

Caprine educational guidelines



Caprine educational guidelines

Project supervisor

Pascal Damois

Président – Managing Director
EAZA Caprinae TAG Chair / IUCN Caprinae SG Member
Trésorier de la Passerelle Conservation / Président de Biodiv'Educ

Writers

Marco Penello

Curator - Parco Faunistico Valcorba
Head of Research and Conservation
EAZA Caprinae TAG Vice-Chair
EAZA EEP Coordinator of Bukhara and Transcaspian urial

Nina Trontti

Director of Animal Care and Conservation, Korkeasaari Zoo
EAZA EEP Coordinator of Markhor

Tero Kirjosalo

Zoo Educator, Korkeasaari Zoo

Photos

Norbert Potensky
Parc Animalier d'Auvergne
Korkeasaari Zoo
Praha Zoo
Stefano Capomagi
R. Wirth
Jan Robovsky
Pietro Laricchiuta
Adobe Stock

Graphic design and layout

Terhi Saalasti

Table of contents

Getting to know caprines	4
What kind of animals are they?	4
Taxonomy	5
Evolutionary history.....	5
Phylogenetic tree.....	6
Where in the world do they live?	7
Habitat	8
Largest and smallest caprines	9
Diet	10
What about the caprinae's diet in the zoos? .	11
Predators	12
All in a name (etymology of the names).....	17
Amazing adaptations.....	22
Visible characteristics	22
Conservation and reasearch.....	29
Threats and conservation	29
Research.....	31
Thermography as a new method to evaluate animal welfare and emotions	32
Husbandry that supports mother-young attachment	35
Safer anesthesia for small ruminants.....	36
RFDI recorders help to monitor animal weights	37
Caprinae (goats and sheep) – educational role and materials	38
I Ecological niche.....	39
1. Food chain and ecosystem service.....	39
2. Ecological niche	41
II Physical characteristics and appearance.....	43
3. Climbing and agility.....	43
4. Physical appearance and interspecies differences.....	45
5. Horns.....	47
6. Caprine-specific terms	50
III Goats and sheep in zoos - wellbeing	52
7. Living in zoos	52
8. Reproduction and marking individuals.....	57
9. Mode of life	59
IV Conservation and endangerment	61
10. Threats.....	61
11. Conservation of animal communities and showcase species.....	66
12. The wild relatives of livestock	68
13. Outdoor research exercise on endangered species	70
14. The Tale of the Alpine ibex.....	72



Getting to know caprines

What kind of animals are they?

Caprines belong to the mammalian class, and more specifically they are part of the group of Caprinae or Caprini (the hierarchical position is fluctuating due to the different look of some experts) of the ruminant family of Bovidae, which in turn belongs to the order of Artiodactyla, also known as even-toed ungulates.

Like the majority of members of this family, the caprines are hoofed and herbivore animals.

Caprinae represents one of the most successful bovid subgroups, as there are currently **35 recognized species** and we are going to learn more about many of them. Within the subfamily of Caprines there is also the major tribe of the Caprini, which includes goats and sheep.

Concerning the typical appearance of the caprines, they tend to be medium-sized ungulates, with a stocky form and a strong body, thick legs, horns of different kinds and dimensions, a smart and sure-footed nature, and almost unrivalled **tolerance to extreme temperatures**, as it is common in mountainous environment.

It is interesting also to note that Caprines are one of the most sexually dimorphic artiodactyls (except for gorals and serows): males are usually twice larger than females (females of Oreamnos, Ovis and Budorcas have $\frac{3}{4}$ body of size of males).

Taxonomy

The taxonomy of the Caprinae subfamily has always been complex and there have been many suggested classifications. It is important to remember that debates and discussions about species and subspecies are always buzzing, so there are often changes and revisions in this subject.

In the past, many taxonomists considered the Caprinae as a separate family called Capridae, but it is now widely accepted that caprines are a subfamily within the family Bovidae. **Most experts currently recognize four different tribes of Caprines:**

1. Pantholopini: chiru
2. Ovibovini: musk ox and takin
3. Rupicapriini: gorals, serows, mountain goat and chamois
4. Capriini: sheep, goats, and tahr

The position of the chiru (*Pantholops hodgsonii*) has only recently been clarified, because in the past this species was thought to be part of the tribe Saigini with the saiga antelope, forming a supposed link between gazelles and goats. Now we are sure that **chiru is an antelope-like caprine**. Additionally, we know that Rupicapriini does not represent a natural group, because **gorals and serows are related to musk ox**; the position of takin and mountain goat remain unstable, but in any case they represent unique lineages of caprines with a long separated history.



Chiru (*Pantholops hodgsonii*)

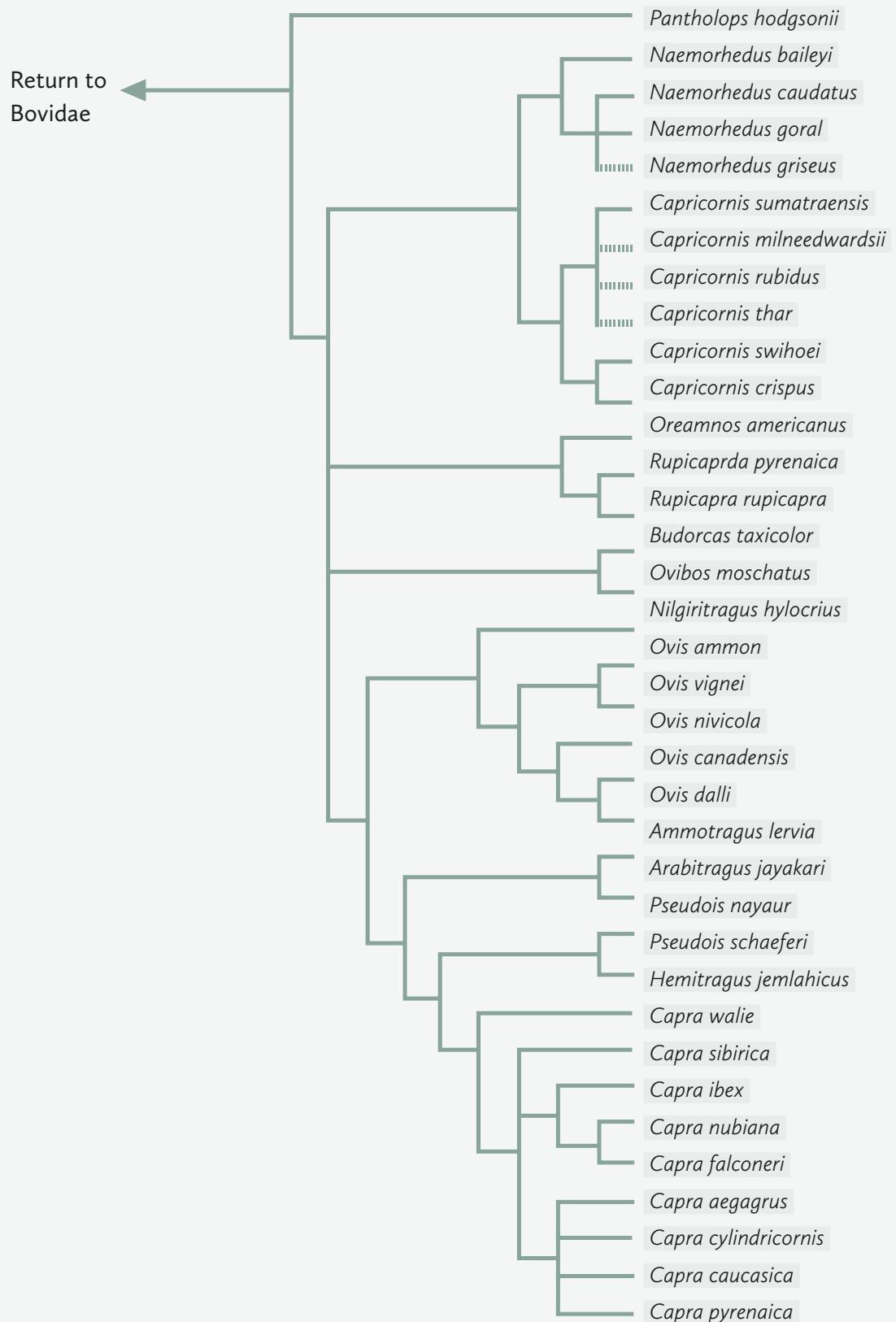
Evolutionary history

We need to begin from the evolution of the Bovidae family to speak about the evolutionary history of Caprinae:

The Caprinae diverged from the other Aegodontia (antelopes except for tragelaphines) in the early Miocene, appearing in the Eurasian fossil record **18-15 million years ago**. The Caprinae might be excluded from the Eurasian lowland habitats by the dominant Cervidae (deer), but were able to fill a specific niche in alpine habitats. The massive presence of mountains throughout Europe and Asia provided the perfect setting for the rapid evolution of the Caprinae during the late Miocene.

Even if the Caprinae are within the Aegodontia, this is the only subfamily which is not seen as containing “antelope” (with the interesting exception of the Chiru, which is also called Tibetan antelope, *Pantholops hodgsonii*); there are some authors that chose to call the members of the Caprinae as “goat antelope”.

Phylogenetic tree



Where in the world do they live?

All the Caprinae species find their perfect habitat wherever there are mountains and rocky environments. They are widely spread in **mountainous regions across Europe, Asia, Africa, and North America.**

The small portion of Alpine habitat in Africa (and on the other hand, the abundance of mountains in Eurasia) and generally limited dispersal of Eurasian elements since the Pliocene in Africa explains why this is the only bovid lineage to be significantly more diverse in Eurasia than Africa.



1 Musk ox
Ovibos moschatus

5 Chamois
Rupicapra rupicapra/ Rupicapra pyrenaica

9 Markhor
Capra falconeri

13 Wild goat
Capra aegagrus

2 Dall's or White sheep
Ovis dalli

6 Alpine ibex
Capra ibex

10 Blue sheep
Pseudois nayaur

14 Nubian ibex
Capra nubiana

3 Rocky mountain goat
Oreamnos americanus

7 Western tur
Capra caucasica caucasica

11 Chinese goral
Naemorhedus griseus

15 Aoudad/Barbary sheep
Ammotragus lervia

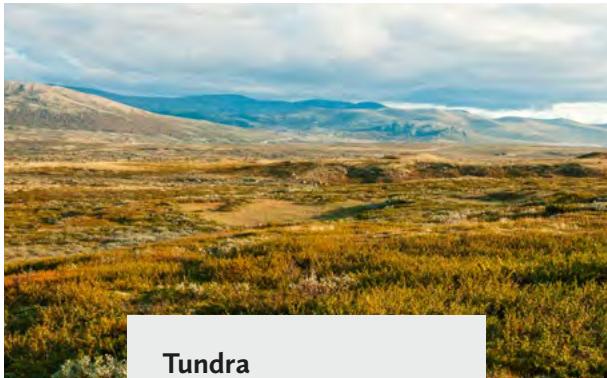
4 Bighorn sheep
Ovis canadensis

8 Urial
Ovis vignei arkal, Ovis vignei bochariensis

12 Takin
Budorcas taxicolor

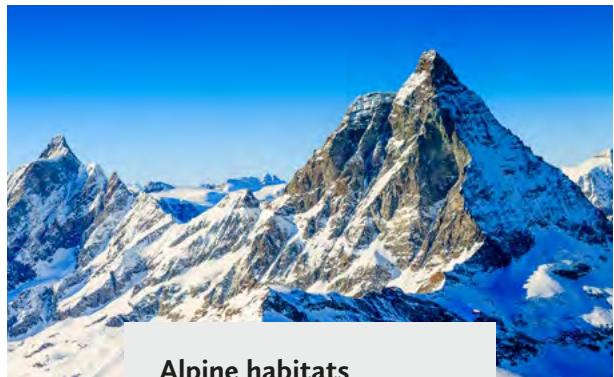
Habitat

The ideal habitat for every Caprinae species is wherever there are mountains and rocky places, but they are very adaptable animals that can thrive in various and very hostile habitats like:



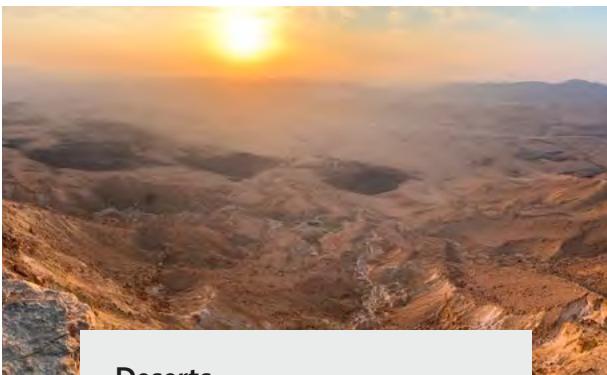
Tundra

(e.g musk ox, snow sheep, and Dall's sheep)



Alpine habitats

(e.g chamois, ibexes, chiru...)



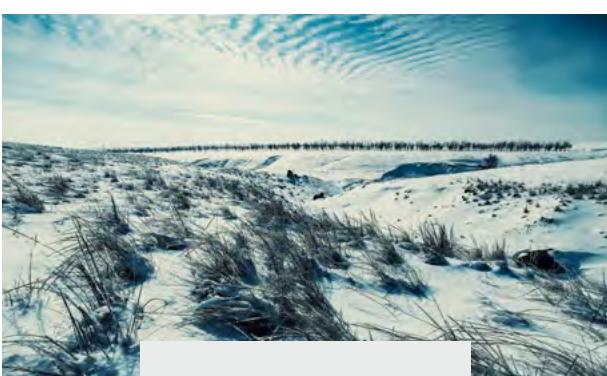
Deserts

(e.g Nubian ibex, Arabian tahr, Barbary sheep, southern subspecies of bighorn sheep)



Wet places in subtropic and tropic regions

(e.g Nilgiri tahrs, takins, serows, and gorals)

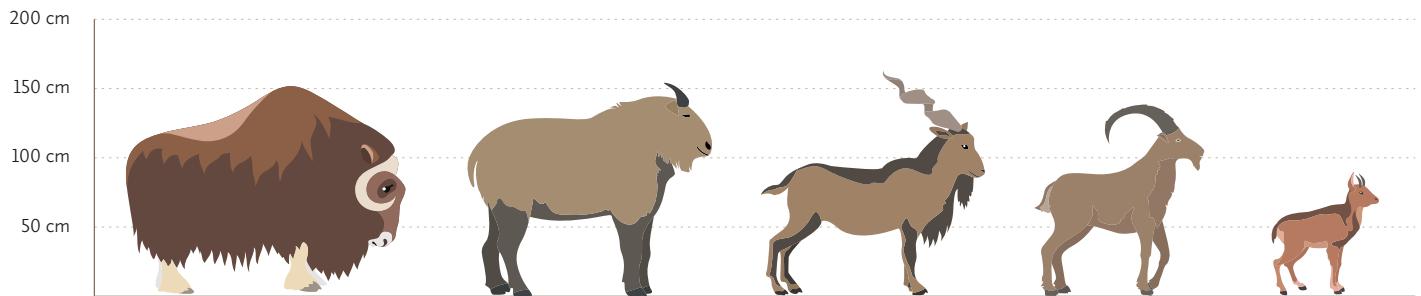


Cold steppes

(e.g urials and argalis)

Largest and smallest caprines

The largest species of caprines are - in the order - the musk-ox and the takin, which belong to the ungulate megafauna with their impressive dimension; while the largest species that belong to the genus Capra are the **Markhor** and the **Siberian ibex**.



Musk ox

shoulder height:
110-150 cm
weight:
180-410 kg

Takin

shoulder height:
97-140 cm
weight:
300-350 kg

Markhor

shoulder height:
65-115 cm
weight:
65-110 k

Siberian ibex

shoulder height:
67-110 cm
weight:
60-130 kg

Goral

shoulder height:
97-140 cm
weight:
25-40 kg

Markhor is the tallest member of the genus Capra, but it is surpassed in weight by the Siberian ibex.

Another interesting record among caprines concerns the **length of the horns**, which is one of the most striking characteristics of those animals.

The longest horns among all the members of Caprinae belong to the Argali, the largest sheep, which has horns up to 190 cm with an impressive weight of 23 kg. After the Argali, there are the Flare-horned markhor and the Straight-horned markhor males with a maximum length of 160 cm; while the shortest horns belong to the Formosan serow with an average length of 7-11 cm, and after this species there is the red goral with an average horns length of 7,5-13 cm.



Argali

Flare-horned
markhor

Straight-horned
markhor

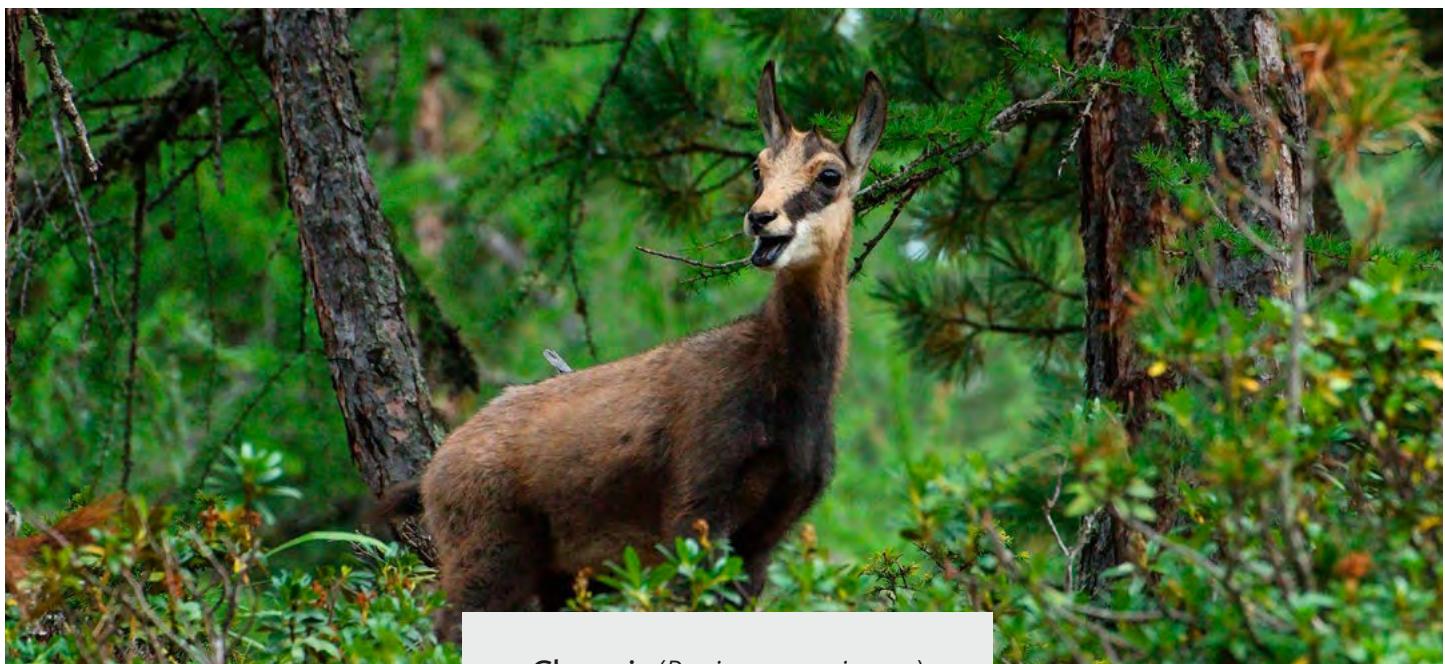
Formosan serow

Goral

Diet

In short....

