VecNet

Vector-Borne Disease Network

Vector Borne Disease Network Update

User Friendly Interfaces

Single Node - OM and EMOD Expert for specific sites, Representative Scenario,

(Multinode simulation interface (spatial analyses))

Tom Burkot, Greg Madey, Benoit Raybaud, Alex Vyushkov and Frank Collins on behalf of the VecNet Consortium

ROLL BACK MALARIA

VecNet

Our Work Tools Contact Us Log out

VecNet

Vector-Borne Disease Network

Explore the VecNet Toolset

VecNet provides a simplified interface to model the impacts of interventions on malaria transmission for control and eradication. Learn more About VecNet

Information Sharing

VecNet is based on a philosophy of global access: all tools and resources are freely available.

Collaborations

VecNet collaborators include NGOs, universities, industry and government. Join us!

News

Discover the latest VecNet news and follow trending malaria topics.

Follow @VecNetNews

Subscribe to our newsletter

Digital Library

Contains curated data, tagged citations, articles & reports on entomology, epidemiology, demography, climatology, and interventions to support the analysis of malaria eradication.

Data Warehouse Browser

Contains location specific datasets containing weather, vector and population information.

Transmission Simulator

Models changes in malaria transmission due to interventions or environmental changes.

ROLL BACK MALARIA

VecNet

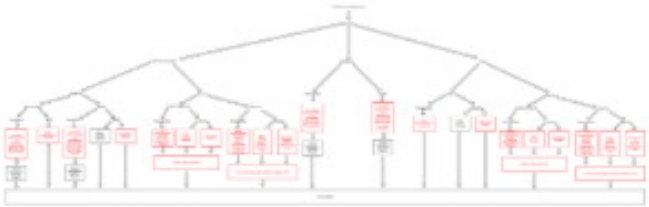
Our Work Tools Contact Us Logout (burkot)

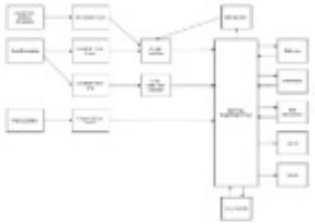
Transmission Simulator

Modeling malaria transmission and control

- Transmission Simulator
- EMOD
- OpenMalaria
- Results Viewer

Welcome to Transmission Simulator





Summary Page Mockup

Transmission Simulator offers user-friendly interfaces to two simulation modelling packages, EMOD (The Institute for Disease Modeling) and OpenMalaria (Swiss Tropical and Public Health Institute). Both EMOD and OpenMalaria are accessible in VecNet via basic and expert user interfaces to create scenarios to analyse malaria transmission and its control. They share a number of common features: each requires mosquito (entomological) and human disease (epidemiological) inputs. The outputs of each are accessible as downloadable graphs and datasets. Both EMOD and OM generate the following outputs:

- Entomological Inoculation Rate (EIR),
- Number of malaria infections by age group,
- Fever prevalence,
- And number of new infections (diagnostic test).

The two models have different features, however, which may make the model more attractive depending on the data available to the user as inputs as well as in the outputs that are generated.

Don't know your model?
Start here

VecNet | Our Work | Tools | Contact Us | Logout (burkot)

Transmission Simulator

EMOD weather conversion tool

Transmission Simulator > Select a model > Select a simulation type

Select a simulation type:

SINGLE NODE SIMULATION

The EMOD System allows the user to build a temporal model that simulates both a baseline of malaria transmission across time in a simulated environment as well as the possible impact on this baseline of different combinations of malaria interventions. The model runs at daily time steps, and in its simplest form, it simulates events at a single point or node. This kind of simulation can conceptually represent a region across which all conditions of malaria transmission and control are represented by the single node simulation.

Single Node Simulation

MULTIPLE NODE SIMULATION

More spatially explicit simulations can be produced two ways. The simplest is to establish a single node simulation that is directly modified by linearly increasing or decreasing the model output parameters by application of an external scaling factor called the Larval_Habitat_Multiplier. These different versions of the single node simulation are linked by data that are shared across each version. A more complex approach that is also much more robust is to run multiple different simulations, each with its own unique parameter settings, that are allowed to communicate with each other at each time step by rules that involve the movement of people and parasites across the different nodes.

Multiple node simulation

VecNet | Our Work | Tools | Contact Us | Logout (burkot)

Transmission Simulator

EMOD weather conversion tool

Transmission Simulator > Select a model > Select a simulation type > Select data type

Select a data type:

EXPERT DATA Track

The EXPERT DATA Track invites the user to create a malaria transmission baseline, along with interventions, that are designed as closely as possible to represent malaria in a real location, such as Garki, Nigeria, where very specific data can be used to set parameter values. This Track also allows the user to select several such sites where the baseline parameter values have already been set and made publicly available by other VecNet users. In addition, this track exposes the user to the highest number of model parameters that can be user defined, although default settings are suggested for users who do not have their own values.

Select Expert track

REPRESENTATIVE DATA

Here, the user is guided to build a malaria transmission baseline by making a series of guided choices from among a small range of settings (typically High, Medium, or Low) that end up defining the weather pattern, the demographic characteristics, the vector or vectors and the parasites present and their endemicity. Calibration of fitted parameters and 'burn-in' is the same as described above. The resulting baseline may be designed to represent malaria transmission under conditions that closely resemble a true site that the VecNet user is attempting to emulate, but strictly speaking the site produced is hypothetical. The main goal of this track is to give the user a relatively simple means of exploring transmission and interventions in a range of different hypothetical settings.

Use Representative data

ROLL BACK MALARIA

VecNet

Our Work Tools Contact Us Logout (burkot)

Transmission Simulator

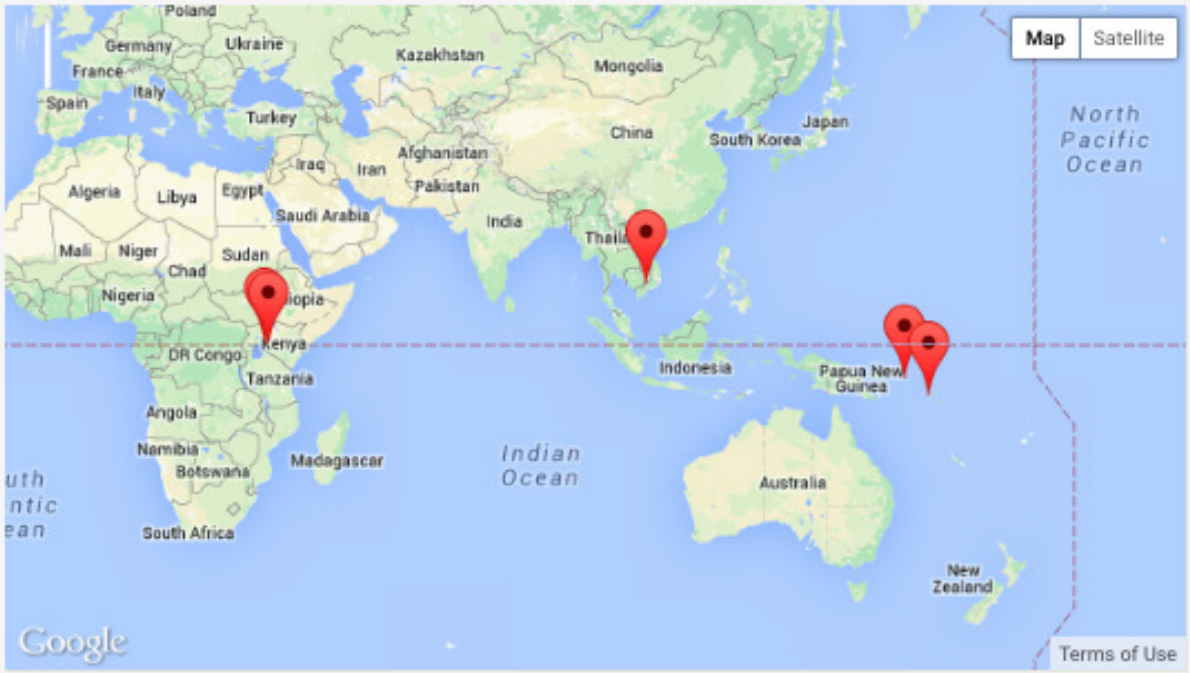
Modeling malaria transmission and control using **EMOD Expert**

- Transmission Simulator
- EMOD
- New Simulation
  - Select Location
- My Simulations
- Public Simulations

Edit Simulation / Select Location

Step 1 of 9: Select Location

Selecting a *Location* provides default values for EMOD parameters, including weather and demographics files. You can change input parameters later.



VecNet

Our Work Tools Contact Us Logout (burkot)

Transmission Simulator

Modeling malaria transmission and control using **EMOD Expert**

- Transmission Simulator
- EMOD
- New Simulation
  - Configure Simulation
- My Simulations
- Public Simulations

Edit Simulation / Configure Simulation

Step 2 of 9: Configure Simulation

Enter configuration options as needed.

