



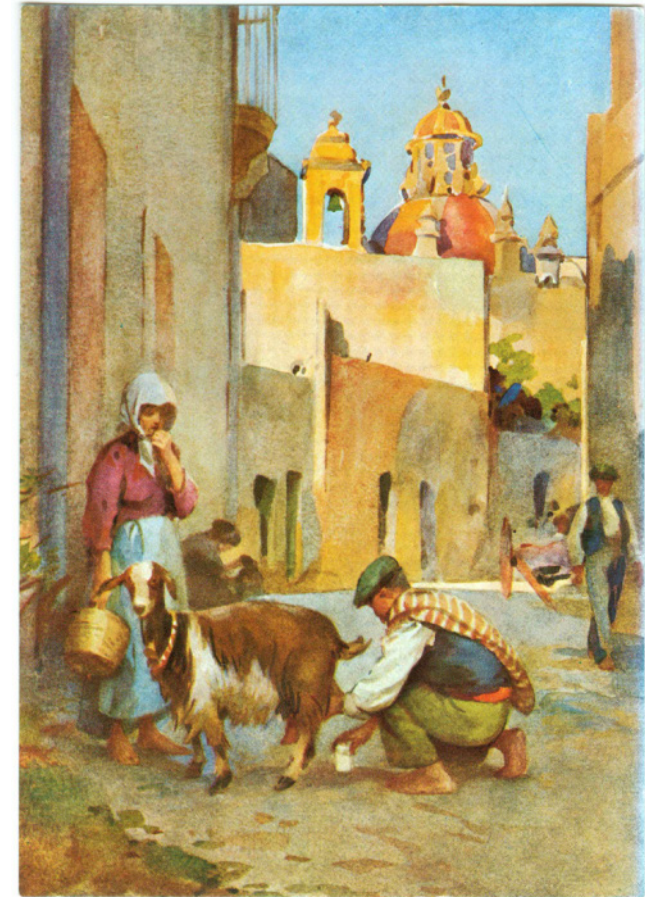
Swiss TPH Winter Symposium 2018

**One Health: Zoonoses Control in Humans and Animals
– Taking Stock and Future Priorities**

Towards brucellosis control and elimination

Brucellosis

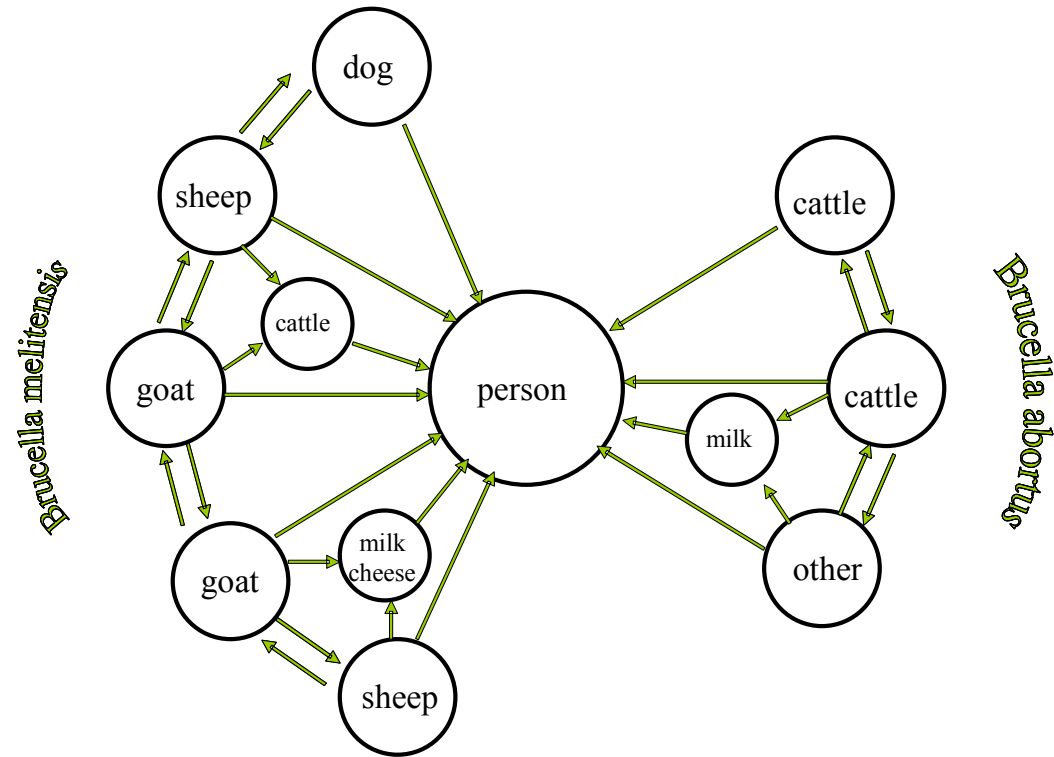
- 1887 Captain **Bruce** the bacteria *Micrococcus melitensis* in Malta - the Maltese physician **Zammit** discovered the zoonotic relationship with **goat milk**
- 1887 Danish veterinarian **Bang** isolated *Bacillus abortus* from **cattle** – later renamed with *M. melitensis* to the **genus Brucella**
- 1914 *B. suis* (zoonotic), 1953 *B. ovis* ,1966 *B. canis* – ongoing e.g. marine mammals
- Also **buffaloes, camelids, deer, bison, antelopes, horses**
- *B. melitensis* generally sheep and goats (small ruminants) and *B. abortus* cattle – cross-infections possible
- Brucellosis often cited as one of the most important zoonotic disease (?)



