Co-funded by the
Erasmus+ Programme
of the European Union

L'élevage dans les régions aride et semi-aride face aux défis du changement climatique

Mardi 12 Mars 2019

Control of ticks (and tick-borne diseases) with acaricides in the traditional livestock system in Southern province of Zambia: implication on public & environmental health

Daniele De Meneghi, DVM, PhD, dipl. ECVPH
CISAO_UniTo and Dept. Veterinary Science, Università degli Studi di Torino
Campus AgroVet, Grugliasco-Turin (Italy)

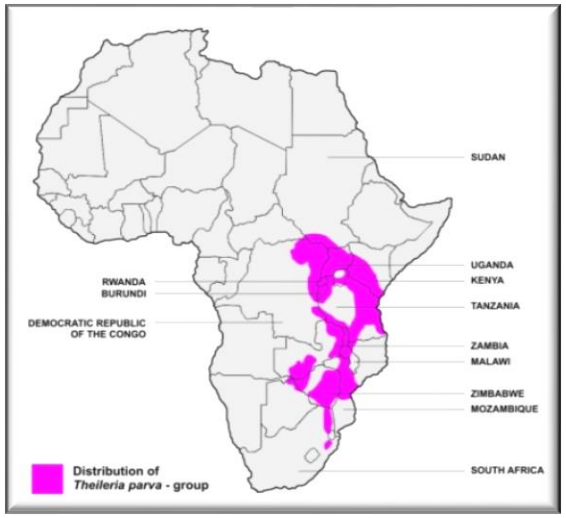
"***Ticks** and **Tick-borne Diseases (TBDs)**, particularly **theileriosis**, and tsetse transmitted trypanosomosis **had and still have more impact on** development of **livestock industry**, **veterinary & public health** infrastructures, **legislation** and **policies**, and **on research** in developing countries (especially **Africa**) than **any other livestock disease**"* (McKosker, 1991; cit. in Norval *et al.*, 1992; **Minjauw & McLeod**, 2003)

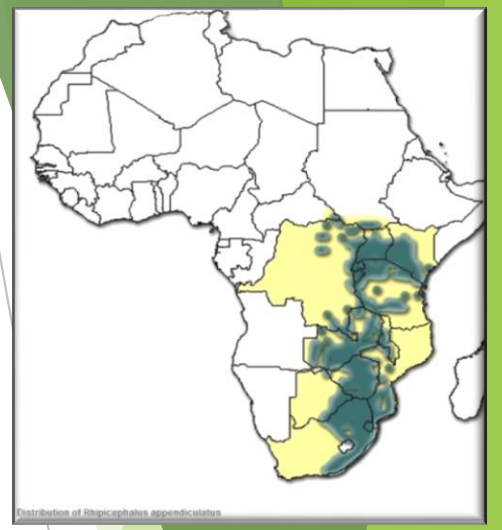
- TBDs affect about 80% of the world cattle population, especially in the (sub-)tropics (Minjauw & McLeod, 2003)
- TBDs are considered (one of) the most important problem in animal health in Africa (Norval *et al*, 1992; Minjauw & McLeod, 2003)
- The estimated annual global costs associated with ticks & TBDs in cattle amount to US$ 13.9 - 18.7 billions (de Castro, 1997)
- Average financial losses (production losses plus control costs) per animal/per year are estimated at USD $7.3 (FAO, 2004)

