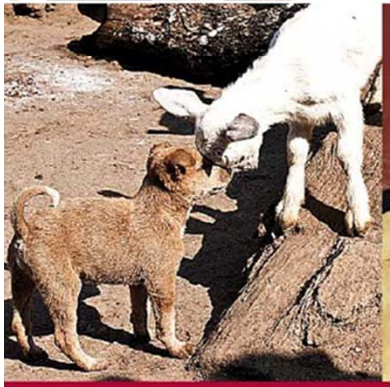
# Conference on Rift Valley Fever
# Challenge, Prevention and Control

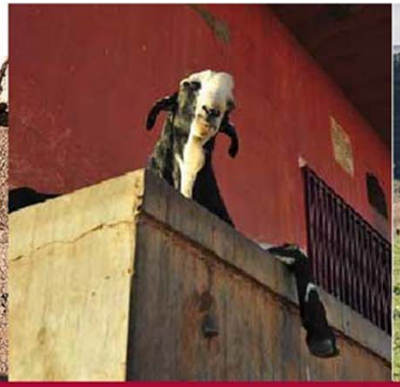
**13-15 November 2012**

Mombasa (Kenya)

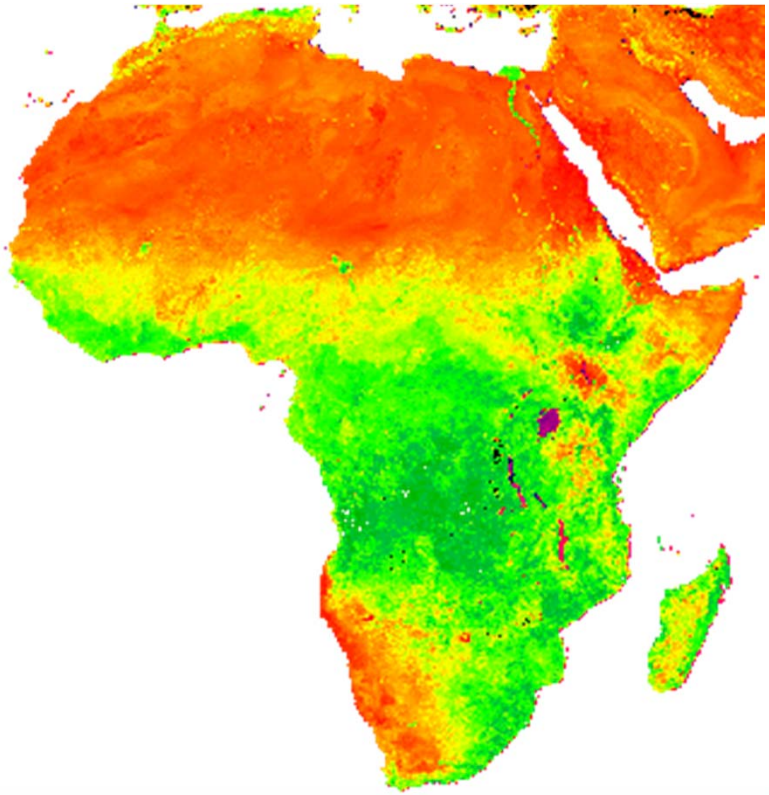
GF-TADs

GLOBAL FRAMEWORK FOR THE PROGRESSIVE CONTROL OF TRANSBOUNDARY ANIMAL DISEASES





# Existing Early Warning Systems and risk assessment tools: prospects and challenges for better forecasting Rift Valley Fever



Vincent Martin

FAO EMPRES Animal Health

# Epidemiological context and current trends, a changing pattern?

- Growing concern of geographical spread (Middle East and European Union countries)
- Inter-epizootic period: More frequent RVF events (combination of increased awareness, surveillance and climate change?)
- 2012: abnormal weather conditions across western and eastern Africa leading to increased risk

