
Social-Ecological Modelling of Innovative Genetic Control Approaches to Mosquito-borne Diseases

A workshop in the IDEA Consortium [Meeting Series](#)

Moorea Ecostation Center for Advanced Studies
1-5 February 2016



[Schedule at a Glance](#)

[IDEA-4 Consortium Meeting](#)

[Organizers](#)

[Venue](#)

[Theme](#)

[Meeting goals and anticipated outcome](#)

[Letter to Participants](#)

[Participant List](#)

[Program](#)

[Group photo](#)

[Abstracts](#)

[Sponsors/Hosts](#)

[Pacific islands : Virtual Ecology Labs](#)

[Acknowledgements](#)

[Breakout 1: MDVSCAPE](#)

Schedule at a Glance

- Arrival Day (for international participants): Sunday - dinner @ 18h
- Symposium: Monday-Tuesday
- Workshop: Wednesday-Thursday
- Field Trips: Friday

[Click Here for participant list](#)

Click here for [Detailed Program](#)

IDEA-4 Consortium Meeting

Organizers

Hervé Bossin (ILM)

Neil Davies (UC Berkeley)

Venue

The workshop will be held in the library of the Gump Station. Most participants will be housed at the Gump Station and CRIOBE.

Theme

The workshop aims to strengthen existing and forge new collaborations between labs in Europe and the Pacific. It is part of an emerging international collaboration - "[IDEA Consortium](#)" - that involves institutions from both regions to develop the Pacific Islands, particularly French Polynesia, as a model system for sustainability science. Specifically, the workshop will deepen existing collaborations between labs in the United States, France, United Kingdom, French Polynesia, and Switzerland while bringing in additional European (Belgium, Austria) and Pacific (Australia) partners to tackle the major societal challenge of emerging vector-borne diseases. It takes advantage of the opportunities provided through breakthroughs in molecular biology and a new generation of genetic technologies for insect control. Many of these approaches are being translated into operational products by Small & Medium Sized Enterprises (SMEs) (e.g., Oxitec Ltd, UK). Applying these new technologies effectively and safely, however, requires government oversight and evaluation (cost-benefit and risk analysis). Picking the right technologies (or combination thereof) is further complicated by rapid local and global change (environmental and social) making this a rich area for basic scientific research. Scenario-based planning is a vital component of any innovative approach to combatting vector-borne infectious disease and represents a pressing need for policy-makers in the Pacific and worldwide.

Social-Ecological Modeling of Mosquito-borne Disease is a particularly urgent need in many Pacific Islands. The emergence and expansion of dengue and other arboviruses (e.g., chikungunya, zika) have become major international public health concerns. Over the past decade the number of outbreaks has escalated and the population at risk is increasing yearly. More than 3.5 billion people are at risk of dengue infection and it has recently been estimated

that there are 390 million dengue infections every year. The situation has become particularly critical in several European overseas territories and island countries in the Caribbean and the Pacific where *Aedes aegypti*, the most important vector of dengue worldwide, and other *Aedes* vectors are present. In addition to *Ae. aegypti*, *Ae. albopictus* of much more recent introduction drives the fastest pace of disease expansion in the region and globally. Certain native vector species like *Ae. polynesiensis* also display a wide distribution range in the Pacific including in French Polynesia, Wallis and Futuna, and Pitcairn. In total, no less than 12 dengue vector species have been identified in the Pacific region, one of the highest numbers among all continents. Arboviral outbreaks and the intense biting pressure *Aedes* mosquitoes exert on human populations also greatly impact tourism, an essential resource for European overseas territories and other island countries. This situation, which is likely to deteriorate considering the lack of successful intervention or treatment strategies, has been connected to societal changes such as population growth and urbanization that can encourage the proliferation of synanthropic mosquito species. These and other extrinsic drivers, such as climate, strongly influence mosquito density and lifespan (e.g., female mosquitoes must live long enough to transmit disease).

Meeting goals and anticipated outcome

The meeting will address critical information gaps that hinder our ability to efficiently control mosquito vectors and thus the spread of mosquito-borne infectious diseases. The goals of the workshop are to:

- Identify a set of research priorities critical to the advancement of sustainable strategies to combat mosquito-borne infectious diseases
- Explore feasible alternatives to conventional control methods for mosquitoes
- Develop an integrated program of collaborative research on identified priorities in the tropical Pacific

Some of the specific scientific questions that might be addressed include, but are not limited to:

- What is the connectivity of mosquito eco-complexes within and between Pacific islands?
- Can we predict the impact of economic development and associated changes in social behavior, land-use and human movement on the distribution and density of mosquito vector species and the diseases they transmit?
- What are the opportunities and risks of new technological approaches to vector control (e.g., use of micro-organisms, transgenics etc.)?
- What are the ethical issues and likely social constraints of new control methods?

