Imperial College London

EpiCollect

David Aanensen
Department of Infectious Disease Epidemiology
Imperial College London

Background

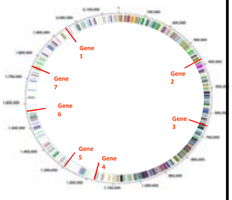
- Web Applications for global molecular epidemiology using open technologies.
- Multilocus Sequence Typing – www.mlst.net

The ability to identify and map incidence of strains of a pathogen is a crucial tool in understanding their spread and epidemiology.

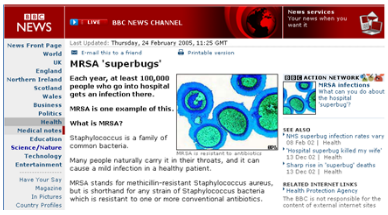
- For most pathogens, many different strains exist in a population and we want to be able to distinguish them and map their distribution.
- E.g. strains of influenza, Antibiotic-resistant strains of bacterial pathogens

Methods

- Precise data generated by molecular methods (typically DNA sequences) can be stored (and queried), along with epidemiological data, in web-accessible databases.



Staphylococcus aureus



Last Updated: Thursday, 24 February 2005, 11:25 GMT

MRSA 'superbugs'

Each year, at least 100,000 people who go into hospital gets an infection there.

MRSA is one example of this.

What is MRSA?

Staphylococcus is a family of common bacteria.

MRSA is resistant to antibiotics

Many people naturally carry it in their throats, and it can cause a mild infection in a healthy patient.

MRSA stands for methicillin-resistant Staphylococcus aureus, but is shorthand for any strain of Staphylococcus bacteria which is resistant to one or more conventional antibiotics.

MRSA infections
What can you do about the hospital 'superbug'?

SEE ALSO
- NHS superbug infection rates vary 08 Feb 02 | Health
- 'Hospital superbug killed my wife' 13 Dec 02 | Health
- Sharp rise in 'superbug' deaths 13 Dec 02 | Health

RELATED INTERNET LINKS
- Health Protection Agency

The BBC is not responsible for the content of external internet sites

- MRSA – methicillin-resistant *Staphylococcus aureus*

- methicillin-sensitive *S. aureus* (MSSA)

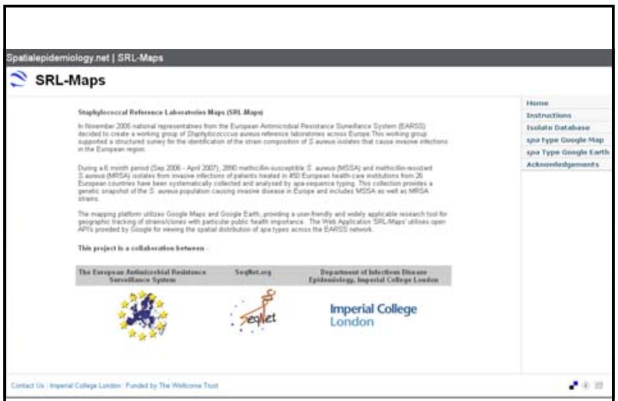
↓

- methicillin-resistant *S. aureus* (MRSA)

Identifying different strains can help understand pathogen evolution and the spread of infection

Questions?

- Which strains are more likely to cause disease?
- Where are these strains found?
- How are they spread?
- For example, we would like to identify and track those strains causing disease between patients, between wards, between healthcare institutes and between countries.



Staphylococcal Reference Laboratories Maps (SRL Maps)

In November 2006 national representatives from the European Antimicrobial Resistance Surveillance System (EARSS) decided to create a working group of Staphylococcus aureus reference laboratories across Europe. This working group supported a structured survey for the identification of the strain composition of S. aureus isolates that cause invasive infections in the European region.

During a 6 month period (Sep 2006 - April 2007), 2890 methicillin-susceptible S. aureus (MSSA) and methicillin-resistant S. aureus (MRSA) isolates from invasive infections of patients treated in 450 European health-care institutions from 26 European countries have been systematically collected and analysed by spa-sequence typing. This collection provides a genetic snapshot of the S. aureus population causing invasive disease in Europe and includes MSSA as well as MRSA strains.

