

TRANSBOUNDARY AND EMERGING DISEASES IN SOUTHERN AFRICA

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O.I.E. CRITERIA FOR LISTING TRADE SENSITIVE AND ZONOTIC DISEASES

- THE PROVEN OR POTENTIAL ABILITY OF THE DISEASE TO SPREAD RAPIDLY WITHIN A COUNTRY OR INTERNATIONALLY
- THE ABILITY OF THE INFECTION TO CAUSE SIGNIFICANT MORBIDITY / MORTALITY IN NAÏVE ANIMAL POPULATIONS
- THE ZONOTIC POTENTIAL OF THE DISEASE
- EMERGING NEW PATHOGENS

TRANSBOUNDARY DISEASES

- NO ACCEPTED SCIENTIFIC DEFINITION
- THE TERM IS SUGGESTIVE OF A GROUP OF DISEASES WITH SIGNIFICANT EPIDEMIC POTENTIAL AND THE ABILITY TO SPREAD THROUGH ANIMAL POPULATIONS AND ACROSS PARK, STATE, PROVINCIAL OR INTERNATIONAL BORDERS.
- GENERALLY ARE RAPIDLY PROPAGATING, BUT MAY BE SLOW.
- ARE GENERALLY DIRECTLY CONTAGIOUS OR MAY HAVE EFFICIENT VECTOR TRANSMISSION.

RINDERPEST – AN HISTORICAL EXAMPLE

- RINDERPEST WAS INTRODUCED WITH INFECTED CATTLE TO THE HORN OF AFRICA IN 1887.
- IT SPREAD THROUGHOUT SUB-SAHARAN AFRICA, EVENTUALLY REACHING NATAL AND THE CAPE PROVINCE IN 1897 / 98



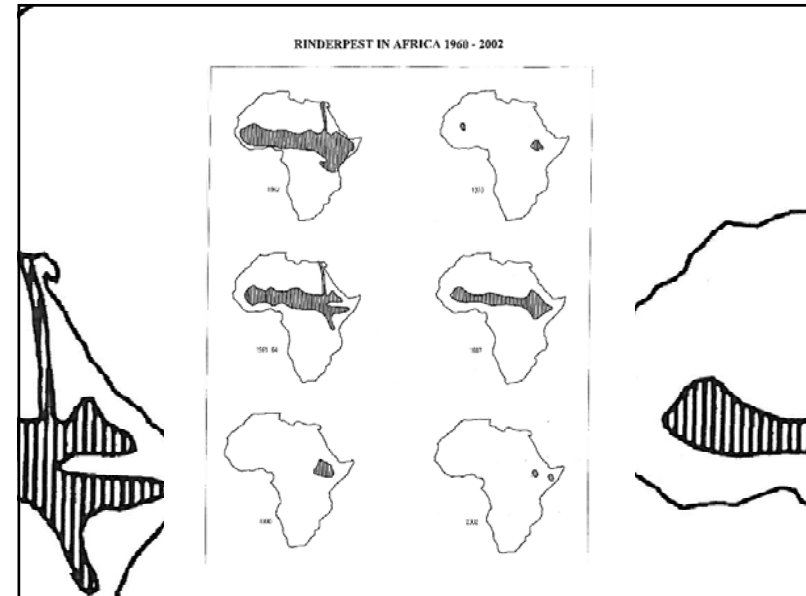
IMPACTS OF THE RINDERPEST PANDEMIC

- SOUTH OF THE ZAMBEZI RIVER ALONE, 5,25 MILLION CATTLE DIED.
- TRANSPORT SYSTEMS COLLAPSED
- SHORTAGE OF AGRICULTURAL DRAUGHT ANIMALS
- THE WHOLE CONTINENT BECAME IMPOVERISHED
- PASTORAL CATTLE-KEEPING TRIBES BECAME WEAKENED.
- PREFERRED WILDLIFE TSETSE HOSTS SUCH AS BUFFALO AND TRAGELAPHIDS WERE HARDEST HIT
- THE DECIMATION OF WILDLIFE AND CATTLE LED TO THE APPARENT DISAPPEARANCE OF TSETSE FLIES FROM SEVERAL AREAS OF SOUTHERN AFRICA.
- DONKEYS AND MULES WERE IMPORTED AND BRED ON A LARGE SCALE



