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Risk based surveillance systems

Professor Mark Burgman

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THE UNIVERSITY OF MELBOURNE
Australia

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Regulator's Conundrum

Biosecurity Regulator

Protect us from Pests:

- Agriculture / Industry
- Human Health
- Environment

but

Facilitate Trade

- Don't Cost too Much
- Don't Take too Long
- Don't Impede Trade

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Where should you look?

Australian 2012-2013 Annual Biosecurity Report

- 16 200 000 Air passengers
- 186 580 000 Mail Articles
- 16 300 First-port visits
- 645 000 Air Freight Consignments (< $1000)
- … etc

Multiple objectives

- Find as much as possible
- Learn as quickly as possible
- Deter

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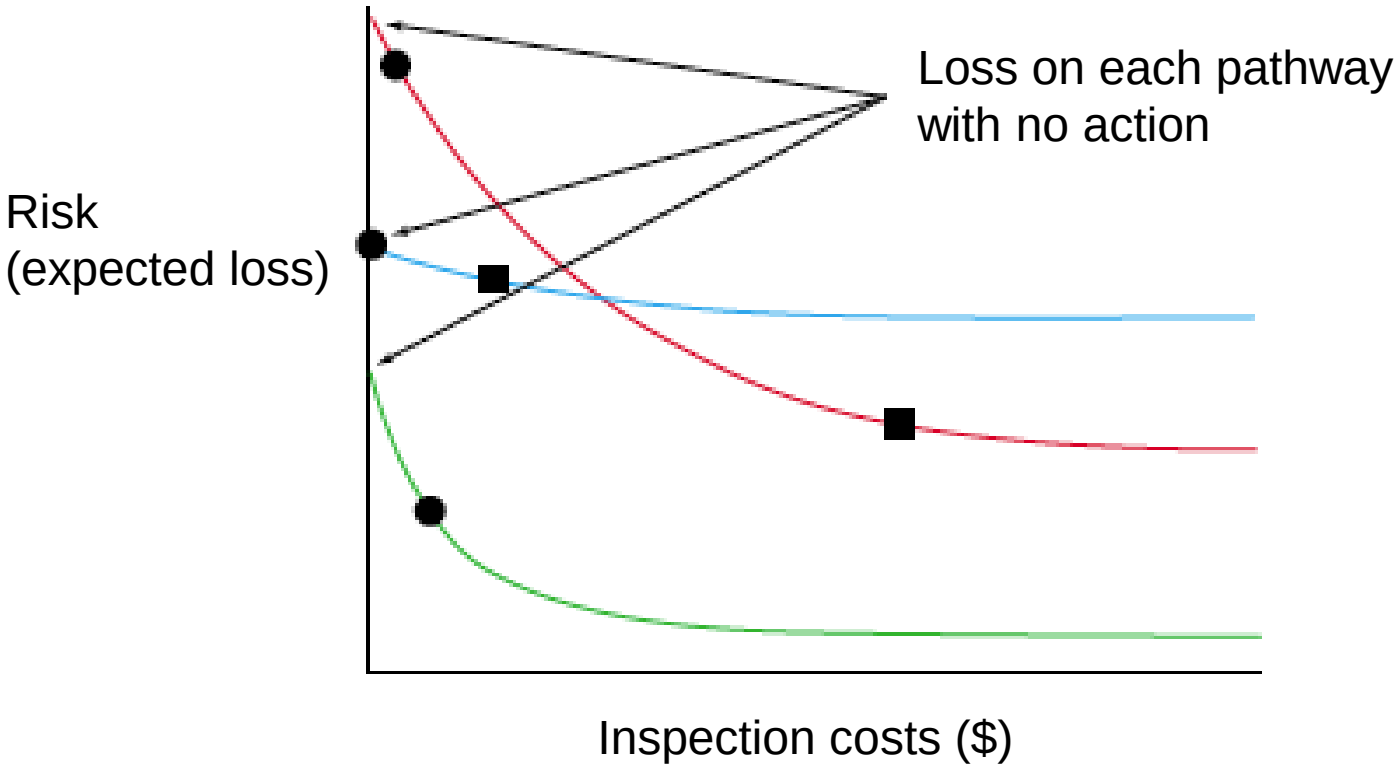
The underlying principle

Maximise risk-reduction per $ spent



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Implementing risk-based surveillance

- When You Have No History: Collect Data and Use It
  Continuous Sampling Protocols (CSP)
- When You Have History: Analyse and Mine It
  Inference and Data Mining
- Build History: Compile Data and Scan for Emerging Threats
  International Biosecurity Intelligence System

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Collecting inspection data

Inspection systems to

- Intercept
- Learn
- Deter

Ecological Applications, 21(4), 2011, pp. 1410–1417

Allocating surveillance resources to reduce ecological invasions: maximizing detections and information about the threat

