Pests & Diseases Challenging Animal's Health in Drylands

ARC-OVR Perspectives

Ongoing contribution of South Africa's Agricultural Research Council, Onderstepoort Veterinary Research Campus.
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International Virtual Expert Meeting on Promoting Sustainable Agricultural Development in Drylands
(9th G20-Meeting of Agricultural Chief Scientists (MACS)-2020)

Agricultural Research Council, Onderstepoort Veterinary Research

- **Strategic Objectives**

Anticipation and mitigation of agricultural risks

- **Impact**

Sustainable agricultural systems for agrarian transformation, food and nutrition security

- **Outcomes**
  - Enhanced resilience of agriculture through risk identification and mitigation
  - A skilled and capable agriculture sector through innovation (knowledge, technologies, skills)

- Hosts OIE Reference Diagnostic Laboratories for Africa
- Provides diagnostic analytical services to the industrialised and emerging agricultural sector aiming to mitigate the risk of domestic and wildlife animal diseases
- Develops new diagnostic test, which contributes to elevated trade in animals and animal's products
- Develops new vaccine candidates for animal diseases that positively impact the agricultural sector
- Conducts and develops robust surveillance strategies in livestock and wildlife populations to provide an alert for impending and spill-over of pathogens from animals to humans
- Contributes to the skills development drive of in South Africa and the region
- Supports smallholder farmers mitigating disease and management risks

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INTRODUCTION

- Drylands are characterized by socio-economic features which affect animal disease transmission dynamics including livelihood, demography, social organization, and health systems
- Animals contacts at the human-domestic animals-wildlife interfaces increases the risk of pathogen spill-over from wildlife. [i.e. transmission of bovine tuberculosis in Sub-Saharan Africa, vector-borne parasites from wildlife and zoonotic filarids from wild mammals (e.g., *Onchocerca spp*., *Dipetalonema spp*.and *Loaina spp*.)]

