

Anthrax in Wildlife



Anthrax, in Afrikaans called miltsiekte, is a serious infectious disease caused by the bacteria *Bacillus anthracis*. Anthrax affects both domestic and wild animals around the world, and can cause severe illness in humans when they come in contact with affected animals.

Sub-Saharan Africa is seen as the 'cradle of Anthrax', and in recent years there have been major anthrax outbreaks. In Etosha annual outbreaks occur, thereby causing mortalities under e.g. zebra, oryx and elephants. In Kruger National Park eight major outbreaks occurred since 1960. The latest outbreak in 2012 wiped out almost 50% of the roan antelope population and over 30 hippos. In 2010 an estimated amount of 2000 animals died. In 2012 more than 165 animals died due to Anthrax in Mana Pools National Park, Zimbabwe, including an estimated 88 hippos, 45 buffalos and 30 elephants. On the 2nd of October 2017 a couple of dead hippos were discovered in the Bwabwata national park in Namibia. Within 7 days, 107 hippo carcasses were found. Anthrax serves as a population regulator in large conservation areas, but it is evident that Anthrax can be devastating on a game farm.

Cycle of infection

The life cycle of *B. anthracis* (Figure 1) involves both a vegetative and spore state. When an infected host dies, it sheds the vegetative bacteria into the environment, usually into the soil under or surrounding the carcass. When the bacteria is exposed to air, the bacteria produces and/or releases spores (sporulation). These spores can be taken up by other animals. Warm climates favour the growth and sporulation in body fluids of infected carcasses. The spores can contaminate the surrounding soil, vegetation and water. Usually spores survive for three to four years, but they may remain dormant and viable over 50 years. The bacteria is more persistent in soils with alkaline pH (pH < 7), high calcium content, high organic matter content and poorly drained areas. The cycle of infection is influenced by:

- Factors that affect sporulation and germination
 - o pH
 - o Temperature
 - o Water activity
 - o Cation levels
- Factors related to the season
 - o Available grazing
 - o Health of the host
 - o Insect populations
 - o Human activities

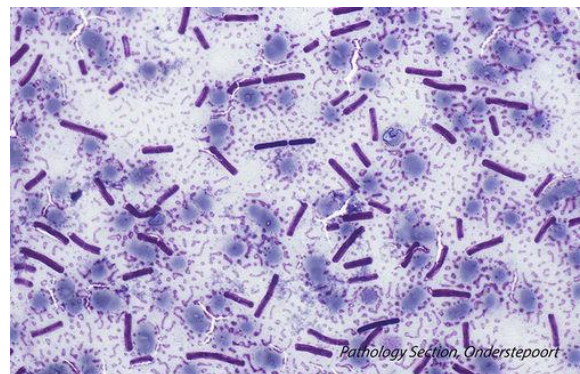


Figure 1 *Bacillus anthracis*
(Source: Pathology Section,
Onderstepoort)