1.Name and describe the simulation

Name Vanuatu tanna

Description

recreation of elimination strategies

Select Simulation Type Malaria Vector

Select Sampling Individual Cohort

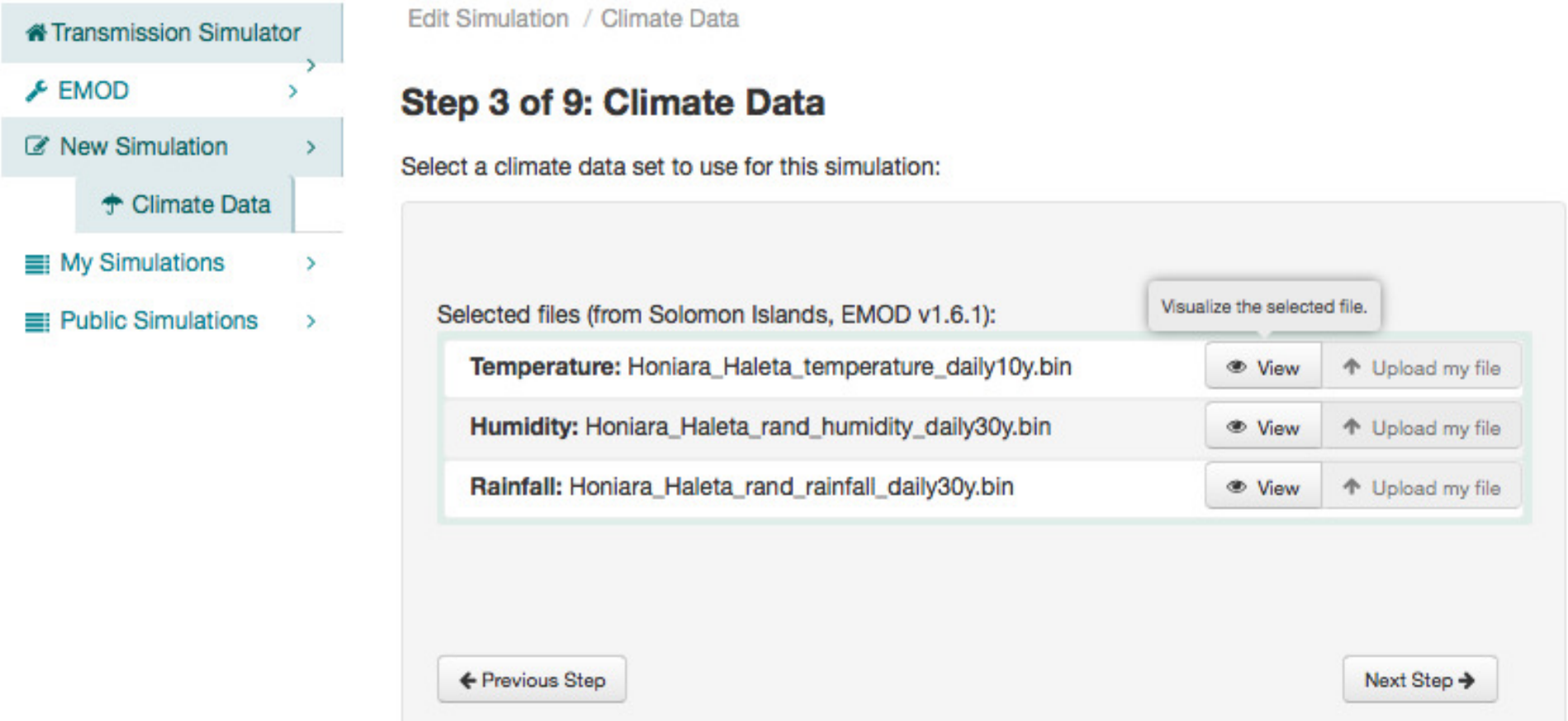
2.Specify duration of simulation

Start time 0 days into temporal data

Simulation duration 10950 days or 30 years

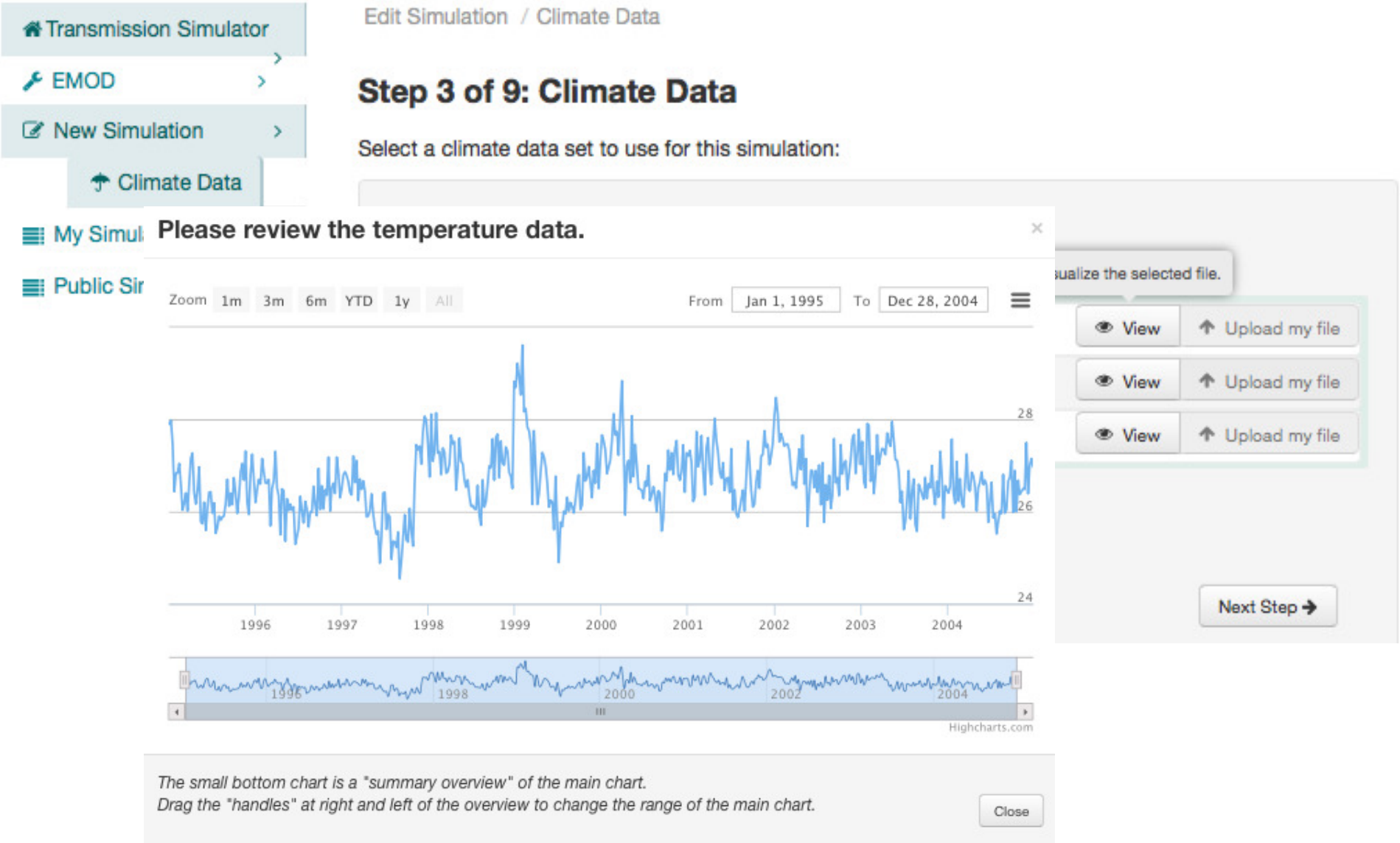
Burn in time 1825 days or 5 years

Previous Step Next Step



Climate data for any geographic location will be provided by the digital library

ROLL BACK MALARIA

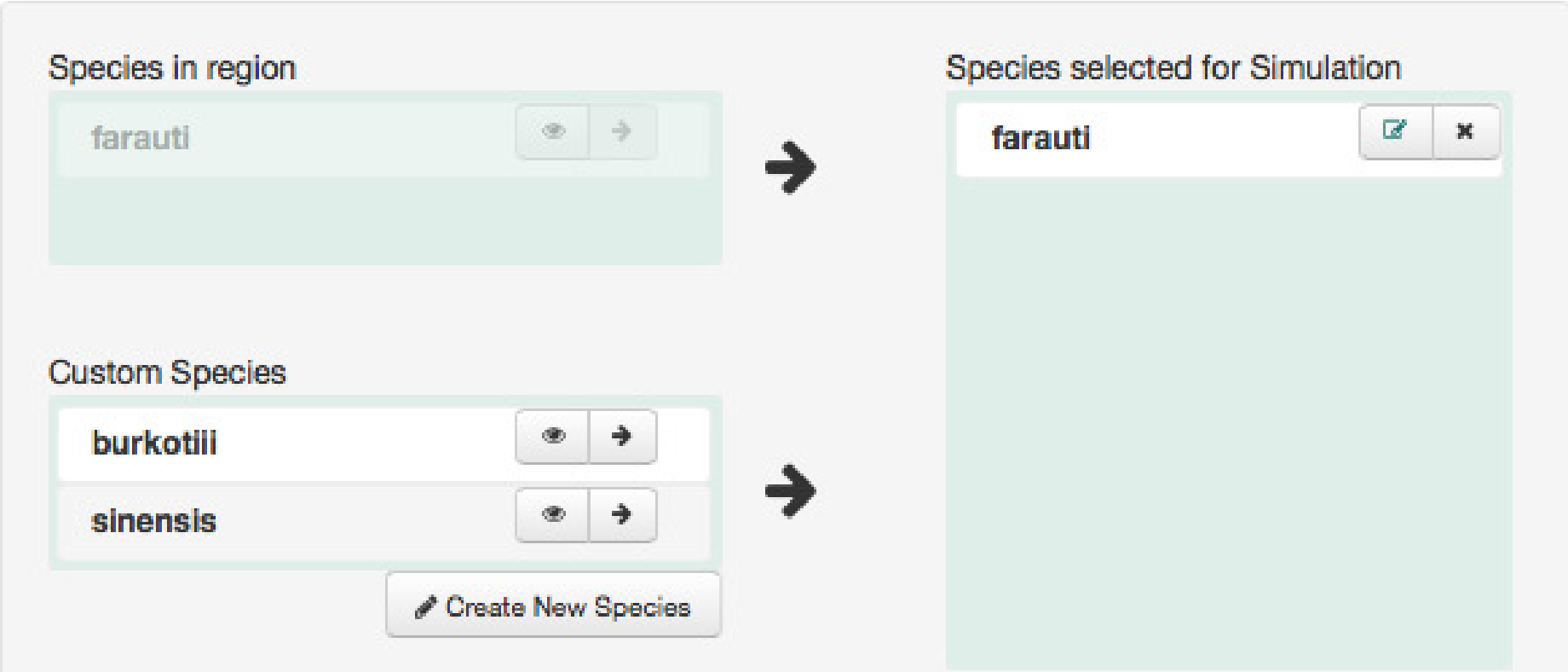


ROLL BACK MALARIA

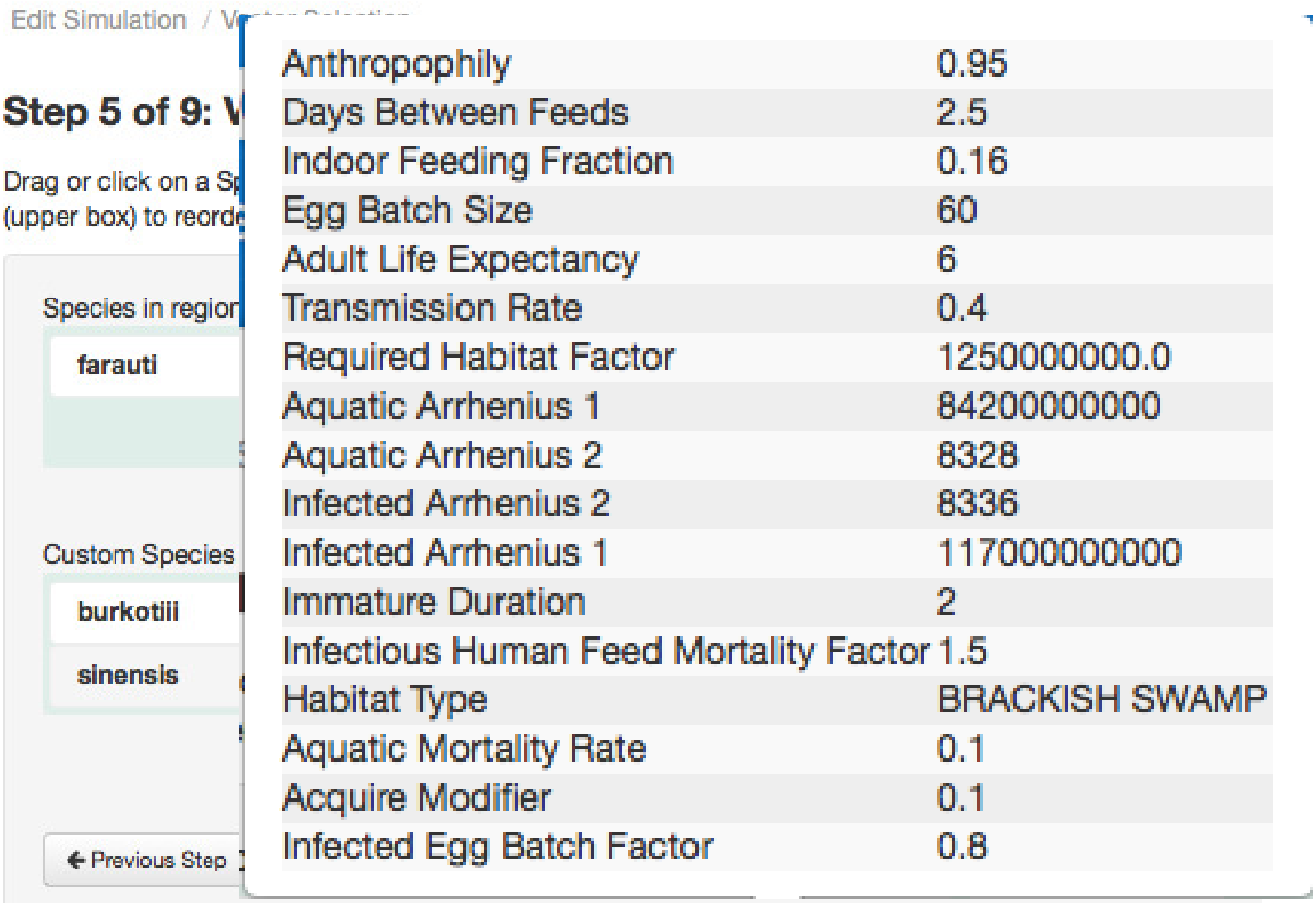
Step 4 of 9: Demography Data – from the digital library

Step 5 of 9: Vector Selection

Drag or click on a Species in the lower box to add it to the simulation. Drag Species within the simulation (upper box) to reorder. If no appropriate Species exists, Create a new one.



ROLL BACK MALARIA



Anthropophily	0.95
Days Between Feeds	2.5
Indoor Feeding Fraction	0.16
Egg Batch Size	60
Adult Life Expectancy	6
Transmission Rate	0.4
Required Habitat Factor	1250000000.0
Aquatic Arrhenius 1	84200000000