# Current Epidemiological context and t

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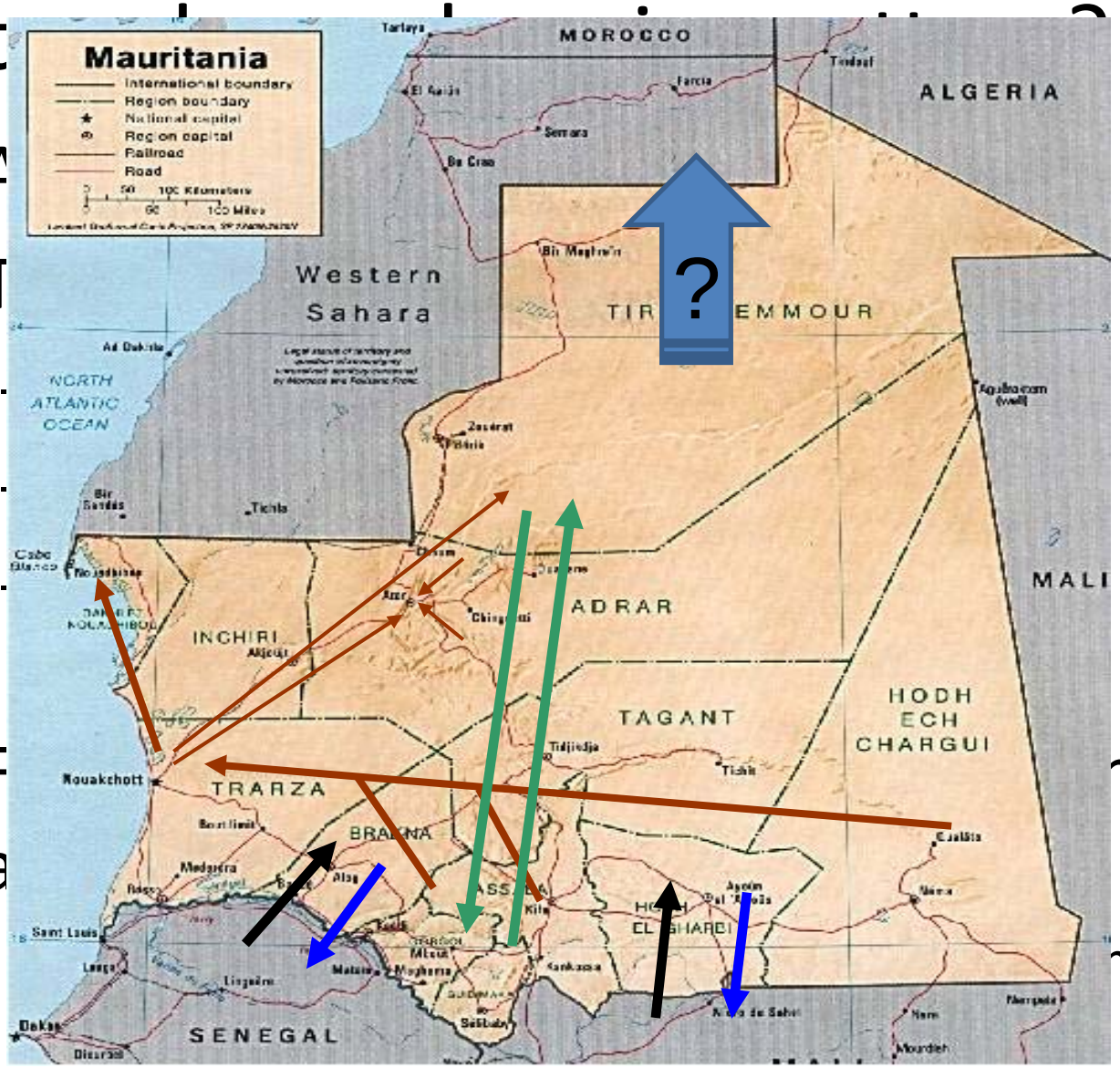


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# Early Warning Systems

- Early warning systems represent the whole body of knowledge developed to anticipate the emergence of a specific risk in order to mitigate its impact on a given community or population
- The aim of an EWS is to provide information on occurring hazards that might evolve into disasters unless early response is undertaken. The objective of EWS thus is to monitor the first signs of emerging hazards in order to be able to trigger early and appropriate responses to these first signs and thus reduce or mitigate disaster risk.