ANDREW ROBINSON,[1,4] MARK A. BURGMAN,[2] AND ROB CANNON[3]

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[2]*Australian Centre of Excellence for Risk Analysis, School of Botany, University of Melbourne, Parkville, Victoria 3010 Australia*
[3]*Biosecurity Services Group, Department of Agriculture, Fisheries, and Forestry, Canberra, Australian Capital Territory 2601 Australia*

Abstract. Allocating resources to detect invasive pests, diseases, and pathogens on exposure pathways requires a trade-off between the need to detect as many contaminated items as possible and the need to acquire knowledge about contamination rates. We develop a model and an algorithm that provide guidance for the allocation of inspection resources across multiple dynamic pathways in cases where not every item can be inspected. The model uses a null hypothesis that the contamination rate of a pathway is above a specified level: a risk cutoff. Pathways with a risk above the cutoff are fully inspected, and those with a risk below the cutoff level are monitored at a rate that would detect a change of the risk to being above the cutoff level with high probability. We base our decision on the 95% upper confidence limit for the contamination rate. We demonstrate via simulations and a data set that focusing inspection resources on specific pathways can result in substantially more effective intervention, and that the reduction in overall effectiveness of monitoring low-risk pathways need not be substantial. Use of the model demands the selection of the risk cutoff, and this limit can be set according to projected consequences.

Robinson et al.
Ecol. Applic. (2011), 21, 1040-1047.

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CSP-1: Risk-Based Inspections

Pathway is in one of two modes: census, or sample.

1. In census mode, inspect all items. Switch to sample after *c* consecutive passes.
2. In sample mode, inspect *f* % of the items, randomly selected. Switch to census upon any fail.

Start in census mode.

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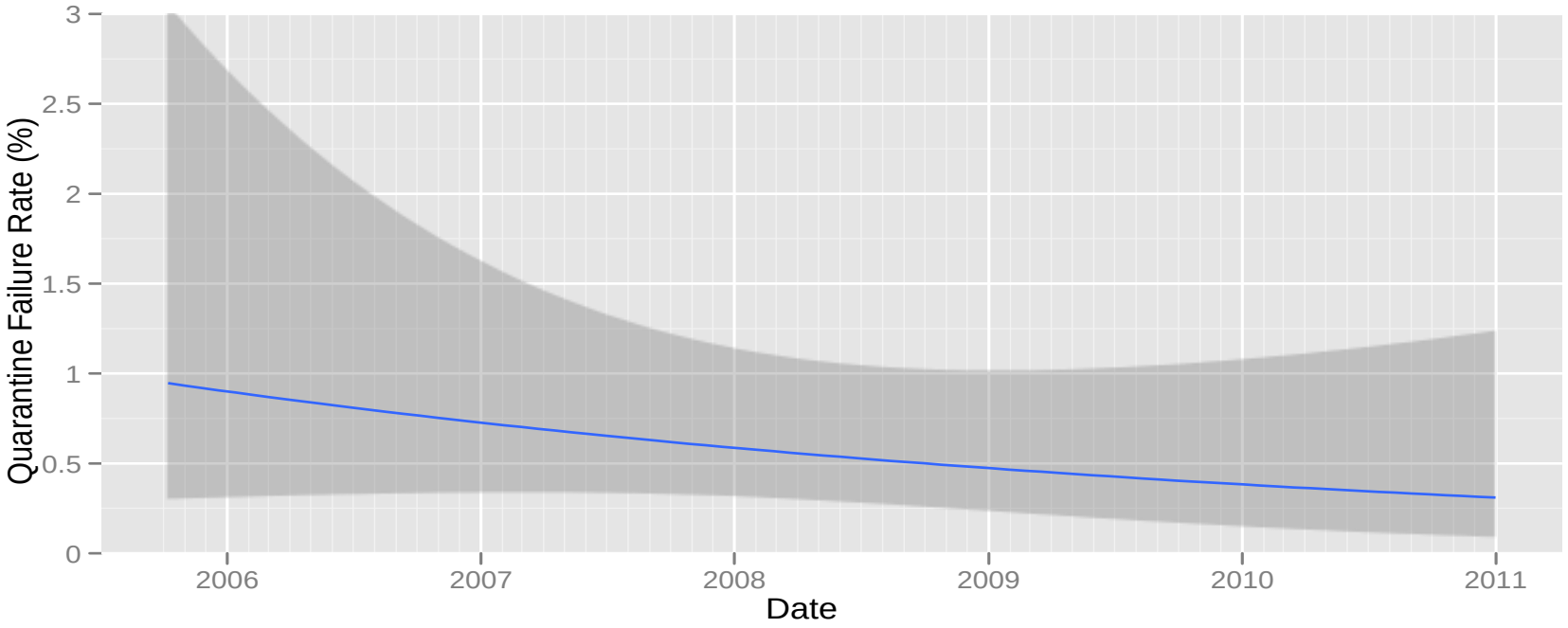
Data analysis (dried apricots)