PROGRESSION OF RINDERPEST

- RINDERPEST WAS ERADICATED FROM SOUTHERN AFRICA BY 1905.
- RINDERPEST PERSISTED ELSEWHERE IN AFRICA, WHEREVER NOMADIC OR SEMI - NOMADIC PASTORALISM WAS COMMON.
- PERSISTENCE OF INFECTION FURTHER NORTH MAY HAVE CONTRIBUTED TO THE DEVELOPMENT OF ISLAND COMMUNITIES OF SPECIES SUCH AS SABLE AND GREATER KUDU.
- The disease was initially controlled to a large extent by stamping out, quarantine.
- Thereafter followed development of safe and effective vaccines, and with the help of the JP15 program, by 1976 there were only two remaining active foci left in Africa.
- In 1979 a second African rinderpest pandemic spread rapidly up the Nile river and in a broad band across Africa North of the Equator.
- In 1986 the Pan African Rinderpest Campaign was initiated and by 1999, had succeeded in eradicating rinderpest from most of Africa, except in Somalia and Sudan (politically unstable and inhospitable areas)



FINALLY IN 2009, RINDERPEST APPEARS TO HAVE BEEN ERADICATED FROM ITS LAST STRONGHOLDS IN THE HORN OF AFRICA AND PAKISTAN, AND POSSIBLY FROM THE SURFACE OF THE GLOBE.

- MAY IT REST IN PEACE

CURRENT AND POTENTIAL TRANSBOUNDARY DISEASES

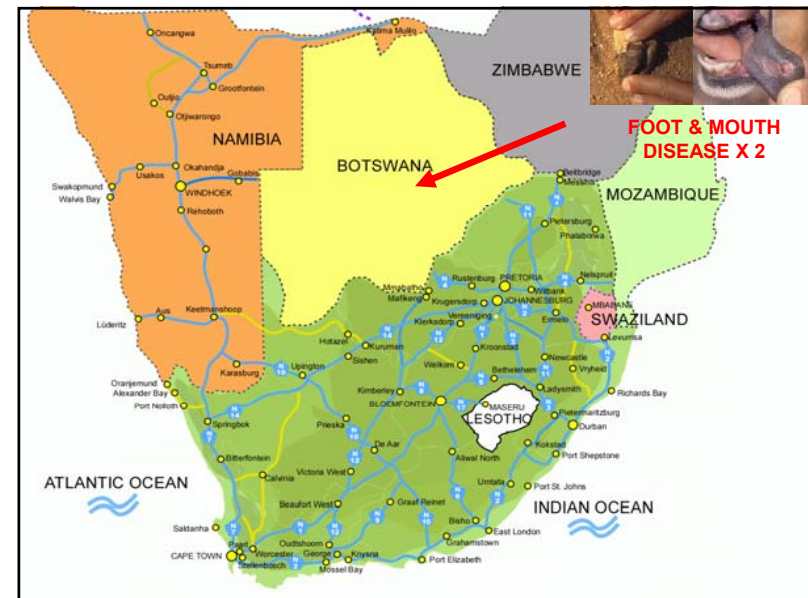
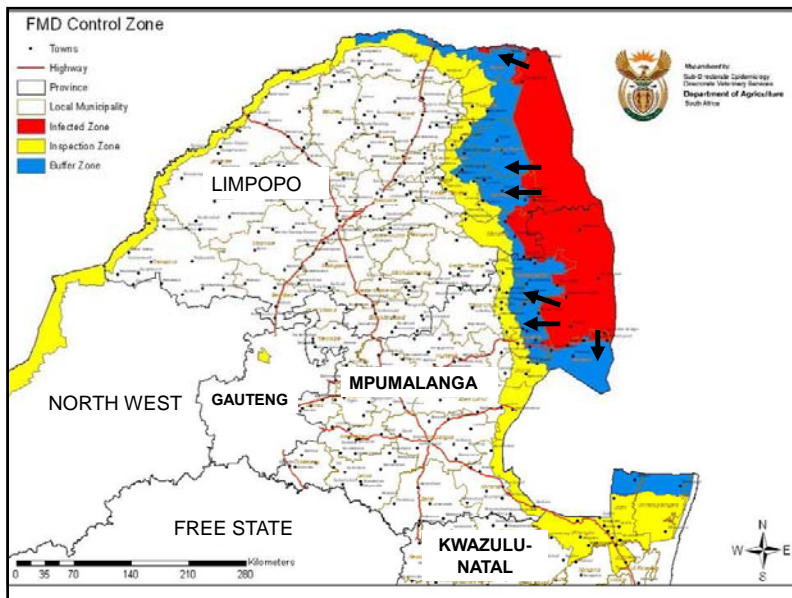
- THE EPIDEMIOLOGICAL DYNAMICS OF CERTAIN INFECTIOUS DISEASES CURRENTLY STILL PRESENT TRANSBOUNDARY THREATS AND RISKS TO NEIGHBOURS.