Caprines are **herbivores**, predominantly grazers and intermediate feeders, but also partly **browsing ungulates** (using Hofmann's approach of herbivore classification), but they are also very adaptable animals, so they are able to survive where other herbivores species could not live, feeding mainly on **grasses, herbs, leaves, twigs, buds and shrubs**.



Chamois (*Rupicapra rupicapra*)

For curious readers that want to learn more....

As just said, all members of the subfamily are generalist herbivores. A wide range of plant material is eaten: grasses, sedges, herbs, shrubs, buds, shoots, and twigs of trees; fruits, acorns, bark, moss, lichen, and fungi. Long-tailed goral in the Russian Far East eats **marine grasses** and even **seaweed**. In a large proportion of the global range of Caprinae, there is a significant difference in forage quality between summer and winter. In winter, animals may be forced to eat **dry vegetation**, twigs, shrubs, and evergreen shoots with a low nutritional content and that may contain secondary compounds. As a result, they lose condition and **may even die of starvation**. Many species descend in spring to reach the first flush of green growth. Lush mountain pastures containing grasses and sedges provide rich feeding grounds, and it has been estimated that Siberian ibex in Pakistan could gain up to 44 lb (20 kg) in weight by the end of the summer. **Invertebrates**, including scorpions and beetles **have been found in the stomachs of urial** in Turkmenistan.

Blue sheep, Siberian ibex, urials, bighorn sheep, musk ox, and Japanese serow all **dig through snow** to reach winter forage.

Wild goat species may stand up on their hindlegs to gain access to browse and use a foreleg to pull down the vegetation.

Himalayan tahr and markhor have been observed climbing into oak trees to feed on the leaves, with some markhor reaching heights of 19–29 ft (6–9 m) above the ground. Serow and mountain goats are also known to **climb into trees growing horizontally out of cliffs** to feed. Takins are

mainly browsers and they may push over young trees to reach the leaves and shoots.

While water needs may be partially met from vegetation consumed or dew that has condensed on vegetation, most species **drink from streams and springs**, and those living at high altitudes **eat snow in winter**. Salt licks are also important to many species: mountain goats, for example, may travel several miles (kilometers) to reach them.



Bighorn sheep (*Ovis canadensis*)

What about the caprinae's diet in the zoos?

If they are in zoos, caprinae species are feeding with grasses, hay, and additional supplements like salt, fruits, vegetables, and specific/concentrate pellets.

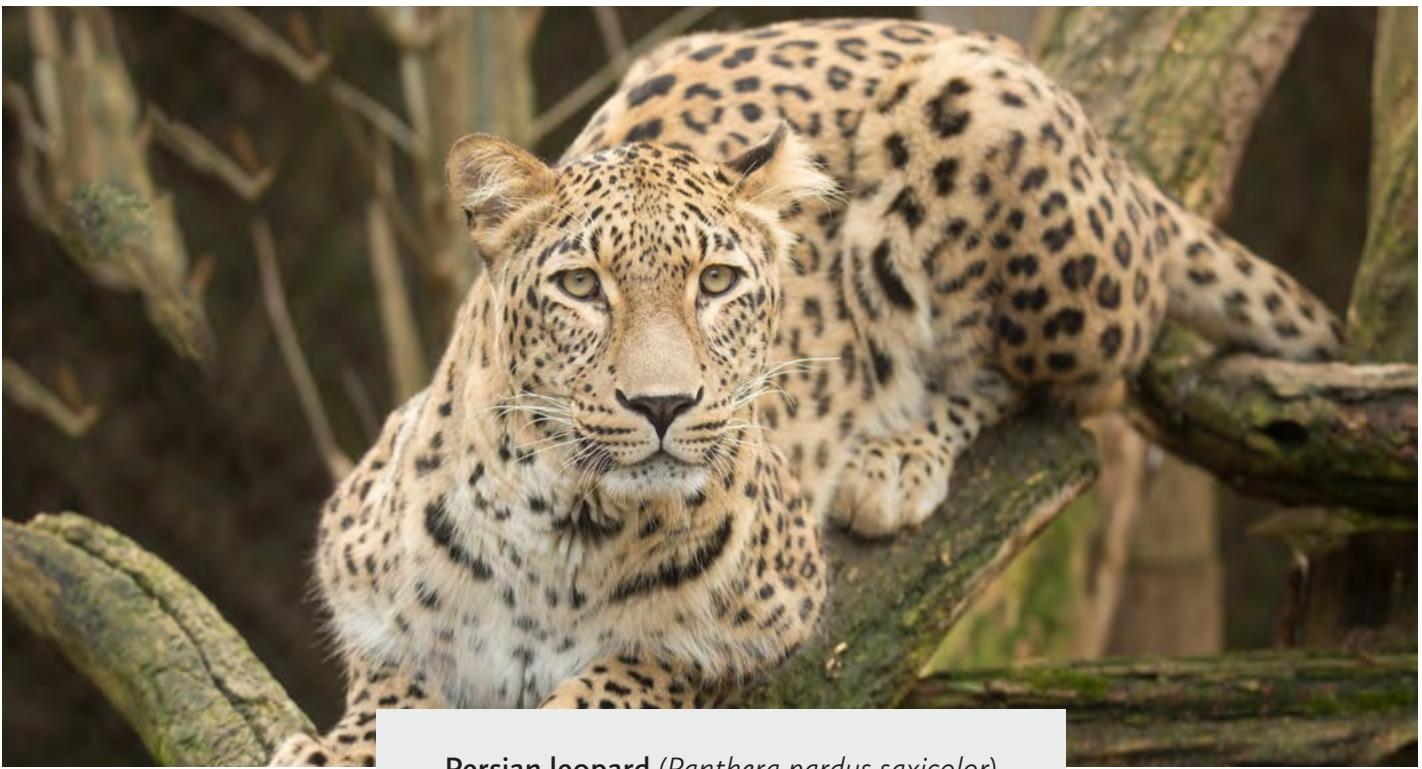


Predators

Caprines have several predators, as they have **always been an important part of many predators' diet**, and a lot of those predators are endangered species like snow leopards, tigers, dholes, wolves and bears. Of course, it depends on the size of the species and on the part of the world in which each species lives.

To each caprine its own predators

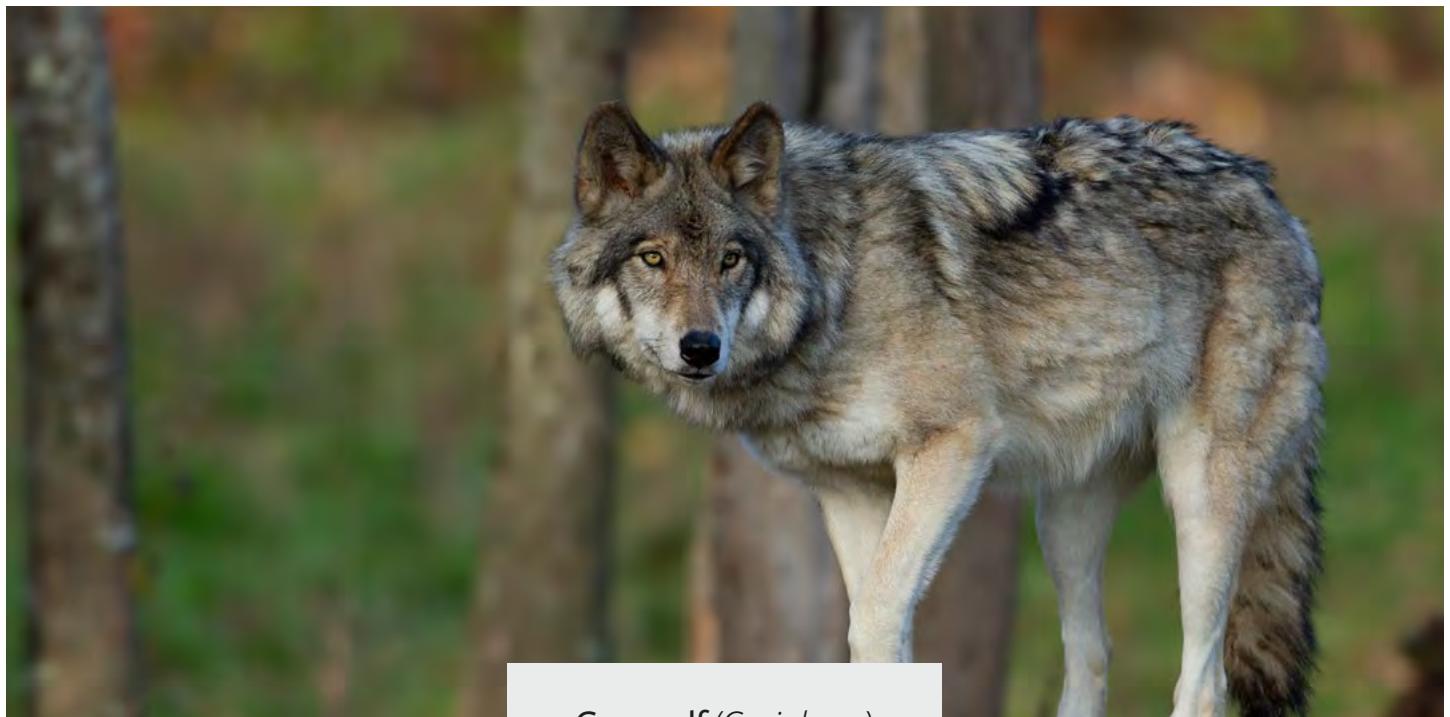
Caprine	Main predator
Chiru or Tibetan Antelope	grey wolf and Himalayan Black bear
Rocky Mountain goat	cougar and brown bear, but eagles and wolverines can prey on first-year kids
Chamois	lynx, grey wolf, brown bear, and fox (foxes prey on calves)
Wild goat	grey wolf and Persian leopard, but golden eagle and bearded vulture can prey on calves and first-year kids
Alpine ibex	grey wolf, brown bear, lynx and fox (foxes prey on calves)
Siberian ibex	snow leopard, dhole, brown bear, lynx, and golden eagle (which preys on first-year kids)
Nubian ibex	leopard, bearded vulture, and eagle (vultures and eagles prey on calves and first-year kids)
Walia ibex	this species does not have almost any predator, thanks to its inaccessible habitat. Maybe, just birds of prey can take young kids

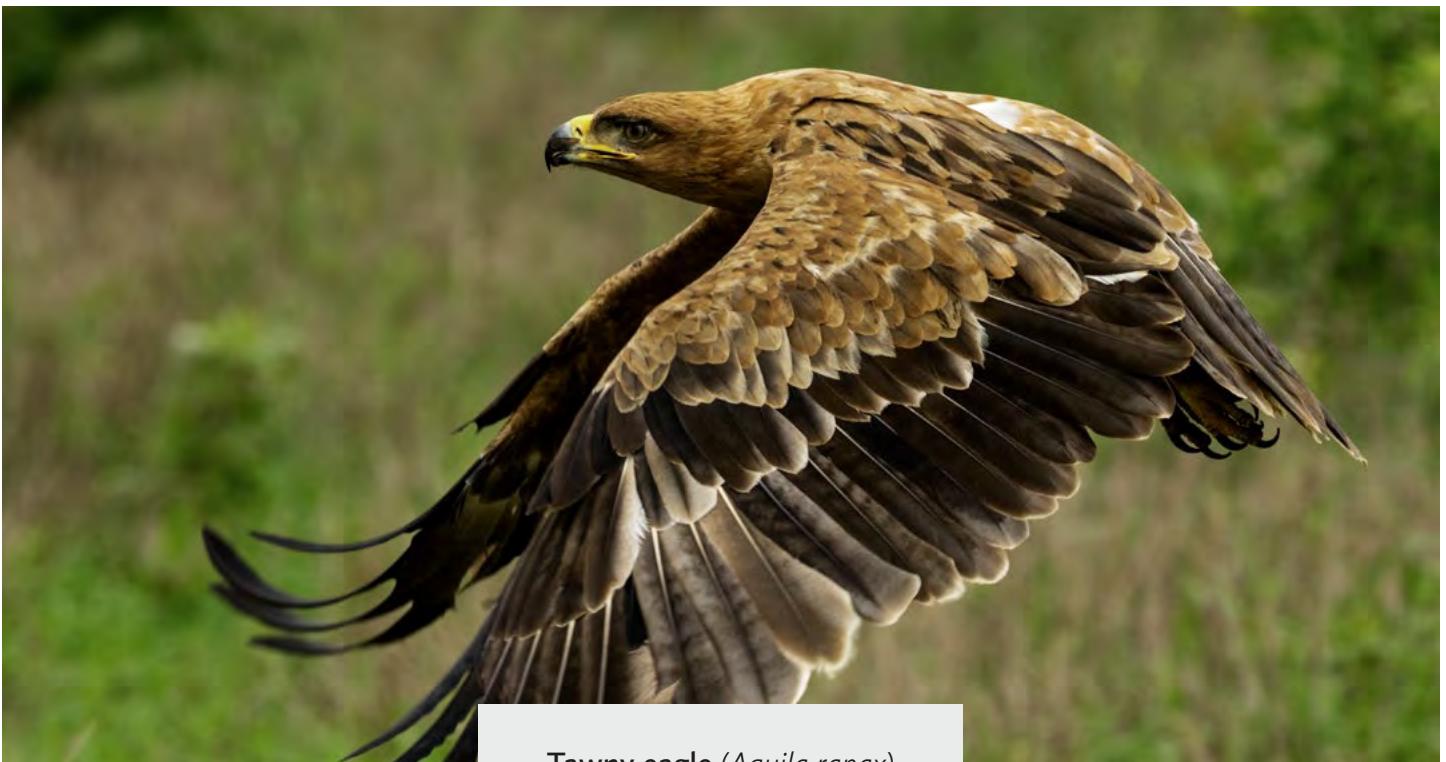


Persian leopard (*Panthera pardus saxicolor*)

Eastern and Western Caucasian tur	Persian leopard (rare in the Caucasus), grey wolf, brown bear, lynx and sometimes golden eagle and bearded vulture (which preys on the young kids)
Maned serow	Sumatran tiger and both clouded leopard species
Japanese serow	this species has very few natural predators, as Japanese wolf has become extinct. Maybe the only potential predator is the Asiatic Black bear
Himalayan serow	leopard, snow leopard, dhole, and eagle (they prey on young-kids)
Red serow	leopard, dhole and eagle (they prey on young kids)
Formosan serow	the only former predator was the clouded leopard, considered currently as extinct

Himalayan goral	dhole, leopard, snow leopard, wolf, tiger, marten (a danger just for the calves), and lynx.
Red goral	leopard and jackal (a danger for the calves)
Chinese goral	dhole, leopard, lynx, and tiger
Long-tailed goral	grey wolf, lynx, and tiger
Markhor	wolf, tiger, snow leopard, and lynx
Barbary sheep	leopard, caracal (which prey on kids) and feral dogs
Himalayan tahr	leopard and snow leopard
Arabian tahr	once the only predator of the species was the Arabian leopard (not it is almost disappeared)
Nilgiri tahr	leopard, dhole and tiger

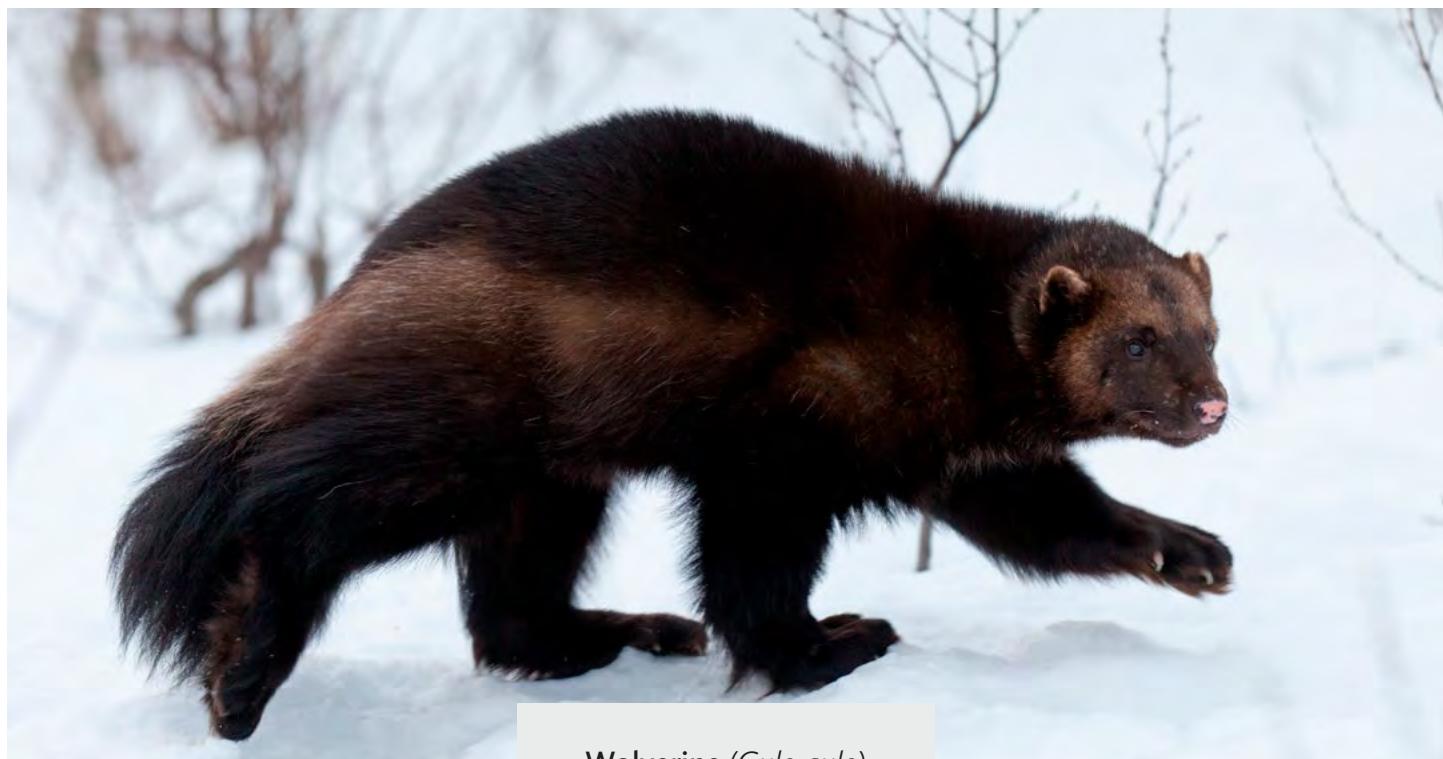




Tawny eagle (*Aquila rapax*)

Bharal	snow leopard, leopard, wolf, fox, and tawny eagle (fox and eagle prey on young kids). The dwarf bharal is preyed also by dhole and large raptors
European mouflon	wolf and eagle (young lambs)
Laristan mouflon	grey wolf and leopard
Transcaspian urial	grey wolf, leopard, golden jackal, red fox and feral dogs
Bukhara urial	leopard, wolf and large eagles
Altai Argali	grey wolf
Tibetan argali	leopard, snow leopard, wolf and eagles (prey on lambs)

Marco Polo Argali	wolf, snow leopard, leopard and dhole
Rocky mountain sheep	wolf, cougar, golden eagle, bobcat, coyote, bears, and lynx
Dall's sheep	wolf, coyote, golden eagle, grizzly bear, and wolverine
Mishmi takin	bear and wolf
Golden takin	bear and wolf
Bhutan takin	bear, wolf, and snow leopard
Sichuan takin	bear and wolf
Musk-ox	wolf and rarely polar bear



Wolverine (*Gulo gulo*)

All in a name (etymology of the names)



Rocky Mountain goat (*Oreamnos americanus*)

Chiru or Tibetan Antelope

Pantholops hodgsonii: pas (neuter pan) (Gr) all; antholops (GR) an antelope.

