Animals and cold weather

Following the good rain season, predictions of a severe and cold winter are around... This poses certain risks to our farm animals (game and livestock alike). While most of us have the opportunity to warm ourselves by a heater or blanket, animals don't have that luxury. How do they deal with Namibia's winter months?

In this article we firstly explain what animals can do to protect themselves against the cold. We also explain why smaller animals (smaller species and young animals) are more susceptible to severe cold stress than bigger animals and then we provide a couple of practical tips you may consider minimising stock losses during cold spells.

How do animals protect themselves against the cold?

Like humans, warm-blooded animals (mammals) must maintain a certain internal body temperature. A cold spell can cause death and injury to livestock and wildlife. If an animal's core body temperature drops below 35°C, they can die of hypothermia. Exposure of body extremities (ears, tail and distal limbs) to temperatures below zero can result in frost bite lesions. Most species have developed different behaviours and adaptations to handle the cold, some examples:

- Sleep and hibernate. Some species go into a deep sleep, and slow down their heart- and breathing rate; *Hibernation*. Their body cools down, and they don't need food or water for a while as their metabolism has decreased. In Namibia, the Southern African hedgehog goes into hibernation. Some mouse and bird species only go into a 'deep-sleep' phase for a few hours or days when it's extremely cold. This is called *Torpor*.
- Migration. Especially birds migrate to warmer areas before the cold winter months are coming.
- Minimising exposure to cold winds. In severe cold and windy spells animals are classically observed sheltering in densely bushed areas which serve as wind shelters.
- Physiological changes:
    - Growing thicker fur
    - Building fat reserves
    - Raising hairs on the body to trap heat, or fluff up feathers

Few of the African antelope species have the ability to build up significant (protective) subcutaneous fat reserves. In addition, most are pregnant during our dry, cold winter months. This puts additional nutritional strain on the animals. Some species, such as kudu, nyala and warthogs are more sensitive to cold then others. We thus often see mortalities in these species (not so much warthog because they shelter in relatively warm ground boroughs) whilst frost bite and the dropping off of ear tips in sable and roan is not uncommon.

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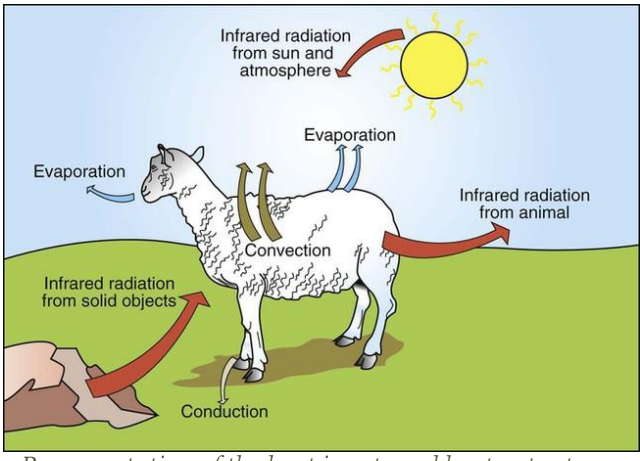
Why are small animals more susceptible to cold stress?

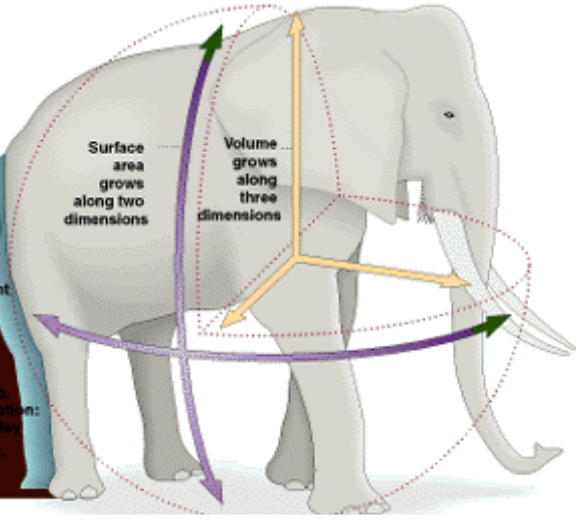
Body heat is either lost to, or gained from, the external environment via the body surface. The larger the surface area of a mammal, the greater the potential rate of heat loss or gain. Body temperature, esp. during cold spells is higher than ambient temperature, especially at night when there is no solar heat absorption. This results in a nett heat loss from the animal.



Representation of the heat input, and heat output between a mammal and the environment © Veterian Key

Mammals have to maintain their body temperature at a relatively constant level (depending on species between 37.5 – 40° C). In contrast to most farm animals, hardly any of the southern African game species have a protective fat layer under the skin to help insulate them from a cold environment. Any excess heat lost must be replaced by heat obtained from the breakdown of food or body tissue (fat, muscle etc) and by energy consuming muscle activity (shivering).