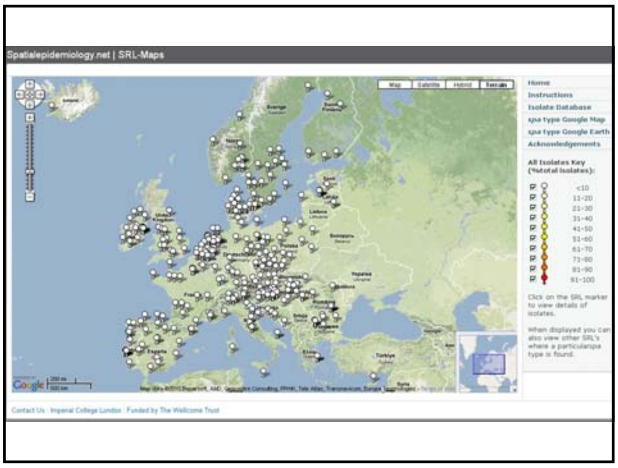
The mapping platform utilizes Google Maps and Google Earth, providing a user-friendly and widely applicable research tool for geographic tracking of strains/clones with particular public health importance. The Web Application 'SRL-Maps' utilises open API's provided by Google for viewing the spatial distribution of spa types across the EARSS network.

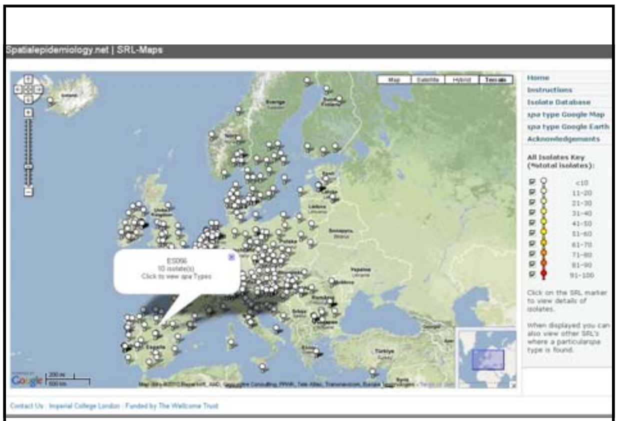
This project is a collaboration between :

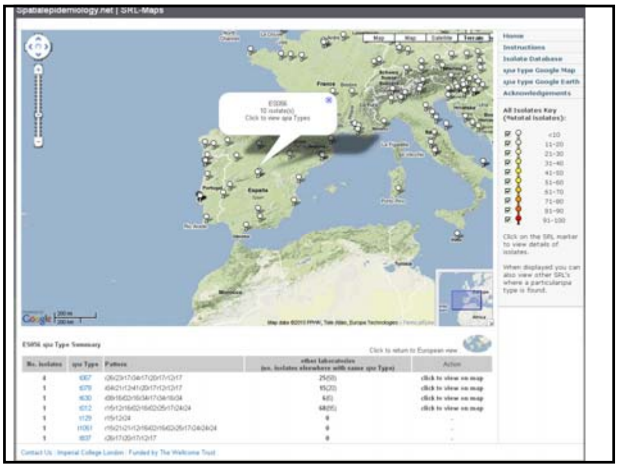
The European Antimicrobial Resistance Surveillance System	SeqNet.org	Department of Infectious Disease Epidemiology, Imperial College London

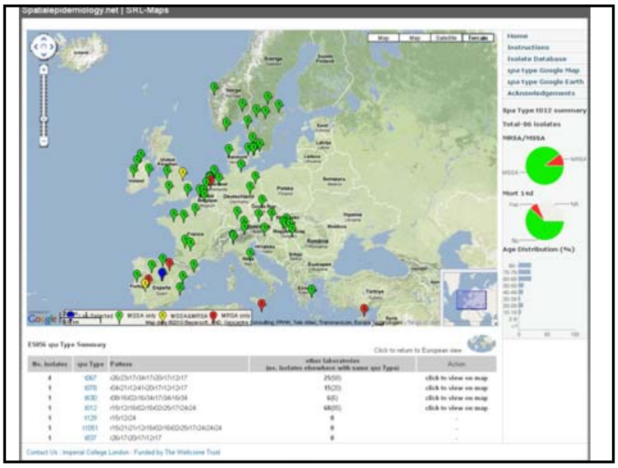
http://www.spatialepidemiology.net/SRL-maps