Major TBDs in Africa

- **Theileriosis-East Coast Fever**

(*Theileria parva* complex) --> *Rhipicephalus appendiculatus*, *R.zambesiensis*

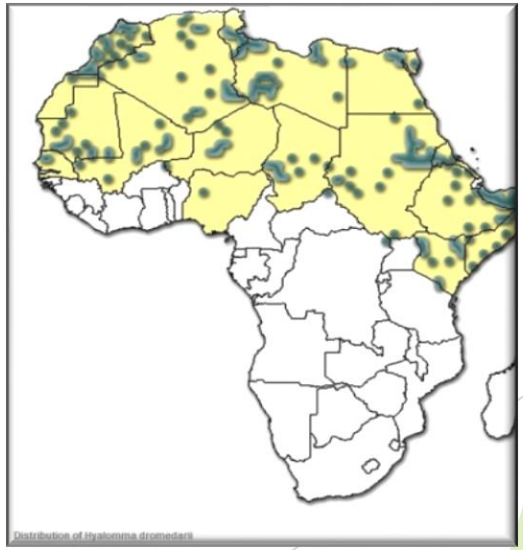


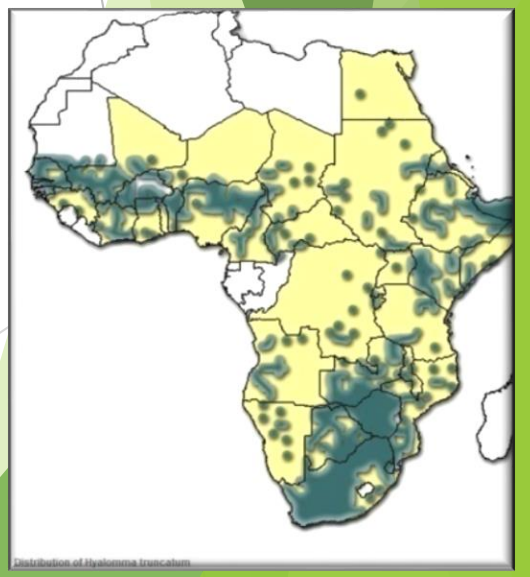


- **Mediterranean/Tropical Theileriosis**

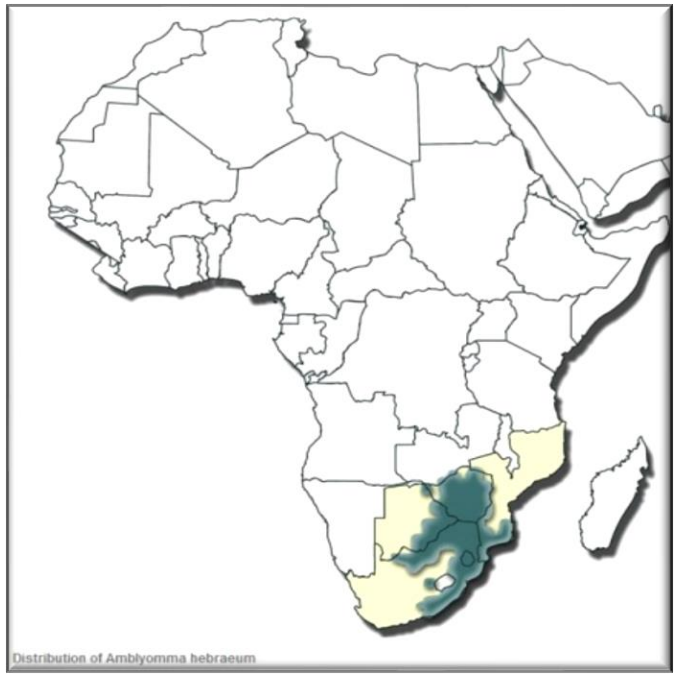
(*Theileria annulata)* --> *Hyalomma* spp. (*H. dromedari*, *H.truncatum)*

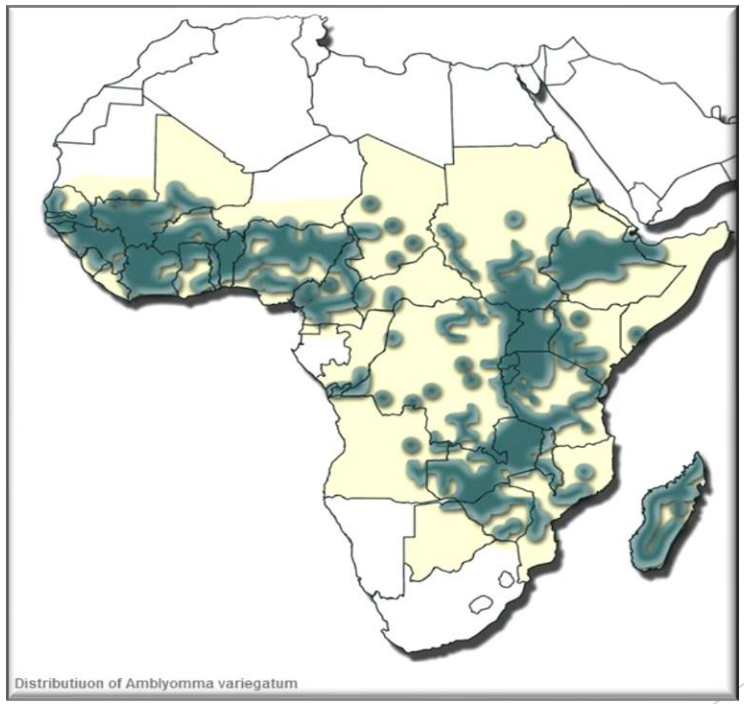
→ *Hyalomma* ticks: important role in CCHF transmission