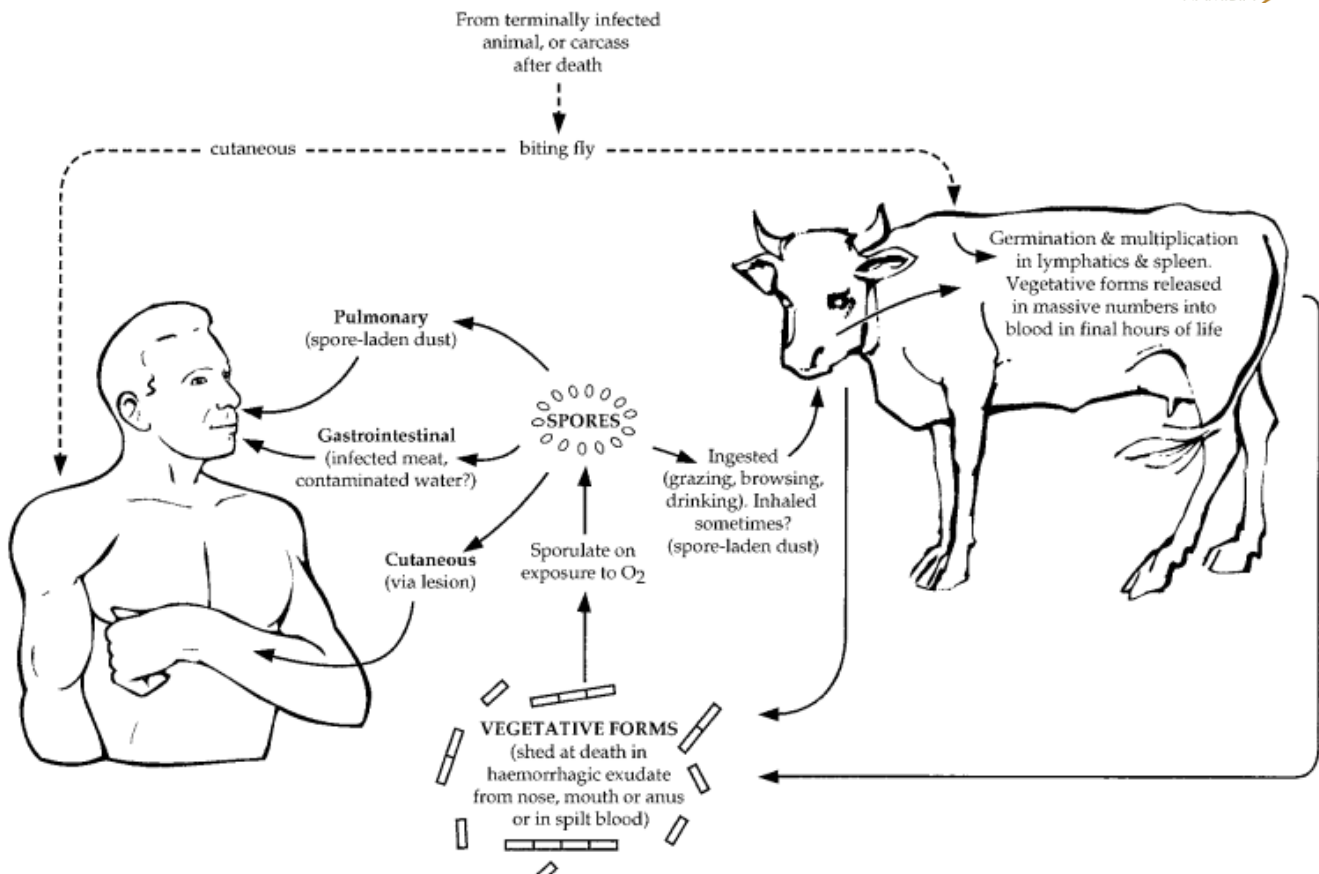




Figure 2 Cycle of infection in anthrax. The spore is central to the cycle, although vegetative forms may also play a role in establishing infection when, for example, humans or carnivores eat meat from an animal that died of anthrax or when biting flies transmit the disease. (Source: Anthrax in humans and animals – 4th ed. World Health Organization 2008)

Animals acquire anthrax by the ingestion of spores while grazing or browsing, or breathing in contaminated dust (Figure 2). Insects possibly also play an important role in disease transmission. When flies feed on the body fluids of infected carcasses, they can deposit their contaminated vomit and/or faeces on the trees and bushes. Browsing herbivores that eat the contaminated leaves may contract Anthrax in this way. Biting flies may have played an important role in Anthrax outbreaks in hippos. Vultures are known to be carriers of spores. After feeding on an infected carcass, they wash and defecate in shallow water, thereby shedding the spores in the water.

There are differences in species affected in different areas. Research showed that in Etosha National Park peak Anthrax mortalities for Burchell's zebra occur in March/April, while for elephant this is in November/December. This might be due to adaptation by different Anthrax types to specific host species. Susceptibility also appears to be age dependent, as adults are generally more vulnerable than young or sub-adults.