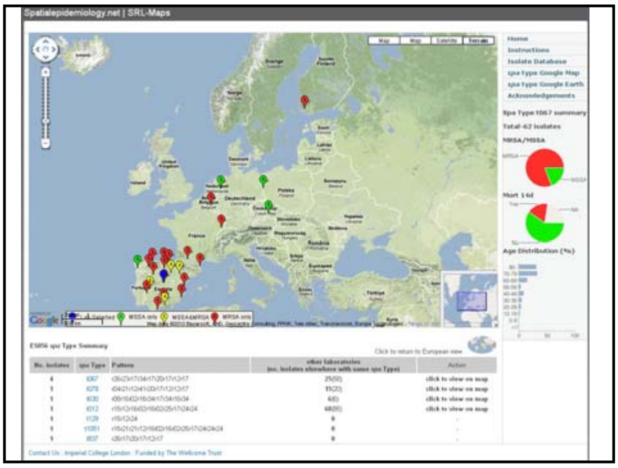
Grundmann, Aanensen *et al* (2010) *PLoS Med* 7(1): e6968











Batrachochytrium dendrobatidis (Bd) (a fungus)

Last Updated: Thursday, 14 October 2004, 18:07 GMT 19:07 UK

Global amphibians in deep trouble

By Alex Kirby
BBC News Online environment correspondent

Scientists believe the world's amphibians are facing an unprecedented onslaught of environmental threats.

They say as many as 122 species may have become extinct since 1980 and a third of known amphibians face oblivion.

Naturalists describe the creatures as sensitive indicators of the health of the wider environment.

The Global Amphibian Assessment, the work of more than 500 scientists, is published in Science Express, the

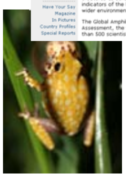
Almost 6,000 amphibian species are known to science

BBC NEWS:VIDEO AND AUDIO
A third of the world's amphibians face extinction

Planet under pressure
In Depth
A six-part series looking at the biggest problems facing the Earth
- Introducing Planet Under Pressure

PART 1: SPECIES UNDER THREAT
- Biodiversity: The sixth great wave

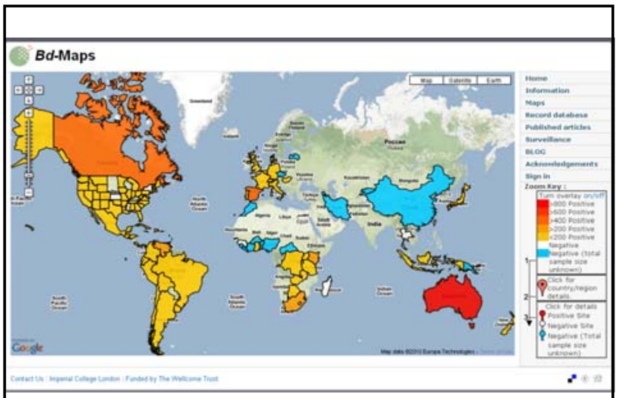
Last fragment
Tim Hirsch visits Brazil's 'Noah's Ark' forest
- Photojournal: Landless settler
- Map: Biodiversity hotspots
- Viewpoints: Saving species
- Quiz: Species and extinction

