Moulding a concept into a product:
overcoming the pitfalls

Els Ducheyne

www.avia-gis.com

How it all started

Emerging infectious diseases

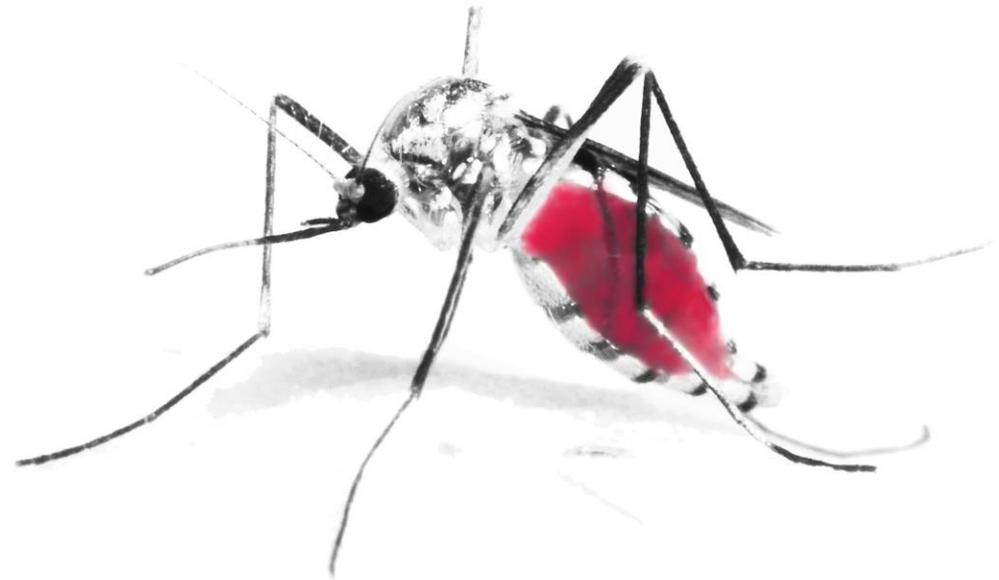What are the needs?

Software development

How it all started

Emerging infectious diseases
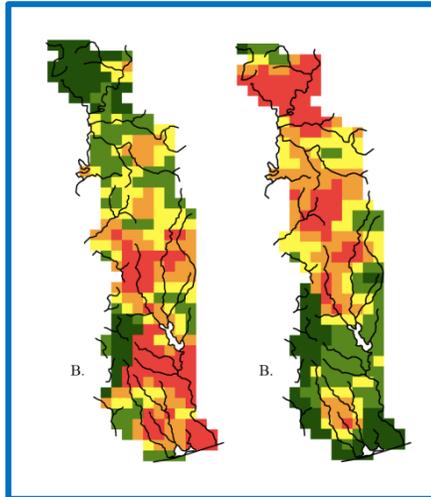
What are the needs?

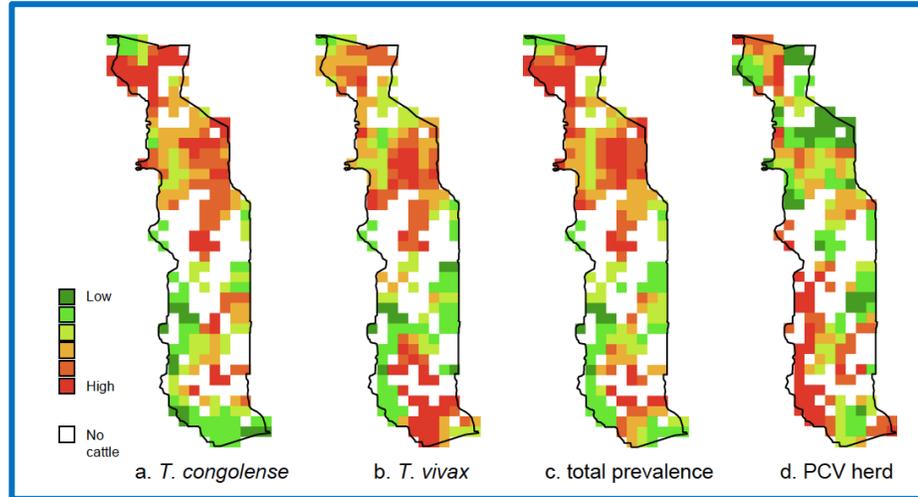Software development

3

Mapping vectors, pathogens and hosts

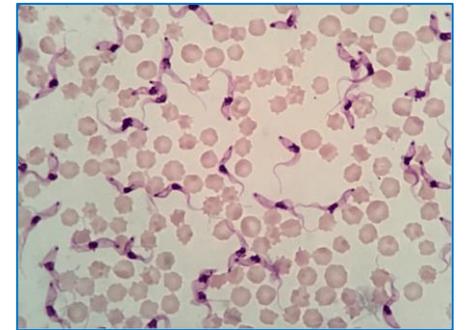## Tsetse transmitted trypanosomiasis in Togo

Vectors

Pathogens

Hosts

a. *T. congolense*   b. *T. vivax*   c. total prevalence   d. PCV herd

Low
High
No cattle

no cattle   100% taurine   < 10% taurine

A1   A2   B

a. total herd   b. female cattle   c. fertile male cattle (3X3 pooled)
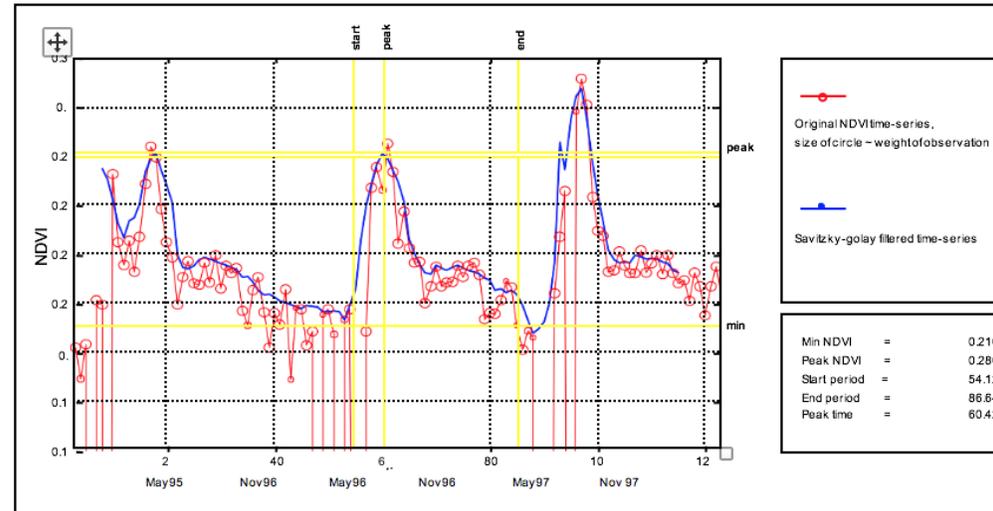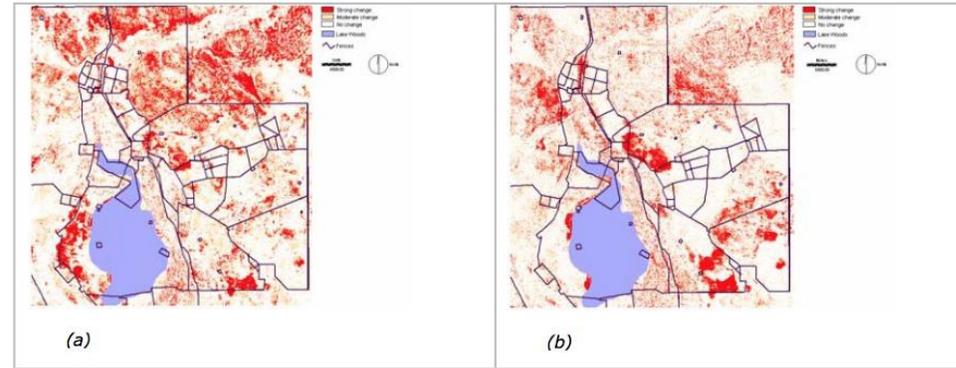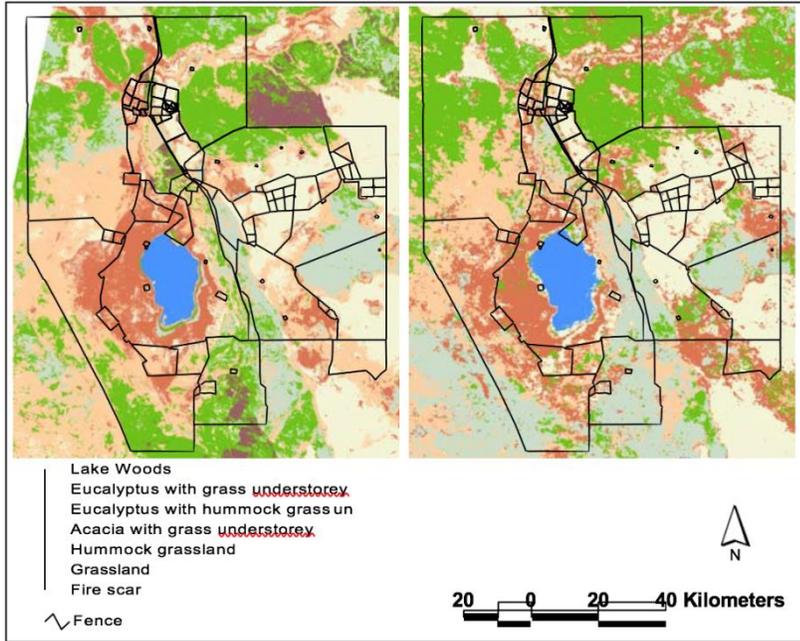
4
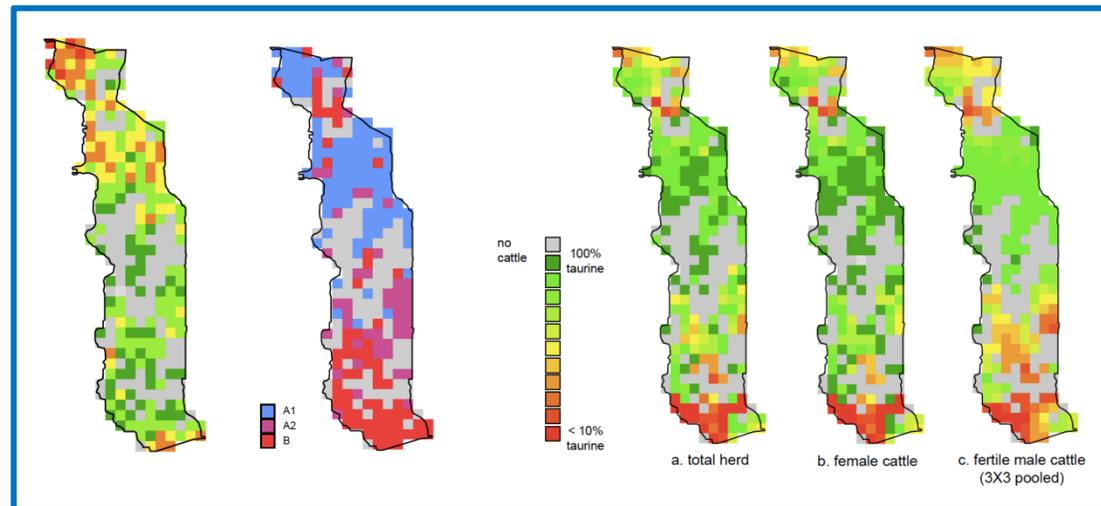
Modeling vectors, pathogens and hosts