# EWS, Climate and RVF

Arthropod vectors are sensitive to climate (affect birth, death and migration rates):

- temperature
- humidity
- rainfall

RVF epidemics have been linked with

- El Niño cycle
- Rainfall
- temperature

# Monitoring pre-epidemic conditions

## What can we monitor ?

| Factors | Options for monitoring |
|---|---|
| Disease epidemiology and ecology | Historical data, agro-ecological features |
| * Climatic conditions | Rainfall, Temperature, vegetation coverage, etc |
| * Viral activity and population immunity | Sentinel herd monitoring, field investigations |
| * Vector dynamic | Mosquito capture, modelling |
| Clinical cases | Disease reports |

# Monitoring pre-epidemic conditions / Prerequesite

2. Identify indicators to monitor and detect these conditions

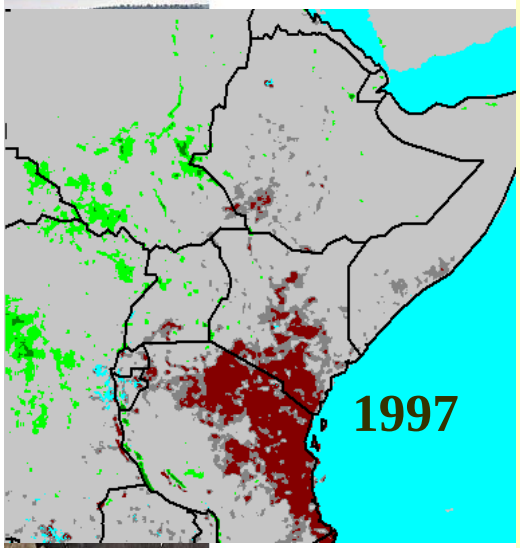
3. Predictors should be highly associated (i.e. occur most of the time when epidemics occur)

4. Predictors should be specific (tend not to occur when outbreaks aren't seen)

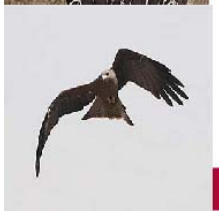
5. Must be able to be monitored cost effectively