FOOT AND MOUTH DISEASE



FOOT AND MOUTH DISEASE

- ONE OF THE BEST KNOWN EXAMPLES OF A HIGHLY CONTAGIOUS “TRADE SENSITIVE” DISEASE
- AFRICA HAS A UNIQUE SITUATION – PERSISTENT INFECTION IN MOST FREE-RANGING BUFFALO POPULATIONS WITH UNIQUELY AFRICAN STRAINS
- IT IS DIFFICULT TO CONTROL IN THE PROXIMITY OF PROTECTED AREAS WITH INFECTED BUFFALO POPULATIONS
- FMD IS AS MUCH A NATIONAL PROBLEM AS AN INTERNATIONAL ISSUE.



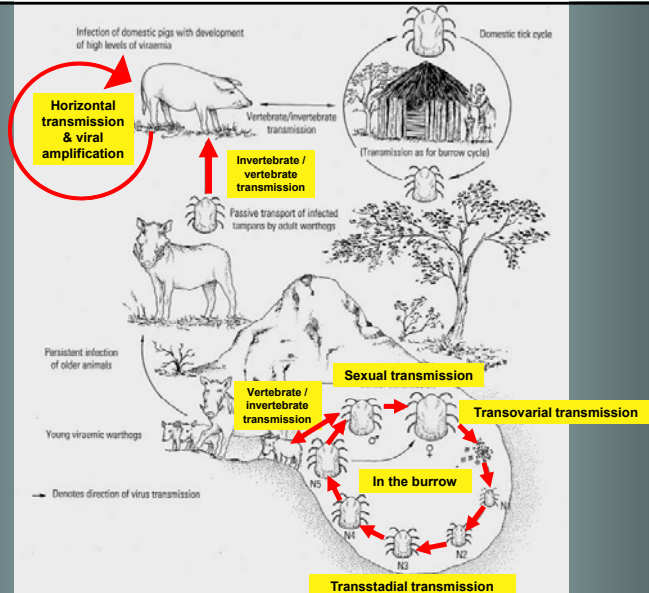
FMD REMAINS A SERIOUS BARRIER TO ACHIEVING COMPATIBILITY BETWEEN CONSERVATION OBJECTIVES (INCLUDING TFCA'S), AND INTERNATIONAL STANDARDS FOR CONTROL OF LIVESTOCK DISEASES



AFRICAN SWINE FEVER

- A VIRAL INFECTION OF SUIDS AND TAMPANS
- ENDEMIC (SILENT CYCLE) IN WILD SUIDS AND TAMPANS
- EPIDEMIC –DIRECTLY CONTAGIOUS CYCLE IN COMMERCIAL DOMESTIC SWINE

