

« Animal surveillance, between biosecurity and biodiversity »

WILD AND DOMESTIC, HUMAN AND ANIMAL:

Colonial and post-colonial surveillance policies in Zimbabwe

Muriel FIGUIÉ
Aurélie BINOT
Alexandre CARON



This text is translated from

Figuié, M., A. Binot, and A. Caron. 2015. Homme, Animal ; sauvage, domestique. Politiques coloniales et post coloniales de surveillance au Zimbabwe. *Revue d'Anthropologie des connaissances*. Dossier « La surveillance des animaux entre biosécurité et biodiversité » coordonné par F. Keck et N. Fortané 9:163-188.

Available at <https://www.cairn.info/revue-anthropologie-des-connaissances-2015-2.htm>

Summary

Implementing surveillance in domestic animal populations has always encompassed more than the simple fact of controlling the way they perform. Indeed, multiple aspects are at stake, evolving in relation to the social, political and economic context. In the case of South Rhodesia (to become Zimbabwe), complex animal surveillance and monitoring systems contributed to the territorial structuring and security of the colonial state as well as its economic development. With the independence of the country, these systems provided the basis for the control of foot and mouth disease according to international regulations, and provided an opportunity to develop a production system dedicated to exportation. These systems relied mainly on a partitioning and a “geographic confinement” of the living (colonists/indigenous people; human/animal; domestic/wild; healthy/unhealthy). The organization of these surveillance systems has been deeply shaken by the land reform of the 2000s’ and its re-establishment is called into question by the upsurge in the political arena of concepts such as biodiversity and “One Health” associated to an ambition of a pro-poor economic development. New surveillance systems emerge (i.e. Transfrontier Conservation Areas, and sanitary standards such as the commodity-based trade) aiming at better associating the control of flows with the control of boundaries, and testifying of continuities and discontinuities with categories inherited from the colonial era.

KEYWORDS

Biodiversity, surveillance, colonization, foot and mouth disease, livestock, southern Africa

RESUME: La surveillance des animaux d'élevage relève d'enjeux multiples qui dépassent le simple contrôle de leurs performances de production et évoluent en fonction du contexte historique, social, politique et économique.

Dans le cas de la Rhodésie du Sud (futur Zimbabwe), les dispositifs complexes de surveillance des animaux ont contribué à l'organisation et à la sécurité territoriale de l'Etat colonial et son développement économique. Avec l'indépendance du pays, ils servent de base à l'organisation du contrôle de la fièvre aphteuse selon les normes internationales, et permettent de développer l'élevage pour l'exportation. Ces dispositifs, reposent principalement sur une catégorisation et « séquestration géographique » du vivant : colons/ indigènes ; homme/ animal ; domestique/ sauvage ; sains/ malsains.

L'organisation de la surveillance va être bouleversée par les réformes foncières des années 2000, et son rétablissement remis en cause par la montée en puissance des concepts de biodiversité et « One Health », et la volonté d'intégrer les populations pauvres au développement économique. De nouveaux dispositifs de surveillance émergent (sous la forme de parcs transfrontaliers et de normes sanitaires de type « commodity based trade ») qui visent à associer davantage le contrôle des flux à celui des frontières, et témoignent de continuités et discontinuités avec les catégories héritées de la période coloniale.

MOTS CLES : AFRIQUE AUSTRALE, SURVEILLANCE, BIODIVERSITE, COLONISATION, ELEVAGE, FIEVRE APHTEUSE

RESUMEN: SALVAJE Y DOMESTICO, HOMBRE Y ANIMAL. POLITICAS COLONIALES Y POSTCOLONIALES DE VIGILANCIA EN ZIMBABUE.

La vigilancia de los animales de ganado hace emerger múltiples cuestionamientos que sobrepasan, hace tiempo, el simple control de su rendimiento productivo y evolucionan en función del contexto social, político y económico.

En el caso de Rodesia del Sur (hoy Zimbabwe), los dispositivos complejos de vigilancia han contribuido a la organización y a la seguridad territorial del Estado colonial y a su desarrollo económico. Con la independencia del país, sirven de base para organizar el control de la fiebre aftosa de acuerdo con las normas internacionales, y permiten el desarrollo de ganado de exportación. Estos dispositivos están basados principalmente en una categorización y “secuestro geográfico” de la vida (colonos/indígenas, hombre/animal, doméstico/salvaje, sano/malsano).

La organización de la vigilancia será perturbada por las reformas territoriales de los años 2000, y su restablecimiento se verá desafiado por el auge de los conceptos de biodiversidad y “One Health”, y por la voluntad de integrar las poblaciones pobres al desarrollo económico. Nuevos dispositivos de vigilancia emergen (bajo la forma de parques transfronterizos y de normas sanitarias de tipo « commodity based trade ») que pretenden asociar más los controles de flujos y fronteras, revelando las continuidades y discontinuidades entre las nuevas categorías y las heredadas del período colonial.

PALABRAS CLAVE: ÁFRICA AUSTRAL, VIGILANCIA, BIODIVERSIDAD, COLONIZACIÓN, GANADO, FIEBRE AFTOSA.

INTRODUCTION

Implementing surveillance in domestic animal populations has always encompassed more than the simple fact of controlling the way they perform; the case of animal surveillance implemented by veterinary services during colonial eras provides a powerful example. This surveillance was central to several control systems sharing a common need for security to ensure economic development to the benefit of the central colonial powers. In the case of southern Africa (e.g. South Africa, Botswana, Zimbabwe) and particularly Zimbabwe, formerly South Rhodesia, the focus of the present study, a range of mechanisms are in place (such as registration and confinement), inherited from the colonial period allowing both the surveillance and control, the creation of knowledge and the exercise of authority, not only on domestic animals and their pathogens, but also on human populations and wildlife.

If the multiplicity of issues at stake in animal surveillance might be longstanding, their nature and the frameworks influencing them evolve according to different factors: new claims arise for more and better links between health policies (human and animal), biodiversity conservation and the fight against poverty; the new considerations in health and environmental approaches related to the context of globalization, associated with biodiversity, biosecurity, emerging diseases and « *One Health* » concepts, showcase the limits of strategies based on sequestration and confinement and the necessity for a better organised control of flows. We examine the role of the national and international, historical, political, economic and social contexts impacting the evolution of surveillance systems.

To analyse the multiplicity and the evolution of the issues related to animal surveillance systems requires involving different research fields: anthropology of sciences and of health, sociology of science and technology but also sociology of the colonial policies and economic sociology.

The first point, dealing with the multiple issues related to sanitary surveillance, has been the focus of several studies. King (2002) identified the historical link between health, trade and security issues in the United States and Western Europe and how surveillance was instrumental to create this link. In the colonial and veterinarian context in particular, Brown and Gilfoyle (2010) studies in English-speaking African countries and Gerbaud (1986) and Landais (1990) studies in Western Africa showed that the emergence of the tropical veterinarian profession was closely related to the development of colonial administrations and that veterinary medicine “emerged as a mean by which colonial administrators sought to exert control over indigenous population” (Brown and Gilfoyle 2010). The Zimbabwean case presented here is original as it demonstrates the continuities and discontinuities between colonial and contemporary periods on one side and the links with biodiversity conservation and local development.

