Moorea IDEA
ISLAND DIGITAL ECOSYSTEM AVATARS CONSORTIUM

5th IDEA Consortium Meeting

Pembroke College, Oxford
11-13 January, 2016

Schedule at a Glance

- Arrival Day: Sunday January 10, 2016
  - 18:00 Informal gathering at [Head of the River Pub](#) for any early arrivals
- 5th IDEA Consortium Meeting: Monday-Wednesday January 11-13, 2016
  - Meetings start 9am, finish at 5:30pm

Program

Click here to see the [detailed program](#) and [list of participants](#)

IDEA-5 Consortium Meeting

Part of the IDEA Consortium - [Meeting Series](#)

Conveners

Neil Davies (UC Berkeley)

David Gavaghan (Oxford)

Sally Holbrook (UC Santa Barbara)

Serge Planes (CNRS-EPHE)

Matthias Troyer (ETH Zurich)

Venue

Pembroke College, University of Oxford, UK.

Pembroke College is located on Pembroke Square just off St.Aldates in central Oxford - see directions. We will be meeting in the Harold Lee Room. See Pembroke Conferences & Events page.

Participant List

Click Here

Letter to Participants

Dear All,

The next IDEA Consortium meeting will be held at Pembroke College in Oxford over three days January 11-13, 2016. Please see details on the IDEA-5 website. The goal of the meeting is to develop a proposal for building the avatar's Data Science Infrastructure (Working Group 1). To that end, we will develop an initial pilot project use case, one that is complex enough to be a real challenge but constrained enough to be do-able, and likely to produce some very interesting results. Water is one of the key societal challenges of the 21st century and we will focus on the impact of sea level rise and changing precipitation patterns on Moorea. These two external drivers affect the island's coupled marine-terrestrial system, and simulating the future of the coral reef will be a crucial aspect. We begin with the first order effects of the physical system, but will then build up to include chemical, biological and ecological processes on land and sea. Human activities will also be vital to any realistic predictions and so we will also consider how to model feedbacks between the island's natural and human systems.

We look forward to seeing you in Oxford.

Best wishes,
The Conveners

Data Science Theme

We propose to develop a computational platform for place-based environmental science for predicting future scenarios in complex, coupled ecological and social systems. The platform will contain infrastructure for managing distributed data sources, discovering and integrating multiple data resources, hosting complex statistical and mechanistic models, integrating data and models operating across multiple spatial and temporal scales and using multiple modeling methodologies within a single, integrated user experience.

While we intend to create a flexible platform useable for addressing questions in a wide range of social-ecological systems, our initial focus will be on modeling entire (small) islands using

Moorea in French Polynesia as a model system. Within that narrowed scope, we will further narrow the domain of the initial case study to modeling scenarios of global change related to the anthropogenic increase in atmospheric CO2 (including climate change, sea-level rise, global warming, ocean acidification, etc.) and changes in the social system (economic development, environmental protection initiatives) on the coastal plain and coral reef and lagoon system of Moorea.

Even a project of this narrowed scope contains considerable complexity and will require coupling models of multiple systems that are typically considered in isolation. The major components include:

1. **Terrestrial hydrology**, important for modeling runoff into the marine system and likely to change due to changes in precipitation frequency and intensity, and climate and development-induced changes to island vegetation.
2. **Coastal erosion and lagoon sedimentation**, including consideration of the impact of economic development on coastal areas, increased wave erosion due to less reef-provided coastal protection caused by more deeply submerged fringing reef, and climate change induced shifts in wave intensity due to changes in local and global storm frequency and intensity.
3. **The coral reef system**, including coral reef growth and reef structure in a changing ocean environment, particularly including ocean acidification and changes in wave action, and reef degradation due to environmental drivers (ocean acidification, temperature-driven coral bleaching, altered wave action) and human impacts (sedimentation, nitrification, fishing induced alterations of the marine ecosystem)

Modeling these coupled systems will require discovering and integrating multiple data sources describing the systems' geography, meteorology, hydrology, terrestrial ecology, physical and chemical oceanography, marine ecology, economy and public policy. Managing and integrating these disparate data sources, in which observations are made across a broad spectrum of spatial and temporal scales, poses considerable challenges.

Each of the subsystems described above will initially be modeled focusing on the primary physical processes at play so that the primary drivers, feedbacks and points of sensitivity of the system can be understood. The results from these initial modeling efforts will then inform which parts of the system need to be modeled in greater detail, incorporating physical, chemical, biological and human socio-economic interactions and feedbacks, to produce useful predictions of the future state of the social-ecological system in Moorea.

Logistics

The meeting will be held in Pembroke College (Pembroke Square, Oxford OX1 1DW) at the University of Oxford, Oxford, UK (see map). Founded in 1624, Pembroke's alumni include

Samuel Johnson, JRR Tolkien, Senator J. William Fulbright, and James Smithson (founding donor of the Smithsonian Institution).

Accommodation - For most participants, we have reserved rooms at the [Head of the River Pub](link) (St Aldate's, 40 Pembroke Square, Oxford OX1 4LB) just 5min walk from Pembroke College ([see](link) [map](link)). Some participants will stay at Pembroke College itself (Pembroke Square, Oxford OX1 1DW [see](link) [map](link)). Please check-in at reception (Porter's Lodge) on arrival. The entrance is at the top of Pembroke Square through a small door in the corner. See [Pembroke FAQs here](link).