The Milkman (from a painting by Chev. Edw. Caruana Dingli), Malta

Brucellosis

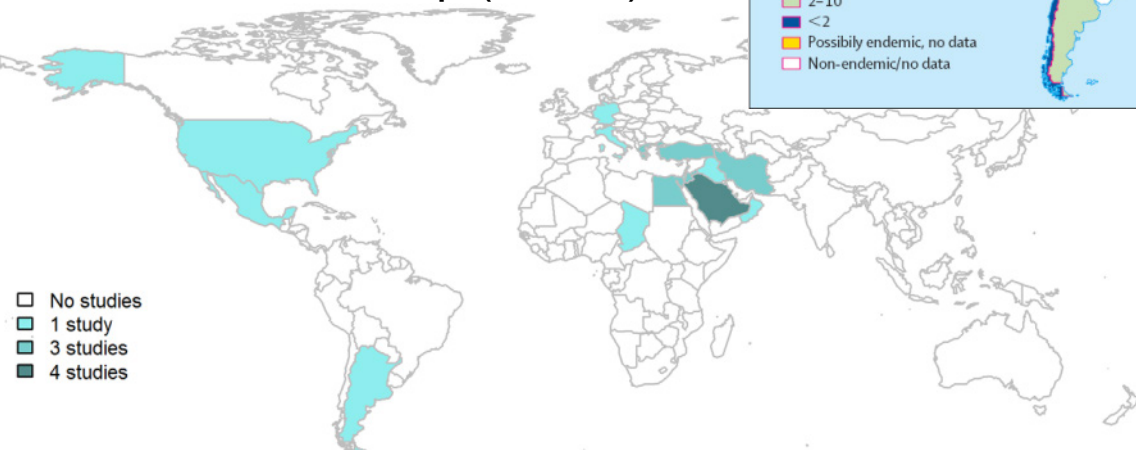
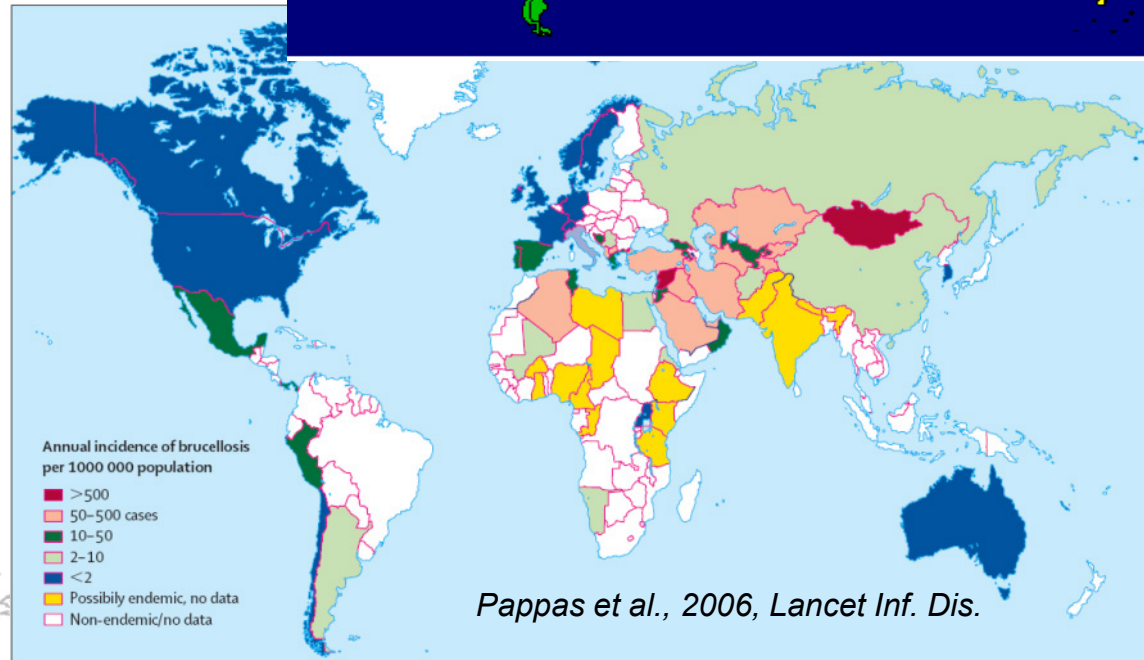
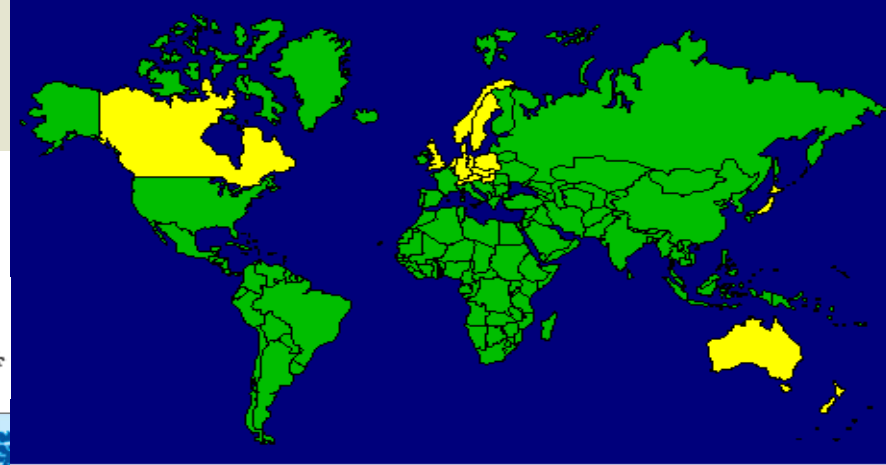
- *Brucella* spp. bacteria **survive** well in aerosols and resist drying
- **Ruminants**: Abortions, birth of weak offspring → reduced milk production → together huge economic losses
- People are infected from livestock (**directly or indirectly**)
- Human brucellosis: chronic, debilitating disease
- For human treatment only *Brucella* spp. is needed (serology) – but for vaccination livestock and epidemiology species needs to be known by culture and typing