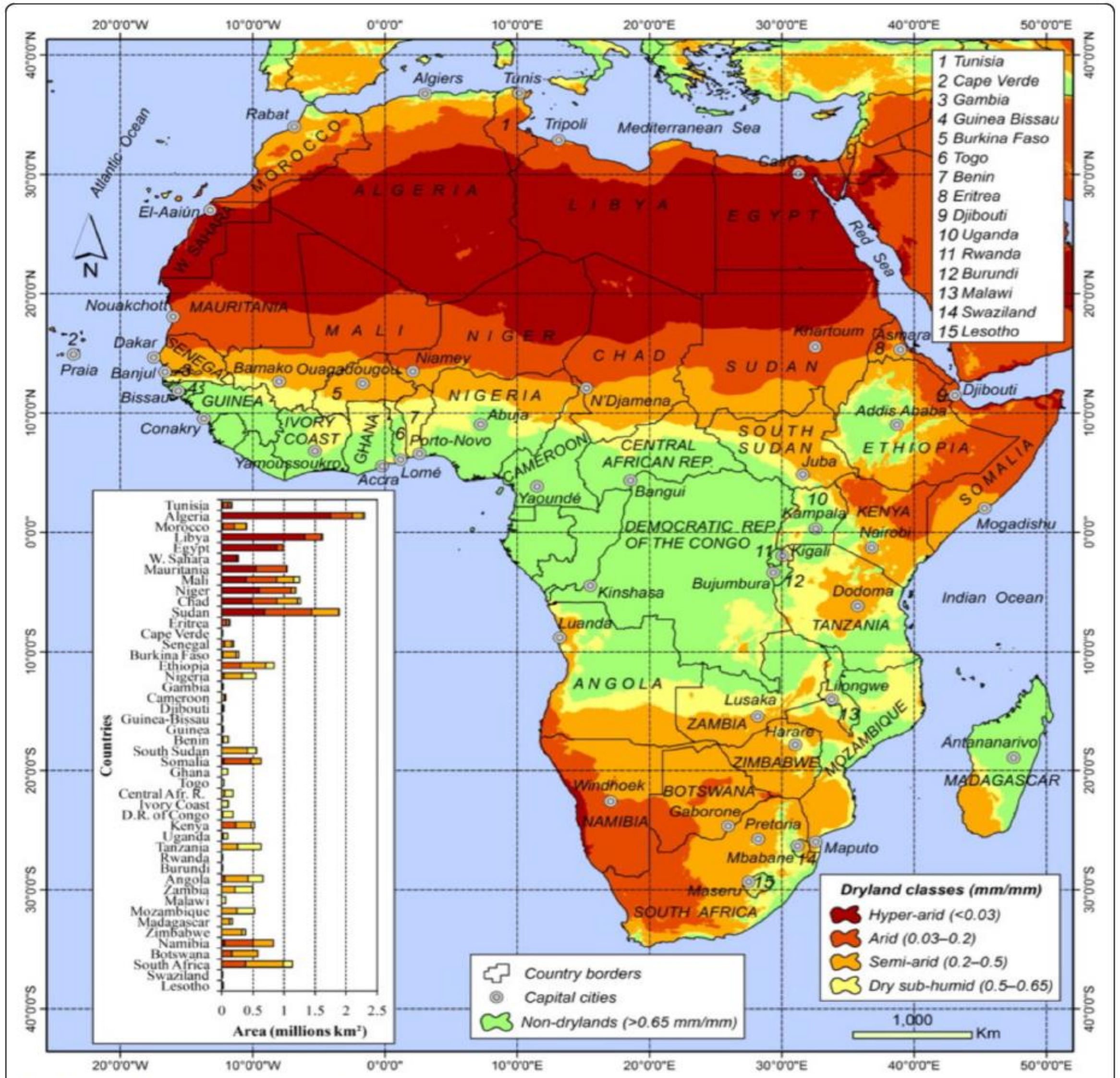

Fig. 1 Map of Africa delineating drylands. This shows the geographic distributions of each of the four dryland types: hyper-arid, arid, semi-arid, and dry sub-humid. Each of these zones exhibits the characteristics inherent to drylands described in the text, including naturally greater climate variability than other biomes, However, Hyper-arid and Arid zones both naturally exhibit more and increasingly extreme climate and environmental conditions, including climate variability, which are expected to increase in the coming decades [2]

(Wilcox et al. (2019)

CHALLENGE AND THREATS TO ANIMAL HEALTH IN DRYLANDS

- Diseases
  - Transboundary animal diseases (i.e. Foot-and-mouth Disease, Highly pathogenic avian influenza)
  - Vector-borne diseases (i.e. Rift Valley Fever, Bluetongue)
- Pests
- Climate change (i.e. Draught)
- Environmental Degradation
  - Land degradation
  - Chemical and radioactive pollution
  - Microbial pollution of soil and water

Sub-Saharan Africa experienced the greatest land degradation, with 13 % of the global ongoing degradation (Sundström et al. (2014).

DISEASE IMPACT ON ANIMAL HEALTH IN DRYLANDS

- Rapid spread of the H5N1 avian influenza (HPAI) virus in Africa
- Foot-and-mouth disease is endemic in most sub-Saharan Africa negatively impacting international trades
- Vector-borne zoonotic diseases such as Rift valley fever continue to affect parts of Africa, threatening to spread to the Middle East, the Gulf countries and southern Europe
- Trypanosomosis and East Coast Fever are among the most devastating diseases in sub-Saharan Africa. They affect more than 500 000 people and kill more than 3 million animals each year.
- Existing infectious disease widespread in Africa continue to be a major source of concern to the global community including:
  - African Swine Fever
  - *Peste des Petits* Ruminants
  - Contagious Bovine Pleuropneumonia
  - Classical Swine Fever
  - Newcastle Disease