This is a very strange name. T.S Palmer in his work Index Generum Mammalium quotes “the vulgar old name for the unicorn”. He goes on to explain that when seen in profile, the two horns appear like one, which has given rise to the belief that the animal is the unicorn antelope mentioned by the French traveler and missionary Abbé Huc. The Mr. B. H. Hodgson was a biologist who lived in Nepal during the years from 1833 to 1843.

Chiru is probably a local native name in Tibet.

Rocky Mountain goat

Oreamnos americanus: oros (Gr), genitive oreos, a mountain; amnos (Gr), a lamb.

The common name is easily explained: these awesome goats live in the Canadian Rocky Mountains and in the Northern part of USA.

Chamois

Rupicapra rupicapra: rupes (L), genitive rupis, a rock or cliff; capra, a sheep/goat.

Chamois is French for wild goat.

Wild goat

Capra aegragus: capra, a sheep/goat; aix (Gr), genitive aigos, a goat; agrios (Gr), living in the fields, of animals, wild, hence; aigragos (Gr), a wild goat.

This species is sometimes known as the Bezoar goat, bezoar being a stony substance found in the stomach of some ruminants such as goats and used to be considered an antidote to all poisons. The word derived from Padzahr (Persian), from pad, protecting, and zahr, poison.

Alpine ibex

Capra ibex: capra (L), a sheep/goat; ibex (L), a kind of wild goat.

Siberian ibex

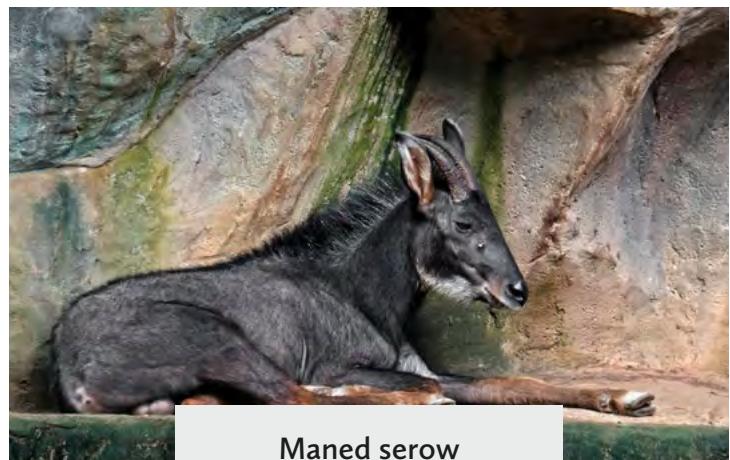
Capra sibirica: capra (L), a sheep/goat; -icus (L), suffix means “belongs to”. It inhabits parts of Siberia, Tibet and China.

Nubian ibex

Capra nubiana: capra (L), a sheep/goat; -anus (L) suffix means “belongs to”. Nubia is a tract of countries in Northern Africa with no precise limits being between Egypt and Sudan.

Walia or Abyssinian ibex

Capra walie: Walia was originally an Ethiopian native name.



Maned serow
(*Capricornis sumatrensis*)

Caucasian tur

Capra caucasica: capra (L), a sheep/goat; -icus (L) suffix meaning “belong to”.

Tur (Russ) a Caucasian goat.

Maned serow

Capricornis sumatrensis: capra (L), a sheep/goat; cornu (L) genitive cornus, the horn of an animal; a reference to the goat-like horns; -ensis (L) suffix meaning “belonging to”. Serow is a name used by the Lapchas, who inhabit Sikkim in the Himalayas, and now used for the other goat-like animals in this genus.

Japanese serow

Capricornis crispus crispus: crispus (L), curly-headed

Himalayan goral

Nemorhedus goral: nemus (L), genitive nemoris, a grove, a forest; haedus (L), a young goat, a kid; it is an allusion to its habitat in mountainous and woody regions.

Goral is a native name from Eastern India.

Red goral

Nemorhedus goral cranbrooki: the Fourth Earl of Cranbrook (1900-1978) was a zoologist who worked in Burma in 1930, and was a Trustee of the British Museum of Natural History in 1963.

Chinese goral

Naemorhedus griseus: griseus (L), it refers to gray color.

Long-tailed goral

Naemorhedus caudatus: caudatus (L), it means “tailed”, having or provided with a tail.



Markhor

Capra falconeri: capra (L), a sheep/goat; Hugh Falconer (1808-1865) was a Scottish paleontologist and botanist in India. Markhor is a name that derives from the Persian mār, a snake, and khor, eating. This is a strange name, as goats are herbivores and no actual case of the markhor eating snakes has been recorded, even if they been known to kill snakes.

Barbary sheep or Aoudad

Ammotragus lervia: ammos (Gr), sand; tragos (Gr), a goat, this is a reference to the colors of its coat; lervia from the wild sheep of Northern Africa called “fishtail” or “Lerwee” by the Rev T. Shaw in his Travels and observation relating to several parts of Barbary and the Levant. Aoudad is a name used by the Berbers, a people of Northern Africa.

Himalayan tahr

Hemitragus jemlahicus: hēmi (Gr), half; tragos (Gr), a goat; it means “something like a goat”, a reference to the absence of a beard and the animal having some of the habits and characteristics of a goat; jemla, probably from hima (Sanskrit), snow, and alaya, an abode; hence also Himalaya; -icus (L), suffix meaning belonging to. Tahr is from thār, the Nepalese name for the wild goat inhabiting the Himalayas.

Arabian tahr

Arabitragus jayakari: Araps (Gr), from the Arabian region; tragos (Gr), a goat jayakari, named after Surgeon colonel A.S.G Jaykar; he collected in the Persian Gulf, chiefly birds, from 1878.



Arabian tahr
(*Arabitragus jayakari*)

Nilgiri tahr

Nilgiritragus hilocrius: neelam (Sanskrit), blue; giri (Sanskrit), mountain. It is thought that the bluish flowers of kurinji shrubs is at the origin of this name. Tragos (Gr), a goat; hulē (Gr), a wood, a forest; krios (Gr), a mutton. The Nilgiri Hills are in the South-Eastern part of India, and represents one of the hot spots of global biodiversity.

Blue sheep or Bharal

Pseudois nayaur: pseudēs (Gr), false; ois (Gr), a sheep. referring to the absence of facial glands and the character of the tail, which makes this genus resemble the goats more than the sheep. Nayaur is a native name for this wild sheep, probably from the Nepal word nahūr. Bharal is a Hindi name.

Mouflon

Ovis aries musimon: ovis (L), a sheep; musimo (L), an animal of Sardinia. Mouflon (Fr), a Sardinian wild sheep.

Urial

Ovis vignei: ovis (L), a sheep; -alis (L), suffix meaning relating to. Urial is from hureāl (Punjabi), a Himalayan wild sheep.

Argali

Ovis ammon: Ammon or Amen was an Egyptian deity, usually represented in human form with a ram's head. Argali is a Mongolian name for this sheep.

Bighorn or Rocky Mountain sheep

Ovis canadensis: -ensis (L), suffix meaning belonging to. Bighorn refers to the massive horns of this sheep.



Argali
(*Ovis ammon*)

Dall's or White sheep

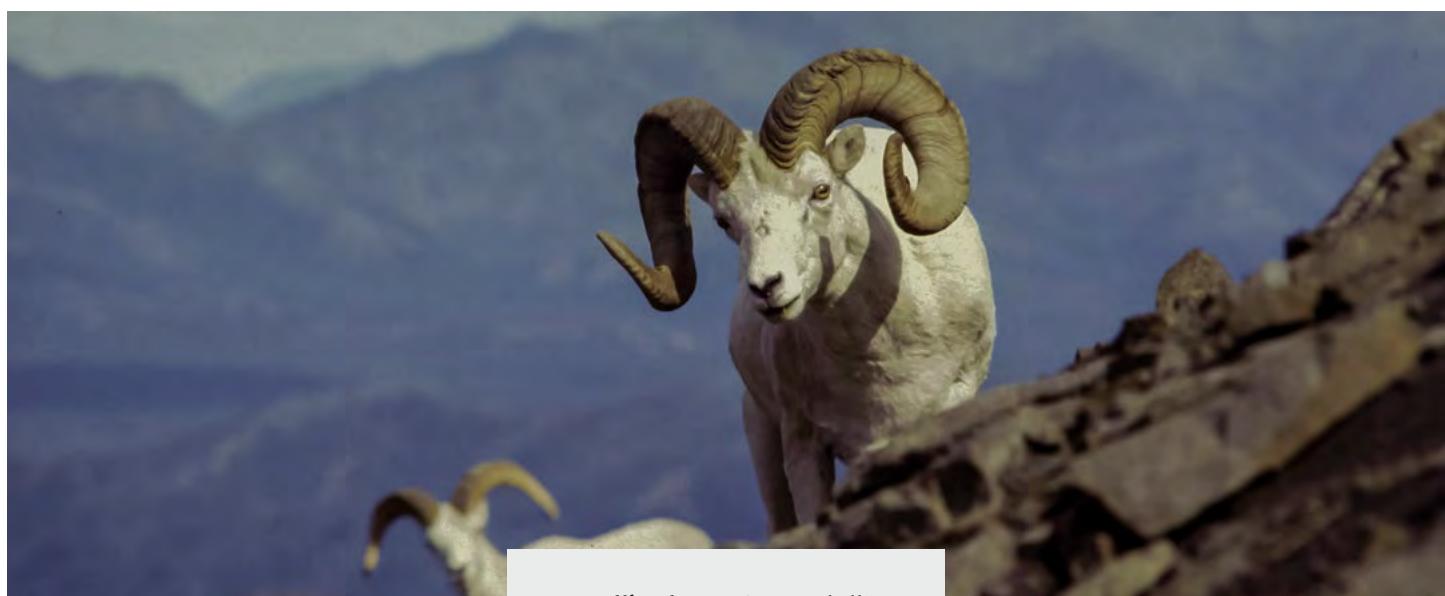
Ovis dalli: William H. Dall (1845-1927) was an American zoologist; this sheep was discovered in 1884 and named in his honor.

Takin

Budorcas taxicolor: bo (= boo, bous) (Gr), an ox; dorcas (Gr), a gazelle; a gazelle-like ox, taxus (New L), a badger, badger-coloured, a yellowish grey. Takin is a Tibeto-Burman name for this animal which is related to the musk oxen.

Musk-ox

Ovibos moschatus: ovis (L), a sheep; bos (L), an ox; this animal has features in common with the ox and the sheep; moschatus (New L), musky, because it has preorbital glands that secrete a musky odour.



Dall's sheep (*Ovis dalli*)



Amazing adaptations

Visible characteristics

Caprines are very special animals able to survive in harsh and extreme environments, and this is possible because they have some specific physical characteristics:

- They have **thick coat** if they live in cold and hard habitats like the Himalayan mountains, Alpes, and other mountain ranges all over the world (e.g Himalayan tahr, markhor, takin, bharal, rocky mountain goat, Alpine or Siberian ibex etc).
- They are **really tolerant to cold temperature**.
- They have **short-haired coat if they live in warmer and tough habitats** like arid mountainous areas (e.g Barbary sheep, Nubian and Walia ibex, Arabian tahr etc.), and in those cases they are really tolerant to hot temperature.
- In general, their **coat color is inconspicuous and many species blend easily into their background** (anyway, there are exceptions like the golden takin and the Rocky Mountain goat with their stunning colors). The coloration ranges from white to black through shades of straw yellow, sandy and brown to deep reddish brown.
- They have **stocky and muscular bodies**, perfectly adapted to be resistant and athletic, to escape from predators like wolves, tigers, leopards, and bears, and, of course, to survive in hostile environments.
- They have **solid hooves** that are well adapted to grip securely on rock.

- They have a relatively **short tail**.
- Some species like Barbary sheep have **long chest ruffs**, males of Himalayan tahr have a **thick ruff in their foreparts**, while argali and urial have **shorter throat ruffs**. Ibexes and markhors have **beards of varying length**.
- Generally, **both sexes** of the Caprinae **have horns** (except in the chiru, where they are found only in males). Caprini have the largest and most developed horn shapes.
- There is remarkable **sexual dimorphism** in the Caprinae, and this is particularly noticeable in the size and shape of the horns. In fact, they belong to the most sexual dimorphic Artiodactyls (except for gorals and serows), and **males are usually twice larger than females**.

©Korkeasaari Zoo



© Korkeasaari Zoo

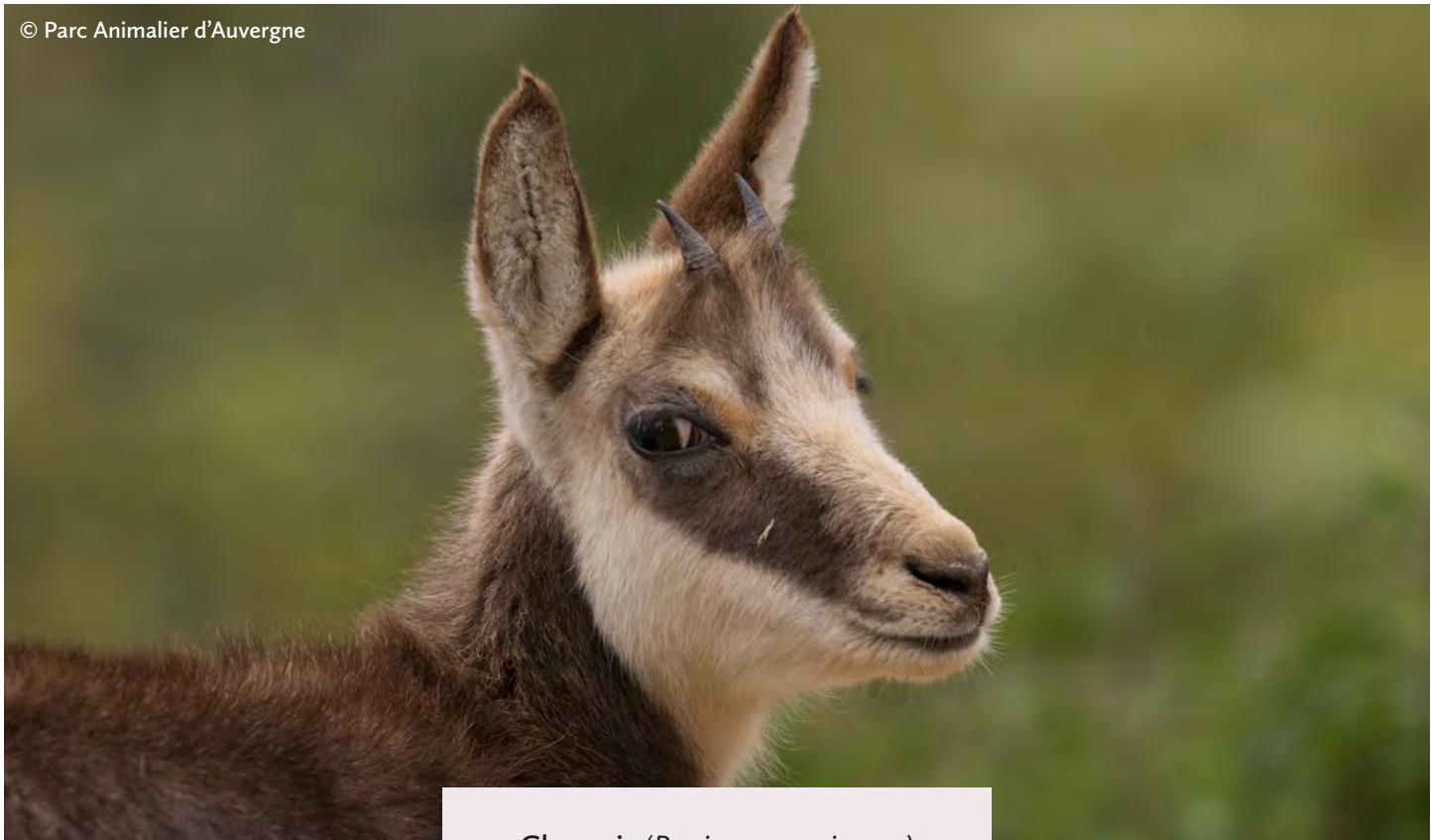
Musk ox (*Ovibos moschatus*)

Senses

The senses of sight and hearing are **well developed or even excellent** (like in all the ibex species), and the sense of smell is keen. All those well-developed senses are essential for caprines, because they have to be always aware of the eventual presence of a predator near them, being ready to give “alarm calls” to their herd.

© Parc Animalier d'Auvergne

Chamois (*Rupicapra rupicapra*)



Behavior and social organization

Caprinae species live in different social systems, there are both **solitary species like gorals** and **serows** and **highly social species like bharals and musk-oxen**.

However, they mostly occur singly or in **small to medium sized groups**. It is possible to observe larger groups, especially at the rut, or at feeding grounds in winter, or occasionally at other times. Herds of up to 500 East Caucasian tur, 400 bharal, 300 takin, or 300 chamois have been reported, but these numbers are not typical.