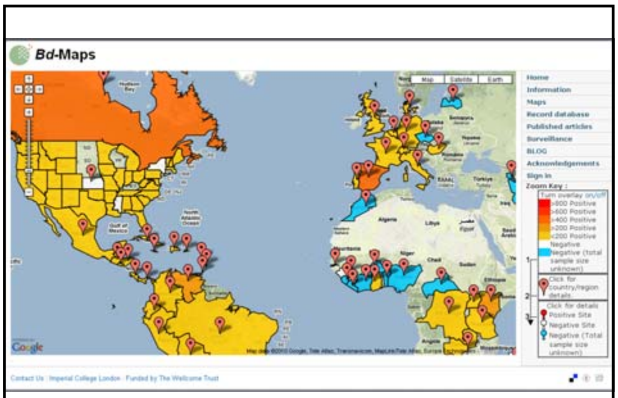


Bd-Maps

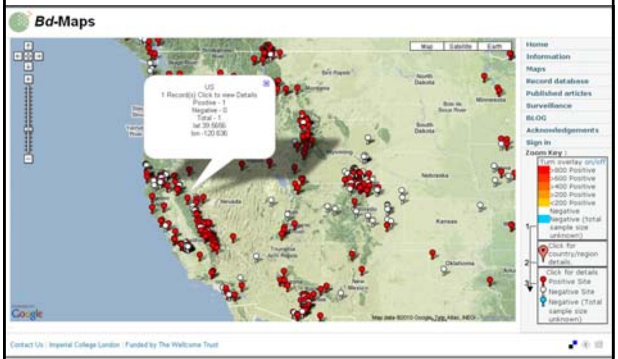
- **Globally, amphibians are declining faster than any other class of vertebrates**
- *Bd* causing wide-spread die-offs and species declines
- Demands logical collection of incidence, location and species distribution

http://www.spatialepidemiology.net/bd-maps



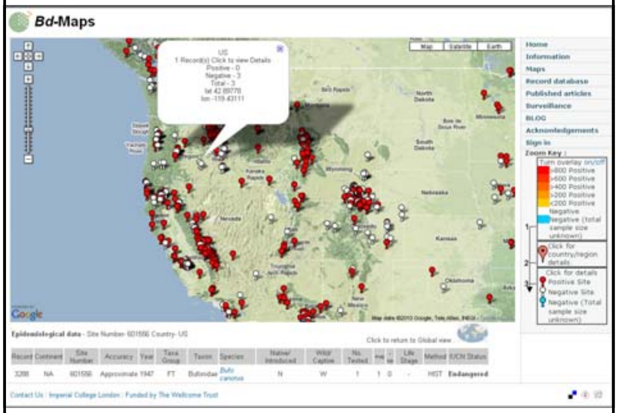


Contact Us : Imperial College London : Funded by The Wellcome Trust



US
1 Record(s) Click to view Details
Positive - 1
Negative - 0
Total - 1
lat 39.5656
lon -120.636

Contact Us : Imperial College London : Funded by The Wellcome Trust

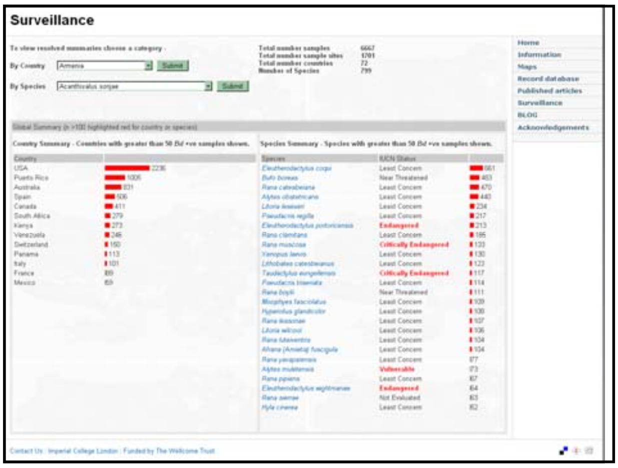


US
1 Record(s) Click to view Details
Positive - 0
Negative - 3
Total - 3
lat 42.69778
lon -119.43111

Epidemiological data - Site Number- 601556 Country- US

Record	Continent	Site Number	Accuracy	Year	Taxa Group	Taxon	Species	Native/ Introduced	Wild/ Captive	No. Tested	+ve	-ve	Life Stage	Method	IUCN Status
3288	NA	601556	Approximate	1947	FT	Bufonidae	*Bufo canorus*	N	W	1	1	0	-	HIST	**Endangered**

Contact Us : Imperial College London : Funded by The Wellcome Trust



Surveillance

To view resolved summaries choose a category :

By Country: Armenia

By Species: Acanthixalus sonjae

Total number samples	6667
Total number sample sites	1701
Total number countries	72
Number of Species	799

Global Summary (n >100 highlighted red for country or species)

Country Summary - Countries with greater than 50 *Bd* +ve samples shown.