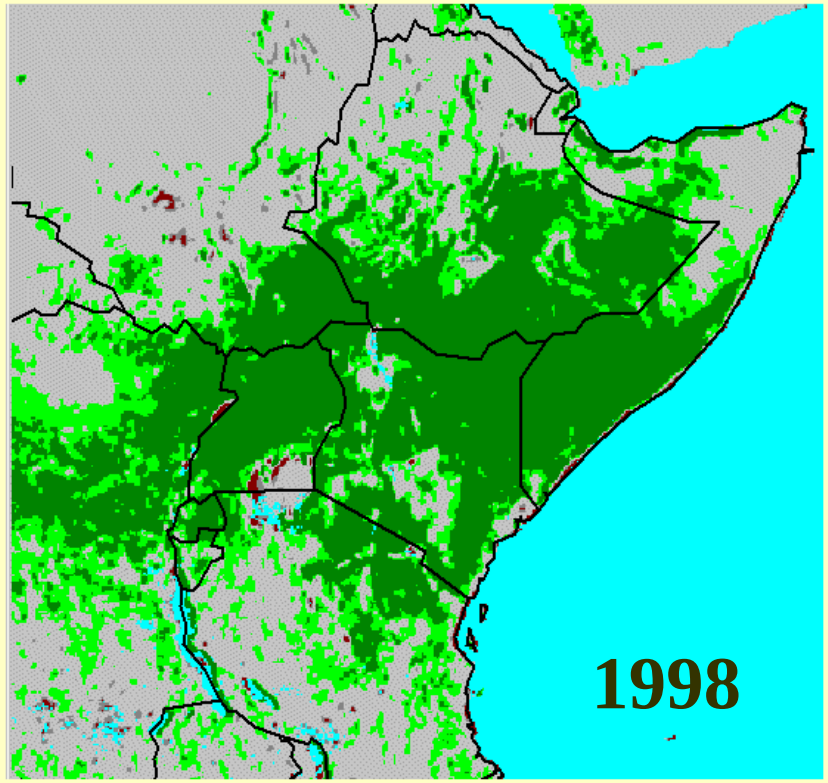
# Vegetation index

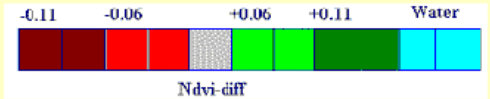


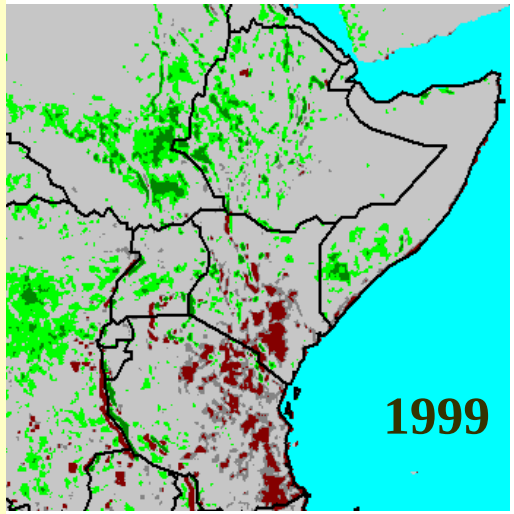