Ruminant brucellosis worldwide

- Successfully eliminated in few countries versus unknown status in most countries
- Brucellosis not on the WHO list of neglected tropical diseases (indeed, no bacterial zoonosis) → Foodborne Diseases Burden Epidemiology Reference Group (FERG)

Free of *Brucella abortus* and *B. melitensis*

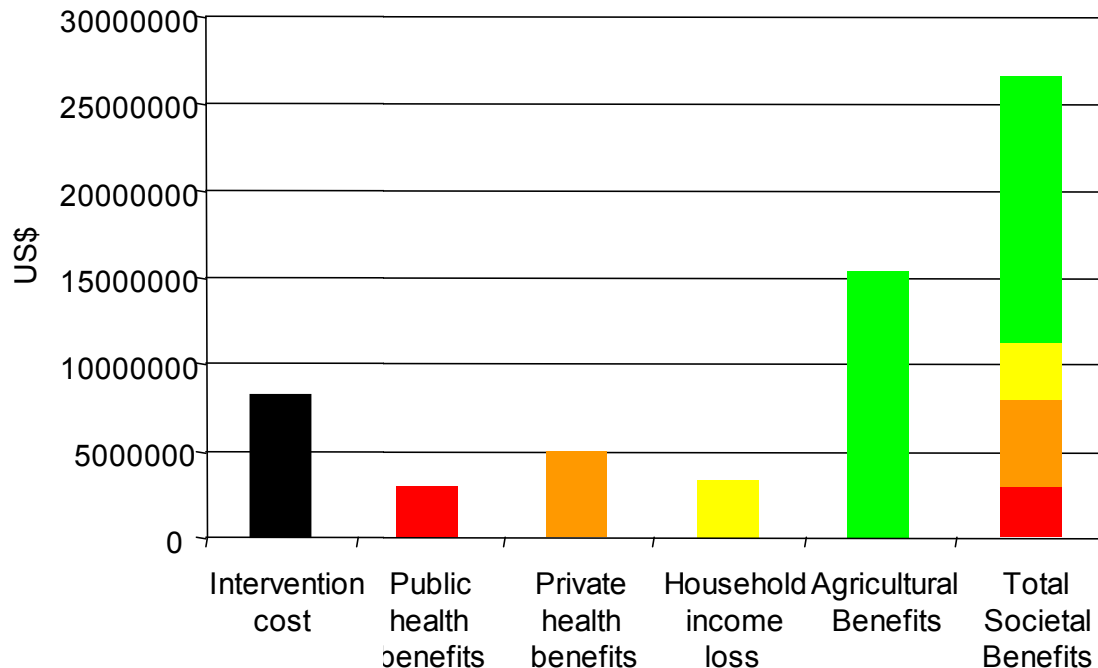


‘Quality studies’ with strict inclusion criteria for systematic reviews;

Dean et al., 2012, PLoS NTD
Pappas et al. 2006, Lancet Infect Dis

Burden of disease and cost-effective control measures

- Cost-effectiveness studies for advocacy of control (of neglected zoonoses)
