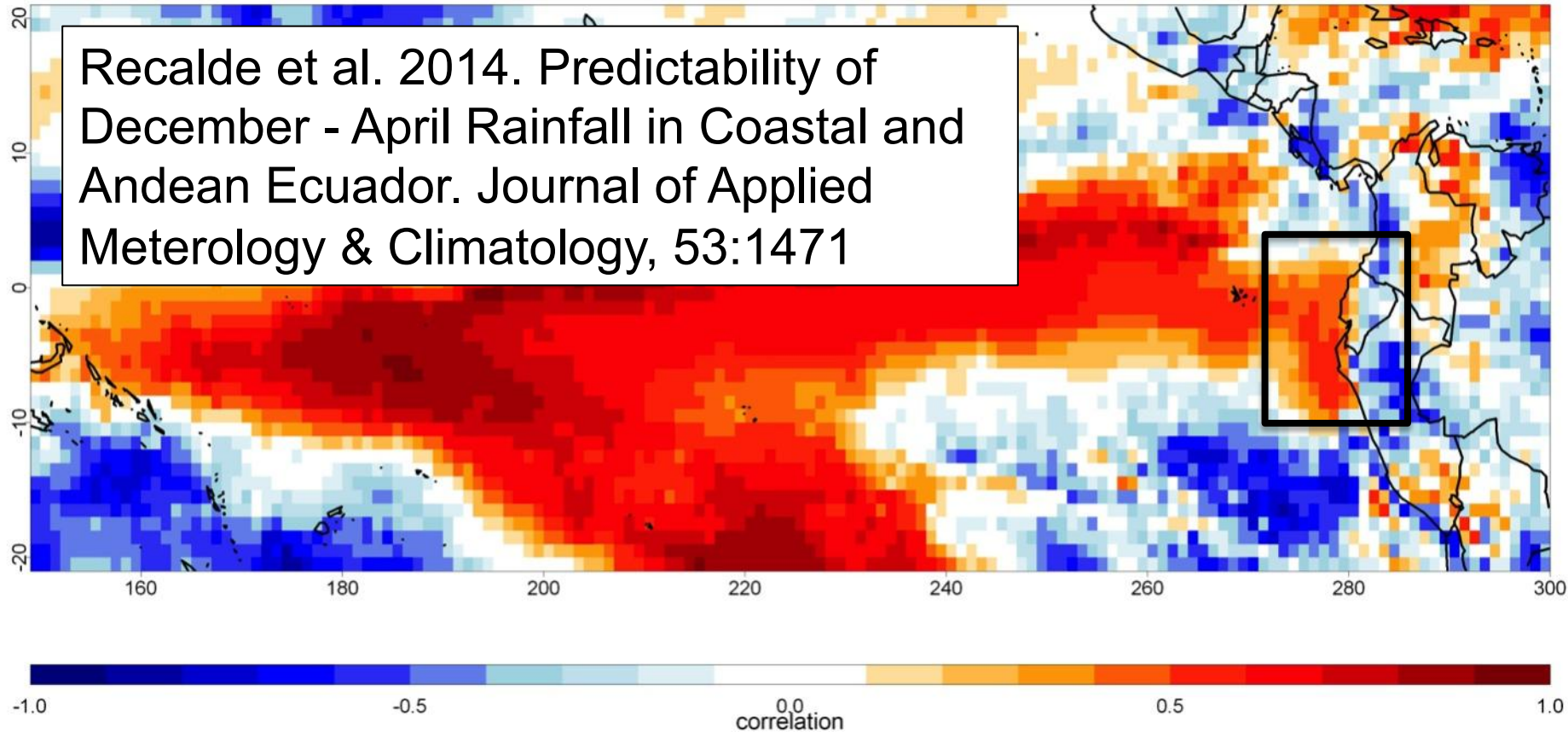
~250,000 pop.

