CLIMATE CHANGE IMPACT ON THE ESTABLISHMENT AND SEASONAL ABUNDANCE OF INVASIVE MOSQUITO SPECIES: CURRENT STATE AND FUTURE RISK MAPS OVER SOUTH-EAST EUROPE

Efthimios Tagaris[1,2]

(1) Environmental Research Laboratory, NCSR Demokritos, Athens, Greece

(2) Department of Mechanical Engineering, University of Western Macedonia, Kozani, Greece

LIFE CONOPS - Development & demonstration of management plans against - the climate enhanced- invasive mosquitos in S. Europe (LIFE12 ENV/GR/000466)

INTRODUCTION

Despite the long history of investments in mosquito control measures, mosquitoes still represent a serious problem for their capacity to:

- transmit diseases either to human and animals
- impact on life quality
- impact on socio-economic activities.

Globalization of trade and travel as well as climate change lead to the spread of mosquitoes in new regions:

- increased risk of transmission of diseases even in areas where there was no problem.

INTRODUCTION

We will deal with the Asian Tiger Mosquito (Aedes albopictus) as within a few decades a wide spread of it has been observed from the East Asian regions.

Public health problem:

It is a transmitter of at least 22 arboviruses with their most important:

Chikungunya (CHIKV)

Dengue Fever (DENV)

Zika virus


Dengue


ZIKA
VIRUS


Fiebre alta
Inicia súbitamente, puede superar los 39 grados
Dolor de cabeza
Dolores musculares
Dolor difuso de espalda
SOY 502


CHIKUNGUNYA

INTRODUCTION

LIFE CONOPS - Development & demonstration of management plans against - the climate enhanced- invasive mosquitos in S. Europe (LIFE12 ENV/GR/000466) (www.conops.gr).

Duration: 01.07.2013 – 31.12.2017 (4.5 years)

Total project budget: ~3 M euro (EC contribution: ~1.5 M euro)

Partners: Greece: Benaki Phytopathological Institute, Agricultural University of Athens, NCSR Demokritos, Panteion University, Terra Nova Environmental Engineering Consultancy Ltd, ONEX Hellenic-Services Provision Private Company-Security Systems

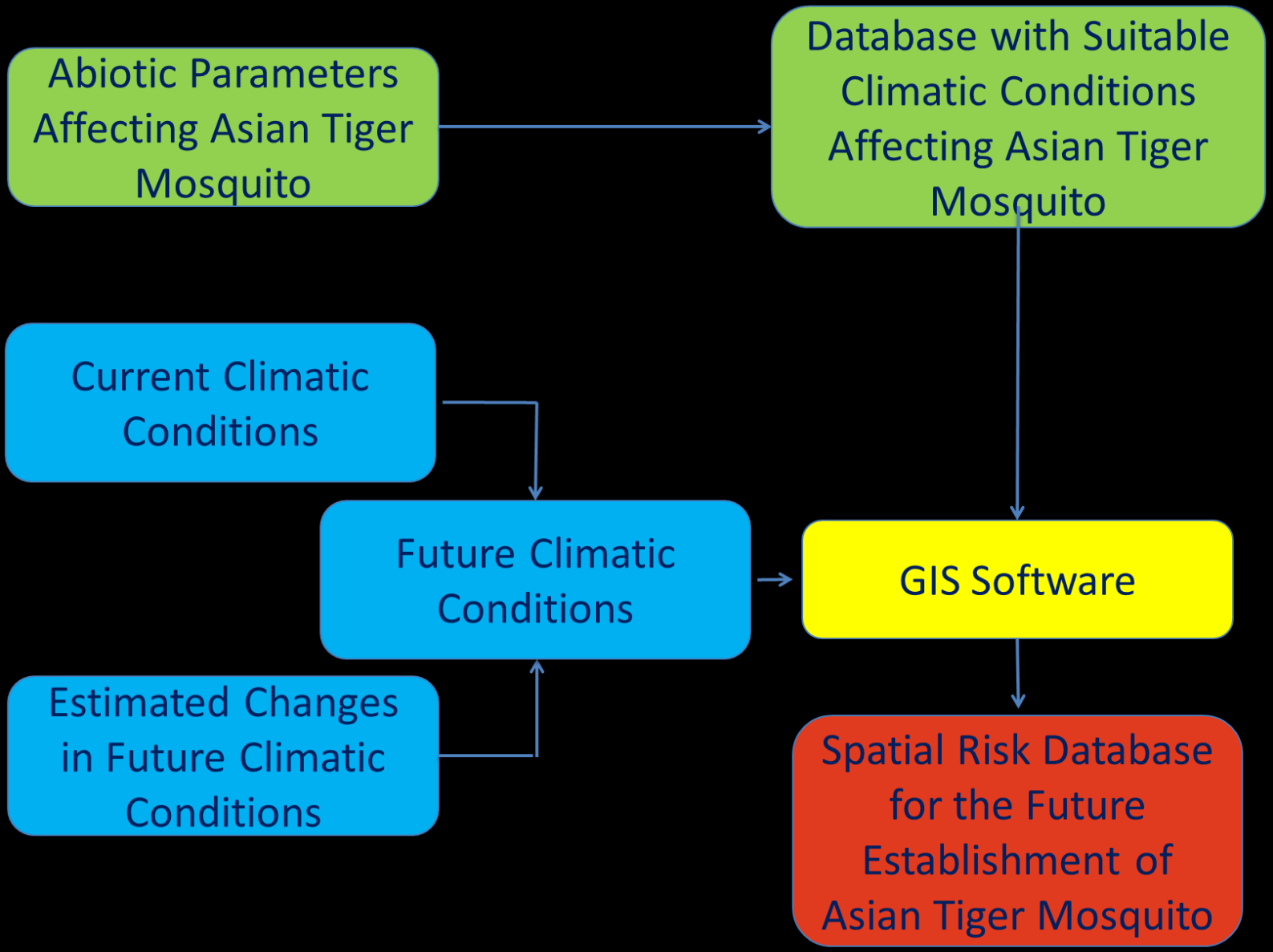
Italy: Azienda Sanitaria Locale Cesena, Azienda Unità Sanitaria Locale Ravenna, Centro Agricoltura Ambiente "G.NICOLI" S.R.L., Regione Emilia-Romagna – Public Health Service.

