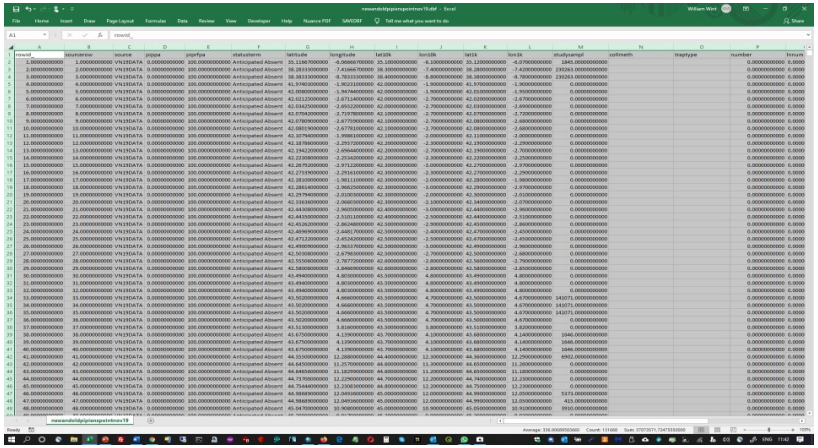
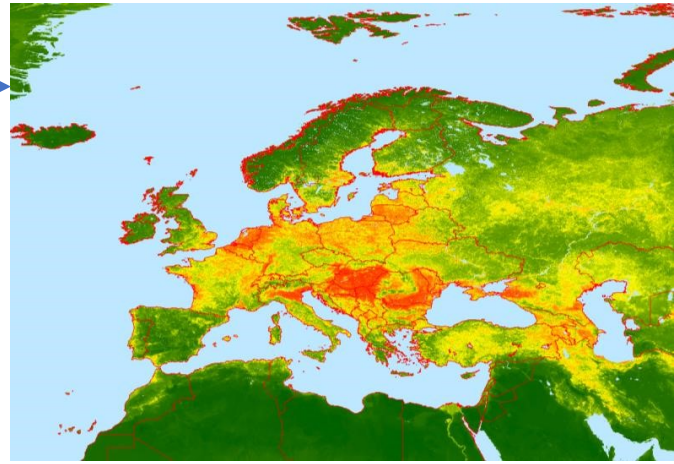
AIMCOST TRAINING SCHOOL
AKROTIRI, CYPRUS
January 2020

FROM VECTOR SAMPLE DATA TO DISTRIBUTION MODELS AND PUBLIC INFORMATION: SOME PRACTICALITIES FROM THE REAL WORLD





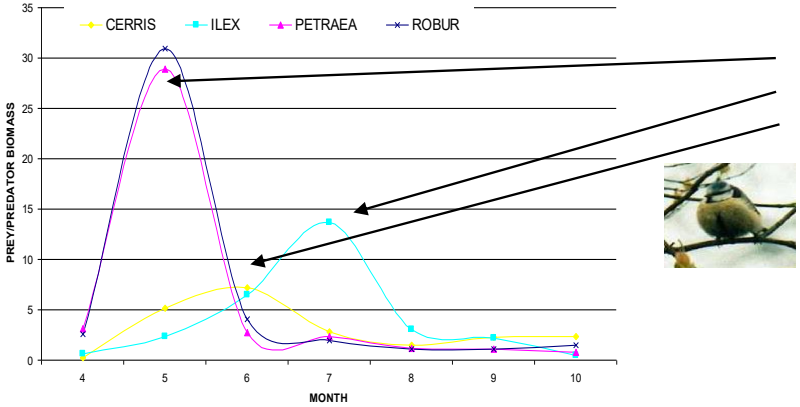
35 YEARS AGO

ULV Pyrethroid mister

Max height of spray 20 ft

Leaf collection
Volume measure
Leaf counts

1 sq metre collecting trays,
Till no more insects fell



Prey Ratios
Spare nosh for non arthropod insectivore

All phytophages assigned **oak specificity**

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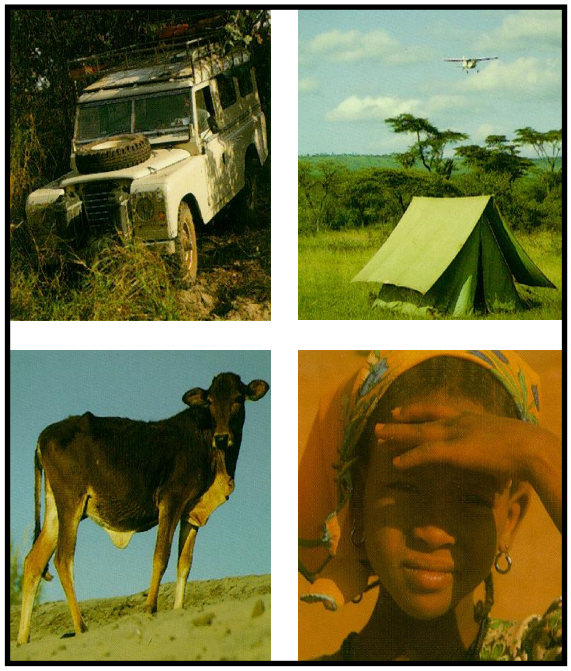
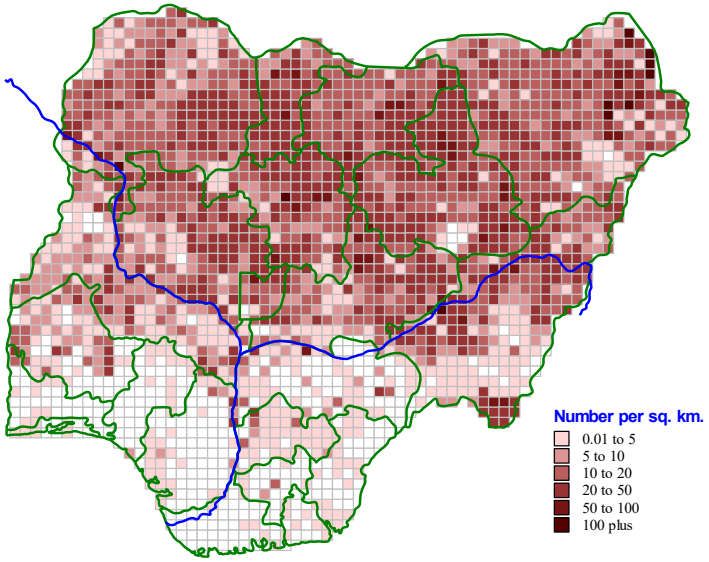
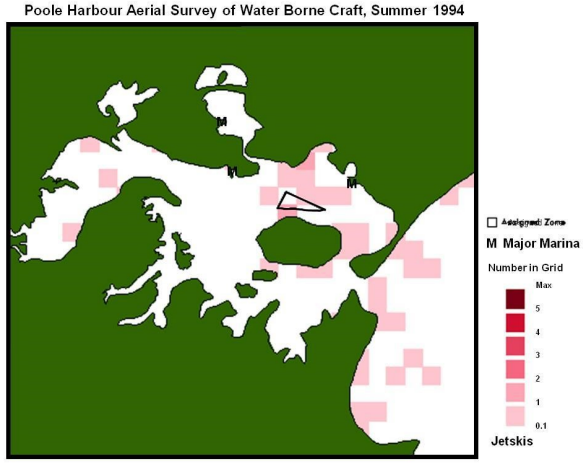
25 YEARS AGO





2m sq km in the rough bits of Africa – much of several times

Mapping everything, even jetskis in Poole Harbour



Colour Map 6: Number of Jetskis, Mean All Surveys

Our maps tend to be first disputed then confirmed, and used to target later activities