Strategic surveillance location

Endemic for dengue



Improving seasonal climate forecasts



(Stewart Ibarra & Lowe, 2011, ASTMH poster)

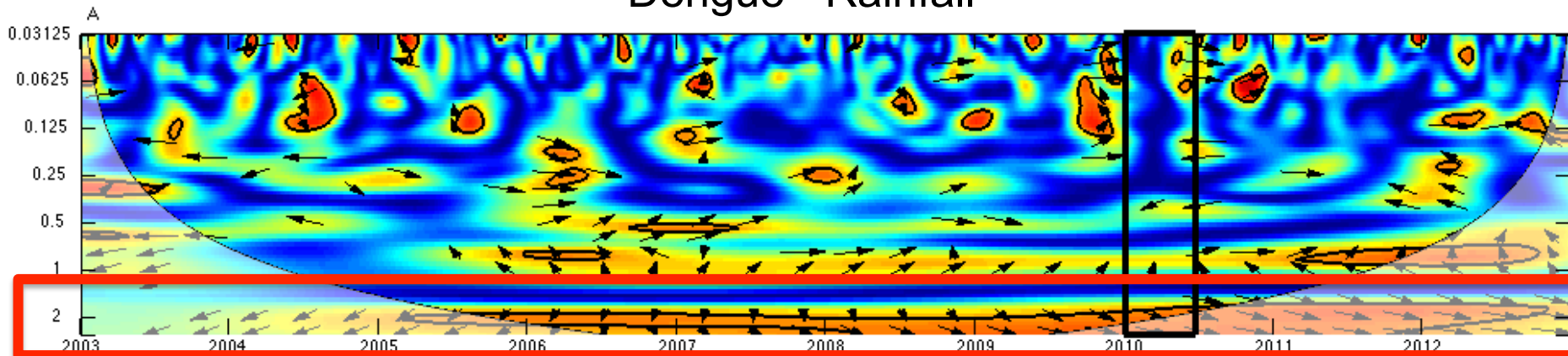
ENSO, local climate & nonclimate factors drive dengue epidemics in the province of El Oro

(Model adequacy results 2001-2010)

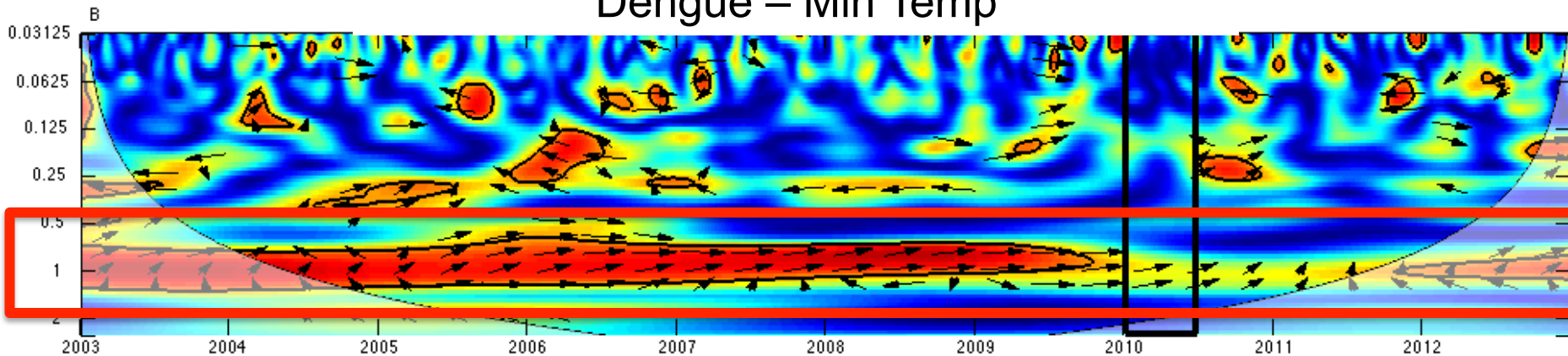
Model	$\log \rho_t$	DIC	R^2_{LR}
Base (Seasonal)	$\alpha + \beta_{t'(t)}$	1313.18	0.44
Climate effects	$\alpha + \beta_{t'(t)} + \sum \gamma x_{jt}$	1305.28	0.49
Non-climate effects	$\alpha + \beta_{t'(t)} + \sum \varepsilon z_{jt}$	1286.63	0.56
Climate and non-climate effects	$\alpha + \beta_{t'(t)} + \sum \gamma x_{jt} + \sum \varepsilon z_{jt}$	1276.67	0.61
Climate, random and non-climate effects	$\alpha + \beta_{t'(t)} + \sum \gamma x_{jt} + \delta_{T'(t)} + \sum \varepsilon z_{jt}$	1245.25	0.72

Evidence of multiyear cycles of climate & dengue in Machala

Wavelet coherence spectrum
Dengue - Rainfall



Dengue - Min Temp



Evidence that the effect of climate on dengue varies within the city of Machala.