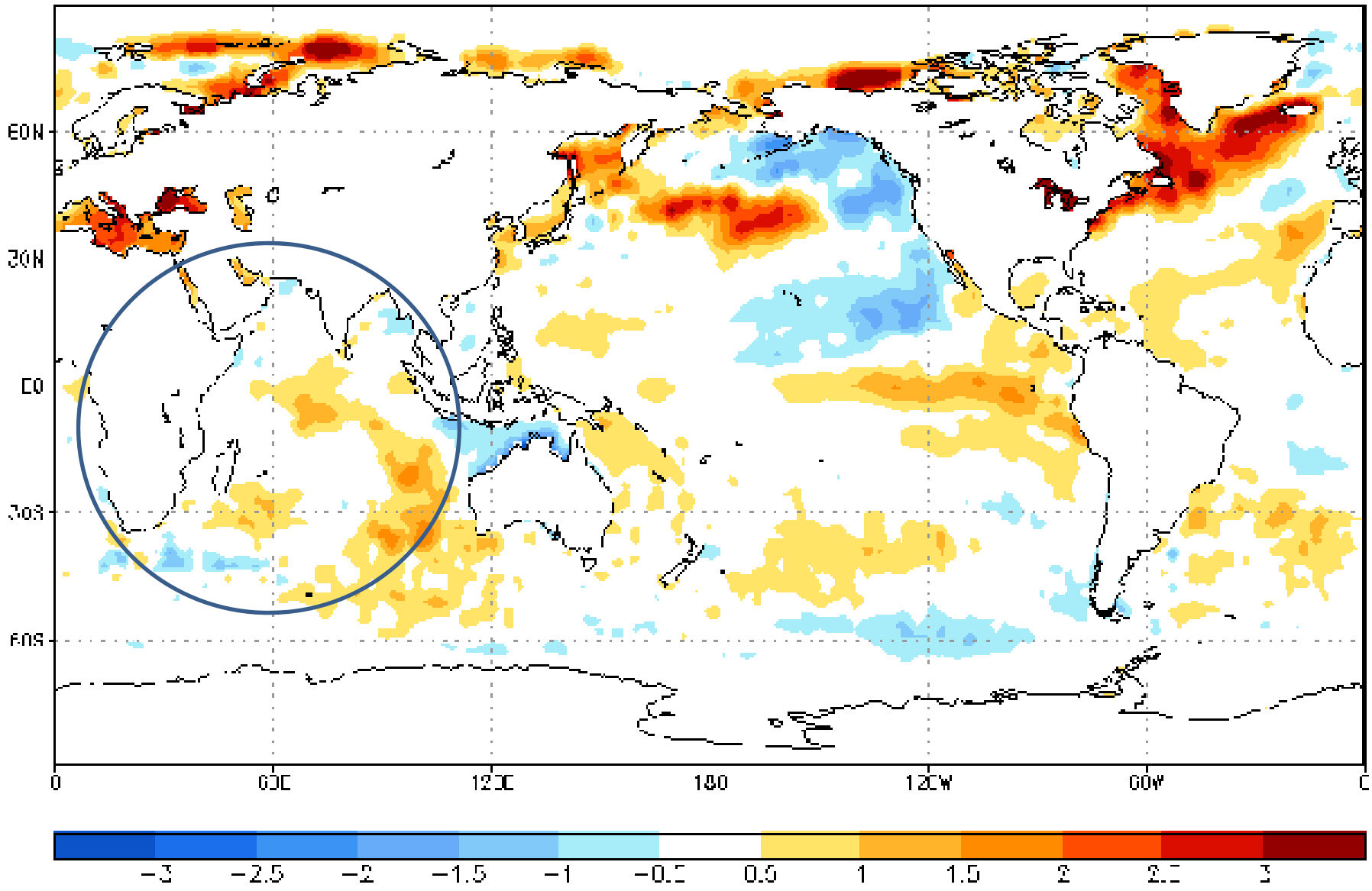


Normalized difference vegetation index (NDVI)
Difference between January 1998 and average NDVI value