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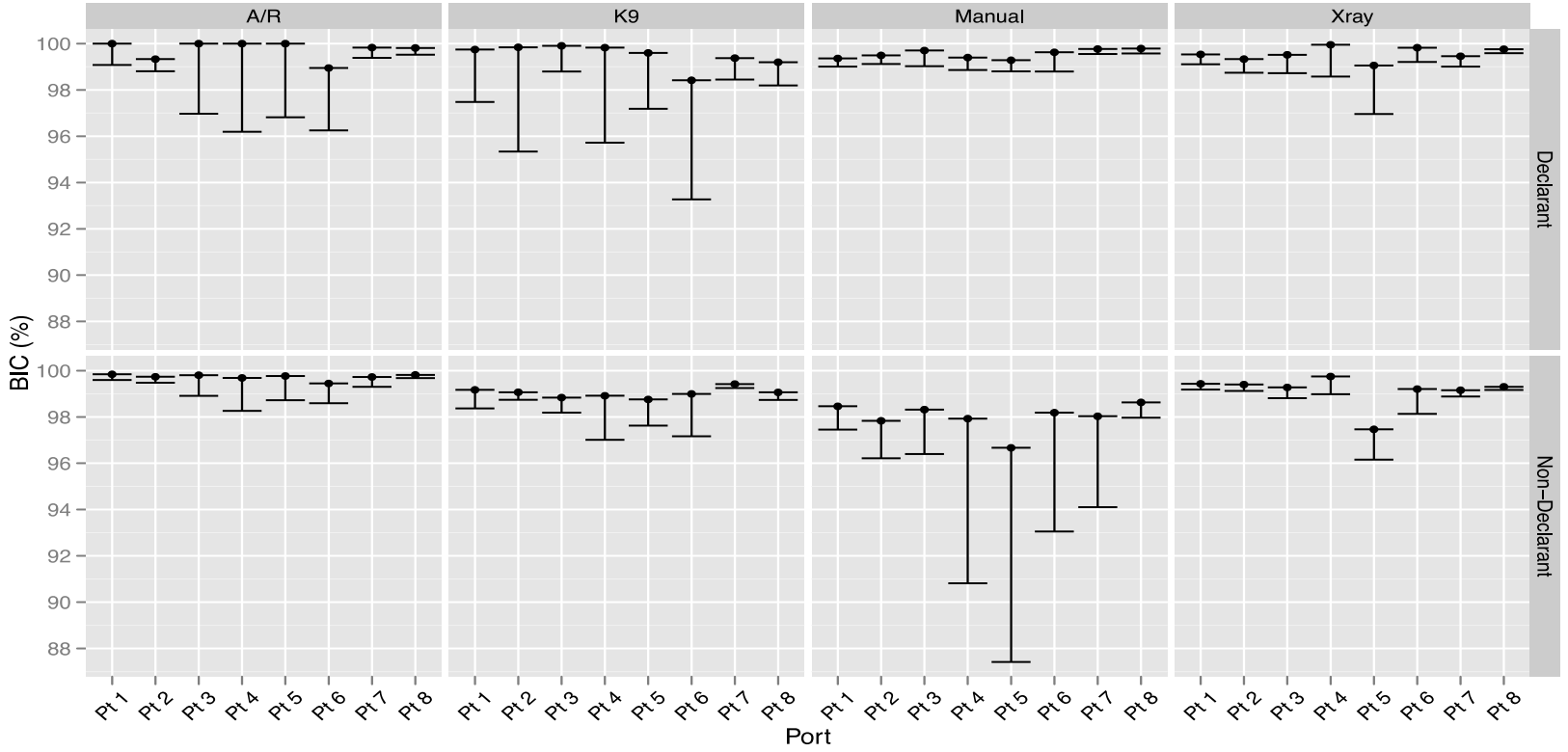
Reporting: Failure rate by Port, Channel, and Declaration



