RVF: the disease epidemiology in animals and overview of its global spread

Inter-regional Conference
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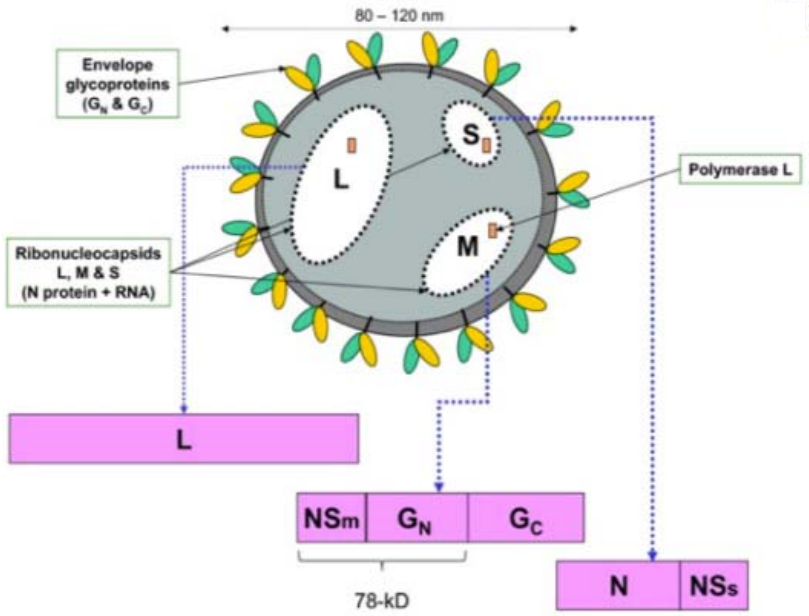
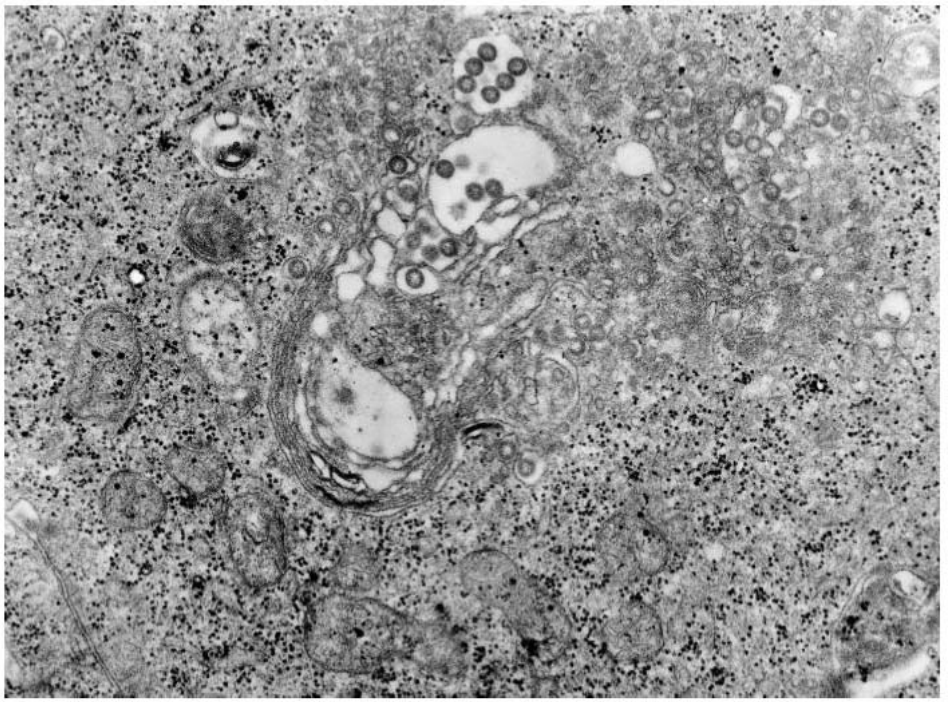
Recap of the disease

- Vector borne disease with a very wide range of vectors
- Bunyavirus family, genus Phlebovirus (RNA)
- Zoonosis – infection either from mosquitos or contact with infected animal material
- High mortality in young animals; abortion in pregnant animals
- Outbreaks are usually associated with heavy rains (El Nino)

Characteristic L,M,S RNA segmented genom, in a separate nucleocapsid in the virion;

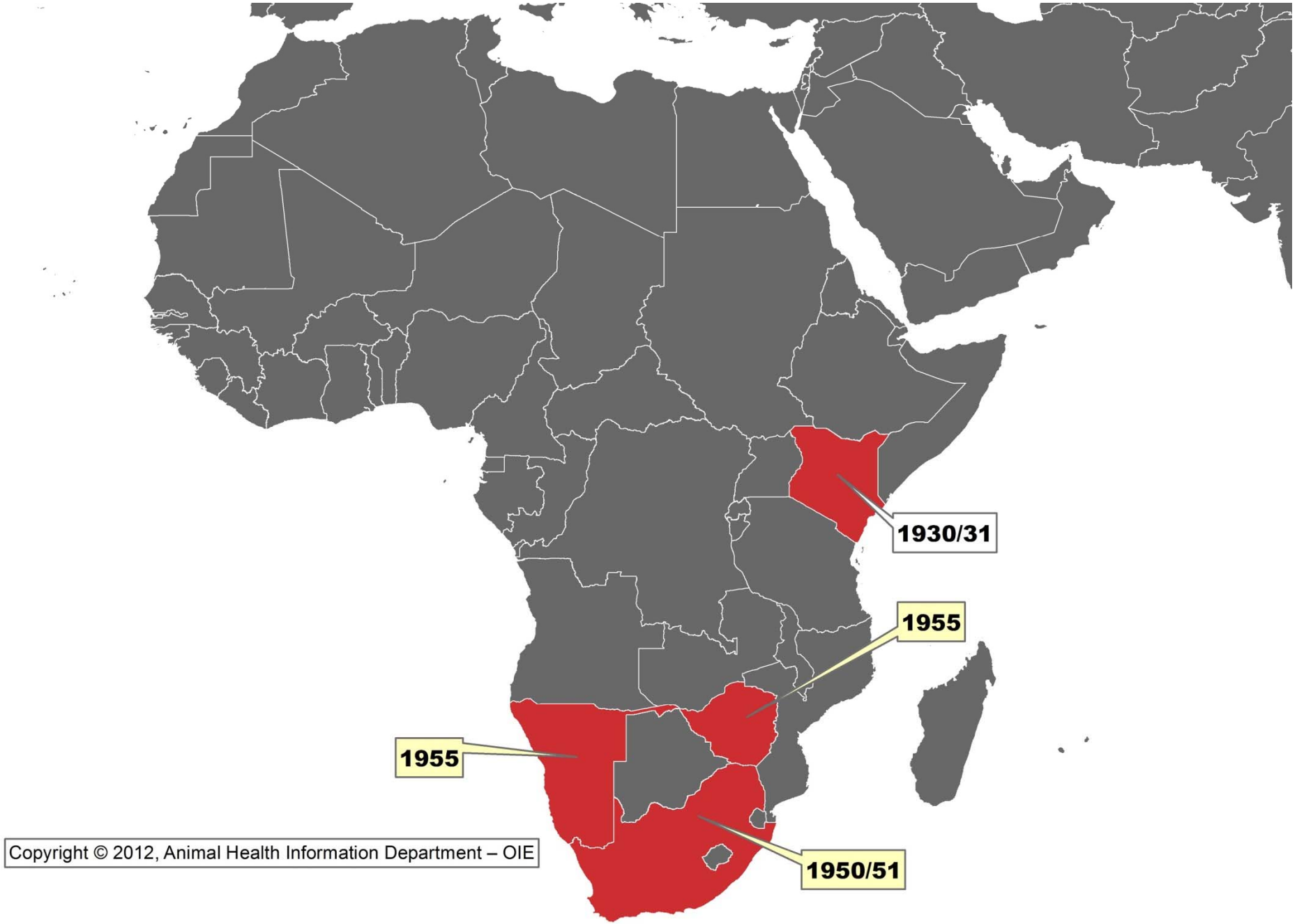
No significant antigenetic differences between isolates from many countries, but differences in pathogenicity, possibly due to minor nucleotid/aminoacid differences