e.g. *Glossina tachinoides*
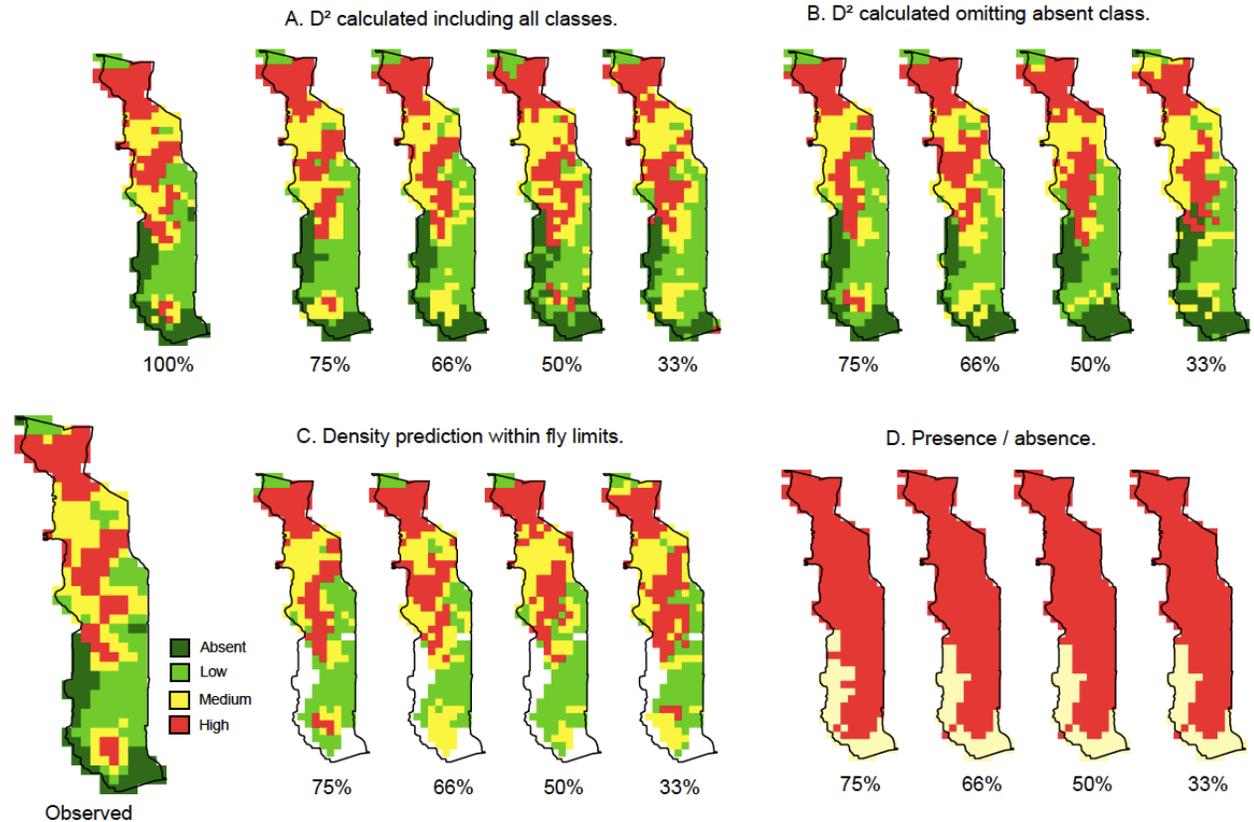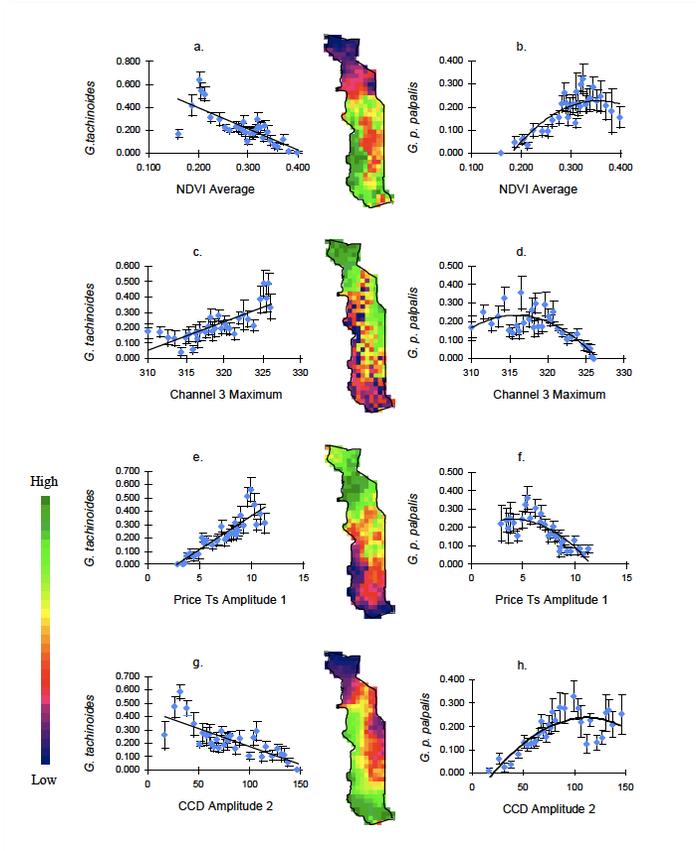
Applying this in Australia
RANGELAND

Applying this in Europe
BLUETONGUE

Cattle= reservoir

Infected midge infects cattle or sheep

Non-infected midge Imbibes viraemic blood
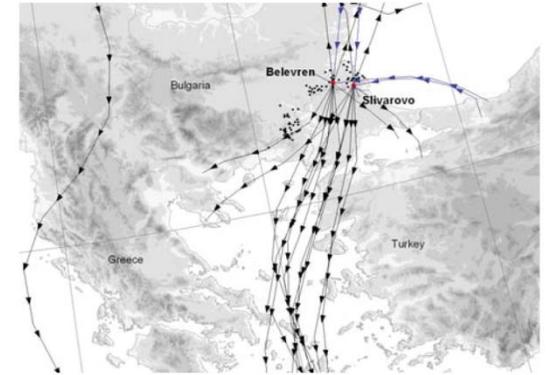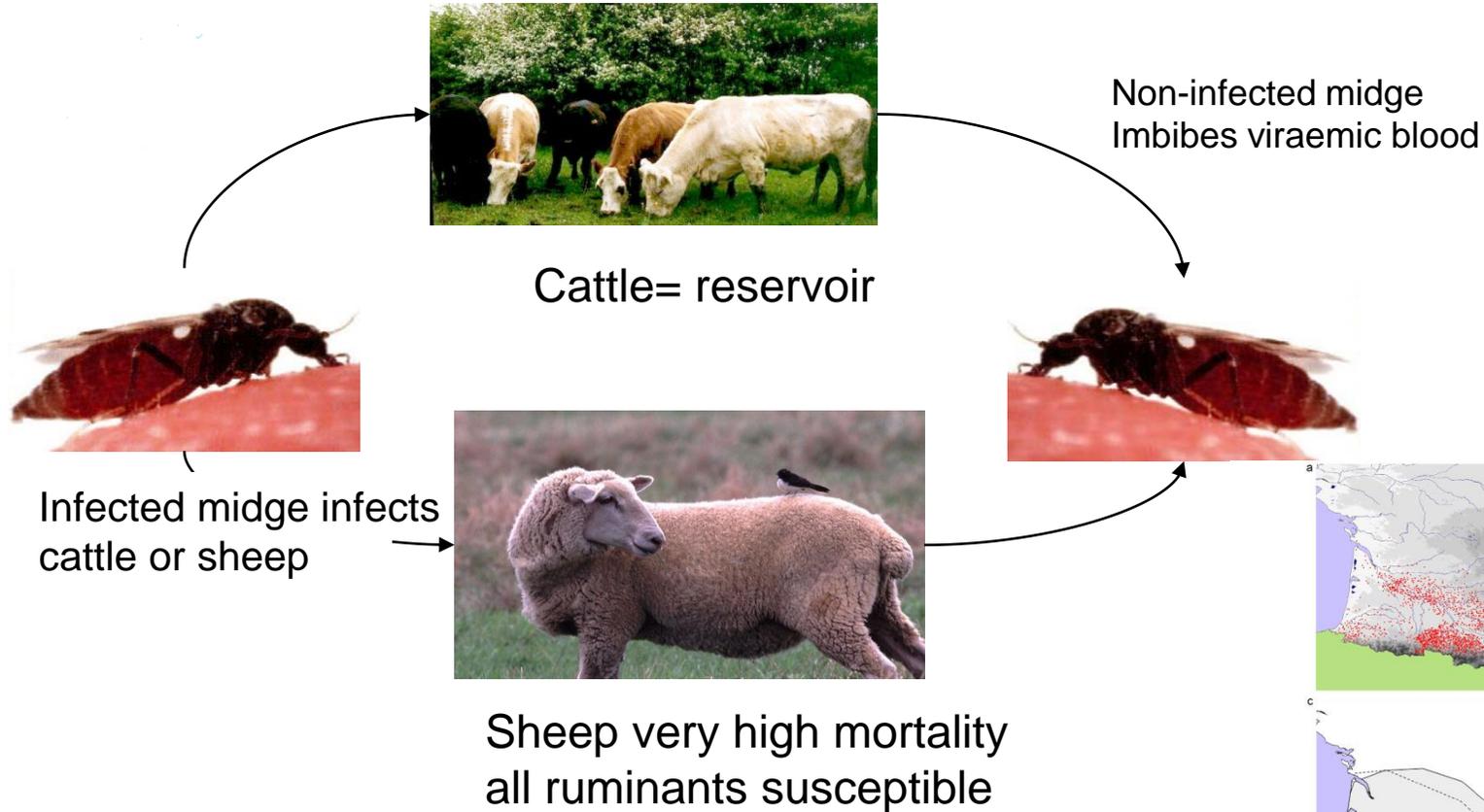
Sheep very high mortality all ruminants susceptible

Fig. 1. (a) Blue trajectories show 1999 BTV-9 backward trajectories to Slivarovo and Belevren (introduction). Black trajectories show 1999 BTV-9 forward trajectories from Slivarovo and Belevren. Red dots are outbreaks recorded in June, black dots are all cases of BTV-9.
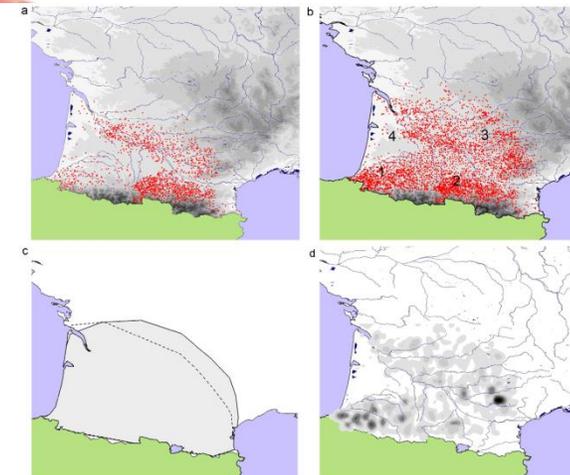
Ducheyne et al 2007

Fig. 4. (a) Observed cases for the BTV1 epidemic in France in 2008. (b) predicted cases from a single model run, labels 1–3 refer to the predicted higher-than-average clusters, 4 refers to the Landes lower-than-average cluster, (c) indicates the convex polygon around the observed (dotted line) vs. predicted cases (full line) and (d) shows the standard deviation on the predicted case density over 5 repetitions (range 0–0.032).

