



ECOMORE II-Laos

SURVEILLANCE & DATA MODELLING TO IMPROVE CONTROL OF ARBOVIRAL DISEASES IN URBAN & PERI-URBAN SETTINGS

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1st National Stakeholder meeting

Vientiane, April 4th 2018

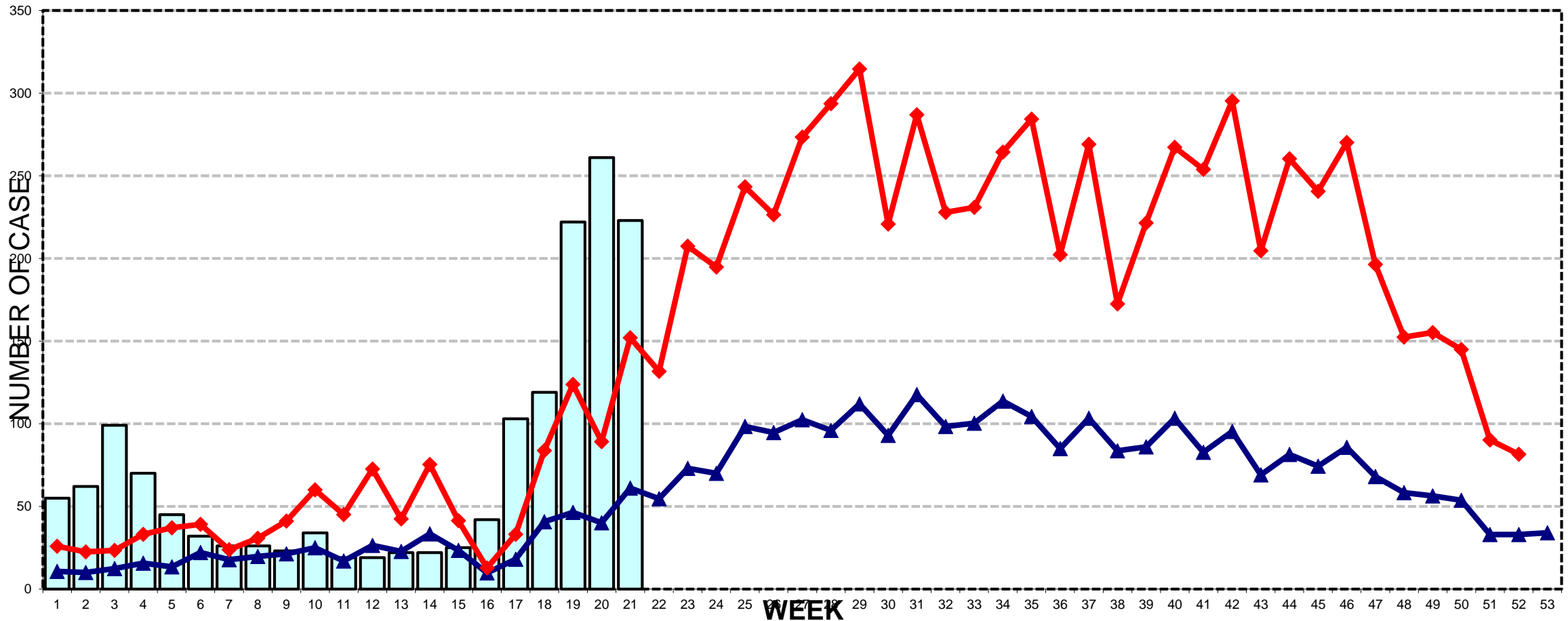
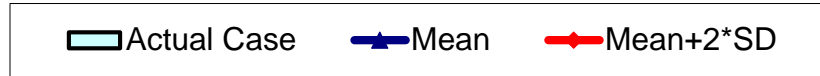
ECOMORE II – GENERAL FRAME

- **General objective: Evaluate the impact on human health of**
 - **human activities**
 - **environmental / climate changes**
- **Approach:**
 - **study the mechanisms of emergence/epidemics (dengue- leptospirosis)**
 - **Measure / anticipate risks for population**
- **Outcomes:**
 - ➔ **Regional strategies to minimize emergence/epidemic**
 - ➔ **Optimize management**
 - ➔ **Reinforce mobilization of the decision makers**

RELEVANCE AT THE NATIONAL LEVEL

- **Dengue remains a main public health problem in Laos**
- **Frequent epidemics of dengue-like syndromes / real incidence – prevalence remain to be determined. D.L.S. = DENV**
- **Alternative etiologies need to be identified**
- **Lao PDR faces drastic changes (urbanization; human migration; human behavior; economic...)**

DENGUE SYNDROMIC-PASSIVE SURVEILLANCE (NATIONAL)



(source: MOH of Lao PDR, DCDC, 2017)