Country	
USA	2236
Puerto Rico	1006
Australia	831
Spain	506
Canada	411
South Africa	279
Kenya	273
Venezuela	246
Switzerland	150
Panama	113
Italy	101
France	89
Mexico	69

Species Summary - Species with greater than 50 *Bd* +ve samples shown.

Species	IUCN Status	
Eleutherodactylus coqui	Least Concern	661
Bufo boreas	Near Threatened	483
Rana catesbeiana	Least Concern	470
Alytes obstetricans	Least Concern	440
Litoria lesueuri	Least Concern	234
Pseudacris regilla	Least Concern	217
Eleutherodactylus portoricensis	**Endangered**	213
Rana clamitans	Least Concern	186
Rana muscosa	**Critically Endangered**	133
Xenopus laevis	Least Concern	130
Lithobates catesbeianus	Least Concern	123
Taudactylus eungellensis	**Critically Endangered**	117
Pseudacris triseriata	Least Concern	114
Rana boylii	Near Threatened	111
Mixophyes fasciolatus	Least Concern	109
Hyperolius glandicolor	Least Concern	108
Rana lessonae	Least Concern	107
Litoria wilcoxii	Least Concern	106
Rana luteiventris	Least Concern	104
Afrana (Amietia) fuscigula	Least Concern	104
Rana yavapaiensis	Least Concern	77
Alytes muletensis	**Vulnerable**	73
Rana pipiens	Least Concern	67
Eleutherodactylus wightmanae	**Endangered**	64
Rana sierrae	Not Evaluated	63
Hyla cinerea	Least Concern	62

Contact Us : Imperial College London : Funded by The Wellcome Trust

Smartphones for data collection - EpiCollect

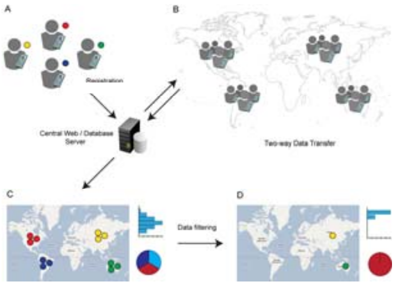
- GPS – 'location aware'
- Cameras for stills or videos
- Keyboards for text entry
- Data transfer to / from central web databases.

android iPhone

Aanensen *et al* (2009) *PLoS ONE* 4(9): e6968

EpiCollect

http://www.epicollect.net



Mobile phone app (Android and iPhone) and web application for data visualisation.

EpiCollect http://www.epicollect.net

- Questionnaires of any nature.
- Any projects where centralising textual data along with GPS and / or photos from many different people, from many different places, would be useful.

EpiCollect http://www.epicollect.net

Create a Project website at EpiCollect.net

Design a form for data collection

Load Project into the EpiCollect mobile app and collect data, including GPS position and photo

View data collected at your project website or on your phone (download, view on maps/charts, filter.)

EpiCollect http://www.epicollect.net

- Completely free and open, with project websites and data storage using Google AppEngine.
- demo

New Project

eufmd

Success

Project Loaded

Project URL is:
http://www.epicollect.net/project.html?name=overtheair1

Select Project: eufmd

Project URL is:
http://www.epicollect.net/project.html?name=eufmd

ID 1 2010-09-2 11:21:28

GPS Set - Accuracy 24.0m

ID 1 2010-09-2 11:21:28

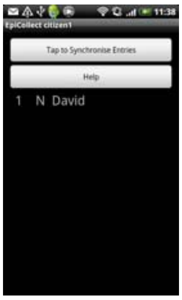
GPS Set - Accuracy 24.0m

What is your name? David

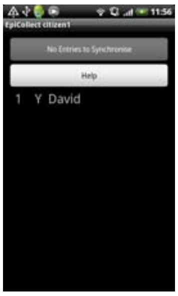
Male or Female? male

Select Project: eufmd

Project URL is:
http://www.epicollect.net/project.html?name=eufmd



1 N David



1 Y David

Animal Health surveillance in Kenya / Tanzania

Ongoing monitoring of:

East Coast Fever; anthrax and rabies; PPR; FMD

Gabriel Turasha (Vetaid Tanzania) Nick Short(RVC) Niall Winters(IOE)

Resource mapping and further work with SACIDS

Some projects people have set up

- Archaeological dig sites – Europe
- Plant distribution Yellowstone National Park- USA
- Street art collection - UK
- Drug administration monitoring and evaluation across Africa (schistosomiasis and lymphatic filariasis). SCORE and Task force
- Malaria surveys

- No reliance on data networks for collection.
- Data can be sent to any / multiple servers
- Simple text (XML) description of project forms and for definition of server locations.
- Code open

XML project definition

```
<xform>
        <model>
                <submission id="ahBlc" projectName=”eufmd” allowDownloadEdits="false" versionNumber="1.0"/>
        </model>

        <input ref="name" required="true" title="true">
                <label>What is your name?</label>
        </input>

        <select1 ref="sex" required="true" chart="pie">
                <label>male or female?</label>
                        <item>
                                <label>male</label>
                                <value>male</value>
                        </item>
                        <item>
                                <label>female</label>
                                <value>female</value>
                        </item>
        </select1>
</xform>
```

XML project definition

```
<xform>
	<model>
		<submission id="ahBlc" projectName=”eufmd” allowDownloadEdits="false" versionNumber="1.0"/>
	</model>

	<input ref="name" required="true" title="true">
		<label>What is your name?</label>
	</input>

	<select1 ref="sex" required="true" chart="pie">
		<label>male or female?</label>
			<item>
				<label>male</label>
				<value>male</value>
			</item>
			<item>
				<label>female</label>
				<value>female</value>
			</item>
	</select1>
</xform>
```

XML project definition

```
<xform>
	<model>
		<submission id="ahBlc" projectName=”eufmd” allowDownloadEdits="false" versionNumber="1.0"/>
	</model>

	<input ref="name" required="true" title="true">
		<label>What is your name?</label>
	</input>

	<select1 ref="sex" required="true" chart="pie">
		<label>male or female?</label>
			<item>
				<label>male</label>
				<value>male</value>
			</item>
			<item>
				<label>female</label>
				<value>female</value>
			</item>
	</select1>
</xform>
```

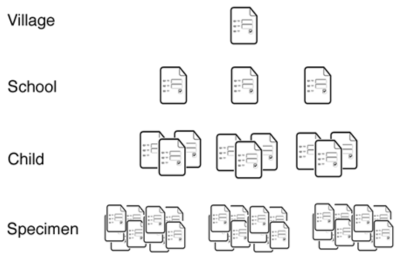
XML project definition

```
<xform>
	<model>
		<submission id="ahBlc" projectName=”eufmd” allowDownloadEdits="false" versionNumber="1.0"/>
	</model>

	<input ref="name" required="true" title="true">
		<label>What is your name?</label>
	</input>

	<select1 ref="sex" required="true" chart="pie">
		<label>male or female?</label>
			<item>
				<label>male</label>
				<value>male</value>
			</item>
			<item>
				<label>female</label>
				<value>female</value>
			</item>
	</select1>
</xform>
```

Increased project complexity



Village

School

Child

Specimen

All defined in XML
as well as text fields each form can also include one or more..

- <gps>
- <picture>
- <video>
- <sound>
- <barcode>
- <bluetooth>

- Skip patterns and validation.

Acknowledgements

- Imperial –Dr Derek Huntley, Jon Evans, Chris Powell, Prof. Brian Spratt
- SRL-Maps – Prof Hajo Grundmann (RIVM) and EARSS
- Bd-Maps – Dr Dede Olson (US Forest Service) and Dr Matt Fisher

Funded by:
wellcome trust

d.aanensen@imperial.ac.uk