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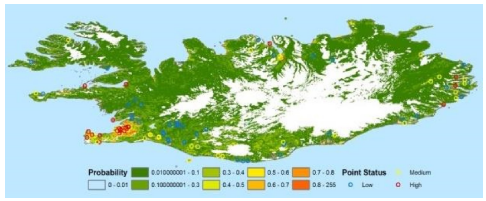
MORE RECENTLY

Environmental Research Group Oxford, (ERGO)

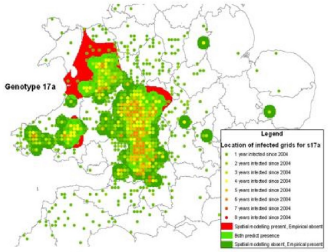
SME Consultancy started in 1984
Based at the (currently homeless) Zoology Department, Oxford

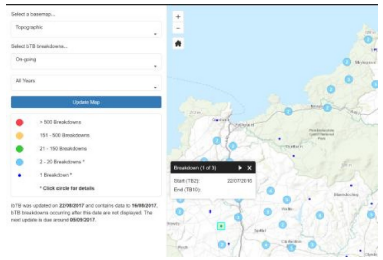
15 years surveying agriculture in Africa ☺
used Africa data to start global spatial modelling of livestock
with TALA Research Group, Oxford == MODIS imagery.
Turned into FAO GLW



Vector, Host and Disease spatial modelling

Tsetse, Midges, Ticks, Rodents,
Mosquitos, Sand flies
Deer, Livestock, Rodents, Birds
bTB, Dengue, Yellow Fever, CCHF





Software

PAATIS, BASIS,
VECMAP, LYMEAPP

Web services, Spatial Databases and web based Archives

IGADweb, iBTB, VECTORNET
EDENDatasite, EDENextData, VMERGEdata
PALEBlu Data, Spatialdatasite, MOOD

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INTRODUCTION TO THIS AFTERNOON

What I hope you leave with is some context and some detail. There is a technical AIMCOST TS on this subject planned for 2022. Have assumed little exposure to subject.

Topic 1: Preparing Data for Mapping and Modelling

- **Sampling strategy depends on how the data will be used**
- **What vector data is needed**
- **Basics of turning data into maps**
- **Worked examples**

Topic 2: What is needed to Model Vectors once you have the vector data

- **Intro to spatial models**
- **What else is needed to produce models**
- **Doing the modelling**
- **How (not) to make maps useful**

TOPIC 1: PREPARING THE VECTOR DATA

Preparations depends on how the data will be used – e.g.

EWS and vector spread

monitoring control

disease risk, nuisance

transmission models

statistical models

campaigns

Also depends on what scale the data are applied and who the final outputs are for - Topic 2

Bias this afternoon will be on data to produce maps or to feed spatial models

We will also cover a few things to be wary of in context of vector mapping

VECTOR DATA FOR MODELLING
SOME CONTEXT

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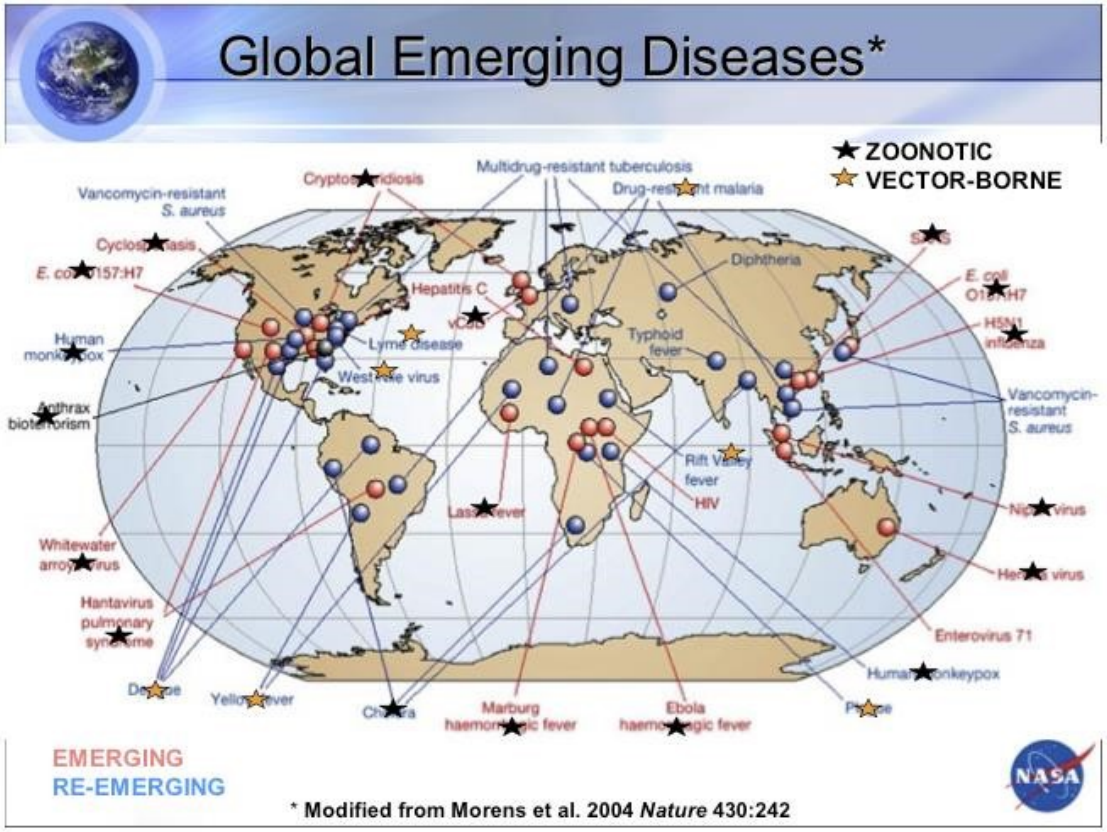
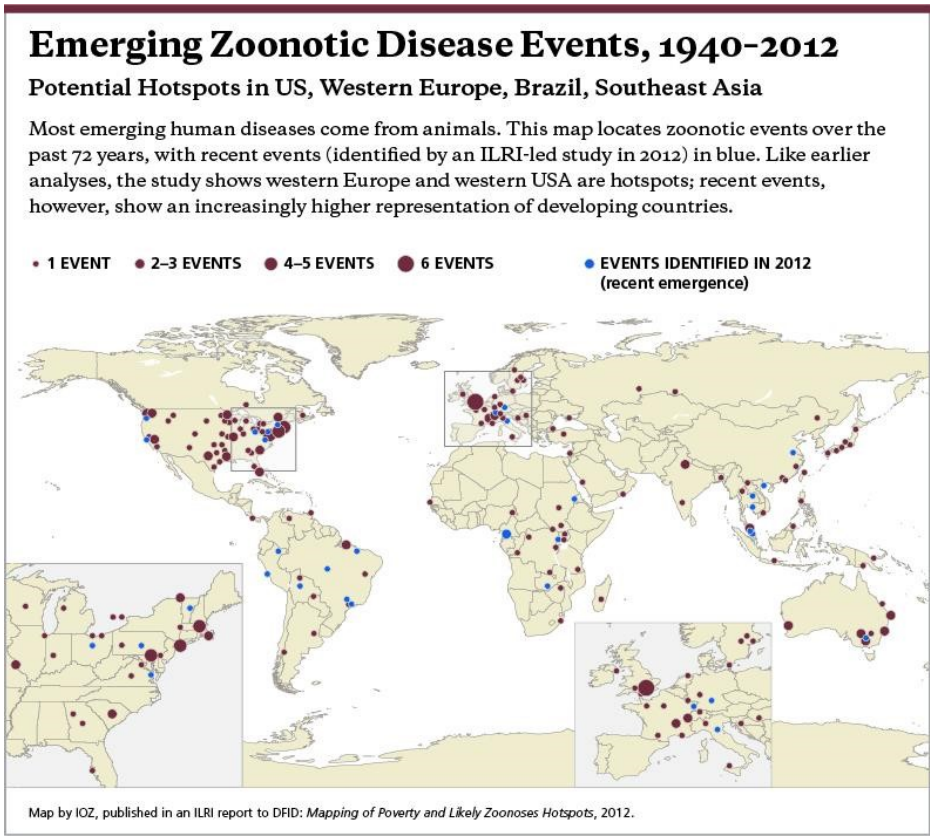
CONTEXT: EMERGING DISEASES