Ducheyne et al 2011

Applying this in Belgium
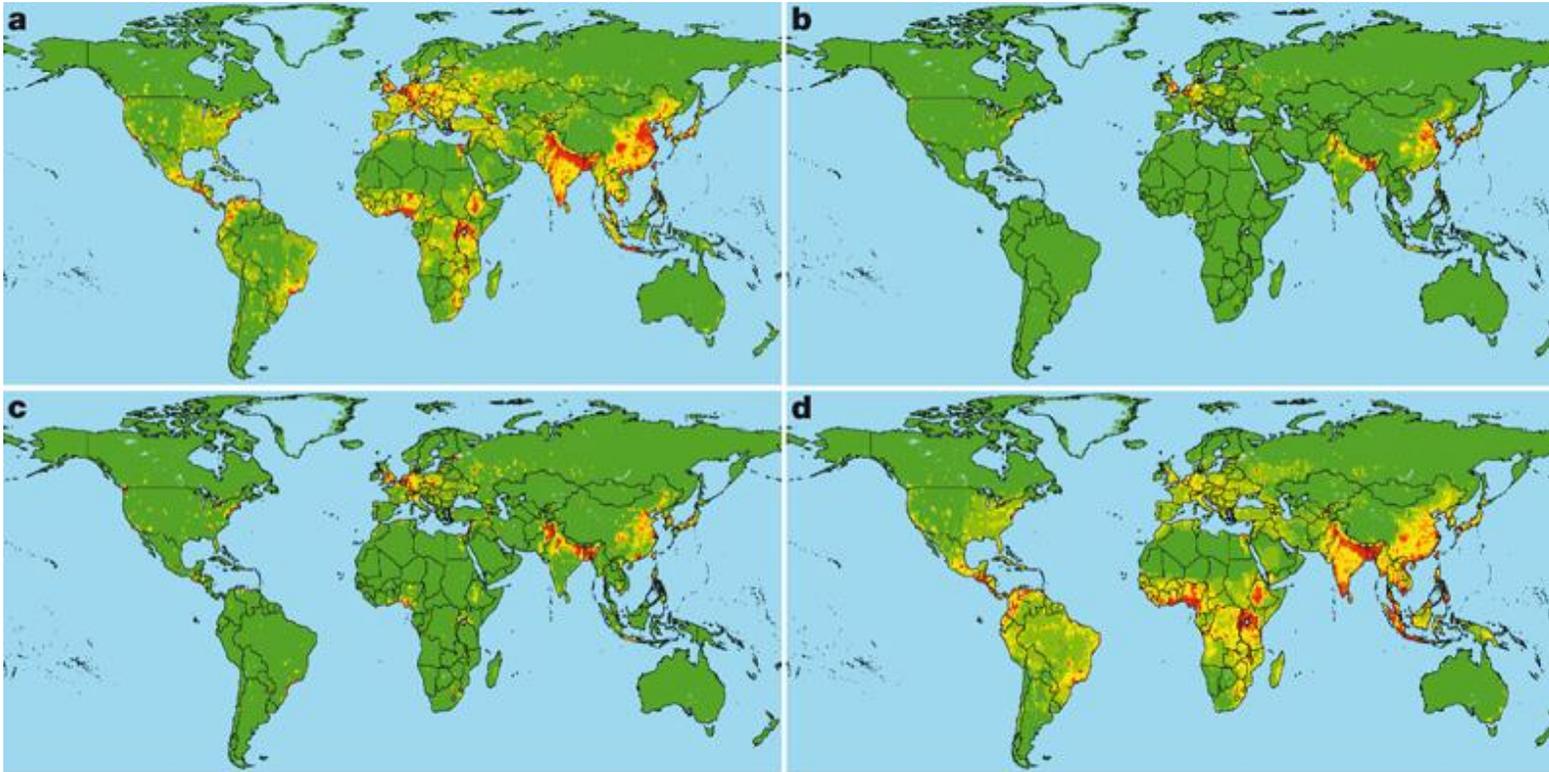## MODIRISK – mapping mosquito diversity
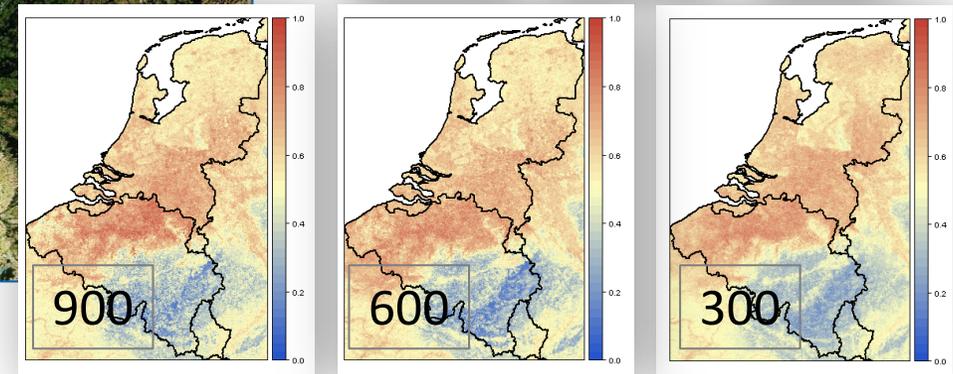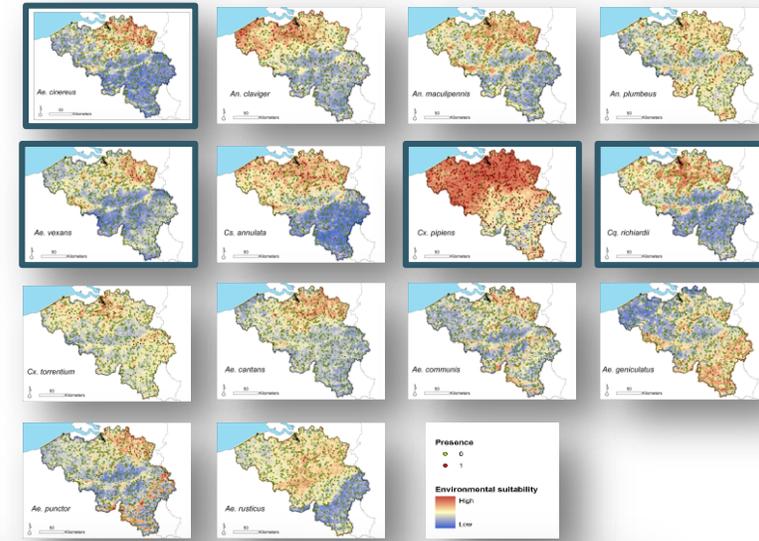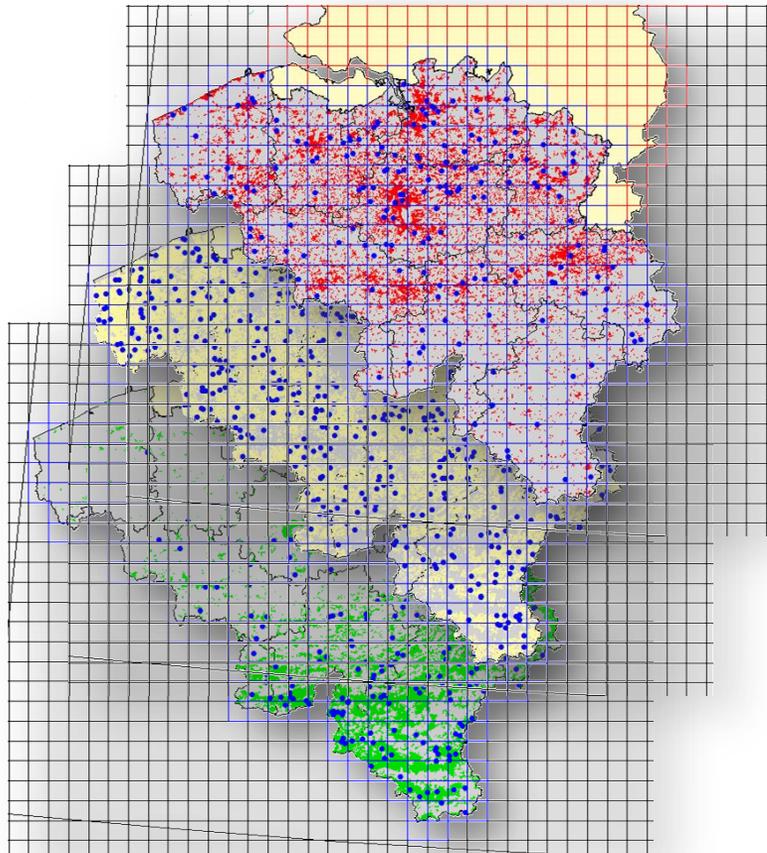
How it all started

[Emerging infectious diseases](#)

What are the needs?

Software development

Emerging Infectious diseases

Drivers of change:

GLOBAL
- Increased traffic of people and goods
- Climate change

LOCAL
- LU/LC changes
- Societal changes
- Environmental awareness

FIGURE AND MODIFIED LEGEND FROM JONES ET AL., 2008 (FIGURE 3). GLOBAL DISTRIBUTION OF RELATIVE RISK OF AN EID EVENT. MAPS ARE DERIVED FOR EID EVENTS CAUSED BY:
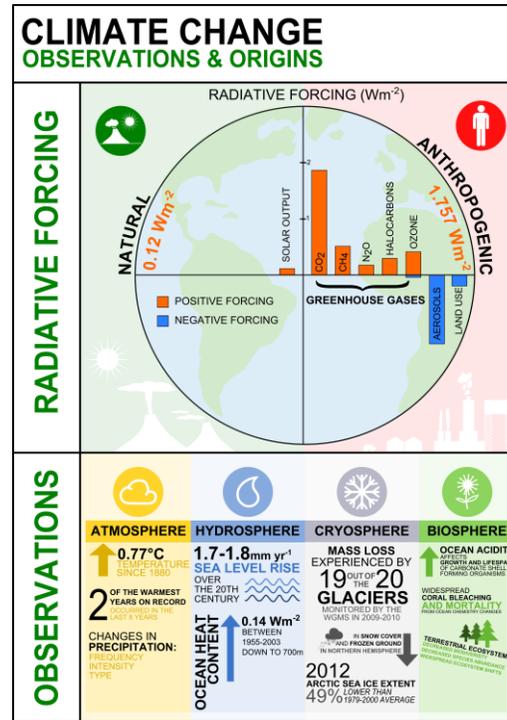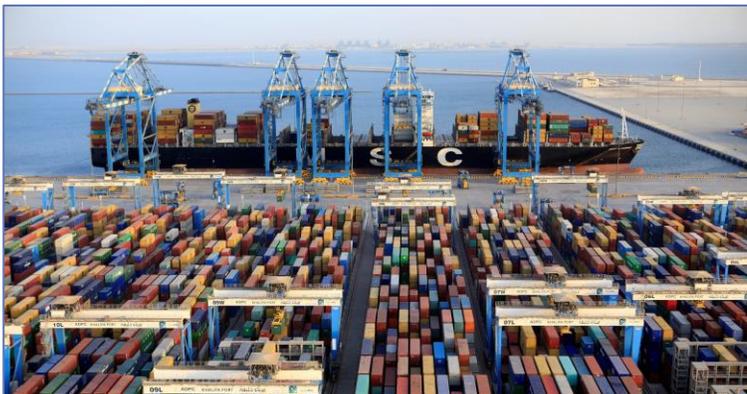(A)   ZOONOTIC PATHOGENS FROM WILDLIFE,
(B)   ZOONOTIC PATHOGENS FROM NON-WILDLIFE,
(C)   DRUG-RESISTANT PATHOGENS, AND
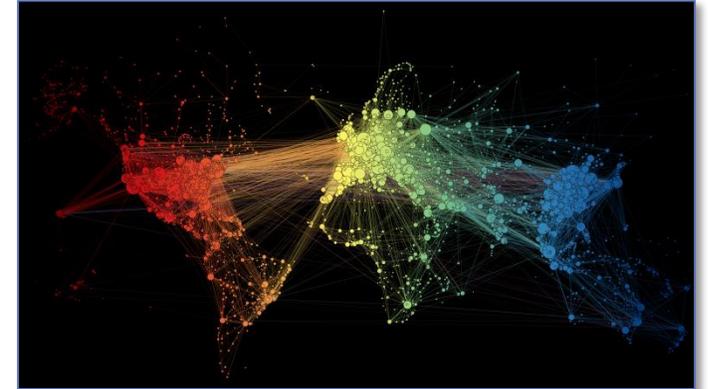**(D) VECTOR-BORNE PATHOGENS**

Drivers of global change
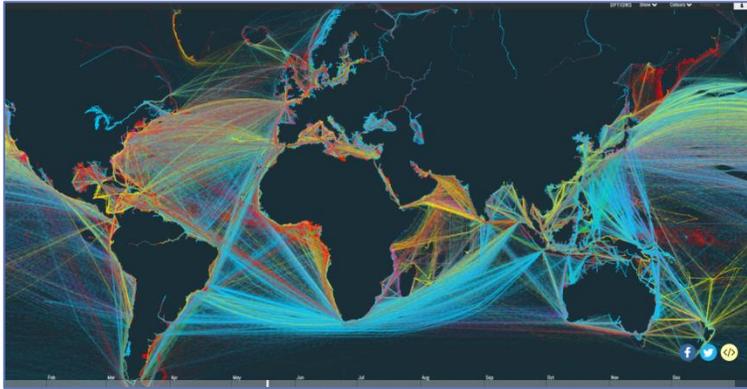
Pests are travelling the world in containers

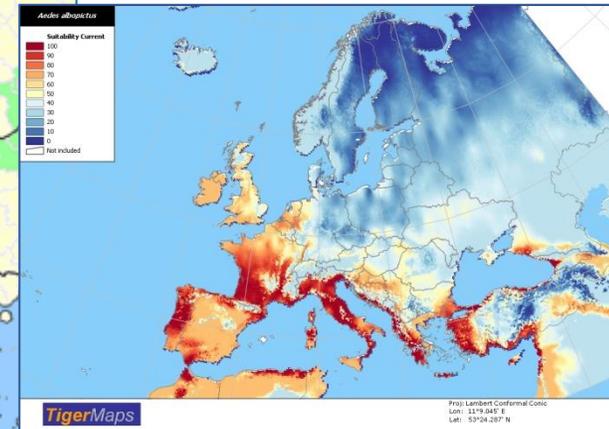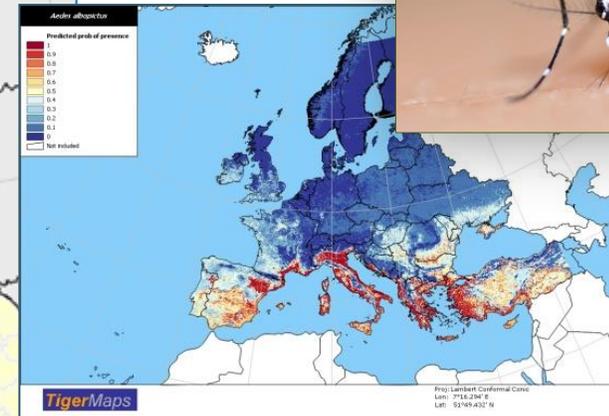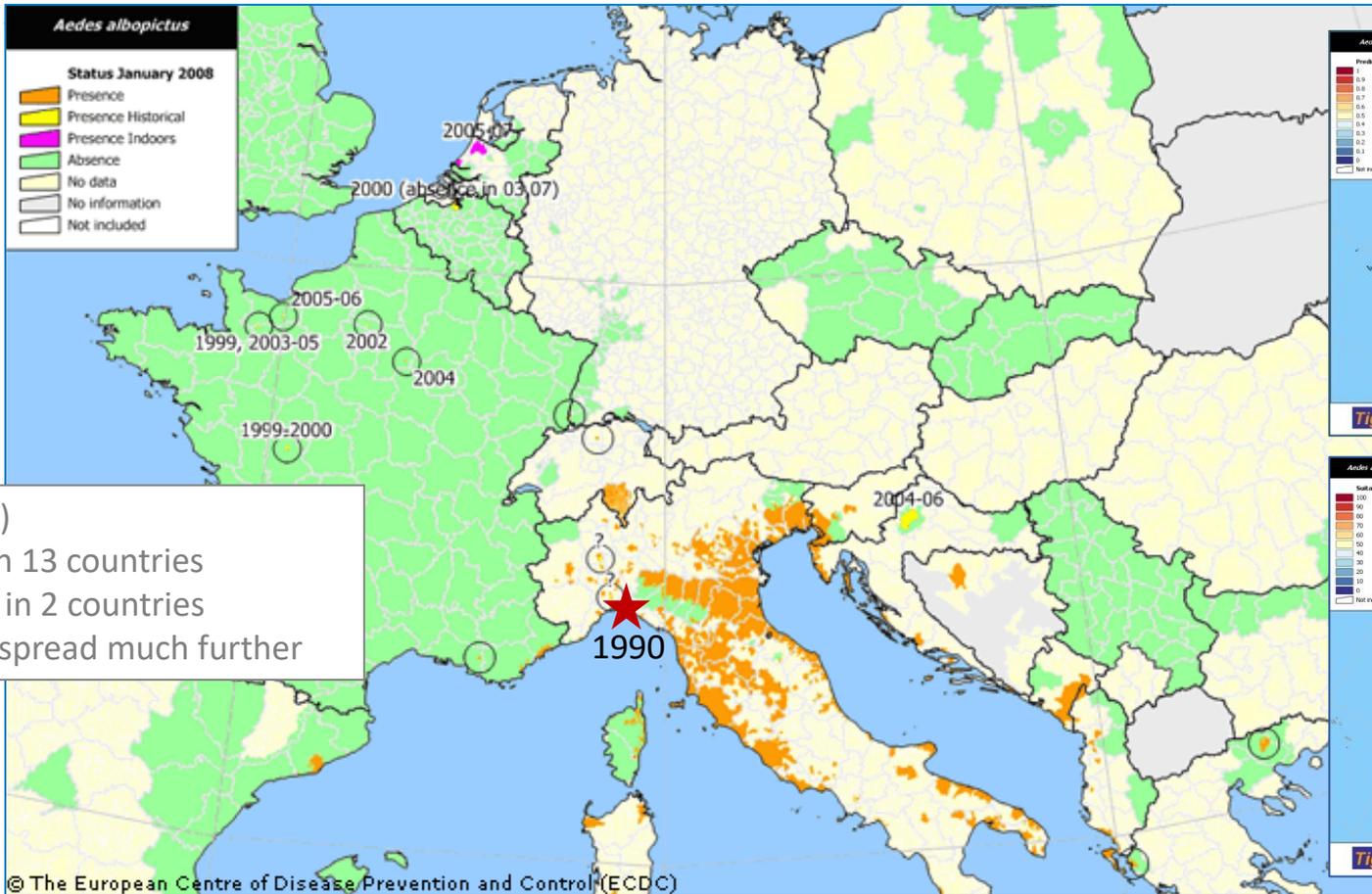Climate impacts on: distribution limits, survival, #generations, ...

Pathogens are travelling the world in hosts

The invasion of the Tiger
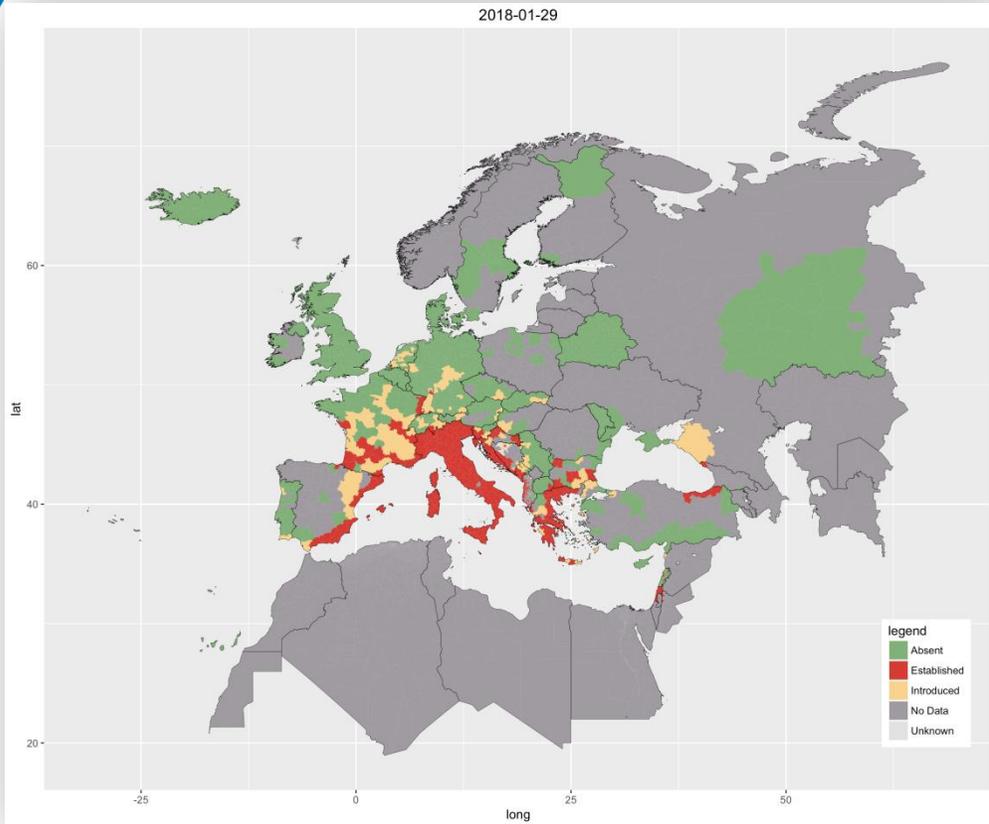
Invasion and predicted spread