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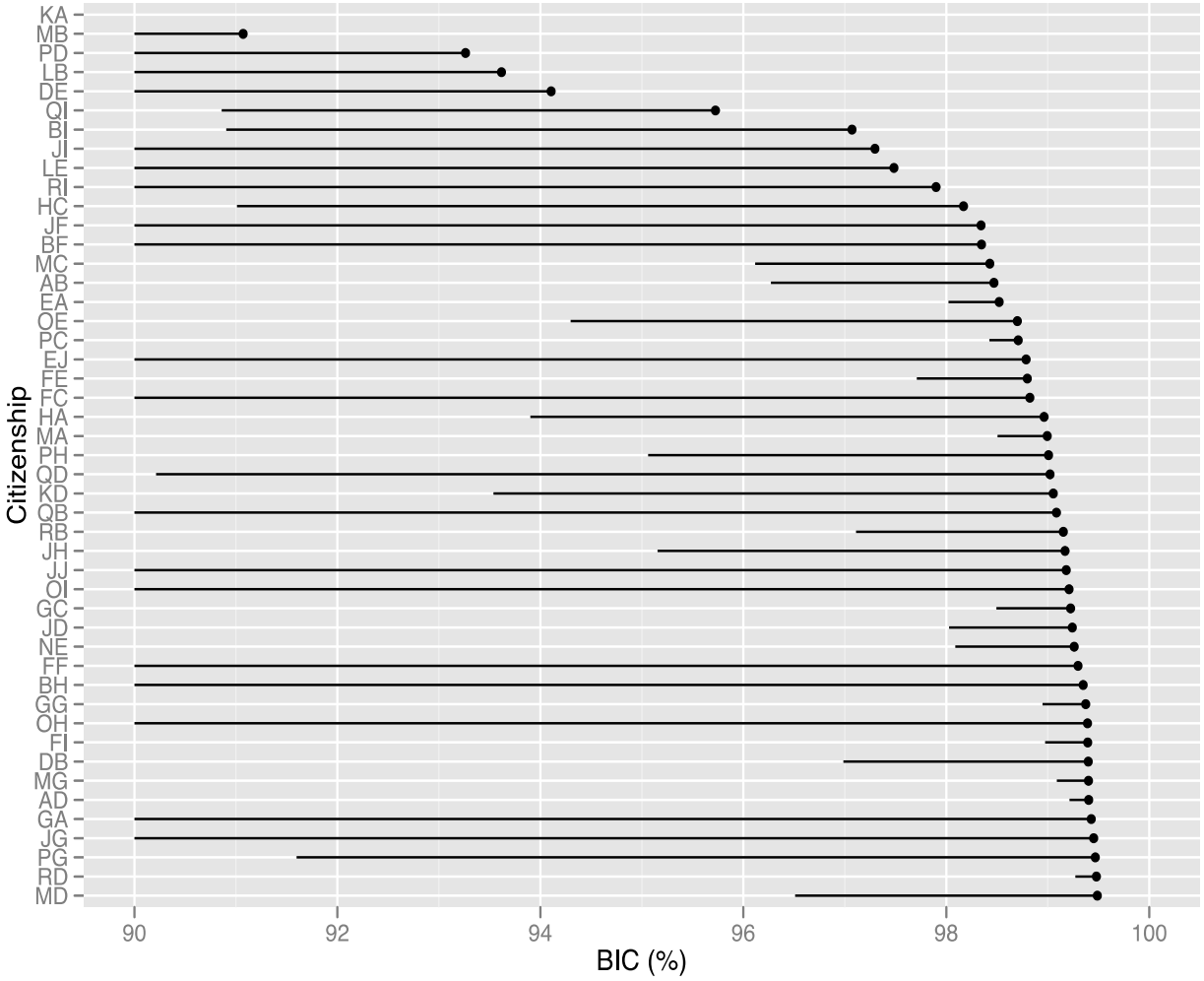
Data mining: e.g., profiling / compliance