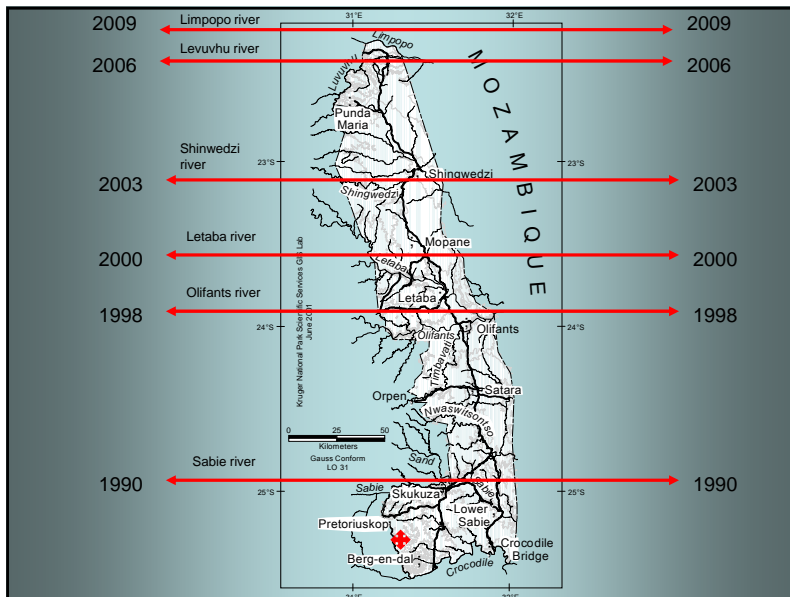
NATURAL HOSTS OF ASF





BOVINE TUBERCULOSIS IN FREE RANGING AFRICAN WILDLIFE

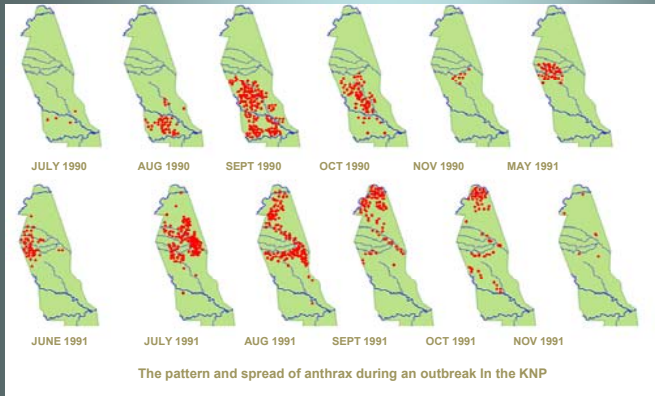
- *Mycobacterium bovis* was probably introduced onto the African continent with European cattle breeds introduced by the Colonial settlers.
- Bovine tuberculosis has subsequently spilled over into free-ranging wildlife populations in South Africa, Uganda, Zambia and Tanzania
- Bovine Tb probably entered the southern Kruger National Park in the early 1960's, and has spread progressively northwards in contiguous buffalo herds
- It reached the northern border of the KNP in 2006, and has subsequently crossed the Limpopo river boundary into Gonarezhou National Park in 2009.



ANTHRAX IN FREE RANGING AFRICAN WILDLIFE

- ANTHRAX OUTBREAKS IN WILDLIFE OCCUR IN CERTAIN ENDEMIC REGIONS OF THE AFRICAN CONTINENT.
- South Africa : KNP and Northern Cape
- Namibia : Etosha National Park and Caprivi Strip
- Botswana : Chobe National Park
- Zimbabwe : South Eastern and Eastern Lowveld
- Zambia : Luangwa river system
- Uganda : Queen Elizabeth National Park
- Tanzania : Lake Manyara and Serengeti system
- Kenya : Northern Frontier District
- Ethiopia : Omo National Park

SPATIO-TEMPORAL PATTERN OF ANTHRAX DURING THE 1990 / 91 OUTBREAK - CULMINATING IN TRANSBOUNDARY SPREAD



The epidemic was interrupted between November, 1990 and May, 1991, by the summer rainy season.