2009 (TigerMaps)
- Established in 13 countries
- First sighting in 2 countries
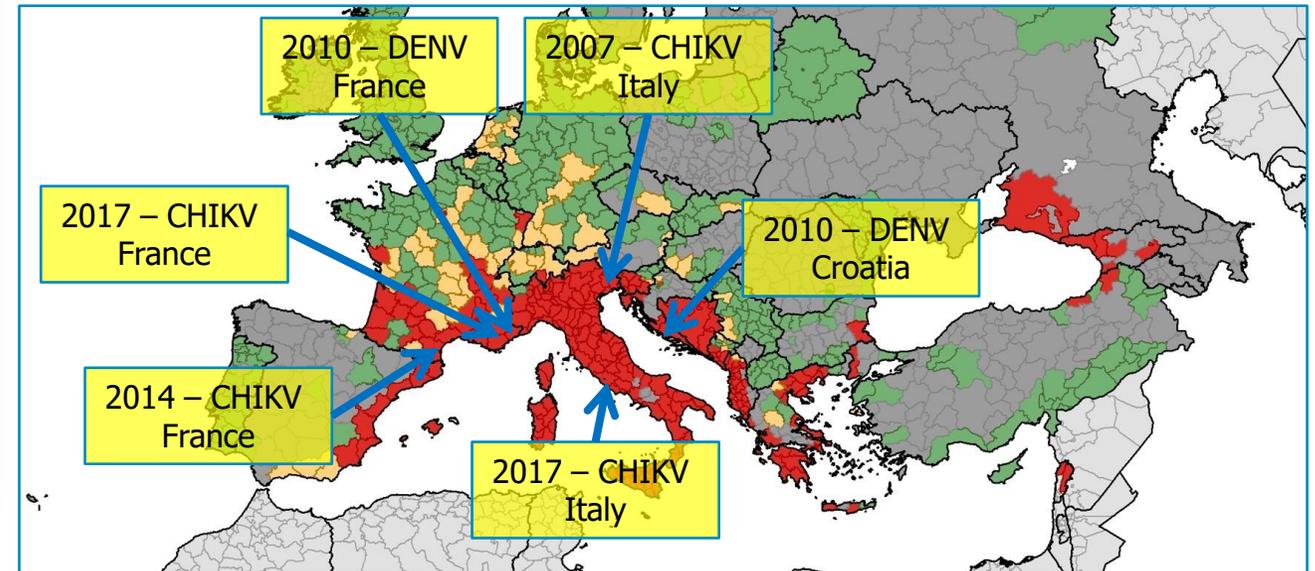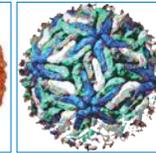- Predicted to spread much further

The invasion of the Tiger

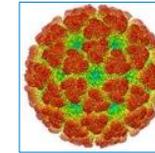## Disease outbreaks

2018-01-29

legend
- Absent
- Established
- Introduced
- No Data
- Unknown

Current disease outbreak situation

2010 – DENV France

2007 – CHIKV Italy

2017 – CHIKV France

2010 – DENV Croatia

2014 – CHIKV France

2017 – CHIKV Italy

How it all started

Emerging infectious diseases

[What are the needs?](#)

Software development

Defining the problem

There is a need for precise information on distribution, abundance and spread of disease vectors and the diseases they transmit

BUT: Field surveys are labour intensive and expensive

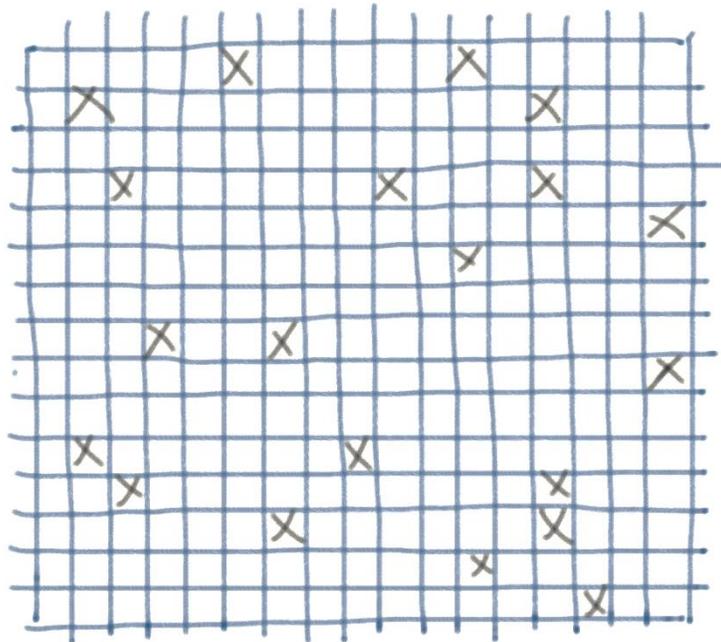The costs of field surveys can be reduced by combining strategic sampling and spatial models using remote sensing data

BUT: This requires expertise and access to state of the art tools and RS data
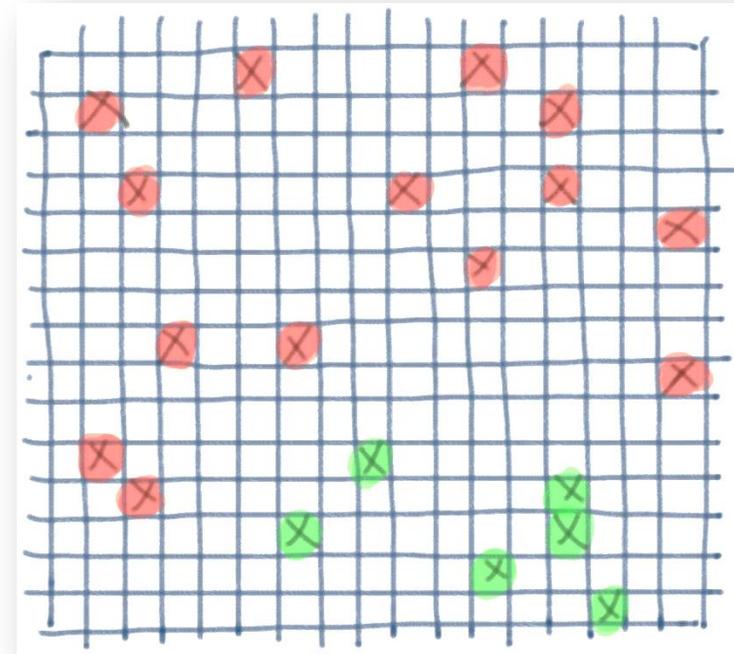
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What are the needs?

How can satellite imagery
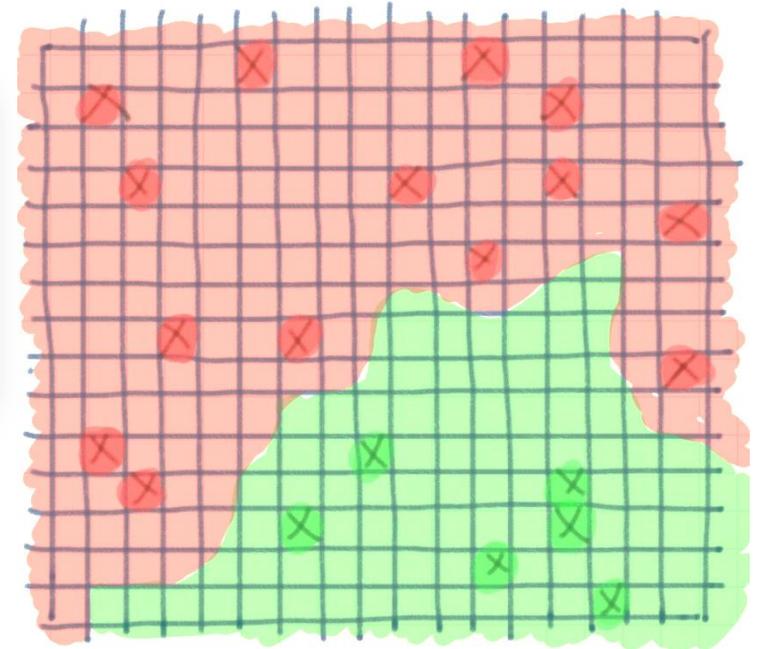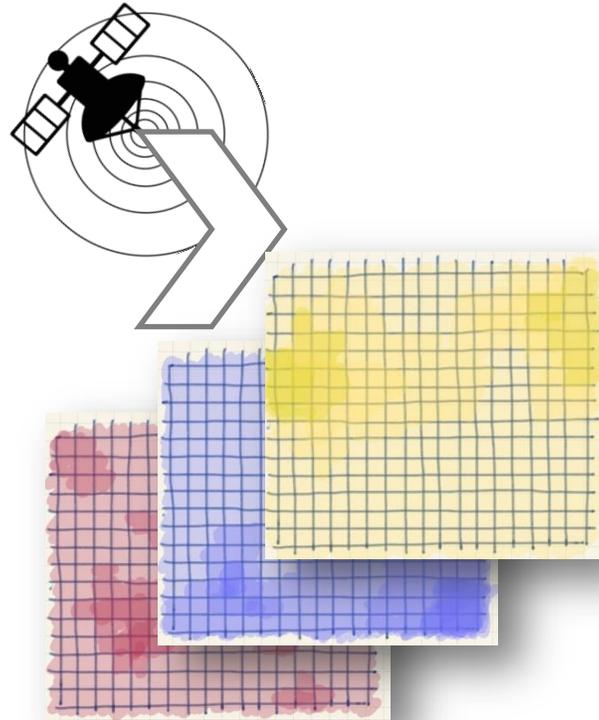## (and other environmental data sets) contribute?
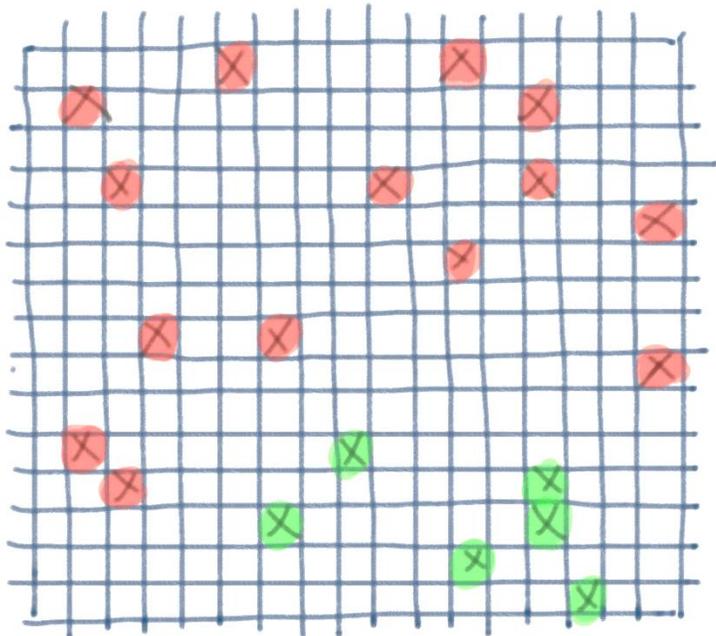