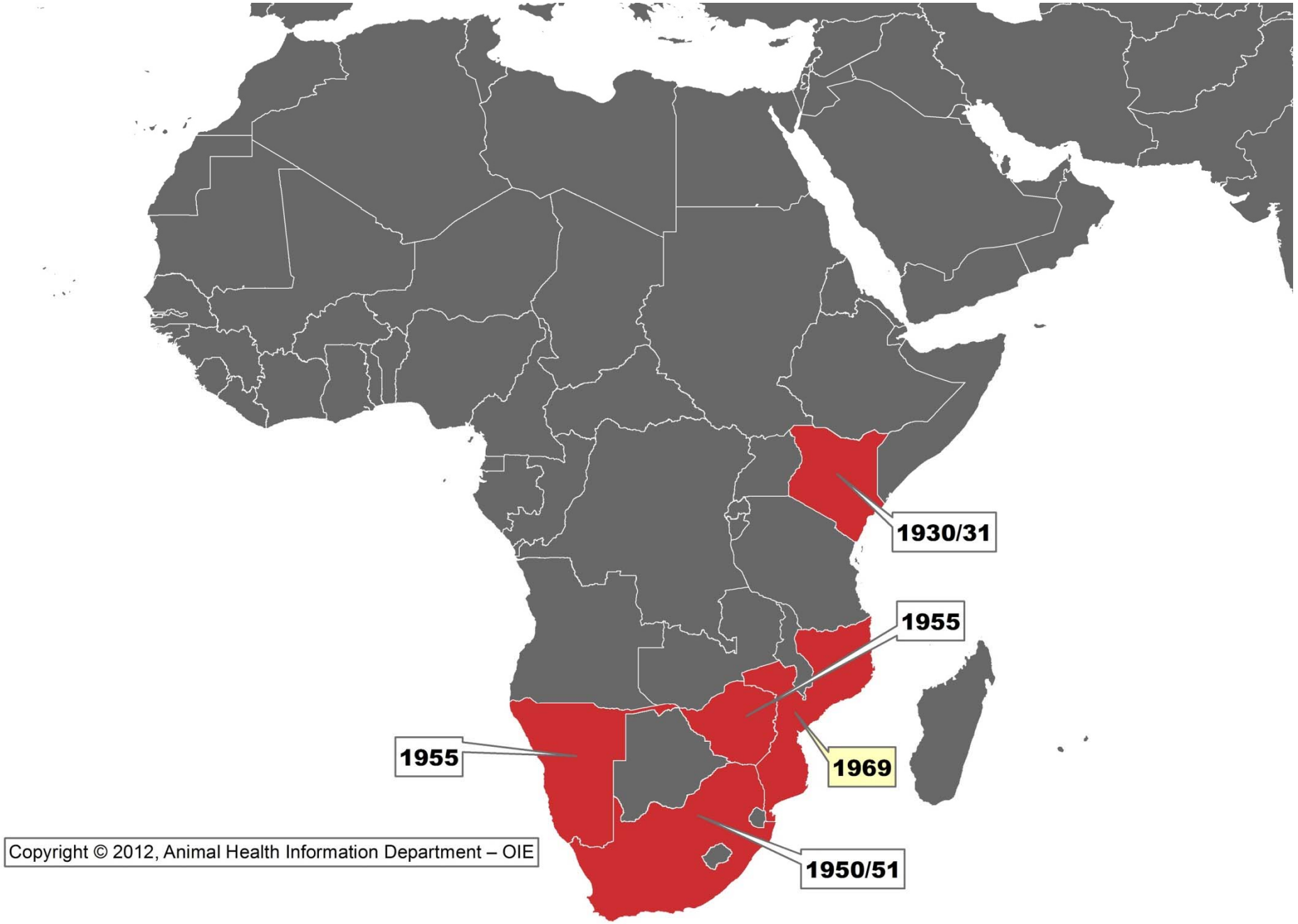


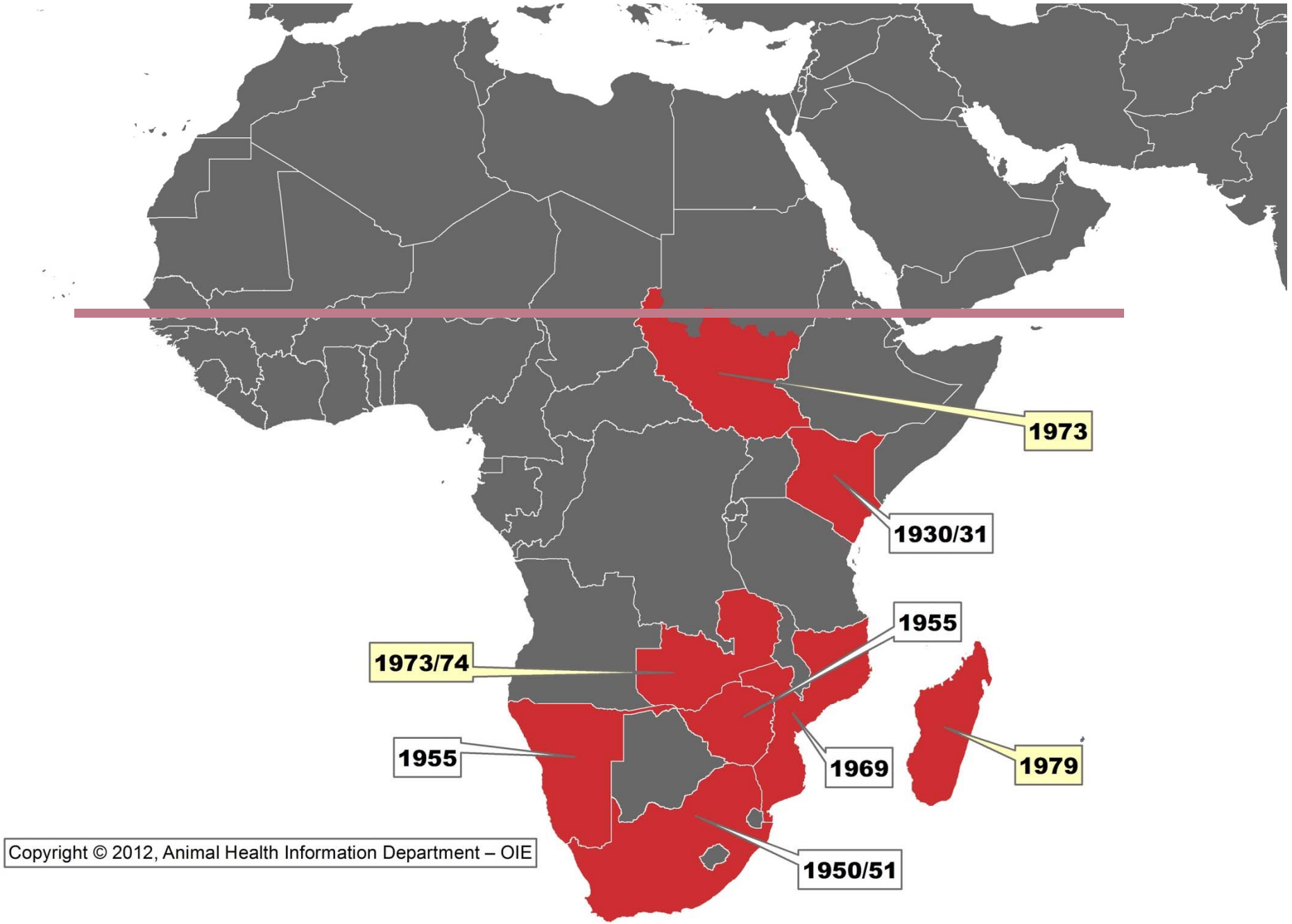


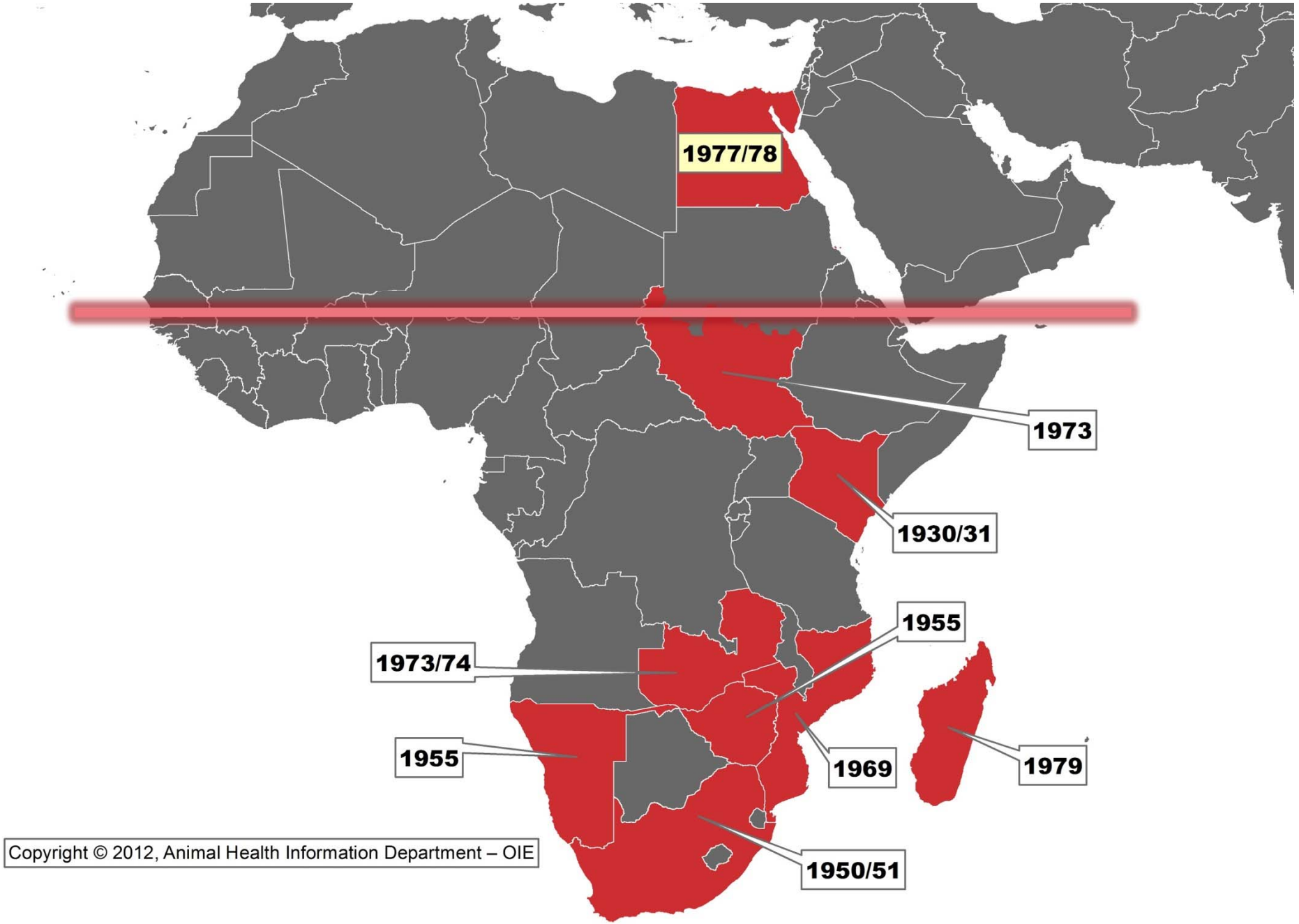
This transmission electron micrograph (TEM) depicted a highly magnified view of a tissue that had been infected with Rift Valley fever virus. Source : Centers for Disease Control and Prevention (USA)

** PhleboV: 68 serotypes, 8 linked to disease in humans: Alenquer virus, Candiru virus, Chagres virus, Naples virus, Punta Toro virus, Rift Valley fever, Sicilian virus, and Toscana virus. + Recently identified SFTS virus (2009, Haemaphysalis).*





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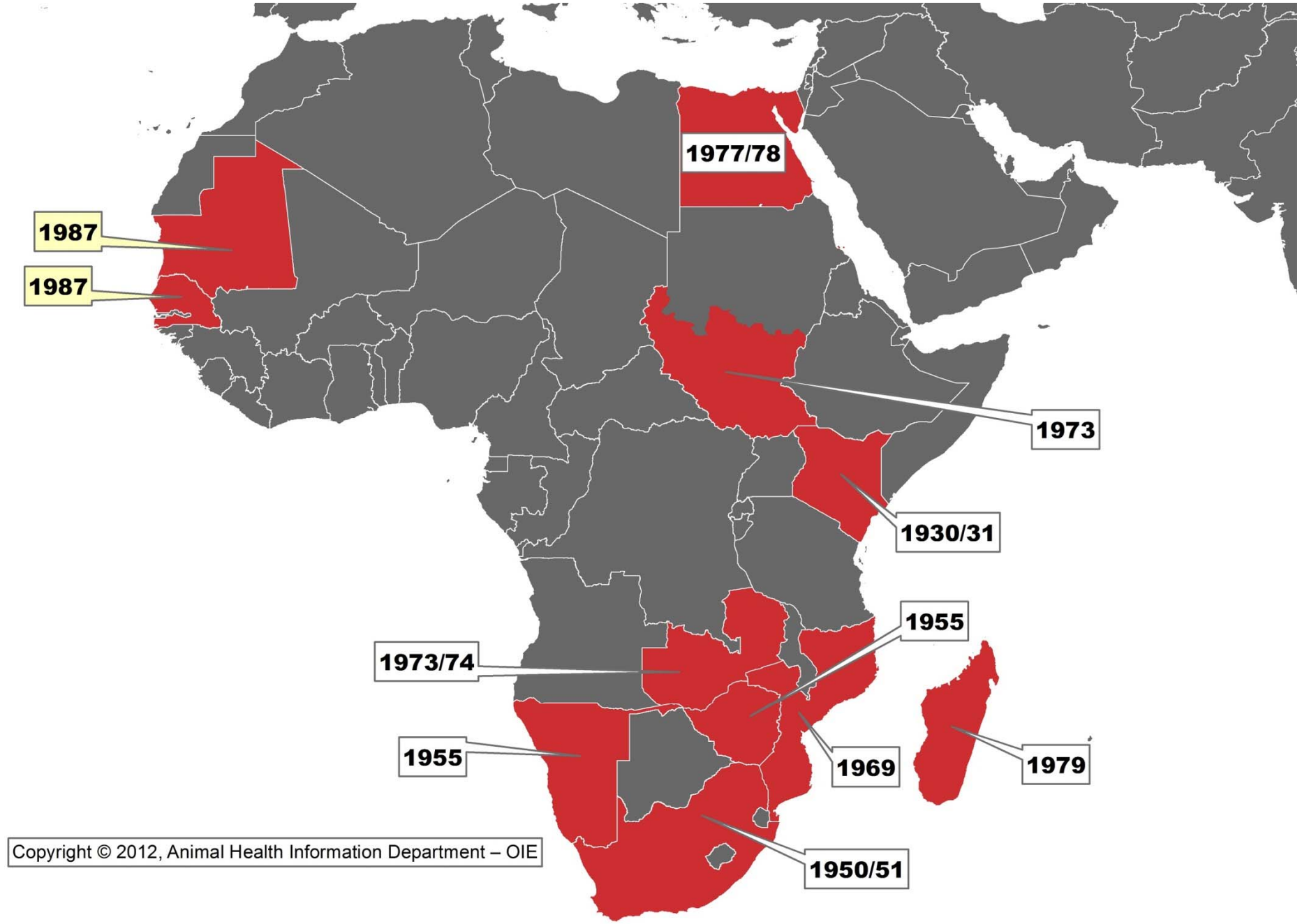
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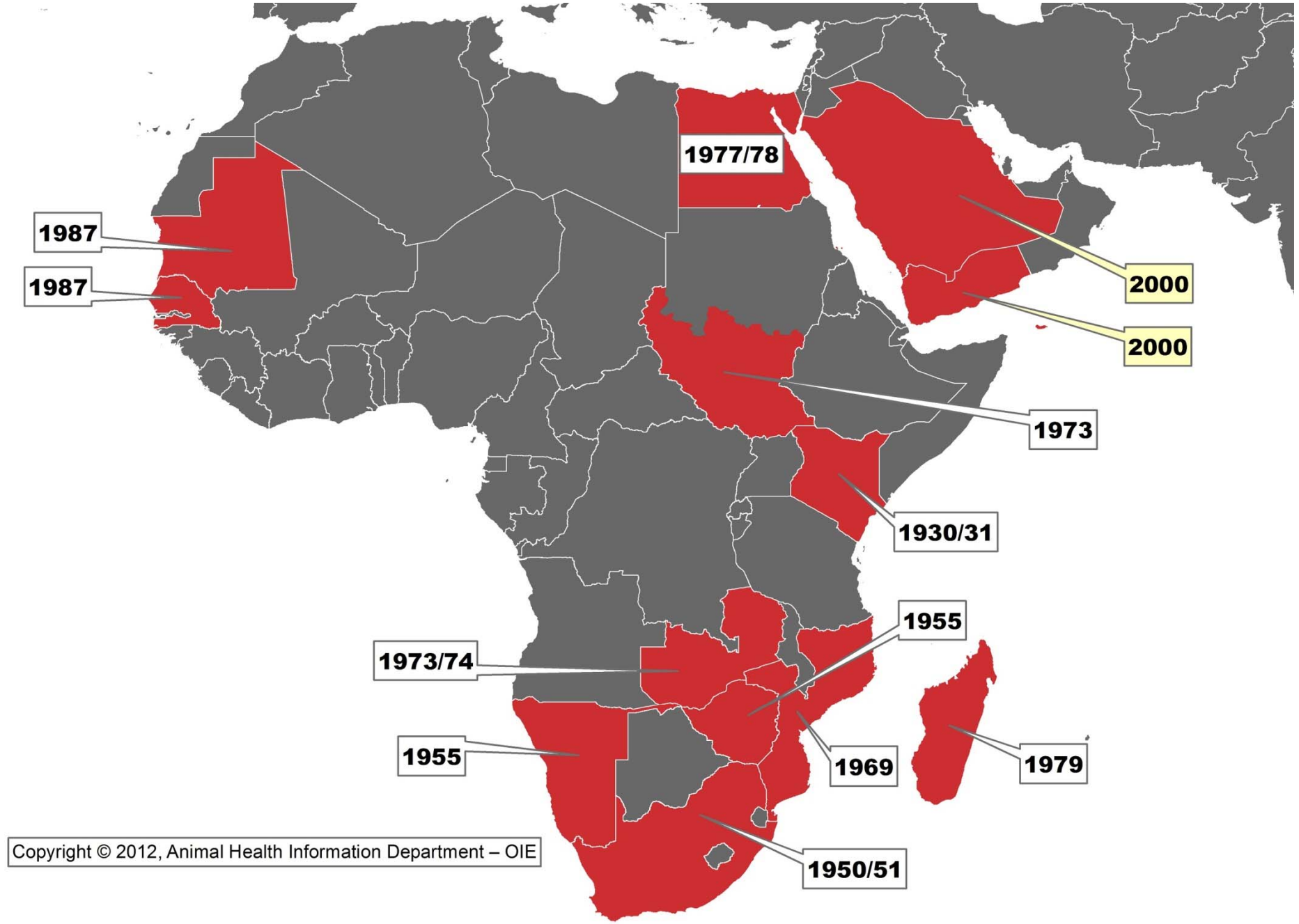
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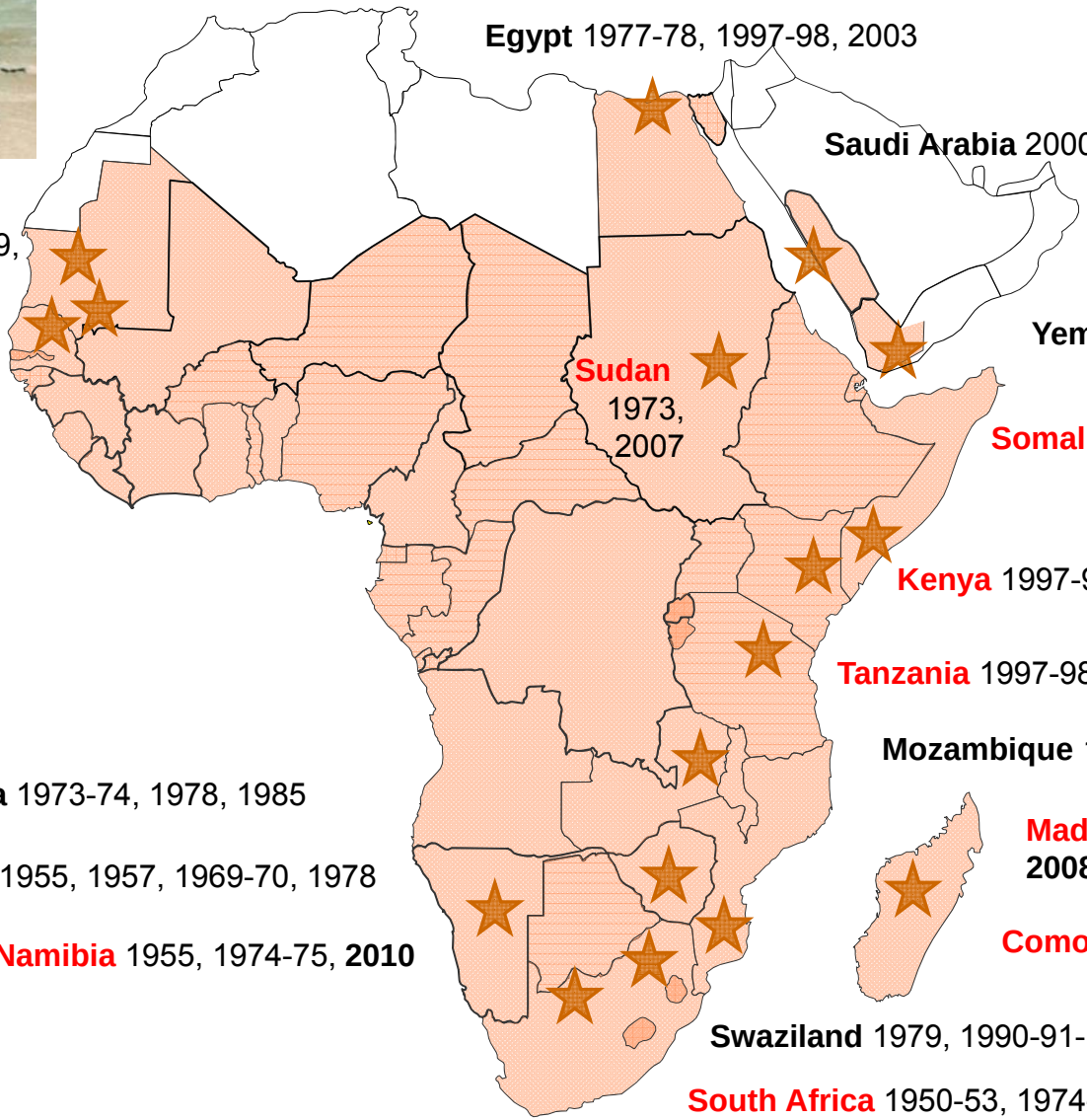
Rift Valley Fever