Central area



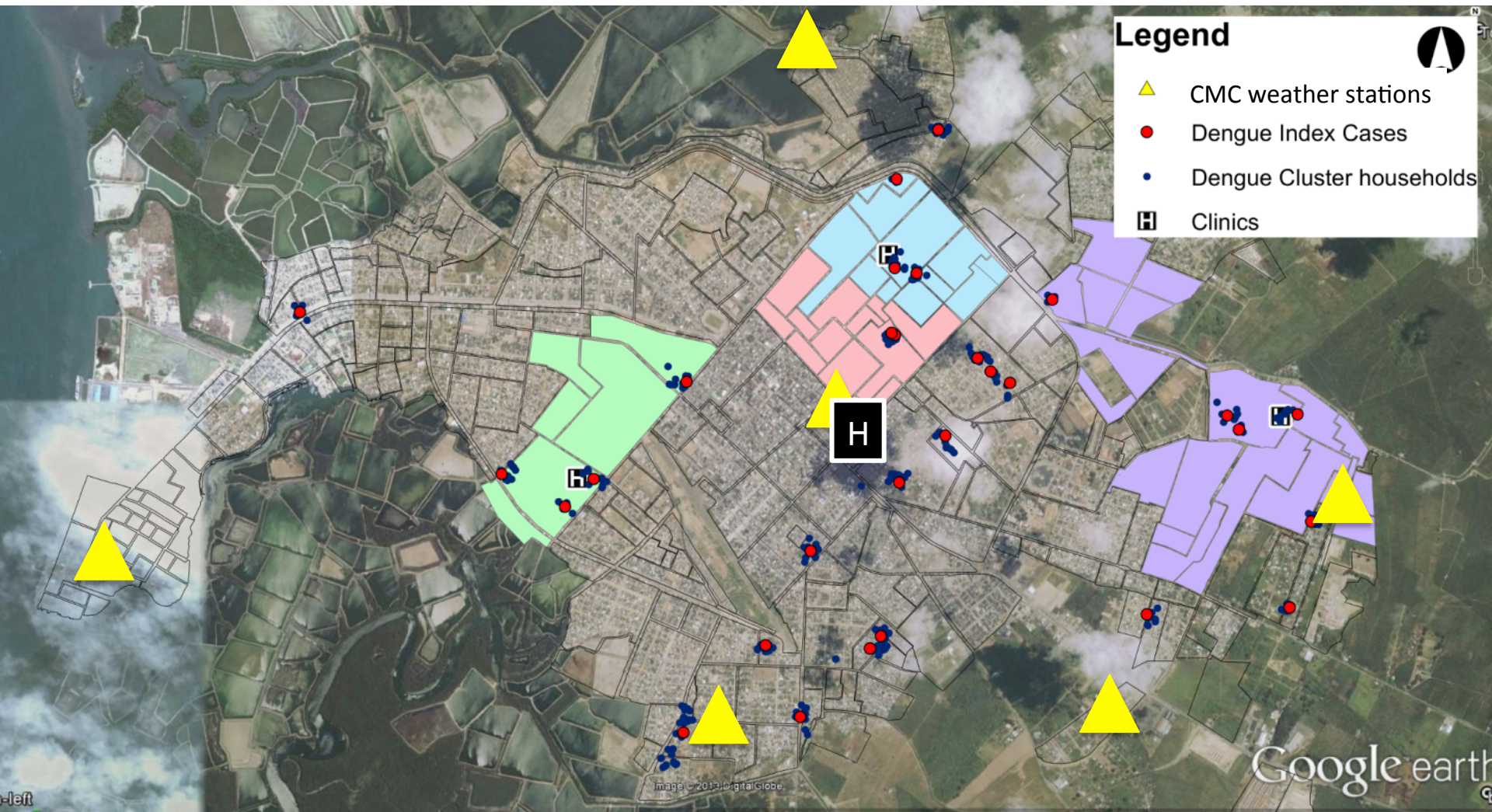
Peripheral area



(Stewart Ibarra, et al. 2013, PLOS ONE)

Strengthening integrated surveillance of dengue virus, vectors, and climate in Machala