The second point concerns the shift of surveillance systems from the control of boundaries towards the control of flows and is supported by different studies having in common a Foucauldian basis.

Foucault (2004) explains how during the 19th century the rising of economic trade and therefore the necessity of movements led to the removal of the walls of the city of Nantes (previously built to restrain thieves and diseases' flows). Security does not any more focus on the control of city walls but in the capacity to separate good and bad circulation. In the case of diseases, Foucault (2004) showed the evolution and did a comparison between plague and smallpox control, from the confinement of plague-infected people to smallpox vaccination of the whole population, overlapping territorial and population governance. In the case of emerging diseases, Hinchliffe *et al.* (2013) remarks the declining efficiency of

fencing technics based on separating the healthy from the non-healthy and on the conceptualisation of the disease as a threat coming from the outside. The emerging diseases “incubate” amongst healthy spaces (through viral mutations, vulnerabilities of hyper-intensive breeding systems, antibiotic resistances); the threat is no longer coming only from wildlife (or from the outside in general) but also from domestic animals themselves. And it is both our spatial and temporal references that become out-dated to manage our future: the territory as a closed space becomes an imperfect measurement unit of disease range and of their governance whereas the past does not anymore inform the future (Hinchliffe *et al.* 2013).

In an evermore globalized and interconnected world, compartmentalization and confinement cannot alone protect life (economic, social and also biological). The sanitary security systems cannot lock down anymore. They have to associate flows control to boundaries control. Hinchliffe *et al.* (2013) suggest considering a topology referring to the knowledge of links and networks (in opposition with a topography and geography of stationary object represented on a same layer) to report on the evolving relationships of distance and of proximity.

This is why traceability mechanisms became major tools for sanitary security policies in France (Torny 1998, Barbier 2006, Barbier and Prete 2010). Traceability has two majors functions: first to introduce “fences” at the gates of network, to implement sorting and exclusion processes to prevent introduction of potential threats; second to give public authorities the ability to trace back products in circulation (withdrawal, destruction, confinement, information) (Torny, 1998).

The evolution of the mechanisms of control is based on the evolution of knowledge-use: “the logic of restraint suggests the creation of appropriate categories, counting and confinement activities taken over by public stakeholders to answer proven and visible hazards. Traceability suggests the recovery and permanent re-actualization of a network composed of people and objects that have been in contact with the supposed or real threat” (Torny, 1998). It redefines at the same time the role of each stakeholder: it suggests the potential mobilization of networks’ stakeholders, and not only public services and it oversteps the Nation-States framework.

The management of global public goods like health and environment necessarily questioned the role of Nation-States, including the former colonist ones. King (2002) and Kerouedan (2013) showed how the global health concept has redefined cooperation between states in favour of a so-called “post-colonial” disease management system: through the framework they promote, global health stakeholders constrain southern countries to prioritise in their agendas sanitary issues shared with northern countries, to the detriment of more specific and relevant local issues. With this Zimbabwe historical study, we follow the continuities and discontinuities between the colonist and post-independence era, the burden of social, political and economic context, national and international, in the orientations and implementations of those frameworks. We focus on their integration with local issues (as Barbier, 2006, does for example, with the management framework of ESB in France) and in an innovative way from a so-called peripheral territory.

This work fits within a set of studies on political analysis and management systems of foot and mouth disease FMD in southern Africa. It is based on a in-depth review and synthesis of literature about Zimbabwe more specifically through historical (history of animal husbandry, of veterinary services, and of protected areas) and socio-political approaches (more

particularly the analysis of development, agricultural, and environmental policies and the 2000's land reform). It is also based on interviews where we explored the political and social dimension of the animal disease surveillance systems in particular at the edges of protected areas (26 interviews run between 2010 and 2014 in Masvingo province and in Harare, Zimbabwe) with livestock stakeholders and managers of protected areas (small-scale farmers, veterinary services, researchers, NGO's representatives). Moreover, the authors were able to attend several meetings between those stakeholders (in South Africa and Zimbabwe) during their involvement in various research and development projects focusing on livestock production in the periphery of protected areas¹.

Firstly, we review the existing policies in southern Africa: colonial, land and agricultural policies, veterinary health policies, wildlife management and environmental policies. And we demonstrate that from the beginning of the colonial period, animal surveillance systems are used as tools articulating those different policies, around security issues overstepping the sanitary concern.

In a second part, we show how stakeholders and the frameworks articulating those policies evolved over time in relation to land claims, the fight against poverty, the economic integration of the whole national territory and communities, and biodiversity, biosecurity and "One Health" concepts.

Beyond the Zimbabwean example, in the third part, we intend to explain how those evolutions testifying of a security objective and historically rooted in territorial protection, are nowadays hustled by the growing motivation to integrate all different territories in trade and flows, to develop an economic activity and promote ecosystem sustainability.

GEOGRAPHIC CONFINEMENT AS A BASIS FOR SECURITY

Colonial period in southern Africa: delimitating secured and healthy territories

The economic model developed by the colonial authorities in southern Africa during the 19th century, initially motivated by resource mining, rapidly shift to agricultural activities, especially cattle farming² The livestock production strategy is mainly based on land expropriation and cattle requisition from black local populations [especially following the first Matabele war in 1893, opposing the Ndebele population to the *British South Africa Company* police in charge of the local exploitation³ (Mutowo, 2001)], indigenous cattle that will be progressively mixed with European breeds.

¹ If these interviews have not been systematically analysed and used in this study, they were still very influential in guiding our readings and in validating our understanding of the relationship between the various observed dynamics.

² Exportation to England was developed under frozen commodities thanks to the Imperial Cold Storage and Supply Company (created in 1899) and particularly during the first World War for the supply of troops (Milton, 1994; Troubridge, Critchell et Raymond, 1912) then also under tin commodities with the building of the Liebig company plant in 1934 (Anderson, 2009).

³ A convention signed in 1889 between the Britannic government and the BSAC, British South Africa Company, authorises this company to administrate a large territory between the Limpopo and Zambezi Rivers.

Colonists quickly consider the abundant wildlife (buffalos, elephants, antelopes...) as a constraint for their project. Wildlife and cattle compete for resources (especially pastures) and wild large carnivores attack cattle and humans. The issue is also sanitary: wildlife is suspected to maintain pathogens that, associated to various vectors (mosquitos, tsetse flies, ticks...), jeopardize the production of European breeds less resistant to endemic tropical diseases circulating in the area.

Domestic animals from so-called “indigenous” populations are also perceived as a constraint: colonial authorities complain about the excessive herd size, only motivated by their owner’s social status. Those herds are considered unproductive, responsible for the degradation of grazing areas, soil erosion, and (as for wildlife) of maintaining animal diseases. Here appears a constant: the negative judgment of African livestock systems during the colonial period and later (see Landais, 1990 for Western Africa).