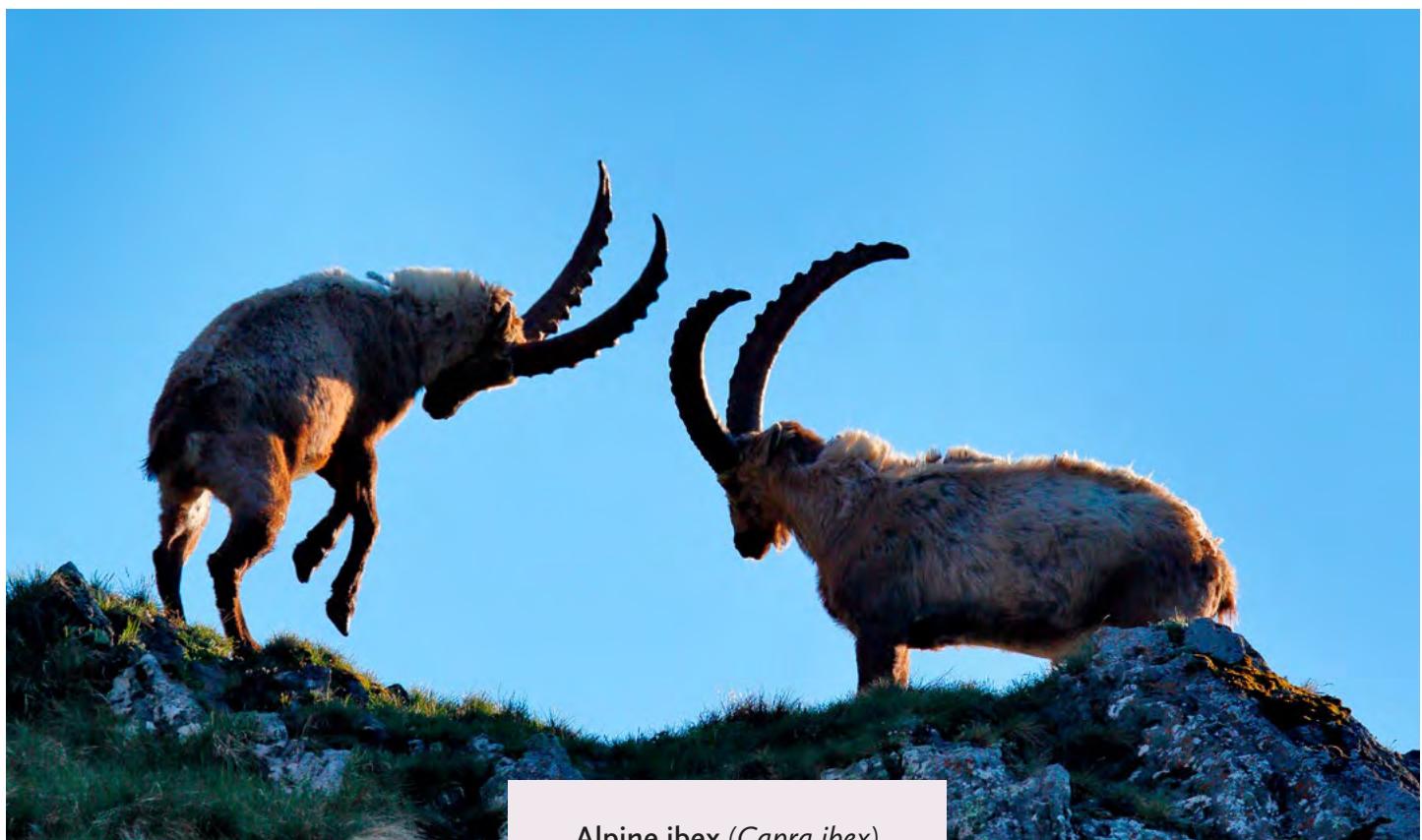
Adult females, young and subadult, or young males often form groups, with **adult males remaining separate**, either solitary or in small groups, and joining the others for the rut. However, social systems in most species **are not clear-cut**, and mixed groups, nursery groups, and solitary males

may all be seen at the same time of year, as, for example, in the case of the blue sheep.

A common activity pattern is basically crepuscular, with feeding taking place mainly in the early morning and late afternoon or evening. The day is spent **resting in shelters** on or near cliffs, in caves, or in dense scrub. Ibex, urial, and blue sheep bed for the night in groups at the top of scree slopes, scraping out a smooth sleeping place and with adult animals **facing in both directions to watch for danger**.

Most species living in high mountains undertake altitudinal movements to lower elevations in winter to **avoid cold temperatures or deep snow and return to higher altitudes in spring**. The extent of these movements may be as much as 6,560 ft (2,000 m). Musk ox, in contrast, moves to more exposed slopes in winter where winds prevent the buildup of snow.

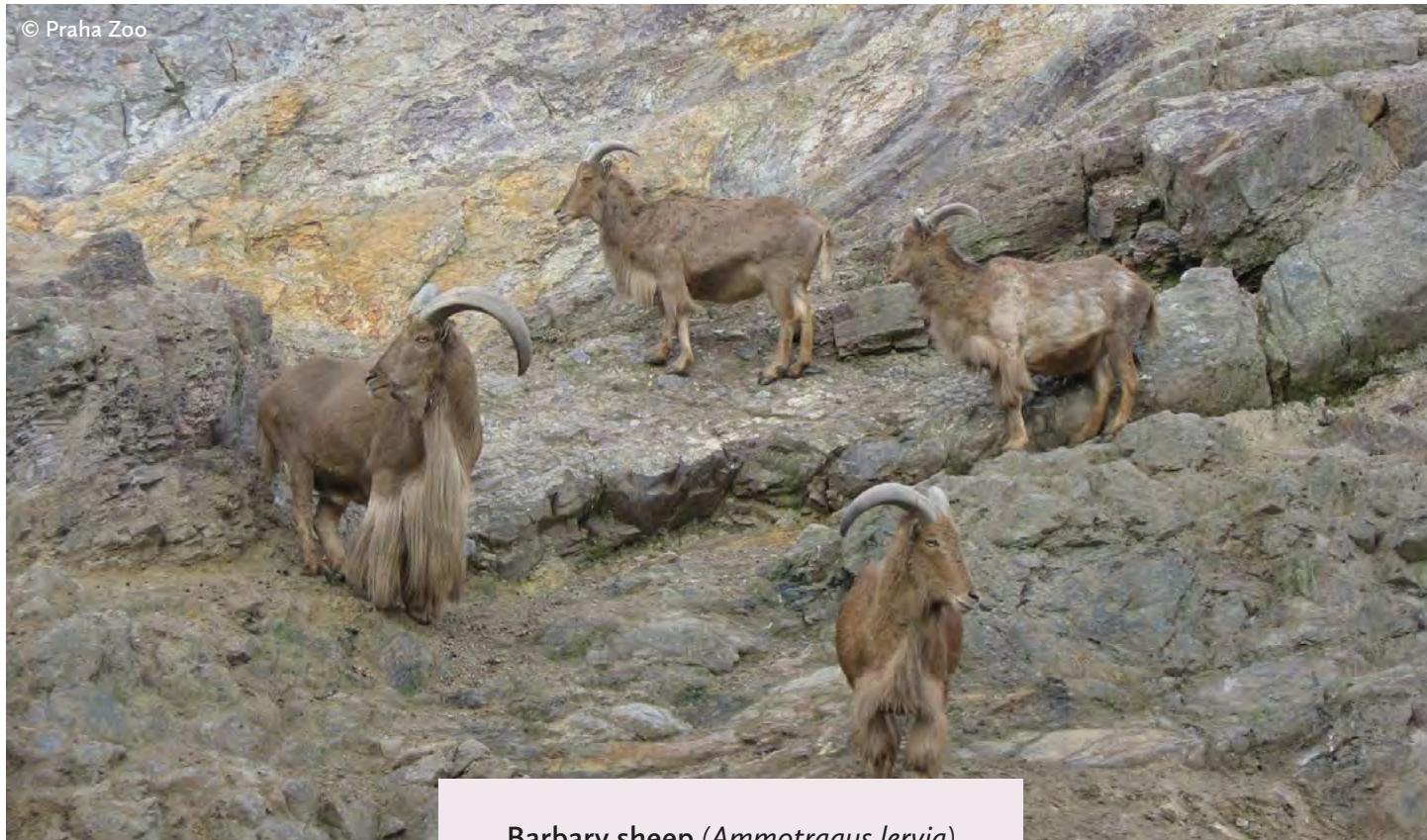
They can show **very charismatic fighting behaviors**, mainly during the mating season, when males can become very aggressive to each other, displaying spectacular but really dangerous duels, using their horns as deadly weapons.



Alpine ibex (*Capra ibex*)

Communication (scents and sounds)

Caprinae species communicate to each other in several ways and the most important sounds for those animals are obviously the **alarm calls**, which consist of a variety of **sneezes, whistles, snorts, and hisses**. Many species also stamp their feet to raise the alarm.



Barbary sheep (*Ammotragus lervia*)

Reproduction

Most Caprinae are **polygamous**, with dominant males enjoying priority access to females. Dominance is established through **displays, threats, and direct combat** prior to or during the rut. Fighting may be really dangerous and may involve **locking horns and twisting, direct head-to-head clashes, or lateral or flank attacks**. Head-on fighting may involve two animals running straight at each other before clashing horns, or rising up on their hind legs, then crashing down together. The sound may carry a long way through the mountains and all-out bouts between animals such as argali with their massive horns are an impressive spectacle. Thickened front parts of the skull protect them from damage. Rupicapriini do not use direct head butts but **attack the flanks of rivals, attempting to stab with their short horns**. Rut-related mortality is especially reported in musk ox and mountain goat. Male displays to females include **tail raising, urine spraying, lip curls, low stretches, and kicks with the foreleg**. Chamois males bob their head

up and down in front of females and Himalayan tahr also nod and shake their heads in display. Mountain goat males mark vegetation during the rut with glands behind the horns, dig rutting pits, and paw the soil onto their flanks and undersides.

Caprinae living in northern latitudes and at high elevations show a **strong seasonality in breeding**. The particular period varies with locality and is timed so that births coincide with an abundance of **fresh green growth in spring or early summer** to meet the nutritional needs of lactation and growth of the young. Cold or wet weather at this time **increases juvenile mortality**. Walia ibex and Barbary sheep may breed throughout the year, but still show seasonal peaks. Gestation period is around **eight months in musk ox and five to seven months in other species**.

Single young are the norm, but twins are not uncommon in some species. The rearing of twins is a great challenge, **even in captivity with a food ad libitum**.

Pregnant females seek out secluded areas to have their young.

Caprinae can stand soon after birth but normally **hide for two to three days** before following the female. Most species are **weaned in four to five months**.

Here there are some interesting “visible timetable” of the different stages of growth of some important caprinae taxa:

Musk ox



Markhor



Takin



Nubian ibex



Ecological and ecosystemic role

First of all, it is interesting to note that as humans we have debts to wild caprines, because our prosperity started thanks to the domestication of goats and sheeps.

Concerning the ecological and ecosystemic role of Caprinae species, they are essential because of **their role of favorite prey of many predators**, among which there are a lot of endangered species (like snow leopard, leopard, tiger, dhole, cougar, lynx, bear, wolf, eagle etc.). Therefore, **the presence of caprines is crucial for the conservation of endangered species of carnivores**.

As browser herbivores, caprines play a key role also in local and global ecosystems: the presence of those animals is known to affect **plant health and productivity, biodiversity and species composition, nutrient cycling**, and other processes. In addition, because grass has a higher albedo than bare soil, browsing and eating grass and leaves reduces the amount of sunlight that is reflected back into Earth's atmosphere, which impacts the global climate.

Goats and sheep are also “ecosystemic engineers” because they influence the landscape dynamics and potential conservation measures, by **dispersing seeds that generate plants**, like it has happened in some natural habitats (like some Mediterranean islands).



Conservation and research

Threats and conservation

Caprinae are **one of the most threatened bovids/ungulates/mammals**: the sub-family approximately includes 23% of threatened species (approx. 10 in case of Bovinae, Antilopini).

The greatest recent threats to wild Caprinae has been **uncontrolled hunting or even poaching**, a factor that intensified sharply during the twentieth century with the introduction of powerful and accurate modern weapons and improved vehicle transport. Indiscriminate hunting has adversely affected all species, driving several towards extinction, wiping out many small populations, and reducing ranges, also because they have high fidelity to their home ranges and they use frequently open habitats (more vulnerable to the hunters). Other factors with a negative impact include **increased competition with livestock, loss of habitat, fragmentation of isolated populations, and road building that improves access to remote mountain areas**. These must also have caused the loss of genetic diversity in most species, to a greater or lesser extent. Another reason that threaten caprines is **low reproduction rate** in comparison with other ungulates.

Some interesting status in the wild

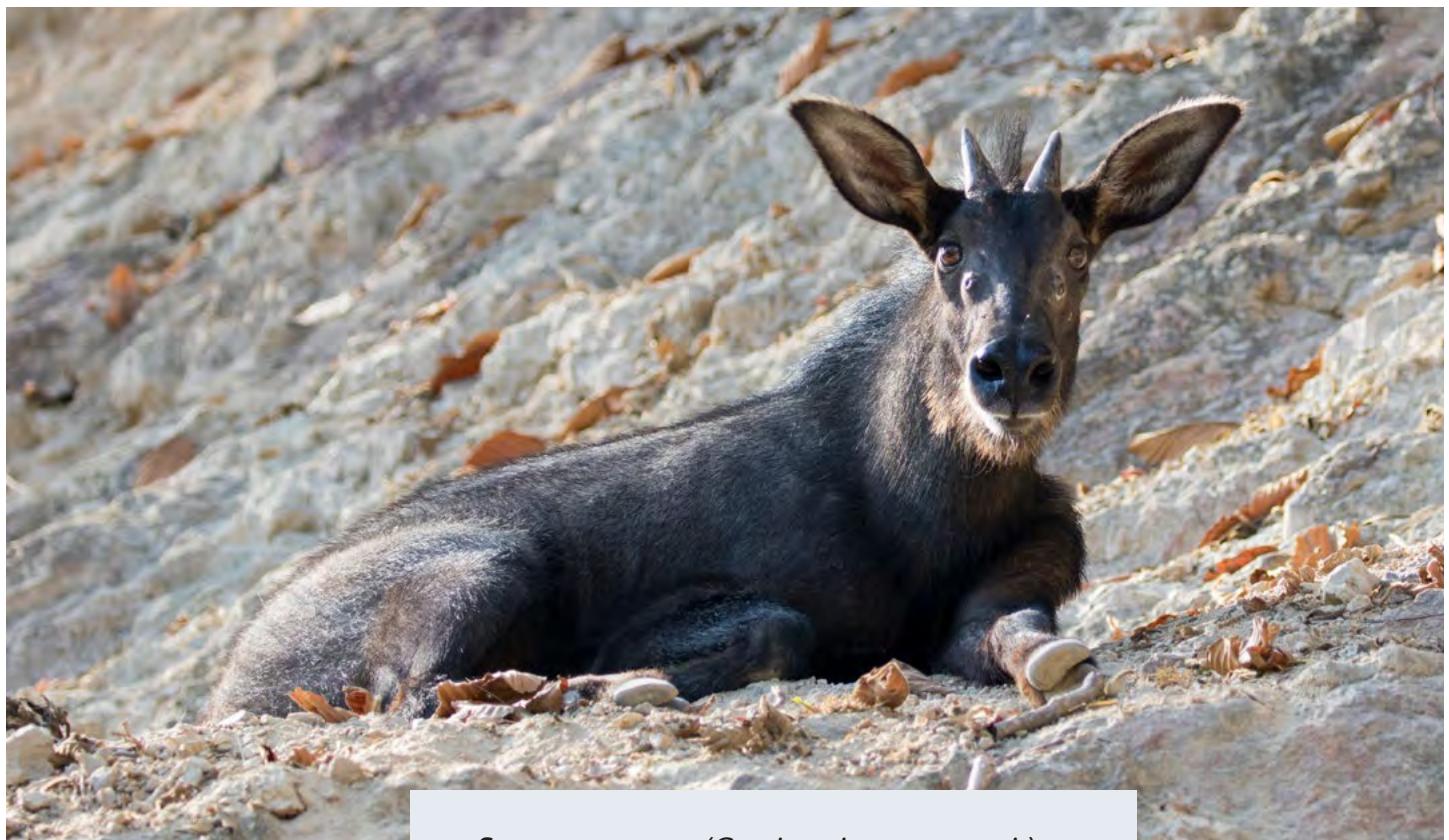
The Walia ibex (*Capra walie*) has been Critically Endangered, but now the population is considered **Vulnerable**. Its population had been estimated to have decreased from 400 in 1983 to 180 in 1996, but recently the **population has somewhat increased** to about 500 individuals in 2004.

Since no captive population is kept anywhere in the world, the IUCN recommends capturing a few individuals to form the nucleus of a captive breeding group

Five species are Endangered, including two species of “tahr”. **Nilgiri tahr** (*Nilgiritragus hylocrius*) and **Arabian tahr** (*Arabitragus jayakari*) have small populations and limited geographic ranges. **West Caucasian tur** (*Capra caucasica*) is restricted to a small area of the western Caucasus, while **markhor** (*Capra falconeri*) has suffered heavily from indiscriminate poaching. **Dwarf blue sheep** (*Pseudois schaeferi*) also has a very restricted distribution in the gorge of the upper Yangtze. Eight species are **Vulnerable**: **takin**, **Nubian ibex**, **urial**, **Sumatran serow**, **Chinese goral**, **red goral**, **long-tailed goral** and **Barbary sheep**. Serow, Arabian tahr, Walia ibex, and several Caprinae subspecies are listed as Endangered by the U. S. Fish and Wildlife Service.

Remember, that IUCN assessment is available for “**conventional**” species, not subspecies. The situation of some taxa (e.g. subspecies of Nubian ibex, wild mouflon, urial, argali, Asiatic chamois) could be therefore critical. For example, population in the wild less than 200 individuals is estimated in case of **Bukhara urial** (*Ovis vignei bochariensis*) and **Northern Chinese argali** (*Ovis ammon jubata*), both taxa are standing **on the verge of extinctions** (some experts consider Northern Chinese argalis as extinct already).

Oman wild sheep is perhaps the most enigmatic caprine taxon currently.



Research

Zoos should do research from which **conservation benefits** accrue to the species (EU Zoos Directive). Caprinae TAG made 2020 a Regional Collection Plan in which they estimated 30 taxa, **19 out of 30 species were endangered** (CR-NT listed in IUCN). EAZA's Research Strategy (2008) encourages zoos to cooperate and communicate with each other and with universities. Research topics are diverse and Caprinea TAG wants to **promote recent research work in this educational material**. Please enjoy our examples below!



Chinese goral (*Naemorhedus griseus*)



Helena Telkänranta

- Doctor of Philosophy (PhD) in Applied Animal Behaviour Science; Master of Science (MSc) in Ecology and Evolutionary Biology.
- Research and development in medical and veterinary technology at the research company Arador Innovations. Previous research positions at the University of Helsinki, Finland and the University of Bristol, UK. Public communication of science with more than 20 years of experience, specializing in animal behaviour and cognition.

Thermography as a new method to evaluate animal welfare and emotions

How does your research/field work help wild caprinae conservation?

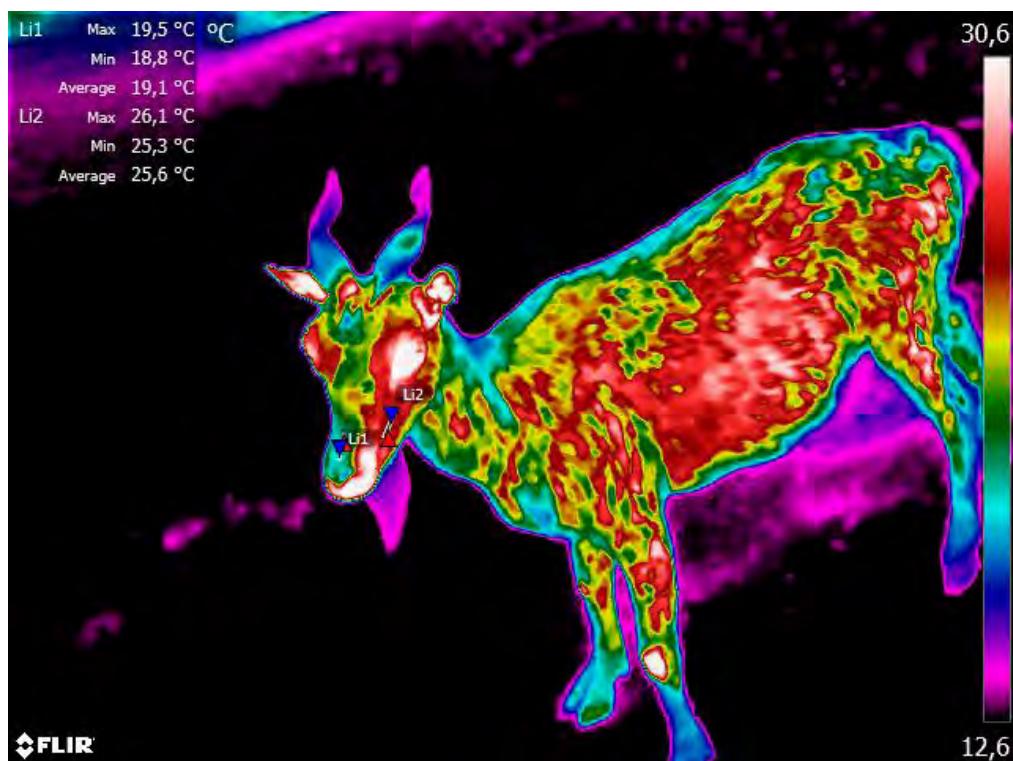
Our research contributes to the development of a new way to measure stress and emotional states in Caprinae at zoos. Knowing whether animals are stressed at a zoo is important for conservation because stress reduces reproductive success. Methods to measure stress will also provide a way to check whether things got better and how much if improvements are made to reduce stress. Furthermore, the ability to measure animal emotions - including positive ones such as pleasure, joy and social bonding - is important too. Positive emotions increase resilience and the ability to buffer the effects of stress, and this too promotes better reproductive success. New methods to measure stress and emotions will also help improve animal welfare at zoos. This is important in itself, and it also can increase the public's favourable opinions on zoos.