Our aim is to develop a framework of research of common importance to tropical island nations of the Pacific, and to formulate initial collaborative projects to advance operational research in vector surveillance and control.

Broader impacts for the Pacific region

The workshop will stimulate cooperation among researchers and institutions in Europe and the Pacific on mosquito-borne infectious diseases, an issue that requires international coordination and scientific knowledge to improve the health and well-being of communities in the region. It will:

- **Focus on a major issue affecting Pacific Island Countries and Territories (PICTS) and other tropical regions around the world** Tropical islands face similar socio-economic challenges. The limited scientific capacity in many of the small island developing States of the region motivates initiatives, such as this international workshop, that pool research resources to generate the knowledge necessary for long-term management of public health threats that cross national boundaries.
- **Foster collaboration of scholars from different disciplines and countries** The cultural, geographic, and biological setting of Pacific Islands offers an unparalleled opportunity for comparative studies that must take a regional perspective. This workshop will formulate a program of international and interdisciplinary research on mosquito-borne infectious diseases, a matter socially and biologically significant.

Letter to Participants

We look forward to seeing everyone in Moorea Feb 1-5. The meeting will be held at the Moorea Ecystation Center for Advanced Studies, a collaboration between the CRIOBE and Gump Station. It continues the [IDEA meeting series](#) started at ETH Zurich, November 2013. Details of the meeting will be posted on the [IDEA "Mosquito Workshop" website](#). The workshop aims to develop a bi-regional collaborative research program combining medical entomology, environmental and socio-ecosystem sciences, applied mathematics and computational sciences. Our aim is **to build data-driven models of *Aedes* mosquito vectors of diseases in space and time** by focusing on populated Pacific island ecosystems (e.g. Moorea) as tractable model systems. The program will identify the factors promoting disease transmission and develop advanced computational simulations to test the efficacy and sustainability of innovative integrated control strategies. Such an approach is of general significance for vector control programs and the results will help improve public health outcomes, ensure environmental protection, and address socio-economic concerns. The workshop will focus on four themes to consider (1) the environmental and social drivers of mosquito-borne diseases, (2) the ecology of *Aedes* species, (3) ecological/evolutionary dynamics of genetic control approaches, and (4) integration of the above into models and simulations to support scenario-based planning for public health policy.

Participant List

[Click Here for participant list](#)

Last	First	Institution
BAMBRIDGE	Tamatoa	CNRS-CRIOBE-EPHE
BOMPARD	Priscillia	Direction de la Santé
BOSSIN	Hervé	Institut Louis Malardé
DAVIES	Neil	University of California, Berkeley
DUMONT	Yves	AMAP CIRAD
GILLES	Jérémie	International Atomic Energy Agency
GRÜN	Armin	ETH Zürich
GUO	Tao	ETH Zürich
HENDRICKX	Guy	AVIA-GIS
HOFFMANN	Ary	University of Melbourne
HOPUARE	Marania	University of French Polynesia
JOURDAINNE	Margaux	Institut Louis Malardé
LI	Zhe	ETH Zürich
LONCKE	Stéphane	Centre d'Hygiène et de Salubrité Publique
MARIE	Jérôme	Institut Louis Malardé
MALLET	Henri-Pierre	Direction de la Santé
MARKA	Szabolcs	Columbia University, New York
MOSES-GONZALES	Nathan	M3 Consulting group
MOU	Yolande	Direction de la Santé
MURPHY	Frank	UC Berkeley, Gump station
PETIT	Hereiti	Institut Louis Malardé
RODERICK	George	University of California, Berkeley
SINKINS	Steve	University of Lancaster
STEWART	Hannah	Tetiaroa Society
STOLL	Benoit	University of French Polynesia
TEAVAI MURPHY	Hinano	Te Pu Atitia Cultural center
TEISSIER	Yoann	Institut Louis Malardé

Program

Click here for [Detailed Program](#)

Group photo



Abstracts

Click here for [abstracts](#)

Sponsors/Hosts

- [Institut Louis Malardé](#)
- [PACENET Plus](#) - The Pacific-Europe Network for Science, Technology and Innovation is the second project [funded by the European Commission](#) to further bi-regional science,

technology and innovation (ST&I) cooperation between the South Pacific island nations and the European Union.