De facto, large infectious animal diseases restrict the economic development based on livestock production: rinderpest in 1896-1898 [that might have reduced 95% of wild and domestic ruminants in Rhodesia (Condy 1979)], East coast fever in 1902, trypanosomiasis in the 20’s and the foot and mouth disease in the 30’s.

This infectious context has an impact that oversteps widely livestock productivity. The tsetse flies (vector of trypanosomiasis, or sleeping sickness, vector that affects human and animals – bovines and equines in particular- and for which wildlife is suspected in 1890 to be a reservoir) limit the extension of colonisable areas, since the imported breeds are unable to survive in areas infested by the tsetse flies. Outbreaks that decimate or at best weaken oxen prejudice the transport of merchandises [dogs, goats, zebras and even camels are trained or imported to replace oxen (Busayi 2006)]. And the equine diseases hamper officials to cover and administrate their district (Mwatara, 2014).

Safe and secured agricultural land for colonists has therefore to be obtained from territories formerly occupied by black population and their livestock, wildlife and disease vectors. In this conquest, colonial authorities will heavily rely on veterinary medicine.

Setting-up a colonial veterinary system: confine indigenous people and the wilderness

The control of infectious animal disease rapidly appears as a central pillar to occupy, administrate and operate the region. This control must also demonstrate the power of the colonial authority to local population, the “indigenous”. The objective is: “bringing order and productivity to the wilderness” (Scoones and Wolmer 2007). It is based on the 19th century hygienist conception mentioned by Latour (Latour 2011) whereby “health and wealth” are closely linked.

An interventionist policy for the control of animal diseases will be therefore quickly implemented. In South Rhodesia, it relies on veterinary services created in 1896 (under Elias Gray authority, first head of veterinary services) and on the adoption of the « Animal Disease Act » the same year (March 1896). This act authorises the quarantine or culling of sick animals. In parallel, preventative measures are developed such as the vaccination of imported animals, thanks to the laboratory studies of the Onderstepoort Veterinary Institute (created in 1908 in South Africa). Renowned scientists like Robert Koch⁴ (in the fight against theileriosis) are called in rescue. From the 30’s, an authoritarian colonial

⁴ Robert Koch is the discoverer of the tuberculosis bacillus, contemporary and rival of Louis Pasteur, as an echo to Anglo-French rivalry.

veterinary regime is implemented, based on the Land Apportionment Act (1931), following the foot and mouth disease epizooty.

The land allocation law organizes colonization on a racial segregation basis, pushing back the “indigenous” and their livestock in “native reserves” established in marginal areas (characterized by arid and semi-arid climate, presence of diseases). The objective is to keep vast territories for colonists, allowing the development of large farms and cattle ranching on land with high agricultural potential (such as the central plain of Zimbabwe above 1000 m in altitude). Two separate farming systems (colonists/indigenous) coexist within both spatial and racial segregation. In indigenous reserves, culling or seizure of cattle are used to reduce indigenous herd size (Chitiyo, 2000) and traditions of transhumance are impeded.

Animal disease surveillance systems, which essentially aim at protecting colonists’ livestock, are based on several strategies: elimination of animal reservoir and disease vectors, spatial compartmentalisation and treatment and monitoring of indigenous herds.

With the recovering of wild ungulate populations (largely depleted by the rinderpest epizooty between 1896-1898), and their associated pathogens and vectors, large campaigns of culling are organized (buffalo hunting primarily), using the support of “white hunters” (Mavhunga and Spierenburg 2007). Starting in the 50’s, wildlife is restrained in reserves (e.g. in the South-east of the country) in order to protect the colonists’ herds from foot and mouth disease. The erection of fences to divide territories is then used to limit animal movements outside of their delimited territories. Starting also in the 50’s, aerial insecticide spraying campaigns against the insect vector of trypanosomiasis, the tsetse fly, will be used on forest galleries.

An authoritarian organization of the territory is implemented: indigenous reserves are inter-spaced between wildlife rich areas and those dedicated to colonist livestock in order to create sanitary buffer zones. The efficiency of this system is strengthened by the implementation of a cattle free zone between the colonist farms and indigenous herds. The mandatory restriction of cattle movements is organized through fences (Condy 1979) and through the culling of any wild or domestic animals outside its defined zones, particularly during epizooties. This organization initiates an epidemiological surveillance, closely linked to movement surveillance and control of their owners: the purpose is to “concentrate the natives and cattle... into a smaller area with a view to obtaining more efficient supervision of cattle and breaking contact between these cattle and surrounding native and European owned herds” [from the Ministry of Agriculture and lands to the Prime Minister in 1939, Zimbabwe National Archives quoted by Scoones and Wolmer (2007)].

Moreover, networks of dip tanks are set-up in native reserves. The “explicit” purpose of dip tanks is the fight against theileriosis and other tick-borne diseases, after the failure of vaccination attempts by R. Koch. The dip tank water contains an acaricide treatment, reducing cattle tick infestation. Their building relies on forced labour imposed on indigenous farmers and their financial contribution (Mavedzenge et al. 2006, Mwatwara 2014)⁵. Starting in 1914, indigenous farmers are compelled to drive their herds regularly to dip tanks. Veterinary officers and inspectors have the authority to control animal health status. It gives them the opportunity to register the farmers and their cattle and to collect taxes. Dipping attendance by indigenous farmers becomes a way of demonstrating its loyalty to the colonial government (Mwatwara 2014).

⁵ In the colonists’ zones, each farm has its own dip tank.

The dip tank network appears then as a powerful institution which allows animal sanitary controls and also regular population census and production of statistics and the implementation of a tax system. In that sense, it is the cornerstone of a surveillance system of herds and consequently their owners. It becomes quickly an essential element of the colonial administration, through the building of a dense network covering the territory.

The veterinary organisation consolidates the colonial vision of a native population representing, like wildlife, a threat that needs to be contained in closed spaces. It contributes to the appropriation of the territory by colonists along a gradient of wildlife/“infected” small-scale native herds/healthy commercial herds benefiting rich white farmers from South Rhodesia (and then young Zimbabwe). The animal sanitary surveillance guarantees the stability of the colonial territorial organization.

Resistance and obstacles to the colonial veterinary authority.

Nevertheless, the veterinary authority faces large-scale anticolonial rebellion [see van Onselen (1972) for South Rhodesia and Bundy (1970) quoted by Mwatwara (2014) for Transkei] from indigenous farmers who perceive those actions as a mean to restrain their movements, their rights to own cattle and, moreover, to occupy their lands. Besides, those farmers do not grasp the reason for those sanitary actions either because some targeted diseases barely affect their herds (like foot and mouth disease) or because the method preferred by the authorities, the quarantine, is diametrically opposed to the habit of dispersing their animals to limit contacts once a disease appears (Mwatwara 2014). *De facto*, quarantine is not always effective: if colonial services register success in many cases, it mainly concerns diseases introduced by colonists [e.g. rinderpest, some tick-borne diseases (Busayi 2006)].