All bodies have a volume and a surface area. When you live in Africa, you rather have a large surface area to the volume ratio as this will help to lose heat faster. However, in Antarctica, you would want a small surface area to volume ratio, as it reduces heat loss.



As animals grow in size, their inside (volume) gets "bigger" than their outside (surface area). The larger the animal, the smaller the surface area-to-volume ratio and so the less relative area there is to lose heat. © Palaeoblog

The ratio of surface area to body mass or volume (SA:V) is critical in determining thermoregulation. With increasing size, an animal's volume increases to the third power (x3) whereas surface area only increases to the second (x2). Smaller animals thus have a comparatively larger surface area through which to radiate heat than do larger animals. This determines the basic metabolic rate, which is the rate at which the body uses energy while at rest to maintain vital functions such as breathing and keeping warm.

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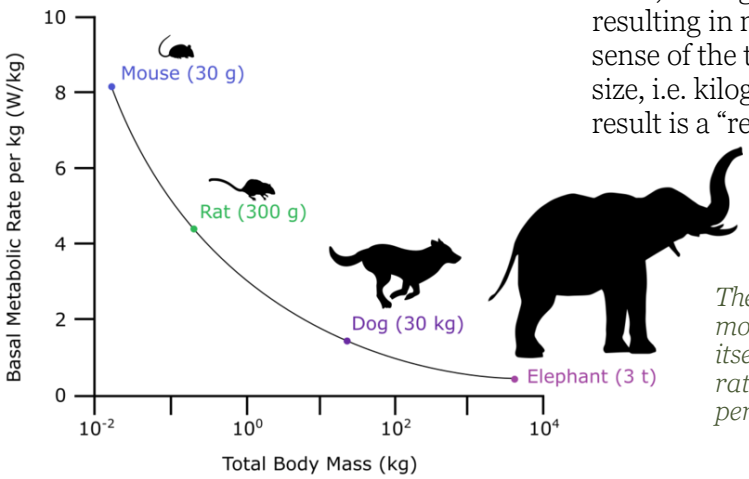
Smaller animals have, on a per kg basis, a much higher energy consumption to fulfil their basic daily functions. As soon as there is a dietary energy deficiency (typical Namibian winter and drought situation) the mere fight for survival places a severe strain on body reserves. This is exacerbated by advanced pregnancy and/or in lactating females.

A large surface area (e.g. mouse) leads to a greater heat loss per unit mass of animal. To compensate for this higher heat loss, a mammal's metabolic rate has to be sufficiently high to maintain its body temperature at a steady value of say 38°C.

Thus, the bigger an animal, the lower its heat loss relative to its size, resulting in more modest food requirements (not in the absolute sense of the total amount of food ingested, but relative to their body size, i.e. kilogram of food per kilogram of body mass). The end result is a "relatively low running costs" for these big animals.



The average elephant weighs 220,000 times as much as the average mouse, but requires only about 10,000 times as much energy to sustain itself. The bigger the animal, the more efficiently it uses energy. Metabolic rate per unit mass vs. body mass for different species (respiration rate per kilogram) © CLFitzgerald

What can you do to help?

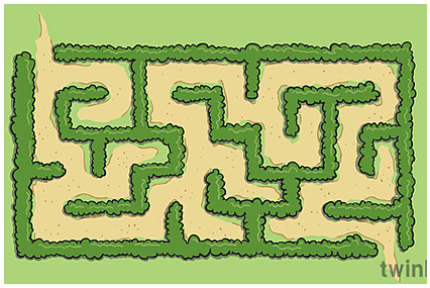
Since few African wildlife species have substantial fat layers under the skin, livestock species are generally better adapted to cold weather. However, severe wind and cold can also cause significant problems for livestock. Under extreme winter conditions farmers may have to take additional precautions to protect their animals. The following are some recommendations and suggestions to protect your animals:

- **Maintain good body condition:** Make sure animals are in good body condition before the winter. Animals in poor body condition start utilising their fat reserves as a source of energy. We all know that fat also has an important insulation function. Animals in poor condition thus not only have minimal body reserves, they also have no physical protection against the cold. Livestock in good body condition can handle winter weather and extreme conditions better than smaller or weaker animals. Cold and wet weather may result in a 100% increase in energy used to help maintain normal body temperature and function (this is especially true for pregnant and lactating animals). Failing to meet these needs may result in condition loss, stunted growth, poor milk production, weakness and death.
- **Vaccinate:** Winter conditions predispose animals to pneumonia – vaccinate if possible.
- **Good quality food:** Ensure sufficient and accessible supply of good quality food to provide the animals with nutrients to maintain body temperature and survive cold temperatures. Providing this food (ideally hay/roughage) in the late afternoon will stimulate rumen microbes digest hay to provide the ruminant with nutrients while fermentation in the rumen produces (at no energy expenditure for the animal) heat to protect your animals.
- **Water and boma/kraal hygiene:** Animals' water consumption increases because of elevated metabolic rates necessary to maintain warmth. Make sure water is clean, free of ice, and in adequate supply. To minimise heat loss avoid keeping animals in wet, muddy kraals. Proper plumbing and maintenance should minimise water leakage. If there are muddy areas around water troughs, consider installing proper drainage and/or making use of soil/gravel filling.
- **Shelter and debushing:** Shelter animals from the wind. Trees, land windbreaks, other natural weather barriers and constructed shelters will assist in blocking winds. These protected areas should provide all animals enough space to lie down safely without being trampled or smothered. Bushes and trees provide cover and shelter against the elements; winds, cold, sun etc. Many game species hide their offspring for the first few days of life in dense bush. Browsers, especially the cold sensitive species such as kudu and nyala, are negatively affected by the reduced availability of browse as well as the lack of shelter.