NB proliferation may be because we are better at looking

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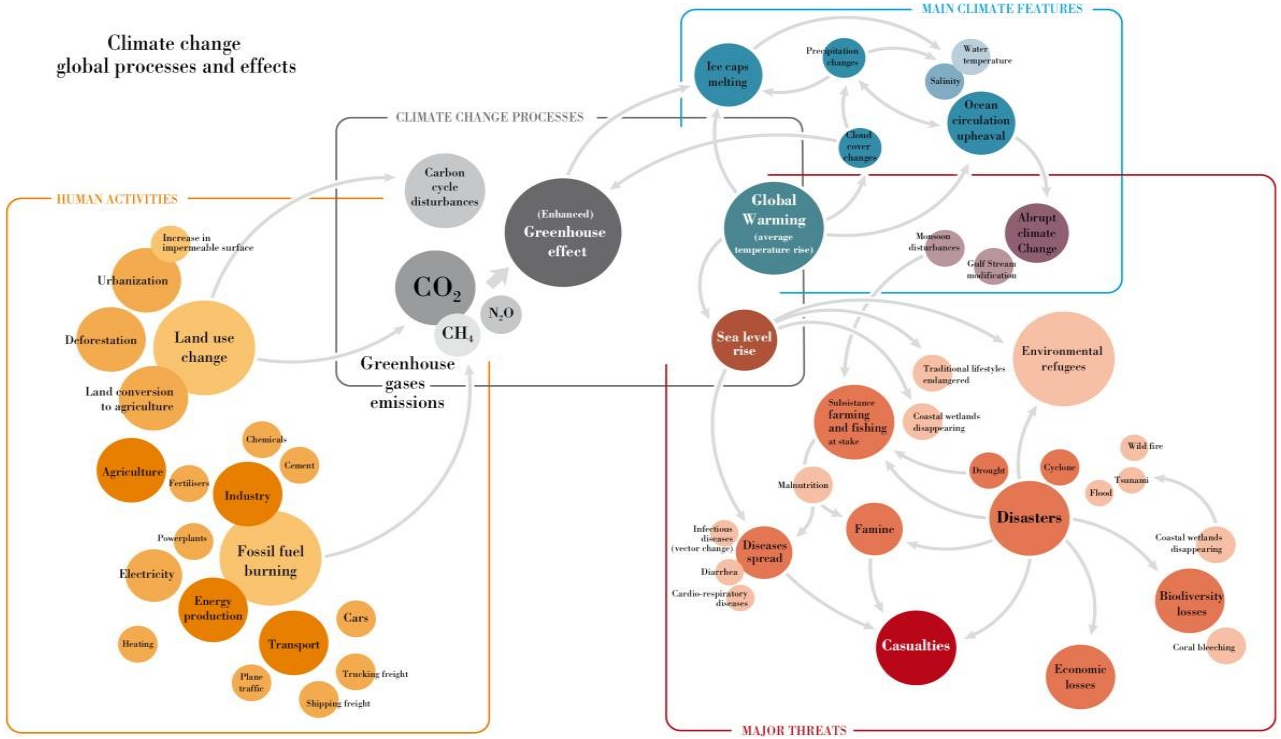
CONTEXT: ENVIROMENTAL CHANGE

Whatever else It's complicated

"Global **change** includes a **suite of** …….. factors that intensify with population growth and are changing in concert, including **climate, land use, urbanization, social and political policies ….**. These factors **interact.**

Not to mention….

Ali S, et al. (2017) PLoS Negl Trop Dis 11(2): e0005135. https://doi.org/10.1371/journal.pntd.0005135



Horrendogram form UNEP/GRID

Evolution and system biology, our capabilities

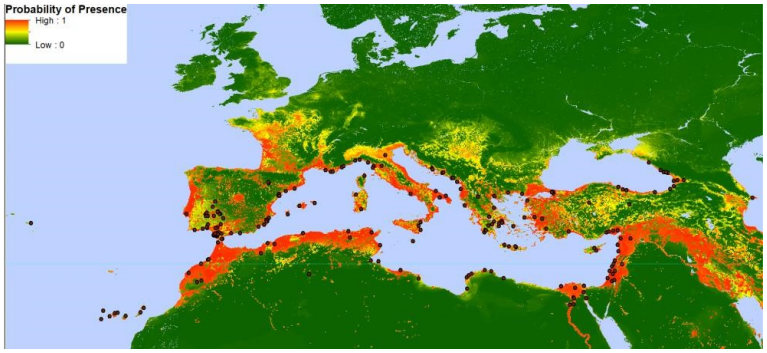
CONTEXT: PAST PRESENT FUTURE

Model **with population** in Covariate dataset

aedeshistuns750databrt_Prob.tif

1910 climate

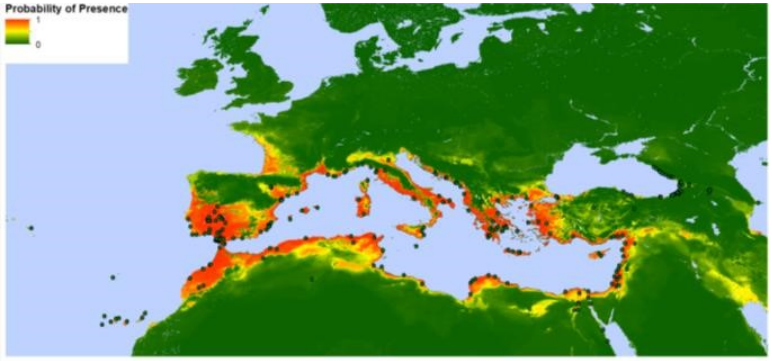
aedeshistdatauns750datawith2050global_Prob.tif



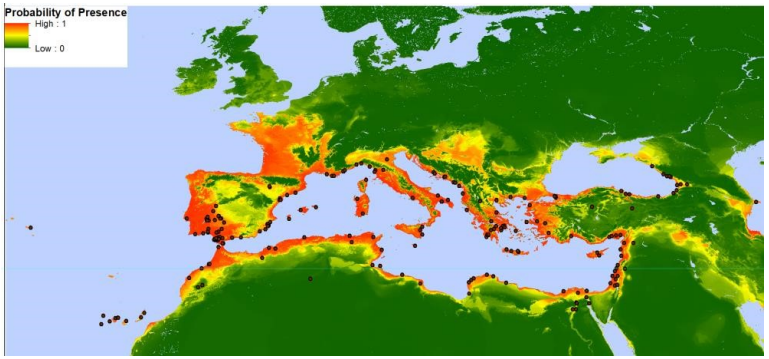
2015 2050

Suitability for aegypti in 1910 expands to 2050 (via 2015)

aedeshistdatauns750databrtnopop_Prob.tif



aedeshist1910unsdatawith2050nopopglobal_Prob.tif



(but vector not returned)

Model **without population** in Covariate dataset

"1910" Models extended suitability

CONTEXT: INSTITUTIONAL DEMAND

Can you make a map for Europe from this?