Transport - Oxford is easily accessible from London's Heathrow Airport (LHR). A regular coach service, the [Oxford Airline](link), serves Terminal 5 and the LHR Central Bus Station for Terminals 1,2, and 3. From Terminal 4, passengers catch a free Heathrow Express train service to the Central Bus Station (just a few minutes journey time). Tickets are GBP29 for a round trip and can be purchased online or in cash from driver. Journey time is 1-2hrs depending on traffic.

There are very regular 24hr bus services ([Oxford Tube](link) and [X90](link)) between central London and Oxford (journey time up to 2hrs depending on traffic). There is also a train from London's Paddington Station to downtown Oxford. Pembroke is about 15mins walking distance from the train station and just a few minutes walk from the bus stops.
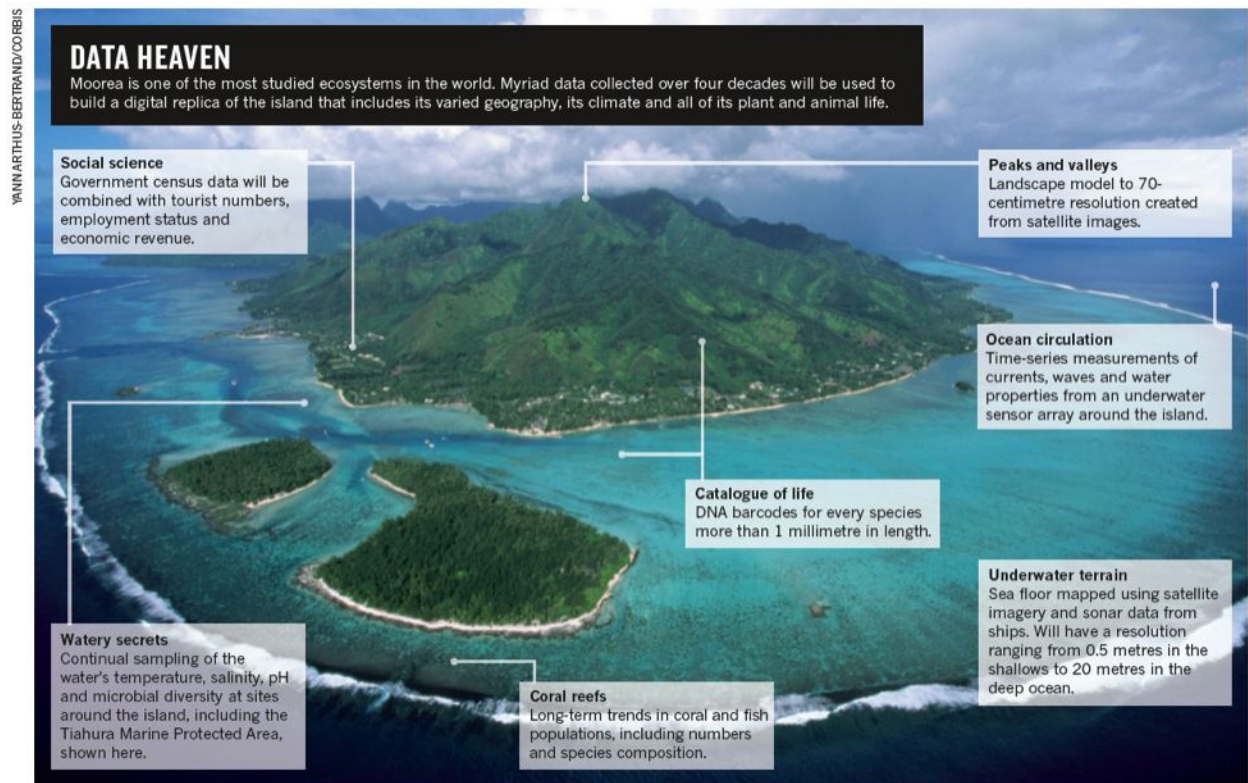
There is limited parking at Pembroke for anyone driving. Please send your name, car registration, and arrival/departure date/times to [Huw Edmunds](link).

Sponsors/Hosts
- UC Berkeley
- CRIOBE
- MCR LTER
- Oxford University

Figure: Virtual Ecology Lab
"*Digital version of Moorea will provide a way to experiment with an entire ecosystem*".[1]

DATA HEAVEN

Moorea is one of the most studied ecosystems in the world. Myriad data collected over four decades will be used to build a digital replica of the island that includes its varied geography, its climate and all of its plant and animal life.

Social science
Government census data will be combined with tourist numbers, employment status and economic revenue.

Peaks and valleys
Landscape model to 70-centimetre resolution created from satellite images.

Ocean circulation
Time-series measurements of currents, waves and water properties from an underwater sensor array around the island.

Catalogue of life
DNA barcodes for every species more than 1 millimetre in length.

Underwater terrain
Sea floor mapped using satellite imagery and sonar data from ships. Will have a resolution ranging from 0.5 metres in the shallows to 20 metres in the deep ocean.

Watery secrets
Continual sampling of the water's temperature, salinity, pH and microbial diversity at sites around the island, including the Tiahura Marine Protected Area, shown here.

Coral reefs
Long-term trends in coral and fish populations, including numbers and species composition.

YANN ARTHUS-BERTRAND/CORBIS

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

Acknowledgements