The native resistance is not alone in the fight against the veterinary administration. A white urban elite of hunters is opposed to the culling of wildlife for sanitary reasons, and to the hunting by black populations. They instead promote the creation of hunting reserves. A first private reserve is created in 1925 in South-West of Rhodesia (in Wankie, chosen because of the absence of tsetse fly; it would be nationalized in 1939). This resistance increases in the 40's with numerous initiatives in favour of the creation of a transfrontier park (Mozambique, South Africa, Rhodesia) around the Limpopo River. Nevertheless, in their conflict against urban hunters, veterinarians and European farmers receive the support of the *Native Affairs Department*, also against the creation of reserves, since these reserves could reduce even more the land that can be allocated to native populations and stirs racial tensions. Despite the country's independence, the resistance movement lead by white hunters will paradoxically win a few successes.

From independence (1980) to the 2000's land reform

The animal surveillance system in the independent countries of Southern Africa, based on a territorial structuring, will be very little changed by the decolonization process in the region. However its purpose evolves to include the delimitation of foot-and mouth disease-free territories potentially able to export meat to the most profitable European markets. Surely, during Rhodesia's war of independence (1976-1980), the control of animal diseases will come to a stop. To mark the insubordination to colonial power, the guerrilla encourages black farmers to avoid dip tanks, even to fill them with stones or to destroy them (Chitiyo 2000). Disease outbreaks will come back (Cook 1991).

But the new Government of Zimbabwe (1980) quickly restores animal disease control. The President Mugabe advocates for reconciliation and maintains its support to the white farmers. Economic partnership agreements between the European Union and the South African Development Community (SADC)⁶ will allow Zimbabwe, Botswana and Namibia to benefit from advantageous conditions to export bovine meat to European countries.

The condition to access this market is to implement an efficient control of animal diseases, including foot and mouth disease, a major concern for Europe. This control becomes then a priority for Zimbabwe sanitary policy. It requires to strictly complying with international sanitary and phytosanitary regulations (known under SPS agreements).

The tools for this control at the international level are based, as for many other animal diseases upon a “geographic confinement” of the disease. This confinement must identify countries or territories considered as healthy, foot and mouth disease-free according to international standards, and so potentially able to export livestock to disease-free countries (like the majority of European countries). This international organization of sanitary control fits well into the colonial veterinary organization.

However, in southern Africa, the situation is complicated by the presence of wild reservoir of foot and mouth disease: buffalo are the known reservoirs; others species such as impalas could also play a role in the disease maintenance. Yet reserves and parks multiply in the 80's in southern Africa. In Zimbabwe, the approval in 1975 (during the South Rhodesia era), of the *Parks and Wildlife Act*, enabled the creation of the Gonarezhou National Park in the Southeast of the country. Wildlife, both for hunting and tourism, becomes more and more an important economic asset.

The objective is now to contain the disease in the “wild” compartment and avoid contacts with animals from the healthy zone. A surveillance area is organised by veterinary services between the wild zone (without any control) and the “healthy” zone. This area plays the role of a buffer (with or without vaccination depending on cases). It matches more or less the old native reserves where lives the majority of farmers, mostly black, practicing extensive farming aimed at self-consumption or to local markets. The healthy zone can then be dedicated to farming for export.

This confinement is based on the multiplication of fences. Built around parks and reserves, they constrain wildlife movements out as well as incursions of poachers and farmers with their herds in.

This system maintains the colonial territorial organisation in relation to animals (wild/potentially carrying foot and mouth disease/healthy) and its associated socio-economic organisation: hunting and tourism/extensive farming/export farming. If this zoning is officially free of its initial racial origin, it contains, *de facto*, poor black populations in the surveillance buffer zones, while commercial farming for export as well as safari and hunting in wildlife areas are monopolised by a minority of ex-colonists white farmers (and by the State for the National Parks).

Therefore, despite the independence of the country, the territorial organisation will not only be maintained but also reinforced through the development of the bovine meat exportation sector and the international sanitary standards. However, after 2000, the veterinary system

⁶ Within the framework of the Lomé agreement signed in 1975 between the ACP countries (Africa, Caribbean, Pacific) and the European Union.

that supports it will be pressurised by various factors of evolution, in particular a growing demand for land reform.

THE CHALLENGES OF A SURVEILLANCE BASED ON GEOGRAPHIC CONFINMENT.

The breakdown of veterinarian authority and of the territorial organisation

The disease control system will undergo another breakdown with the 2000's land reform in Zimbabwe and the deep economic, social and political crisis that will follow.

The population living in marginalized lands since decolonization calls for a land reform, as stipulated in the Lancaster's agreements at independence. This land reform has been continuously postponed due to the Government willingness to maintain an economic alliance with former colonists and good relationships with occidental countries. Nevertheless, from 1996, the Zimbabwean Government started important social and economic reforms, and among them a "Fast Track Land Reform". Analysis of its consequences is still controversial (Compagnon 2008, Mavedzenge et al. 2008, Scoones et al. 2011, King 2012) but it is consensual to state that it has greatly disturbed the animal diseases control system.

The land reform initiated in the 2000's materializes through the expropriation of white farmers, in particular those with large cattle farms, to the benefit of black populations, but with a lack or absence of measures to capacitate these settlements and to organize a proper land reform. The land redistribution is undertaken under pressure and to the benefit (some analysts will say mainly) of the liberation war veterans, usually lacking expertise in and interest for agriculture. Therefore, this reform triggers a collapse of the agricultural sector, combined to a massive drop in international support as a sanction for the political decisions (as well as an exclusion from the Commonwealth in 2003), which contributed to throw Zimbabwe into a deep economic crisis.

At the same time, populations unsatisfied by the land redistribution process, operate land invasion with their livestock (in commercial farms and private and sometimes public protected areas), sometimes with the local authority endorsement, across fences (most of them were destroyed), across sanitary lines and more generally with no respect of the new territorial organisation (Mombeshora and Le Bel 2009). The territorial sanitary zoning is therefore shattered. The dismantlement of the territorial organization and the lack of means and funds of veterinary services due to the economic crisis, cause the breakdown of the disease control system. In consequences, animal disease incidence soared, such as foot and mouth disease (with an explosion of outbreaks including in the export zone) leading to an export ban to European markets and affecting the financial resources of the country [bovine meat exportation from Zimbabwe to Europe used to provide around US\$ 50 million per year before 2000 (Scoones et al. 2010)].

However, at the worst of the economic crisis in 2008, the Government aims at returning to the previous sanitary system by restoring controls (focusing on foot and mouth disease, anthrax, tick-borne disease and rabies) and guaranteeing the respect of territorial zoning, in order to recover its exporter status and to protect its parks' integrity. The foot and mouth disease control exceeds commercial considerations: it represents now an indicator of the quality of the country's veterinary services and its sanitary status in general on the

international scene (Hargreaves 2010), a type of accreditation, of worldwide “gold standard”. But even more globally, the Government is using the demonstration of its capacity to handle foot and mouth disease as a symbol of the return to normality and of its complete territorial control. However, the challenges are still numerous.