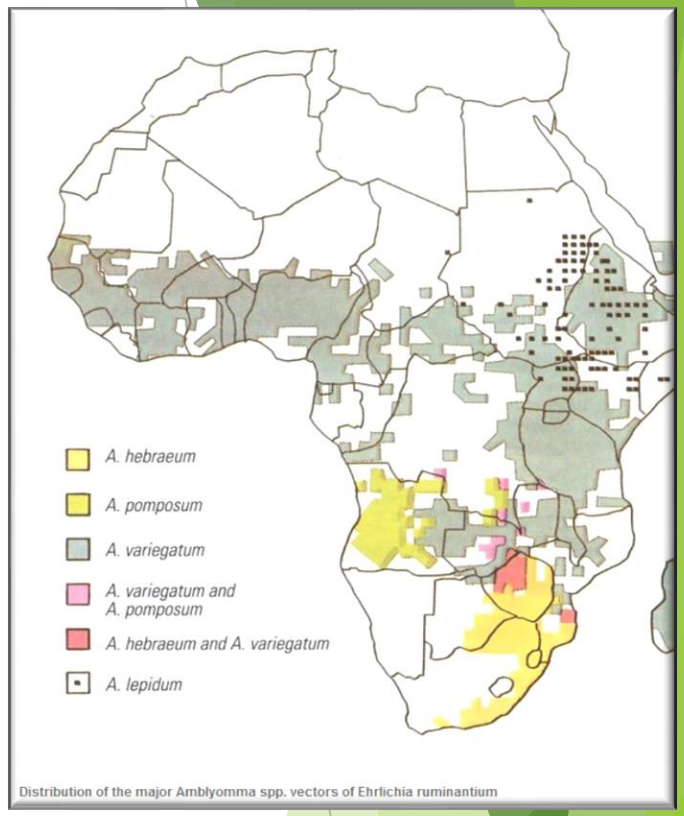




- **Cowdriosi-Heartwater** [Ehrlichia (*Cowdria*) *ruminantium*] --> *Amblyomma variegatum*, also other **theileriosis** (mainly benign); *A.variegatum* ticks → predisposing factor/mechanical vectors of **dermatophilosis/ streptotricosis**

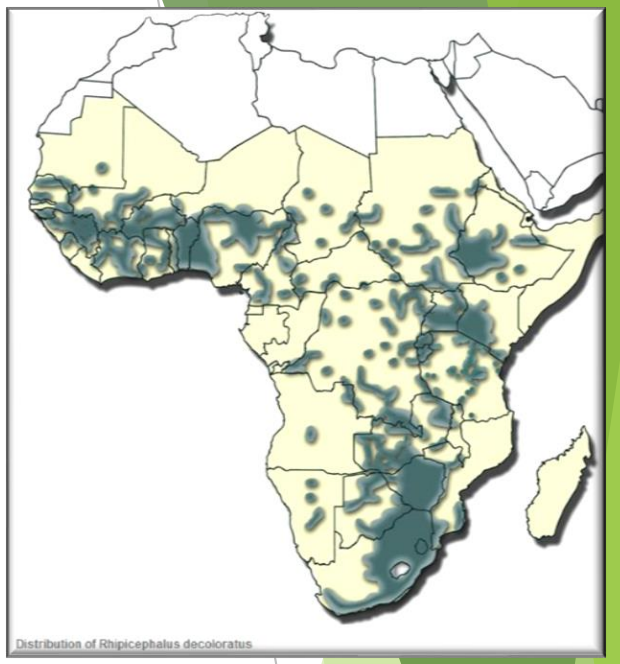


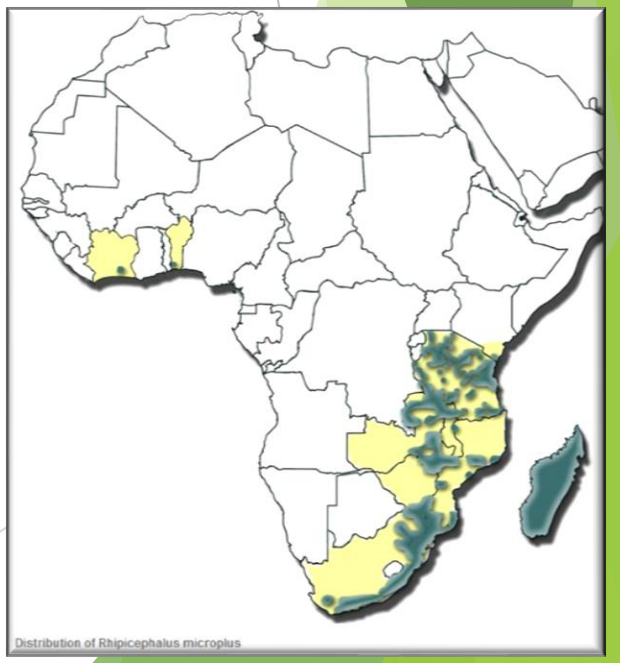




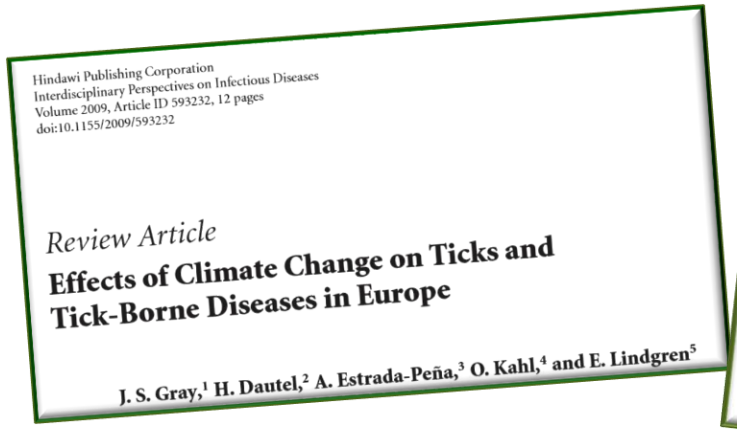
•**Anaplasmosi-Gallsickness** (*Anaplasma marginale*, *A. centrale) --> Rhipicephalus* (*Boophilus) annulatus*, *R. microplus*, *R. decoloratus*

• **Babesiosi-Redwater** (*Babesia bovis*, *B.bigemina*) --> *Rhipicephalus* (*Boophilus)* spp.; in Europe (Northern/temperate) → *B. divergens*; in Eurasia-Magreb → *B.major*





Ticks and TBDs and Climate Change (CC)