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Symptoms and pathology

In southern Africa deaths due to Anthrax have been recorded in at least 52 species. Herbivores are most susceptible to the disease. Carnivores are more resistant than herbivores, but can die from Anthrax. Cheetahs in Namibia have shown a high mortality rate due to Anthrax, which might be due to a higher susceptibility to the infection.

The incubation period in naturally-infected cattle is 1 to 14 days. When wildlife is affected with Anthrax, usually no symptoms are seen. A sudden death in apparently healthy animals with a very short period of disorientation should raise a high index of suspicion. Animals may have bloody discharges from body openings, such as the mouth, nostrils, ear and anus (Figure 3, Figure 4). Other characteristics are rapid bloating of the carcass, an incomplete rigor mortis, early breakdown of tissue (autolysis) (Figure 5) and the absence of clotting of the blood (Figure 6). Carnivores with anthrax might have a swollen face (Figure 7).



Figure 3 Zebra that died of anthrax with bloody discharge from the nose (photo by U. Tubbesing)



Figure 4 White rhino with bloody discharges from the nostrils and eyes (photo by U. Tubbesing)



Figure 5 White rhino bleeding from skin without obvious wound (photo by U. Tubbesing)



Figure 6 Absence of clotting of the blood (photo by U. Tubbesing)



Figure 7 Carnivores often show a swollen face, frequently confused with snake bite (photo by U. Tubbesing)

Figure 8 shows the development of a zebra carcass infected with Anthrax, and how much effect the opening of a carcass can have on infection of the surrounding soil.

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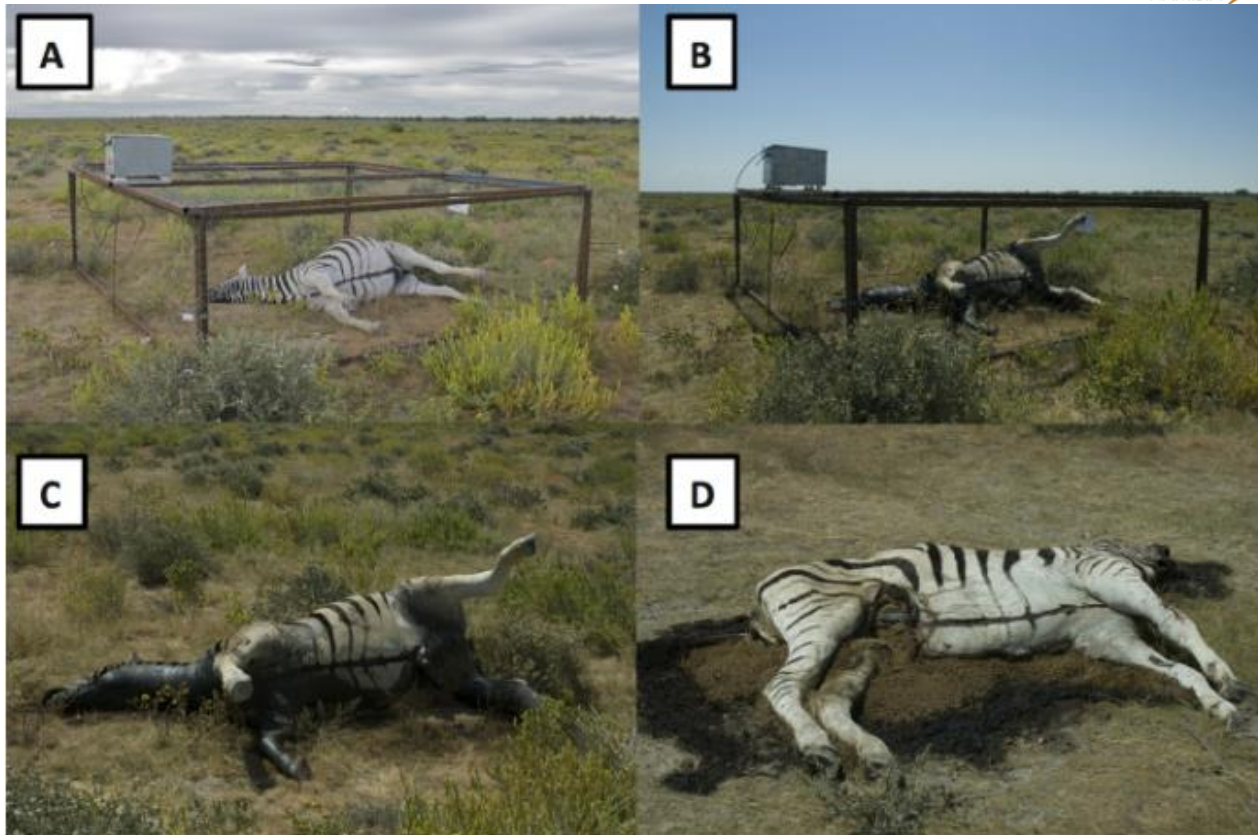