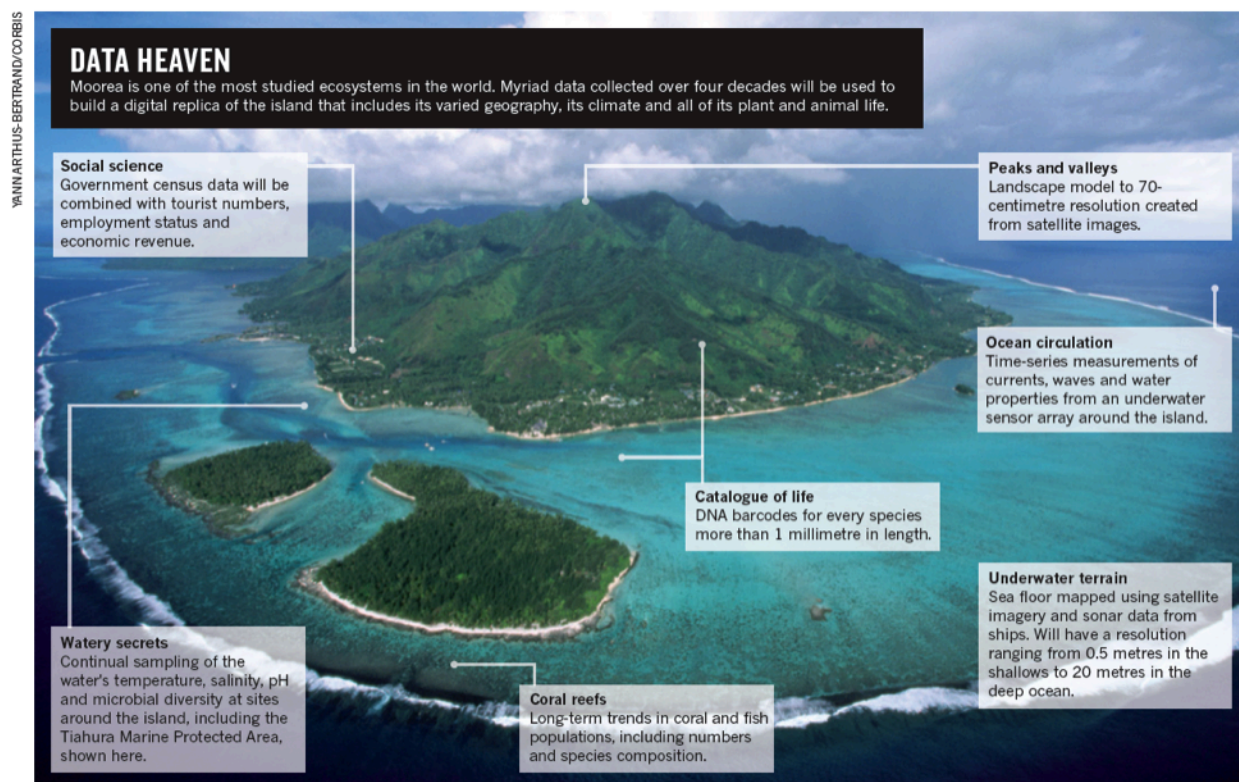
- UC Berkeley [Gump Station](#)
- CNRS-EPHE [CRIOBE](#)
- Tetiaroa Society

Media coverage

- [Tahiti Infos - Un séminaire sur la "lutte innovante contre les moustiques", 02/01/16](#)
- [La Dépêche de Tahiti - Un séminaire pour lutter contre les maladies vectorielles, 02/02/16 \(print edition\)](#)
- [La Dépêche de Tahiti - Un séminaire pour lutter contre les maladies vectorielles, 02/02/16 \(web edition\)](#)
- [TNTV Evening News, 2nd February, 2016](#) (segment starts at 10'40")

Pacific islands : Virtual Ecology Labs

“Digital version of Moorea will provide a way to experiment with an entire ecosystem”.[1]



[1] Nature 517, 255–256 (2015) [Tropical paradise inspires virtual ecology lab](#). doi:10.1038/517255a

Acknowledgements

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[Breakout 1: MDVSCAPE](#)

Click link above to see notes from this session