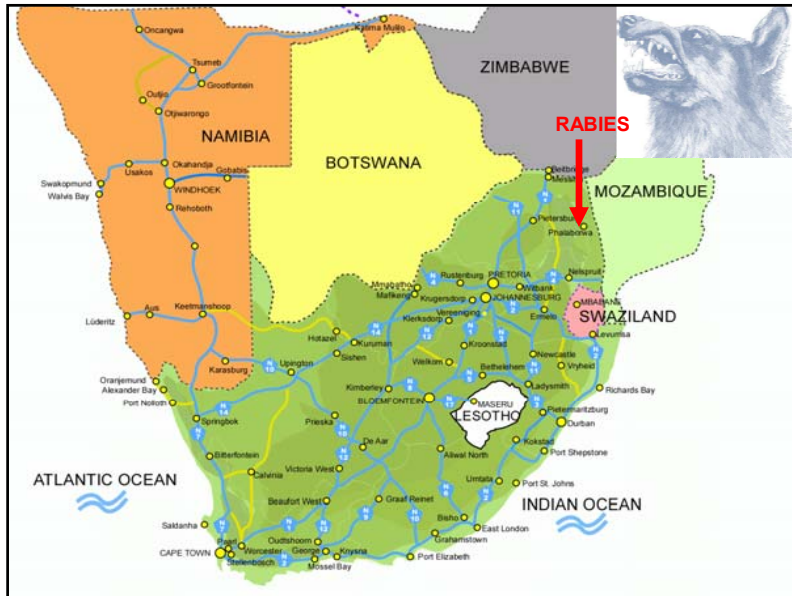


Rabies



TRANSBOUNDARY RABIES INCURSION

- 2002 – 2010 – SOCIO-ECONOMIC TURMOIL IN ZIMBABWE.
- VACCINATION OF CATTLE AND DOGS – ALMOST NON EXISTENT IN RURAL AREAS.
- RAMPANT OUTBREAKS OF RABIES
- LARGE SCALE CROSSING OF LIMPOPO RIVER BY ZIMBABWEAN REFUGEES ACCOMPANIED BY DOMESTIC DOGS STARTED IN 2005 / 2006.
- Limpopo Province had poor vaccination coverage at the time : Government sponsored dog vaccination program was playing second fiddle to successive FMD outbreaks.
- Zimbabwean strain of Rabies genotype 1 was introduced resulting in large scale rural and urban dog rabies outbreaks in Limpopo Province.
- More than 40 human fatalities occurred
- FIRST CASE IN A WILD ANIMAL DETECTED IN THE KNP



CANINE DISTEMPER

- CANINE DISTEMPER VIRUS INFECTION IS ALSO THOUGHT TO BE A RELATIVELY RECENT INTRODUCTION TO THE AFRICAN CONTINENT.
- CD INFECTION HAS FLOURISHED IN INFORMAL COMMUNAL AND URBAN DOG POPULATIONS.
- SPILL OVER OF INFECTION HAS OCCURRED ACROSS THE BOUNDARIES OF SEVERAL NATIONAL PARKS,
- IN 1993, AN OUTBREAK OF CANINE DISTEMPER WAS THOUGHT TO HAVE BEEN PARTIALLY RESPONSIBLE FOR THE DEMISE OF MOST OF THE WILD DOGS AND 30% OF THE LIONS IN THE SERENGETI ECOSYSTEM.
- IN 2009, A CANINE DISTEMPER OUTBREAK IN LIONS WAS DETECTED IN THE SOUTH AFRICAN SECTOR OF THE K GALAGADI TRANSFRONTIER NATIONAL PARK. Unconfirmed reports of similar mortalities in lions have been received from the Botswana sector of this TFCA.
- Infected dogs in peripheral communities are thought to be the source of infection