  Many farmers try to literally eradicate the much-maligned blackthorn (Swarthaak) *Acacia mellifera* – now called *Vachellia mellifera*. We would like to caution against such a radical approach since it is usually the first bush to start greening, flowering and producing pods following winter and thus providing essential food for browsers like kudu. Sparse density of leafless trees are ineffective windbreaks – avoid radical debushing! For game ranches we recommend structured debushing, in the pattern of a cheetah or zebra skin. Create open grass plains (the yellow part), interspersed with 1- 5 ha sized patches of denser bush (the black spots), where the animals can find cover from the elements and hide.

Let nature guide you; debush according to a cheetah or zebra skin. Leave dense spots for animals to hide and seek shelter. Natural patterns look more attractive for yourself, and guests.

- **Additional shelter:** Avoid excessive heat loss by providing insulation. For very susceptible animals (e.g. nyala, lambs and kids etc.) consider constructing a maze-like structure from stacked hay bales and hay bedding. These are very effective BUT, esp. for wild animals, must be constructed early in the winter (close to feeding and drinking site) to allow the animals time to get used to the structure and enter it on cold nights. Such a "maze" should obviously have multiple openings to allow easy entrance and exit.



Shelter with grass bales © Living my dream life on the farm

Another type shelter with grass bales © Dr. S. John Martin

Hedge shelter © BBC Gardeners' World Magazine

- **Concentrating animals:** Try concentrating animals into sheltered spaces so that proximity to other animals provides some form of shelter and heat. Take for example the penguins in the Antarctica, who huddle up against each other against the cold. This is of course more applicable to livestock and not so much for game.
- **Bedding:** Keep bedding as dry and clean as possible to avoid increased ammonia fumes which can irritate the respiratory lining of livestock thereby increasing susceptibility to pneumonia.
- **Monitor:** During extreme cold spells animals should be monitored often. Specifically monitor the young/smaller animals (e.g. Nyala) that are more at risk to cold temperatures - Care for young animals first, since they have lower body energy stores and are more vulnerable than larger animals.
- **Buy animals from areas similar to yours:** When buying game, especially exotic species best adapted to sub tropic or tropic regions (nyala, lechwe, bushbuck etc.), ideally source these from game ranches where they have been exposed to cold temperatures for a few generations (e.g. nyala sourced from the Freestate area vs. those sourced from Natal adapt far better). In the case of translocations within Namibia, game from traditionally cold areas animals from the Nina/Seeis area will do better when taken to say Tsumeb than the other way round. This gives some guarantee of the animals being more cold-adapted thus hopefully reducing your losses in a harsh winter.

The tips of these sable ears have frozen off. Under normal circumstances, blood carries oxygen to keep all tissues healthy. If an animal's body temperature starts to drop, blood vessels constrict → the blood is kept close to the vital organs. This means the extremities (such as the ears) get less blood. This lack of blood and oxygen damages the tissue cells in the extremities, and ice crystals start to form. Blood cloths may start to occur, leading to further damage of the tissues. If this condition lasts long enough, the tissue dies off. This is what we know as frostbite. © M. Bijsterbosch

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Preparing for a cold spell

With modern weather prediction models, we receive fairly accurate information and advance warnings of pending cold spells. This enables the farmer to take a couple of steps to prevent or minimise stock losses. These include the following:

Try to maintain animals in the best condition possible: Animals in poor body condition start utilising their fat reserves as a source of energy. We all know that fat also has an important insulation function. Animals in poor condition thus not only have minimal body reserves, they also have no physical protection against the cold.

In case of a severe cold spell such animals will utilise the last energy reserves to generate body heat and are very likely to succumb to the cold. The cold spell associated with the first rains following the 2019 drought comes to mind – most farmers reported massive stock losses even though temperatures hardly approached 0°C.

If you are aware of severe cold coming in, consider giving your animals a late afternoon meal of **good quality roughage**. You are not just supplying the animals with food, roughage fermentation by rumen micro-organisms results in substantial heat production. This "passive" heat from fermentation does NOT require any work from the animal – thus near zero energy consumption.

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