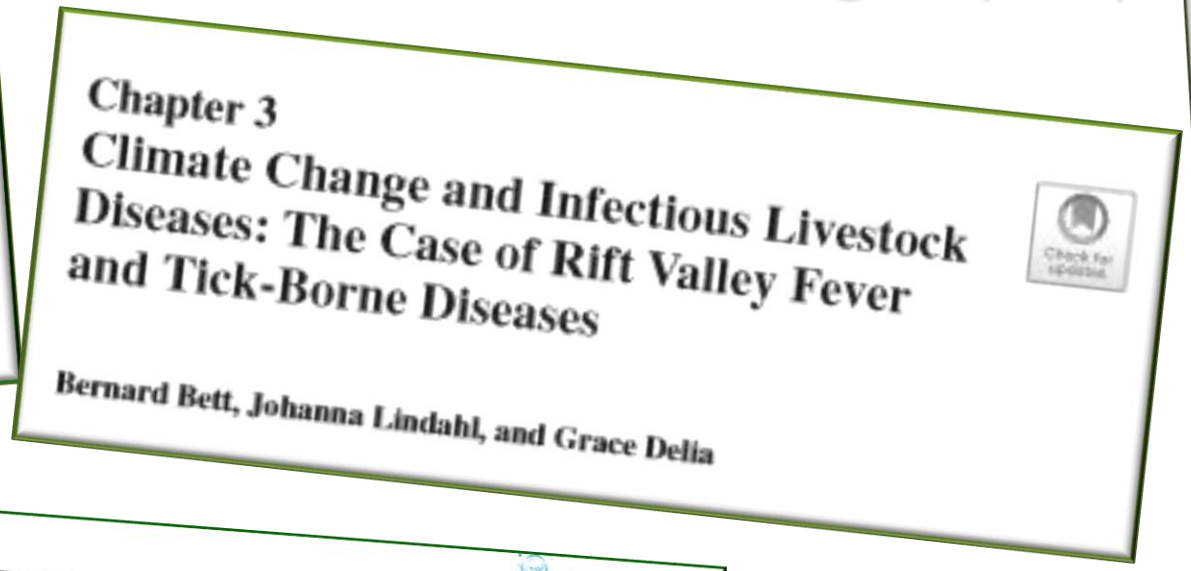


Hindawi Publishing Corporation
Interdisciplinary Perspectives on Infectious Diseases
Volume 2009, Article ID 593232, 12 pages
doi:10.1155/2009/593232

Review Article

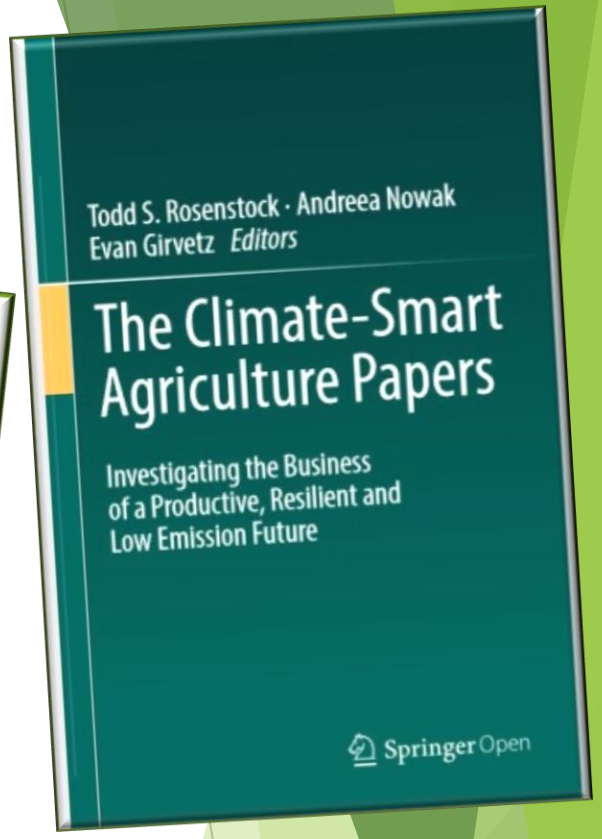
Effects of Climate Change on Ticks and Tick-Borne Diseases in Europe

J. S. Gray,[1] H. Dautel,[2] A. Estrada-Peña,[3] O. Kahl,[4] and E. Lindgren[5]



Chapter 3
Climate Change and Infectious Livestock Diseases: The Case of Rift Valley Fever and Tick-Borne Diseases

