Maps and models in One Health: using ArcGIS as a tool to understand pathogen transmission in coastal California

Liz VanWormer, University of California, Davis, One Health Institute
Family members of the Orlando MERS patient have also been placed in home isolation and are awaiting test results, officials said. Another 500 people who shared three U.S.-bound flights with him have also been contacted.

The latest MERS scare comes two weeks after an American man was hospitalized with symptoms of the respiratory virus in Indiana. The man, whose name has not been released, was also working as a healthcare provider in Saudi Arabia before traveling by plane to London and Chicago and by bus to Munster, Indiana. He was discharged from the hospital Friday in what health officials hoped would mark the end of MERS in the U.S.
Although fruit bats are considered possible natural hosts of the Ebola virus, direct transmission to humans is rare. However, animals that may eat fruit dropped by infected bats, like chimps and gorillas, have been linked to spreading the disease in communities that eat them.

Source: International Union for Conservation of Nature and Natural Resources (IUCN); World Wide Fund for Nature (WWF); World Health Organization

Map showing the range of fruit bats, chimps, and gorillas in Africa, all linked to spreading the Ebola virus in communities that eat them. Reuters.

**Ebola map shows people in more African regions risk infection from animals**

By Reuters Media on Sep 8, 2014 at 10:02 a.m.

http://www.brainerddispatch.com/content/ebola-map-shows-people-more-african-regions-risk-infection-animals
Maps and models in One Health: using ArcGIS as a tool to understand pathogen transmission in coastal California
A parasite carried by cats is killing off sea otters, a veterinary specialist has told a major US science conference.

The Californian researcher has called for owners to keep their cats indoors.

Cat faeces carrying Toxoplasma parasites wash into US waterways and then into the sea where they can contaminate the otters, causing brain disease.

The parasite is familiar to medical researchers, as it can damage human foetuses when expectant mothers become infected while changing cat litter.

The most likely source of infection for sea otters is the parasite's tough egg-like stage, known as the oocyst, which is passed in the faeces of cats.

"We need to control the infections in sea otters and reduce the risk to humans by managing our cats more responsibly," said the study author Patricia Conrad of the Wildlife Health Center at the University of California, Davis.
Toxoplasma gondii: Human and Animal Health Consequences

- Role of immune function
- Acute infection during pregnancy
- Waterborne outbreaks
- Wildlife species mortality
- Atypical strains
- Behavior changes in people and animals
Domestic and wild felids contribute to terrestrial oocyst burden and marine parasite loading.
Modeling oocyst loading and transport from land to sea
Modeling wild and domestic felid terrestrial oocyst loading
Pet cats
Developing a model of oocyst loading in the coastal environment
Census blocks and Land use data
- Animals per 30 x 30m grid cells

Oocyst shedding
- Oocysts per grid cell
Modeling oocyst transport in freshwater runoff
Modeling oocyst transport in freshwater runoff
By combining domestic cat and wild felid oocyst loading models with hydrology runoff models, we can simulate the movement of oocysts from land to sea.

Less precipitation is required to move oocysts in red-shaded areas to the ocean than those in the blue regions.
The total load of oocysts delivered to the ocean and the contributions of domestic cats and wild felids vary among watersheds bordering the sea otter range.
How do coastal development and precipitation influence pathogen flow from terrestrial to aquatic environments?
Coastal development and increased precipitation enhance oocyst delivery to the ocean.
ANIMAL

HUMAN

ANIMAL

ECOSYSTEM

Additional One Health Resources:

http://www.onehealthinitiative.com/

http://www.cdc.gov/onehealth/index.html


https://www.avma.org/KB/Resources/Reference/Pages/One-Health.aspx

http://www.oie.int/for-the-media/onehealth/
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ArcGIS maps and models are essential tools for exploring health at the human-animal-environment interface

Human-driven coastal development and precipitation have the potential to accelerate pathogen flow from land to sea

evanwormer@ucdavis.edu
or
liz.vanwormer@unl.edu