VIENTIANE City



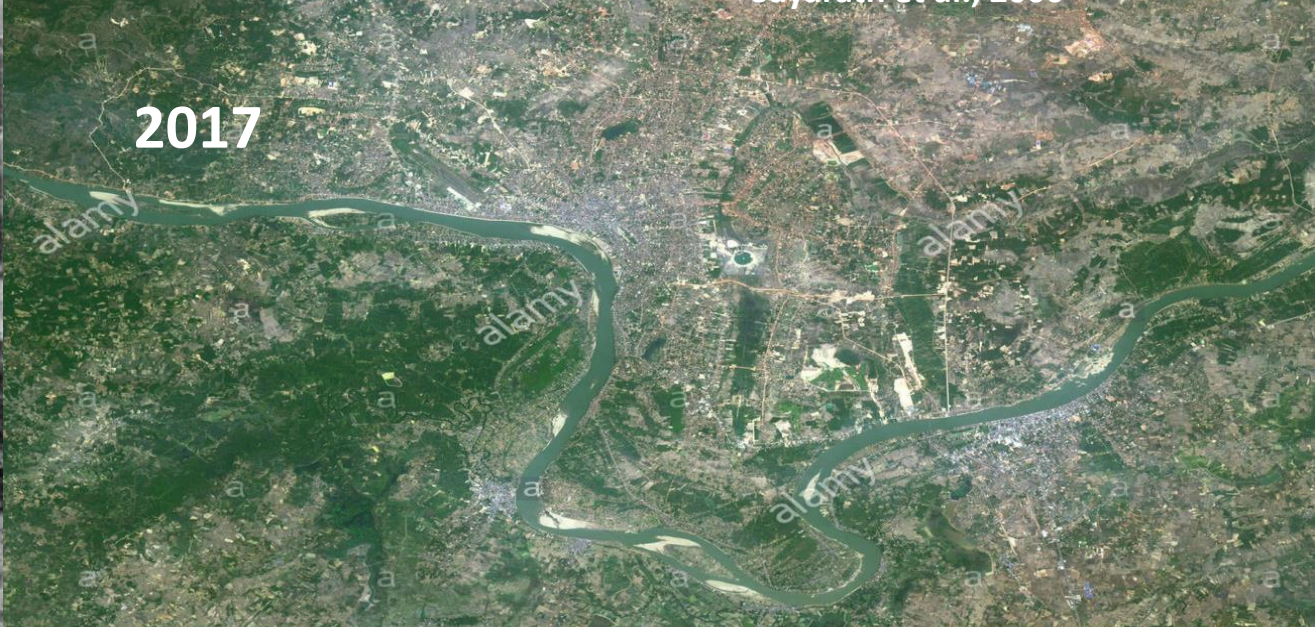
Sayarath et al., 2000



Sayarath et al., 2000



Sayarath et al., 2000



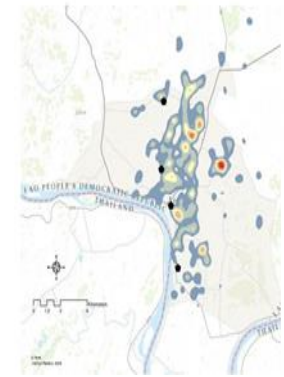
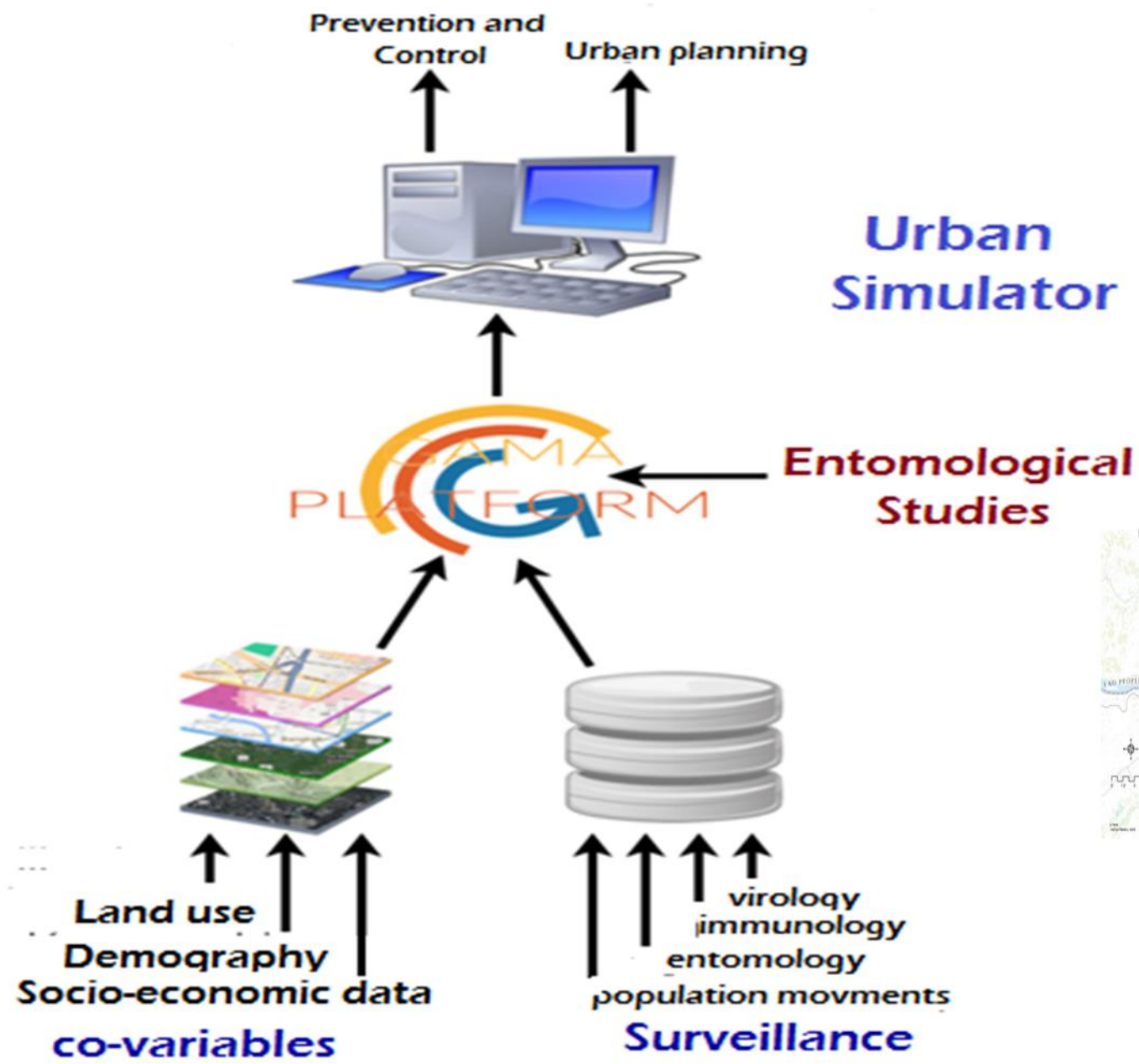
2017

HOW IP LAOS COULD ANSWER

- **DENV laboratory surveillance system in place since 2012**
 - **Local expertise (virology; entomology)**
 - **Background of data (dengue) exists**
 - **Use of data to attempt anticipating DENV transmission (external experts since 2014)**
- **Surveillance in Vientiane city → constant evolution**
 - **Size & diversification of the population**
 - **Connections with neighboring countries**
 - **Economic development / new challenges (tourism...)**
- **Request Lao authorities to improve diseases forecasting and control**

SPECIFIC OBJECTIVES - MEANS

- **Improve DENV vector control**
- **Create/ validate simulation tools**
- **Create / reinforce interactions with decision makers (data sharing/knowledge translation)**
- **Dengue laboratory surveillance → Early detection / alert / follow up**
 - **Improve evaluation of dengue burden (seroprevalence)**
 - **Mapping**
 - **Capacity to monitor implementation of alternative control strategies**
- **Data modelling**
 - **Additional sources of data (environment; meteo...)**
 - **Dynamic mapping**



- **Laboratory surveillance: S. Somlor; P. Bounmany; S. Keosenhom; M. Grandadam**
- **Entomology: P. Thammavong; S. Marcombe; P.T. Brey**
- **Data analysis - modeling: Olivier Telle (CNRS); Marc Choisy (IRD)**
- **Epidemiology: V. Pommelet (IPL); Ph. Cavaille (epidemiologist ext);**
- **Administration: Phouvannamalee Vilaysouk (Oye)**