Egypt 1977-78, 1997-98, 2003

Saudi Arabia 2000

Mauritania 1987, 1998-99, 2002, **2010, 2012**

Senegal 1999, 2002

Gambia 1999, 2002

Sudan 1973, 2007

Yemen 2000

Somalia 1997-98, **2006-07**

Kenya 1997-98, **2006-07**

Tanzania 1997-98, **2007**

Mozambique 1969

Zambia 1973-74, 1978, 1985

Madagascar 1979, 1990-91- **2008-2009**

Zimbabwe 1955, 1957, 1969-70, 1978

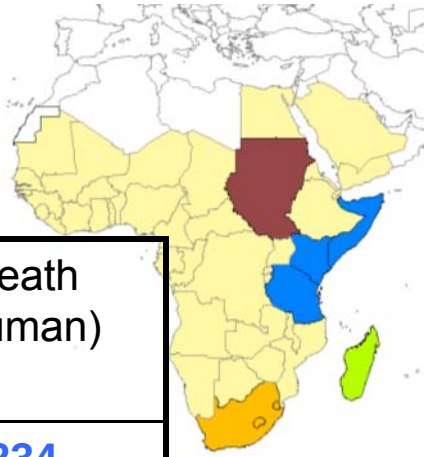
Comores, Mayotte 2008

Namibia 1955, 1974-75, **2010**

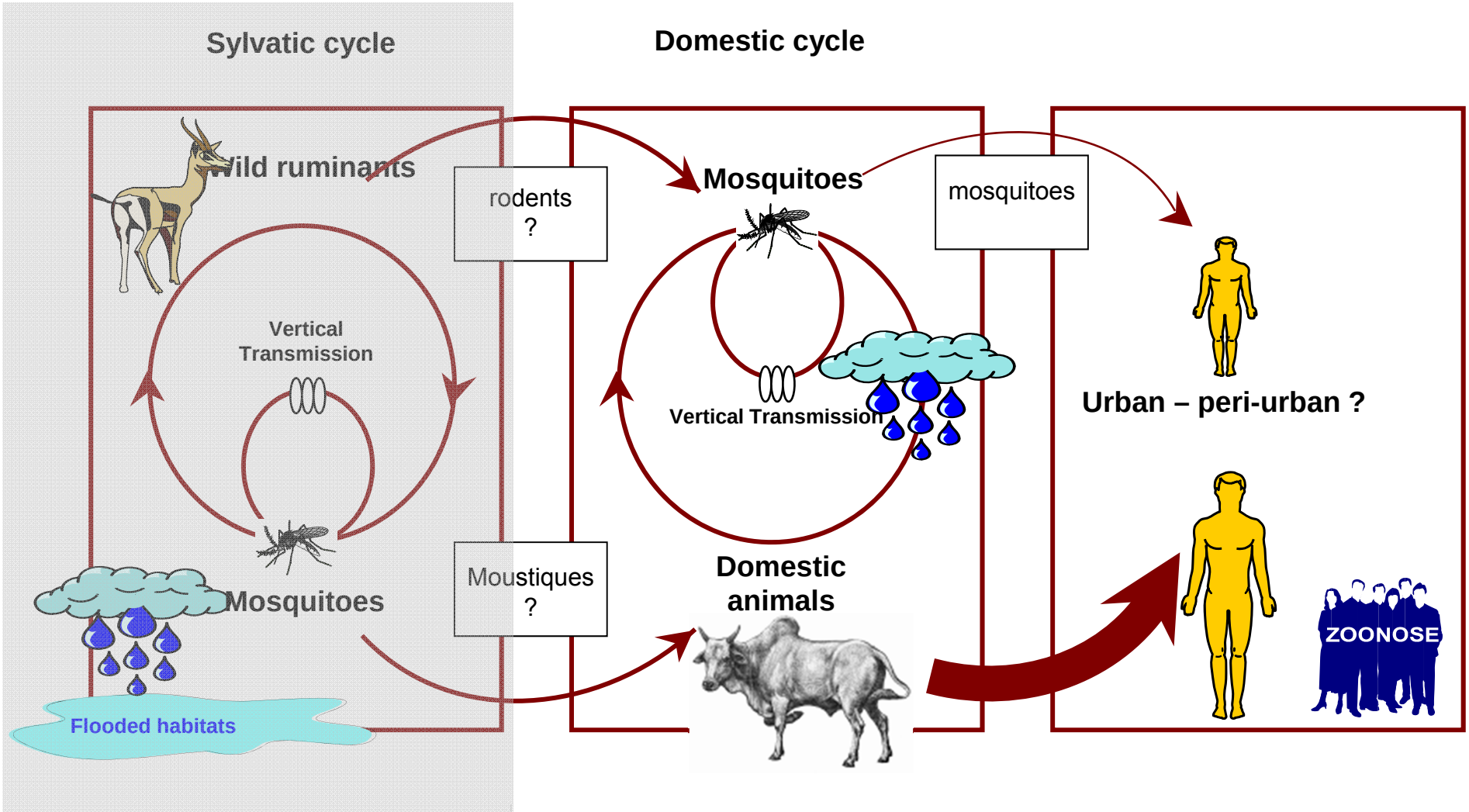
Swaziland 1979, 1990-91- **2008**

South Africa 1950-53, 1974-75, 1999, **2008-11**

Rift Valley fever in Africa
The last outbreaks



Year	country	Estimated (human)	Reported (human)	Death (human)
2006-07	**Kenya**	**75.000**	**684**	**234**
2006-07	**Somalia**	**30.000**	**114**	**51**
2006-07	**Tanzania**	**40.000**	**264**	**109**
2007-08	Sudan	75.000	738	230
2007-08	Madagascar	10.000	418	17
2008-09	Madagascar	2.500	233	4
2007-09	South Africa	-	15	0
2010-11 /12	Mauritania	500	69	17



Epidemiological cycle of RVF

Source: B.Mondet (IRD), in Gerring et al, 2003

8 different families of arthropods ofwhich 6 are mosquitoes (Aedes, Culex, Mansonia, Anopheles, Coquillettidia and Eretmapodites);

About 30 species of mosquitoes have been reported infected and some of them have been proven to have vector competence [EFSA, 2005].

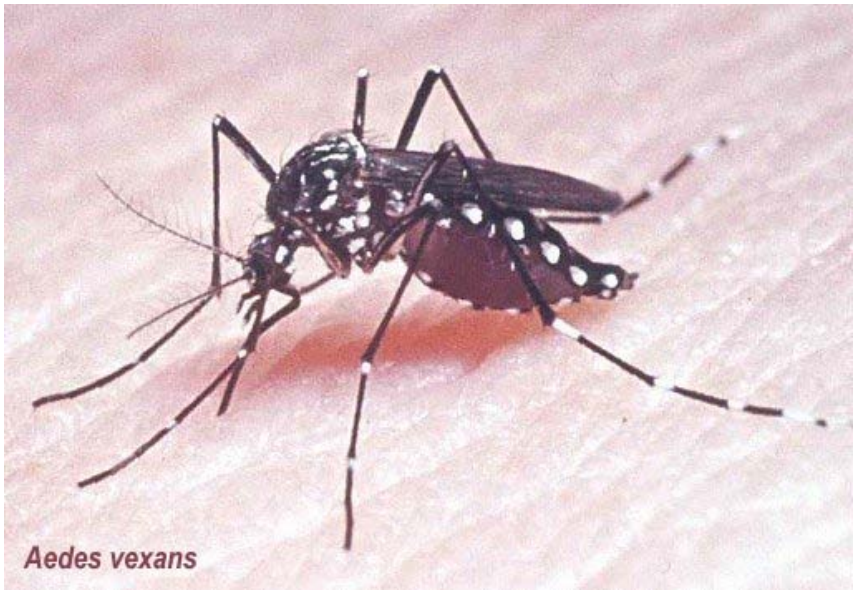
Other arthropods include culicoides, phĺebotomes, ticks..