TRANSBOUNDARY DISEASES ON A MORE GLOBAL SCALE

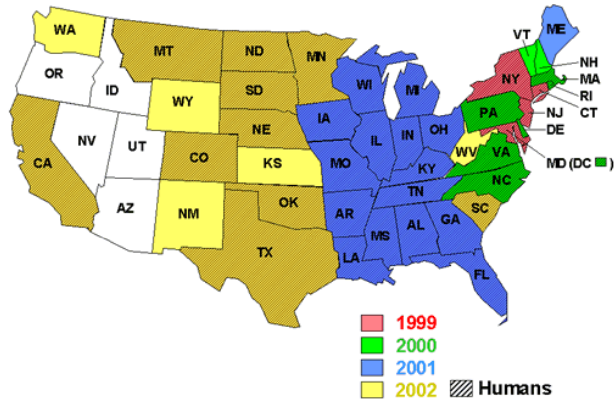
- IN THE PAST DECADE SEVERAL INTERNATIONAL TRANSBOUNDARY DISEASES HAVE RECEIVED A LOT OF SCIENTIFIC AND MEDIA ATTENTION.
- These include :
- Highly pathogenic H5N1 Avian Influenza in Southeast Asia, Eastern and central Europe, the Middle East and North Africa .
- Bluetongue in Europe and U.K.
- BSE in UK, Europe and North America
- Equine Influenza in Australia
- African Swine Fever in Georgia and Ukraine

A CLASSIC EXAMPLE OF A RECENTLY INTRODUCED VECTOR-BORN TRANSBOUNDARY DISEASE IS WEST NILE VIRUS INTRODUCTION INTO NORTH AMERICA

- SUSPECTED INTRODUCTION OF INFECTED MOSQUITOES BY RAPID INTERNATIONAL AIR TRAVEL
- MOSQUITOES INFECTED BIRDS IN IMMEDIATE VICINITY OF THE INTERNATIONAL AIRPORT
- LOCAL RESIDENT BIRDS- ESPECIALLY CORVIDS - ACTED AS VIRUS AMPLIFIERS
- RESIDENT MOSQUITOES WERE PATENT VECTORS

Coast to coast in 3 years

West Nile Virus in the United States, 1999 - 2002



EMERGING DISEASES

- **DEFINITIONS INCLUDE :**
- A NOVEL, PREVIOUSLY UNKNOWN DISEASE
- A DISEASE WHICH HAS APPEARED IN A POPULATION FOR THE FIRST TIME
- A DISEASE / PATHOGEN THAT DISPLAYS CHANGES IN BEHAVIORAL CHARACTERISTICS – SUCH AS INCREASING PATHOGENICITY AND PREVALENCE, INCREASING GEOGRAPHIC OR HOST RANGE.
- Emerging diseases are not necessarily infectious, and may include emerging environmental health issues.

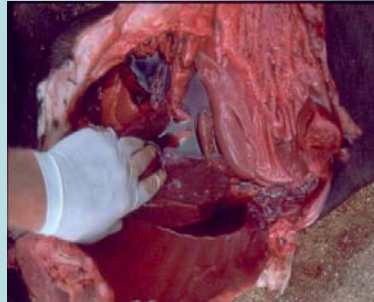
SOME POSSIBLE CAUSAL ASSOCIATIONS RESULTING IN DISEASE EMERGENCE

- Encroachment of human populations or agricultural activities on natural ecosystems – favours transfer of pathogens
- Ecosystem alterations – frequently anthropogenic in origin – e.g. the building of dams, clearing of forests, or changing agricultural practices that may alter distribution or abundance of pathogens / vectors or may intensify the interface.
- Environmental pollution with mining, industrial, agricultural wastes or sewerage.
- Increased frequency and speed of local or international travel.
- Human – assisted movement of animals and animal products.