Aquatic Arrhenius 2	8328
Infected Arrhenius 2	8336
Infected Arrhenius 1	117000000000
Immature Duration	2
Infectious Human Feed Mortality Factor	1.5
Habitat Type	BRACKISH SWAMP
Aquatic Mortality Rate	0.1
Acquire Modifier	0.1
Infected Egg Batch Factor	0.8

ROLL BACK MALARIA

Step 6 of 9: Parasite Parameters

Please customize the Parasite Parameters.

Endemicity: < 30% | 30 - 60% | > 60% | Custom (user specified)

User selects the prevalence (range)…

Antigen Switch Rate

1e-09

Range: 0 to 1

Parasite Switch Type

RATE_PER_PARASITE_7VARS

Falciparum Msp Variants

4

Range: 0 to 100

Falciparum Nonspecific Types

4

Range: 0 to 100

Falciparum Pfemp1 Variants

300

Range: 0 to 2.14748e+009

New Diagnostic Detection

0.1

Range: 0.0001 to 100000

Parasite Smear Sensitivity

0.01

Range: 0.0001 to 100

… and the sensitivity of the diagnostic test

Previous Step

Undo Changes

Step 8 of 9: Run Simulation

Run this simulation. Once the results have been processed, you can change the parameters in the previous steps before rerunning it. You will also be able to accept the simulation as approved (this will allow addition of interventions).