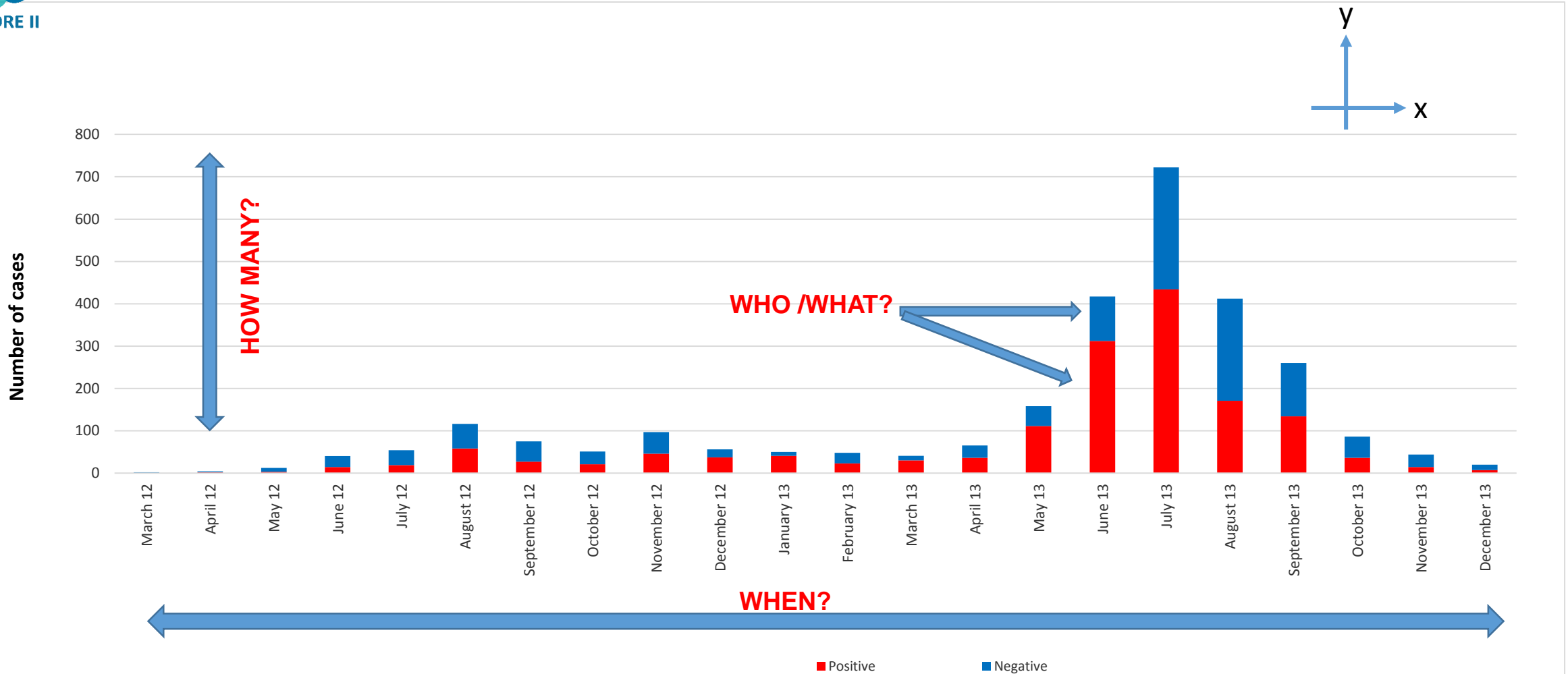
OUTCOMES FROM LAB SURVEILLANCE

- **Large scale surveillance in Vientiane city (# general population)**
- **Hospital network in Vientiane (common case definition)**
 - **Stable recruitment (any season)**
 - **Increase dengue infection diagnostic capacities**
 - ➔ **direct feed back to clinicians (case management)**
- **Field actions: patients' follow up; vector assessment**



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2D VISION OF DENGUE



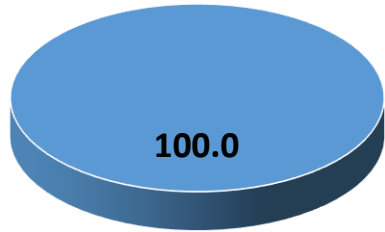
➔ **Magnitude - When to act ? - On what ? (hidden etiologies)**



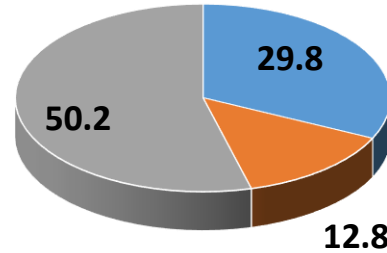
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DENGUE INFECTION = 4 VIRUSES