INTRODUCTION

The objective of this study is to assess current state and future potentiality of the Asian Tiger Mosquito spread and establishment over Greece and Italy based on the estimated changes in climatic parameters.

Mediterranean is the most prominent climate response Hot-Spot since it is located in a transition zone between the arid climate of northern Africa and the wet climate of central Europe.

METHOD


Abiotic Parameters Affecting Asian Tiger Mosquito
Database with Suitable Climatic Conditions Affecting Asian Tiger Mosquito
Current Climatic Conditions
Future Climatic Conditions
GIS Software
Estimated Changes in Future Climatic Conditions
Spatial Risk Database for the Future Establishment of Asian Tiger Mosquito

METHOD

Abiotic Parameters Affecting Asian Tiger Mosquito:

Annual Rainfall

0 for rainfall <450 mm and max for rainfall >800 mm

Coldest Month Temperature (January)

0 for temperatures are <-1^{o}C and max for temperatures are >3^{o}C

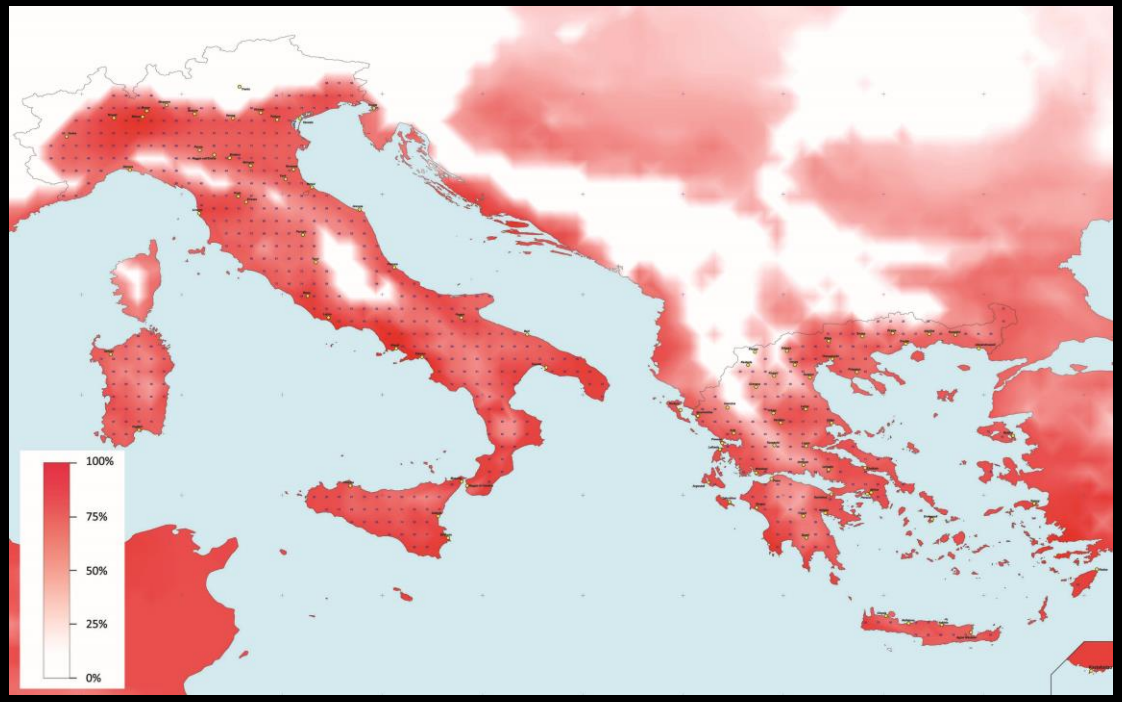