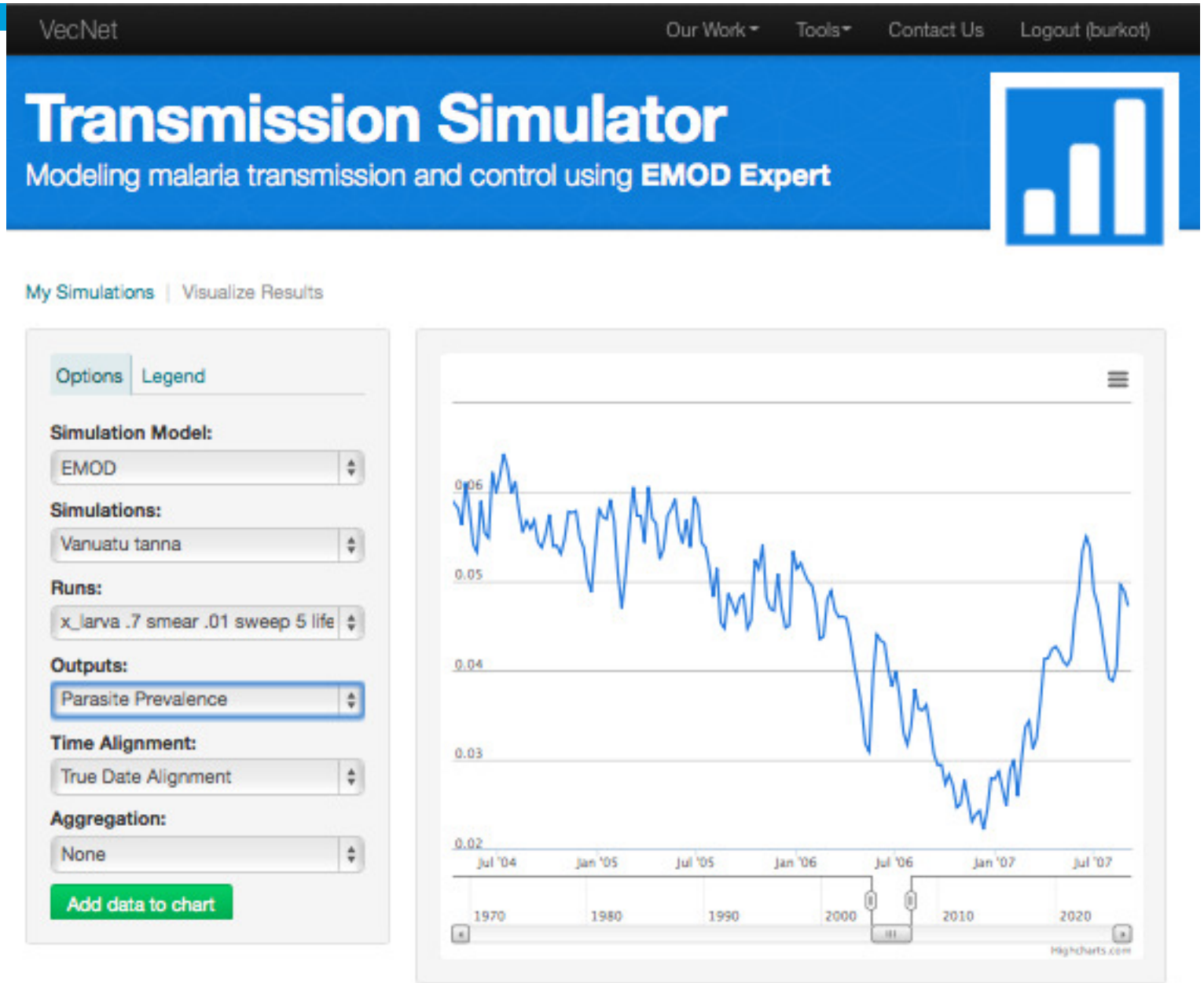
Name Test Run 2015-01-20 17:58:38.5983

You can change the name of this test run if you want to.

If you have run this simulation and not made changes since, you may skip this step.

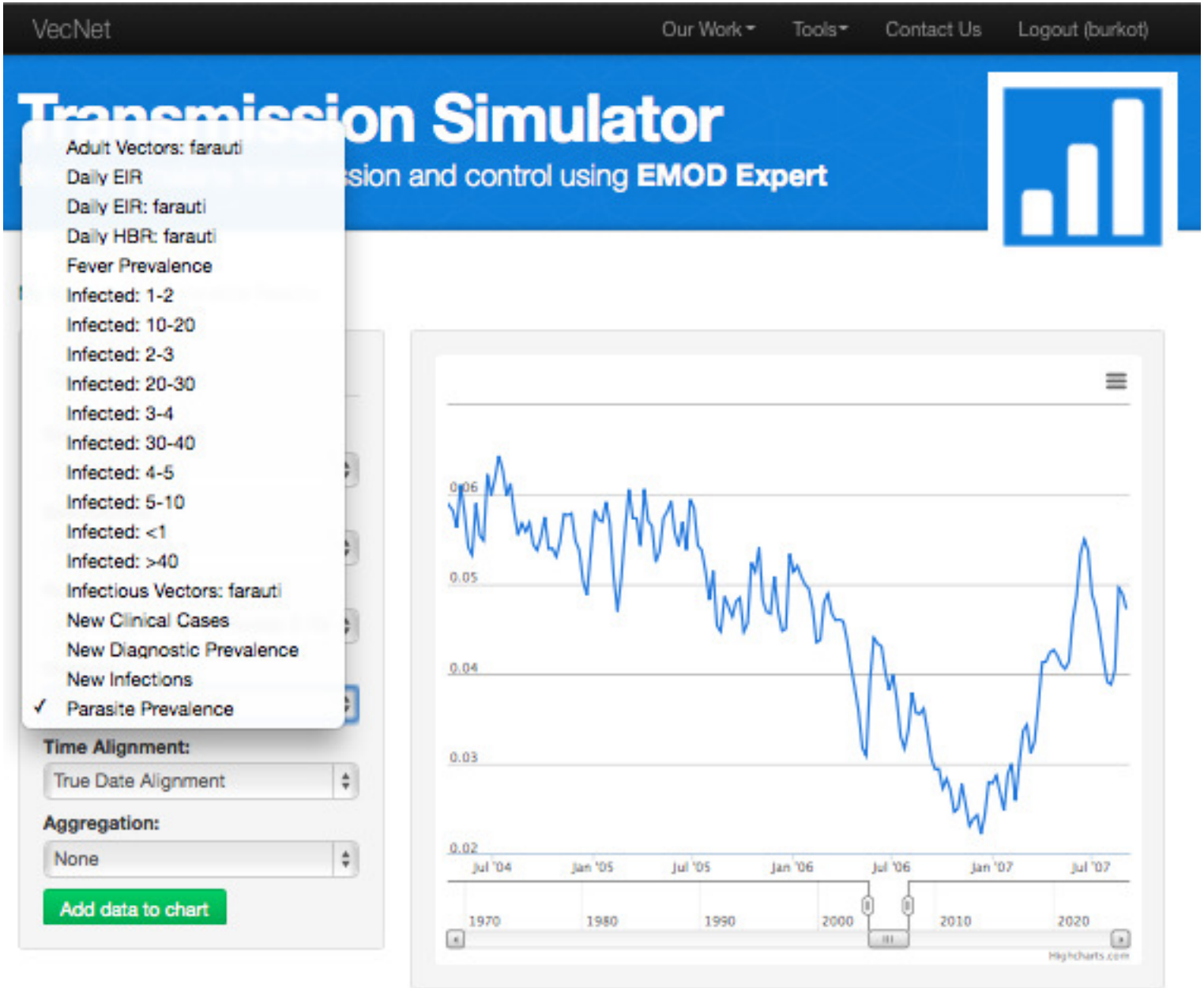
← Previous Step | Skip to Review previous Run → | Run Simulation ▶

ROLL BACK MALARIA



Calibrate against biting rate and parasite prevalence

ROLL BACK MALARIA



BACK MALARIA

Campaign Files- to add Interventions to the baseline

Outbreak

Edit | Remove

Start Day: 0 | Max Number to Distribute: 2

Number Repetitions: 400 | Time Between Reps: 30

drug_

Edit | Remove

Start Day: 5475 | Max Number to Distribute: 1 | Demographic Usage: 88 %

Number Repetitions: 8 | Time Between Reps: 7

Cost To Consumer: 10

Range: 0 to 999999

Dosing Type: FullTreatmentCourse

Drug Type: Chloroquine

ROLL BACK MALARIA

Intervention(s) selected for Simulation **777 Vanuatu tanna**

Outbreak

Edit | Remove

Start Day: 0 | Max Number to Distribute: 2

Number Repetitions: 400 | Time Between Reps: 30

drug_

Edit | Remove

Start Day: 5475 | Max Number to Distribute: 1 | Demographic Usage: 88 %

Number Repetitions: 8 | Time Between Reps: 7

Cost To Consumer: 10

Range: 0 to 999999

Dosing Type: FullTreatmentCourse

Drug Type: Chloroquine

- Please select...
- Artemether_Lumefantrine
- Artemisinin
- ✓ Chloroquine
- GenPreerythrocytic
- GenTransBlocking
- Primaquine
- Quinine
- SP
- Tafenoquine

Intervention(s) selected for Simulation **777 Vanuatu tanna**

Outbreak

Edit | Remove

Start Day: 0 | Max Number to Distribute: 2

Number Repetitions: 400 | Time Between Reps: 30

drug_

Edit | Remove

Start Day: 5475 | Max Number to Distribute: 1 | Demographic Usage: 88 %

Number Repetitions: 8 | Time Between Reps: 7

Cost To Consumer: 10

Range: 0 to 999999

Dosing Type: FullTreatmentCourse

Drug Type: Chloroquine

- Please select...
- SingleDose
- ✓ FullTreatmentCourse
- Prophylaxis
- SingleDoseWhenSymptom
- FullTreatmentWhenSymptom
- SingleDoseParasiteDetect
- FullTreatmentParasiteDetect
- SingleDoseNewDetectionTech
- FullTreatmentNewDetectionTech

ROLL BACK MALARIA

Simple_Bednets_(predefined)