Resisting the dominant sanitary order

The implementation of the control of foot and mouth disease met several practical obstacles: fences are regularly destroyed by wildlife (in particular by elephants) or dismantled by neighbouring populations for use and sell, and for access to natural resources such as wood, bushmeat and grazing lands in parks (a behaviour increased in times of crisis and drought). Fences therefore need a permanent and expensive maintenance, difficult to implement in the financial context of veterinary services. Moreover, vaccines against foot and mouth disease are produced in insufficient quantity for the region, are too expensive for the State and their efficiency is questioned.

The geographic confinement of foot and mouth disease, “a colonial policy trap”?

Furthermore, this policy, considered as a trap created by the combined influence of the colonial inheritance and the international sanitary and commercial pressures, meet also ideological issues: its relevance is challenged by the reassessment of sanitary issues in relation to the need for biodiversity conservation and the fight against extreme poverty.

The proposal to include the fight against foot and mouth disease on the international and national agendas is contested (Scoones and Wolmer 2007, Figuié and Fouilleux 2013, Thomson et al. 2013a, Thomson et al. 2013b) as it supports the priorities of intensive farming practices (more exposed than extensive farming) and the priorities of occidental countries (trying to avoid the reintroduction of the disease in their free of disease countries via commercial trades). This is the reason why foot and mouth disease is qualified by some local stakeholders as an “intensification disease”, a “commercial disease” and a “political disease” (our interviews). Therefore, like dip-tank attendance once symbolized acceptance to colonial rules, participation of a country in foot and mouth disease control is perceived by some as the signal of their acceptance of the global sanitary and economic order.

At the Zimbabwean scale, the choice to prioritize the control of this disease appears for lot of people as a colonial policy continuity and trap. It indicates the Government willingness to re-embark on the commercial exportation sector, neglecting the domestic and regional markets and its “small-scale” farmers. This option is judged as socially unfair and is also criticized from an economic point of view. On one side, the access to quality meat markets (meaning the meat once produced in commercial farms in Zimbabwe) in occidental countries is more and more difficult (renegotiation of commercial agreements with Europe, reinforcement of sanitary standards, growing requirement from supermarket distribution); while on the other side a national and regional market, less demanding technically, is expanding for low cost meat of a lower quality (our interviews).

The Biodiversity issue

Foot and mouth disease eradication appears for a lot of people as an obstacle to wildlife conservation, which pertains to the global biodiversity problematic since the 90’s, supported by international environmental NGO’s (e.g. WWF). The biodiversity concept went over the sole purpose of conservation of some emblematic wild species to focus on the conservation of the global living diversity. Therefore, the issue of stopping the culling of buffalos for

sanitary reasons for example expands now to all species: eradication of tsetse fly today (in order to eradicate trypanosomiasis) is also questioned. Beyond species, the attention is now concentrated on the protection of whole ecosystems.

These movements partly contest the spatial organisation of the fight against animal diseases that are based on fencing (our interviews). Fencing deeply affects the dynamics of wild animal populations by isolating groups and more widely, ecosystems. In Botswana, this situation seems to have contributed to a great reduction of impala populations during periods of drought (Cumming 2004, Ferguson and Hanks 2010).

Moreover, the priority given to the control of foot and mouth disease at the expense of wildlife is questioned by the growing economic value of the wildlife sector (Ferguson et al. 2013). Since the 2000's, commercial farmers having lost the export markets (and previously opposed to the conservation of abundant wildlife populations) see in wildlife hunting in concessions, game ranching or vision tourism, a new source of income and a way to face the new uncontrolled sanitary situation and the drop in beef prices (Wolmer 2003). It also represents a new legitimacy to oppose the threat of occupation under the land reform.

Backed-up by international stakeholders and the former colonists, the biodiversity conservation and the creation of protected areas are sometimes interpreted as "white man ideas rooted in colonial inheritance" (Compagnon 2002) that could be seen as a form of continuity with the former colonial order.

The fight against poverty issue

Closely linked to the issues of development and biodiversity conservation, the question of the fight against poverty is important in a country where more than 76% of rural and 38% of urban populations live under the poverty line (ZimStat 2013).

Poor areas often coincide with intense sanitary monitoring areas, located between protected areas and commercial farms dedicated to exportation. In these areas, populations suffer from wildlife conflicts (attacks on people, livestock and crops) whereas wildlife activities (tourism, hunting) benefit former colonists and some rich black businessmen.

Furthermore, those populations are not only excluded from the commercial sector but also support the burden of geographic standards in place of the commercial sector (Ferguson et al. 2013). These standards restrain their animal movements, limit drought-mitigating strategies (frequent and imposing a high mortality rate in livestock sometimes up to 97% for farmers that did not manage to relocate their herds, Mavedenze 2006) and restrain the radius for livestock product commercialization. Those small-scale farmers are thus "victims by geographic association". Eventually, the treatment to fight foot and mouth disease is considered worse than the disease itself by those promoting veterinary services and control strategies targeted at diseases more relevant to pastoral extensive farming (Kock et al. 2002).

In the process of de-compartmentalization of protected areas, Zimbabwe was one of the first African countries to adopt, in 1989, a community-based program for wildlife management⁷ benefiting rural populations. This decentralized approach, aiming at shifting the authority over wildlife management towards the local level, is, at that time, a real innovation

⁷ Called CAMPFIRE, the first Community-Based Resource Management project.

in territorial management⁸ and is based on a transfer of the legal expertise at local scale. It allows the populations living around protected areas to benefit from natural resources (grazing, wood, hunting, tourism income) by balancing conservation and development goals. Those evolutions will impact animal surveillance, in particular in the way it articulates sanitary and environmental issues. They belong to a new paradigm of security and surveillance that associates border protection and flow control.

SURVEILLANCE: OF TERRITORIES AND FLOWS

Biodiversity, biosecurity and « One Health »

As some stakeholders request a reorientation of the sanitary systems for a better consideration of wildlife conservation and to fight poverty, a new perception of the linkages between biodiversity and health is growing with the « One Health » concept adopted by international organizations.

With the adoption of the biodiversity concept, the narrow goal of nature conservation in national parks, considered as fortresses, is henceforth widened with many others issues and articulated with news sectors and scales of intervention. Those modifications attest of a new objective of fluidity, taking different aspects.

The biodiversity concept is linked to the global public good concept. It locates conservation areas within globalized spaces. National frontiers even disappear with transfrontier park concept such as the Great Limpopo Transfrontier Conservation Area (GLTFCA) between South Africa, Mozambique and Zimbabwe (Andersson et al. 2013).

Parks are no longer considered as closed entities but can now be connected between them in order to ensure wildlife movements within enlarged ecosystems. Moreover, they have to be accessible to a certain extent to peripheral local populations (Jones 2006) through the implementation of community-based natural resources management (CBNRM) projects to address the sustainable development goal. Biodiversity and ecosystems are no longer seen as entities that need to be closed to stay protected, but as flows and processes that need to be maintain.