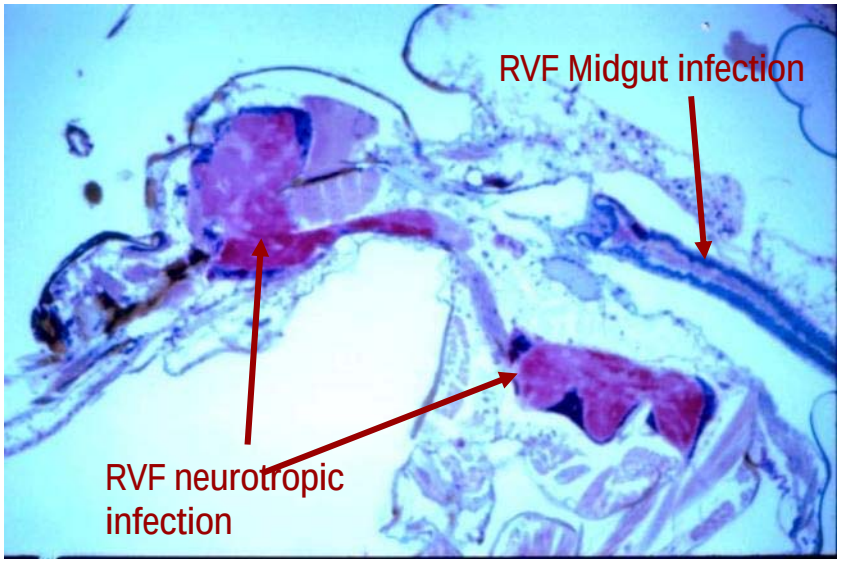
Aedes albopictus

Genre	Espèce	Pays (année)
Aedes (Aedimorphus)	*cumminsii*	Kenya (1981-1984)
		Burkina Faso (1983)
	dalzieli	Sénégal (1974, 1983)
	dentatus	Zimbabwe (1969)
	durbanensis	Kenya (1937)
	ochraceus	Sénégal (1993)
	tarsalis	Ouganda (1944)
	vexans arabiensis	Sénégal (1993)
		Arabie Séoudite (2000)
Aedes (Neomelaniconion)	*circumluteolus*	Ouganda (1955)
		Afrique du Sud (1955, 1981)
	mcintoshi	Zimbabwe (1969)
		Afrique du Sud (1974-1975)
		Kenya (1981-1984)
	palpalis	RCA (1969)
Ochlerotatus (Ochlerotatus)	*caballus*	Afrique du Sud (1953)
	caspius	Suspecté, Egypte (1993)
	juppi	Afrique du Sud (1974-1975)
Aedes (Stegomya)	*africanus*	Ouganda (1956)
	demeilloni	Ouganda (1944)
Aedes (Diceromya)	*furcifer group*	Burkina Faso (1983)
Anopheles (Anopheles)	*coustani*	Zimbabwe (1969)
		Madagascar (1979)
	fusicolor	Madagascar (1979)
Anopheles (Cellia)	*christyi*	Kenya (1981-1984)
	cinereus	Afrique du Sud (1974-1975)
	pauliani	Madagascar (1979)
	pharoensis	Kenya (1981-1984)
Culex (Culex)	*spp.*	Madagascar (1979)
	antennatus	Nigeria(1967-1970)
		Kenya (1981-1984)
	neavi	Afrique du Sud (1981)
	pipiens	Egypte (1977)
	poicilipes	Sénégal (1998)
	theileri	Afrique du Sud (1970)
		Zimbabwe (1969)
	tritaeniorhynchus	Arabie Séoudite (2000)
	vansomereni	Kenya (1981-1984)
	zombaensis	Afrique du Sud (1981)
		Kenya (1981-1984, 1989)
Culex (Eumelanomya)	*rubinotus*	Kenya (1981-1984)
Eretmapodites	*chrysogaster*	Ouganda (1944)
	quinquevittatus	Afrique du Sud (1971)
		Kenya (1981-1984)
Coquillettidia	*fuscopennata*	Ouganda (1959)
	grandidieri	Madagascar (1979)
Mansonia (Mansoniodes)	*africana*	Ouganda (1959, 1968)
		RCA (1969)
		Kenya (1989)
	uniformis	Ouganda (1959)
		Madagascar (1979)
Autres diptères	*Culicoides spp.*	Nigeria (1967)

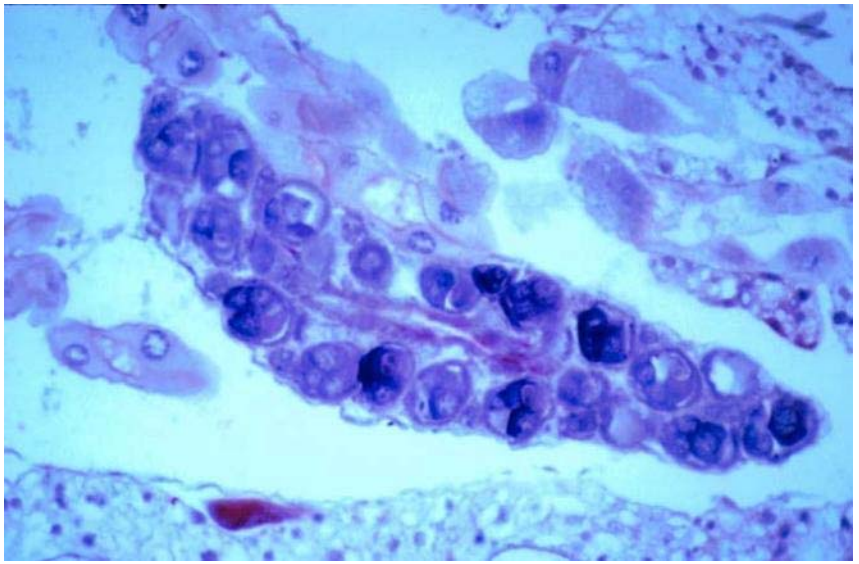
Culex pipiens

Aedes macintoshi & vexans





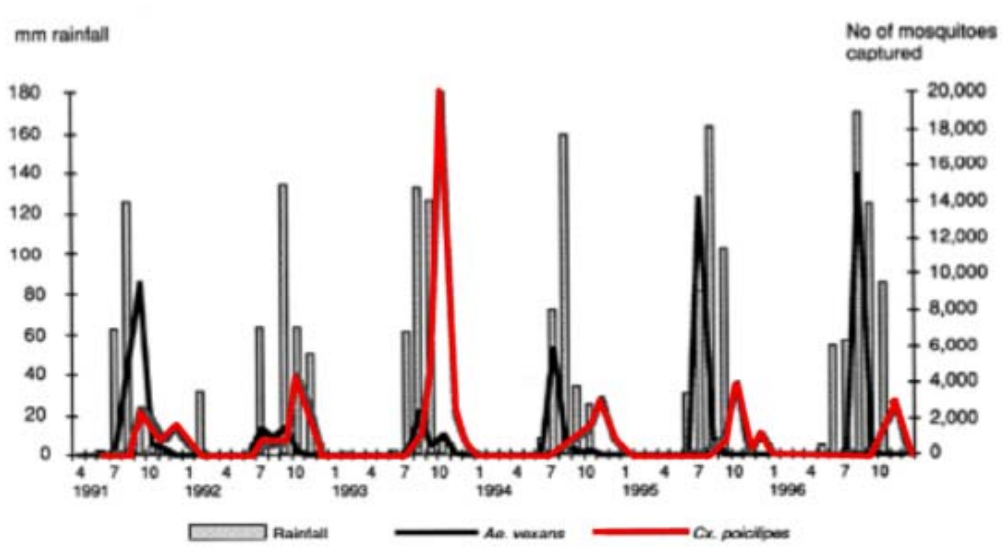
K.Linthicum



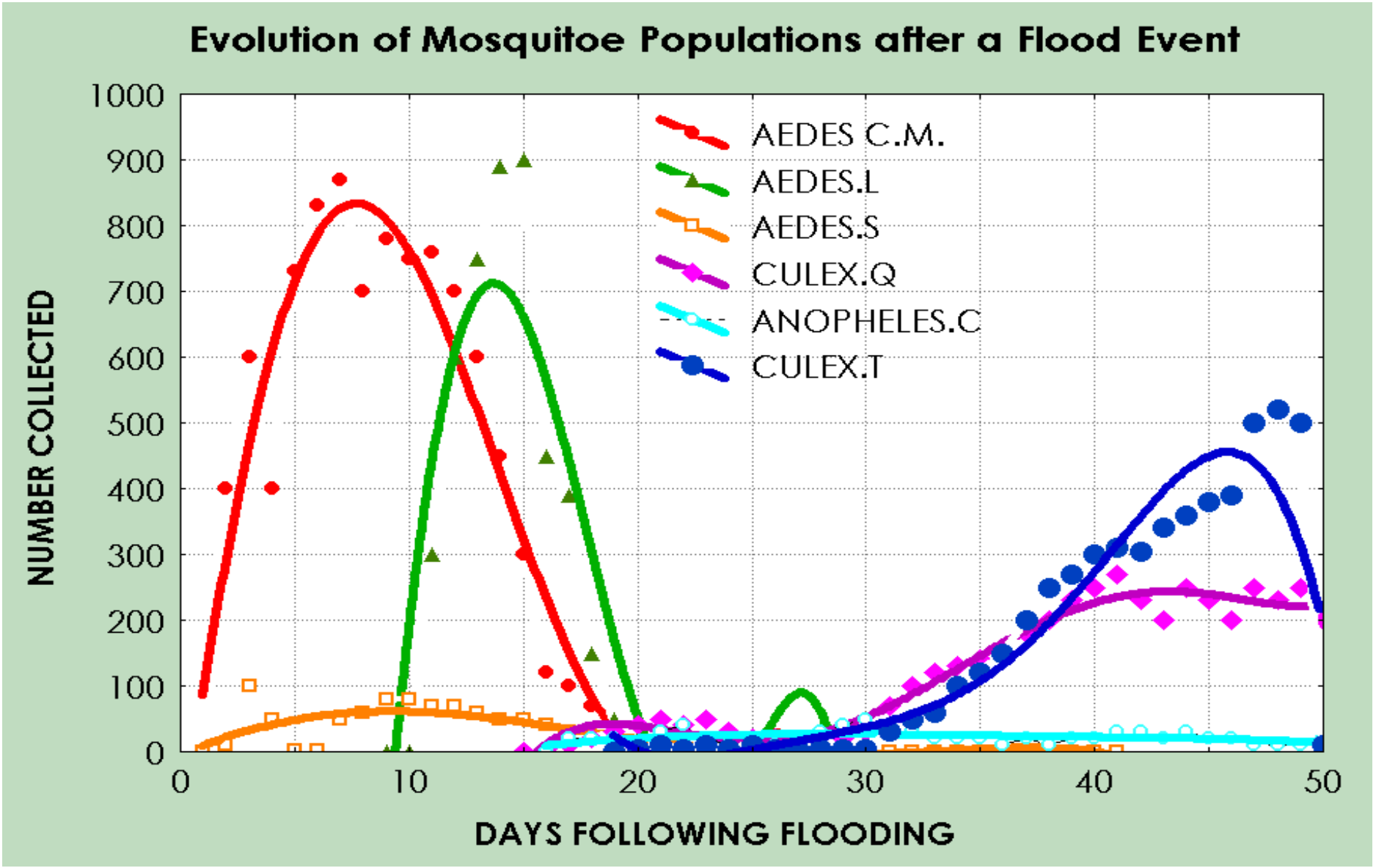
K.Linthicum

- Eggs of certain *Aedes* species can remain in dried mud for several years; hatch with the rain
- Even if it rains, not all hatch (60%) (survival strategy!)
- Transovarial transmission in *Aedes* (not in *Culex!)*
- Regular low-level transmission to livestock
- Transmission efficacy influenced by temperature and doses of virus
- Infection increases mosquito's biting rate!
- During epidemics, virus levels in animals is so high that mechanical transmission is also possible

Small water points in West Africa – every year virus activity with low level sero-conversion in cattle (Thiongane)

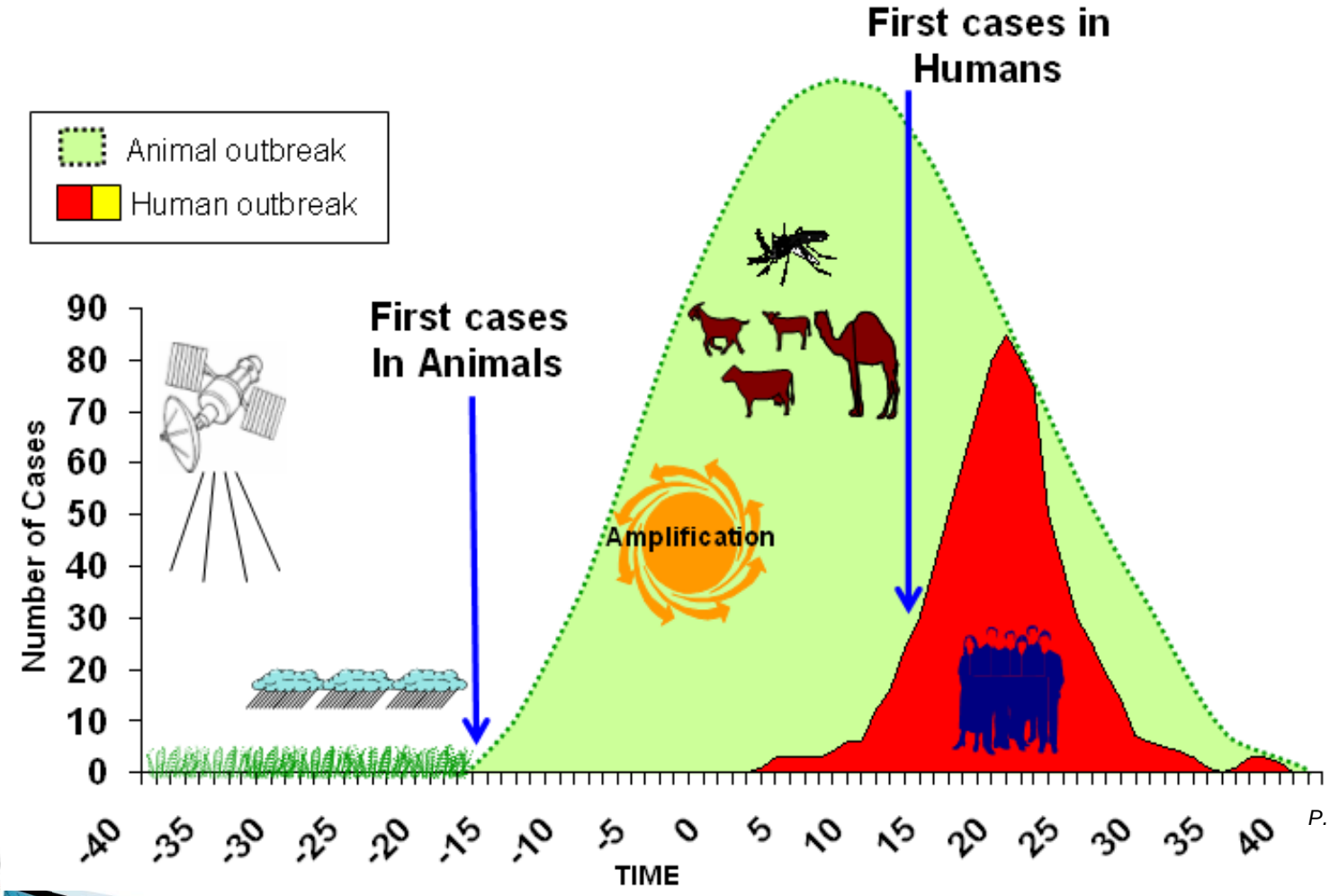


Emergence of populations of *Aedes vs Culex* after flooding
Source: Fontenille et al, 1998