Edit | Remove

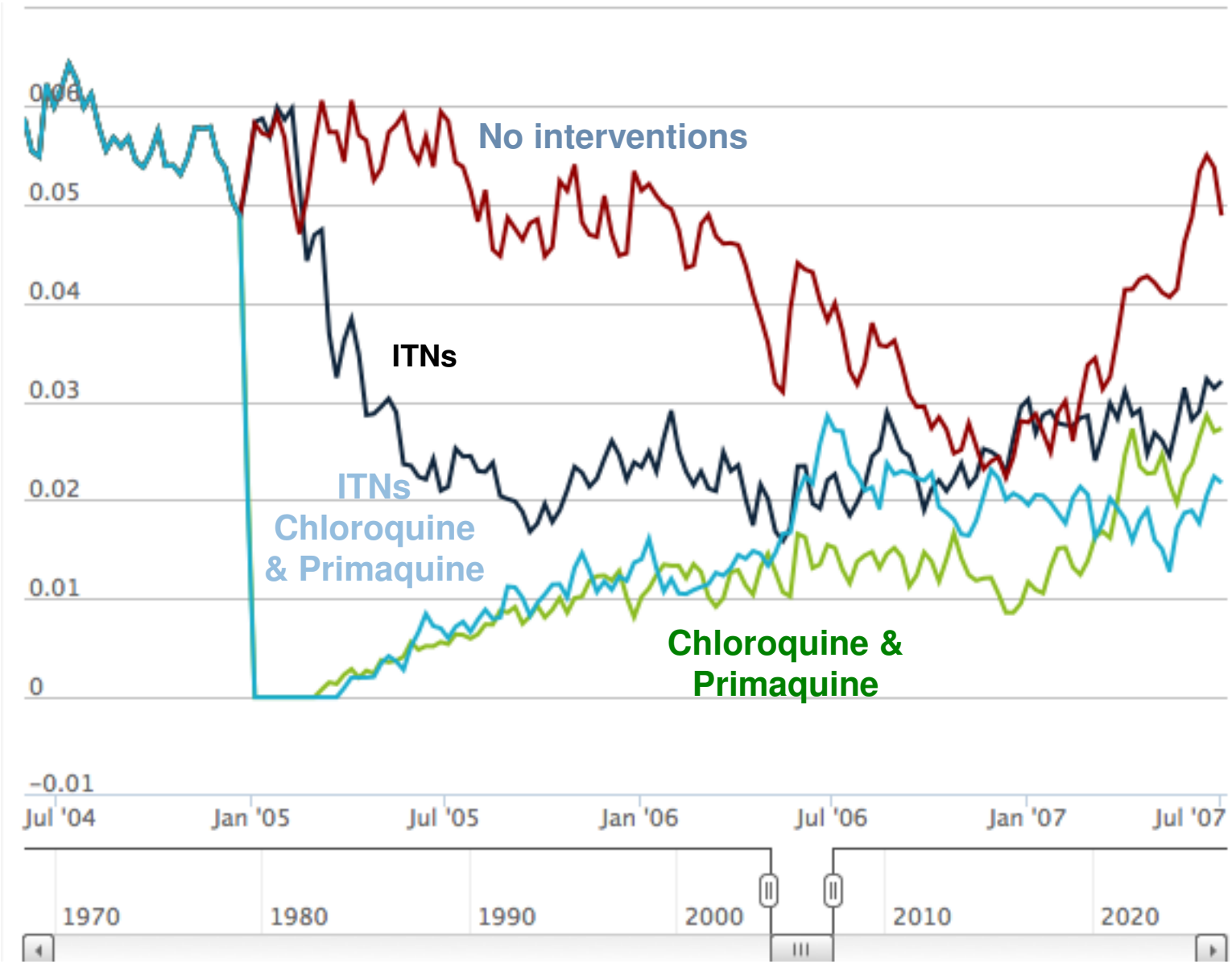
Start Day: 0 | Max Number to Distribute: | Demographic Usage: 100 %

Number Repetitions: | Time Between Reps:

Bednet Type	LLIN
Blocking Rate	0.8 *Range: 0.00 to 1.00*
Cost To Consumer	3.75 *Range: 0 to 999999*
Durability Time Profile	BOXDECAYDURABILITY
Killing Rate	0.8 *Range: 0.00 to 1.00*
Primary Decay Time Constant	365 *Range: 0.00 to 1e+006*
Secondary Decay Time Constant	730 *Range: 0.00 to 1e+006*

Save | Save and go to Launch Tool

ROLL BACK MALARIA



ROLL BACK MALARIA

VecNet

Our Work Tools Contact Us Logout (burkot)

Transmission Simulator

Modeling malaria transmission and control with OpenMalaria

In Alpha Stage of Development

‹ Transmission Simulator

- OpenMalaria
- New Scenario
- My Scenarios
- Utilities ›
- Upload Experiment ›

OpenMalaria Basic User Interface

OpenMalaria offers flexibility for modelling malaria in humans (epidemiology) allowing great input in the details of human disease including; variation in human exposure and response to the parasite, vaccine mechanisms, and drug treatments available to villages prior to intervention simulation. These strengths in epidemiology make OpenMalaria attractive to those interested in human disease outputs and human population dynamics. Read more on OpenMalaria here.

OpenMalaria's additional output parameters include:

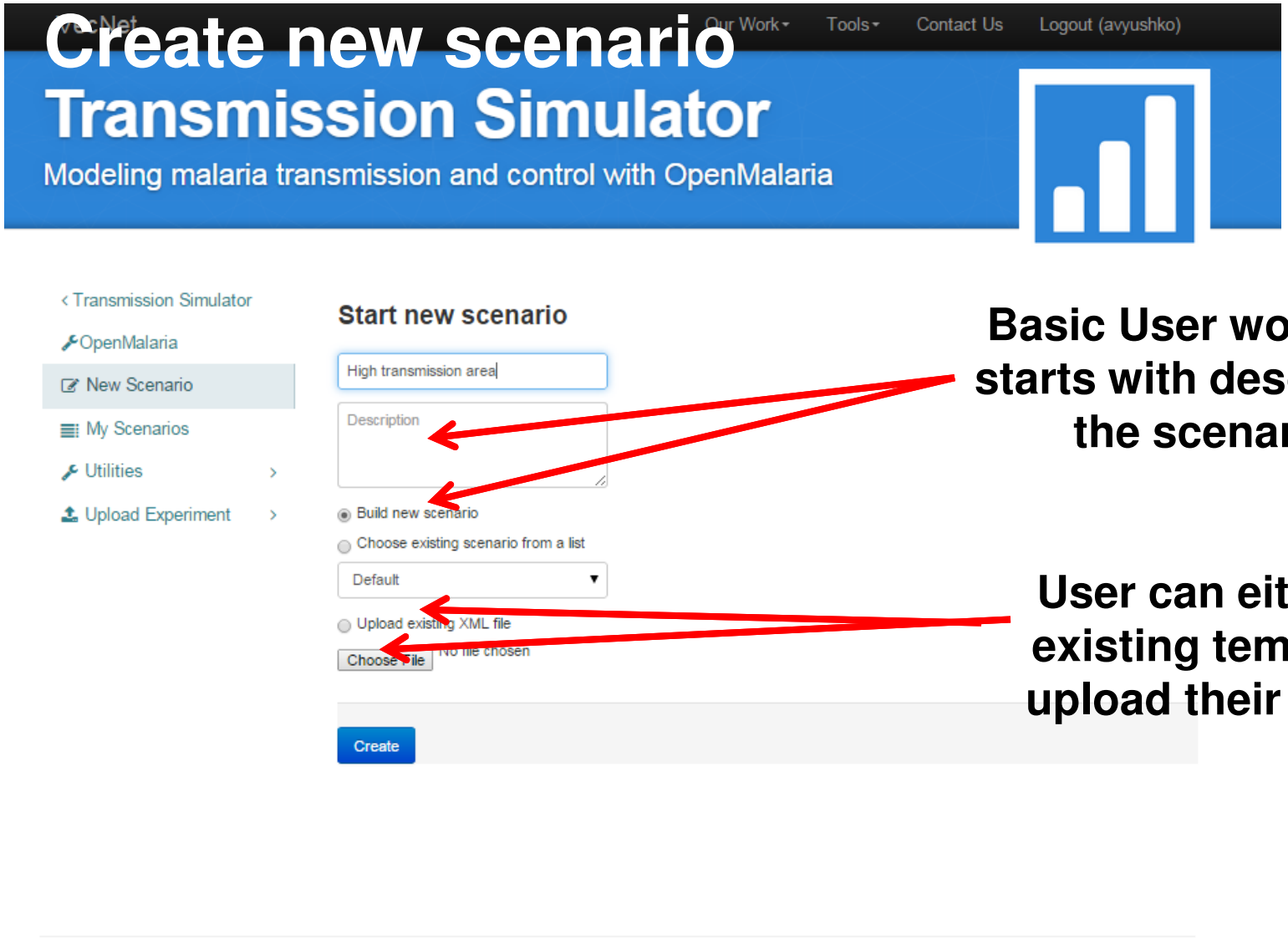
- Hospitalizations,
- Direct deaths,
- Indirect deaths,
- Number of doses of MDA/vaccine administered
- Number of people screened and treated via MSAT
- Number of people newly protected by ITN/IRS

User friendly interface for editing input parameters
Expert (xml) mode is available

+ Add a New Scenario

ROLL BACK MALARIA

Create new scenario



Basic User workflow starts with describing the scenario

User can either use existing template or upload their own file

ROLL BACK MALARIA

Back to Main Menu

Monitoring

Demography

Health System

Entomology

Interventions

Summary

Monitoring

"What do you want to measure, when do you want to measure it, and for whom?"

