CLIMATE CHANGE AND WILDLIFE

Climate Change and the Shape of Wildlife in Future

If the climate gets hotter, it can be expected that flamingos will need to lose heat, so more will be seen standing on both legs.

BY FELIX PATTON

Will the safari-going tourist of the future find elephants with bigger ears or more flamingos standing on two legs? According to some scientists, it is more than likely if climate change continues to lead to hotter weather.

Animals need to maintain their body temperature between critical limits to avoid loss of normal functions or even death. Overheating can particularly affect the ability to carry out essential physical activities such as moving to areas where they can find food.

The two main ways of controlling body heat are evaporative heat loss, (for example by sweating with the water released being turned into vapour by body heat) and dry heat exchange (for example by the temperature of the blood being reduced in the presence of colder air.)

Many species release excess heat through selected body parts. It is well known that elephants flap their ears to cool down. Flapping sends colder air across a mass of veins near the surface of their ears to cool the blood. This is called thermoregulation.

There are two biogeographical "rules" that govern thermoregulation – Allen's and Bergmann's rules. Allen's rule is based on the size of body appendages such as beaks, tails and legs. This suggests that larger appendages relative to body size provide a greater surface area from which to lose body heat. So, in warmer climates, larger appendages would be more of an advantage while being a disadvantage in cooler climates.

Bergmann's rule is based on the size of the whole-body surface with the reduced body surface area to volume ratio of larger

BELOW
Flamingos regulate their body heat through their legs. They shed heat by standing on two legs and preserve heat by standing on one leg.

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bodies enabling animals to retain heat more effectively.

Given these "rules" and the examples of their working in practice, species that have thermoregulatory potential may react to rising temperatures caused by climate change by selecting for larger appendages relative to body size. Or conversely more readily accepting smaller appendages so that heat is not lost so readily in colder climates.

Either way, this would result in a change in body shape.

In birds, beaks and legs offer opportunities to cool down. Flamingos are traditionally seen standing on one leg with the other leg tucked away under its feathers. A study showed that more of the birds were seen standing on one leg as the temperature decreased. This is because legs offer a way to shed heat and by putting one of the legs under the feathers heat loss is reduced.

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The beak of birds are highly vascularised -- that is to say, it has many blood vessels which allow for heat exchange. Considered a rival to the elephant in its ability to radiate body heat is the South American toco toucan. It has the largest beak in relation to the size of its body of any bird species and is capable of modifying the blood flow to its beak so acting as a "transient thermal radiator" like the ears of the elephant.

Parrots seem to be more adaptable to "shape-shifting" than perching/songbirds. Research has shown that the Australian gang-gang Cockatoo and Red-rumpus Parrots have increased bill size by four per cent and 10 per cent respectively since 1871.

In geological time, Paleogene birds living in a period some 65 million years ago, had larger bills which may have been a consequence of temperatures some nine degrees centigrade above those of today in the tropics.

Animals with legs without feathers or fur have been linked with heat exchange, including the ears of rabbits and the tail of mice. Relative ear, tail, leg and wing sizes, as appropriate, have increased in some shrews and bats, which could be attributed to rising temperatures or changes in feeding practices or their interaction.

The most likely species to undergo "shape-shifting" are those which adhere to Allen's rule such as the common frog, starlings, song sparrows and a host of seabirds and small mammals.

However, only some appendages, and not all, may perform to Allen's rule. For example, with the Chinese pygmy dormouse, it is only ear size that is altered while with the North American hare, it is only ears and tails but not legs.

LEFT CLOCKWISE
Chinese pygmy dormouse, South American toco toucan and elephant. The tails in small mammals, beaks in birds and ears of elephants are all used to regulate body temperature. If the wind is blowing, elephants will face into it and extend their ears to benefit from the effects. If there's no wind, they'll flap their ears to create air currents around them that carry away heat from their bodies.

An interesting phenomenon in the "shape-shifting" concept is known as phenotypic plasticity or, in layman's terms, the ability of some species to reverse changes in appendage size. In short-term laboratory experiments, mammals tails and birds beaks grew larger and more rapidly in hotter conditions but this could be reversed when placed back in lower temperatures. However, it is argued that this reversal might not occur in the longer term.

Of course, the effects of climate change on wildlife will result in a lot more than "shape-shifting" in species that exhibit dry heat exchange. Those species that are reliant on evaporative heat loss need water to lower their temperature, for example by wallowing in wet mud or water pools and for drinking to avoid dehydration.

Fluctuations in rainfall have resulted in more and longer droughts as experienced recently across South Africa. Lack of essential drinking water leads to reduced breeding rates and increased mortality, especially of new births, across a range of wildlife species.

Rainwater is essential for maintaining nutritious food resources. Long dry spells reduce the quality and quantity of vegetation. For example, in Kenya many buffalos starved to death as they refused to eat poor quality grass due to drought. In addition, alien invasive plant species are better able to tolerate climate extremes and force out the preferred food species.

The monsoon rains in South Asia are becoming more unpredictable causing more intense droughts and floods. The Greater one-horned (or Indian) rhino lives in wet grassland. They need sufficient water to protect them from the high temperatures while they cannot survive in floodwaters.

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TOP
Without rain due to a change in climate conditions wildlife end up dying due to lack of food and drinking water.

BELOW
Monsoon rains are becoming more unpredictable, threatening Indian rhinos.

Melting ice and warmer temperatures are causing rising sea levels which in turn cause more flooding particularly around coasts. The 80+ population of the Javan rhino exists only in the Ujong Kulong National Park on the western tip of Java and could be wiped out in just one flood.

Whether it is increasing or decreasing body shape or increasing or decreasing water levels, climate change will have a major impact on wildlife just as much as it will on humans.

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