There already are some ways to measure stress in zoo animals, such as observing behaviour and measuring various hormones in the blood, but these have their limitations. Stress is not easily visible in behaviour, because the observed goat may just spend a bit more time standing still or startle more easily. Hormones provide more information, but they are measured by analysing samples of blood, saliva, droppings or hair, which is expensive and time-consuming, and especially with blood sampling, disturbs the animals. This is why we are developing an additional method for zookeepers, veterinarians and others to use.

What kind of techniques/methods do you use in your research?

The future methods, which our research helps develop, will be based on infrared thermography. This means the use of thermal cameras to measure subtle differences in surface temperature, such as on an animal's face, at a distance of many metres and without disturbing the animal. Thermal cameras and software for other purposes, such as detecting heat leaks in buildings or finding local inflammation in animal patients, do exist already. However, detecting stress and measuring emotions in animals requires different kinds of thermal cameras and software, which do not exist yet. Our project will contribute to their development.

One of our first study species in the project is the markhor (*Capra falconeri*). As the other species of Caprinae are quite similar in the structure of their face (such as the shape of their bones and muscles, and the locations of their blood vessels), the results will be useful for other species of Caprinae as well.



In our research, we measure changes in the temperature of various parts of the animals' faces during different emotional states and levels of stress. It is previously known that the working of the brain during different emotions does cause changes in the activation of nerves and muscles, as well as distribution of blood flow on the face. It is not yet known which of these cause surface temperature changes that are clear and consistent enough to use as a way to know what the animal is feeling. The outcome of our research will be information on which changes are reliably linked to particular emotions and particular types and intensities of stress. We also measure

simultaneous air temperature and other factors, so that we can find out which changes in the temperatures on their faces are caused by these environmental causes and which changes actually do provide information on stress or emotions.

As our research equipment, we use two different types of high-resolution thermal video cameras, that have originally been developed for other purposes (such as monitoring industrial processes and at veterinary clinics). We also use weather meters to collect information on air temperature and other environmental factors that affect the temperatures on the goats' faces. At first, we extract temperature data from the thermal videos by using software developed for other purposes, but we will soon start writing our own software, which also will serve as the basis for the development of future software that can be used at zoos to monitor animals.

What is the best achievement at this point of your work?

At the time of writing this (summer of 2021), our project has just started, and it will continue for five years. Therefore, we do not have results yet. The best achievement from earlier similar projects by us, including projects on an ungulate species (the domestic cow), is that we have shown it will be possible to develop thermographic methods to tell the difference between positive and negative emotions. Earlier research by others had only shown it is possible to develop methods to show how alert an animal is, without knowing whether it is excitement or fear.

In summary, this research is at a very early stage. It is not yet possible to measure an animal's stress level or emotions with a thermal camera. The research by us and others aims at making it possible in the future, several years from now.



Ewa Wikberg

- Bachelor of Science (BS) in Ecology and Zoology
- Head of Zoology at Nordens Ark, Sweden

Husbandry that supports mother-young attachment

How does your research/field work help wild caprinae conservation?

With our studies on mother-young attachment we collect data to optimize husbandry routines around breeding season. With improved knowledge about the importance of mother-young attachment we can reduce the risk of breaking that bond during the most sensitive period.

What kind of techniques/methods do you use in your research?

We have used photo trap cameras in the hidden part of the enclosure to collect behaviours of mother and lamb 24 hours during several weeks.

What is the best achievement at this point of your work?

Improved husbandry leading to better breeding results. One of the changes in the husbandry is longer time before first induced disturbances of the new born offspring's.



Sanna Sainmaa

- Doctor of Veterinary Medicine (DVM)
- Veterinarian at Korkeasaari Zoo, Finland

Safer anesthesia for small ruminants

How does your research/field work help wild caprinae conservation?

Aim of the vatinoxan is to improve safety of the anesthesia by alleviating side effects of the common used sedatives

What kind of techniques/methods do you use in your research?

Physiological parameters of the anesthetized goats are measured both with indirect methods and arterial samples. Goats are anesthetized for the routine hoof care and besides the normal anesthetics they receive either placebo or vatinoxan in the double blinded study.

What is the best achievement at this point of your work?

We have concluded that the vatinoxan is safe to use in goats, improves physiological parameters and we have found a suitable dose range that can be studied further.

Mats Niklasson

- Doctor of Philosophy (Ph.D) in Agricultural Sciences
- Scientific Leader at Nordens Ark, Sweden; Researcher at Centre of Southern Swedish Forest Research

RFID recorders help to monitor animal weights

How does your research/field work help wild caprinae conservation?

In the case of unassisted weighing there is at first glance not an obvious association with conservation. However, breeding of captive populations are becoming more and more important. Frequent weighing can potentially be a powerful tool to detect illness at an early stage and thus decrease mortality.

What kind of techniques/methods do you use in your research?

Unassisted weighing RFID reader records the ID of the individual animal standing on the scale and thus connects a weight to the ear tagged individual

What is the best achievement at this point of your work?

Unassisted weighing is untested so far for most zoo species. We are just starting, but one obvious advantage is the radically reduced handling of animals



Link to materials:

<https://bit.ly/37GHqpQ>



Caprinae (goats and sheep)

- educational role and materials



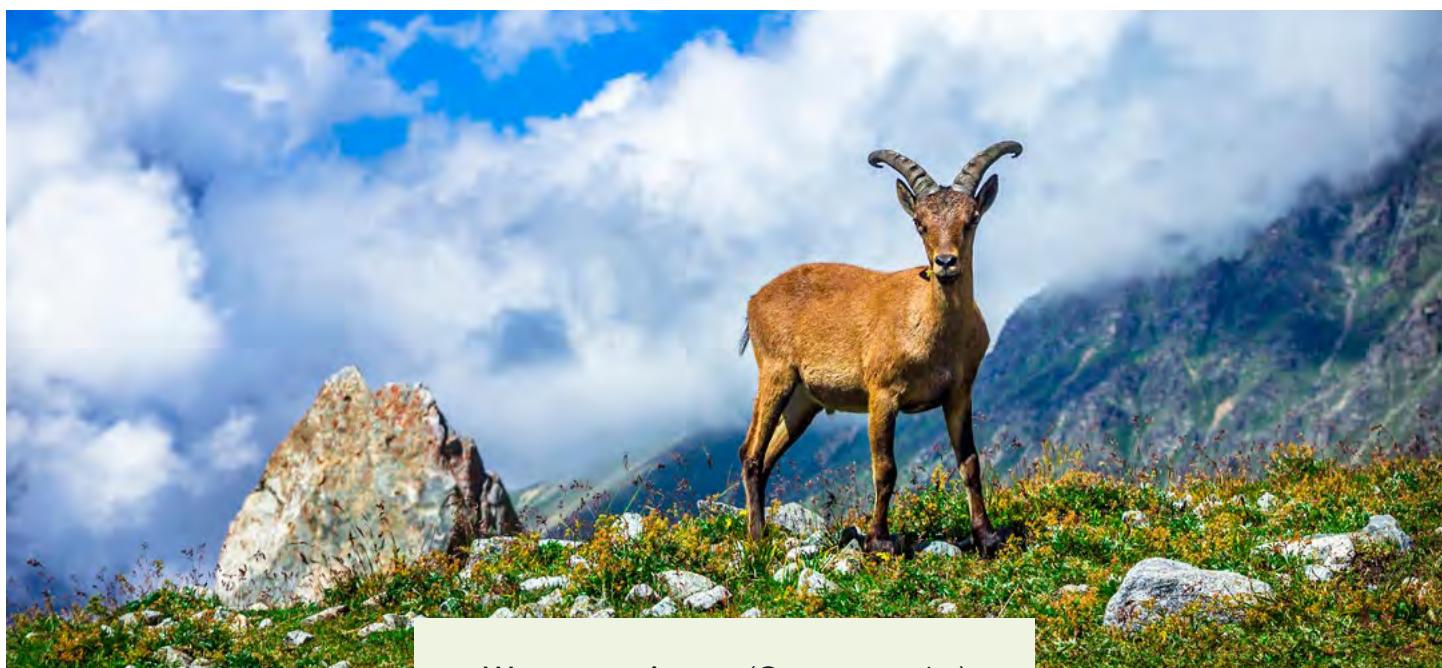
I Ecological niche

1. Food chain and ecosystem service



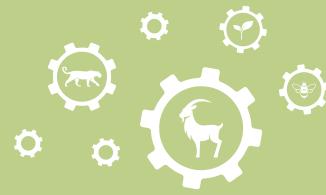
Background:

Caprines play a crucial role in the food web and ecosystem of alpine environments. They are important prey for larger predators and their grazing has a significant impact on alpine flora. Grazing maintains plant diversity and prevents grasses from growing tall, providing more suitable growing conditions for smaller plants as well as small animals. Predators in turn keep goat and sheep populations in check preventing overgrazing. A healthy natural balance with thriving flora reduces erosion due to the plants' roots keeping the top soil in place. NB! In an environment without predators, goats have the potential to greatly decimate local flora leading to increased erosion. For this reason, goats are among the top 100 invasive species as they have spread along with humans to places they are not indigenous to, such as many islands.



I Ecological niche

1. Food chain and ecosystem service



Food chain exercise

Required materials: multiple sets of picture cards with different alpine plant species (grass, shrubs, flowering plants, seed-bearing plants), goat/sheep species (Markhor, Bharal, Mountain Goat, Argali, Takin), Marmot, Pika, Snow Leopard, Lynx, Wolf, Himalayan Monal, Golden Eagle, Bearded Vulture, Himalayan Vulture.

[Find the pictures for this exercise in the material bank.](#)

Goal: Understanding the role of goats and sheep in alpine ecosystems, food chain, and that each species is an important part of the bigger picture.

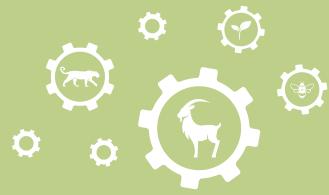


- Divide into groups of 3-4 students and provide them with one set of picture cards. Instruct the students to build as many food chains or a food web using the cards.
- The significance of each species can be exemplified by entirely removing one species from the chain/web and discussing the effect this would have. Can another remaining species replace it? How would this affect the other remaining species?
- This exercise can also be performed/demonstrated by the teacher, but participation of students is always recommended. At the end, the results should be discussed and summed up with the entire group.



I Ecological niche

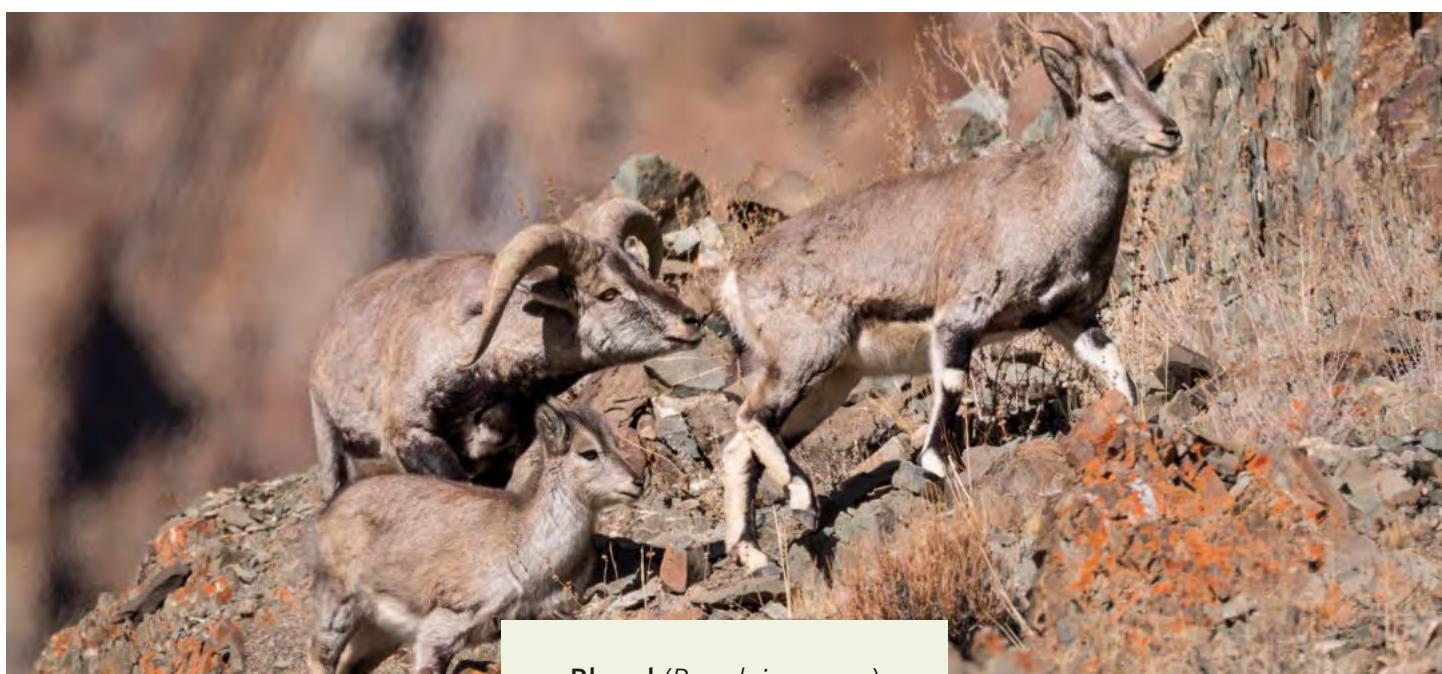
2. Ecological niche



Background:

The different caprines are adapted to slightly different parts of the alpine environment: for example, Markhor thrives at high altitudes and on the steepest slopes, whereas the Bharal does best at slightly lower altitudes and more gentle slopes. Takines on the other hand live in bamboo and rhododendron thickets on slopes at even lower altitudes.

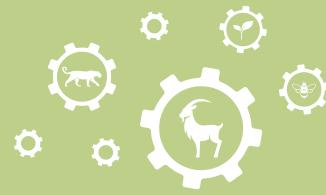
For the winter, herds migrate to altitudes below the forest line where winter temperatures and winds are more moderate than on the exposed mountain slopes. They spend the summer grazing on mountain pastures. Predators, such as Snow Leopards, follow the seasonal migration of their prey. Long-legged species are doing better in dense coniferous forests as they have an easier time moving through deep snow. Short-legged species on the other hand prefer less dense forests or open ground where snow is more easily blown away and therefore its depth varies.



Bharal (*Pseudois nayaur*)

I Ecological niche

2. Ecological niche



Ecological niche exercise

- **Required materials:** white-/black-board or crafting materials for making a mountain slope, picture cards (cut into the animal shape would be nice!) with the following species: Markhor, Bharal, Takin, Snow Leopard (optionally also other species from the same area); there can be more than one card per species; fastening supplies (magnets or tape).
[Find the pictures for this exercise in the material bank.](#)
- **Goal:** Visualize the different vegetation zones of mountain slopes as well as the environmental requirements, that is their niche of animals and its significance. Visualize the impact of the changing seasons on alpine fauna.



© Korkeasaari zoo

- Draw a mountain slope on the white-/blackboard or craft one from e.g. cardboard, onto which you can place the following from top to bottom: glacier, steppe on a steep slope, steppe on a gentle slope, rhododendron zone, coniferous forest zone, boreal forest zone, bamboo zone, rain forest zone.
- Place the picture cards along the mountain slope where the animals are thought to spend most of their time during summer.
- Discuss what happens when winter comes and why these changes occur.
- At the end, discuss why not all species live in the same.



© Stefano Capomaggi

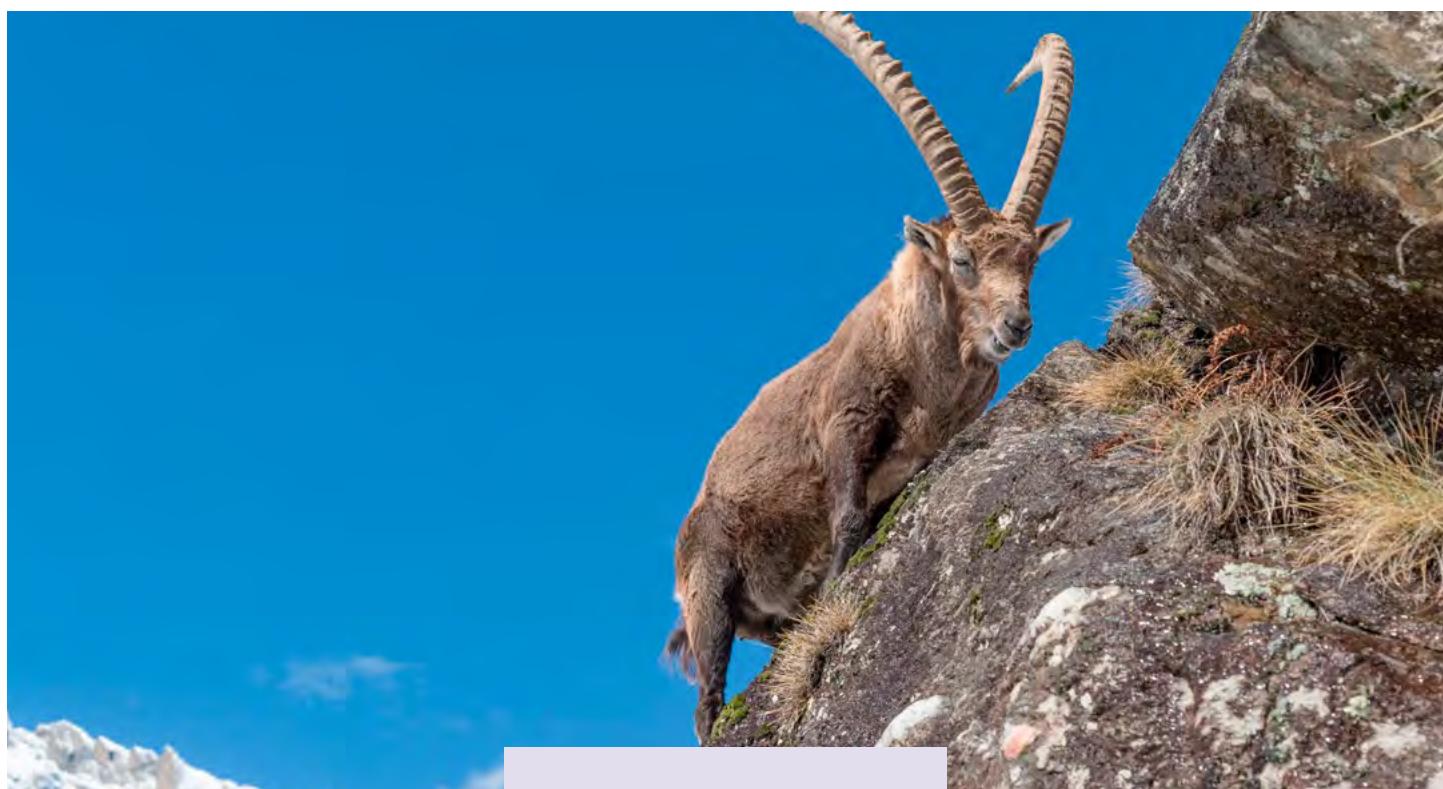
II Physical characteristics and appearance

3. Climbing and agility



Background:

Goats and sheep of alpine environments are extremely skilled and agile climbers. This can be observed in zoos as well, provided the enclosure is rocky and the animals have access to steep rock faces. The caprines' hooves work like a combination of rock climber's shoes and pickaxe. Their edge is hard and sharp while the centre part is as soft as a pillow. Because of this specialised structure, the hooves can get a firm hold of even the smallest cracks in the rock. The specialized hooves together with strong muscles and precise body control enable caprines to climb, jump and balance on the steepest mountain slopes.