Simple | Advanced

Output measures

Tracked continuously throughout the simulation

- [x] Daily EIR (required)

Tracked only at the time points specified below

- [x] Number of individuals per age group (required)
- [x] Patent infections (detected by a test) (recommended)
- [x] Uncomplicated episodes (outpatient fever) (recommended)
- [ ] Severe episodes
- [ ] Hospitalizations
- [ ] Direct deaths
- [ ] Indirect deaths
- [ ] ITNs: number of people newly covered
- [ ] IRS: number of people newly covered
- [ ] MDA: number of doses given
- [ ] MSAT: number of people screened
- [ ] Vaccine: number of doses delivered
- [ ] Number of new infections

Simulation timeline

Simulation start date: Year 2015

Monitoring start date: Year 2025

Type of diagnostic for parasite detection: RDT (100 parasites per microlitre)

How often do you want to measure outputs? Yearly

Monitor for: 10 years 0 months

Next

User specifies the outputs, and frequency of the outputs and duration of the simulation

ROLL BACK MALARIA

VecNet

Our Work Tools Contact Us Logout (avyushko)

Transmission Simulator

Modeling malaria transmission and control with OpenMalaria

- Back to Main Menu
- Monitoring
- Demography
- Health System
- Entomology
- Interventions
- Summary

Demography

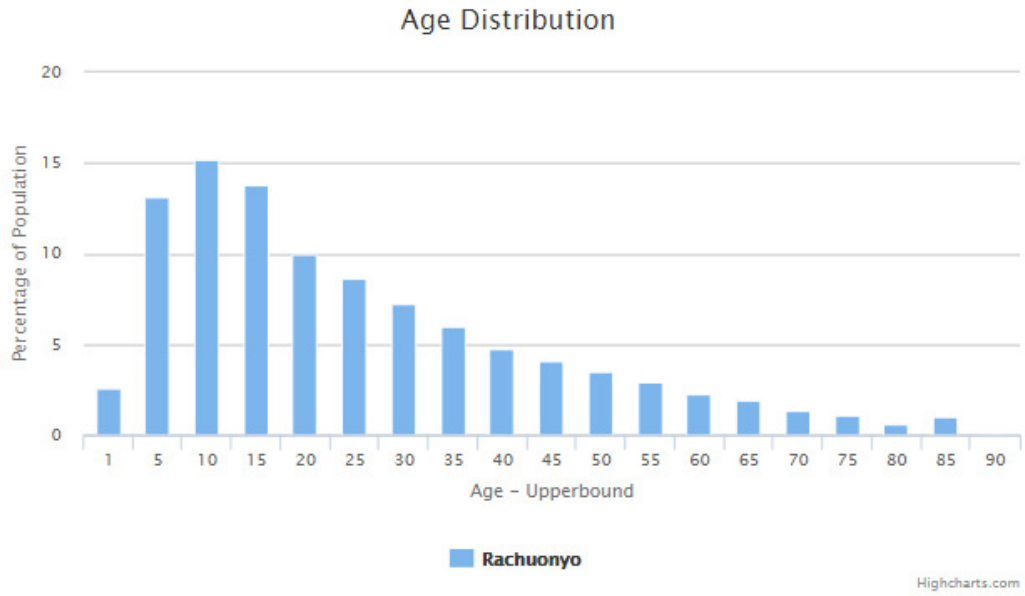
"What location does your scenario describe, for how many people, and how long will it run?"

Simple | Advanced

User selects population size and age distribution

Simulated human population size: 100

Age distribution: Rachuonyo Kenya — Source



Previous | Next

VecNet

Our Work Tools Contact Us Logout (avyushko)

Health System

Transmission Simulator

Modeling malaria transmission and control with OpenMalaria

- Back to Main Menu
- Monitoring
- Demography
- Health System
- Entomology
- Interventions
- Summary

Health system

"How many fevers access treatment, and what are they treated with?"

Simple | Advanced

Percentage of fevers in children under 5 treated with an antimalarial

16 %

Percentage of these treatments accessed through formal care providers

65 %

First line drug

Artimisinin combination therapy (A

Previous | Next

User specifies drugs used and access

User defines vectors, relative abundance and biological characteristics

Interventions identified, effectiveness, when deployed

VecNet | Our Work | Tools | Contact Us | Logout (avyushko)

Transmission Simulator

Modeling malaria transmission and control with OpenMalaria

- ‹ Transmission Simulator
- OpenMalaria
- New Scenario
- My Scenarios
- Utilities ›
- Upload Experiment ›

Run Successful

11/11 test runs complete.

Experiment: **Test**

This experiment contains 0 scenarios.

Visualize Results

Notify me by email when simulation is completed

Delete Experiment | Download experiment | Go to Experiment Creator

Contact us | FAQ | User Privacy Policy | Terms of Use

VecNet

ROLL BACK MALARIA

VecNet

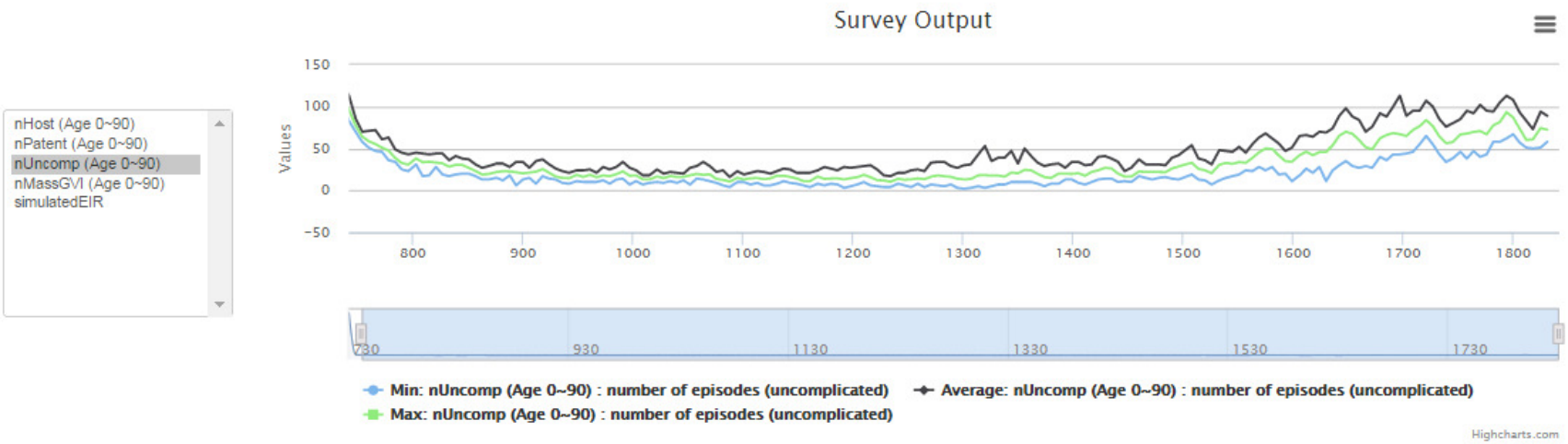
Our Work Tools Contact Us Logout (avyushko)