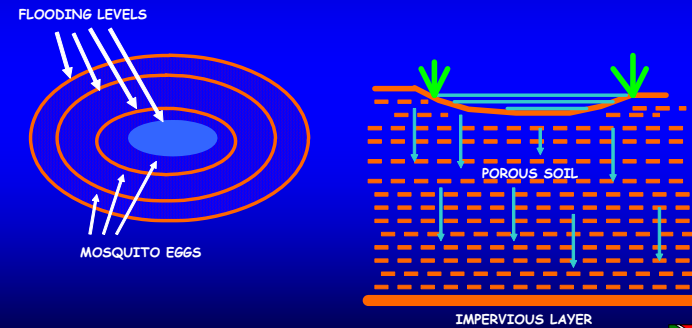
SOME EMERGING INFECTIOUS DISEASES IN AFRICA, OR SPREADING FROM AFRICA

- **# 1 - IS OBVIOUSLY THE VARIOUS SIMIAN IMMUNO-DEFICIENCY VIRUSES WHICH HAVE CROSSED THE SPECIES BARRIER (AS HIV1, 2 &3)- RESULTING IN ONE OF THE MOST DEVASTATING HUMAN PANDEMICS EVER RECORDED.**
- **FILOVIRUS INFECTIONS SUCH AS EBOLA AND MARBURG VIRUS INFECTIONS IN TROPICAL WEST AFRICA AND ANGOLA.** Recent research has shown that these viruses naturally cycle and are maintained in certain canopy and cave dwelling fruit bats. Humans and other primates become incidentally infected, but thereafter, direct contagious propagation occurs in communities.

Rift valley fever

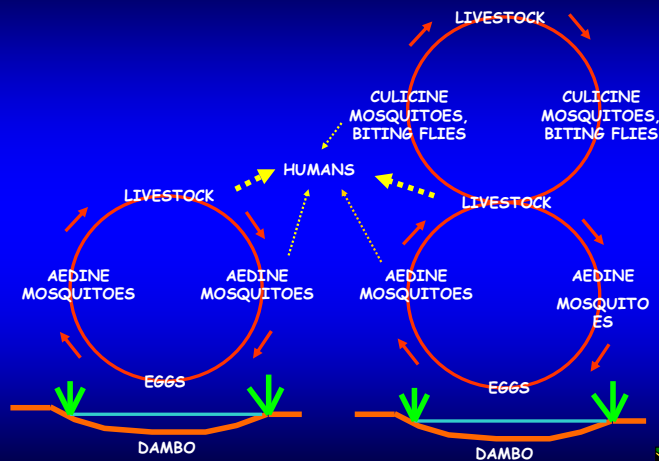


DRAINAGE/DRYING OR FLOODING OF DAMBOS: EFFECTS ON FLOODWATER-BREEDING AEDINE MOSQUITOES



RVF ENZOOTIC CYCLE

RVF EPIZOOTIC CYCLE



RIFT VALLEY FEVER : CURRENT THINKING

- The distribution of RVF virus was initially thought to be limited to countries along the great Rift geological fault, with occasional excursions both northward and southward.
- It has now been shown that the virus is maintained (sometimes for many years) in dormant eggs of certain “flood breeding” *Aedine* mosquitoes.
- Damming of drainages and flood irrigation practices have allowed this disease to expand its geographical range.
- Recent findings are that this disease is now endemic in the KNP, and probably in the irrigation farming areas on the banks of the Orange river in Northern Cape Province, and those supplied by the Aswan dam in Egypt.

BOVINE TUBERCULOSIS – an emerging disease of wildlife that has now been confirmed in eight geographically distinct conservation areas in Africa