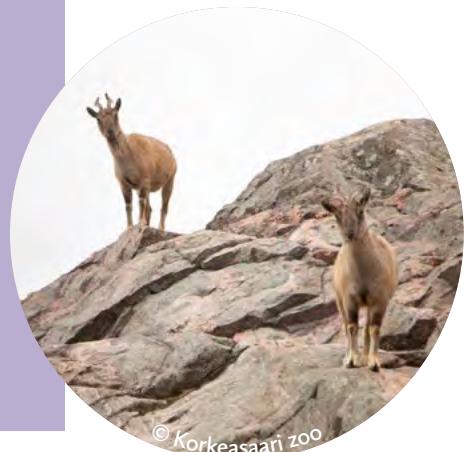
II Physical characteristics and appearance

3. Climbing and agility



Climbing and agility exercise

- **Required materials:** imagination, optionally some props such as rock climbing equipment, a picture of caprine hoof (or a real hoof if available).
- **Goal:** Visualize hoof structure and its role in climbing (= adaptation to the environment). Understand that humans need equipment to cope in most environments.



- Look at a rocky slope or rock face that a goat would be able to climb and discuss how humans would manage to climb the same wall. What equipment would we need? Give the students some time to think about it themselves.
- If available, climbing equipment that humans use to replace hooves could be shown/examined.
- At the end, summarize the following: Caprines need no equipment, because their hooves are made for rock climbing. Show the picture again (or the real hoof).



II Physical characteristics and appearance

4. Physical appearance and interspecies differences



Background:

At a quick glance, wild goats and sheep look alike, but a closer look reveals differences in horn shape and position, fur colouration and goatee – not all species even have a goatee.



II Physical characteristics and appearance

4. Physical appearance and interspecies differences



Exercises and practical information

- **Goal:** Visualize that multiple caprine species exist and that they can be told apart despite their similar looks.

[Find the pictures for this exercise in the material bank.](#)



© R. Wirth



- Create an info board for a goat or sheep enclosure with images of nine (or six) caprine species at least one of which should be in the enclosure.
- The species in the images will depend on which species are present in the zoo.
- The species name should be hidden behind an openable hatch.
- The task or question on the board could be, for example: Which one of these is a Markhor?
- Encourage independent learning and provides enrichment. Especially kids love to open hatches.



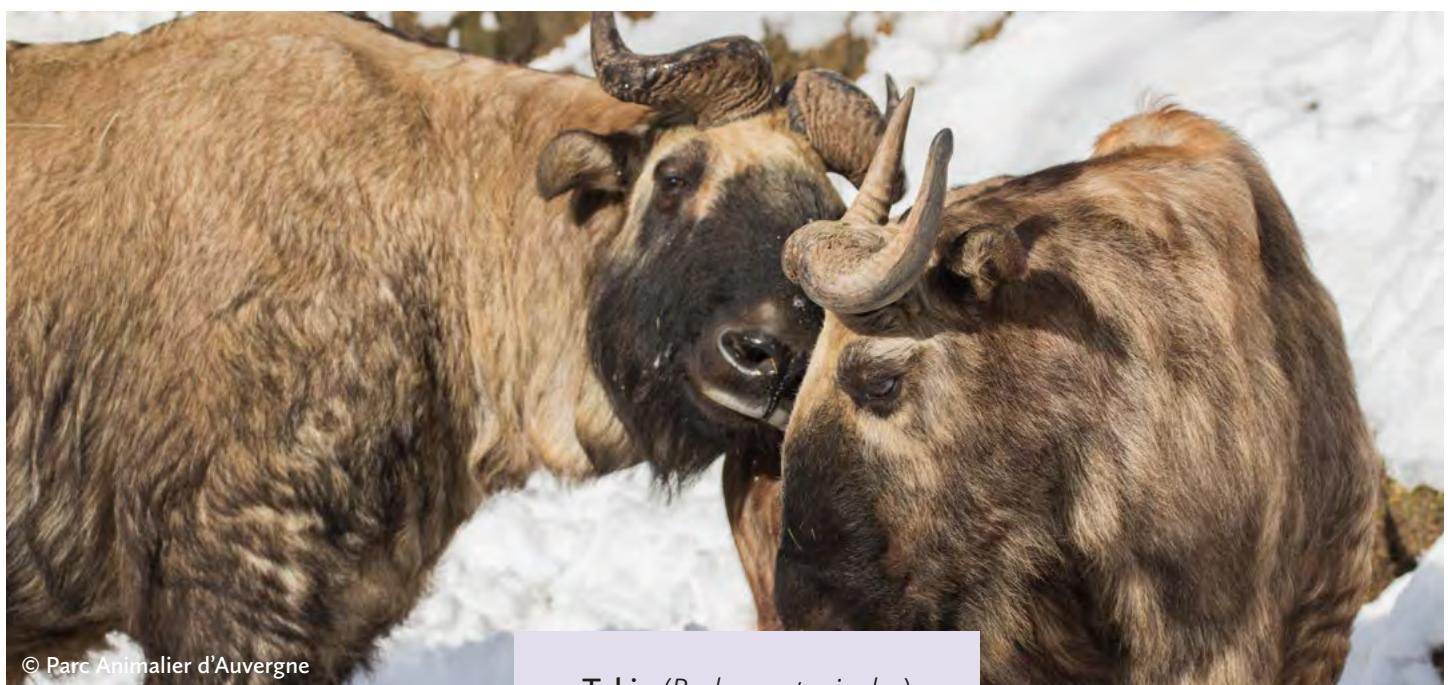
II Physical characteristics and appearance

5. Horns



Background:

The horns are one of the most characteristic and captivating features of caprines. Each species has unique horns that make species identification relatively easy. Horns are used for defending, ostentation and determining the hierarchy within the herd. Males have significantly larger horns than females: up to one metre in Markhor and West Caucasian tur, up to 60 cm in Takin males. People are usually quite interested in horns and especially children are very keen on testing what the horns feel like. Unlike caprines and other bovids, deer do not have hollow horns, but solid antlers. Furthermore, caprine horns never drop and males grow them continuously even though the growth rate decreases with increasing age, growth “rings” are often detectable. Deer antlers on the other hand, are renewed annually.



II Physical characteristics and appearance

5. Horns



Exercises and practical information 1

- **Required materials:** real horns, fastening supplies, wall, hatches, representative pictures for each species, laminated picture or name cards if this exercise is done in class.
- **Goal:** Familiarise yourself with horns using different senses (touch, visual, opening hatches). Recognise the two major types of horns (hollow, solid) and deduce which horns belong to which animal. Learn the different species.



- Set up a horn exhibit near a caprine enclosure including antlers from different species so that all horns/antlers are hidden behind openable hatches. The task would be to connect the horns (or antlers) to the correct animal. Furthermore, the species name should be revealed by opening a hatch. Preferably use species that are in the enclosure.
- The hatches and hinges should be designed to automatically close the hatch after opening.
- You can also adapt this for class room situations with double-sided picture cards and name cards. On one side, the entire animal is shown while on the other the horns/antlers are missing (cropped or edited image). The task would be to connect the correct horn, picture card and name card.
- Oral or written quiz on the differences between horns and/or antlers (hollow vs. solid).

II Physical characteristics and appearance

5. Horns



Exercises and practical information 2

- **Required materials:** representative pictures of caprines, preferably species present in the zoo with sufficient information on the species; can be done virtually on, e.g. social media or physically on site which requires an info board and means to conduct a poll or vote.
[Find an example for the exercise in the material bank.](#)
- **Goal:** Focus attention on details such as horn shape. Increase appreciation for the beauty of nature. Realise that there is not always one correct answer, but sometimes the own opinion is just as valuable.



- 
- Creating the opinion poll/vote: The King of the Goats (or similar title), where the idea is to allow visitors to vote on which caprine species are the most magnificent, charismatic, etc.
 - Could be seasonal or in combination with events culminating in the announcement of the results, which provides an opportunity to place the species in question as well as related species in the spotlight.
 - The voting itself can be done by simply providing pens and paper slips together with a collection box or virtually using QR codes and a web-based voting platform. The virtual voting has the benefit of eliminating printing and the physical collection box as well as having to count votes manually.
 - Participation in the vote should be somehow encouraged by for example, a raffle (chance to win free tickets or similar).
 - People are quite actively participating in these kinds of activities.

II Physical characteristics and appearance

6. Caprine-specific terms



Background:

In many cases, males, females, and offspring of a species have been given species-specific names and this is also the case for caprines. To make matters more complicated, still, goats and sheep each have their own terminology. Billy goats usually have a beard and their horns are long, pointing upwards and are only slightly curved. Rams do not usually have a beard and their horns are often thicker and shorter than the ones of goats. They furthermore grow more towards the sides and are strongly curved backwards, in some species to a degree that the tip is pointing forward again. Telling females apart is more difficult, not to mention offspring.



II Physical characteristics and appearance

6. Caprine-specific terms



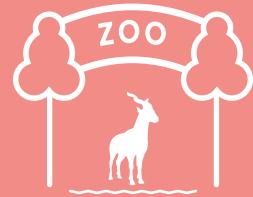
Caprine-specific terms exercise

- **Required materials:** picture cards of billy goats, nanny goats, kids, rams, ewes, and lamb (possibly multiple different species); text cards that say billy goat, nanny goat, kid, ram, ewe, lamb, female goat, male goat, goat offspring, female sheep, male sheep, sheep offspring.
[Find the pictures for this exercise in the material bank.](#)
- **Goal:** Learn caprine-specific terminology such as goat and sheep names. Tell goats and sheep as well as their sexes apart.



- Every participant receives one card, either a picture or a text card.
- Ask the participants to team up with the students that have pictures or text cards with the same animal.
- The teacher checks that everyone has found the correct student.
- At the end, each group presents their pictures to the others and summarises how to tell goats and sheep apart using the appropriate terminology.
- This exercise could benefit from an identification key
 - Goat or sheep?

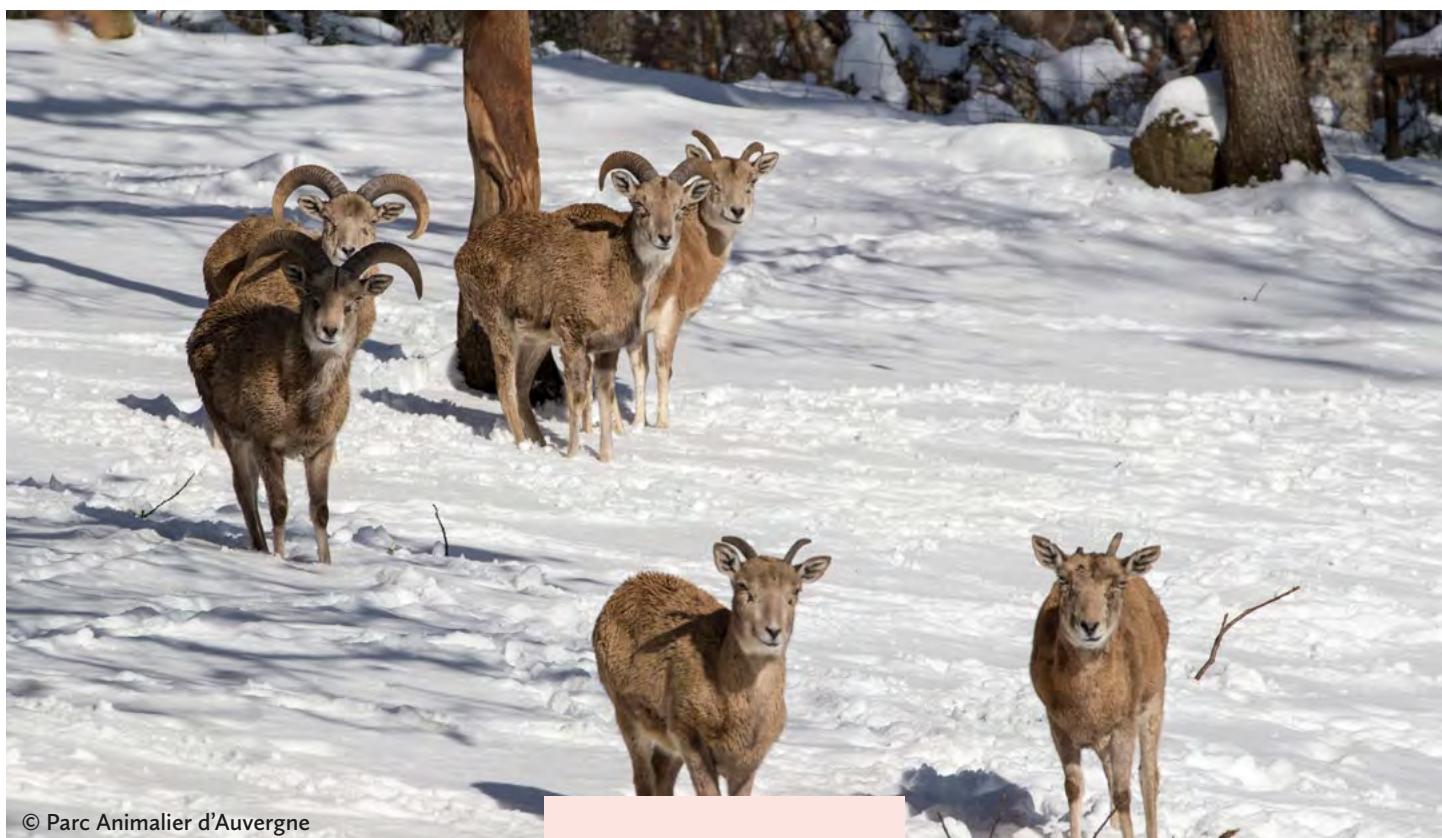
III Goats and sheep in zoos - wellbeing



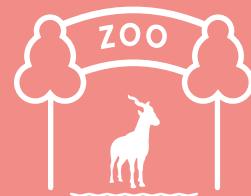
7. Living in zoos

Background:

Most caprines are from mountainous environments. In zoos the goal is to provide the animals with as natural an enclosure as possible. The zoo architect exercises' aim is to compare the animals' natural environment with the enclosure and to identify what the species in question requires to thrive. Goats and sheep are also suitable subjects for the below-mentioned ethogram exercise as there are usually multiple individuals in a zoo, which means interaction between the animals is likely and they are active during opening hours.



III Goats and sheep in zoos - wellbeing



7. Living in zoos

Zoo architect exercise 1

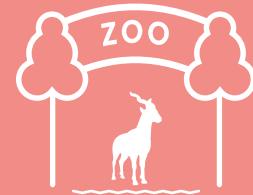
- **Required materials:** a picture of the species' natural habitat (optionally with a small map in the corner to indicate the species distribution); the picture could be laminated to be reused or a paper version for the student to keep; pens.
- **Goal:** Identify the species' natural habitat. Understand that zoos attempt to provide elements from the natural environment in enclosures. Exemplify and evaluate enclosures in terms of the animals' needs and wellbeing.



- Compare the image of the natural environment to the animals' enclosure and mark elements in the picture that can also be found in the enclosure.
- How many elements were you able to mark?
- Why does the enclosure differ from the natural environment to some degree?
- How would you grade the enclosure? Would it be possible to improve it?

III Goats and sheep in zoos - wellbeing

7. Living in zoos



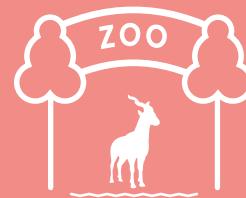
Zoo architect exercise 2

- **Required materials:** handout, pen, writing tablet.
[Find the handout for this exercise in the material bank.](#)
- **Goal:** To identify the requirements animals have in terms of wellbeing and in what way animals as well as customers have been taken into consideration in the zoo design.



- Examine an enclosure and mark the things that can be found in it in the handout.
- Think about why not all the listed items can be found in this particular enclosure.
- Evaluate the enclosure and its immediate surroundings from the point of view of the visitor.
- Discuss possible improvements that would enhance the zoo environment for the animals and/or visitors.

III Goats and sheep in zoos - wellbeing



7. Living in zoos

Ethogram

- **Required materials:** ethogram handout, pen, writing tablet, stop watch/phone for taking time.
Find the handout for this exercise in the material bank.



- Ethogram should be done in groups of 3-4.
- The group decides on one animal in the enclosure and studies it for 10 min. One person takes notes, one takes time and the others study the animals.
- Before beginning the ethogram, some background information on the species should be gathered and a hypothesis formed on what the animal is likely to do during the examination.
- After the examination, the obtained results are compared to the hypothesis. Discuss why the animal did what it did.
- At the end, present and compare the results from each group.

Ethogram

Animal species of interest _____

1. *What do you think the animal is doing?* _____
 2. *Select one animal from the herd and keep watch over it for 10 minutes. Every minute put the crosses to the activity, which the animal does at that moment.*

3. Have your prediction come true? yes :) no :(partly :/

4. Consider about why the animal have behaved in that way you have seen!

III Goats and sheep in zoos - wellbeing



8. Reproduction and marking individuals

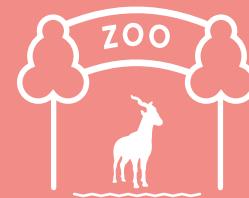
Background:

Depending on the species, caprines give birth to 1-3 young in the spring. Twins are quite common in goats. Kids and lamb are born well developed and are immediately skilled climbers. Only one day after birth, they are almost as agile and quick as their parents. This is why in zoos kids and lamb need to receive their ear tags or subdermal microchips within 24h after birth, because after this time, it is very challenging to catch them. Marking animals is important to keep a record of who the individuals are and which individuals they are related to.



III Goats and sheep in zoos - wellbeing

8. Reproduction and marking individuals



Observation exercise

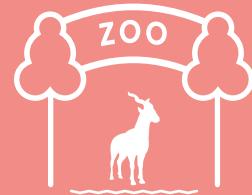
- **Required materials:** info board, basic information on 2-4 individuals for which some of the following are known: name, age, some other interesting facts such as personality or status within the herd; binoculars may be helpful.
Find the example for this exercise in the material bank.
- **Goal:** Tell apart and observe individuals in a herd instead of observing the herd as a whole. Understand the importance of marking animals and how this is done in practice.