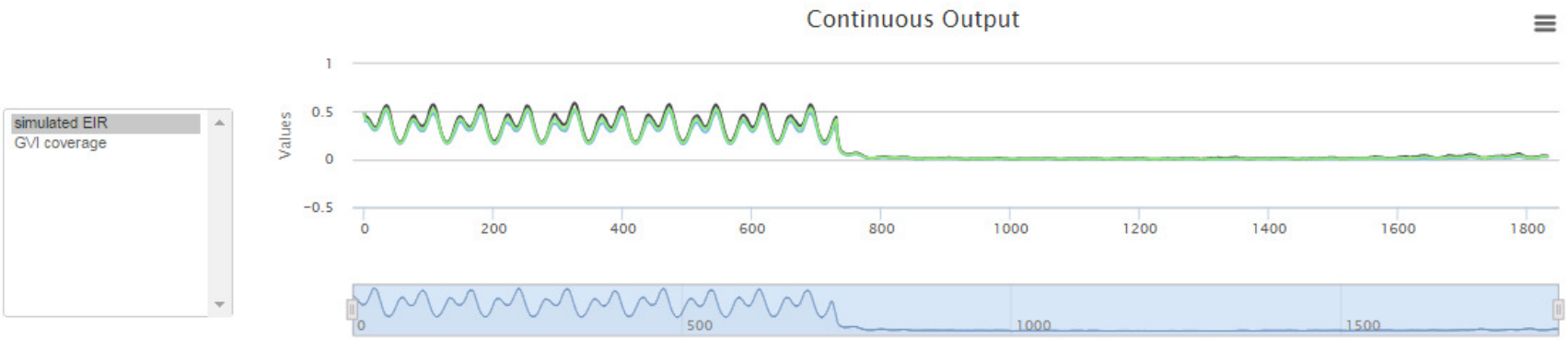
Transmission Simulator

Visualizing the OpenMalaria model output

Experiment output

1715 1714 1713 1712 1711 1710 1709 1708 1707 1706 1705

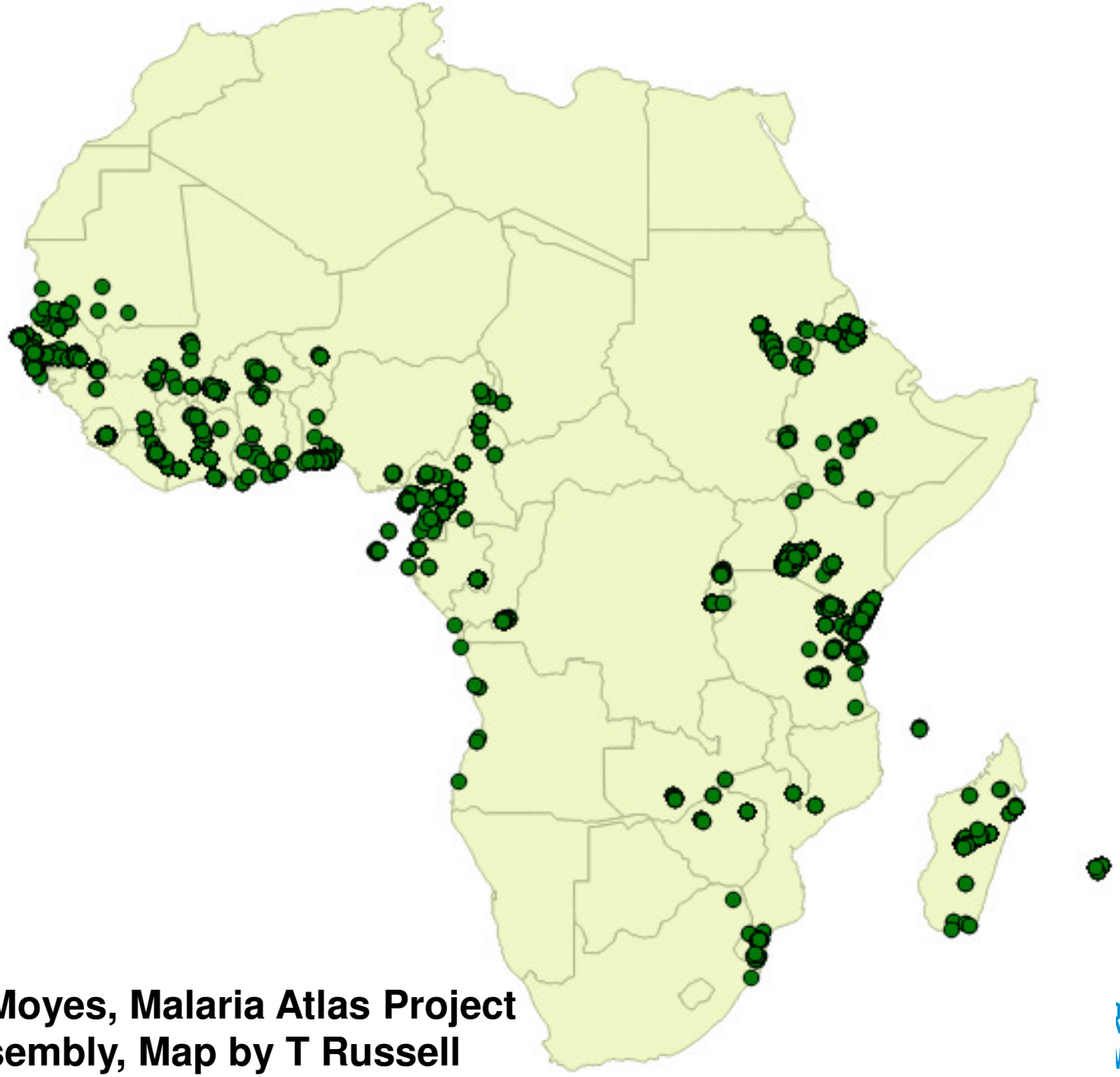




Min: simulated EIR : EIR acting on simulated humans. Units: from schema version 26, inoculations per adult per timestep, previously inoculations per person per timestep.
Average: simulated EIR : EIR acting on simulated humans. Units: from schema version 26, inoculations per adult per timestep, previously inoculations per person per times
Max: simulated EIR : EIR acting on simulated humans. Units: from schema version 26, inoculations per adult per timestep, previously inoculations per person per timestep

Highcharts.com

Published Data on Malaria Vectors: 1985-2013



Sinka and Moyes, Malaria Atlas Project
Data assembly, Map by T Russell

ROLL BACK MALARIA

Parity Rates

Daily Survivorship

Sinka and Moyes, Malaria Atlas Project
Data assembly, Map by T Russell

ROLL BACK MALARIA

Representative Scenario Interface

Weather pattern

Annual amount of rain
How much total rain during the year.

LOW | MEDIUM | HIGH

Rainfall distribution
How many rainy seasons.

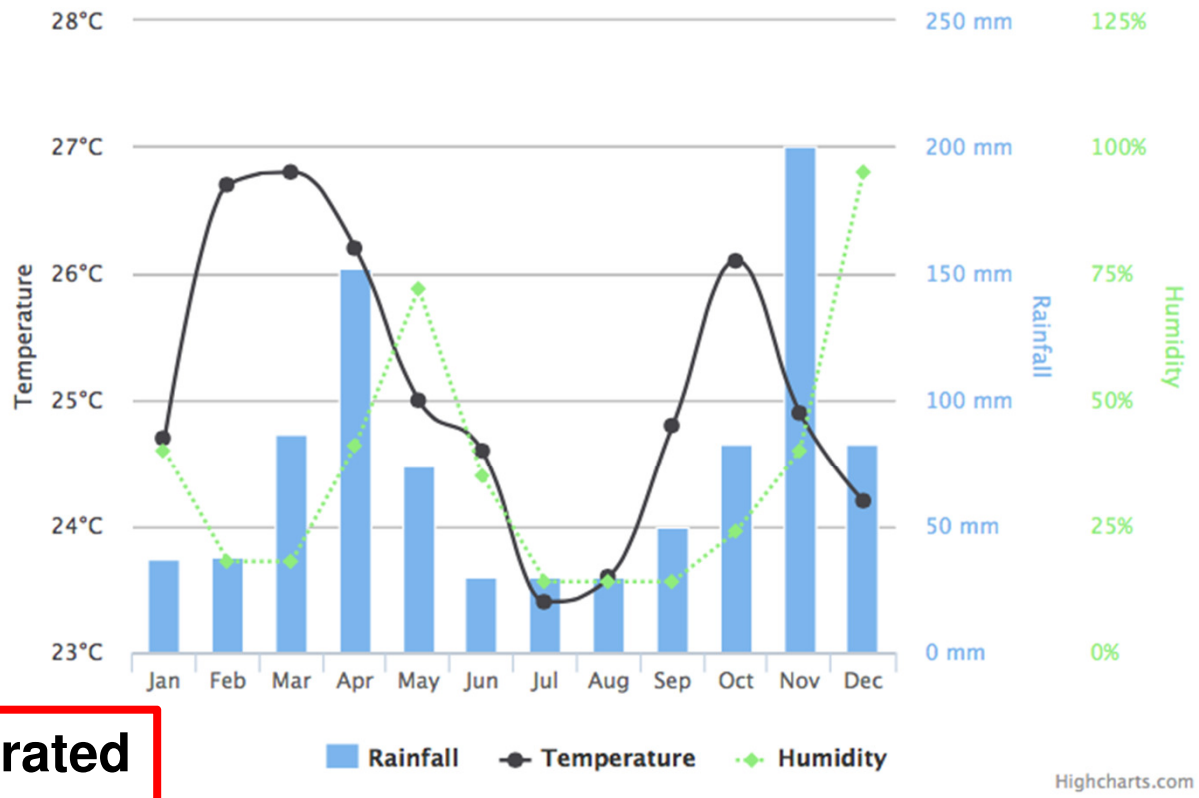
UNIFORM | ONE SEASON | TWO SEASO

Dry seasons rains
How dry are the dry seasons.

LIGHT | DRY | VERY DRY

Temperature averages
How warm it is.

COLD | AVERAGE | HOT



The daily weather is generated using the monthly values shown in the graph

ROLL BACK MALARIA

Representative Scenario Vectors Attributes

Mosquito species

Species present

- An. gambiae
- An. funestus
- An arabienis
- An. minor

+ ADD A NEW SPECIES

An. gambiae ✖ Delete species

Feeding behavior

Indoor feeding
How often the species will try to feed on human indoor.

LOW | MEDIUM | HIGH

Anthropophily
How much the species will prefer feeding on human over animals.

LOW | MEDIUM | HIGH

Early stages and survival

Life expectency
How long the mosquito will leave?

SHORT | MEDIUM | LONG

Gonotrophic cycle
How long a full gonotrophic cycle will take?

SHORT | MEDIUM | LONG

Habitat selection

Water vegetation: Habitat related to the presence of water vegetation.

☑ **Temporary rainfall**: Habitat dependant on the rain.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Human population: Habitat due to the presence of human in the area.

Brackish swamp: Habitat that will fill up with rain but eventually emptying if rainfall are too important.

Constant: Constant habitat that doesnt depend on anything.

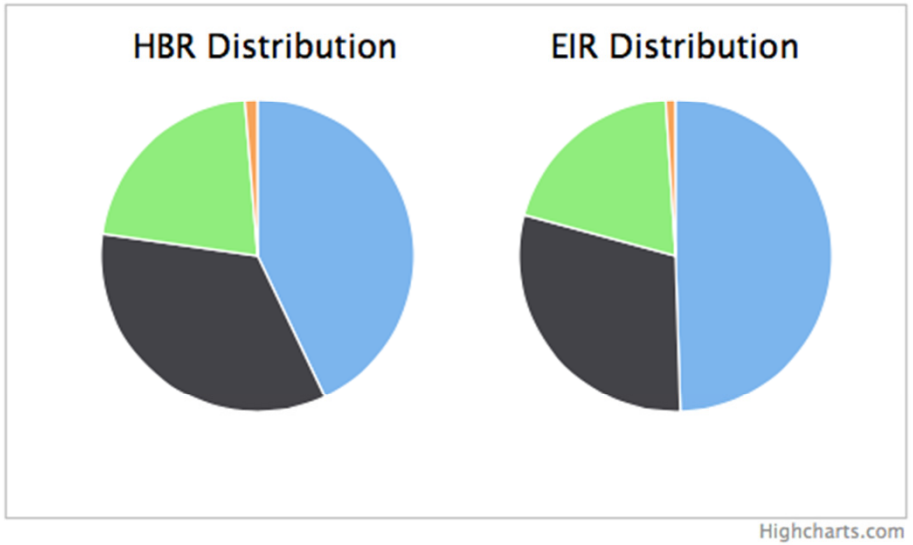
ROLL BACK MALARIA

Representative Scenario Biting Rate & Annual EIR

The user defines the species biting rate and the annual EIR per species (Graphs are automatically generated to show this distribution)

Distribution of species

Please specify the Human Biting Rate per day per individual.



An. gambiae

10	bites per day
50	yearly EIR

An. funestus

8	bites per day
30	yearly EIR

An arabienis

5	bites per day
20	yearly EIR

An. minor

0.3	bites per day
1	yearly EIR

ROLL BACK MALARIA

Demographics and transmission

Human birth rate
How often new born are introduced to the simulation.