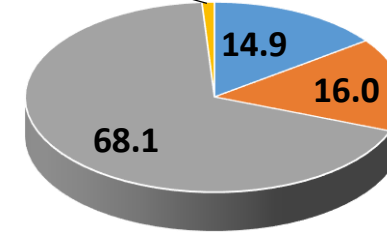
March-April 2012



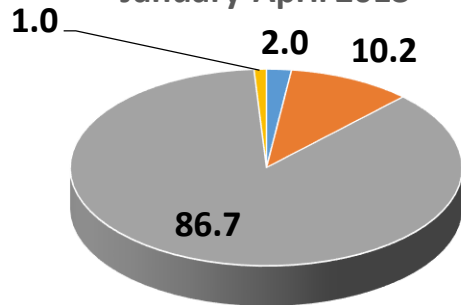
May-August 2012



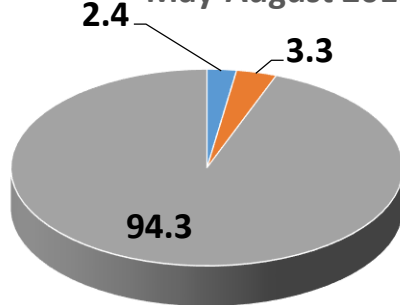
September-December 2012



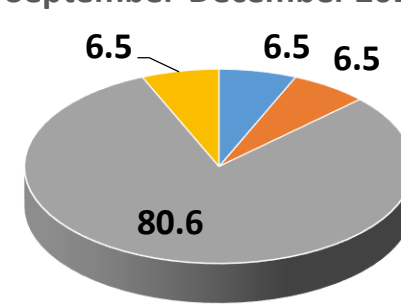
January-April 2013



May-August 2013



September-December 2013

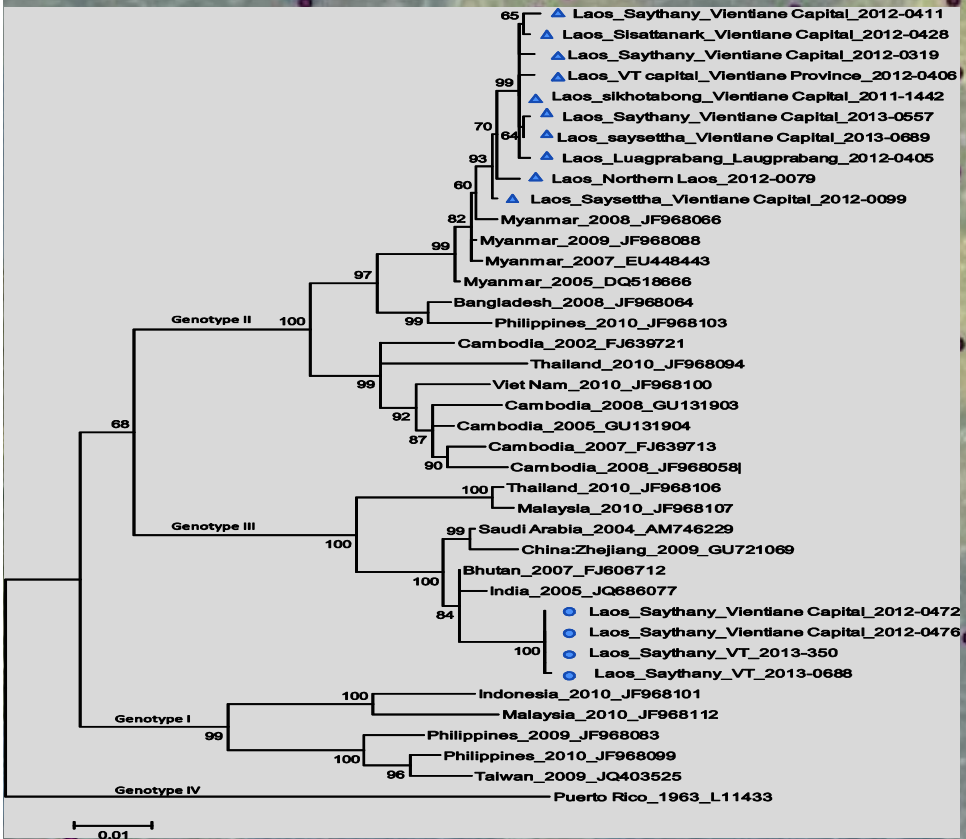
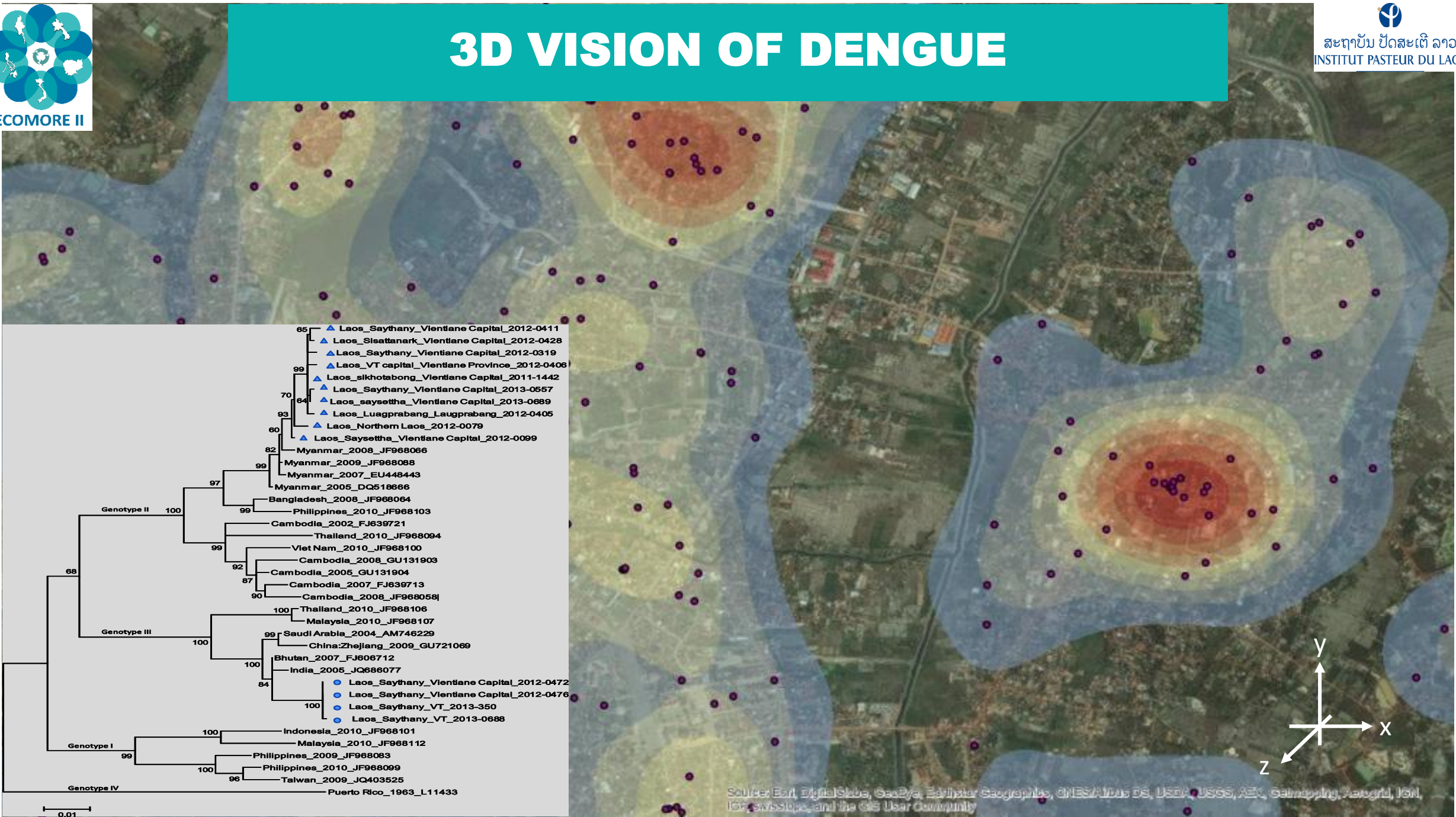