- **National estimates of burden of disease** needed (particularly Africa - and not only from assumed high risk groups such as pastoralists)
- Assumed **incremental benefits of combined control measures** (i.e. make best use when veterinarians reach herds) - safety and efficacy studies needed



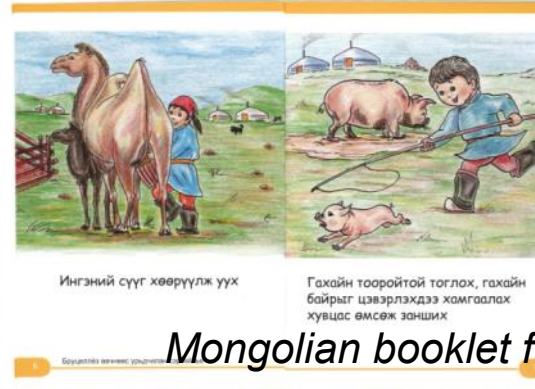
- **Livestock mass vaccination against brucellosis in Mongolia**
- Societal Benefit – Cost ratio = 3.2
- Share of Public Health 10-20%
- Cost-effectiveness ~20 US\$ / DALY averted

Good information on protection - is half of the intervention

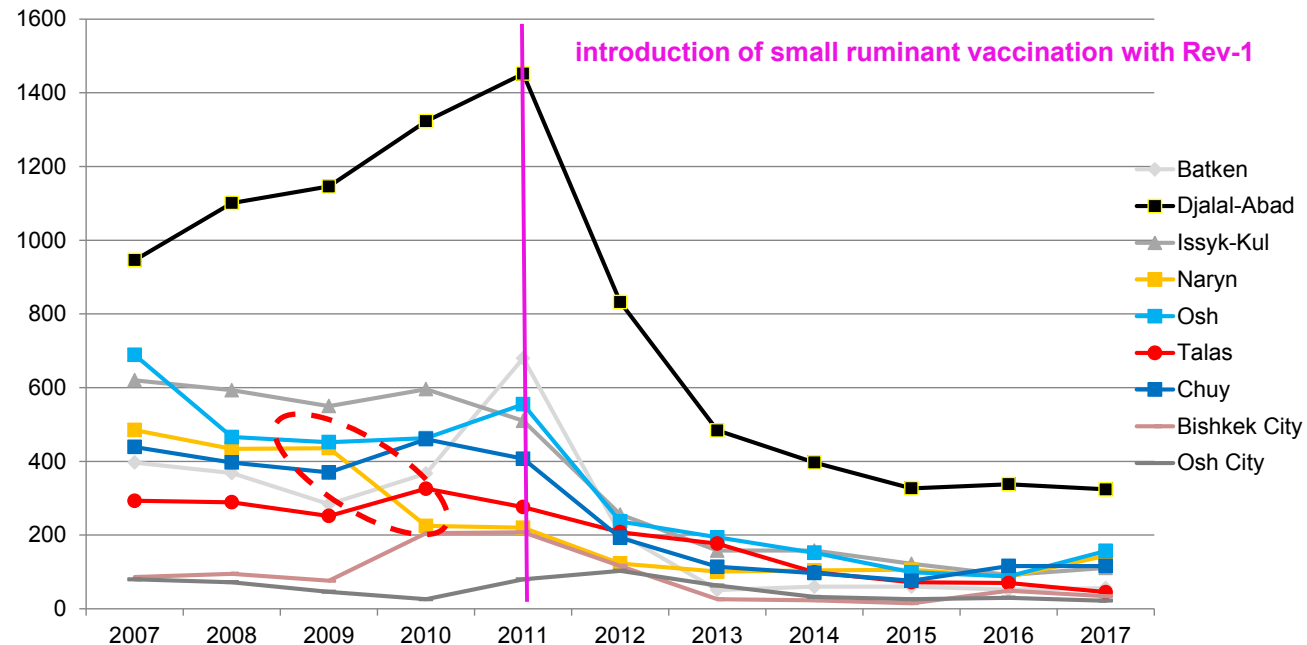
- Understand perceptions, local coping / resilience strategies and expectations of authorities → social sciences
- Maintain funding