Bernard Bett, Johanna Lindahl, and Grace Delia

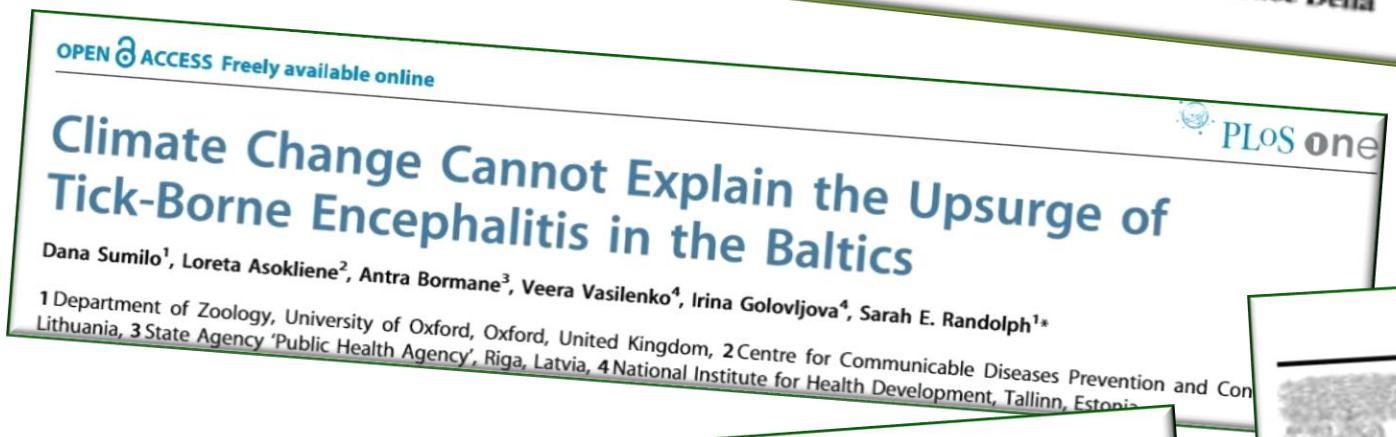


Todd S. Rosenstock · Andreea Nowak
Evan Girvetz *Editors*

The Climate-Smart Agriculture Papers

Investigating the Business of a Productive, Resilient and Low Emission Future

Springer Open



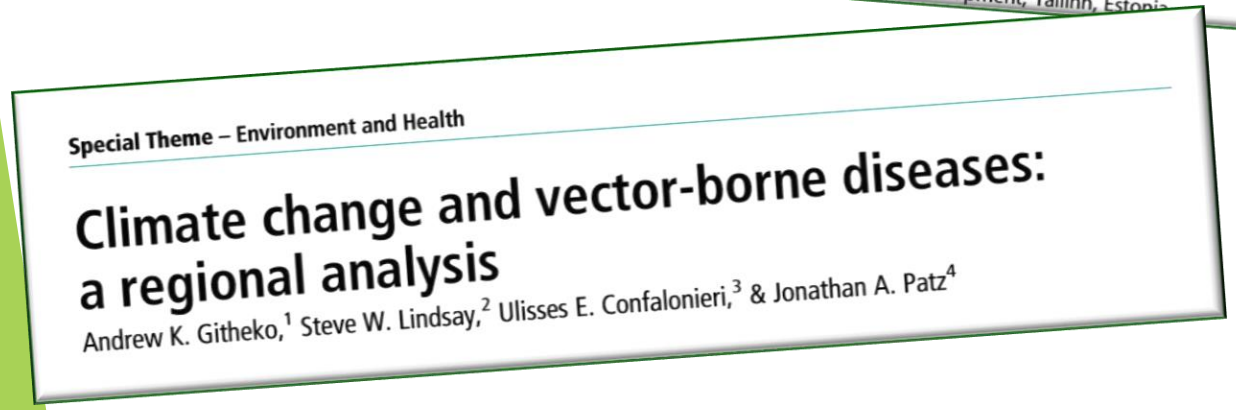
OPEN ACCESS Freely available online

PLoS one

Climate Change Cannot Explain the Upsurge of Tick-Borne Encephalitis in the Baltics

Dana Sumilo[1], Loreta Asokliene[2], Antra Bormane[3], Veera Vasilenko[4], Irina Golovljova[4], Sarah E. Randolph[1]*

1 Department of Zoology, University of Oxford, Oxford, United Kingdom, 2 Centre for Communicable Diseases Prevention and Con
Lithuania, 3 State Agency 'Public Health Agency', Riga, Latvia, 4 National Institute for Health Development, Tallinn, Estonia



Special Theme – Environment and Health

Climate change and vector-borne diseases: a regional analysis

Andrew K. Githeko,[1] Steve W. Lindsay,[2] Ulisses E. Confalonieri,[3] & Jonathan A. Patz[4]

International Journal for Parasitology: Parasites and Wildlife 4 (2015) 452–461

Contents lists available at ScienceDirect

International Journal for Parasitology: Parasites and Wildlife

journal homepage: www.elsevier.com/locate/ijppaw

ELSEVIER

Climate change, biodiversity, ticks and tick-borne diseases: The butterfly effect

Filipe Dantas-Torres [a, b, *]

[a] Department of Immunology, Aggeu Magalhães Research Centre, Oswaldo Cruz Foundation, 50740465 Recife, Pernambuco, Brazil
[b] Department of Veterinary Medicine, University of Bari, 70010 Valenzano, Italy

Co-funded by the
Erasmus+ Programme
of the European Union

Climate change (CC) and rise of temperature have the **potential to expand** the **geographical range** of about **50% of tick species** (especially in Northern countries)

CC will cause **local shifts in geographical ranges** of **most vectors** and **VBDs** → 2 distinct processes: in **hot/dry areas** >> rainfall & humidity would promote >> survival rates of vectors; in **cool/wet areas** >> temperatures would allow overwintering of vectors.