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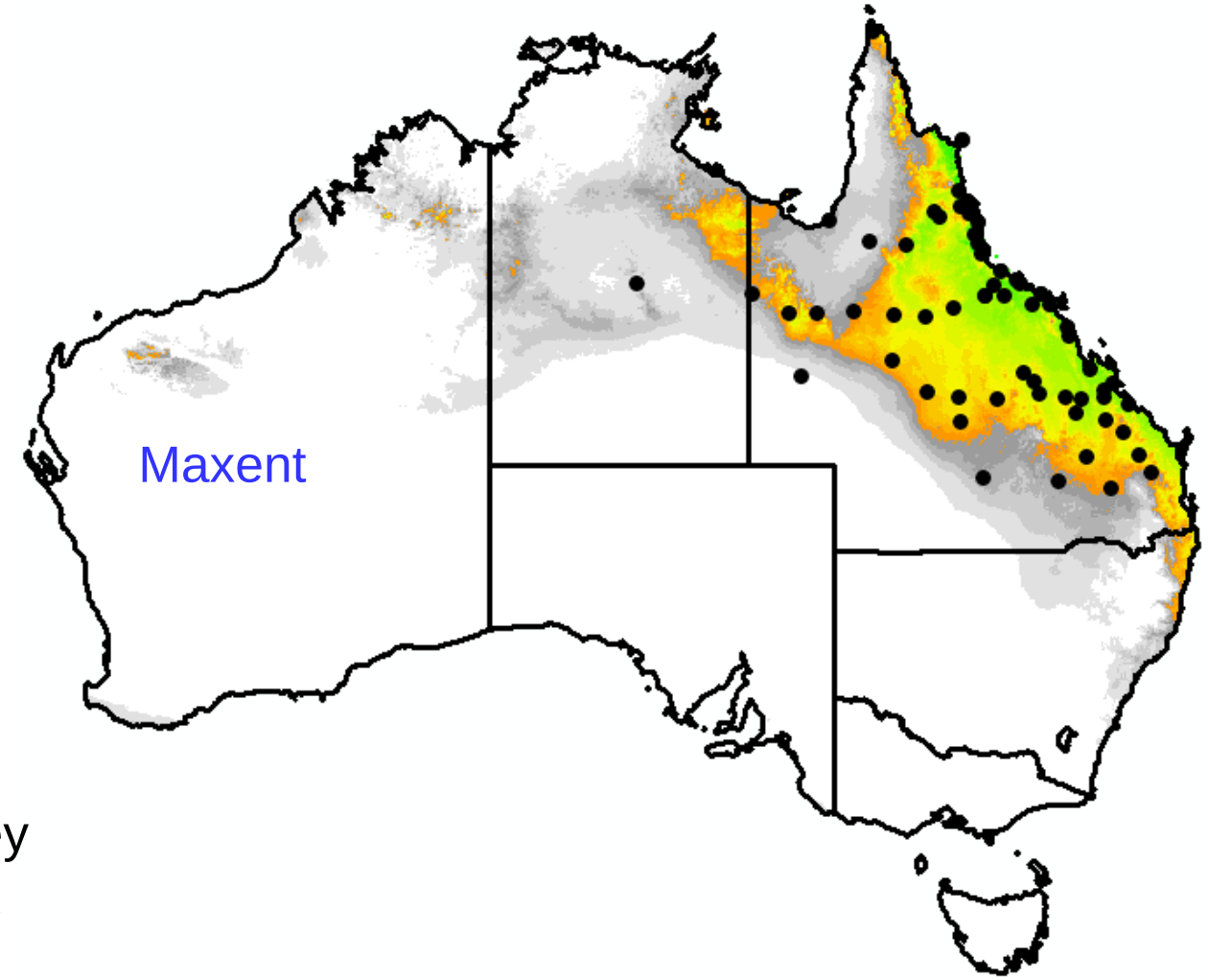
Data mining
e.g. species distribution modelling



Jane Elith
Michael Kearney
John Leathwick

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Software for Biosecurity Intelligence

ProMED

GPHIN

WDIN

BioCaster

EpiSPIDER

HealthMap

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ORIGINAL ARTICLE

Comparison of Web-Based Biosecurity Intelligence Systems: BioCaster, EpiSPIDER and HealthMap

A. Lyon[1,2], M. Nunn[3], G. Grossel[3] and M. Burgman[1]

[1] Australian Centre of Excellence for Risk Analysis, University of Melbourne, Melbourne, Vic., Australia
[2] University of Maryland, College Park, MD, USA
[3] Department of Agriculture, Fisheries and Forestry, Canberra, ACT, Australia

Keywords:
BioCaster; EpiSPIDER; HealthMap; automated biosecurity intelligence; open-source information

Summary

Three web-based biosecurity intelligence systems – BioCaster, EpiSPIDER and HealthMap – are compared with respect to their ability to gather and analyse information relevant to public health. Reports from each system for the period

Lyon et al. (2011) Transboundary and Emerging Diseases 59, 223-232

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Principles

- IBIS gathers open-source intelligence on aquatic animal, terrestrial animal and plant health issues
- Articles are validated by the user community
- Open community, anyone can join
- Users can suggest their own subjects and search terms
- Users are also able to review ‘raw’ articles and make decisions about whether or not to 'publish' them
- Simple alert function to get a ‘daily digest’ email of promoted articles of interest

Welcome to IBIS! The latest 20 articles are displayed. To customise the home page results to match your preferences, log in or sign up.

Join the network

IBIS is an intelligence network for plant and animal (aquatic and terrestrial) biosecurity. The network and database is growing daily with members devoted to collecting and organising information used for tracking and forecasting diseases and following emerging disease trends.

By joining the network, you will gain access to more features and be able to contribute back to the network --- e.g., by adding your own topics to search for. To join the network, use the registration form, and an administrator will respond as soon as possible.