Kyrgyz village health committee members with information material

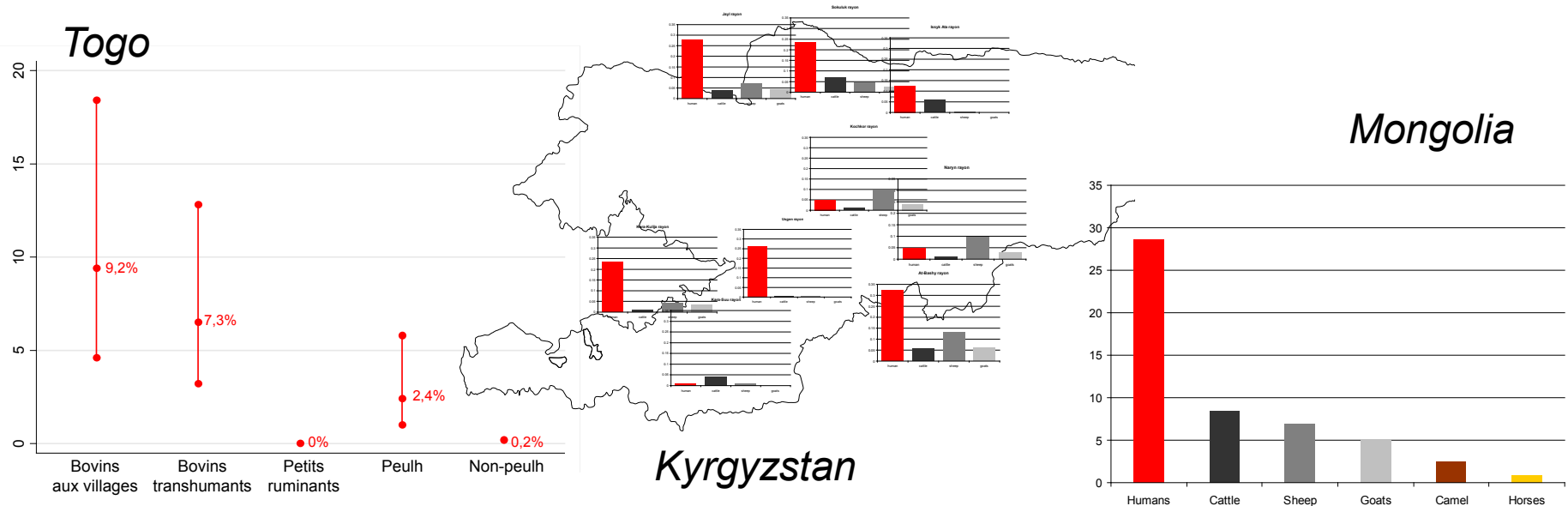


Mongolian booklet for children

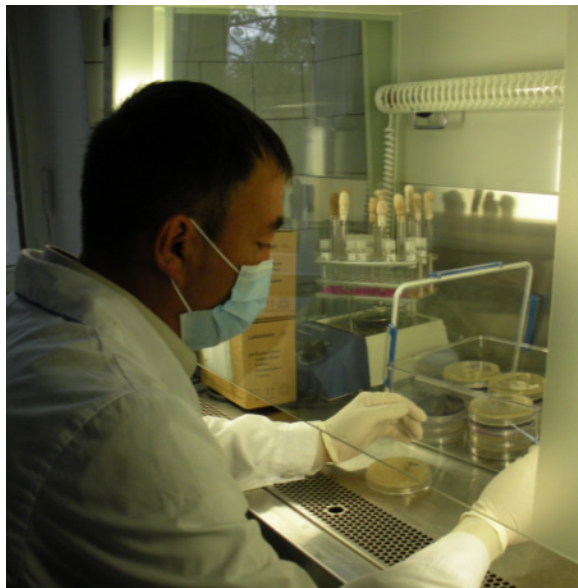


Clarify the epidemiology – implications for control measures

- Correlations of sero-prevalences often only at higher aggregated levels such as districts rather than within households, particularly in mobile households
- West African countries correlations of human seropositivity to cattle, in Kyrgyzstan to sheep, in Mongolia both cattle and small ruminants, and camels
- **Epidemiologic links** livestock and health sectors of multi-host infections → importance that public health and livestock sectors analyse data together
- Joint surveillance also implies regulator exchange of registries and laboratory data – or also of laboratories