CC would affect **transmission patterns** of infectious **diseases** in **multiple ways**, including **lowering** the **effectiveness of existing intervention strategies**.

Development rate of **most arthropods increases** with **temperature**, leading to a **change in population dynamics** → the present **vector control measures (i.e. by acaricides)** might **need to be reviewed.**

Relationships between **CC &TBDs** is **not uniform** across **regions** & **tick species**; ticks **response to CC** & hosts density can be **extremely variable**; complex **ecological processes** make TBDs **difficult** (if not impossible) **to be predicted** on a long term; many **interdependent variables** and **complex tick-host-pathogen dynamics** may trigger the so called … ***"butterfly effect"***


OPEN ACCESS Freely available online PLOS one

Climate Change Cannot Explain the Upsurge of Tick-Borne Encephalitis in the Baltics

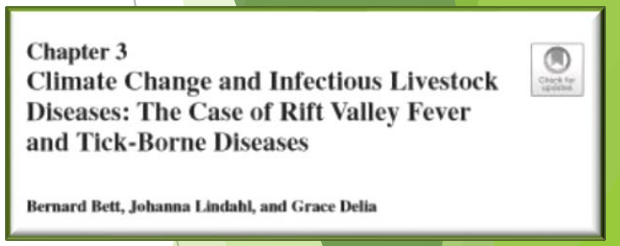
Dana Sumilo, Loreta Asokliene, Antra Bormane, Veera Vasilenko, Irina Golovljova, Sarah E. Randolph


Hindawi Publishing Corporation
Interdisciplinary Perspectives on Infectious Diseases
Volume 2009, Article ID 593232, 12 pages
doi:10.1155/2009/593232

Review Article

Effects of Climate Change on Ticks and Tick-Borne Diseases in Europe

J. S. Gray, H. Dautel, A. Estrada-Peña, O. Kahl, and E. Lindgren


Chapter 3

Climate Change and Infectious Livestock Diseases: The Case of Rift Valley Fever and Tick-Borne Diseases

Bernard Bett, Johanna Lindahl, and Grace Delia


Special Theme – Environment and Health

Climate change and vector-borne diseases: a regional analysis

Andrew K. Githeko, Steve W. Lindsay, Ulisses E. Confalonieri & Jonathan A. Patz


International Journal for Parasitology: Parasites and Wildlife

Climate change, biodiversity, ticks and tick-borne diseases: The butterfly effect

Filipe Dantas-Torres

…TICKS & TBDs ARE A SERIOUS PROBLEM FOR LIVESTOCK PRODUCTION, ANIMAL HEALTH & PUBLIC HEALTH … HOW TO CONTROL?

Main Control Methods of Ticks & TBDs

chemical control (for ticks)

- Dipping (in DTs) → intensive, strategic, threshold regimes)
- Spray race
- Hand spray
- Foot-bath (*pediluve acaricide*)
- Pour-on, spot-on
- Hand-dressing
- Ear-tags, tail decoys, self-applicators
- Ruminal boluses, etc.

Main Control Methods of Ticks & TBD (cont.)

chemical control - types/classes of acaricides

- **Organophosforous-OPs** (chlorphenvinfos, coumaphos, diazinon, dioxathion)
- **Carbamates** (carbaryl)
- **Pyretroids** (permethrin, decamethrin, deltamethrin, cyhalothrin, cyfluthrin, flumethrin, etc.)
- **Amidines** (amitraz)
- **Macrocyclic Lactones** (ivermectin, moxidectin, doramectin)
- **Benzoyl-phenylurea insecticides** (Fluazuron® → chitin synthesis inibitors)

Main Control Methods of Tick & TBD (cont.)

biological & ecologic control (for ticks)

- Pasture spelling (pasture management, rotation, fencing, ect.);
- Natural acaricides, anti-ticks plants;
- Predation on ticks and parasites/pathogens for ticks;
- Anti-ticks vaccines (→ TICK-GRAD, GAVAC);
- Host resistance/tolerance to ticks;
- Pheromones, sterile male/hybrid mating technique

Main Control Methods of Ticks & TBD (cont.)

control methods for TBDs

- Vaccination → live vaccines (ITM), attenuated, inactivated, recombinant)
- Pharmacologic Treatment (therapy & chemoprophylaxis)

What is the best method? Is there an ideal approach for ticks & TBD control?

«Integrated Ticks & TBDs Control Package»

a sustainable, strategic and integrated approach

Cooperazione Italiana allo Sviluppo

Www.iss.it

A case study: Control of ticks and tick-borne diseases with acaricides in the traditional livestock system in Southern province of Zambia - implication on public & environmental health

- ***Name of the Cooperation programme***: Animal Health Programme in the Republic of Zambia
- ***Sub-programme component / project name***: Control of Malignant Theileriosis in the traditional cattle sector of Southern Province of Zambia
- ***Financing body***: Development Cooperation, Ministry of Foreign Affairs, Rome Italy
- ***Implementing agency***: WHO/FAO/CC/ISS, Rome (Italy), jointly with Dept. Veterinary & Tse-tse Control Services, Ministry of Agriculture, Lusaka (Zambia)
- ***Starting date/project duration***: 1987; 3 yrs + 1 yr extension