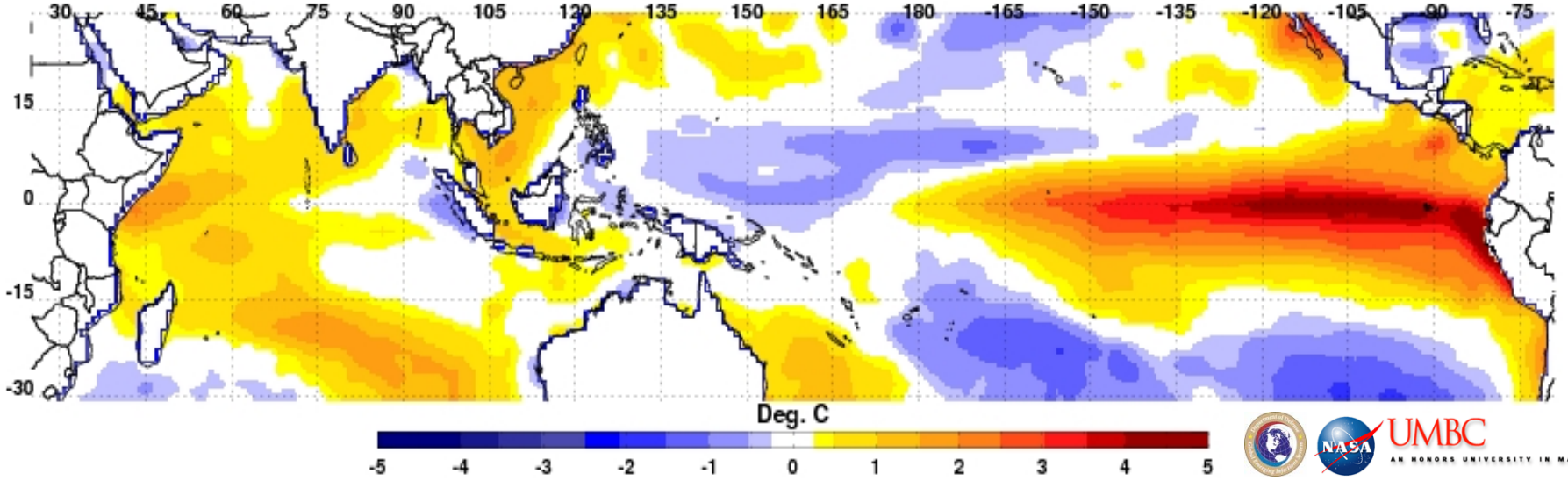
K. Linthicum et al, 1983

Dynamic of a RVF outbreak

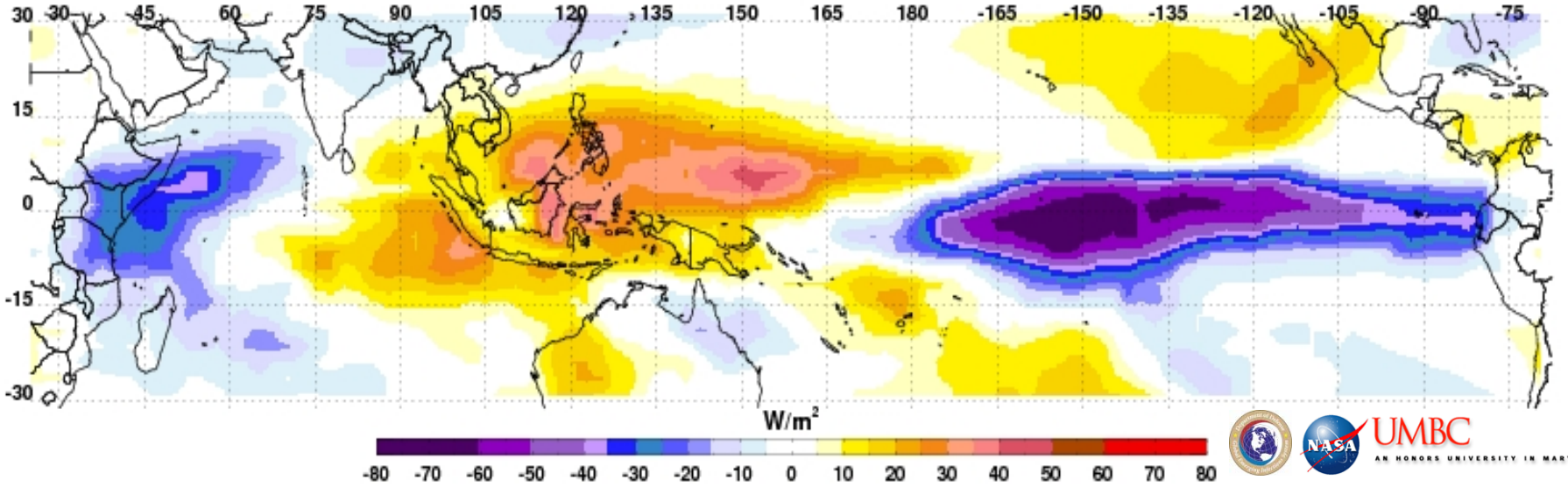


P. Formenty, WHO

Seasonal SST Anomaly, Dec 1997 - Feb 1998



Seasonal OLR Anomaly, Dec 1997 - Feb 1998

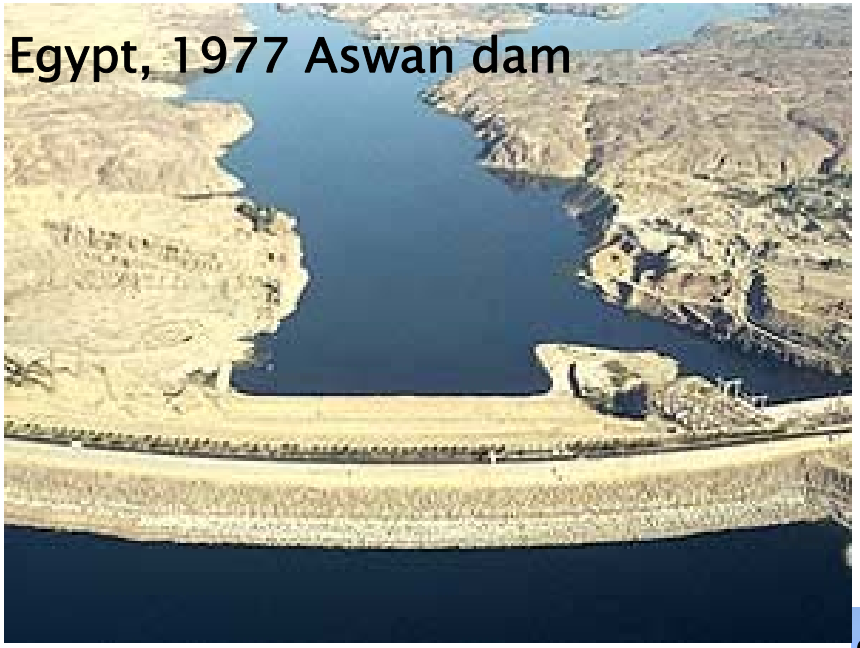


A. Anyamba et al, 2009

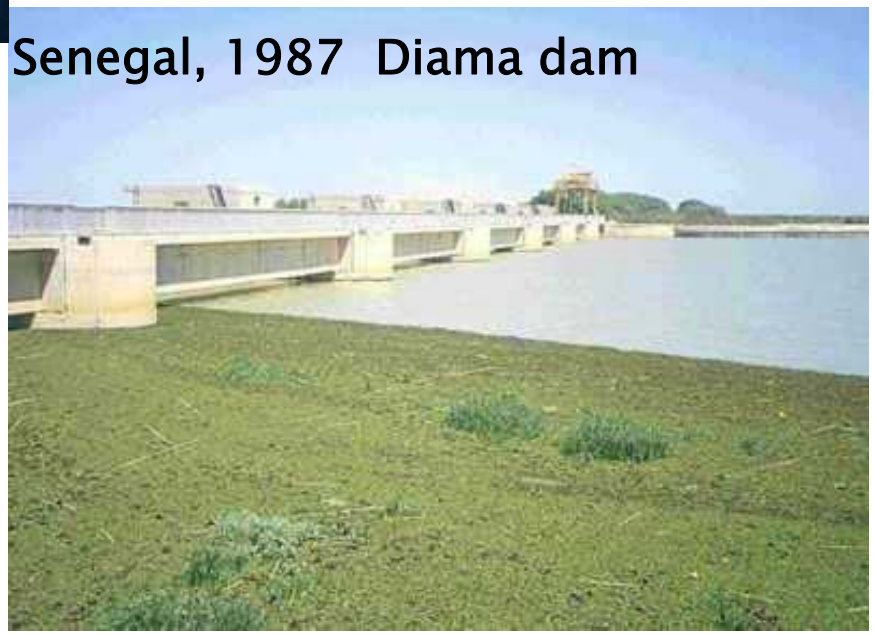
Floods in Horn of Africa, October-November 2006