Warm Period Temperature (March - October)

0 for temperatures <15^{o}C and >30^{o}C and max from 20^{o}C to 25^{o}C

CURRENT STATE

Current climatic parameters were collected using daily data from the European Climate Assessment and Dataset (ECA&D) project.

The current suitability for Asian Tiger Mosquito is found to be particularly high for both countries.

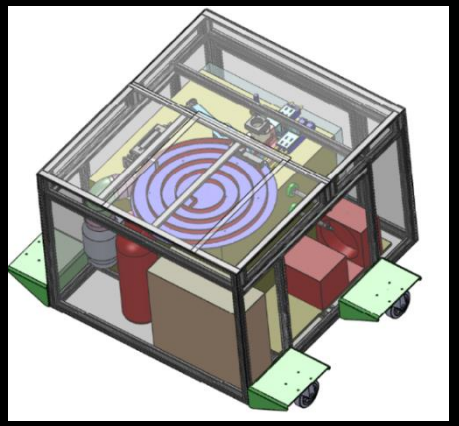


Asian Tiger Mosquito Current Suitability Map

78% and 75% of Italy and Greek, respectively, are having a suitability factor higher than 60%.

CURRENT STATE

Current state of Invasive Mosquito Species (IMS) over Greece and Italy is validated from the installation at key points across the two countries of a prototype IMS Monitoring Device (MD) that has been designed and developed in the LIFE CONOPS project.



FUTURE CLIMATIC CONDITIONS

Global Climate Model

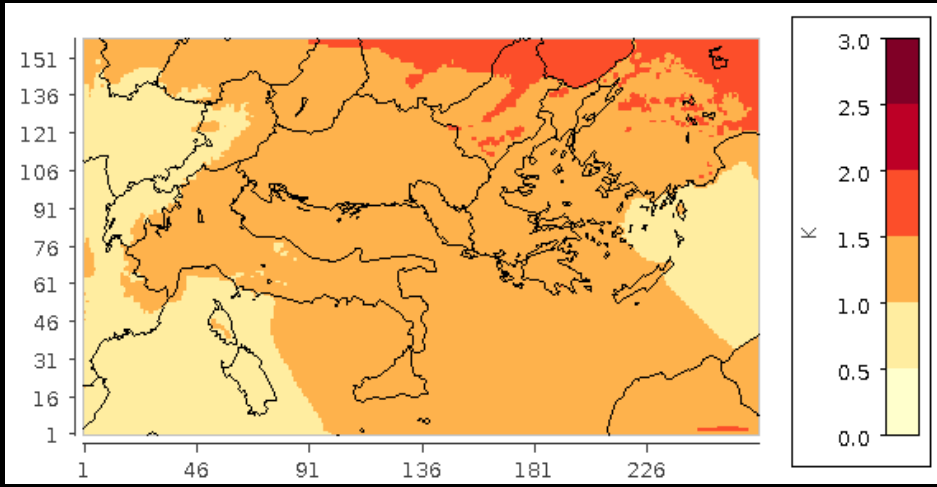
The NASA GISS GCM ModelE is used to simulate climate under the IPCC A1B emission scenario