Figure 8 The site of an anthrax-positive zebra carcass that has been experimentally caged from the date of death is shown on the date of death (A) and 4 days later, after substantial bloating and when the cage was removed (B). A close-up of the same carcass (C) better displays the soil saturated with non-haemorrhagic fluid (the blackened disturbed area surrounding the carcass), which exhibited high levels of *B. anthracis* spore contamination. A carcass that had been slightly opened prior to caging (D) exhibited a larger area of soil saturated with non-haemorrhagic fluid, as well as substantial maggot activity, 4 days after host death. (Source: S.E. Bellan, P.C.B. Turnbull, W. Beyer, W.M. Getz (2013). Effects of experimental exclusion of scavengers from carcasses of Anthrax-infected herbivores on *Bacillus anthracis* sporulation, survival and distribution)

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Diagnosis

It is crucial to find dead animals quickly to have a proper diagnosis. It is difficult to confirm Anthrax based on the signs, as several diseases can cause sudden deaths, such as e.g. African horse sickness, botulism, blackleg, Rift Valley Fever, poisoning, snake bites, lightning strike or metabolic disorders (bloat, magnesium deficiency, lactic acidosis). Sudden death and dark unclotted blood are most prominent.

When Anthrax is suspected, DO NOT open the carcass to prevent infection and the release of spores! Inform a veterinarian immediately.

Characteristic post-mortem signs of Anthrax are dark unclotted blood, enlarged haemorrhagic (bloody) spleen, haemorrhages throughout the organs (Figure 9) and dark oedematous (accumulation of fluid) intestinal tract. The most advanced lesions will be located in the area of initial infection.



Figure 9 Post mortem on a white rhino that died of anthrax; severe lesions in the lungs, upper airways and throat as well as bleeding in heart muscle (photo by U. Tubbesing)

In hoofed animals and cheetahs a blood smear is very likely to show the classic, capsulated Anthrax bacteria, although there are several cases in which the bacteria do not show. In an intact and un-scavenged carcass blood can be obtained by means of a syringe from a vein for about 24 hours after death. Alternatively, a dry swab inserted in a small incision in an area with many blood vessels (the ear for example) can be used to make a smear. A veterinarian can fixate and stain the smear, and examine it under the microscope. Note that smears become unreliable about 24 hours after death.