Sanitary issues have also evolved together with the biosecurity concept. At the international scale, public health policies (human and veterinarian) have been redirected during the last decades, consequently to the emergence of new diseases in a globalization context. Global governance scheme has been implemented (Figué 2014) showing the interdependence of the States and signing the end of the model based solely on border surveillance. The goal is now to ensure the security and the continuity of flows of people, products, and information through the monitoring of movements and tracks (with traceability). This governance is based on “institutional fluidity in response to the increasing economic, political, and social interdependence of the modern world and the resulting common dangers and opportunities in the form of diseases, products, and ideas that readily cross borders” (Fee et al. 2008): 632). Aside from traditional means of border controls to protect national territory, those paradigms tend to promote the mobilisation of transnational and non territory-based networks of disease surveillance and control with the objective of prevention and action at the source (King 2002: 774).

⁸ In the framework of conservation projects integrating development: it is the Community-Based Natural Resource Management approach.

The emergence of biodiversity and biosecurity concepts follows therefore common evolutions. But what is also new is the articulation they reorganise between the two intervention areas they rely on. This reorganisation is linked to the emerging disease issue.

The emergence of new infectious diseases strengthens the view of wildlife as a threat. Indeed, animals and wildlife play a key-role in emerging disease problematic: 60% of emerging infectious diseases are zoonotic, meaning communicable to human; and among them 72% come from wildlife (Anthrax, Ebola, AIDS, Rabies, SRAS, Nipah virus...) (Cleaveland et al. 2001, Taylor et al. 2001). However at the same time, those new diseases have strengthened the idea among the scientific and political community of the need for a multidisciplinary understanding of disease ecology and for inter-sectoral public policies: the emerging idea is that human, animal (wild and domestic) and environmental health are inter-dependent issues. This approach is now widely referred as the "On Health" concept by international organisations.

Those evolutions have an impact on how to think surveillance, on its stakeholders, goals and systems.

New surveillance systems

Wildlife surveillance

Gradually, the idea of including wildlife in disease surveillance systems is growing. Actually, wildlife is already monitored to protect it from poachers and to avoid it from going out of protected areas. From the end of the 70's, large African rinderpest eradication programmes, funded by Europe have included wildlife sanitary surveillance in their research programmes to define the role of wildlife in the disease epidemiology (Roeder et al. 2013). In Zimbabwe, in the 90's, a unit from the veterinary services is created to monitor foot and mouth disease in wild populations in the context of meat exportation to Europe.

But, with the concept of emerging diseases, the wildlife surveillance programmes intensified at international, regional and national scales, through different tools: national park staff integrate sanitary surveillance networks reporting any abnormal wildlife morbidity or mortality that can potentially be an indicator of disease outbreak; or through a more active surveillance benefiting from new innovative technologies such as GPS, satellite imagery or drones. The institution in charge of livestock within the African Union, the AU-IBAR introduced officially in its strategic plan for 2010-2014 wildlife surveillance for sanitary purposes. Despite this clear willingness, those ideas are difficult to put in practice. Nevertheless, it testifies of a new approach of animal health including wildlife health not simply with a role of reservoir that needs to be eradicated.

The CBT

Another approach recently designed for animal health surveillance and articulating biodiversity and biosecurity is the CBT or commodity based trade concept – defended by a group of actors (Anglo-Saxon NGO's in particular some like the Wildlife Conservation Society; members of veterinary services...). The CBT concept aims at focusing disease surveillance on commodities derived from animals and on the value chain rather than the epidemiologic status of the zone where animals come from. This concept would allow to market (even at international levels) animal products coming from foot and mouth disease infected areas but from value chain certified virus-free (Thomson et al. 2013b). CBT is based on the fact that several simple technics can nowadays guarantee the absence of the foot and mouth virus from animal product. This approach could emancipate from the international hegemonic standards whole areas where foot and mouth disease is endemic. It would help

to fight poverty by concentrating the costs of exportation on export actors and reducing the constraints for small-scale farmers. In addition, by avoiding a strict territorial zoning, it re-establishes the connectivity between ecosystems claimed by environmental actors. Finally, this concept could even allow for the marketing of wild meat in the context of the sustainable use of natural resources. Veterinary services from southern Africa and in particular from Zimbabwe seem to be exploring this option, which would imply a sudden change in strategy and approach.

Through wildlife surveillance and the CBT standard, new actors are now involved in animal disease surveillance systems and attempt, through it, to promote development objectives and a new balance of power.

DISCUSSION

During the colonial period, animal surveillance serves several objectives with a common goal to delineate safe and healthy territories benefiting the colonial power. This surveillance is based on geographic confinement of indigenous populations, their animals and wildlife through the zoning of the territory and erection of fences. It is also based on registering populations and their animals through dip-tank network, on culling measures (wild and domestic animals) and on mandatory sanitary treatments (dip-tank system in particular).

It contributes to justify the implementation of a segregation of “races” (white/black), of wild and domestic species, associated to a territorial agricultural planning. Beyond animal disease control, the security of the colonists and the prosperity of their territories are supported. Indigenous populations and their herds are excluded from this economic development and are given the role of a buffer for sanitary purpose defining them as an intermediate category between the animal and the white man, between the wild and the domestic animal.

Through this territorial organisation, separating wild from domestic, man from animal, colonists from indigenous, the colonial power signifies its presence and its authority; it imprints the territory with its civilising mission. As written by Mauz (2002), (discussing the concept of the right place of animals and men in the French Alps), the distance between man and animal relies on the distance between wild and domestic and “for men to stay men and not to go back to animality, they must contain wild and domestic animals at their respective place”.

This territorial organisation translates also the presence of the State; the modern State is responsible of citizen security living in a given area (Gros 2012). This security is ensured by controlling borders and by confinement processes and fences. It stands on three emblematic roles of modernity: the judge, the policeman and the soldier. In the colonial context, the veterinarian has a key role, at the heart of the colonial state construction, as this document and some other studies are demonstrating (Brown and Gilfoyle 2010).

Confinement systems are based upon tools like the wire fence representing, as Netz (2004) highlights it, a simple and eminently modern tool to perform an anonymized control on space at small and large scales, and upon animals (e.g. western America and ranches) and men (e.g. gulags, Boer war and Nazi camps). The regulation of their movements aims to *fence them out* from the area or to *fence them in* an exclusion area, sometimes particularly cramped (Netz 2004), and with various levels of violence depending on the political issues at stake.

Those systems are also related to the creation of knowledge: to delineate areas, identify their “potential” (that was the role of cartographers and geographers associated with the

colonists), but also to index men and their animals and to ensure that they all stay at “their place”. Therefore, the “dip-tank” system presented here is a more sophisticated tool than the wire fence: it illustrates the theories as defined by Foucault of the link between knowledge and power. Indeed, through its sanitary surveillance and management role, the system produces knowledge allowing the census of populations (e.g. numbers, human and animal population dynamics) and it allows the implementation of a biopolitic, as defined by Foucault, applying on populations.

This explains the apparent paradox of the continuity of those systems; in particular geographic confinement after the independence of the country, despite its racial origin. Through their maintenance, the objective is to respond to business opportunities offered by ACP agreements. But, it expresses also the presence of an independent and modern state on its territory and is a way to strengthen political and economical alliances.