We are paying you

We cannot admit to our funders that what they ask is impossible

So do whatever you can

Something… anything

By tomorrow

Or else ……

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HYPERBOLE

The research community isn’t beyond bigging up threats

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CONTEXT: THE MEDIA

DAILY STAR

BUZZING BEASTS: Mosquitoes are set to bring terror to the UK [PH]

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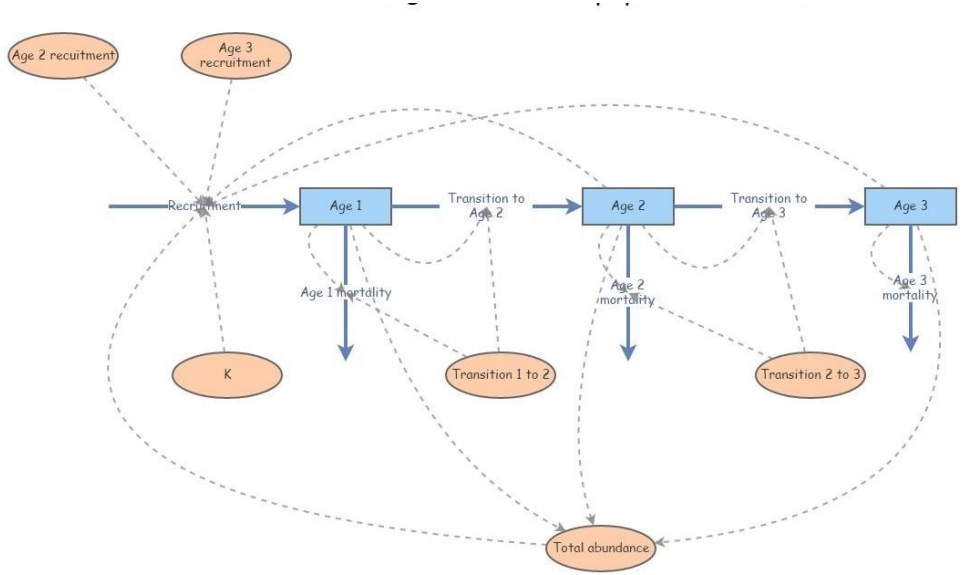
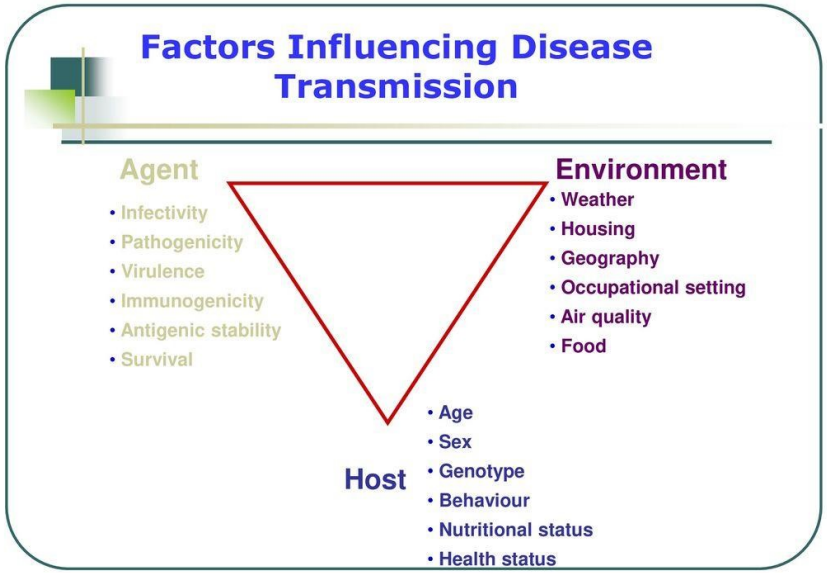
WHY SURVEY VECTORS ?

WHY SURVEY VECTORS: TRANSMISSION/POPULATION MODELS

To parameterise mechanistic and other models





To predict vector population changes, and risk of disease

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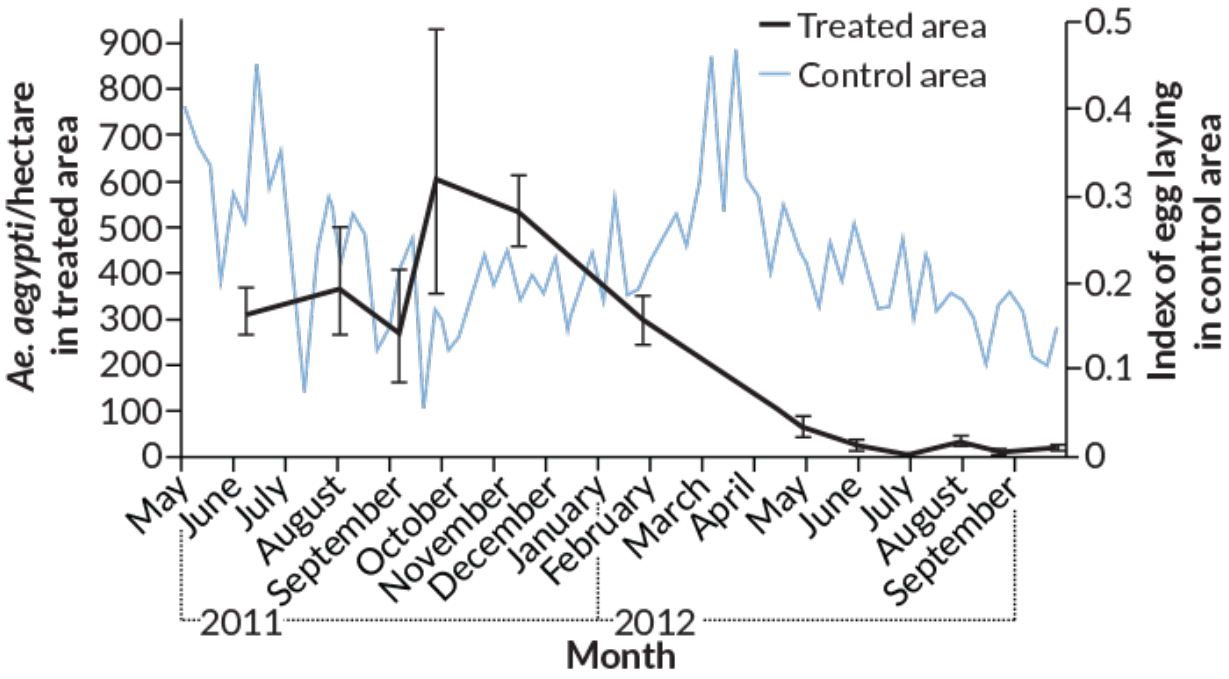
WHY SURVEY VECTORS:
MONITORING & TARGETTNG CONTROL

To target control, monitor population levels (risk)



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WHY SURVEY VECTORS:
AS INDICATORS OF DISEASE

Efficient: One vector => several diseases = *Ae. aegypti* => Dengue, Zika, Chik, YFV, etc

Vector sampling often easier than disease sampling.