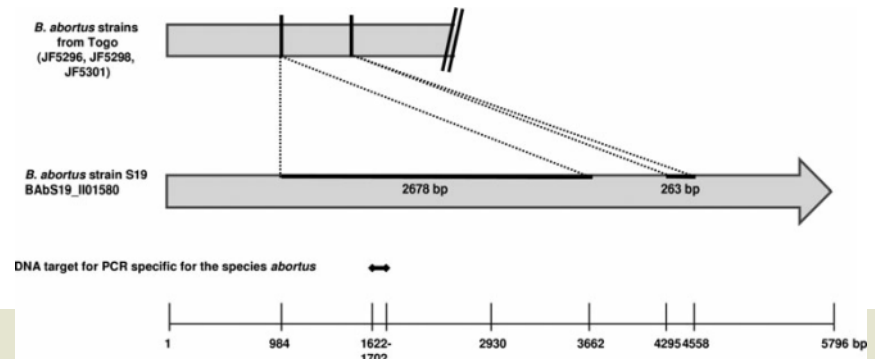


Species identification from cultures - still key to epidemiology



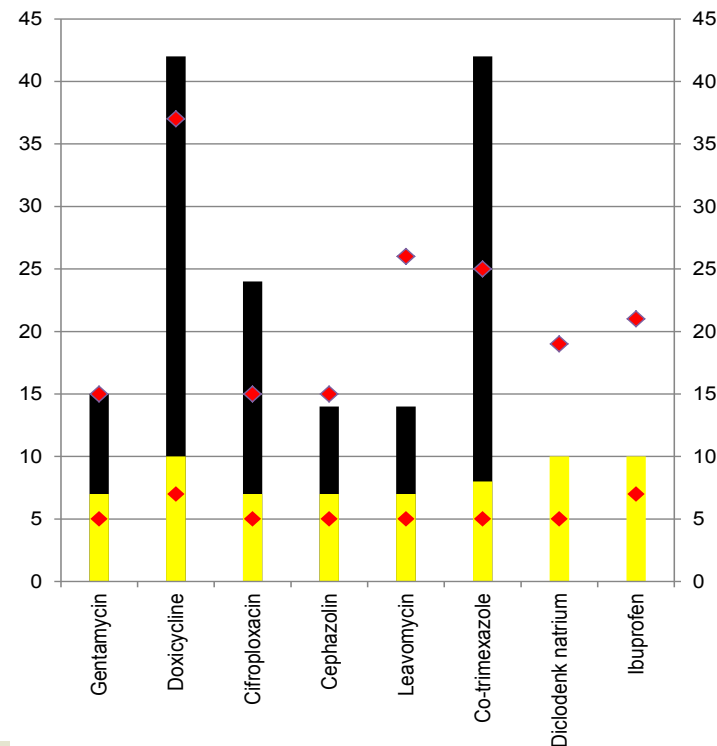
- Requires **good bacteriologists** in **biosafety** laboratories continuing work – upgraded with new tools such as DNA extraction
- Biochemical tests, PCR or VNTR - which one is most effective to have timely results?
- Validate tests → reference strain and sera banks
- New serological tests next to agglutination tests?
- Quality vaccine production and along the chain

Togolese *B. abortus* strains: deletion in *bruAb2_0168* gene: target for PCR species identification and encodes putative autotransporter → influencing virulence and/or host predilection?