■ DEN-1 ■ DEN-2 ■ DEN-3 ■ DEN-4

→ Quantitative historic data

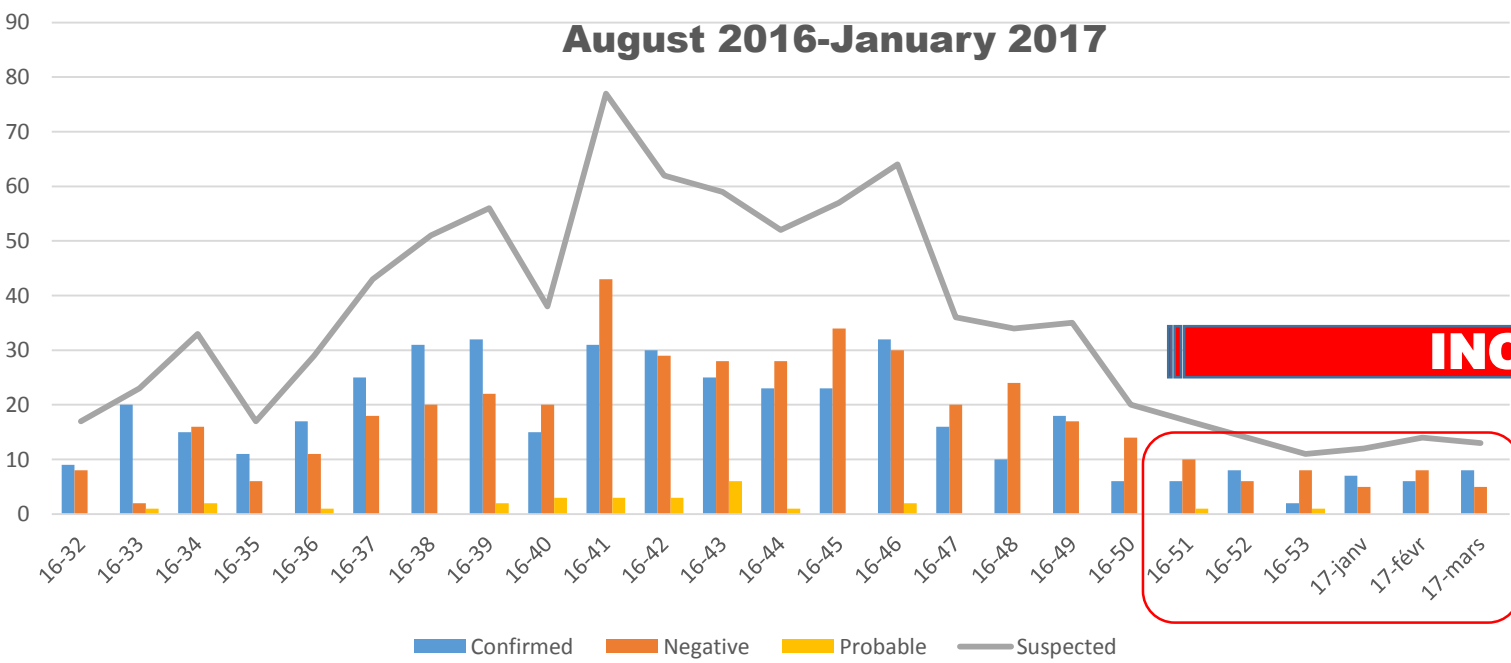
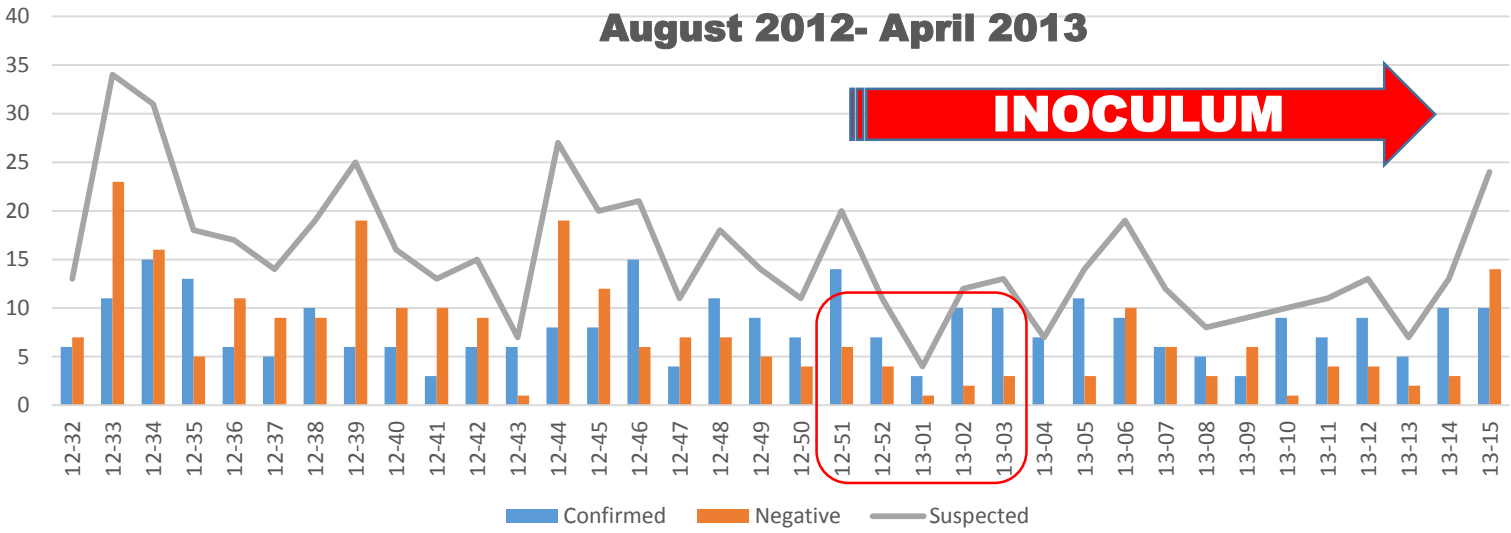
No inter-serotypes cross protection → Immunity in the general population?

3D VISION OF DENGUE



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, Aero, GSA, IGN, IGN, swisstopo, and the GIS User Community

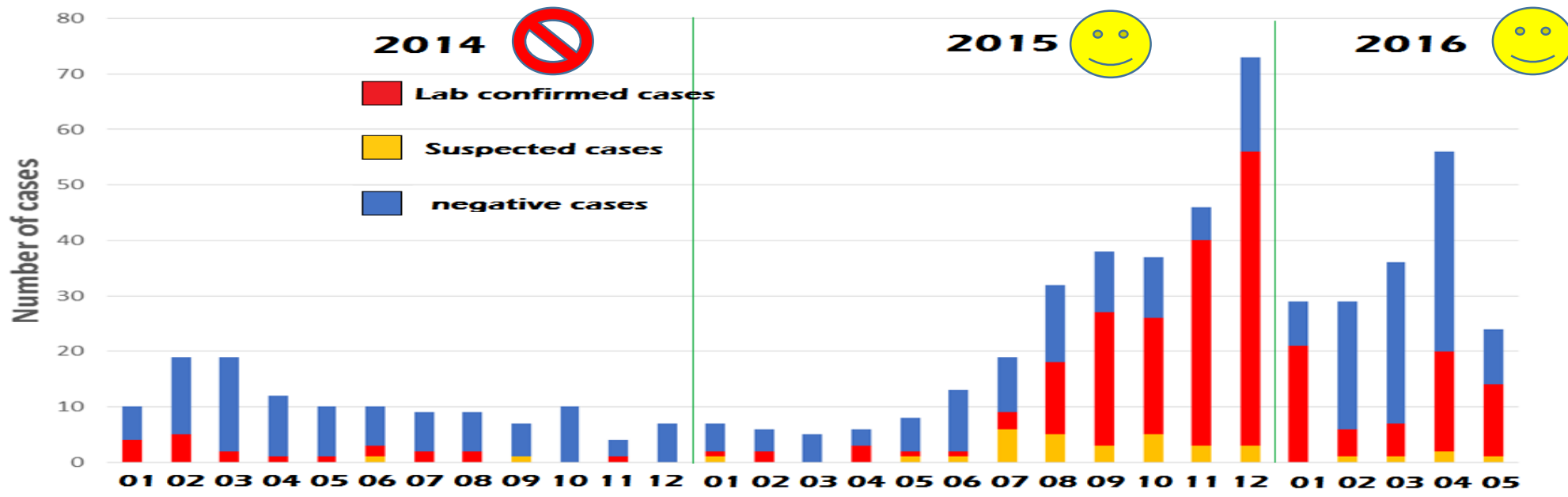
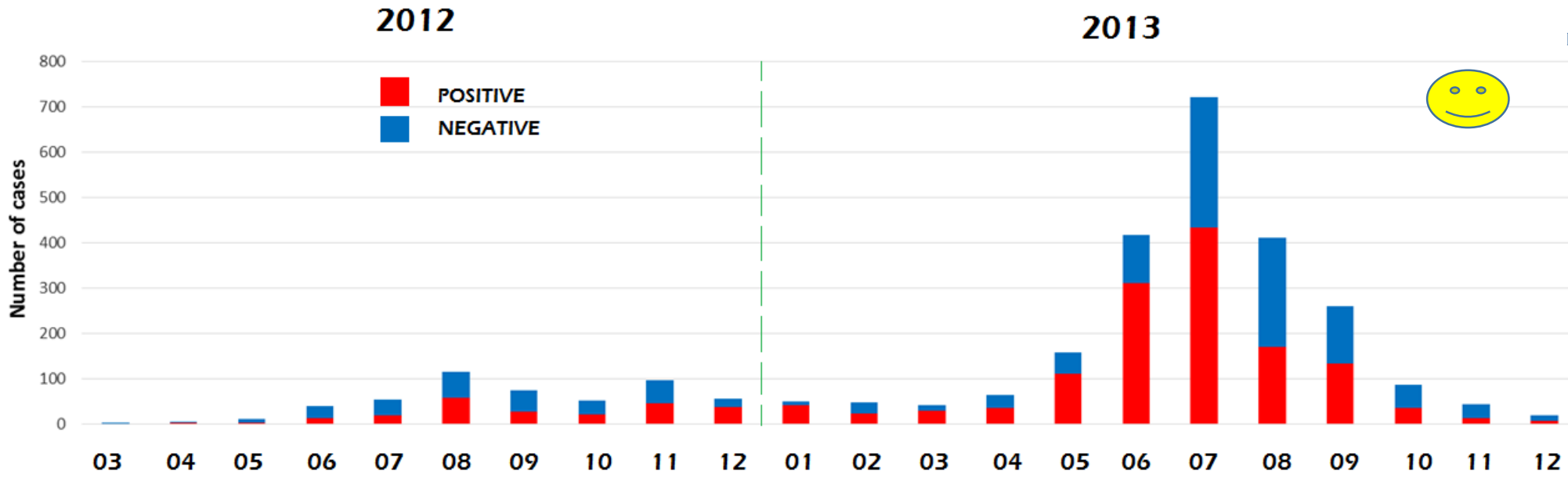
PREDICT THE FUTURE OF DENGUE ?