LOW | MEDIUM | HIGH

Parasite prevalence
How intense the transmission is. Also drive the immunity of the population.

LOW | MEDIUM | HIGH

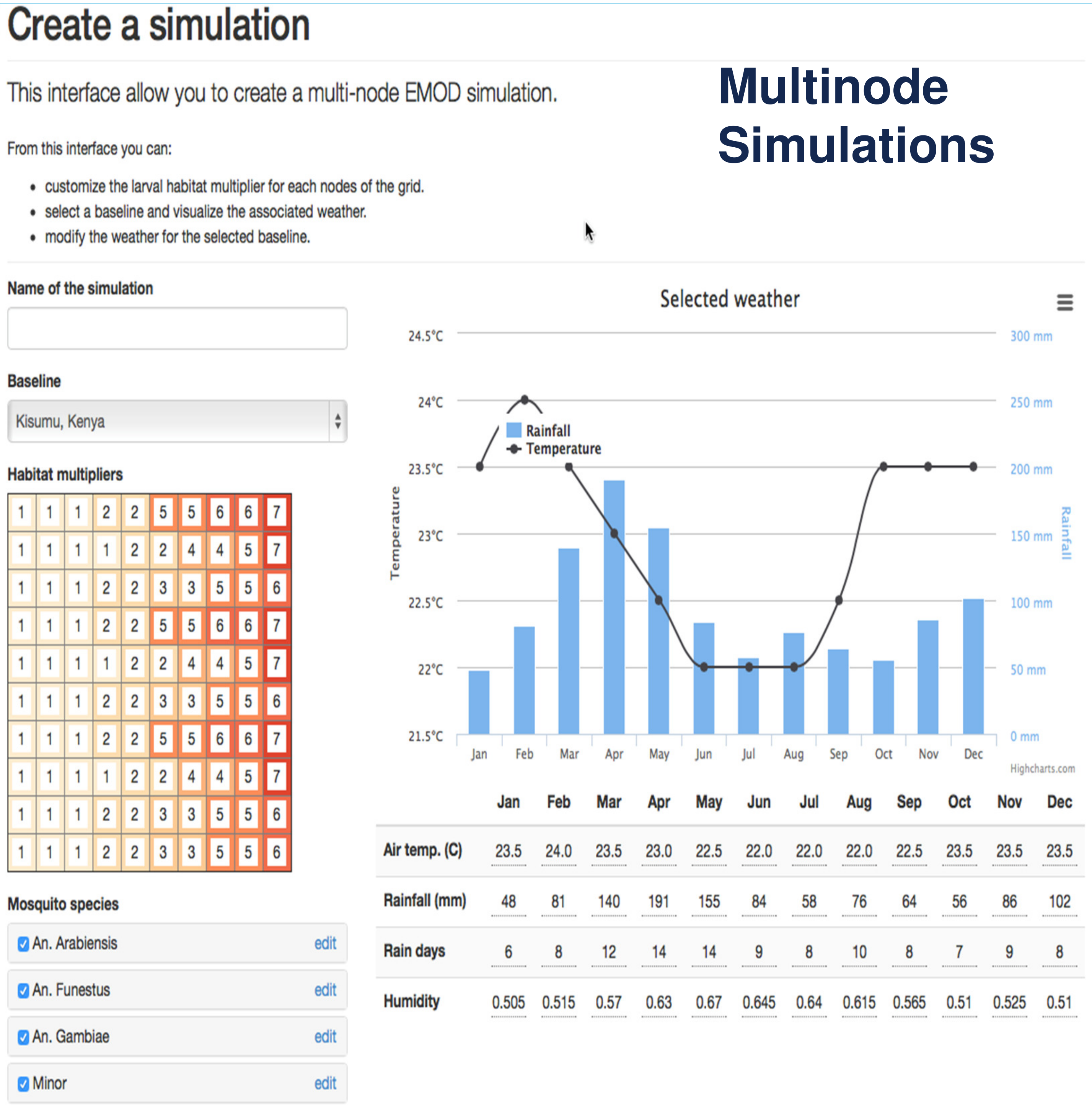
Human life expectancy
How long an average person lives.

SHORT | MEDIUM | LONG

Launch calibration!

ROLL BACK MALARIA

Multinode Simulations



Create a simulation

This interface allow you to create a multi-node EMOD simulation.

From this interface you can:

- customize the larval habitat multiplier for each nodes of the grid.
- select a baseline and visualize the associated weather.
- modify the weather for the selected baseline.

Name of the simulation

Baseline

Kisumu, Kenya

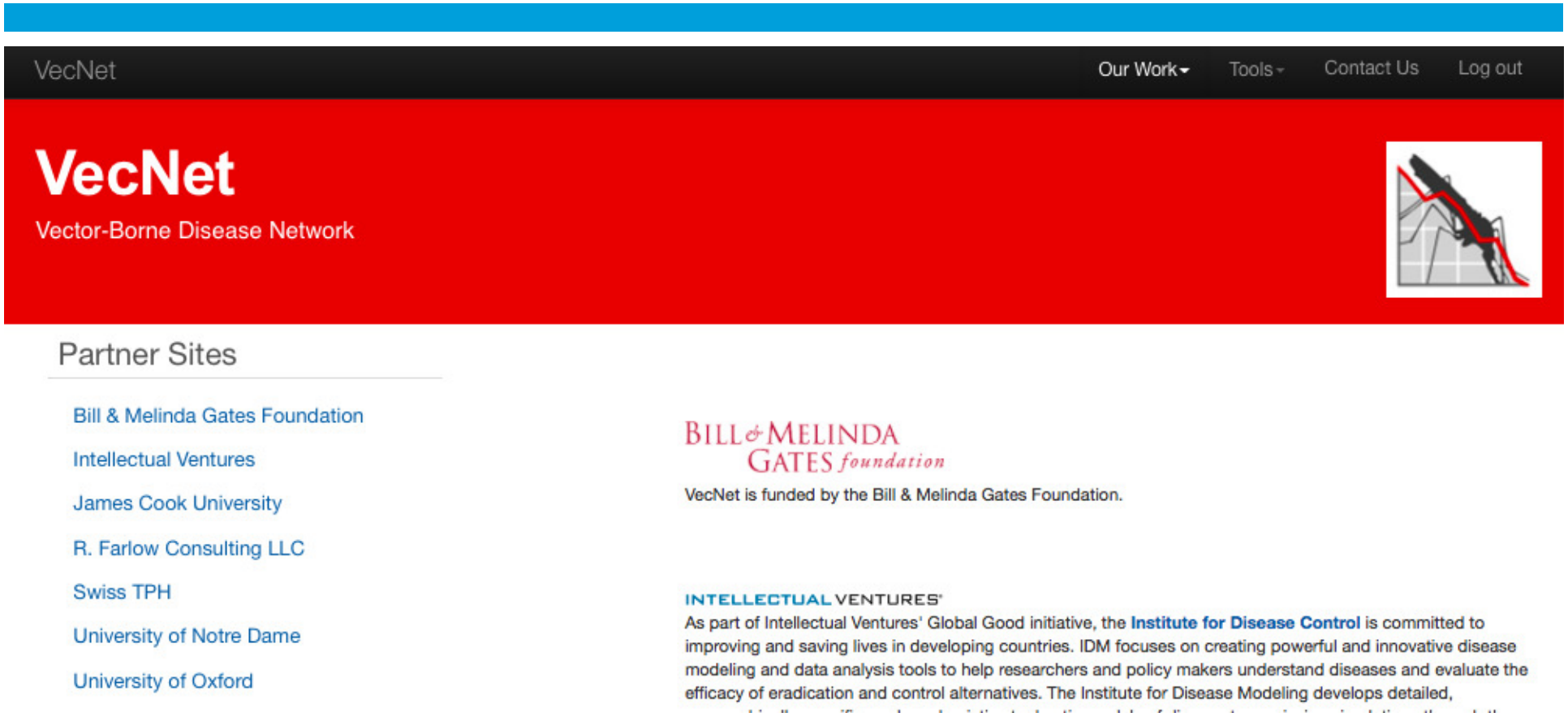
Habitat multipliers

1	1	1	2	2	5	5	6	6	7
1	1	1	1	2	2	4	4	5	7
1	1	1	2	2	3	3	5	5	6
1	1	1	2	2	5	5	6	6	7
1	1	1	1	2	2	4	4	5	7
1	1	1	2	2	3	3	5	5	6
1	1	1	2	2	5	5	6	6	7
1	1	1	1	2	2	4	4	5	7
1	1	1	2	2	3	3	5	5	6
1	1	1	2	2	3	3	5	5	6

Mosquito species

- ☑ An. Arabiensis edit
- ☑ An. Funestus edit
- ☑ An. Gambiae edit
- ☑ Minor edit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air temp. (C)	23.5	24.0	23.5	23.0	22.5	22.0	22.0	22.0	22.5	23.5	23.5	23.5
Rainfall (mm)	48	81	140	191	155	84	58	76	64	56	86	102
Rain days	6	8	12	14	14	9	8	10	8	7	9	8
Humidity	0.505	0.515	0.57	0.63	0.67	0.645	0.64	0.615	0.565	0.51	0.525	0.51



Key Dates: EMOD and OM Expert Interfaces - Q2 2015
Representative Scenario Interface - Q3 2015

ROLL BACK MALARIA