Monitoring and follow-up on findings – e.g. since 2011 new vaccination campaigns in Mongolia

- Joint training of provincial veterinarians and doctors within one year: theory (epidemiology, laboratory, protocol, transdisciplinarity), preparation and doing field study, data management and analysis
- Training now given by Mongolians
- Human incidences as sensitive outcome
- Takes a **long commitment** of Governments (>10 years campaign, +?)



Availability of human brucellosis drugs in Mongolia

Operational veterinary services needed

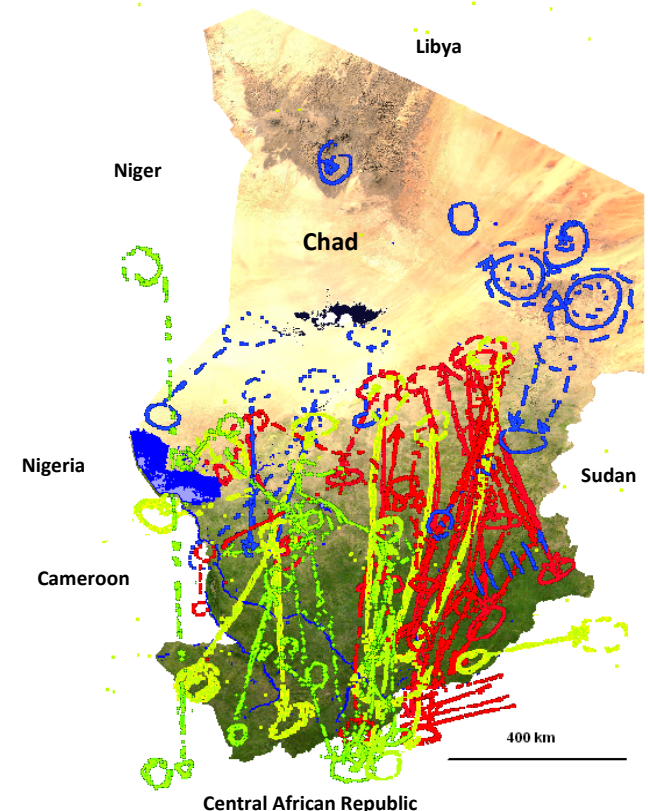
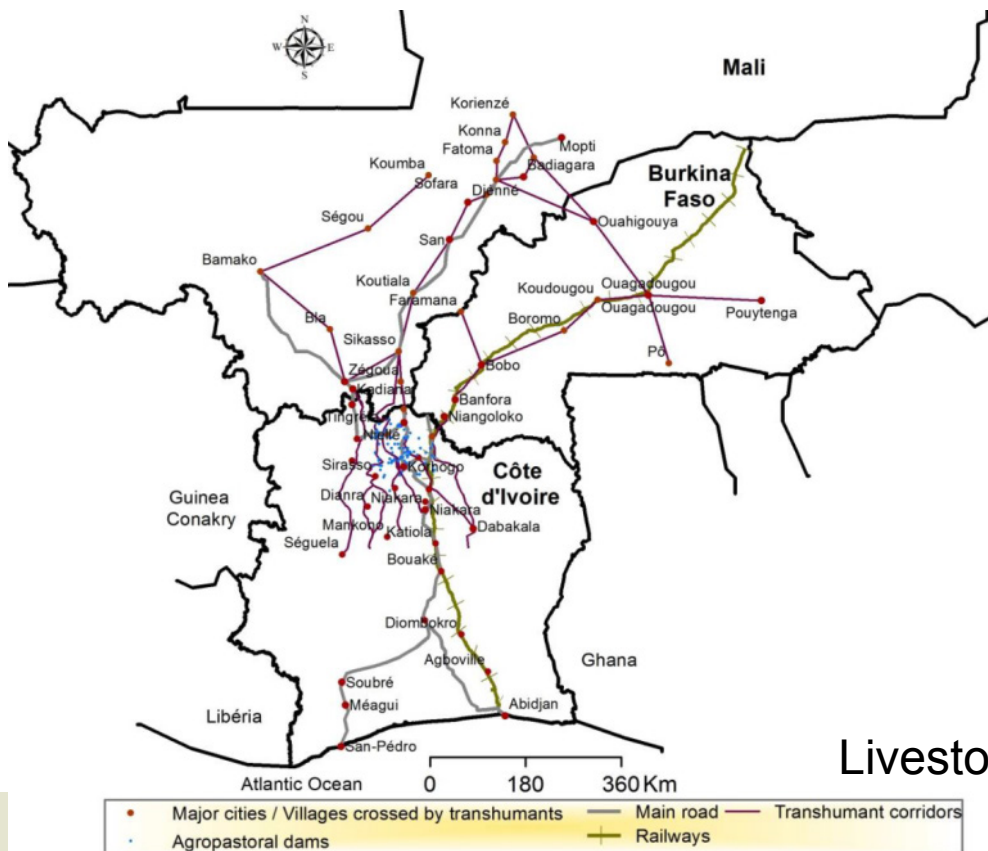
- Brucellosis vaccination needs to be part of a **business plan of (private) veterinarians** - who are at the forefront of control - (i.e. costs to reach remote herds to be fully covered)