- Provide students with information on how many animals are in the enclosure and that all of them have ear tags or similar to aid in the identification of individuals.
- Explain how the ear tags are given.
- Give some more in-depth information on, for example three animals such as how you can recognise them and what kind of individuals they are.
- The task is to find the individuals in question amongst the other animals in the herd (possibly using binoculars).
- Ear tags or rings are given to almost all animals, so you can do this exercise for any number of species.

III Goats and sheep in zoos - wellbeing

9. Mode of life



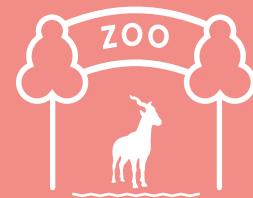
Background:

Caprines commonly live in herds and their mode of life in the natural environment is a vital piece of information for zoos to be able to provide the animals with suitable surroundings. In nature, caprine herds consist of only males or females for a large part of the year. During the mating season, however, the herds merge and males gather a number of females around them. Gestations last for about five months (nine in Takins) and depending on the species 1-3 kids/lamb are born. Twins are common in goats.



Takin (*Budorcas taxicolor*)

III Goats and sheep in zoos - wellbeing



9. Mode of life

Quizz

- **Required materials:** physical handout or some virtual environment; powerpoint or similar presentation; possibly paper slips with A, B, C and D for answering.
- **Goal:** Familiarise yourself with the caprine mode of life. Develop reading skills.
- One or more options may be correct.
- The correct answer is bolded.
- Questions can be modified to fit your own zoo's species better

How do caprines commonly live?

- a) A family spends the entire year together and does not tolerate other families nearby.
- b) Females and young spend most of the year together, whereas males form their own herds.**
- c) Caprines do not mind males and females living together in a herd.
- d) Caprines prefer a solitary lifestyle.

When do caprines usually have their mating season?

- a) in spring
- b) in summer
- c) in autumn**
- d) in winter

When are kids and lamb usually born?

- a) in spring**
- b) in summer
- c) in autumn
- d) in winter

Males, so billy goats or rams

- a) spend most of the year in male-only herds.**
- b) tolerate each other, except during mating season when they compete for females and status in the herd.**
- c) are solitary, except during mating season when they seek out females.
- d) are usually much larger than females and they have clearly larger horns.**

Caprines of cold mountain ranges

- a) stay in the same area throughout the year.
- b) descend to lower altitudes for the summer and higher altitudes for the winter.
- c) descend to below tree line altitudes for the winter and migrate to higher altitudes for the summer.**
- d) grow a thicker fur coat for the winter.**

Kids and lamb

- a) learn to climb on rock faces and slopes when they are a few weeks old.
- b) are as agile and skilled climbers as their parents one day after birth.**
- c) have horns when they are born.
- d) feed only on milk just after birth, but begin the transition to a solid diet at a few weeks of age.**

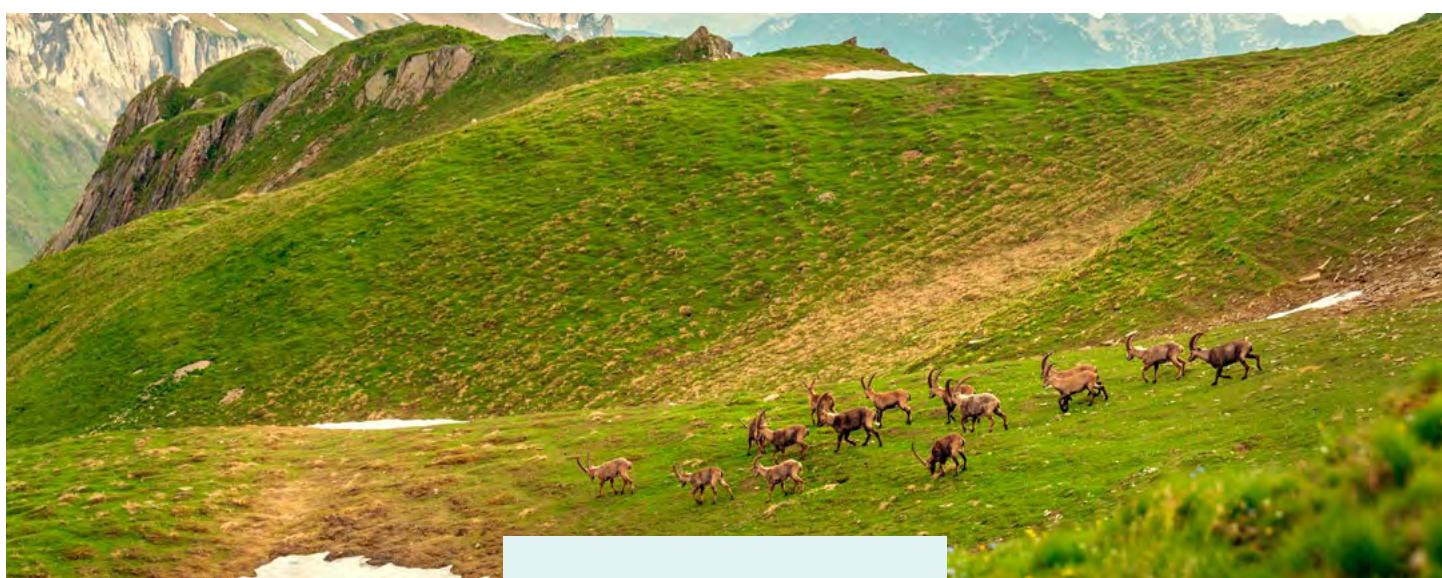
IV Conservation and endangerment



10. Threats

Background:

Many natural caprine populations are endangered mostly due to habitat loss and fragmentation, excessive hunting and/or poaching as well as competition with livestock. Livestock is a potential source of diseases that can spread to natural populations, which in turn have no resistance to these diseases. Conservation efforts have already proven successful and saved numerous species such as the Alpine Ibex and Mountain Goat from extinction. One important factor for the success of conservation efforts is the involvement of locals in or near nature preserves as well as the protection of the species itself. Zoos maintain populations of endangered species, manage breeding programs, and participate in the re-introduction of animals to the wild, as, for example, has been done with the Alpine Ibex. Assisted reproduction and artificial insemination are also becoming more important in the ex situ conservation of caprines.



IV Conservation and endangerment



10. Threats

Quizz

- **Required materials:** physical handout or some virtual environment; powerpoint or similar presentation; possibly paper slips with A, B, C and D for answering.
- **Goal:** Familiarise yourself with the threats natural caprine population face and methods for conservation. Develop reading skills.
- One or more options may be correct.
- The correct answer is bolded.
- Questions can be modified to fit your own zoo's species better



Rocky mountain goat (*Oreamnos americanus*)

IV Conservation and endangerment

10. Threats



One of the threats that natural caprine populations face is livestock such as Domestic Goats and Sheep. Why?

- a) Livestock transmits diseases.
- b) Livestock and wild populations compete for the same resources.
- c) Livestock attracts predators that wouldn't prey on caprines otherwise.
- d) Domestic animals are always larger than their wild counterparts and scare them off.

► Competition for resources (pastures etc.) and diseases transmitted by livestock are a threat to wild populations. Predators such as Snow Leopards on the other hand prefer to prey on wild caprines and turn to livestock only when natural prey is unavailable. In some species, the domesticated form is indeed larger than the wild one, but in some species, for example yaks, the opposite is true.

In some areas, wild caprines are hunted extensively, depending on the species even illegally. Why?

- a) In many cultures, caprines are believed to bring bad luck.
- b) Trophies such as the head of a horned animal are in demand.
- c) Jewellery made from their hooves is in fashion.
- d) Bezoar stones that sometimes form in the stomach of goats are a raw material for medicine.

► Trophies are nowadays a major reason why caprines are hunted, but also the bezoar stone, formed by the accumulation of indigestible matter in the stomach, is sought for as it is ground and used in medicine. It was believed that the stone helps to cure many ailments and poisoning, which is not the case. However, in some countries these traditional remedies are still in use.

How does climate change affect caprines?

- a) Not at all.
- b) The vegetation in mountainous areas will change and suitable habitat will shrink.
- c) Not all possible effects are known.
- d) The fur of all species will become lighter.

► Climate change, warming in particular, alters the limits of vegetation zones everywhere, but most dramatically on mountain slopes – for example, the tree line moves further north and higher up on a slope. Many caprines live on exposed mountain slopes and pastures and are thus not adapted to live in a dense forest. The other potential effects of climate change are not yet known with certainty.

What are the reasons for shrinking habitat threatening caprines?

- a) Climate change causes a change in alpine vegetation and the tree line to rise.
- b) Suitable habitat becomes fragmented as humans expand their activities further into remote areas.
- c) The construction of ski slopes destroys habitat.
- d) Mountain areas are exposed to oil spills which renders them uninhabitable.

► The reasons for shrinking habitat are manifold, including the rise of the tree line due to climate change, the expansion of human influence to include ever more remote areas, as well as the establishment of pastures and ski resorts. Habitat fragmentation in turn decreases the exchange of individuals between herds and their range of movement, which does not only reduce the available space but also the genetic diversity of the population.

IV Conservation and endangerment

10. Threats



What other factors can be potentially threatening?

- a) Traffic
- b) Freely roaming dogs
- c) Human diseases
- d) Tourism

► Goats and sheep are increasingly frequently killed in traffic, because road construction encroaches further and further on remote areas. Freely roaming dogs tend to be a danger to kids and lamb. Tourism has a negative effect on natural caprine population, as prey animals do not tolerate disturbance and avoid humans whenever possible. Human diseases on the other hand are rarely a threat, but livestock does present a potential source of disease.

The Alpine Ibex used to be quite a common sight in zoos, but their numbers in zoos have declined. What is the reason behind this change?

- a) Alpine ibexes do not do well in zoos.
- b) The species has gone extinct in the wild and there is no hope of rescuing it.
- c) The situation in the wild has improved due to conservation efforts and keeping Alpine ibexes in zoos is no longer required.
- d) Hoof and mouth disease has decimated the zoo population in 2018.

► The Alpine Ibex is an example of a species that has benefitted from conservation efforts and its extinction could be prevented. The low point was reached in the 1850s when only around 30 individuals were left in the wild, while nowadays there are over 30, 000 individuals. The species was thriving in zoos and individuals have been reintroduced to the wild from the zoo population. The Alpine Ibex does no longer require conservation efforts from the part of zoos so the focus has shifted to other caprine species that require protection more urgently.

What methods can be employed in the conservation of caprines?

- a) Nature preserves to provide a safe natural habitat.
 - b) In the case of some species, assisted reproduction and artificial insemination can be employed.
 - c) Zoo protection programmes to maintain a healthy population of endangered species.
 - d) Natural populations also benefit from protection efforts aimed at other species in the area.
- Conservation of animals can be done in multiple ways in zoos or the wild. Conservation efforts are always based on the cooperation of multiple parties, and the more parties are involved in its execution, the more effective the measures. The protection programmes of zoos are aimed at maintaining a healthy population, which can require assisted reproduction and/or artificial insemination to reduce the number of animals having to be moved between zoos.



III Goats and sheep in zoos - wellbeing



10. Threats

Observation exercise

- **Required materials:** pen and paper, possibly computer; suitable for slightly older students.



- Plan your own conservation project for an endangered caprine species.
- Where would the project be executed (in zoos, in the wild, or both)?
- What would be done in practice?
- How would people participate?
- What else would need to be taken into consideration to ensure the success of the project?
- How would the project receive funding and how do you market it to people?
- You can plan the project together with the whole group, in which case you should divide the students into teams to plan different aspects of the project (e.g. marketing) or the group can be split into teams each planning a project for a different species, which they then present to the rest of the group.
- If your group designs multiple projects, presenting each project could be done in a seminar where each presenting group is assigned to an opponent group to ask questions and provide feedback.

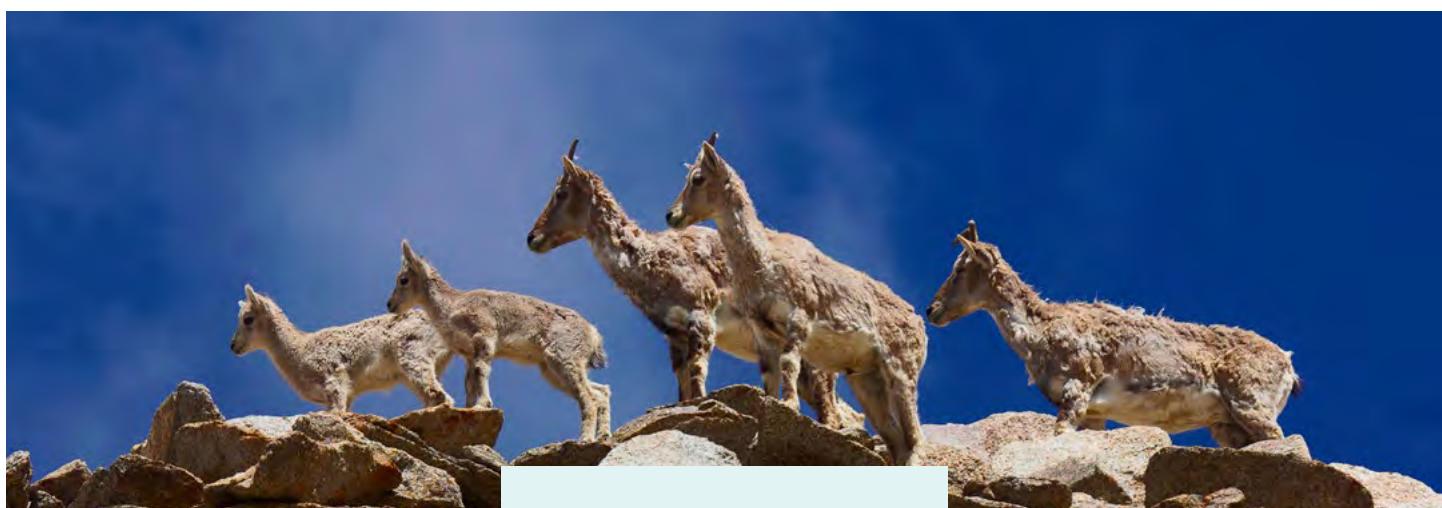
IV Conservation and endangerment

11. Conservation of animal communities and showcase species



Background:

Wild caprines are an important part of their local animal community and ecosystem, in other words nature as a whole, which means that everything affects everything else and each species fulfils a function. The interconnectedness is easily visible in that protection of one species also benefits other animal and plant species in the same area. For educational reasons, it is important to keep in mind that multiple species in a zoo may be from the same areas as wild goats and sheep. This may include a, to the average visitor, more attractive species that could be used as a showcase example for the conservation efforts that ultimately also benefit caprines as well as many others. For example, the Takin has benefitted from the protection of the Giant Panda and Red Panda, while nature preserves established for the protection of Snow Leopards have aided in the conservation of the Markhor, Bharal and multiple other caprine species and vice versa. With proper marketing and branding, also goats and sheep can become showcase species!



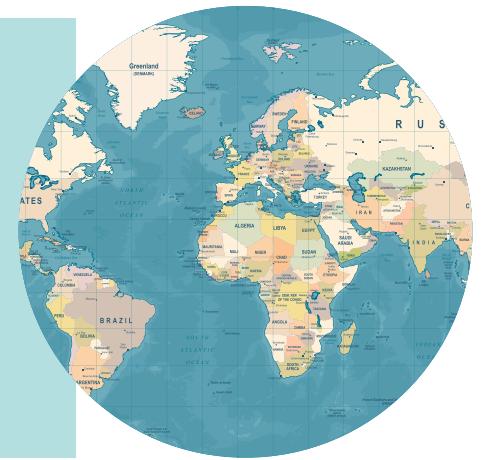
IV Conservation and endangerment



11. Conservation of animal communities and showcase species

Exercise

- **Required materials:** map, writing tablet, pen.
- **Goal:** Visualise the species distribution and natural environment. Familiarize yourself with the content of info boards and websites. Understand which species make up the community of the target area. Realizing the importance of showcase species in conservation efforts.



- Mark the distribution of the target species on the map by using information gathered from info boards or other sources. Gather information on the natural habitat at the same time.
- Based on the distribution, find out in which countries the species occurs.
- Study other animals of the zoo as well and find species that occur in more or less the same area and habitat as your target species (if needed, the teacher should restrict the area of the zoo in which to do this exercise). **Mark these species down as well. You can also take photos.**
- Using other sources, find out what other species occur in the same area.
- Discuss which of these would make a good showcase for species and why.
- How does the protection of this species benefit others within the same area?

IV Conservation and endangerment



12. The wild relatives of livestock

Background:

Wild caprines are close relatives of domesticated goats and sheep. The Wild Goat or Bezoar Ibex is considered the ancestor of the domesticated goat, whereas the Domestic Sheep is probably a descendent of the Argali. The goat has been domesticated in the Middle-East around 7000-9000 years ago and was probably the first domestic animal for milking. The domestication of the sheep probably took place in the Middle-East, Central Asia, and Europe around 5000 years ago. Livestock is an important source of meat, milk, hides, and wool. Under more extreme conditions, domestic animals benefit from the genetic background of their wild ancestors. However, livestock competes with natural populations for pastures and may transmit diseases that the wild populations have no resistance to. Furthermore, the number of livestock greatly exceeds that of wild individuals.



IV Conservation and endangerment



12. The wild relatives of livestock

The wild relatives of livestock exercise

- **Required materials:** picture cards of wild and domestic animals including species from your zoo.
[Find the pictures for this exercise in the material bank.](#)
- **Goal:** Understand that each domestic animal has a wild ancestor. Discuss their similarities and differences and whether the wild species may provide benefits to the domestic animal and vice versa or what could be potential drawbacks.



- Everyone gets one picture card. Does it depict a wild or domesticated animal?
- Think about which species could be the ancestor(s) of the domesticated ones.
- Discuss first in pairs and then with the whole group, which benefits and drawbacks the wild and domestic animals can have on each other.
- What is the benefit of the domestic animals for humans?