Assess potential for spread into uninfected populations = *Ae. albopictus* in EU but not dengue

Assess potential for spread (and retraction) caused by environmental change (*aegypti*)

To populate maps for modellers and PH campaigns

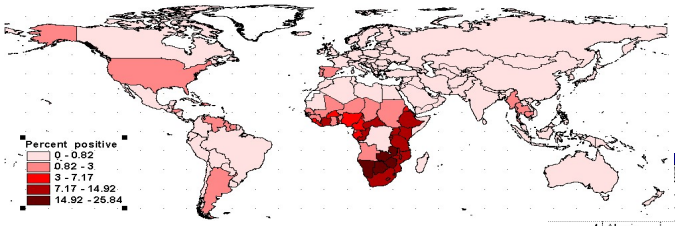
WHY MAPS

WHY MAPS

Maps are pictures

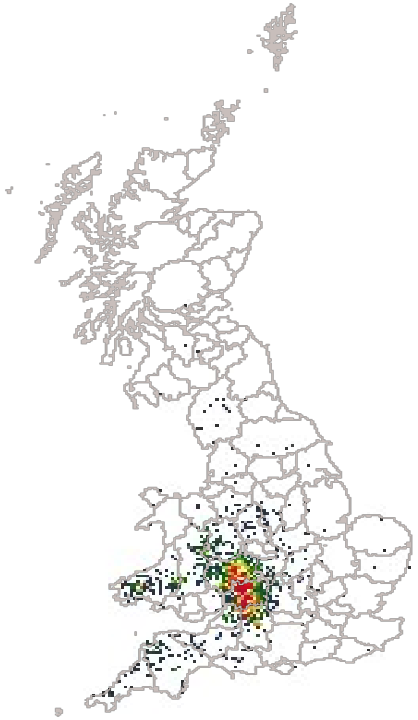
worth a thousand words (or tables)

attract attention = funding, prevention



4	Algeria	0.070
5	Azerbaija	0.000
6	Albania	0.010
7	Armenia	0.010
8	Andorra	0.000
9	Angola	2.120
10	American	-99.000
11	Argentina	1.000
12	Australia	0.000
13	Austria	0.000
14	Anguilla	-99.000
15		0.000
16	Bahrain	0.150
17	Barbados	3.000
18	Botswana	25.100
19	Bermuda	-99.000
20	Belgium	0.000
21	Bahamas	4.000
22	Banglades	0.030
23	Belize	1.890
24	Bosnia-He	0.040
25	Bolivia	0.070
26	Myanmar	1.790
27	Benin	2.060
28	Belarus	0.170
29	Solomon I	0.000
30	Brazil	0.630
31	Bhutan	0.000
32	Bulgaria	0.000
33		0.000
34	Brunei	0.200
35	Burundi	8.300
36	Canada	0.000
37	Cambodia	2.400
38	Chad	2.720

SP17



Maps show several types of information

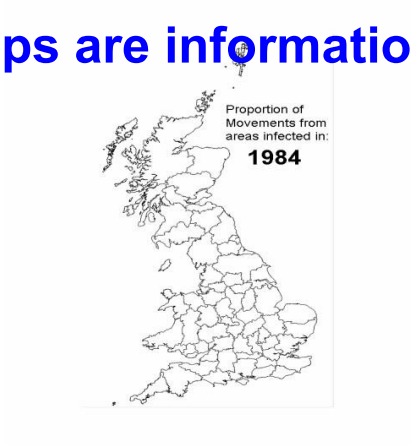
numbers

spatial relationships

distributions

spread

Maps are information rich



concise and efficient

generate hypothesis

target resources

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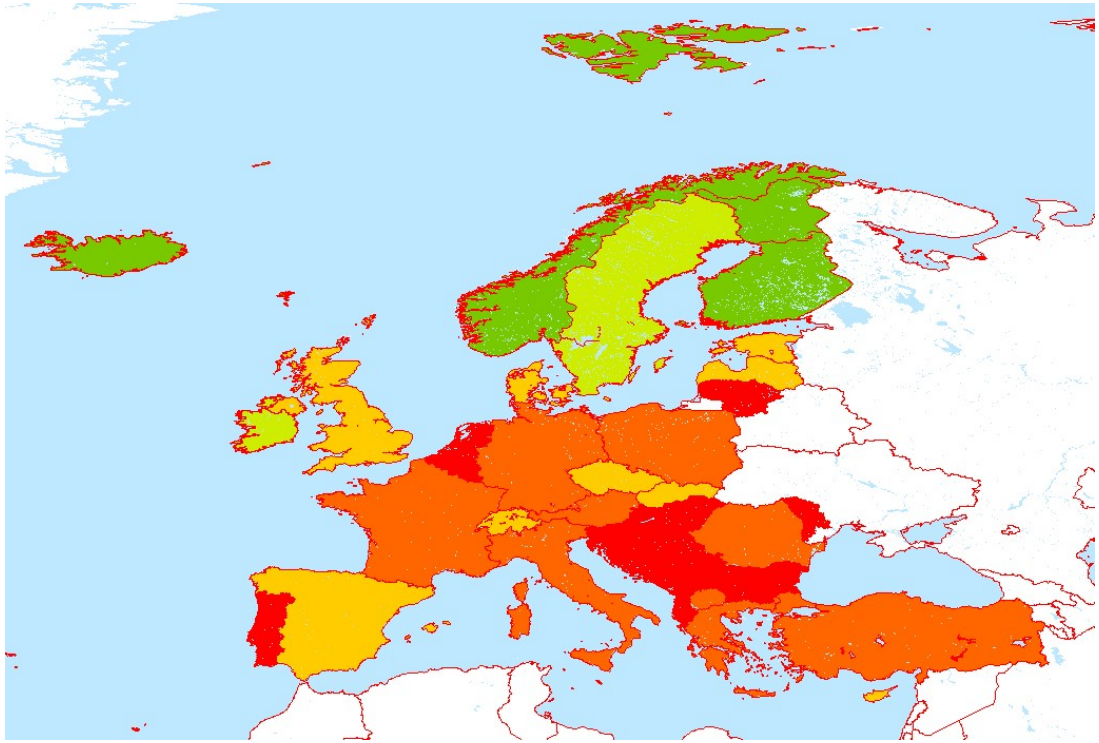
WHY VECTOR MAPS: RISK MAPS

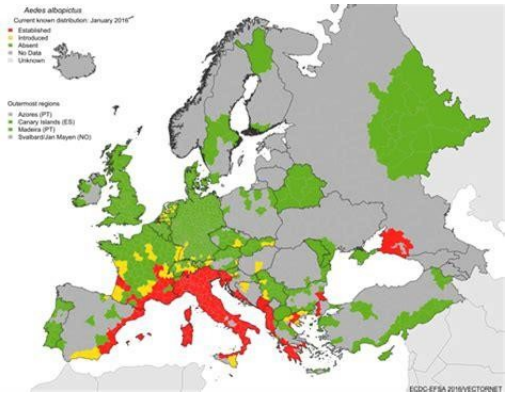
These are typical institutional risk map
Large scale, little detail, but NO GAPS