Ongoing studies: *Micro-climate modeling, Social-ecological risk, Vector-virus dynamics, Micronutrient-dengue interactions, Immunology, Virology...*



Complimentary projects in Ecuador funded by Ecuadorian & regional institutions (2014)

- Interaction between climate variability and the occurrence of harmful algae blooms (HABs) and their impact on human health in an estuarine-coastal environment (Estero Salado -Santa Elena) (ESPOL)
- Creation of a South American Network on Diagnostics, Treatment and Control of Vector Borne Diseases (UNASUR)
- Pilot evaluation of attractive toxic sugar baits (ATSB) for dengue vector control in Ecuador (PUCE, pending)
- Exploratory study of risk factors for dengue virus transmission on Santa Cruz and San Cristobal, Province of Galapagos. (USFQ)
- Determining the mosquito and sand fly fauna diversity at the Tiputini Biodiversity Station, Yasuní National Park, using classical taxonomy and novel DNA barcoding techniques: Scientific collaboration between USFQ (Ecuador), WRBU-WRAIR (USA), and SUNY UMU (USA). (USFQ)
- Prometeo Fellowship. US-Ecuador collaboration for Dengue Research (SENESCYT)
- Developing an operational research framework to assess local flood response capacities in Ecuador, the Dominican Republic and Bolivia (IAI)

It is important to have *strong institutional partners* and a team of people who facilitate this kind of research.

Research is driven by national strategic priorities

Formalize through MOUs and other agreements

Implement through continuous engagement, formal & informal communication.

Build trust, relationships, reputation. Face time is critical.

Local champions are key.

Need partners who understand local-national governance structures, regulations, and culture.

Often a moving target!

Policy

Ministry of Health
National Institute of Meteorology
Ministry of Environment
World Health Organization

Social science

Sociologists
Anthropologists
Communications experts

Civil society actors

Community leaders
NGOs
Media
Artists

Public-Private Partnerships

Pharmaceuticals (vaccines, diagnostics)
Insecticide producers

Biomedical science

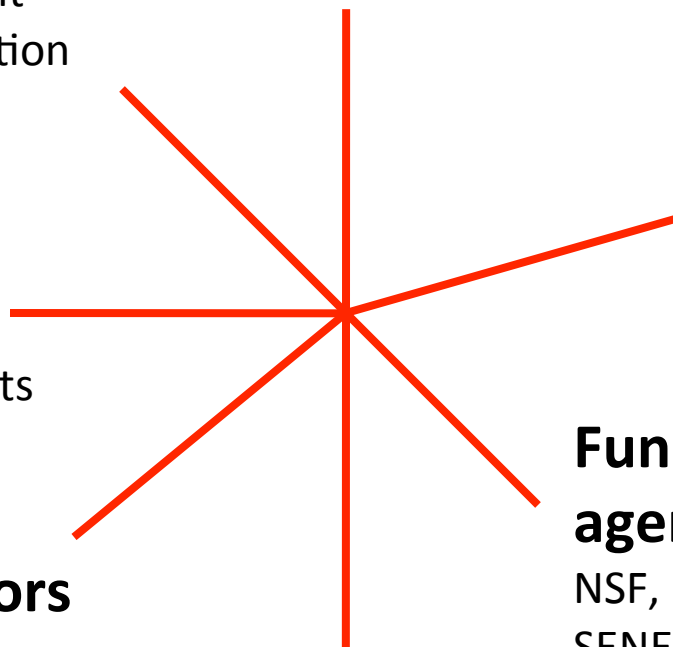
Doctors
Virology
Immunology
Epidemiology

Funding & Regulatory agencies

NSF, NIH, DoD, FDA
SENECYT, ENFARMA, ARCSA

Biophysical science

Climate science
Modelers (GIS, math)
Ecology
Entomology



It is important to have strong institutional partners and *a team of people who facilitate this kind of research.*

- **Open** to new ideas and non-expert input
- **Flexible** to adjust as needed when change arise in the study
- Willing to **embrace ambiguity and complexity.**
- Willing to **examine personal biases** and epistemological assumptions.
- **Active team participants**
- Willing to **express their values** to the group and **understand the role and work of other participants.**
- Experience working in an interdisciplinary team, or have **patience and willingness** to learn the process.
- **Collaborative**, exhibiting **respect, humbleness, and trust** for the people and process.
- Ability to **clearly communicate.**

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