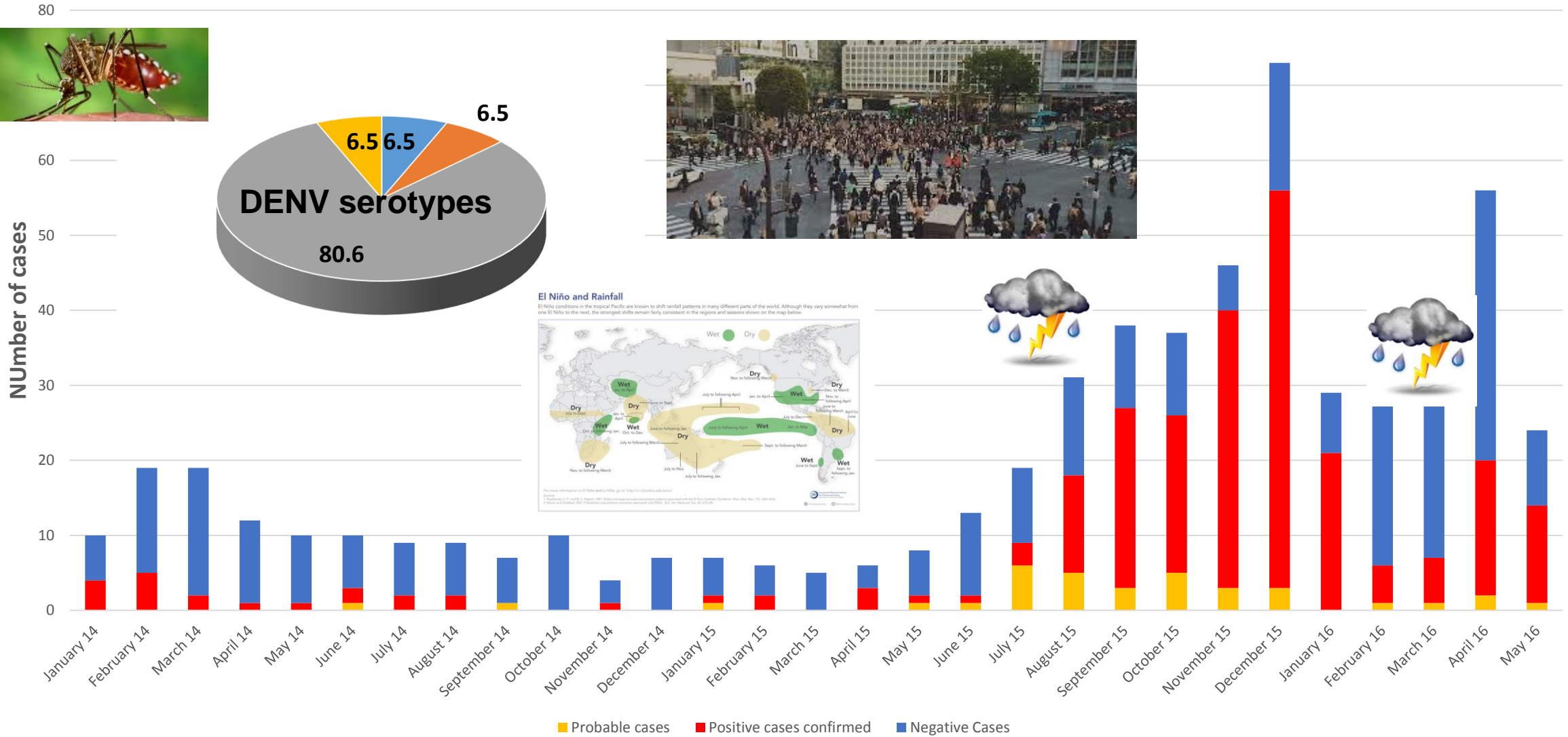
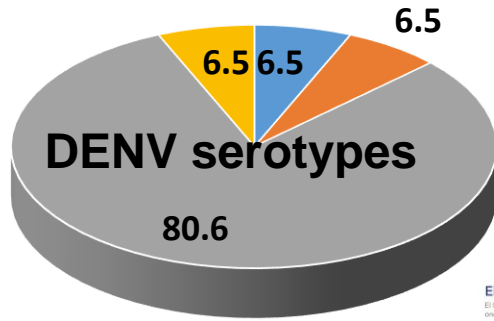


PREDICT THE FUTURE OF DENGUE ?

ECOMORE II		2012 / 2013	2016 / 2017
FACTORS	Characteristics	Status	Status
Dengue virus	Serotype	<ul style="list-style-type: none"> - DENNV-3; 2 genotypes - (Re)emergent - Predominant - > 6 months 	<ul style="list-style-type: none"> - DENV-4 - (Re)emergent - Predominant - > 6 months
Human population	Immunity Age class Confirmed cases Density	Low All $5 < X < 15$ (+ asymptomatic) To be determined	Low All $5 < X < 10$ (+ asymptomatic) To be determined ↑
Vector	<i>Aedes</i> species Stage Activity Density Insecticide resistance	<i>Ae aegypti; albopictus</i> Larvae; adults Permanent ? ?	<i>Ae aegypti; albopictus</i> Larvae; adults Permanent Preliminary Data I/R
Climat (December)	Temperature Rainfalls Humidity	26.5°C 2.79 mm 65.4%	24.3°C 0 65.9%
Environment	Construction sites	To evaluate	To evaluate ↑