Regional Climate Downscaling

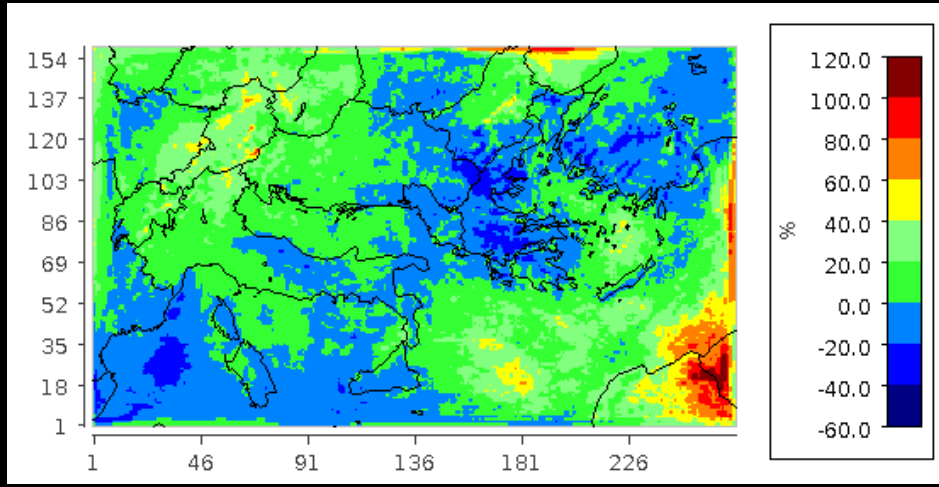
The outputs from the GCM are relatively coarse (i.e., 2˚ × 2.5˚) for applications to regional and local scales. The need for regional climate projections in a finer grid size is assessed, here, using the WRF model to dynamically downscale NASA GISS GCM ModleE simulations.

FUTURE CLIMATIC CONDITIONS

Temperature and precipitation changes between 2060s and 2010s (9 km by 9 km grid resolution)