The role of man made dams

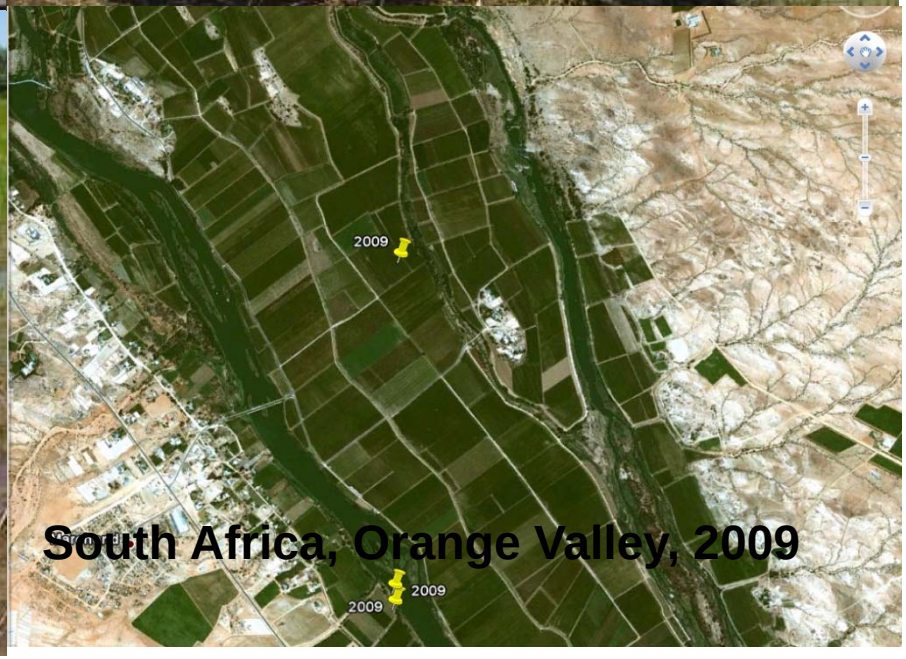
Egypt, 1977 Aswan dam



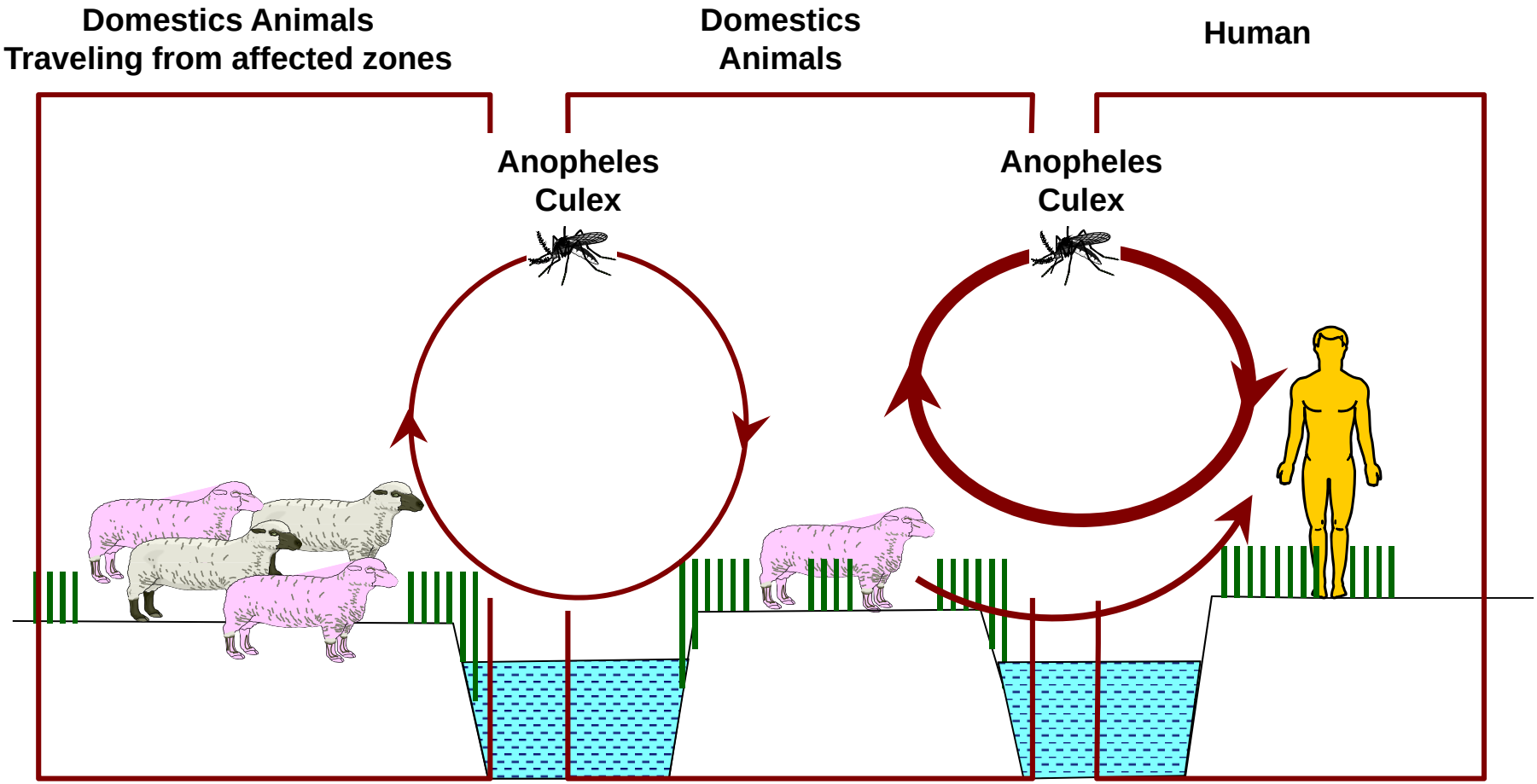
Senegal, 1987 Diama dam



Irragation and riverine habitats



The irrigated areas system



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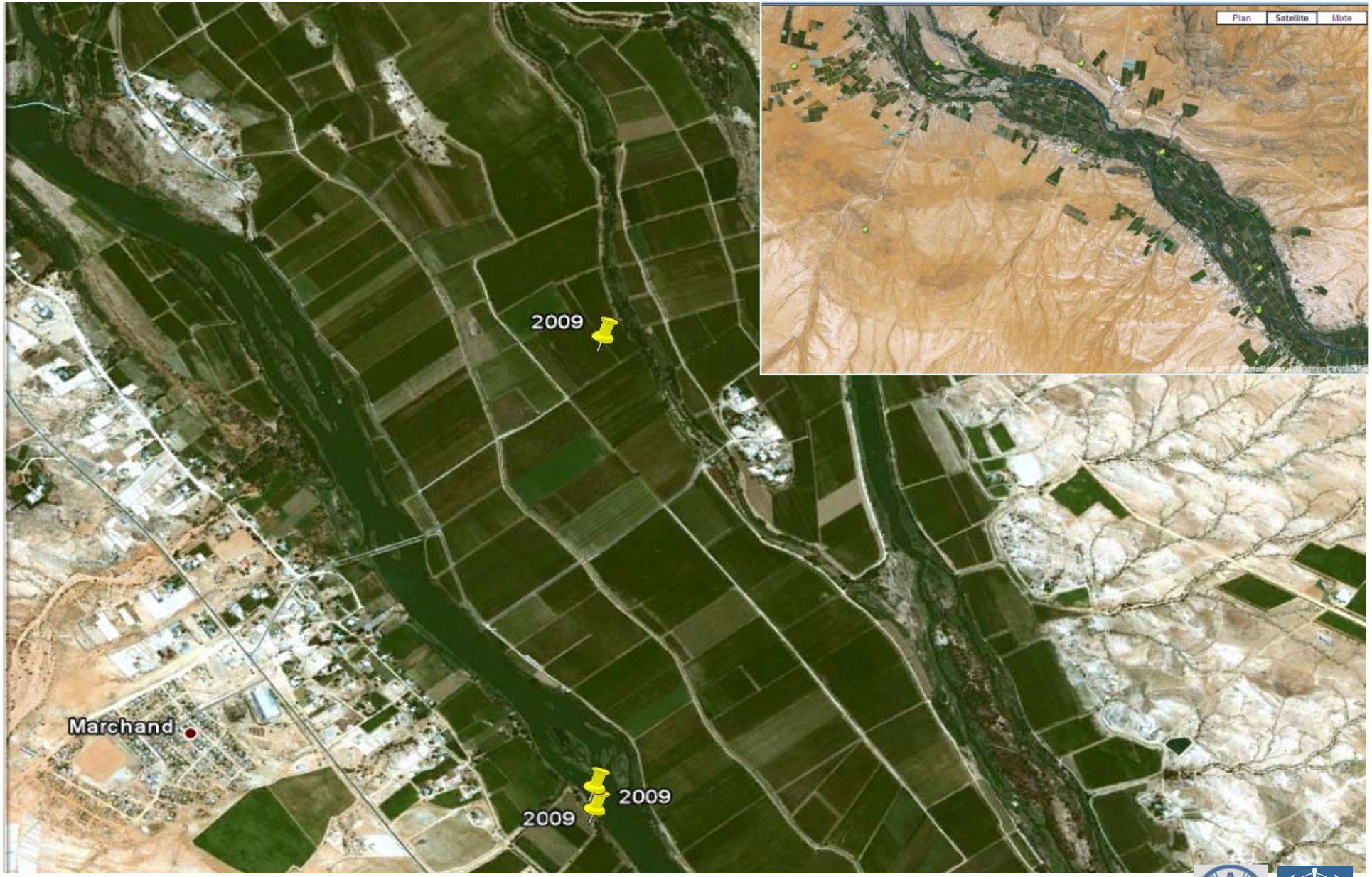
South Africa, Orange Valley, Nov 2009

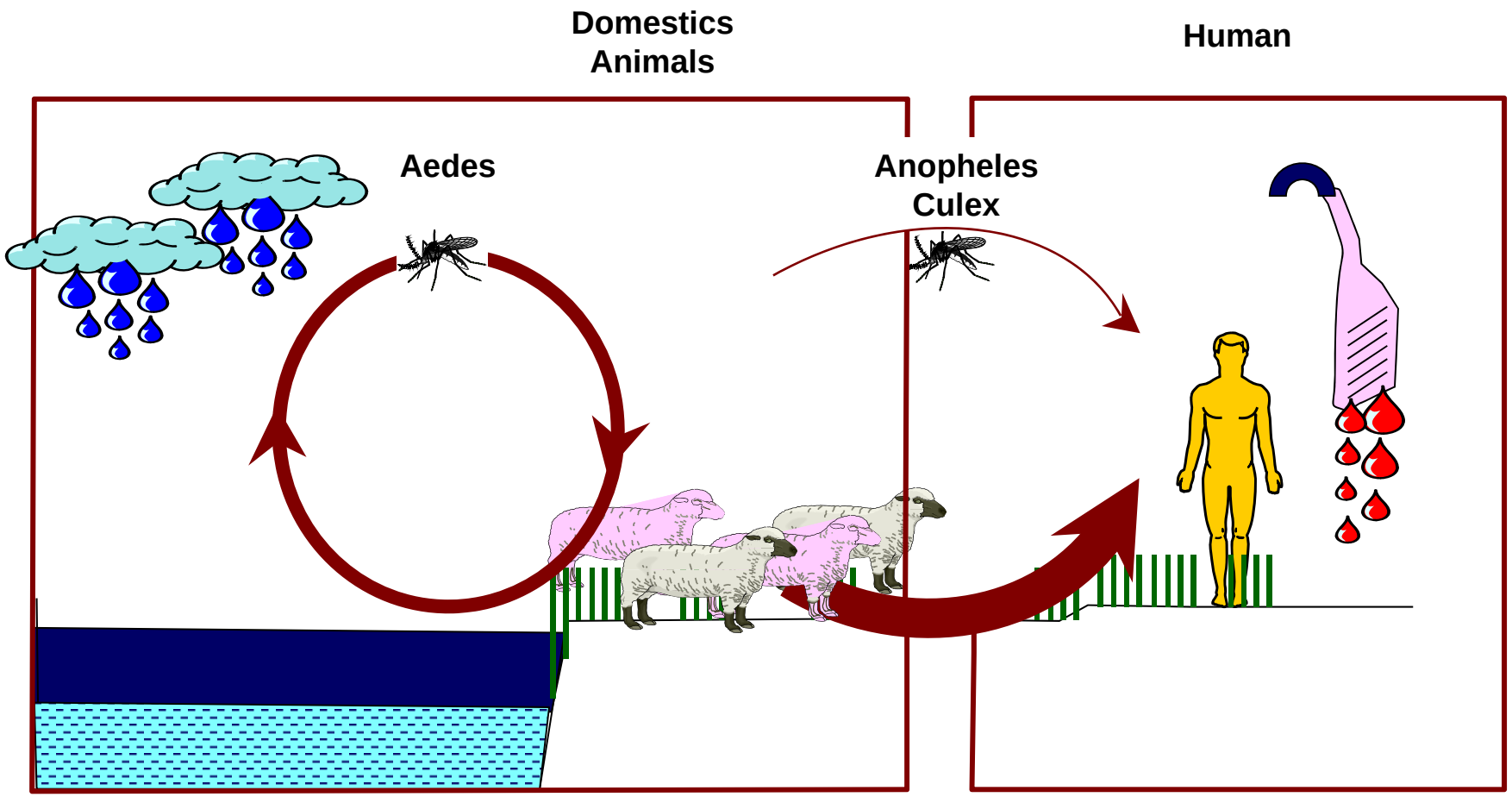


Sudan, Ghesira, Nov 2007: 28 confirmed human cases

The Dambo system

Sudan, While Nile, November 2007

The dambo system



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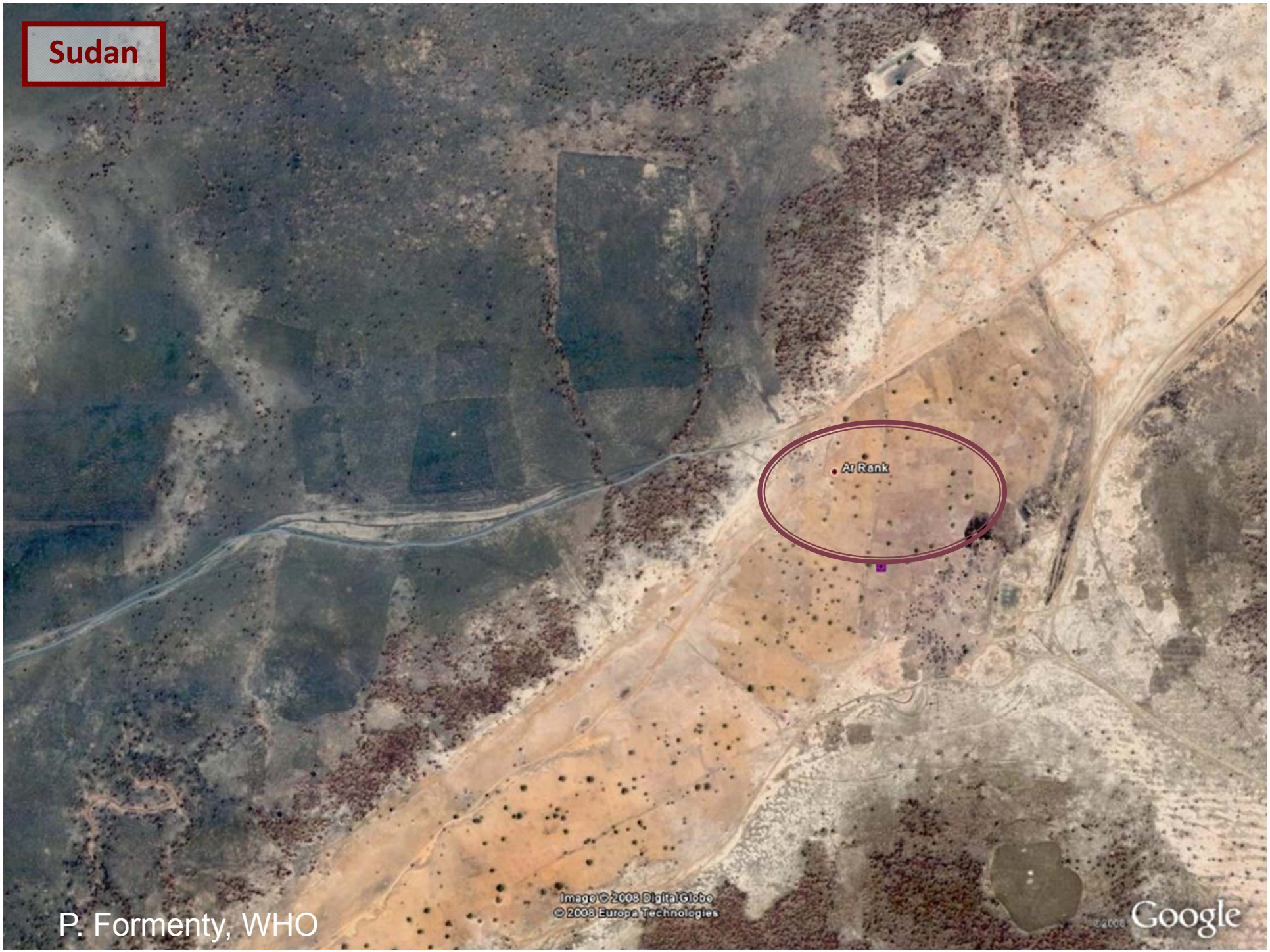