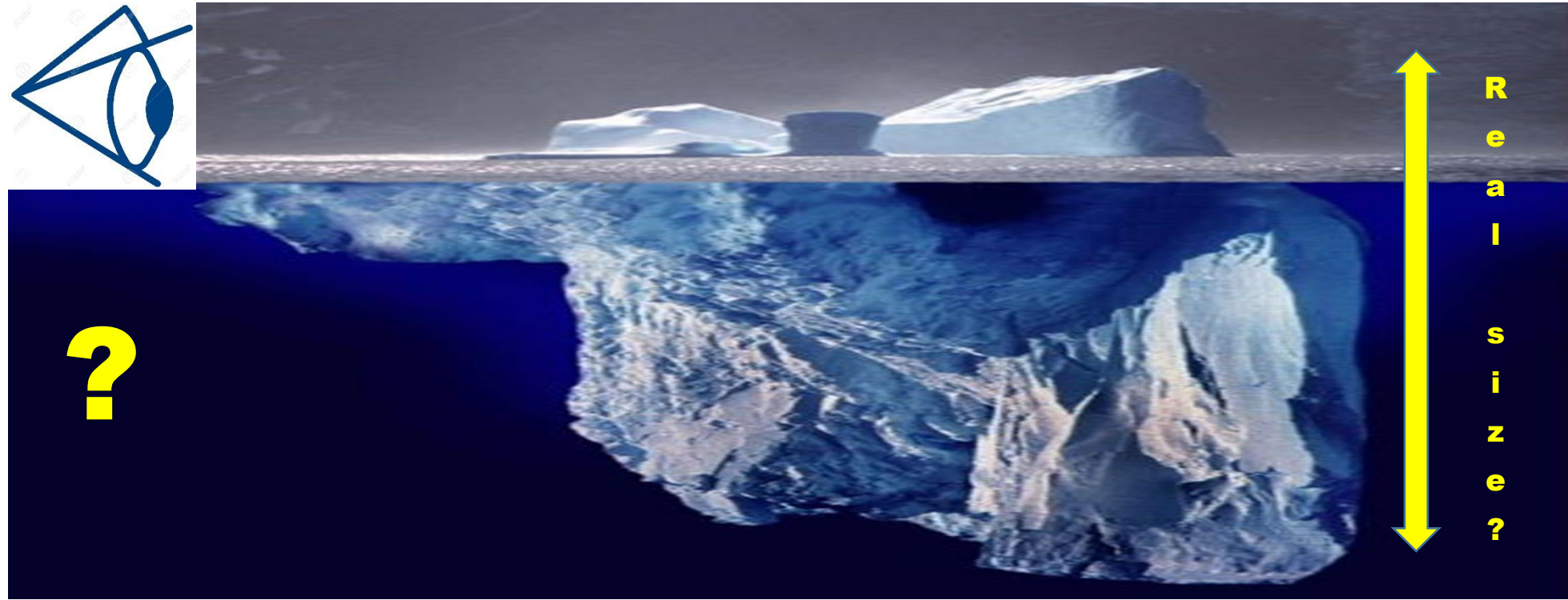
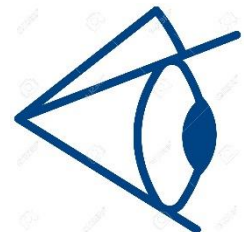
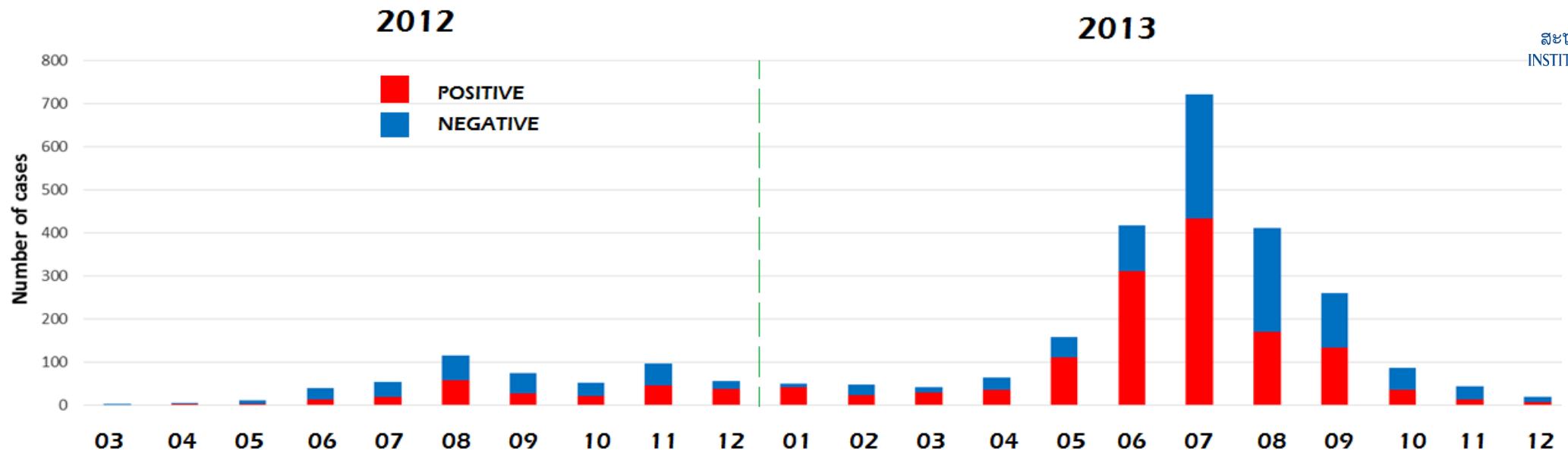
MULTIPLE DRIVING FACTORS



ECOMORE II EXPLORES THE DARK SIDE OF..



ENGUE



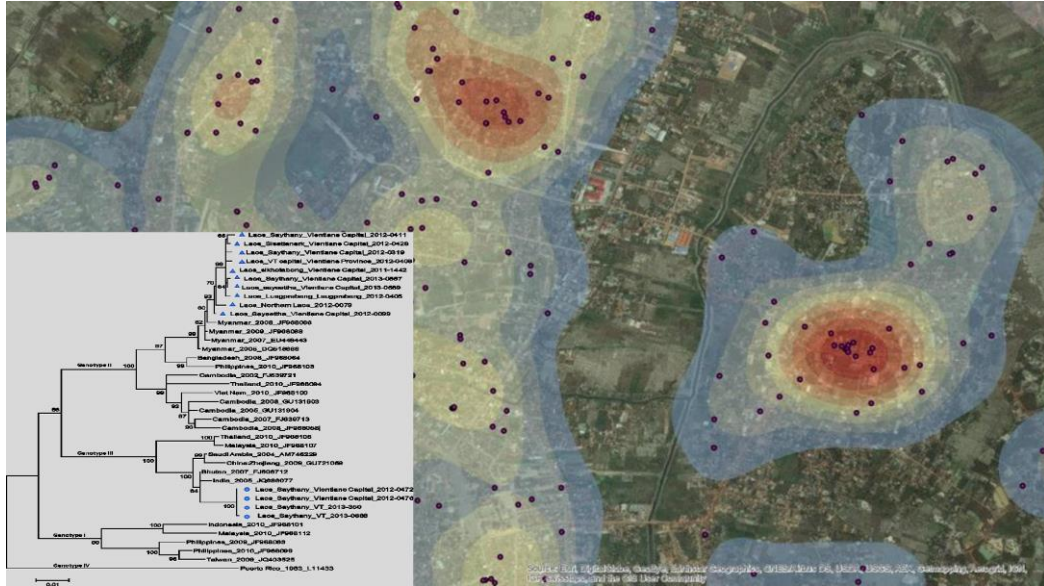
SEROPREVALENCE STUDIES

- **Annual seroprevalence studies in Vientiane Capital city:**
 - **Exposure profile(s) in the general population of the city**
 - **Estimate the real incidence of DENV (proxy for asymptomatic infections)**
 - **Seroprevalence by DENV serotypes**
 - **Seroprevalence by age group**
- **Expected outcomes:**
 - **Increase prediction accuracy by age group**
 - **Increase prediction accuracy for each DENV serotype**
 - **Establish threshold for each DENV serotype**