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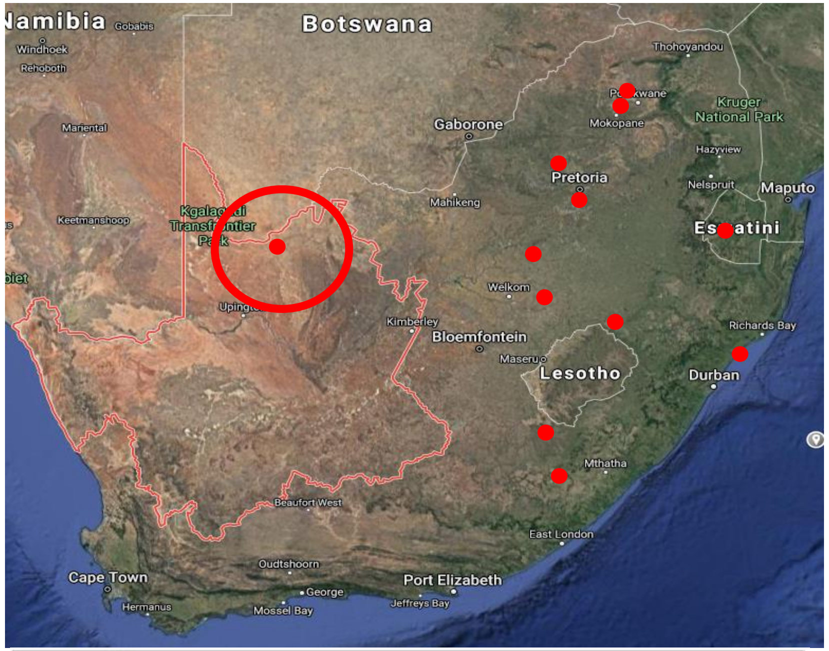
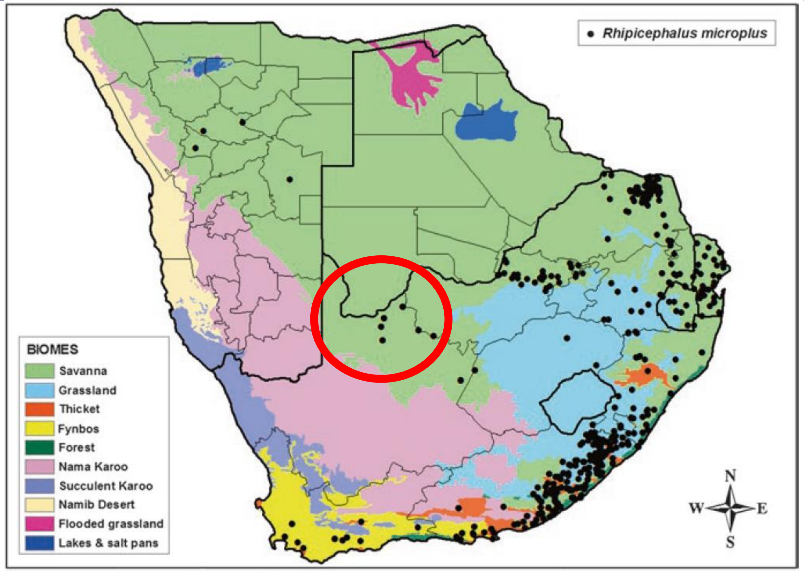
ARC-OVR PROJECTS: TICKS AS DISEASE VECTORS IN DRYLANDS

Babesiosis as emerging disease in a dryland setting





Disease	**Vectors (Blue ticks)**	**Parasite**
Asiatic red water	*Rhipicephalus microplus*	*Babesia bovis*
African red water	*Rhipicephalus microplus*	*Babesia bigemina*
	Rhipicephalus decoloratus	

Table 2

Seroprevalence of *B. bovis* and *B. bigemina* infections in cattle from different provinces in South Africa.

Provinces	Total	*B. bovis*		*B. bigemina*	
		ELISA (+)	IFAT (+)	ELISA (+)	IFAT (+)
Limpopo	100	19 (19%)	20 (20%)	30 (30%)	36 (36%)
Mpumalanga	100	68 (68%)	73 (73%)	42 (42%)	49 (49%)
Gauteng	100	19 (19%)	21 (21%)	14 (14%)	17 (17%)
KwaZulu-Natal	96	55 (57.3%)	61 (63.5%)	44 (45.8%)	52 (54.2%)
Eastern Cape	100	42 (42%)	50 (50%)	32 (32%)	41 (41%)
Free State	70	21 (30%)	25 (35.7%)	24 (34.3%)	33 (47.1%)
Northern Cape	100	22 (22%)	26 (26%)	23 (23%)	26 (26%)
North West	53	8 (15.1%)	10 (18.9%)	7 (13.2%)	9 (16.9%)
	719	254 (35.3%)	286 (39.8%)	216 (30%)	263 (36.6%)

Terkawi et al (2011)