User login

Username *

Password *

Create new account
Request new password

Log in

Issues

October 2015 - Trending Issue: Turtles

Vp goes global - a one health issue

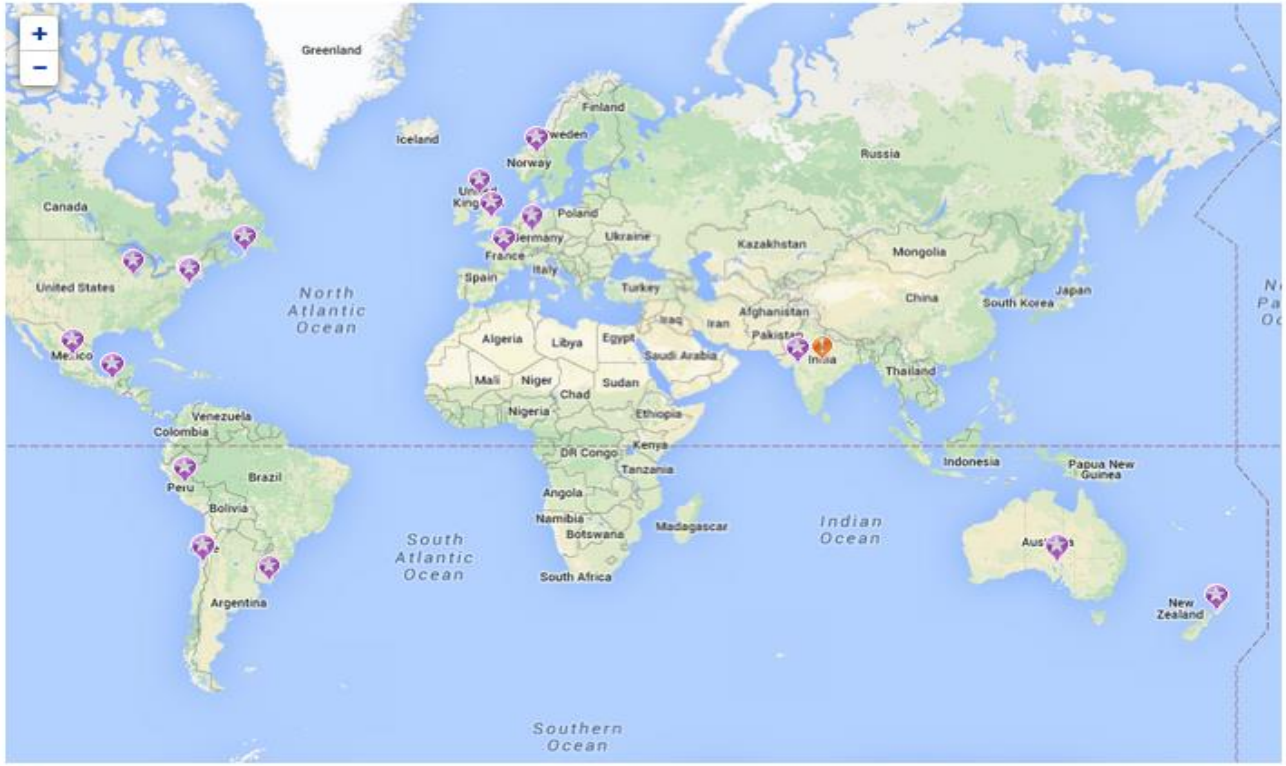
China - Pushing the Envelope

International trade in ornamental fish. What are the disease risks?

Streptococcus agalactiae & Vibrio - food security & food safety 2013-15

View all

Latest articles



Articles listed by publish date.

2015-02-01 Mysterious whale deaths along SA coast baffle scientists

2015-01-30 French state oysters spread sex disease | The Times

2015-01-30 Sea lice infestation risks too great to enable salmon farm renewal - PlanningResource (subscription)

2015-01-30 New weapons in the battle against salmon lice | ScienceNordic

2015-01-30 Senckenberg Nature Research Society | crayfish plague: The Killer heels - Fast and reliable detection of the pathogen in water samples | Press Release | Press Release

2015-01-30 Disappearing shellfish on B.C.'s coast confounding experts - Globalnews.ca