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How can satellite imagery
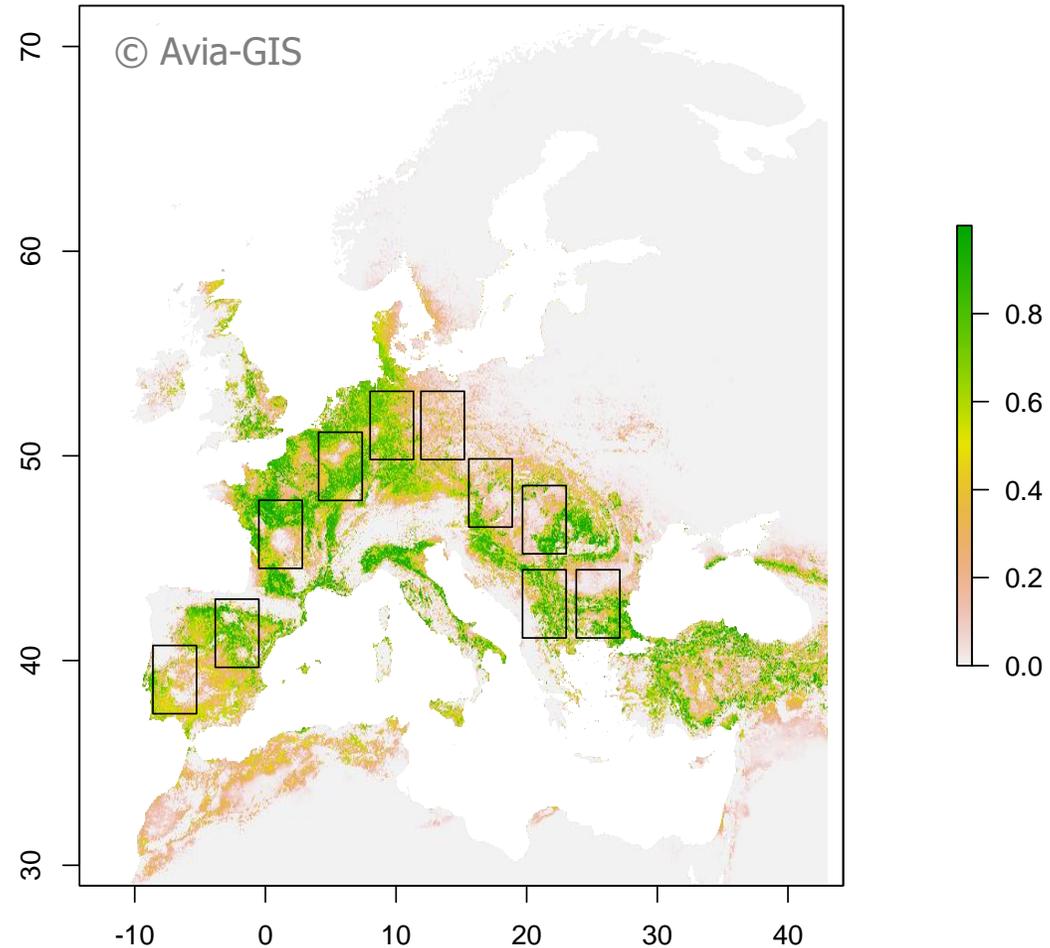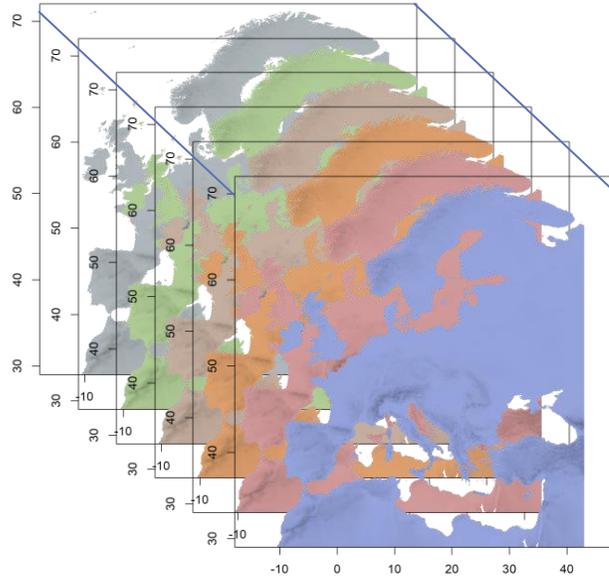## (and other environmental data sets) contribute?

© Avia-GIS

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon$$

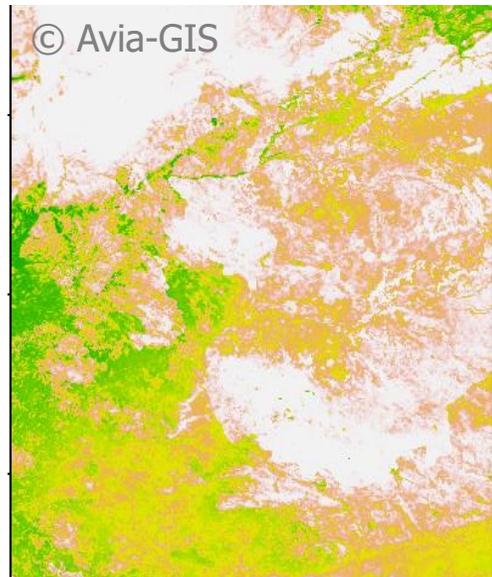# How can sample size be optimized?
The virtual vector

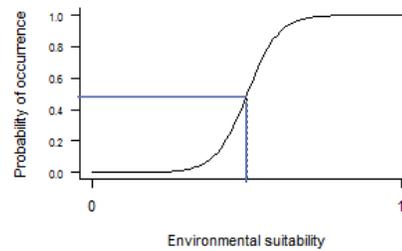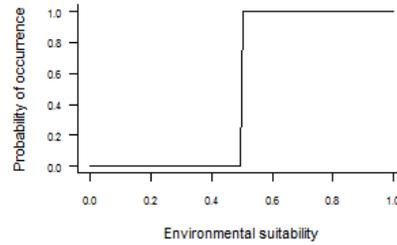Eco-climatic Predictor Variables
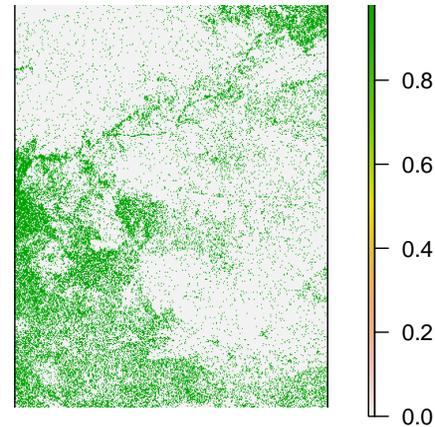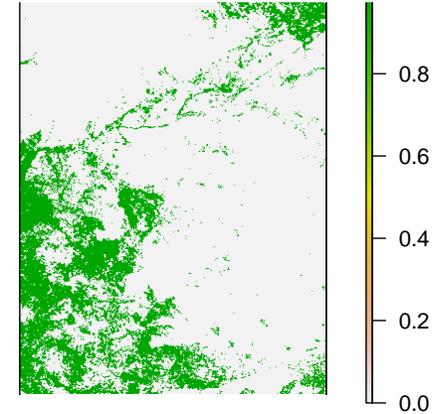1X1km

© Avia-GIS

10 test areas of 400X400km = 160.000 km² each

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The virtual vector
Methodology

Habitat suitability
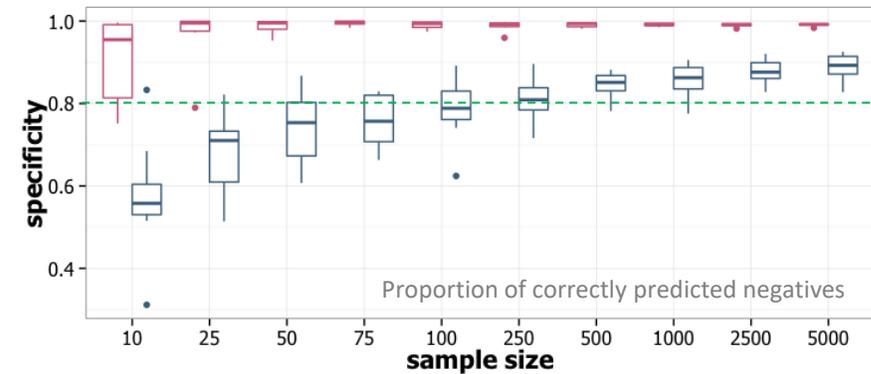
Response curve

PA map

Testing sample size

Random stratified sample, 50 replicates
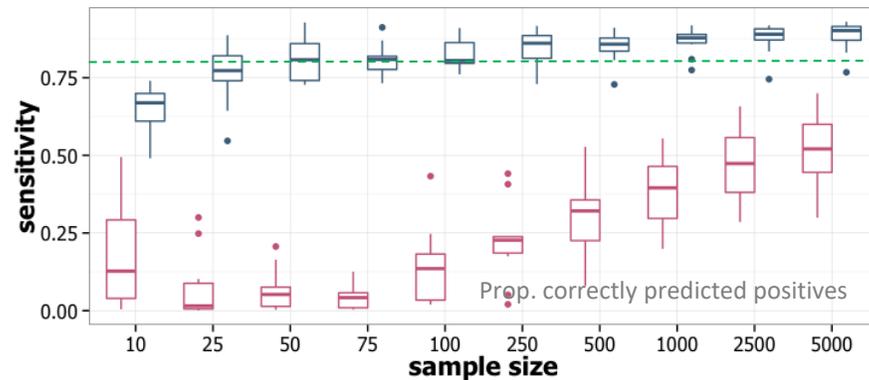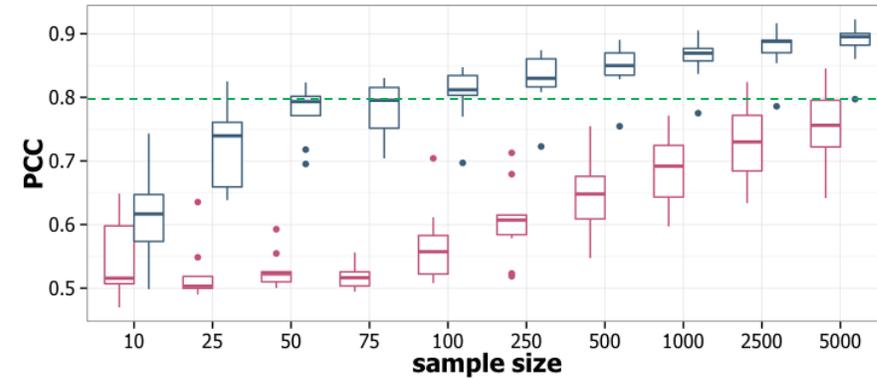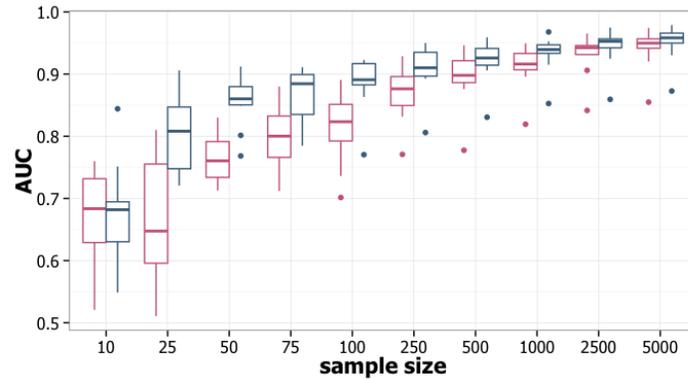
How it all started

Emerging infectious diseases

What are the needs?