Serological detection of *Babesia bovis* and *Babesia bigemina* in Northern Cape

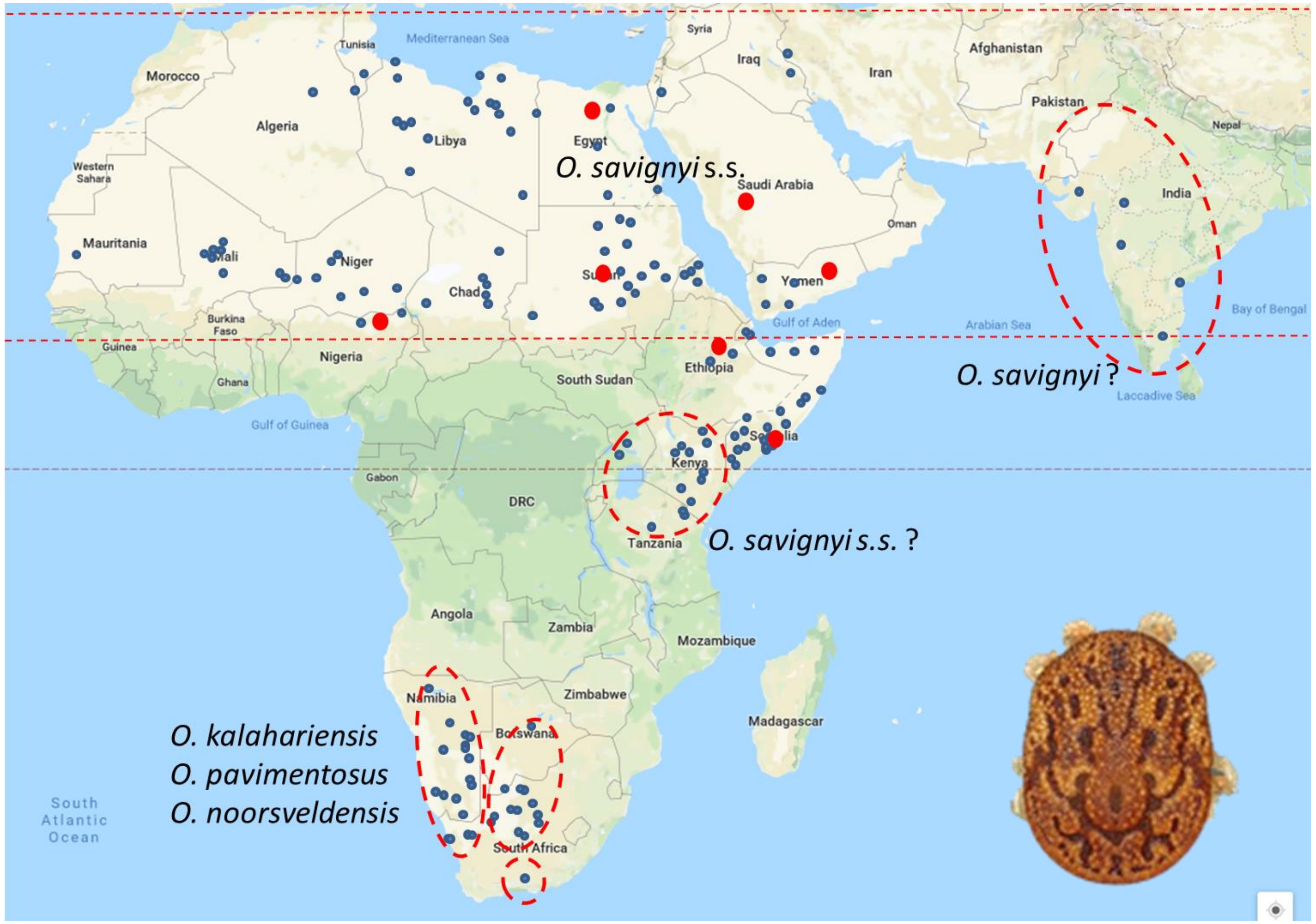
Nyangiwe et al. (2017)/ Horak et al. (2018)

Range expansion of *Rhipicephalus microplus* in the Northern Cape

Sensitive serological and molecular diagnostics can serve as early detection systems
Develop diagnostic tools of epidemiological use

ARC-OVR PROJECTS: TICKS AS DISEASE VECTORS IN DRYLANDS

The sand tampan as disease vector



Ornithodoros savignyi – wide distribution across Africa, Middle East to India in semi-desert regions

Cause sand tampan toxicoses that kills life stock
Vector of human borreliosis: *Borrelia kalaharica*
Vector of Alkhurma hemoraghic fever virus in Middle East

One species since 1955 – A species complex?