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Issues

Scrapie and sporadic Creutzfeldt-Jakob disease (sCJD) - mouse model relationship

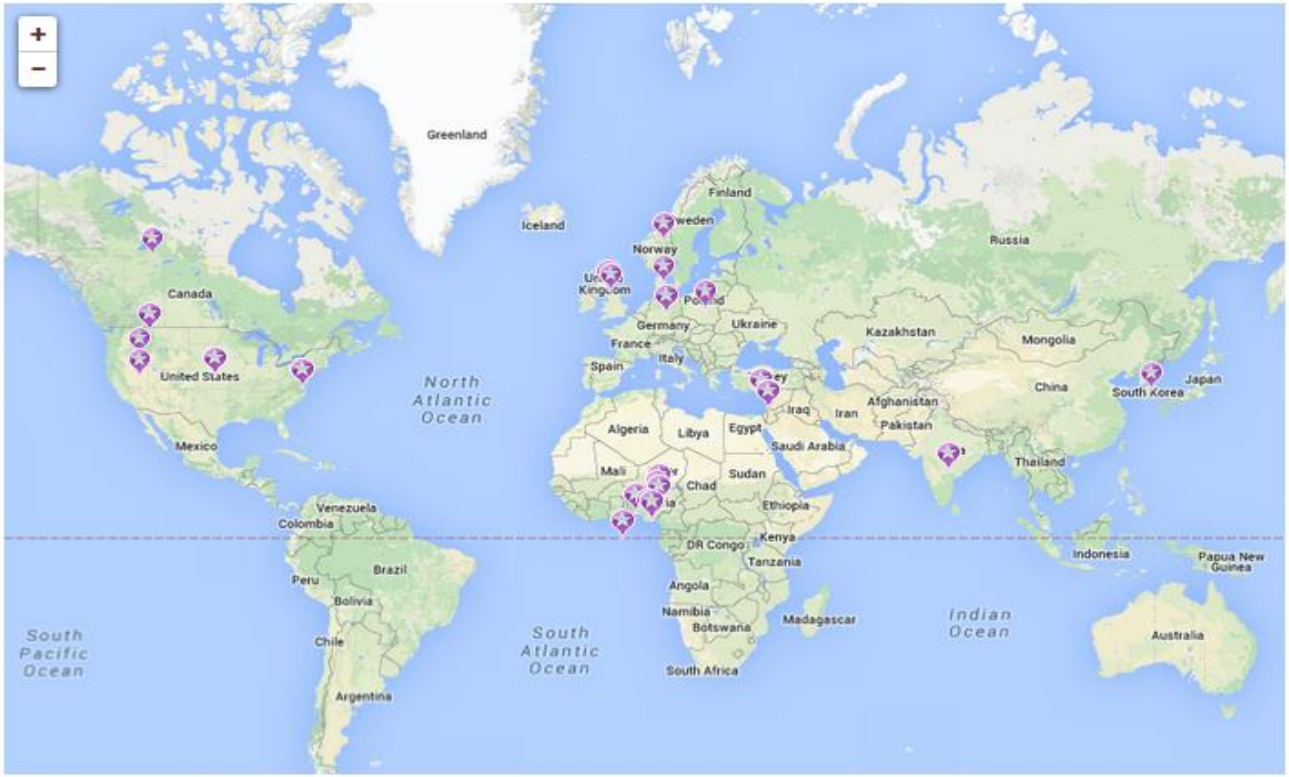
LUMPY SKIN - Emerging Issue CYPRUS Dec 2104

Foot and mouth disease in South Korea

Equine Herpes Virus spreading?

View all

Latest articles



Articles listed by publish date.

- 2015-02-01 LSD vaccines against diseases will be provided
- 2015-01-31 Study models FMD vaccine strategies - American Veterinary Medical Association
- 2015-01-31 canada says husband of woman diagnosed with avian flu also infected
- 2015-01-31 Nevada confirms avian flu case - Reno Gazette Journal
- 2015-01-30 FEATURE-Road-kill deer get mulched as US states turn to composting - Reuters
- 2015-01-29 Danish Pig Industry Adapting to New Challenges - ThePigSite.com

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Username *

markab@unimelb.

Password *

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Log in

Issues

Brown Marmorated Stink Bug in the USA

The Drosophila suzukii threat to grapes in Europe

Northern Australia - Cucumber mosaic virus outbreak 2014-15

Africa - Cassava brown streak disease getting

Latest articles

Articles listed by publish date.

- 2015-02-01 GWSS Detection Program News
- 2015-02-01 Comments to "Xylella fastidiosa:" Next week declared a state of calamity "
- 2015-01-31 Early detection device developed for catastrophic citrus tree greening disease - Daily Mail
- 2015-01-31 Citrus quarantine in Fresno County - The Packer
- 2015-01-30 NT teams work to wipe out virus crippling banana industry - 9news.com.au

Plant Health

IBIS | Aquatic Animal Health | Terrestrial Animal Health

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By joining the
to more featu
back to the ne
own topics to
network, use
administrator
possible.

www.planthealth.org

User login

Username *
markab@unimelb.