Animal Health Programme in the Republic of Zambia

Project area: Southern Province of Zambia (25°10'-28°50' E; 15°14'-18°00' S); 83,000 sqkm; 8 admin. districts; population: 800,000 habitants (1994); 2 distinct ecological zones: *valley* and *plateau*; vegetation cover: *miombo* and *mopane* woodland and pasture/grassland; elevation: 700-1400 m asl.; climate: 3 seasons (hot-dry; warm-wet; cool-dry); rainfall: from 500-600 to 800-900 mm/year

Southern Province
600,000 cattle (1/3 national herd)
Sanga type; Tonga breed
herd size: 30 - 1,000 head
traditional livestock keeping system

grazing on communal land
transhumance to Kafue flats / flooded plains (during dry season)

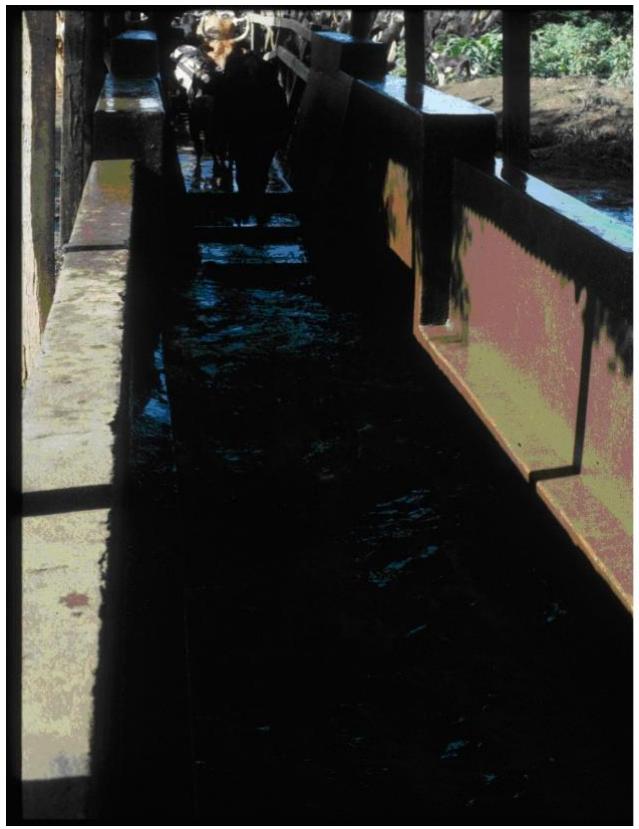
Main project objective: control of ticks vectors of "**malignant" theileriosis (MT)** and other ticks (*Amblyomma variegatum*) & TBDs;

agent: *Theileria parva* complex;
vector: *Rhipicephalus appendiculatus*, 3-host tick (brown ear tick) + *R. zambesiensis*
In 1985-87 → MT single most important cause of cattle mortality in Zambia

Methods/Activities: **strategic dipping** with acaricide → weekly interval in rainy season (max. activity of adult ticks vectors), **no dipping in dry period** (to favour building-up of enzootic stability) ;

network of **142 dip-tanks (DTs)** throughout Southern Province

- dipping implemented under partial recovery system (sustainability?!)



- ***Acaricide used :*** organophosphorus → chlorfenvinfhos (dipwash: 500mg/L)

Dipping → cost-effective method, but public health (direct and indirect) **risks** for :

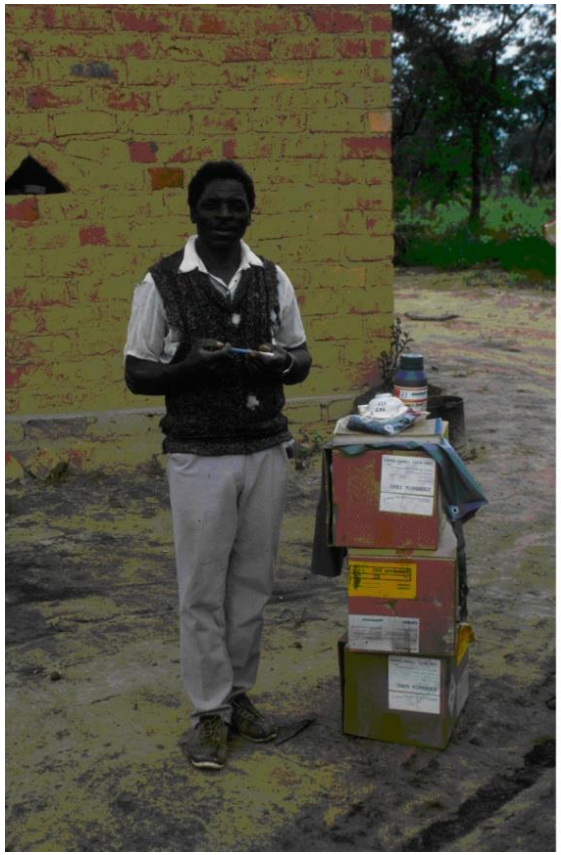
- DTs workers & livestock keepers (**risk1**)
- farmers, villagers and consumers (**risk2**)
- environment (**risk3**)

Research to evaluate public health risks related to the use of acaricides/pesticides