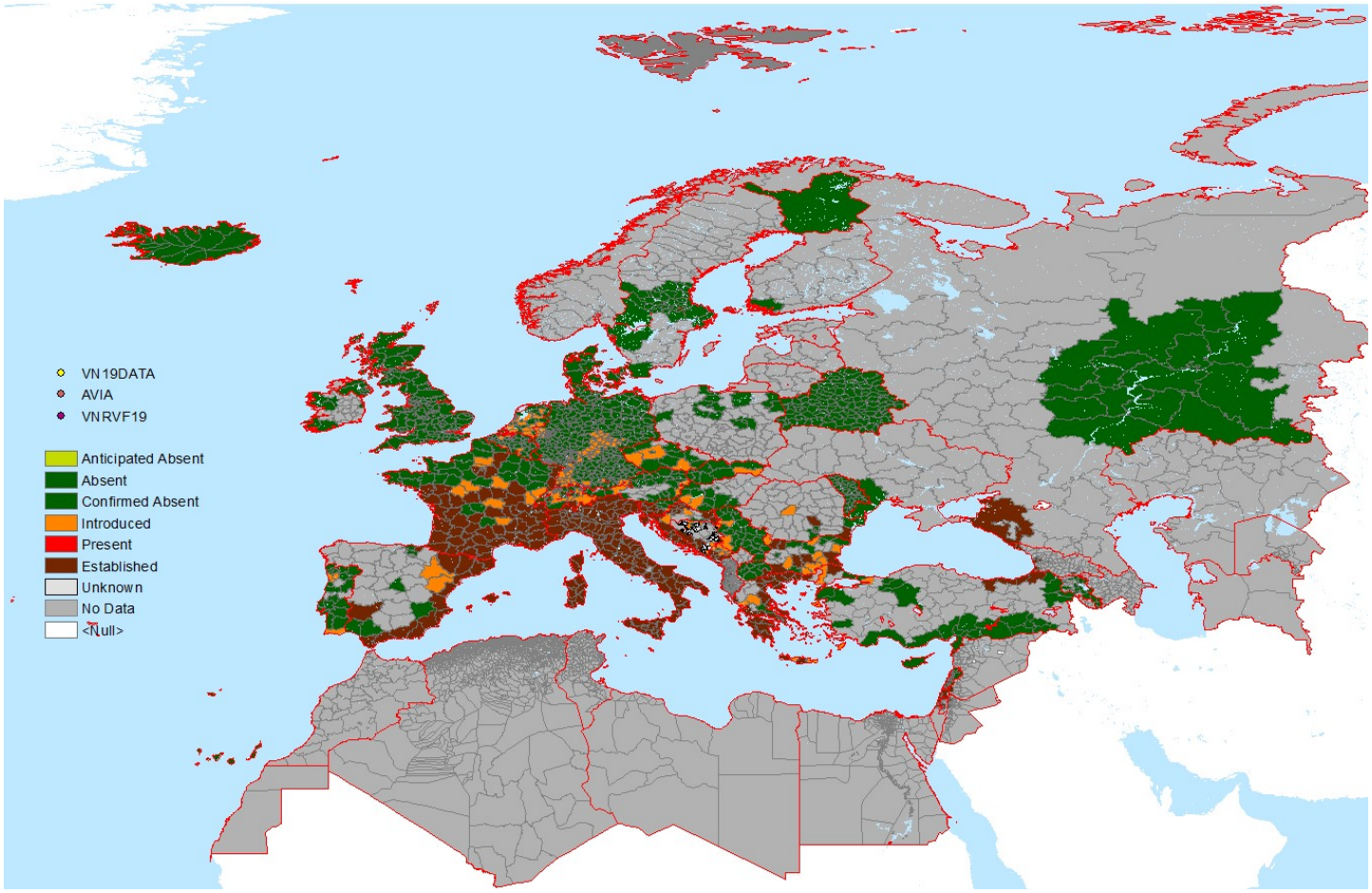
NO GAPS means info needed from everywhere, or extra/inter –polation of sampled data

WHY VECTOR MAPS: SPREAD MAPS

This is a typical institutional vector map



Widely used as vector = disease



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WHY MAPS: THEY ARE THE POLITICIANS DREAM

Showing you what they want you to see

Same information Different picture

And so can be misused

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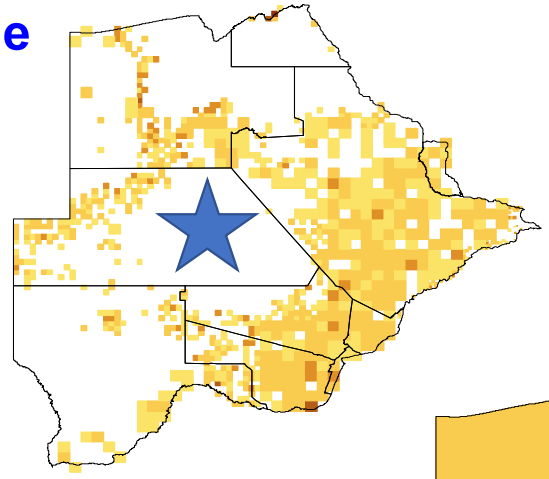
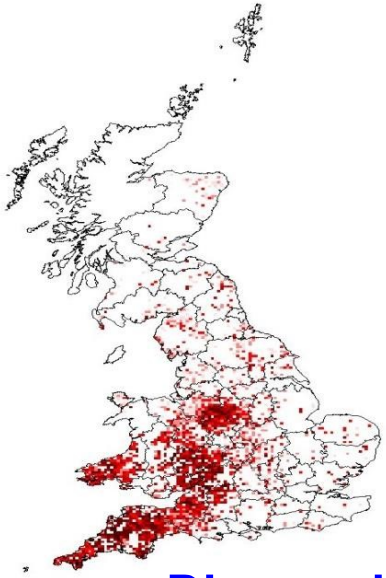
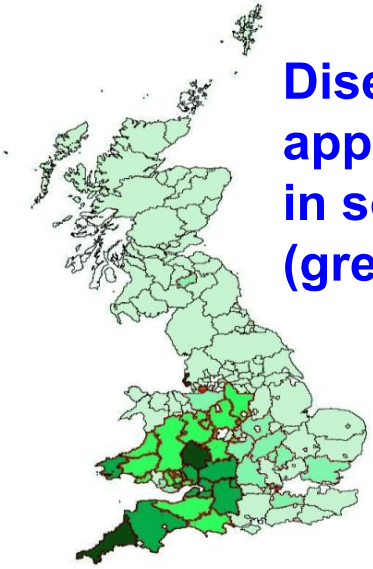
MULTIPLE MESSAGES: CAVEAT EMPTOR

Maps can easily (be used to) give wrong impression

The game reserve is safe from cattle



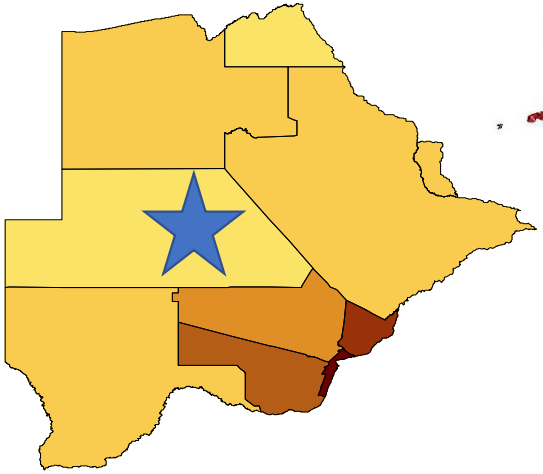




Disease in UK appears least risk in south west (green is good)

Disease in UK appears high risk in south west (green is good)