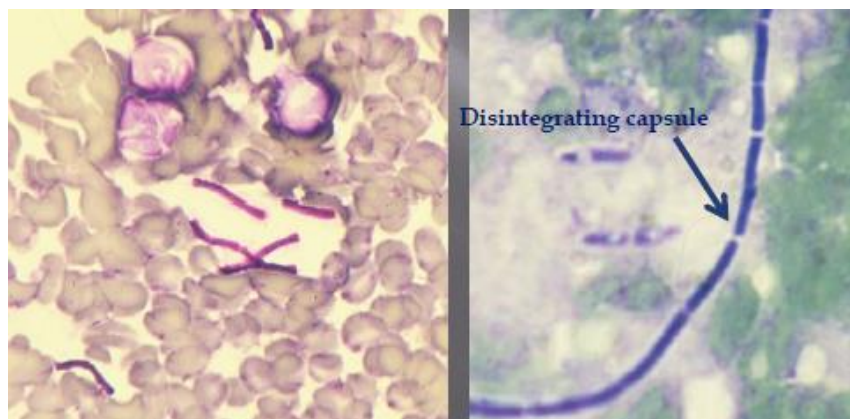


Figure 10 Left image showing brick shaped bacteria surrounded by a light pink capsule typical of anthrax bacteria on a blood smear. The right image (blood smear from a more rotten carcass) also shows anthrax bacteria with the typical "bamboo stick" appearance but here the pink capsule has disintegrated, making a diagnosis more difficult (photo by U. Tubbesing)

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Managing the disease

Confirmation of the disease is important, although often difficult to establish. When Anthrax is suspected:

- Avoid contact with the carcass, use protective clothing such as gloves, boots, coveralls etc.
- Report to a veterinarian
 - o Based on the veterinarian's advice blood and/or soil samples might be taken
- Do NOT open the carcass and keep scavengers away!
- Dispose the carcass correctly
 - o Bury the carcass and disinfect the carcass and area with disinfectant, e.g. 10% formalin (Figure 11)
 - o Burn the carcass (Figure 12)
- Decontaminate the area where the animal might have walked and died with 10% formalin
- Consider the need and practicality of disinfecting artificial water holes with chlorination (at least 5000 ppm concentration) and make water points unattractive for vultures
- Control flies (poison or fly traps near the carcass)
- Avoid bringing animals in from outbreak areas (unless treated/vaccinated)



Figure 11 Burying and disinfecting of a white rhino



Figure 12 Burning carcasses

When animals show signs of Anthrax they can be treated with antibiotics. Do NOT give antibiotics and the vaccination at the same time!

Vaccination of animals in areas where Anthrax naturally occurs is of utmost importance. There are different vaccines on the market which are cheap and effective, although vaccination of wildlife might become more expensive due to the need of a helicopter. The vaccine provides one year protection. Note that cattle vaccines are NOT effective in species such as rhino and hippo. These species should be vaccinated with Rhinovax.

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Humans and Anthrax

People can get infected with Anthrax when spores enter the body (Figure 13). People can acquire Anthrax by breathing, eating or drinking spores, or get spores through a cut or scrape in the skin:

- Cutaneous Anthrax – Hide porter's disease
 - o Anthrax occurs on the skin
 - o Most common form, without treatment the risk of death is 24%
 - o Incubation period of 2-6 days
 - o Symptoms: skin lesions and ulcers with a black centre
- Intestinal infection
 - o Most often caused by consuming Anthrax-infected meat
 - o Can be treated, however mortality rates are 25 to 75%
 - o Incubation period of 3-7 days
 - o Symptoms: vomiting blood, severe diarrhoea, acute inflammation of intestinal tract, loss of appetite. Lesions in mouth and throat
- Respiratory infection
 - o Relatively rare, mortality rates are 25-80%, even with treatment
 - o Incubation period of 4 days, but maybe up to 11 days
 - o Non-specific symptoms: flu-like symptoms (fever, sweating, fatigue, coughing etc.), pneumonia, respiratory collapse





Figure 13 Human infected with cutaneous Anthrax and gastrointestinal Anthrax (Source: CDC)

About 2,000 people globally get affected each year. If the diagnosis is made early enough, Anthrax is in most cases treatable. Anthrax is not a contagious disease, meaning it cannot spread from person to person.

People that have been exposed to Anthrax should seek medical expertise as soon as possible, and should get preventative antibiotics. Contaminated body parts should be washed with antimicrobial soap and water. Waste water should then be treated with bleach/antimicrobial agent. Clothes which might have spores should be burned to destroy the spores. Formaldehyde is effective in cleaning objects that might have been contaminated, or objects can be boiled in water for at least 30 minutes. People can get vaccinated against Anthrax.

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