Software development

Who are we today?

BE SME established in 2001
75% Europe – 25% Overseas
16 collaborators
International networks
Annual growth of 17%

Avia-GIS
Holding

Avia-GIS
RSA

Avia-GIS
Caribbean

...

Avia-GIS
HUB n

How do we differ from research groups?

R&D Program

Feasibility

Demonstration

Prepare for market

Products

Software development

Commercial deployment

Real world

- TRL 9
- TRL 8
- TRL 7

Simulated world

- TRL 6
- TRL 5
- TRL 4

Research lab

- TRL 3
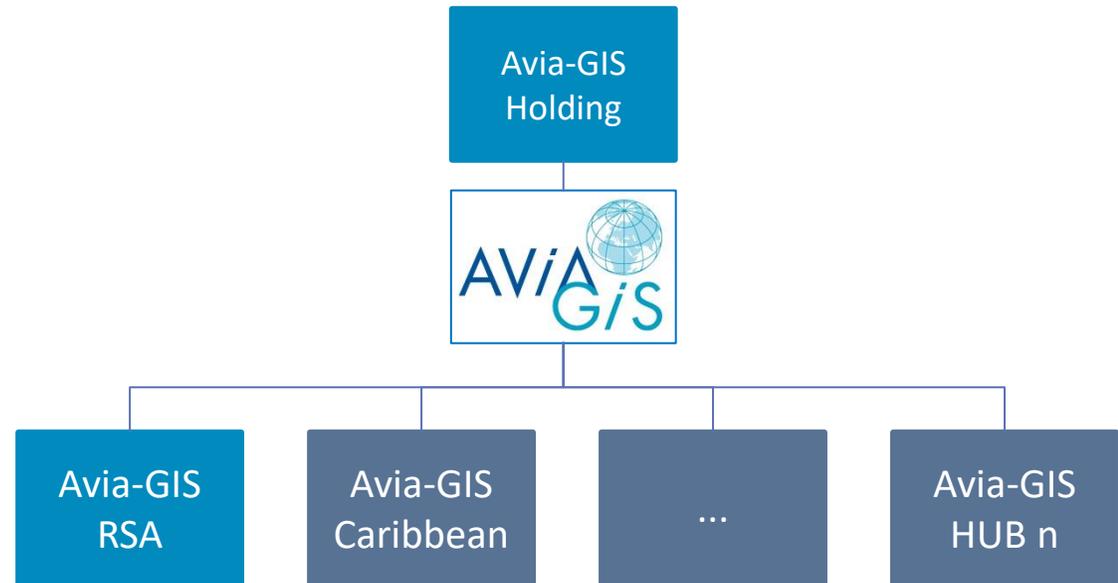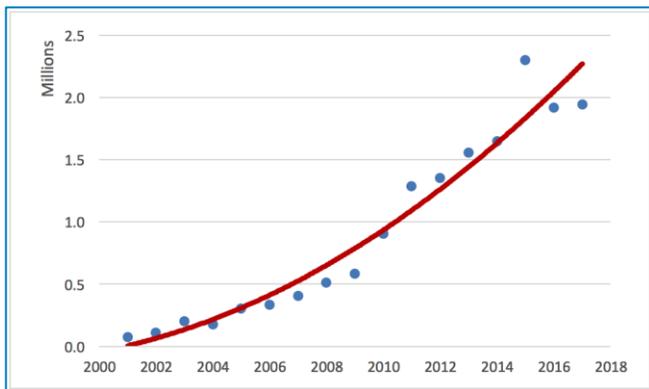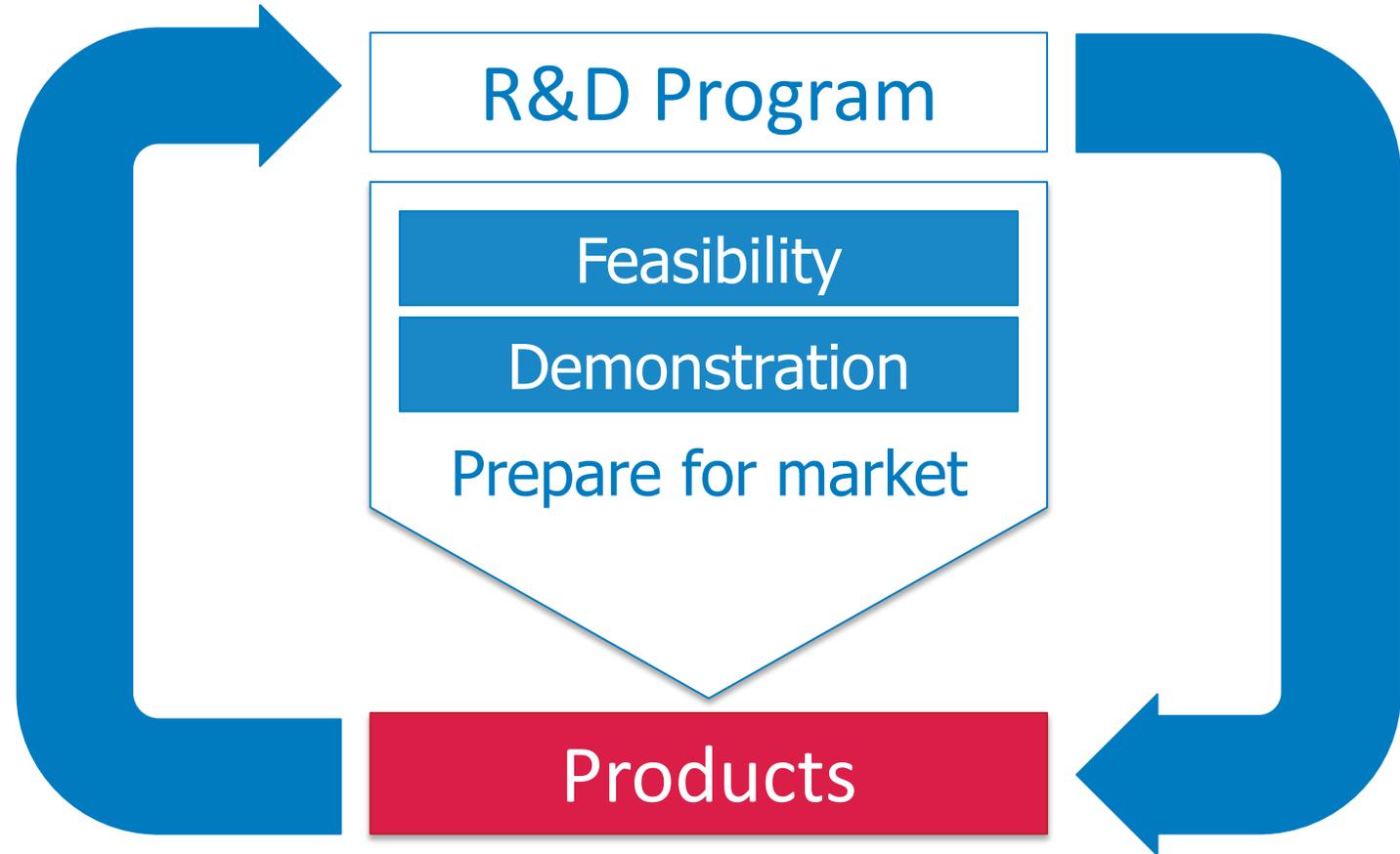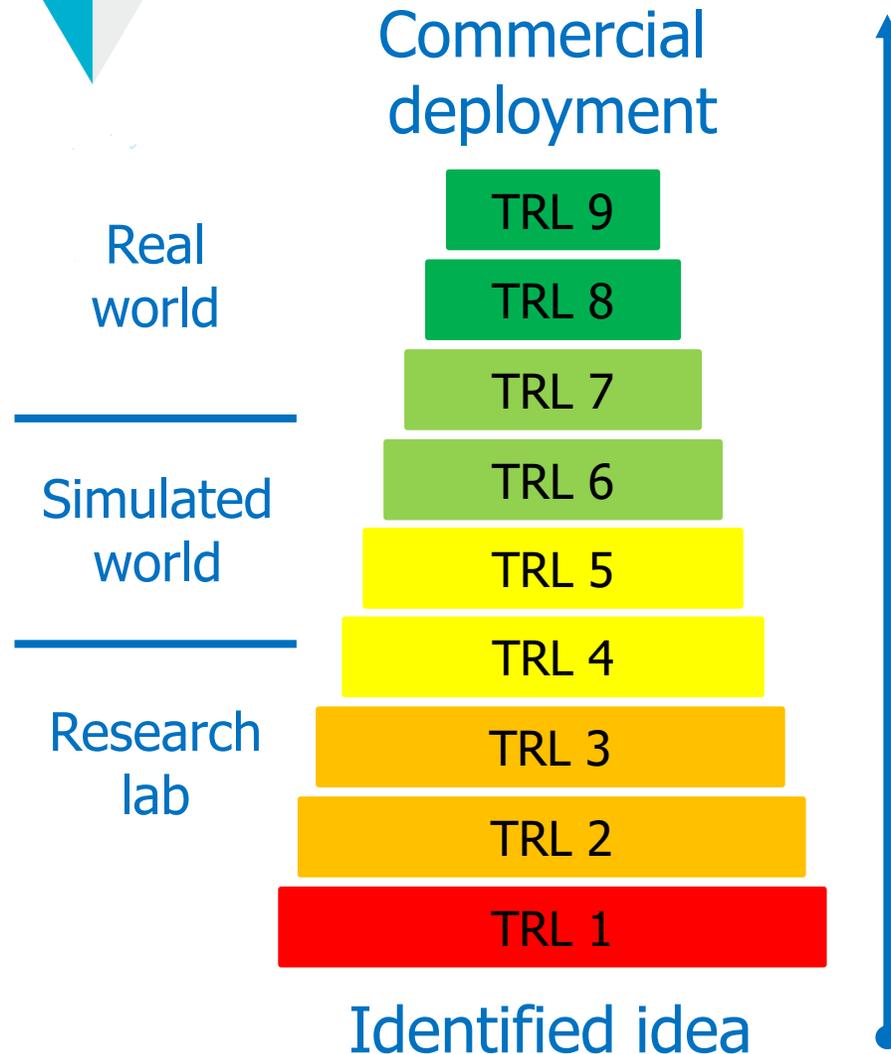- TRL 2
- TRL 1

Identified idea

2018: VECMAP commercial deployment

2017: VECMAP market entry sales in Research and Decision Making segments

2013-16: VECMAP used as a capacity building tool by Avia-GIS in research projects and networks in EU and Africa

2011-13: VECMAP software development and field demonstrations with 12 users in 10 countries in Europe