The game reserve is not safe from cattle



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CHANGING MESSAGES

Maps can combine different types of information and transform message

Order	Country	Pc:1549sq3
1	Aruba	-99.000
2	Antigua a	0.000
3	Afghanist	0.000
4	Algeria	0.070
5	Azerbaija	0.000
6	Albania	0.010
7	Armenia	0.010
8	Andorra	0.000
9	Angola	2.120
10	American	-99.000
11	Argentina	1.000
12	Australia	0.000
13	Austria	0.000
14	Anguilla	-99.000
15		0.000
16	Bahrain	0.150
17	Barbados	3.000
18	Botswana	25.100
19	Bermuda	-99.000
20	Belgium	0.000
21	Bahamas	4.000
22	Banglades	0.030
23	Belize	1.890
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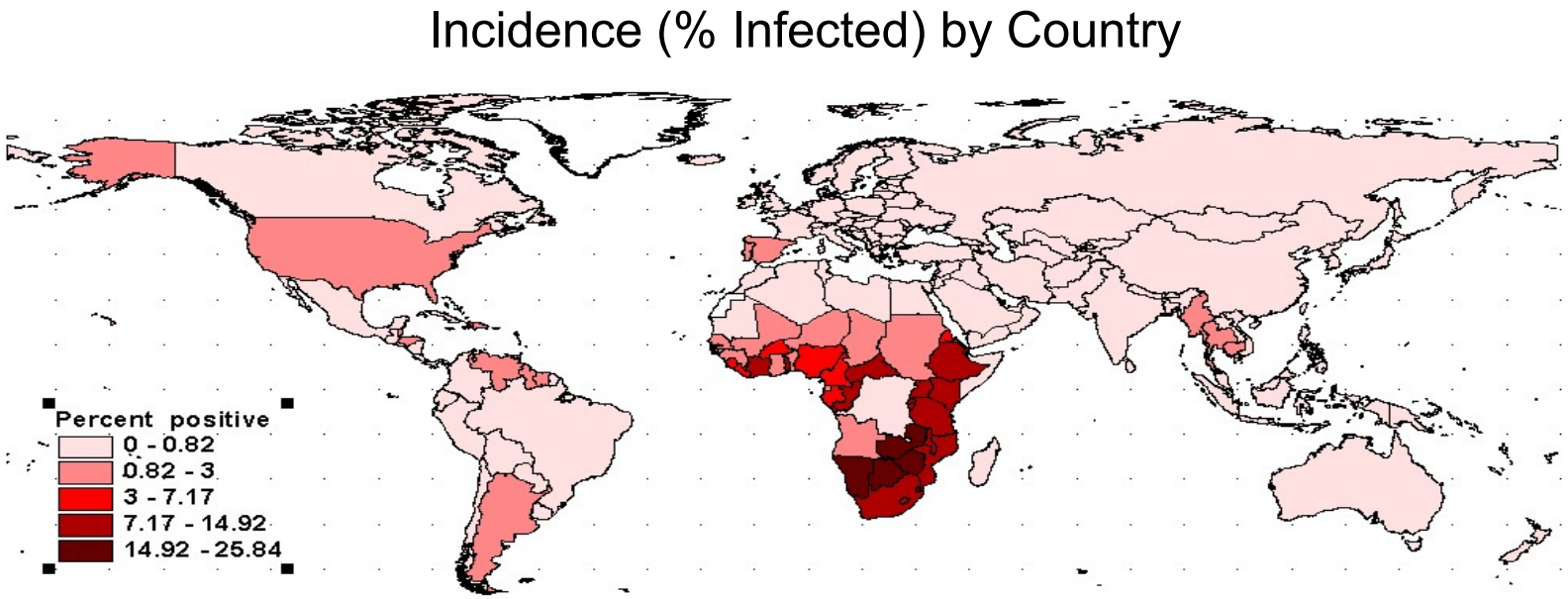

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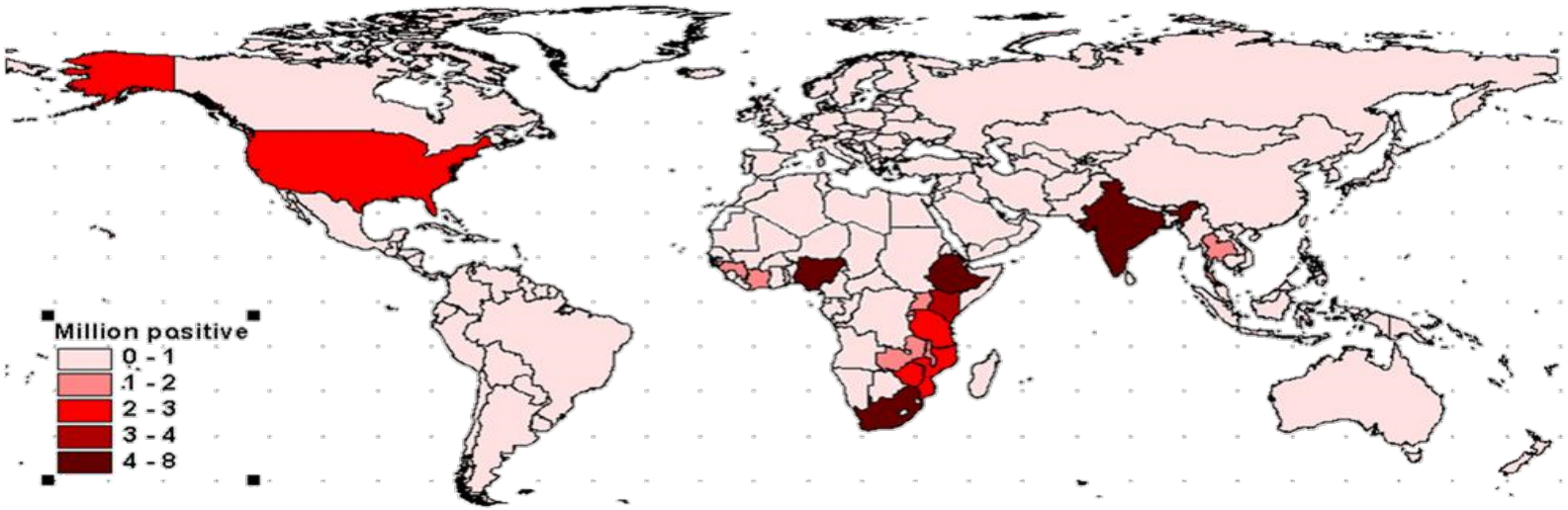
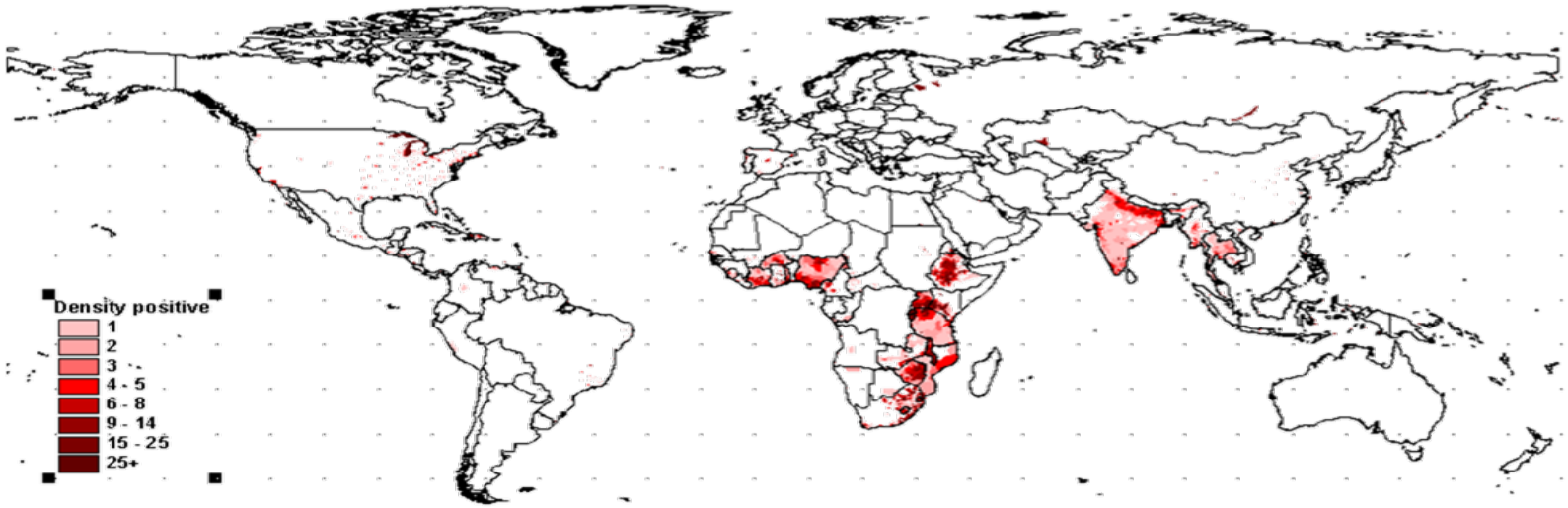
CHANGING MESSAGES