Veterinary medicine no career plan for young people in Armenia or Kyrgyzstan



Transborder mobility of livestock

- High mobility of livestock e.g. in West and Central Africa and Asia
- 20% of livestock moving across borders in Chad
- Work towards regional exchange of experiences and shared control efforts



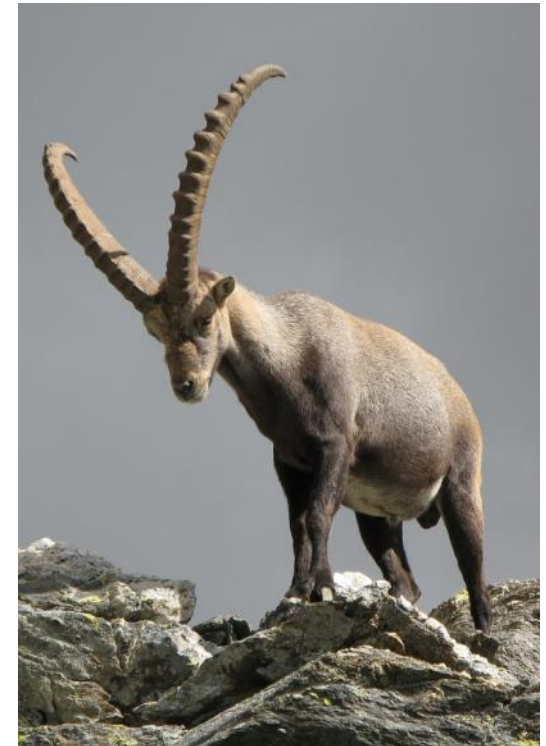
Livestock movements in West and Central Africa

Can camels (and wildlife) re-introduce brucellosis to cattle, sheep and goats after vaccination campaigns?



Brucellosis in wildlife – can threaten past control efforts

- France officially brucellosis-free in 2005. In 2012 an autochthonous human case in the French Alps
- Brucellosis strains from human, bovine and **ibex** cases were identical
- Alpine Ibex population acting as a **silent reservoir**
- All local ruminant herds tested after transhumance to summer pastures
- Management of the infection in alpine Ibex is challenging due to their status of **protected species** and the threat it (vice-versely) represents for the dairy production
- → increases costs and complexity of elimination





Conclusions brucellosis control and towards elimination - no rocket science needed – but field and operational work

- **Good** (enough) livestock **vaccines** exist (and minimal effective vaccination coverage needed <70%), also models on how to eliminate based on livestock vaccination → tools exist
- More **national burden of disease** – and refer to cost-effectiveness assessments done in other countries, needed to prioritize interventions
- **Long-term commitment** needed of all actors including funding agencies to have long-lasting results
- **Operational research** in resource-poor. mobile contexts and without individual marking of animals
- Maintain good **information** for livestock keeping communities
- Support burdened affected households and private veterinarians

Conclusions

- **Strategically** introduce new **laboratory tools** – such as more sensitive tests for chronic brucellosis, differential diagnosis, better methods for strain isolation and species identification (e.g. PCR); national strain and sera banks to validate new tools within countries – but **maintain** well-operating structures in place
- **Monitoring** of implementation for corrective actions
- **Interdisciplinary** research and One Health – iterative field, laboratory, costing, stakeholders
- Research partnerships, collaborations with international organizations, **networking** within regions