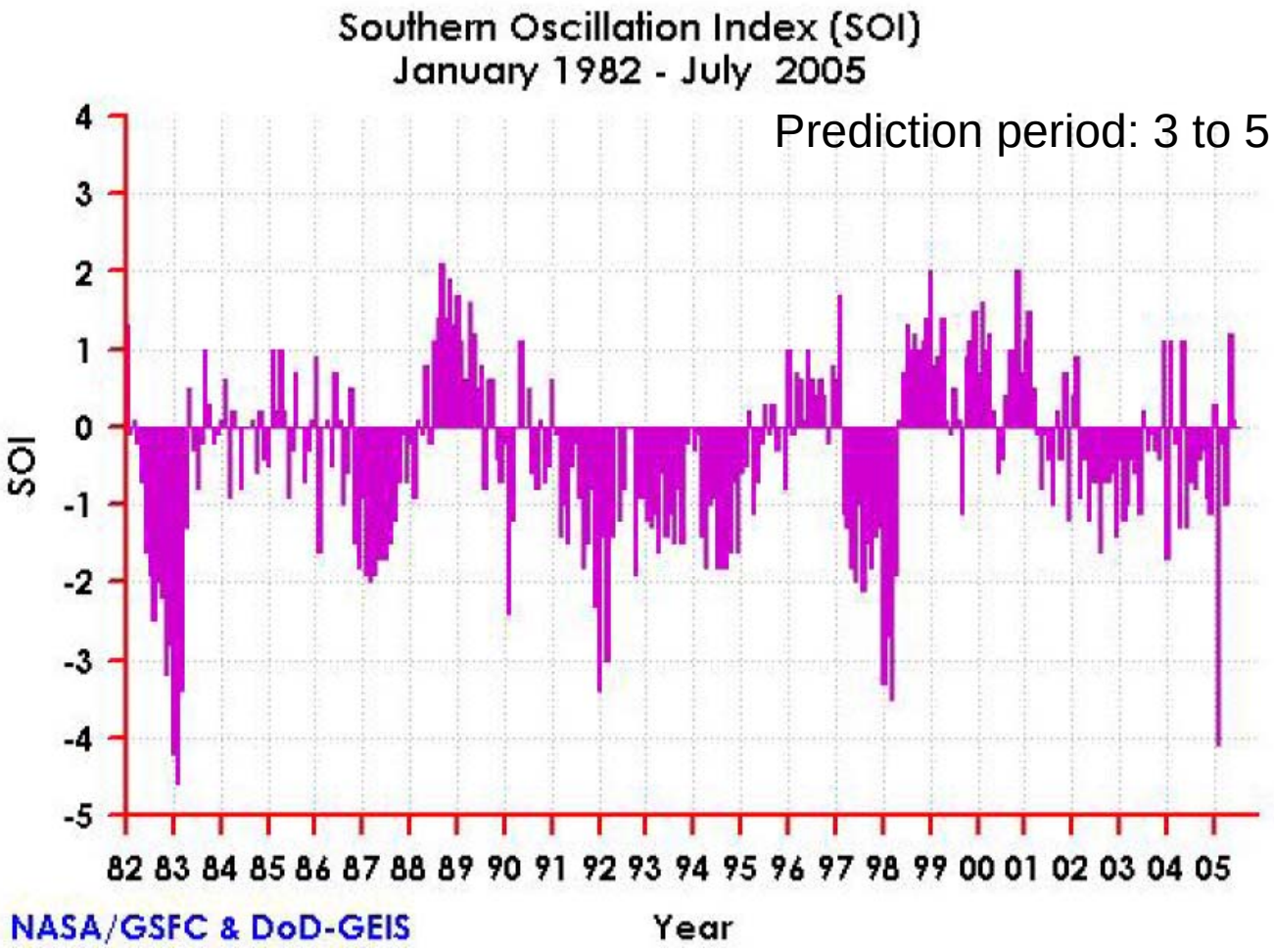



July 2012 Sea Surface Temperature Anomalies (Reynolds OI.v2)
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
−3
−2.5
−2
−1.5
−1
−0.5
0.5
1
1.5
2
2.5
3

# El Niño - SOI




Prediction period: 3 to 5 months

*Linthicum et al. Nature, 1999*

# Issues and challenges

- Epidemics at irregular intervals (5–20 years)
- Climate change and impact on disease distribution and range
- Surveillance and awareness tend to decrease after few years, so as funding for RVF EWS
- Lack of specificity of Remote sensing Global regional RVF Early Warning Systems

# Issues and challenges

- Epidemiological understanding, outside of the HoA is growing but remains limited
- Passive surveillance: detection difficult - Non specific clinical signs (abortions small ruminants)
- National Veterinary Services -capacity to monitor, interpret results of RA and respond following a trigger remains limited
- Which strategy with  which vaccines?

# Perspectives

- Regional/national seasonal remote sensing RVF prediction capacity is needed:
  - Low cost technology, reduce field activities
  - Better resource management and cost-effective intervention
  - Combined with other existing regional Early Warning Systems

# Perspectives: exploring new modeling techniques

FAO/Oxford collaboration on RVF modeling

- Primary and secondary foci

- Non-linear discriminant analysis approach was used, with data for presence and pseudo-absence points divided into three clusters each

- Rainfall variables defined Primary RVF areas, with WORLDCLIM mean rainfall (derived from meteorological station data) consistently chosen as the top variable, followed by CMORPH mean rainfall (a satellite derived variable).

# Perspectives: exploring new modeling techniques

- Proximity to seasonal water sources was also among the top ranked variables. **In contrast, irrigation was the top ranked variable for Secondary RVF areas, followed by the CMORPH mean**.

- In general neither livestock nor human population density appeared particularly important amongst the very top variables, although sheep density was in the top ten variable list for Endemic RVF and human population density in the top ten for Secondary RVF.

- Overall: the great importance of irrigation in sustaining RVF across the region

*NB: CMORPH (CPC MORPHing technique) produces global precipitation analyses at very high spatial and temporal resolution – from National Oceanic and Atmospheric Administration (NOAA)*

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Primary outbreaks

N
W
E
S

Decimal Degrees
0 3 6 12 18 24

GF-TADs
GLOBAL FRAMEWORK FOR THE PROGRESSIVE CONTROL OF TRANSBOUNDARY ANIMAL DISEASES
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Secondary outbreaks

