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
Mapping vectors, pathogens and hosts
Tsetse transmitted trypanosomiasis in Togo
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

Ducheyne et al 2007

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

Pathogens are travelling the world in hosts

Climate impacts on: distribution limits, survival, #generations, ...
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 European Centre of Disease Prevention and Control (ECDC)
The invasion of the Tiger

Disease outbreaks

Current disease outbreak situation

- 2007 – CHIKV Italy
- 2010 – DENV Croatia
- 2014 – CHIKV France
- 2017 – CHIKV Italy
- 2010 – DENV France

- Croatia
- Italy
- France
- 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
What are the needs?
How can satellite imagery (and other environmental data sets) contribute?
How can satellite imagery (and other environmental data sets) contribute?

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon \]
How can sample size be optimized?

The virtual vector

10 test areas of 400X400km = 160,000 km² each
The virtual vector
Methodology

Habitat suitability
Response curve
PA map

© Avia-GIS
Testing sample size

Random stratified sample, 50 replicates

Blue – Balanced sample: 50% presence / 50% absence
Red – Unbalanced sample: 10% presence / 90% absence
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
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
System set-up
Mobile app configuration
Project management
Team management
Staff management

Sampling strategy
Follow-up
Spatial analysis
Spatial modelling

Lab forms
Species identification
Data upload

Task assignment
Router
Offline data storage
Data synchronisation

KIR Janssen innovation prize
What direct value do we offer?

**Research Institutes**
- Focus on research instead of technology development

**Public Health Decision Makers**
- Improved decision making with smaller teams

**Pest Control**
- Efficiency X2
- Survey costs reduced by at least 60% AND significantly increase data quality

**Urban**
- Revenue X2 & Increased market share

**Private**
Our investment strategy

Product development

Investment Round 1

Investment Round 2
Next step: from risk mapping to IPM

- from area-wide to URBAN
- from vectors to all URBAN PESTS
- from risk mapping to IPM
- from outdoors to INDOORS
Acknowledgments

Avia-GIS VECMAP development team
Thank you for your questions

educheyne@avia-gis.com
www.avia-gis.com