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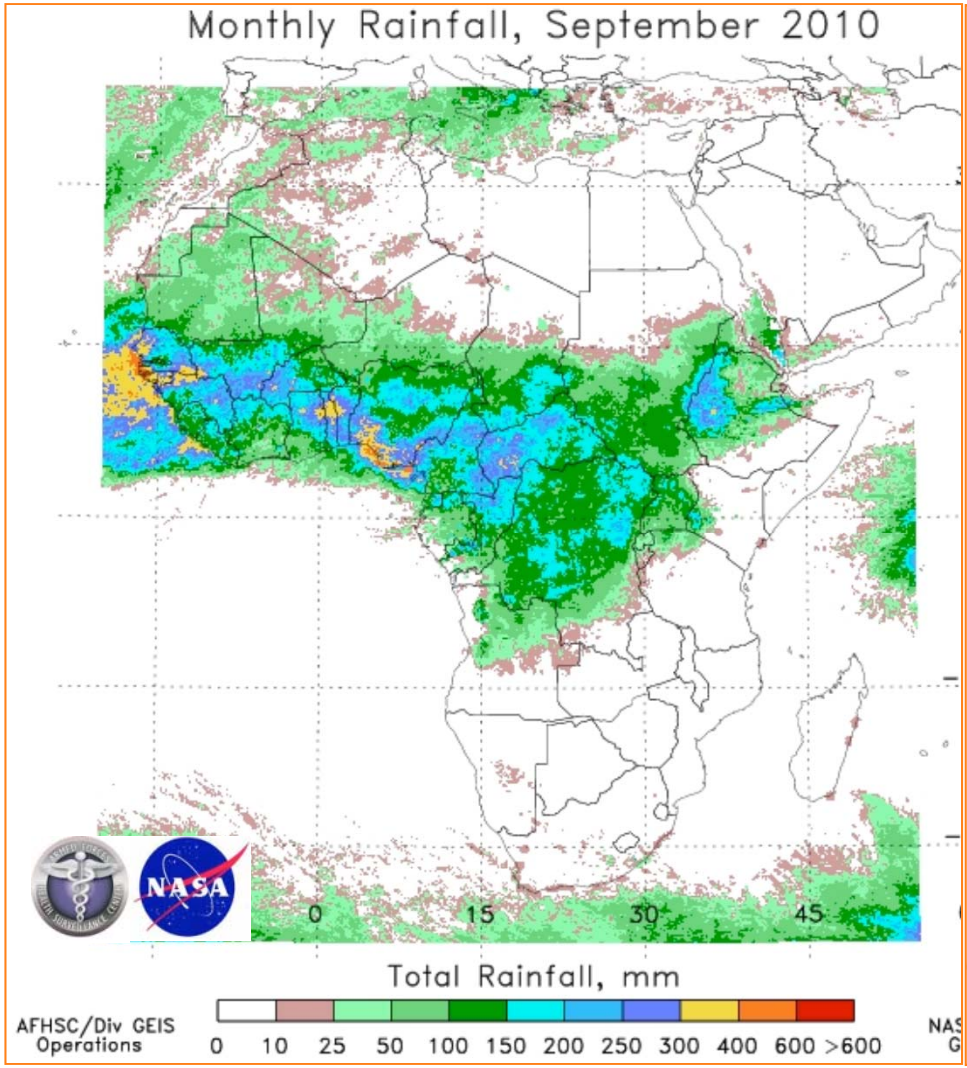
Sudan White Nile, Nov 2007 : 17 confirmed human cases