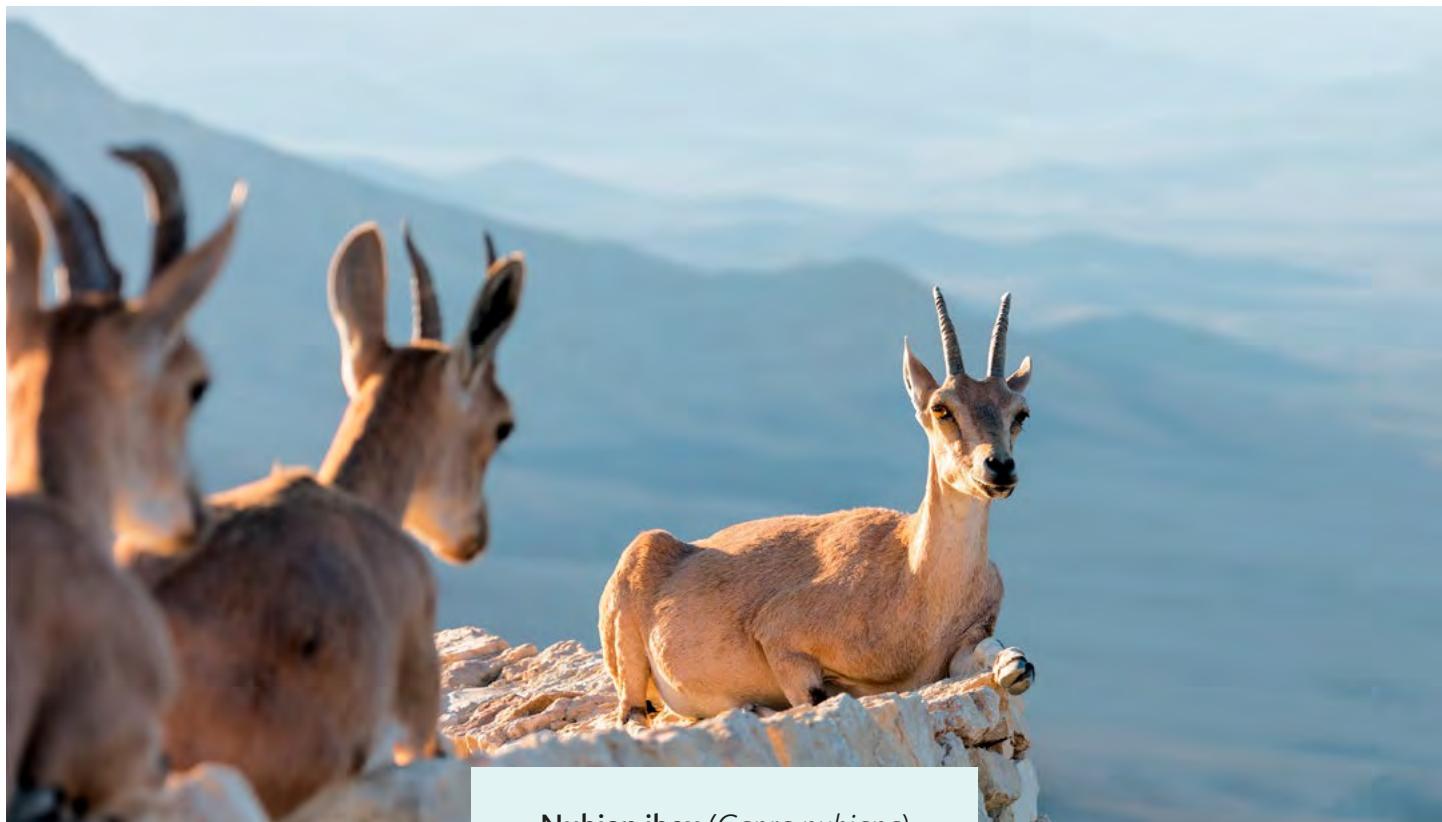
IV Conservation and endangerment

13. Outdoor research exercise on endangered species



Background:

Familiarising oneself with endangerment and its causes works quite nicely by way of studying examples to – find out where the species lives, what are its threats and how is it or could be protected, what is its role and significance in nature. In this case, bringing in some subjectivity is helpful – How can I promote the protection of this and other species? In what way is this species special and amazing in my opinion? This exercise suits 11-year-olds and above and works with any species.



Nubian ibex (*Capra nubiana*)

IV Conservation and endangerment

13. Outdoor research exercise on endangered species



Outdoor research exercise

- **Required materials:** exercise cards, possibly notebook, and pen.
[Find the handout for this exercise in the material bank.](#)
- **Goal:** Familiarize yourself with endangerment and its causes. Discuss the significance of the species and its position in the ecosystem. Discuss what other values the species has. Discuss how your own actions can support conservation of endangered species.



- Divide the class into groups of 3-5. Each group receives their own species to work on.
- The students need to find the enclosure of the animal and carry out their research project by examining the animal(s) in the enclosure, reading info boards and websites as well as by using other potential sources of information.
- Before beginning this exercise, providing the students with some general background on endangerment, its causes, the species IUCN endangerment classification and conservation work done by zoos is recommended.
- At the end, each group presents their species to the others.

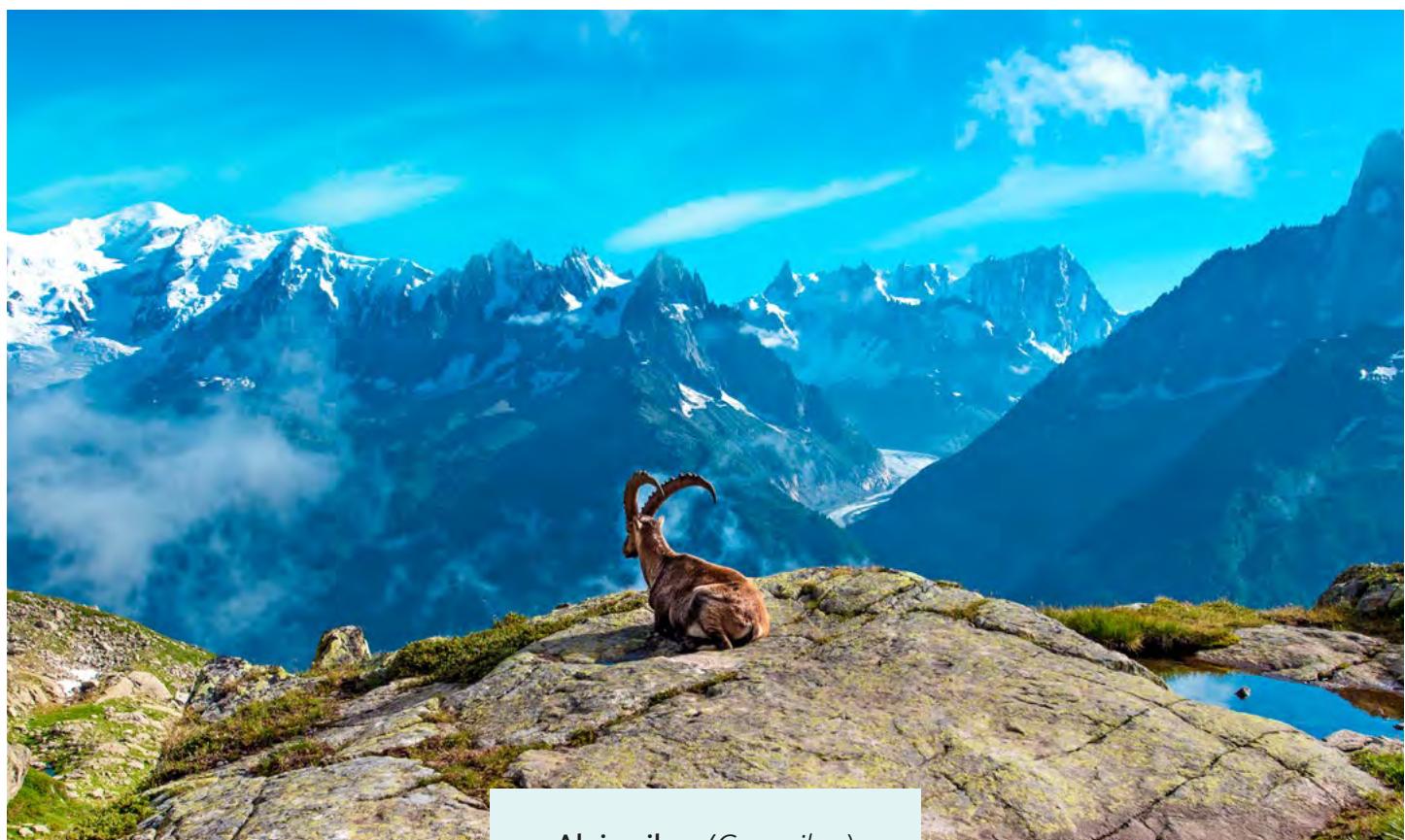
IV Conservation and endangerment



14. The Tale of the Alpine ibex

Background:

The Alpine ibex used to be at the brink of extinction, which could be prevented due to conservation efforts. For this reason, they were commonly kept in zoos, but nowadays their numbers in zoos are shrinking as they are being replaced with endangered caprines that require protection more urgently. The story of the Alpine Ibex, however, serves as a good example for the protection of other species such as the West Caucasian tur.



Alpine ibex (*Capra ibex*)

IV Conservation and endangerment



14. The Tale of the Alpine ibex

Story and questions

- **Required materials:** story text, possibly supporting material such as pictures and maps in e.g. powerpoint, questions to be asked afterwards.
- **Goal:** Learn reasons for diminishing caprine populations and methods for their conservation. Realise that there are also positive stories and successful conservation projects. Realise that similar conservation methods can be applied to many other species.



- Read the story and afterwards ask the summarising questions, which can also serve to start a more broad discussion on the topic.
- Furthermore works as an independent reading exercise, but probably not quite as effectively.



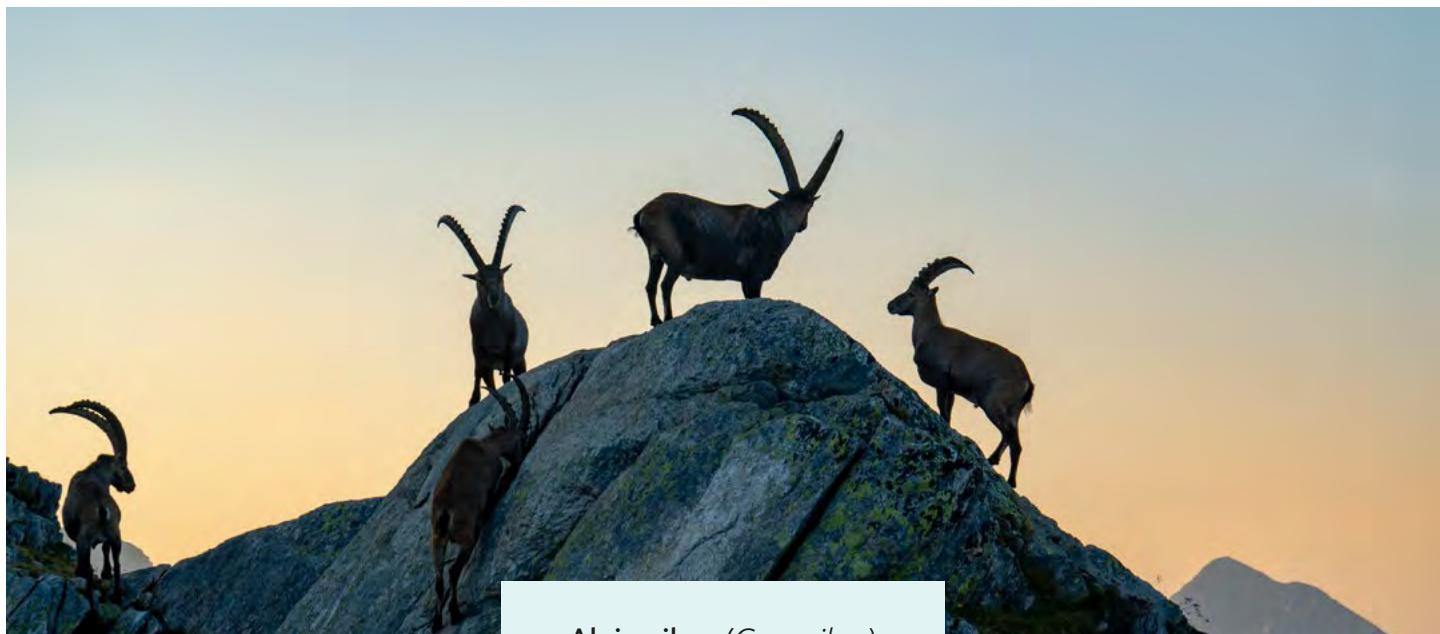
IV Conservation and endangerment

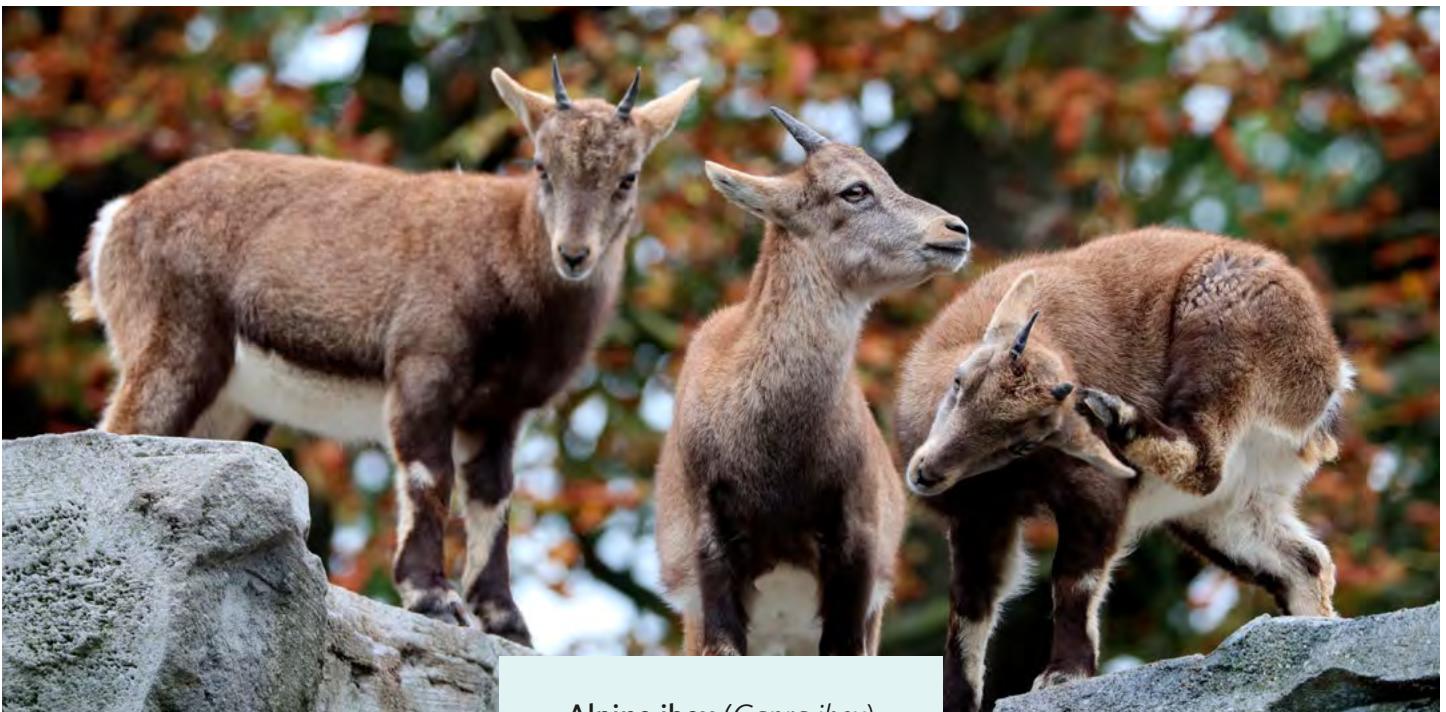


14. The Tale of the Alpine ibex

Already centuries ago, Alpine Ibices, sure-footed inhabitants of mountain slopes equipped with most impressive horns, populated the Alps. They lived in what is today known as the mountainous parts of France, Italy, Switzerland, Liechtenstein, Germany, Austria and Slovenia.

Their numbers started to decline and their habitat to shrink as early as 1500, so roughly 500 years ago, during the medieval times. Ibexes were hunted for their meat, hide and not the least for their magnificent horns. However, hunting efforts further increased over time, because the bezoar stone, a round lump of undigested matter in the goats' stomach, exerted an irresistible force of attraction on people. Medicines made from bezoar stone were believed to cure many different ailments and poisoning. Even the blood vessels covering the heart of the goats were believed to have healing properties. In medieval times, valleys in the Alps had their own "Ibex Pharmacies" that sold various remedies made from these goats. Predators of the mountain regions, such as wolves and lynxes, were also hunted, which caused the number of Alpine Ibices to soar in some places and they eventually ran out of food. In other words, hunting had completely shattered the balance of nature.





Alpine ibex (*Capra ibex*)

By the 1700s, about 300 years ago, the Alpine Ibex had disappeared from Switzerland and Germany. In the mid 1800s, they could no longer be found anywhere in the Alps except for a small part near the French-Italian border, the Italian part of which was called Gran Paradiso, while the French part was named Vanoise. At that time, the entire area belonged to the kingdom of Sardinia, ruled by King Victor Emmanuel II, who later became the first king of the united Italy. Victor Emmanuel II played a crucial role in the protection of the Alpine Ibex from extinction, since in 1854 he established royal hunting grounds in Gran Paradiso. These hunting grounds were the ibexes last refuge.

The Alpine ibex population's all-time low was a mere 30 individuals, which were kept in an enclosure in Gran Paradiso under the protection of an entire battalion of rangers sent there by the king himself. Bit by bit, the numbers of Alpine Ibices started to rise, allowing the first individuals to be brought to zoos and eventually to other nature preserves as well. Finally, the remaining Ibices of Gran Paradiso were released into the wild and 60 years later, in the 1920s, over 3000 Alpine Ibices roamed freely.

Gran Paradiso became a national park in 1922 further increasing its impact on the protection of Alpine Ibices as well as many other species. Ibex herds from the area were now able to grow and spread beyond the borders of the national park. However, the Alps are vast with many valleys and rivers, cities and other settlements, which has hindered the spreading of Alpine Ibices to their former territories or even made it entirely impossible in some places. Therefore, humans that once almost eradicated this species, assisted the Alpine ibex in reclaiming the lands of their ancestors.

Alpine ibexes thrived quite well in zoos and subsequently young kids could be reintroduced to their natural alpine habitat. Amongst others, Austria, Italy, and Germany participated in reintroduction projects that were run by zoos including the Helsinki Zoo, which made its own contribution over the years by relocating more than 30 Alpine ibexes to the Austrian Alps. Furthermore, wild ibexes were relocated as part of these conservation projects, to help them reclaim former territories they would not have reached by themselves.

Thanks to the protection of the Alpine Ibex, the entire ecosystem of the Alps, its slopes and pastures, is healthier than it used to be. The same pastures are also inhabited by the Alpine Marmot and at slightly lower altitudes by the Chamois. This in turn has supported the reintroduction of the bearded vulture and griffon vulture as they could more easily find food, which includes goat carrion. A single ibex carcass can sustain vultures for a long time. Not only vultures have benefited from the return and protection of the Alpine ibex, but also the Lynx has now an easier time finding prey. Nowadays, the Alpine ibex is hunted, but to a much lesser degree to maintain a healthy and reproducing natural population.

Currently, over 30, 000 Alpine ibexes exist again in their natural habitat. The number is still growing and the species is once again classified as “Least Concern” by the IUCN. In fact, the situation has improved to the degree that it is no longer necessary for Alpine Ibices to be kept in zoos, which can now focus on other caprines that are much more endangered and require the same kind of conservation efforts that saved the Alpine ibex from extinction. Luckily, the know how gathered during the recent decades on the conservation of the Alpine ibex can now be put to good use in the protection of its endangered relatives such as the Markhor or West Caucasian tur. Hopefully, in a hundred years we will be able to tell a similar story about the success of their conservation!

Questions:

- Where was the Alpine ibex originally from?
- Why did their numbers decrease and why did they disappear entirely from certain areas?
- What was an Ibex pharmacy?
- Why was Victor Emmanuel II, King of Sardinia and Italy, mentioned?
- How were the last remaining wild Alpine ibexes protected 150-160 years ago?
- How were they protected after that?
- What was the role of zoos in this conservation?
- What was the significance of returning the Alpine ibex to nature?
- What is the current situation of the Alpine ibex?
- How does the experience gathered from this conservation effort benefit us nowadays?



Korkeasaari
ZOO