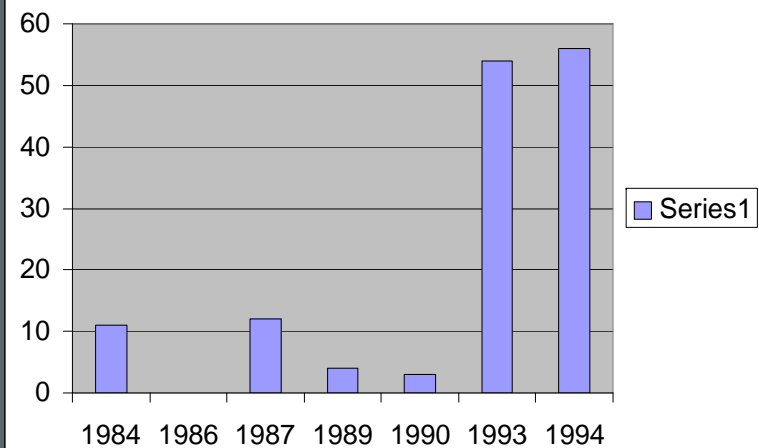
ENCEPHALOMYOCARDITIS IN FREE RANGING AFRICAN ELEPHANTS

- From the summer of 1993 and extending well into 1994, significant elephant mortalities occurred in the Kruger National Park.
- This was a novel event, and carcass counts far exceeded the normal sporadic elephant mortalities that are reported annually in rangers reports.

SOME EPIDEMIOLOGICAL DETERMINANTS

- MORTALITIES WERE TEMPORALLY CLUSTERED
- MORTALITIES WERE SPATIALLY CLUSTERED
- 83% OF ALL CARCASSES FOUND WERE ADULT BULLS

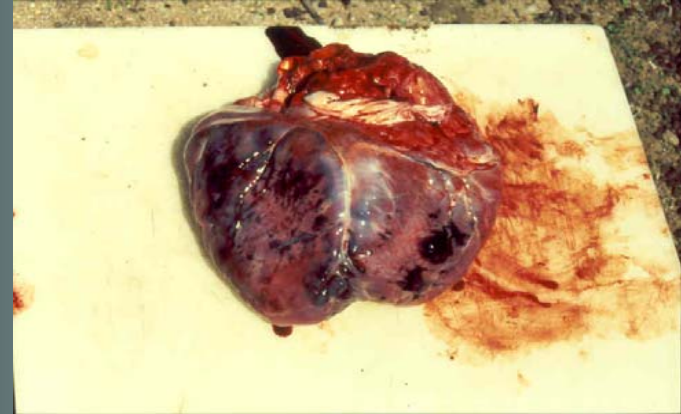
% RODENT TRAPPING SUCCESS



THE MAIN RODENT SPECIES INVOLVED WAS
Mastomys natalensis, THE MULTIMAMMATE MOUSE



ENCEPHALOMYOCARDITIS VIRUS WAS
ISOLATED FROM LESIONS IN ELEPHANTS'
HEART MUSCLE



EMERGING NON INFECTIOUS
ENVIRONMENTAL HEALTH ISSUES



CYANOBACTERIAL BIO-INTOXICATION



MAN-MADE IMPOUNDMENTS – HIPPO EUTROPHICATION



FLOPPY TRUNK SYNDROME IN FREE-RANGING AFRICAN ELEPHANTS - ECOLOGICALLY DISTURBED AREAS WITH TOXIC PRIMARY SUCCESSION PLANTS ???



PANSTEATITIS IN CROCODILES AND BARBEL IN THE OLIFANTS RIVER



INTERNATIONAL EMERGING DISEASES

SEVERAL IMPORTANT DISEASES, MOST OF WHICH WERE ZONOTIC, EMERGED ON THE INTERNATIONAL SCENE OVER THE PAST DECADE. THESE INCLUDE :

- Highly pathogenic H5N1 Avian and Pandemic H1N1 influenza infections
- SARS – Bat and Palm Civet associated
- West Nile Virus infection – Vector borne
- Hendra, Nipah and Menagle virus infections – all associated with fruit bats
- Hanta virus infection – associated with rodents.
- Spongiform encephalopathies (bovine and cervid)

IN CONCLUSION

- PROBABLY AS A RESULT OF EXPANDING HUMAN POPULATIONS, RAPID INTERNATIONAL TRANSPORT AND INTENSIFYING WILDLIFE, LIVESTOCK INTERFACES – A PLETHORA OF EMERGING DISEASES – SOME OF WHICH HAVE TRANSBOUNDARY POTENTIAL – ARE BEING EXPERIENCED GLOBALLY.

THE END