N
W
E
S

Decimal Degrees
0 3 6 12 18 24

# Social Network Analysis: Trade and RVF dissemination in Madagascar Highlands

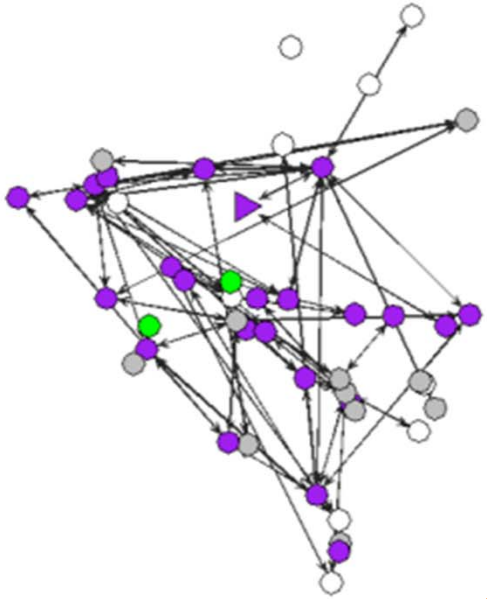

*Figure 5: Kapsile network*

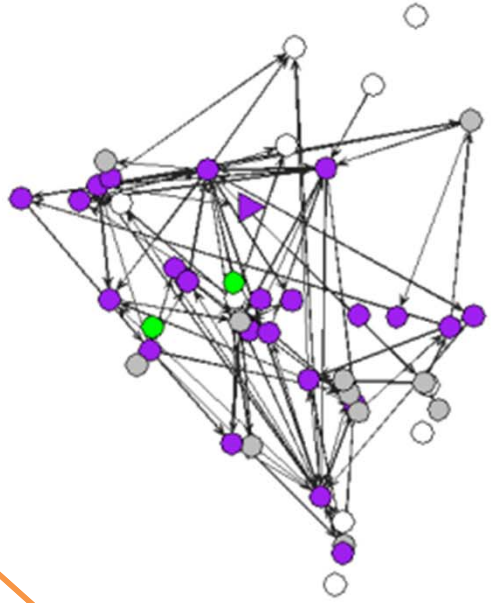

*Figure 6: Réseau d'achats/ventes*

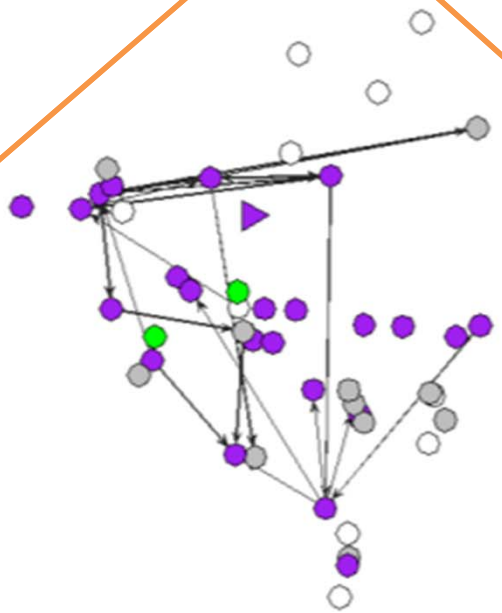

*Figure 7: Les liens communs*

**Vert** = Pas d'infection
**Violet** = Infecté en 2009 et 2010
**Gris** = Infecté en 2009 mais pas en 2010
**Blanc** = Abs de données

Corrélation* (0.22; p<0,0001)

G. Nicolas et al, Acta Tropica, 2012)

# Perspectives: exploring new modeling techniques: **MCDA**

Multi Criteria Decision Analysis (MCDA) : a process that “transforms and combines **geographical data** and **expert opinion** to obtain appropriate and useful information for decision making”

=> Appropriate for a first assessment when few data are available

1. Factor (criteria) selection
   - Definition
   - Raw data transformation
   - Standardisation

2. Factor aggregation
   - Decision rules to explicitly represent the epidemiological cycle
   - Weights representing the relative importance of each factor in the transmission process

3. Sensitivity analysis and validation

# Conclusion

- Continue exploration of new avenues for EWS
- Regionalization of the prediction to match variety of ecological systems
- Articulation with sound response Strategy is needed
- One of the best OH candidates for a “system-perspective” and Ecosystem health approach
- Integrated approach to small ruminant health, including through the use of combined vaccination
-

# Conclusion

- Finalize Risk mapping activities (update mask, etc)
- Build on recent success stories:
  - Document the response to RVF epidemics and define GMPs
  - Operational framework for an efficient phased response
  - Basis for putting the OH concept into Action
- Further involvement of GF-TADs (working/study group on RVF?)

# Thank you for your attention