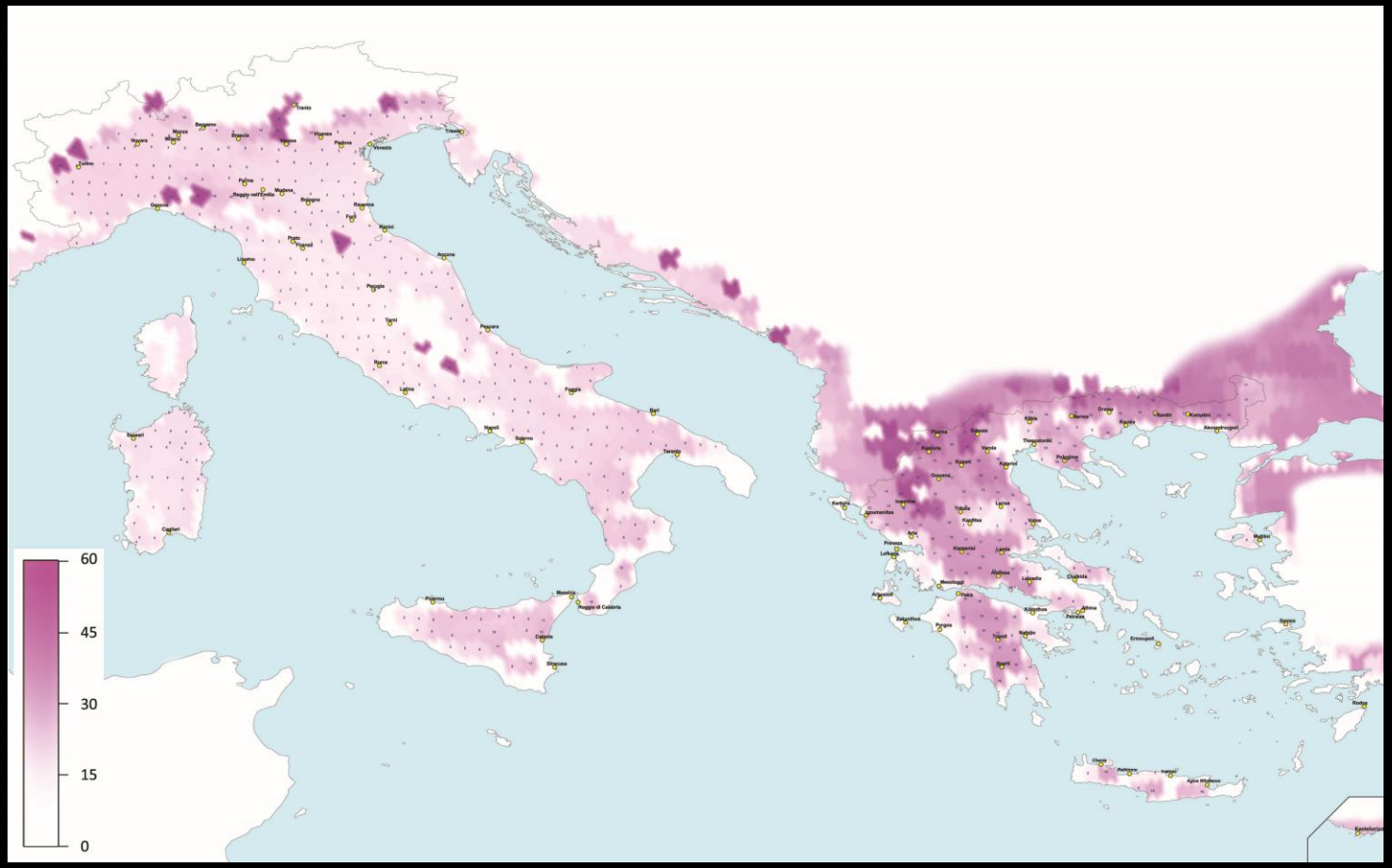


Annual temperature change



Annual precipitation change

FUTURE STATE

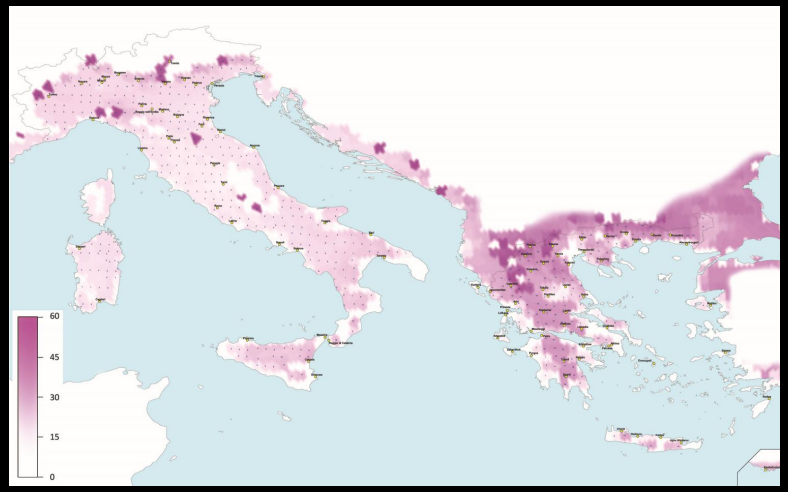


Spatial distribution risk map presenting the differences between current (2010s) and future (2060s) suitability on the potential distribution of Asian Tiger Mosquito in Greece and Italy.

FUTURE STATE

The spread and establishment of Asian Tiger Mosquito over Greece and Italy is favored. This pattern appears mild for both countries, with significant changes (increase) in some medium and high altitude areas. For Greece, the regions that will be affected more are the mountainous regions of Pindos and Rodopi.

The maximum difference in suitability for Italy is estimated up to 44%, while for Greece up to 38%.



In Greece although the difference in suitability will be smaller compared to Italy, the differences are more intense and widespread.

CONCLUSIONS

Future climatic conditions are estimated to favor the spread and establishment of Asian Tiger Mosquito over Greece and Italy.

This can lead to a change in the biodiversity of areas where the new species will compete with native species of mosquitoes or other organisms and will be a major threat to humans and animals.

LIFE CONOPS - DEVELOPMENT & DEMONSTRATION OF MANAGEMENT PLANS AGAINST - THE CLIMATE ENHANCED-INVASIVE MOSQUITOS IN S. EUROPE (LIFE12 ENV/GR/000466)