- **risk1**: acute poisoning by contact/ingestion
- **risk2**: consumption of contaminated milk /no compliance with withdrawal period (max residues limits: 0,008 mg/kg ; 24 hrs)
- **risk3**: DTs leakages, emptying DTs on fallow land, improper storage and disposal of acaricide tins

- **Persons/categories at risk: DTs workers & livestock keepers (risk1)**

→ actions taken:



- **provision of protective equipment:** gloves, plastic apron, face masks; antidote: atropine sulphate (village dispensaries, rural clinics, hospitals)
- **training:** courses/DT manuals (***A manual on DT management for field staff***) and information leaflets (English and Tonga languages)

De Meneghi et al. (Eds) (1990). ***VPH Reports ISS/WHO/CC90.10***
Ghirotti et al. (1990) ***VPH Reports ISS/WHO/CC90.12***

- **Persons/categories at risk: farmers, villagers and consumers (risk2)**

→ actions taken:

research on acaricide residues in milk under field condition

- 10 cows; milk samples taken at 3, 9, 24, 48 hrs after dipping (results: after 24 hrs, ≤ 0,005 mg/kg)
- 8 samples of bulk milk from local market (results: < 0,005 mg/kg)

Camoni et al. (1990). ***Vet Res.Comm., 14: 503-506***

Material for health education/promotion :

- radio program using rural broadcasting radio network (in Tonga language and English)
- information leaflets (Tonga language)

Scorziello et al. (1993). ***Health Prom. Int. 8(2): 103-110***

- **Other risks: environment (risk3); farmers, villagers → actions taken:**

health education programs by rural radio (Tonga language and English); information leaflets (Tonga language); **meetings** (tins, DTs decantation pits, etc.)

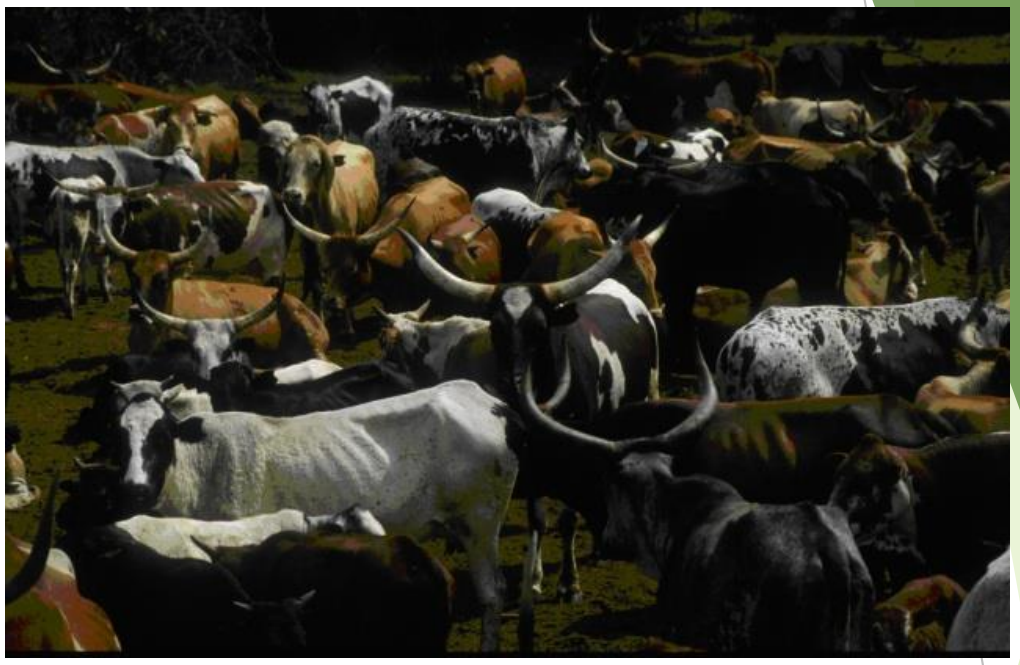
Scorziello et al. (1993). ***Health Prom. Int. 8(2): 103-110***
De Meneghi et al. (eds) (1990). ***VPH Reports ISS/WHO/CC90.10***

Additional activities: sero-epidemiological survey on selected cattle diseases/**zoonoses** (incl. zoonoses transmissible via raw milk consumption)

- **1,911 cattle** sampled and tested (from **116 villages**)

Brucellosis	plateau 16.2% (n:1031)	valley 6.6% (n:666)	Kafue flats 28.5% (n:214)
Q-Fever	plateau 0.1% (n:1031)	valley 0.2% (n:666)	Kafue flats 0.9% (n:214)
RVF	n.d.	n.d.	Kafue flats 14% (n:214)

Ghirotti et al. (1991) ***Vet Res. Comm. 1: 25-36;***
De Meneghi (1994). ***PhD Thesis, Univ. of Turin;***
De Meneghi et al. (1995) ***Proc. 8° Conf. Inst.Vet. Med. Vol.II: 284-288.***



Whether the project involves **livestock** and/or **wildlife**, and/or **environment** and/or **man**, one of the most **important communication tool** is the «***classical meeting under the tree***» ….. communicating / informing / training / sharing with stakeholders are fundamental keys for the success of a project !!


Thanks for your attention…
Merci de votre attention
Shukran