2009-11: VECMAP feasibility investigated with 7 users in 5 countries

2007-10: MODIRISK research project to map mosquitoes in Belgium = development of VECMAP precursor

1999: PhD on the use of satellite imagery to model the distribution of tsetse and trypanosomiasis in West Africa
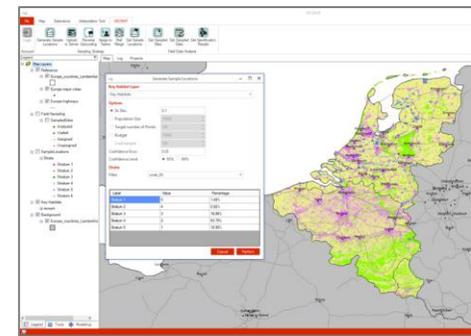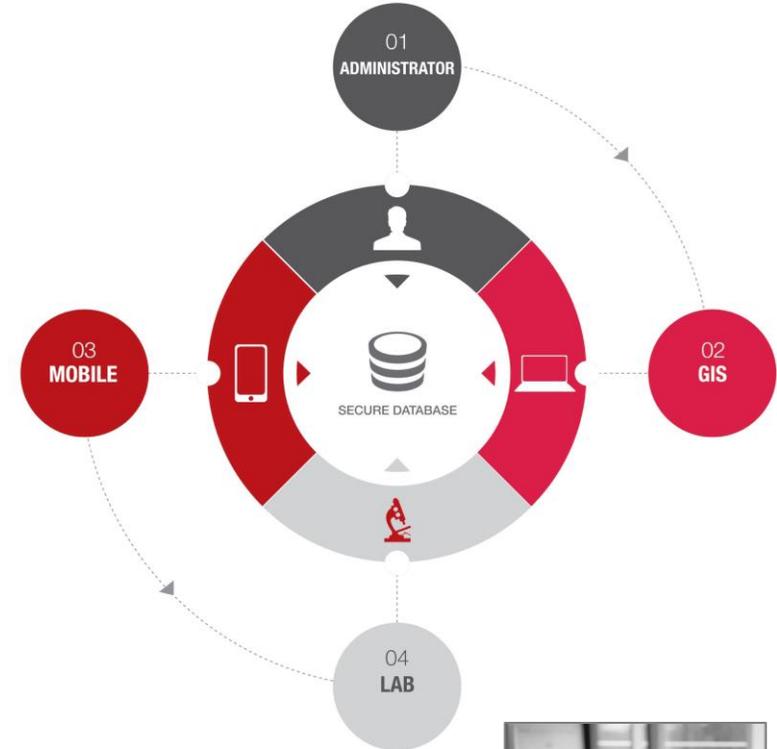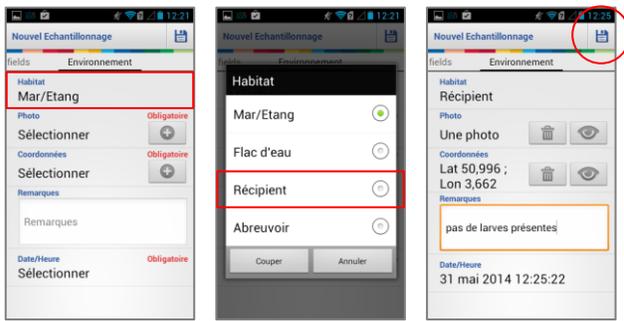
1997: Laureaat Academie voor Overzeese Wetenschappen

25
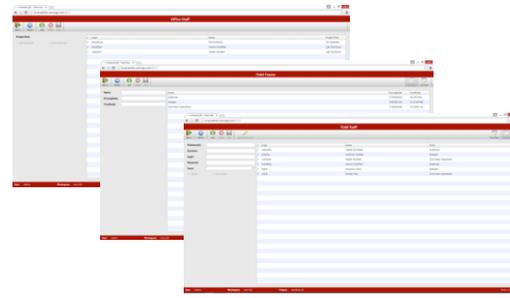
System set-up
Mobile app configuration
Project management
Team management
Staff management

VECMAP®

Task assignment
Router
Offline data storage
Data synchronisation

01
ADMINISTRATOR

03
MOBILE

SECURE DATABASE

02
GIS

04
LAB

Sampling strategy
Follow-up
Spatial analysis
Spatial modelling

KIR Janssen innovation prize

Innovatieprijzen voor drie Kempense bedrijven
Door Marc Balduyck op 11 november 2012

45 people like this.

De Kempense Innovatieraad (KIR) heeft tijdens het Festival van de Creativiteit in Turnhout drie Kempense bedrijven een Innovatie Award toegekend. De prijzen gingen naar Avia-Gis uit Zoersel Galaxy Studios uit Mol en het Resource Lab uit Turnhout.

Het Festival van de Creativiteit was een enorm succes.

Lab forms
Species identification
Data upload

MEDES · ERGO · Environmental Research Group Oxford · AViA GiS

What direct value do we offer?

Research Institutes
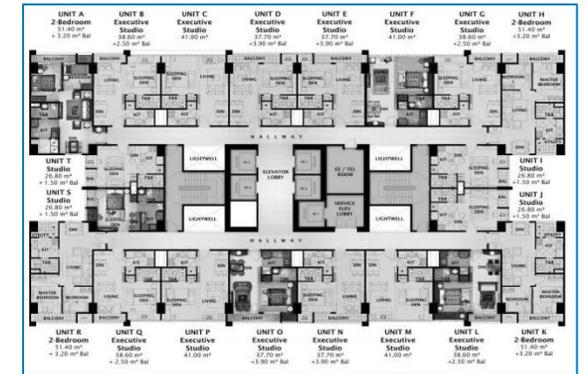
Public Health Decision Makers
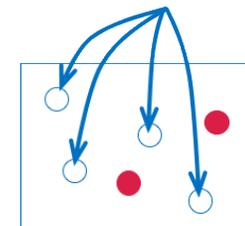
Pest Control

Urban

Private

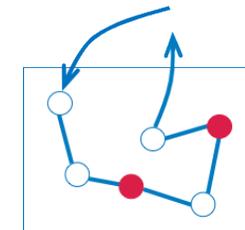Survey costs reduced by at least 60% AND significantly increase data quality

Focus on research instead of technology development

Improved decision making with smaller teams

Efficiency X2
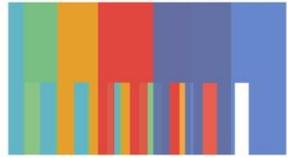
Revenue X2 & Increased market share

Our investment strategy
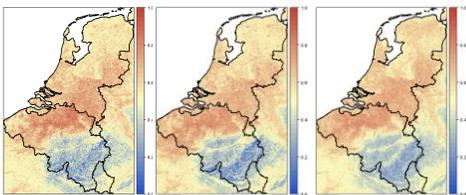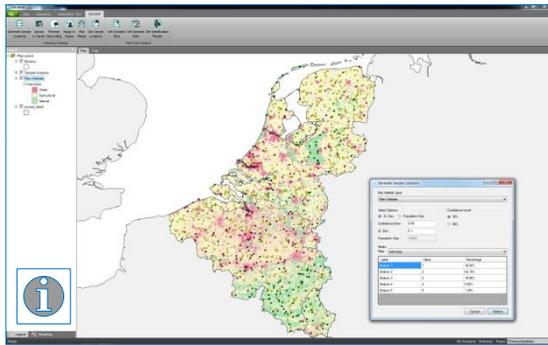
Product development

Investment Round 1

Investment Round 2

Next step: from risk mapping to IPM

VECMAP®

Risk Mapping Expertise

SEAL OF EXCELLENCE
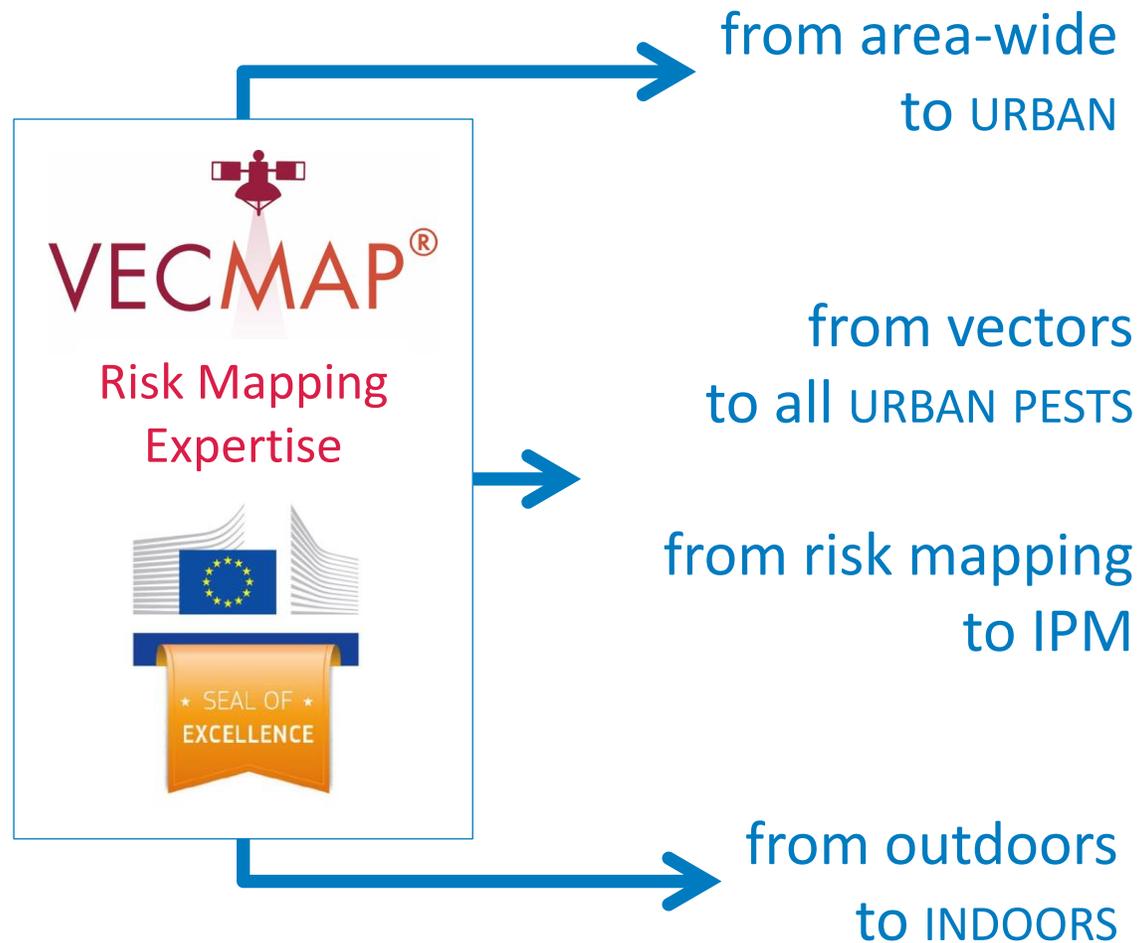
from area-wide
to URBAN

from vectors
to all URBAN PESTS

from risk mapping
to IPM

from outdoors
to INDOORS

900   600   300

AViA GiS

Acknowledgments

Avia-GIS VECMAP development team

Thank you for your questions

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www.avia-gis.com