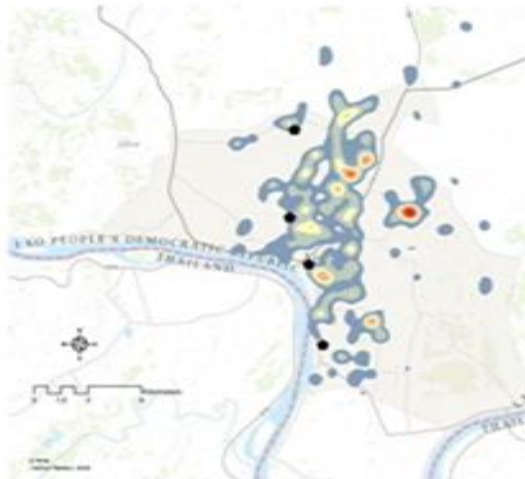


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HOW - WHY IMPROVING DENGUE CASES MAPPING

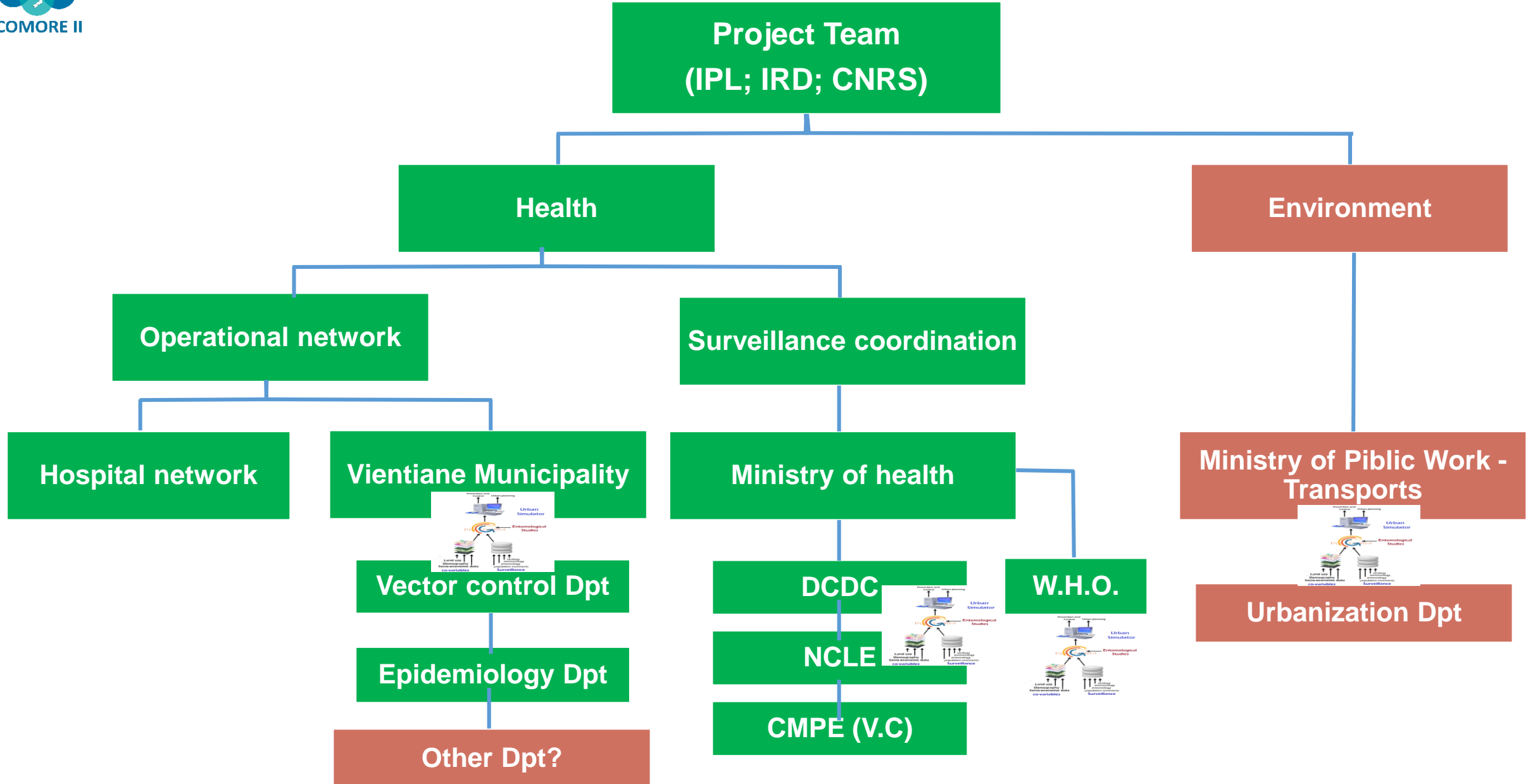


- Identify hot spots of transmission (\neq household based DENV confirmed cases hot spots)
- Understand mechanism(s) of DENV spreading; identify areas at risk



- Driving vector control strategies: target areas hierarchy; adaptation of V.C. tools

COOPERATION LANDSCAPE



INTERACTIONS IPL - TRANSVERSAL WP CLIMAT

- **REGIONAL FORECASTING:**

- **Provide national surveillance data (retrospective – prospective)**
- **5 countries (Laos; Cambodia; Viet Nam; Myanmar; Thailand)**
- **Regional**

- **NATIONAL FORECASTING:**

- **Use provincial data (+/- supported by lab surveillance)**
- **Tendencies at the provincial/country scale**

- **LOCAL FORECASTING:**

- **Extrapolation of local data at the national scale?**
- **Determine a confidence interval of accuracy of national data**



Acknowledgements

➤ Collaborations:

- ✓ CNRS: CNRS, UMR 8504, Paris 1
- ✓ IRD: MIVEGEC (Univ. Montpellier-CNRS 5290-IRD 224), Hanoi, Vietnam
- ✓ Institut Pasteur Paris: Environment and Infectious risks Unit

➤ Fundings

- ✓ Institut Pasteur Paris, International Division: ACIP-A16-2011; PTR-408, 2011; ACIP-A09-2014; ACIP-A15-2014; PTR491, 2014)
- ✓ WHO (AusAID/WHO)
- ✓ UnitedDengue