Bakkes et al. (2018) / Mans et al. (2019)
Recently described 3 new species from this complex in South Africa: *Ornithodoros kalahariensis*, *Ornithodoros noorsveldensis*, *Ornithodoros pavimentosus* (resurrected)

Implications for disease vector status still needs to be elucidated

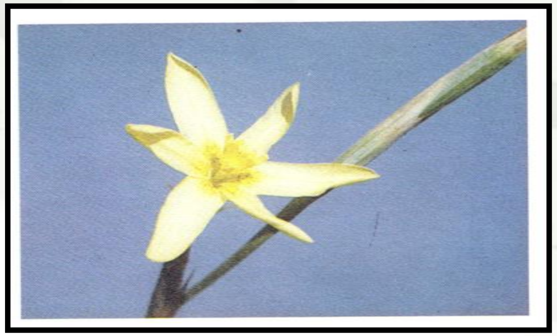
GERTRUD THEILER TICK MUSEUM

Maintain the Gertrud Theiler Tick Museum as National Collection and focus for basic research on tick taxonomy

Basic tick taxonomy remains relevant to the understanding of tick-borne diseases

ARC-OVR PROJECTS: POISONOUS PLANTS IN DRY LANDS

- Poisonous plants are normally the first to appear after dry season
- Poisonous plants are drought resistant when grazing is scarce during adverse conditions
- Use of fertilizers may increase toxicity



Moroea pallida

Lantana spp

Paveta harborii

Moroea pallida

Lantana spp

Fadogia homblei

ARC-OVR PROJECTS: POISONOUS PLANTS IN DRY LANDS

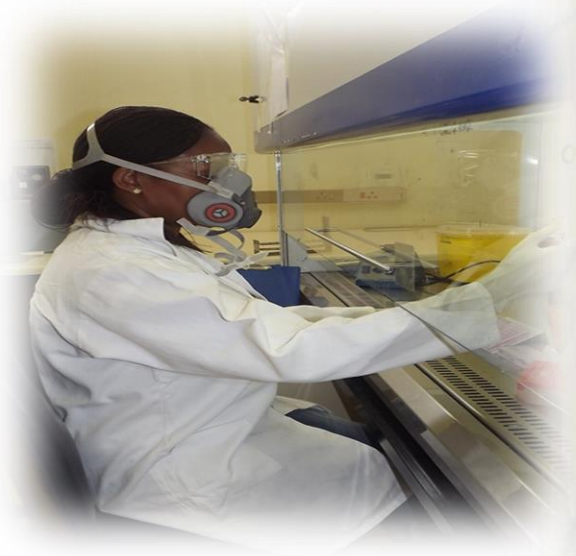
Conditioned Feed Aversion (CFA)

(a) Demonstration of dosing the aversion mixture to cattle

(b) Cattle on a tulp infested grazing avoiding the toxic Yellow tulp

Public awareness on Conditioned Feed Aversion

ARC-OVR PROJECTS: RIFT VALLEY FEVER IN DRY LANDS



Intra-African collaborative research on Rift valley fever

ARC-OVR'S PILLARS FOR PREPARDNESS AND RESPONSE

- Epidemiology and Surveillance (Disease risk mitigation)
- Analytical Services (Food safety)
- Diagnostic Services (Food Security)
- Innovative Research (Rapid diagnostic techniques)
- Vaccine development (Disease prevention)
- Public Awareness and Education(Knowledge transfer)

Epidemic (Pandemic) early warning

Disease filed surveys and surveillance

Modelling the distribution of parasites and disease vectors

Interaction with OIE Reference laboratories

Mapping animal and zoonotic diseases

Disease Trends Analysis

Promoting One Health Approach

Specific epidemiological studies

Enhanced pandemic preparedness

Performing diseases risk assessment and risk mapping.

Conducting Climate change related studies on diseases/vectors/parasites

Understand transmission dynamics

Information hub for stakeholders

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THE WAY FORWARD

- Disaster risk reduction and prevention approach
- Investment in emergency and disaster prevention
- Systematic and integrated approach for addressing transboundary animal diseases
- Building human capacities
- Enhancing networking among stakeholders
- Regional cooperation between affected countries
- Developing self-reliant surveillance systems and knowledge based standards
- Public stewardship
- Investing in economic strength
- Applying environmentally friendly interventions.
- Diversification of risk monitoring and international assessment of agricultural sector
- Assurance of global food security
- Strengthening adaptive capacity

A cohesive and inclusive approach at all levels and capacities for the design and implementation of disease and pest prevention and control measures

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- Sundström et al. (2014). Future threats to agricultural food production posed by environmental degradation, climate change, and animal and plant diseases – a risk analysis in three economic and climate settings. Food Sec, 6:201–215
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THANK YOU