Password *
••••••••

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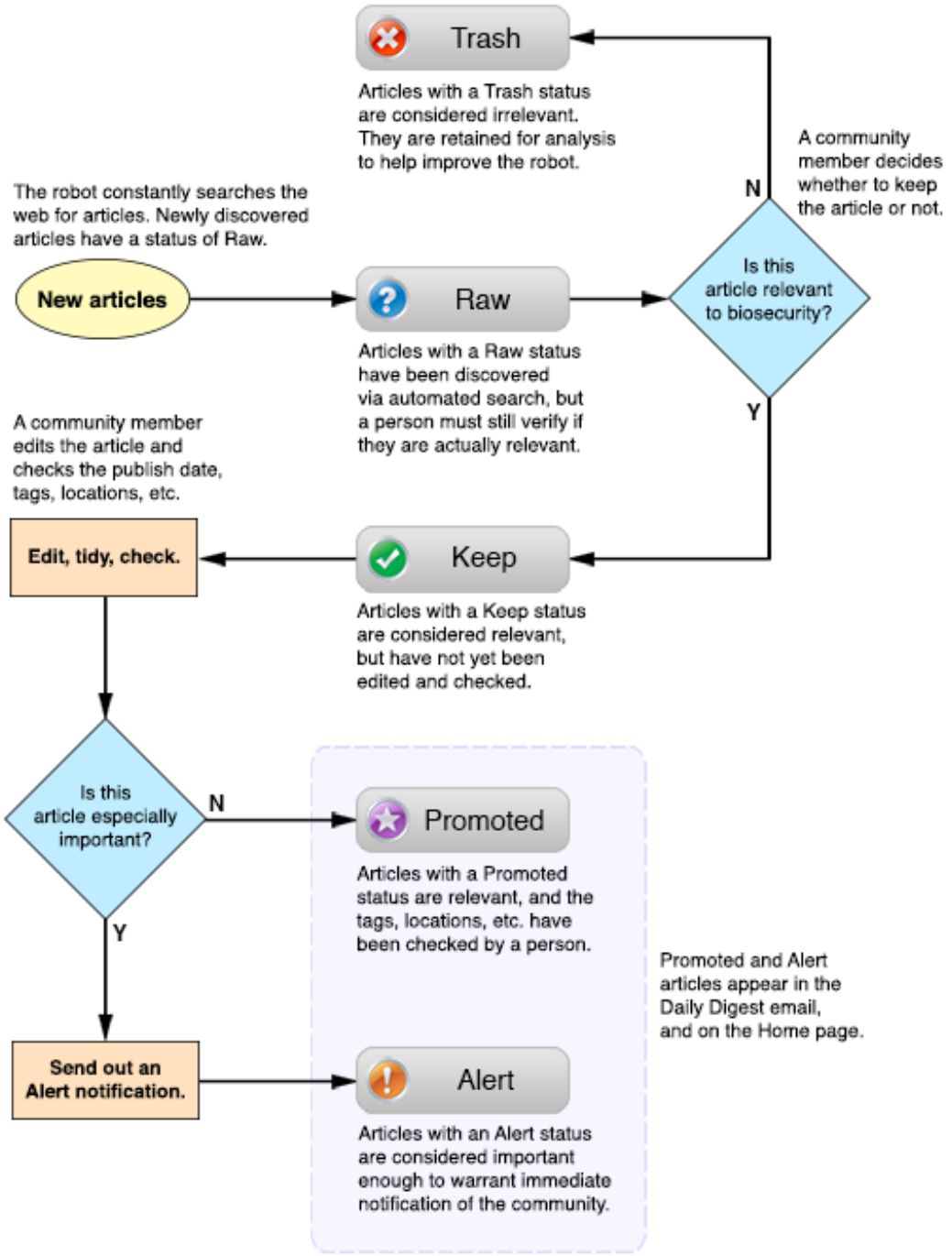
Workflow



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Some of the search sources

- Google: news, blogs, web, scholar
- Microsoft academic
- News sources: CIDRAP
- Journals: e.g. Emerging infectious diseases
- OIE alerts, ProMED, UC Davis FMD news
- Social media: Twitter

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Article publication process

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Diversity and Distributions, (Diversity Distrib.) (2013) 19, 640–650

BIODIVERSITY RESEARCH

Using internet intelligence to manage biosecurity risks: a case study for aquatic animal health

Aidan Lyon[1]*, Geoff Grossel[2], Mark Burgman[3] and Mike Nunn[2]

[1]Department of Philosophy, University of Maryland, College Park, MD, USA, [2]Department of Agriculture, Fisheries and Forestry, Animal Biosecurity, Canberra, ACT, Australia, [3]School of Botany, University of Melbourne, Parkville, Vic, Australia

ABSTRACT

Aim AquaticHealth.net is an open-source aquatic biosecurity intelligence gathering and analysis application. The system collects information in much the same way as other similar systems (e.g. HealthMap, BioCaster). However, the information collected undergoes minimal automated analysis, and analysis is largely left to AquaticHealth.net's users. The result is an automated system of intelligence gathering, combined with a manual system of intelligence analysis. This approach relies on a large number of users, and so AquaticHealth.net relies on an open-intelligence analysis method: any user can publish their own analyses for all to see and analyse further. By combining automated data collection and human analysis, AquaticHealth.net will provide fast and accurate forecasts, accompanied with nuanced explanations. These methods can be applied to other areas of biosecurity and disease surveillance.

Lyon et al. (2013) Div. Distrib. 19, 640-650.

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Challenges for the future

- Developing and maintaining an engaged user community
- Dealing with inaccurate material
  - Current approach: promote comment and discussion
- Social media: can we find the relevant information?
  - Do people 'tweet' relevant biosecurity information?
- Search engine optimisation
- Site performance
- Turning intelligence into action

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Questions?

Thanks to

- Geoff Grossel
- Aidan Lyon
- Sam Hamilton
- Neil Grant
- Simone Tolson
- Andrew Cupit
- Andrew Robinson
- Shaun Moss
- Josh Lee
- Justin Trefry
- And many others…