Despite the difficulties following the land reform and the economic crisis of the 2000' in Zimbabwe, the government still aims at re-instating the system even if arguments against are strong and difficulties numerous. The same confinement system is still found nowadays in countries of the region that have experienced apartheid policies and where wildlife represents a sanitary risk. In Namibia, Miescher (2012) describes a system built upon apartheid policies and that still split the country into two by a sanitary cordon: “communal lands” in the North with black small-scale farmers and community-based wildlife management; and the exportation business sector in the South based on large farms mainly owned by white owners. In South Africa, around Kruger National Park where the main population of buffalos lives and represents a continuous source of foot and mouth disease contamination, mechanisms of animal health control restrain herds' movement and limit access to market for small-scale black farmers. Botswana is cut into two as well areas, with wildlife on one side and commercial livestock on the other side.

CONCLUSION

The historical analysis of animal surveillance in Zimbabwe shows the diversity and the evolution of associated issues and mechanisms upon which it stands.

To grasp this diversity and this complexity, one needs to look at the biological, social, economical and political dynamics. Our work, based on this condition, reveals the power of those systems to impose and materialize a vision of the world through categories as essential for our societies as wild and domestic, human and animal.

The contemporary paradigms of biosecurity and biodiversity integrate the constraint of fluidity in a globalized world, still fragmented (biodiversity reserves, separated development). The “One Health”, CBT and “transfrontier parks” concepts could represent the right time to implement new solidarity systems between economic compartments (self-subsistence and export livestock production), between countries with different economical and sanitary status and also between species.

Acknowledgments

This study has been implemented within the framework of the Research Platform “Production and Conservation in Partnership” (www.rp-pcp.org) and of the project “Emergence et Risques Sanitaires” coordinated and financed by Cirad, France. The authors are grateful to Mrs Carole Goulet for the English translation of the French version of this article.

REFERENCES

- Anderson, D. (2009). Kenya's Cattle Trade and the Economic Empire, 1918-48, chap14. In K. Brown, Daniel (Ed.), *Healing the Herds: Disease, Livestock Economies and the Globalization of Veterinary Medicine*. Athens Ohio: Ohio University Press pp. 250-268.
- Andersson, J. A., Garine-Wichatitsky de, M., Cumming, D. H. M., Dzingirai, V. et Giller, K. E. (2013). *Transfrontier conservation areas. People living on the edge*. London: Earthscan, Routledge.
- Barbier, M. (2006). Surveiller pour abattre. *Terrains & travaux*, 2 (n° 11), 101-121.
- Barbier, M. et Prete, G. (2010). Un regard sociologique sur la biopolitique des maladies émergentes et ré-émergentes. In J. Barnouin et I. Sache (Eds.), *Les maladies émergentes. Épidémiologie chez le végétal, l'animal et l'homme*. Paris, QUAE ed. pp. 411-422.
- Brown, K. et Gilfoyle, D. (2010). *Healing the herds: Disease, livestock economies and the globalization of veterinary medicine*. Athens Ohio: Ohio University Press.
- Busayi, R. M. (2006). History of veterinary medicine in Zimbabwe. *Historia Medicinae Veterinariae*, 31 (3), 45-52.
- Chitiyo, T. K. (2000). Land violence and compensation. Reconceptualising Zimbabwe's land and war veterans' debate. *Track two*. http://reference.sabinet.co.za/sa_epublication_article/track2_v9_n1_a1 consulté le 23 mars 2014, 9 (1).
- Cleaveland, S., Laurenson, M. K. et Taylor, L. H. (2001). Diseases of humans and their domestic mammals: Pathogen characteristics, host range and the risk of emergence. *Philosophical Transactions of the Royal Society B-Biological Sciences*, 356 (1411), 991-999.
- Compagnon, D. (2002). La conservation de la biodiversité, improvable bien public mondial. In F. Constantin (Ed.), *Les Biens Publics Mondiaux : Un mythe légitimateur pour l'action collective ?* Paris: L'Harmattan pp. 163-189.
- Compagnon, D. (2008). Zimbabwe: de la "réforme agraire" à l'insécurité alimentaire. *La Découverte Hérodote*, 4 (131), 118-136.
- Condy, J. B. (1979). A history of foot and mouth disease in Rhodesia. *Rhod. Vet. J.*, 10, 2-10.
- Cook, A. J. C. (1991). Communal farmers and tick control. A field study in Zimbabwe. *Trop. Anim. Health Prod.*, 23, 161-166.
- Cumming, D. H. M. (2004). *Sustaining animal health and ecosystem services in large landscapes – 2nd Draft*: Wildlife Conservation Society.
- Fee, E., Cueto, M. et Brown, T. M. (2008). WHO at 60: Snapshots from its first six decades. *American Journal of Public Health*, 98 (4), 630-633.
- Ferguson, K., Cleaveland, S., Haydon, D. T., Caron, A., Kock, R., Lembo, T., et al. (2013). Evaluating the potential for the environmentally sustainable control of foot and mouth disease in sub-Saharan Africa. *EcoHealth*, 10 (3), 314-322.
- Ferguson, K. et Hanks, J. (2010). *Fencing Impacts: A review of the environmental, social and economic impacts of game and veterinary fencing in Africa with particular reference to the Great Limpopo and Kavango-Zambezi Transfrontier Conservation Areas*. Pretoria, South Africa.
- Figuié, M. (2014). Towards a global governance of risks: international health organisations and the surveillance of emerging infectious diseases. *Journal of Risk Research*, 17 (4), 169-483.
- Figuié, M. et Foulleux, E. (2013). *How much severe is a disease? The social construction of the Foot and Mouth Disease*. Communication présentée à: ESA/ISA mid term conference "Risk and Uncertainty: Ontologies and Methods". University of Amsterdam, The Netherlands.
- Foucault, M. (2004). *Sécurité, territoire, population. Cours au Collège de France, 1977-1978*. H ed. Vol. A). Paris: Gallimard Seuil.
- Gerbaud, O. (1986). *Les premiers vétérinaires français engagés pour le service des colonies entre 1770 et 1830* Vol. 19: Institut d'élevage et de médecine vétérinaire des pays tropicaux, Département du Centre de coopération internationale en recherche agronomique pour le développement.
- Gros, F. (2012). *Le principe sécurité*. Paris: Gallimard.
- Hargreaves, S. (2010). Comments. Responses and reactions to Scoones et al. "Foot-and-mouth disease and market access: challenges for the beef industry in southern Africa". *Pastoralism*, 1 (2), 166-167.
- Hinchliffe, S., Allen, J., Lavau, S., Bingham, N. et Carter, S. (2013). Biosecurity and the topologies of infected life: from borderlines to borderlands. *Transactions of the Institute of British Geographers*, 38, 531-543.
- Jones, S. (2006). A Political Ecology of Wildlife Conservation in Africa. *Review of African Political Economy*. ROAPE publication (109), 483-495.
- Kerouedan, D. (2013). *Géopolitique de la santé mondiale*. Paris: Collège de France/Fayard.
- King, N. B. (2002). Security, Disease, Commerce: Ideologies of Postcolonial Global Health. *Social Studies of Sciences*, 32 (5-6), 763-789.