Incidence * Population (Number cases) by Country



CHANGING MESSAGES

Cases per sq km (incidence * density) by pixel



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WHY MAPS

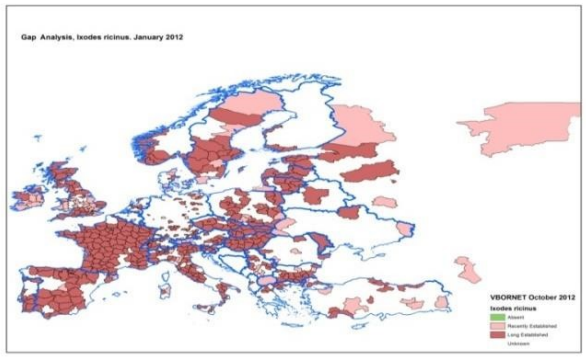
The technicians tool

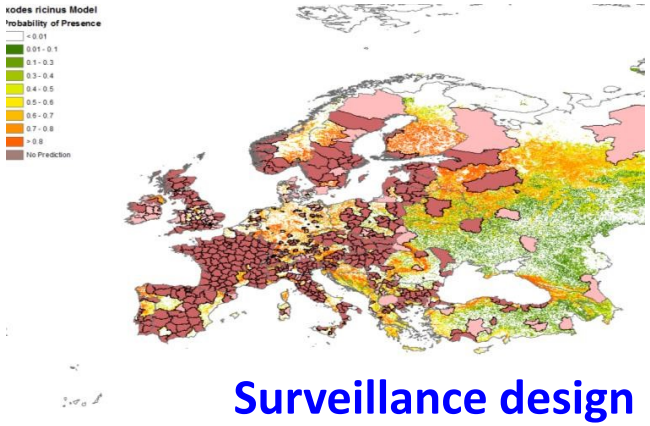
Same topic

Different aspects > different uses

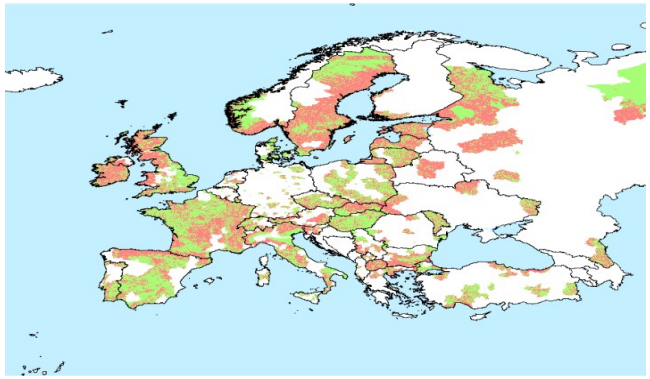
MAPPED OUTPUTS

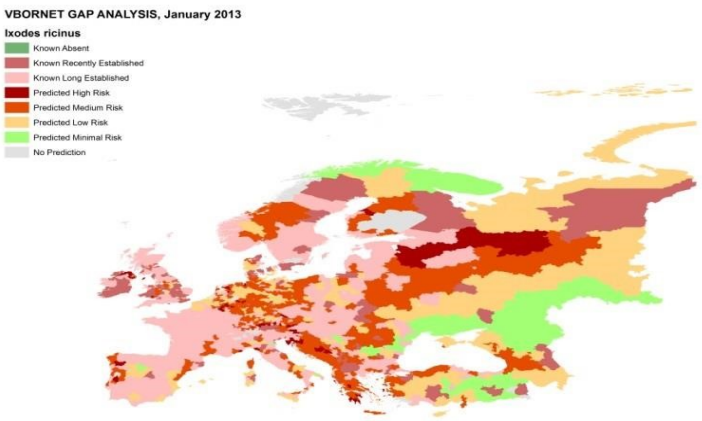
Different technical ways of presenting same data: this is for a tick (not a mosquito 😮)





Surveillance design





Resource allocation

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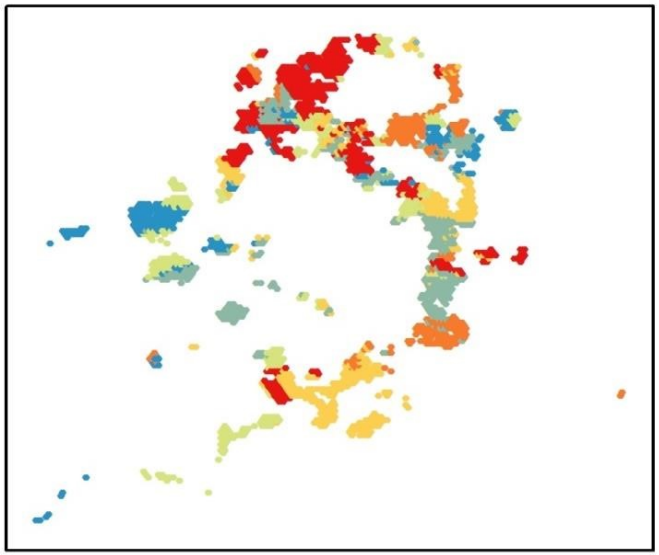
DIFFERENT ASPECTS OF SAME PROBLEM

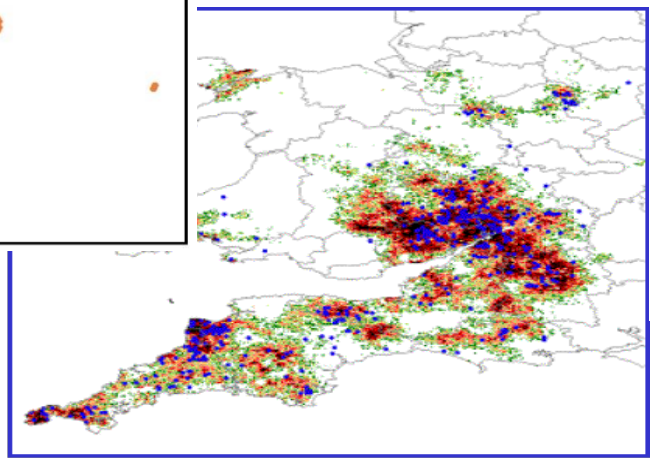
Drivers
(NB Effects of scale)



Policy, regulation

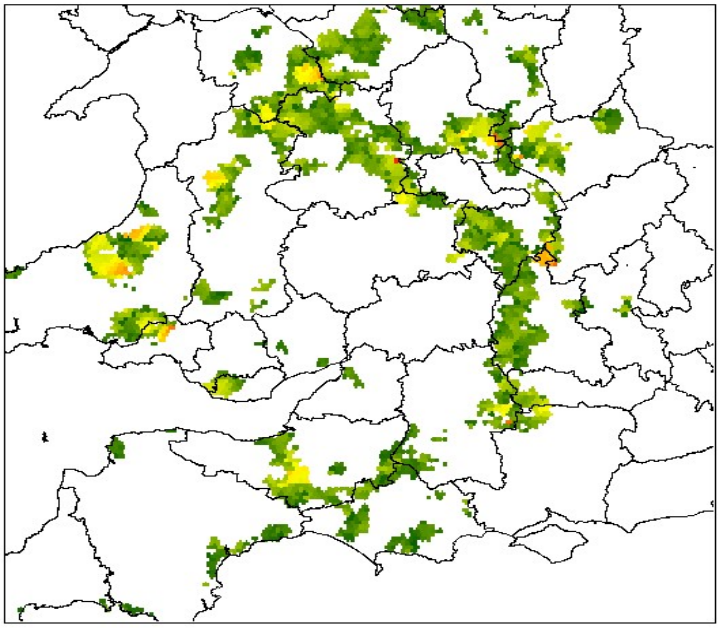
Even worse,
this is about
cattle

Presence



Testing, preparedness, mitigation

Spread rate



Early warning