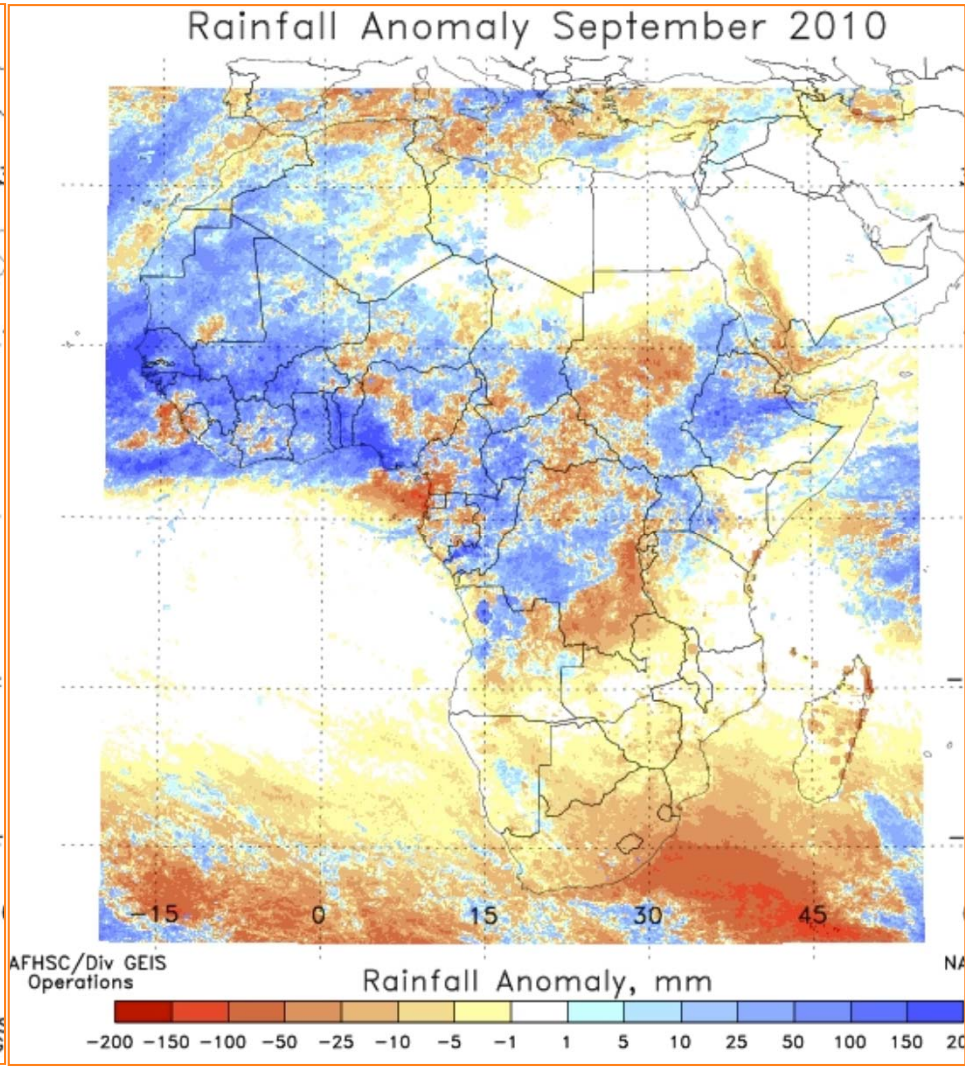
S. de La Rocque

Sudan, Ghesira, Nov 2007: 28 confirmed human cases

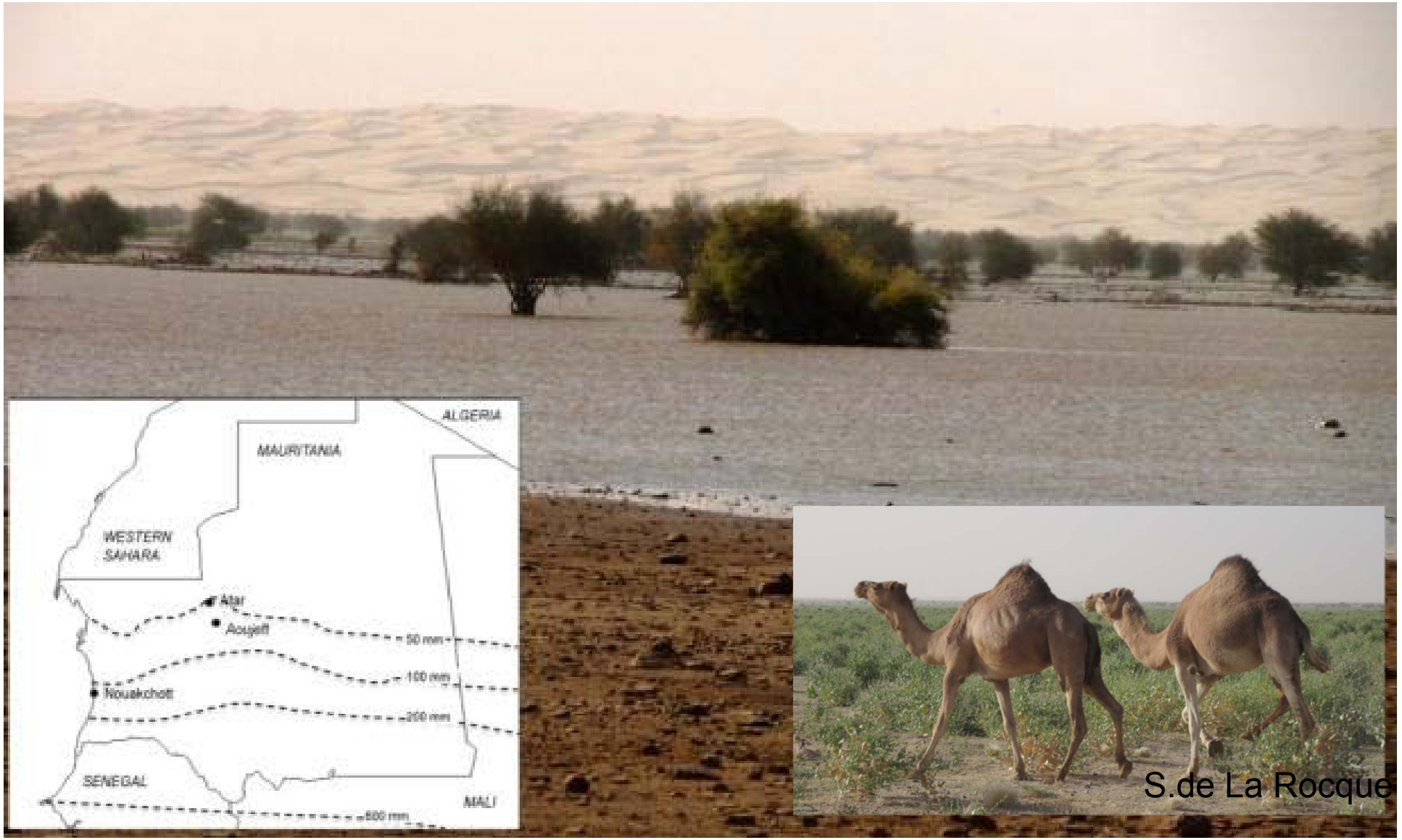
S. de La Rocque

The story of Mauretania



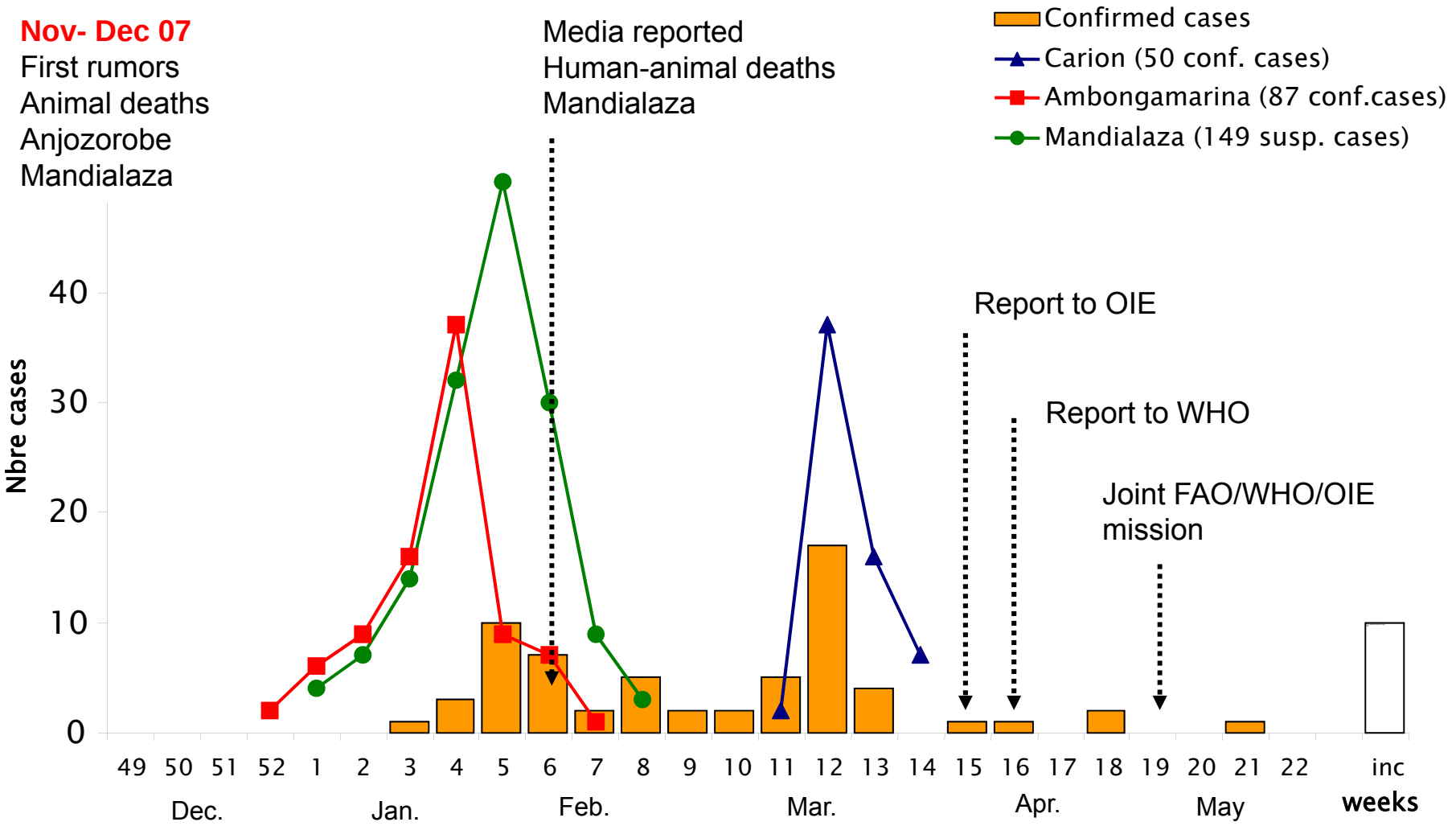


Mauritania, Graret Lefrass, December 2010: 18 human deaths



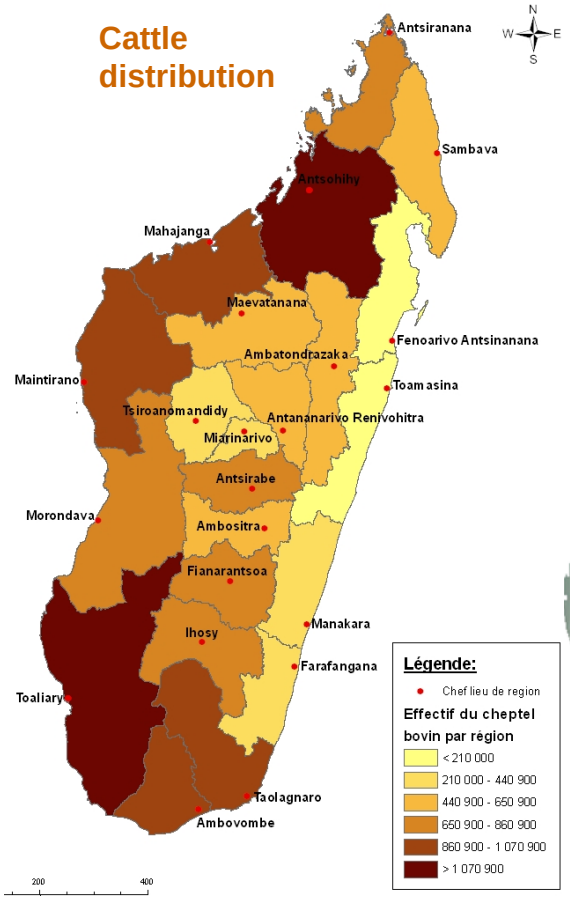
Epidemics and (non) reporting..

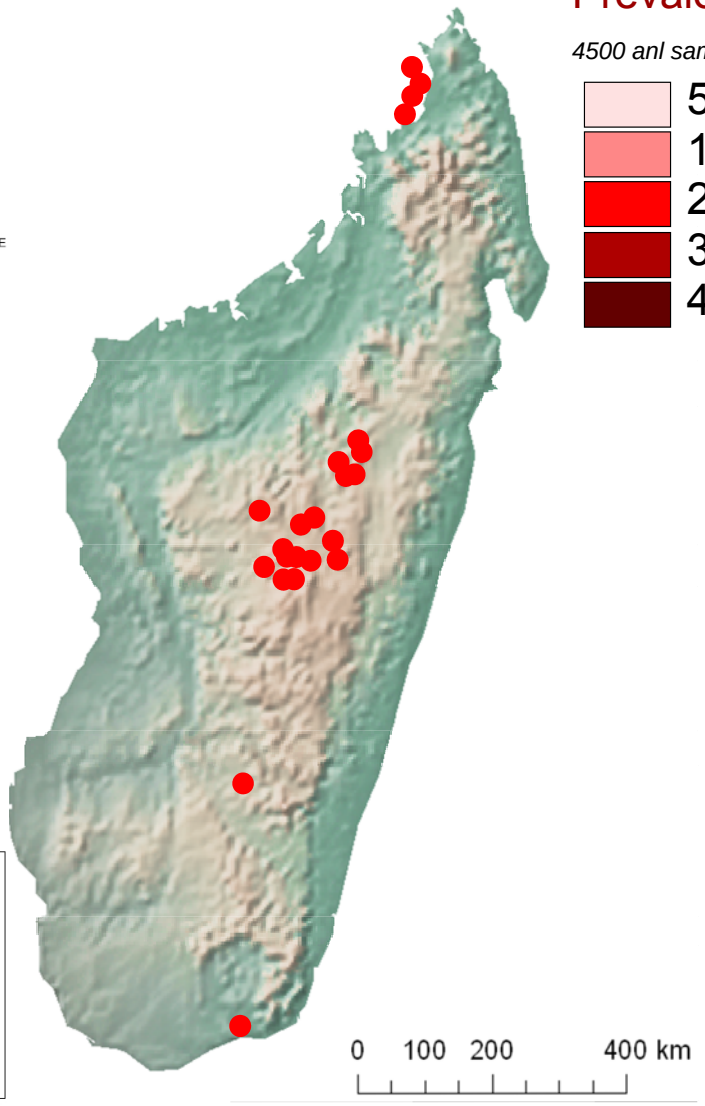
The story of Madagascar
Jan. 2008 – May 2008 (n = 72 cases)



Madagascar, Rift Valley Fever

Apr. 2008

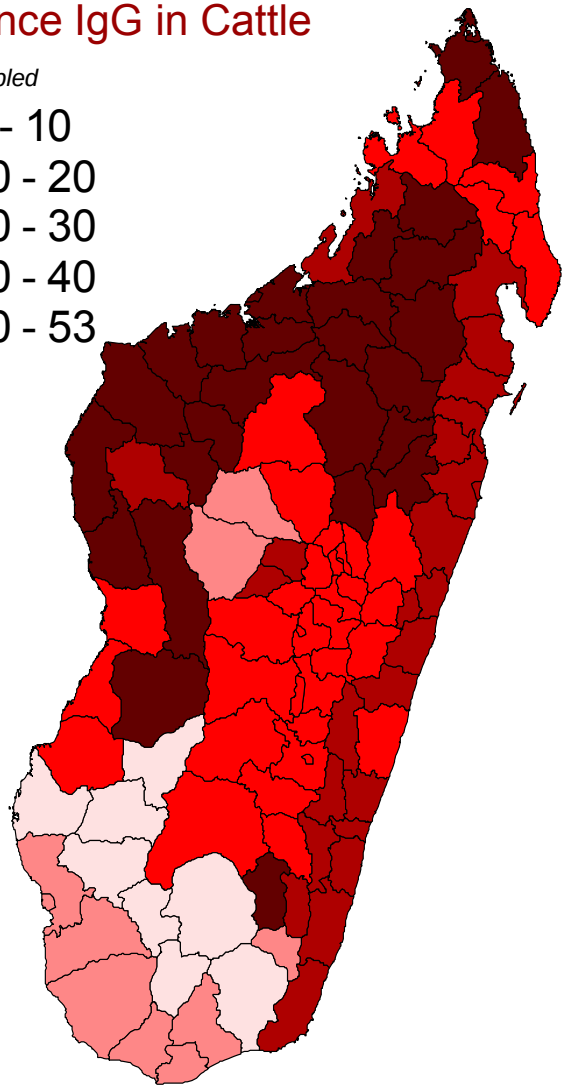




Prevalence IgG in Cattle

4500 anl sampled

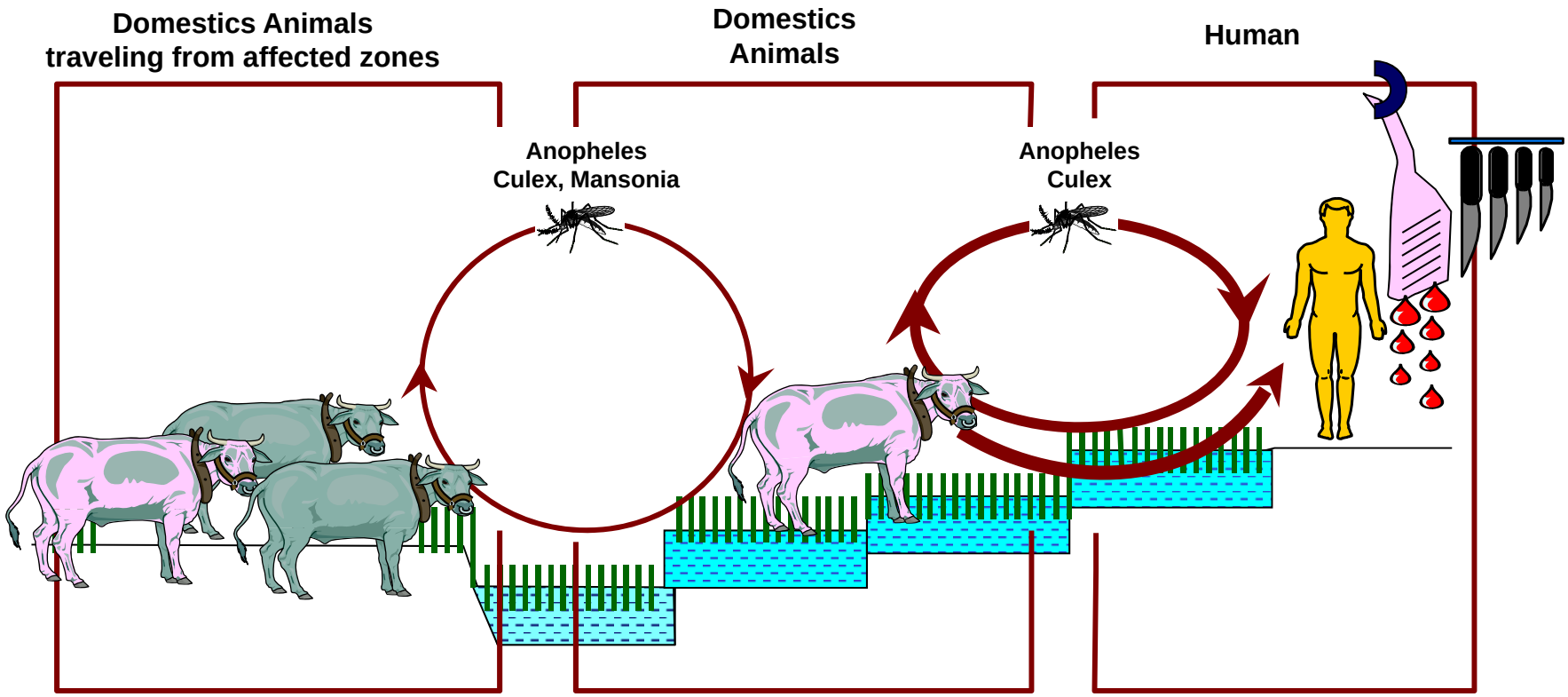
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 53



The story of Carion

March 2008: 50 confirmed human cases, all affected from a single Zebu

P. Formenty



P. Formenty, WHO

Thank You

For the work done on RVF

Ministry of Health and Ministry of Agriculture Kenya
Ministry of Health and Ministry of Agriculture Madagascar
Ministry of Health and Ministry of Agriculture Somalia
Ministry of Health and Ministry of Agriculture Senegal
Ministry of Health and Ministry of Agriculture South Africa
Ministry of Health and Ministry of Livestock and Fisheries Sudan
Ministry of Health and Ministry of Agriculture Tanzania
Ministry of Health and Ministry of Rural Development Mauritania

Bob Swanepoel, NICD; Assaf Anyamba, NASA/GFSC; K. Lithicum, USDA, Tom Ksiazeck and Pierre Rollin, CDC Atlanta;, H ElBushra EMRO, JM Reynes IP Madagascar, D.J. Rogers Uni. Oxford, Yaya Thiongane, ISRA, Truuke Gerdes, OVI…

KEMRI-CDC in Nairobi, Kenya; NAMRU-3 in Cairo, Egypt; Institut Pasteur Sénégal; Institut Pasteur Madagascar; NICD South Africa; CIRAD, France

Médecins Sans Frontières …