- King, T. (2012). Zimbabwe's land reform: myths and realities. *Journal of Southern African Studies*, 38 (3), 737-739.
- Kock, R., Kebkiba, B., Heinonen, R. et Bedane, B. (2002). Wildlife and pastoral society--shifting paradigms in disease control. *Annals of the New York Academy of Sciences*, 969, 24-33.
- Landais, E. (1990). Sur les doctrines des vétérinaires français coloniaux en Afrique noire. *Cahier des Sciences Humaines*, 26 (1-2), 33-71.
- Latour, B. (2011). *Pasteur : guerre et paix des microbes*. Paris La découverte.
- Mauz, I. (2002). Les conceptions de la juste place des animaux dans les Alpes françaises. *Espaces et sociétés*, 110-111, 129-145.
- Mavedzenge, B. Z., Mahenehene, J., Murimbarimba, F., Scoones, I. et Wolmer, W. (2006). *Changes in the livestock sector in Zimbabwe following land reform: the case of Masvingo Province*. Brighton, UK: IDS
- Mavedzenge, B. Z., Mahenehene, J., Murimbarimba, F., Scoones, I. et Wolmer, W. (2008). The dynamics of real Markets: Cattle in Southern Zimbabwe following Land Reform. *Development and Change*, 39 (4), 613-639.
- Mavhunga, C. et Spierenburg, M. (2007). A finger on the pulse: Hidden voices of colonial anti-Tsetse Science on the Rhodesian and Mozambican borderlands., 1945-1956. *South African Historical Journal*, 58, 117-141.
- Miesher, G. (2012). *Namibia's Red Line: The History of a Veterinary and Settlement Border*: Palgrave.
- Milton, S. (1994). *The Killing floor: The First World War and the emergence of the South African beef industry 1902-24*.
- Mombeshora, S. et Le Bel, S. (2009). Parks-people conflicts: the case of Gonarezhou National Park and the Chitsa community in south-east Zimbabwe. *Biodiversity & Conservation*, 18 (10), 2601-2623.
- Mutowo, M. K. K. (2001). Animal Diseases and human Population in Colonial Zimbabwe: the rinderpest epidemic of 1896-1898. *Zambezia*, XXVIII (i), 1-22.
- Mwatwara, W. (2014). 'Even the calves must dip': East Coast Fever, Africans and the Imposition of Dipping Tanks in Southern Rhodesia, c.1902-1930. *South African Historical Journal*, 66 (6), 320-348.
- Netz, R. (2004). *Barbed Wire: An Ecology of Modernity*,). Middletown: Wesleyan University Press.
- Roeder, P., Mariner, J. et Kock, R. (2013). Rinderpest: the veterinary perspective on eradication. [Historical Article Review]. *Philos Trans R Soc Lond B Biol Sci*, 368(1623), URL]. doi:DOI
- Scoones, I., Bishi, A., Mapitse, N., Moerane, R., Penrith, M. L., Sibanda, R., et al. (2010). Foot-and-mouth disease and market access: challenges for the beef industry in southern Africa. *Pastoralism*, 1 (2), 136-164.
- Scoones, I., Marongwe, N., Mavedzenge, B. Z., Murimbarimba, F., Mahenehene, J. et Sukume, C. (2011). *Zimbabwe's Land Reform. A summary of findings*. Brighton: IDS.
- Scoones, I. et Wolmer, W. (2007). Land, Landscapes and Disease: The Case of Foot and Mouth in Southern Zimbabwe. *South African Historical Journal*, 58, 42-64.
- Taylor, L. H., Latham, S. M. et Woolhouse, M. E. J. (2001). Risk Factors for human disease emergence. . *Proceedings of the Royal Society of London Series B*, 356, 983-989.
- Thomson, G. R., Penrith, M. L., Atkinson, M. W., Atkinson, S. J., Cassidy, D. et Osofsky, S. A. (2013). Balancing Livestock Production and Wildlife Conservation in and around Southern Africa's Transfrontier Conservation Areas. . *Transboundary and Emerging Diseases*, 60 (6), 492-506
- Thomson, G. R., Penrith, M. L., Atkinson, M. W., Thalwitzer, S., Mancuso, A., Atkinson, S. J., et al. (2013). International trade standards for commodities and products derived from animals: the need for a system that integrates food safety and animal disease risk management. *Transboundary and Emerging Diseases*, 60 (6), 507-515.
- Torny, D. (1998). La traçabilité comme technique de gouvernement des hommes et des choses. *POLitix*, 44, 51-75.
- Troubridge Critchell, J. et Raymond, J. (1912). A history of the frozen meat trade. Available from <https://ia600408.us.archive.org/28/items/historyoffrozenm00crituoft/historyoffrozenm00crituoft.pdf>
- van Onselen, C. (1972). Reactions to Rinderpest in Southern Africa, 1896-1897. *Journal of African History*, 13 (3), 66-84.
- Wolmer, W. (2003). *Transboundary conservation: the politics of ecological integrity in the Great Limpopo Transfrontier Park*. Brighton: Institute of Development Studies.
- ZimStat (2013). *Poverty and Poverty Datum Line Analysis in Zimbabwe 2011/12*. Harare: Zimbabwe national statistics agency.

Muriel FIGUIÉ is sociologist (sociology of risk, sociology of food) at Cirad (UMR Moisa). She conducts researches on the way zoonotic risks are perceived and handled in various social and geographical contexts (Asia, Africa) and at different scales (local, national, international). She studies the interactions between these different levels through the organisation of market chains and the functioning of epidemiological surveillance systems.

Address CIRAD ES
73, av. J.-F. Breton
TA C -99/15
34398 Montpellier Cedex 5 France

Email muriel.figuie@cirad.fr

Aurélie BINOT is a researcher in social sciences (Anthropology and Geography) and Agronomy at CIRAD and is hosted as adjunct professor at Kasetsart University Faculty of Veterinary Medicine (Thailand). She is involved in interdisciplinary research projects addressing integrated management of health risks across sectors (agriculture, health and environment) and implementing participatory approaches within a “One Health/ECOHEALTH” framework merging social, epidemiological and environmental dynamics.

Address Faculty of Veterinary Medicine
Kasetsart University, Chatujak
50 Ngamwongwan Rd
Lat Yao Subdistrict Chatujak District
Bangkok 10900. Thaïlande

Email aurelie.binot@cirad.fr

Alexandre CARON is a disease ecologist, specialised in infectious transmission processes at the wildlife/livestock interface. Full-time researcher at CIRAD in the research unit AGIRs, he contributes to the animation and coordination of the Research Platform « Production and Conservation in Partnership » through his work on the sustainability and resilience of southern Africa socio-ecosystems. In 2015, he left Zimbabwe to be based in Mozambique.

Address Faculdade de Veterinária
Universidade Eduardo-Mondlane
Maputo, Mozambique

Email alexandre.caron@cirad.fr
