By Stefan Ionescu, Science Editor

Nature's Loggers: Beavers

Amazingly huge rats

The first beavers appeared in North America about 32 million years ago (at the beginning of Oligocene); by the end of Oligocene, 23 million years ago, they entered Europe, and by the end of Miocene, 5 million years ago, they entered Asia. There are 22 extinct genera of beavers. In Pleistocene, 2 million years ago, Trogontherium (Europe) and Castoroides (North America) were as big as a large bear, having up to 300 kg (670 pounds). They co-existed for a time with the modern genus of beaver, the Castor, that appeared 3 million years ago. [img=2]Today, there are two species: the European beaver ("Castor fiber") and the North American beaver ("Castor canadensis"). During the Ice Age, the European beaver, which also inhabits Siberia, was present in China and Turkey. At the arrival of the Europeans, there were 200 million beavers in North America. Now there are 10 million. There are chromosome differences between the two species. The European beaver is also less prolific (it has a litter of maximum 5 offspring), it is less aggressive and less dynamical than the American beaver, its fur being less greasy and lighter (tawny-reddish). Beavers live in faithful couples, in colonies made of 4-8 individuals representing the parents and the young of 2-3 generations (which are rarely over 2 years old). The density is of 0.4-0.8 colonies per square kilometer, but sometimes up to 3 colonies for the same area. These rodents are semiaquatic, inhabiting lakes and slow rivers. They can dig galleries with underwater entrances, in a web over 10 m (33 ft) long. But, usually, they build lodges on rivers (on the pond created by beavers' dams) and lakes with deep water, which are made from deposits of mud and large stones, covered by branches. They are located near the shore and can be 2 m (7 ft) tall, 12 m (40 ft) wide at the base (on the bottom of the water), and on the surface, over the water level; the lodges have an unique inner chamber, being 2 m wide and 0.6 m (2 ft) tall. The chamber is upholstered with soil and dry wood and presents an aeration orifice. For protection against predators, the lodge has underwater entrances. There is a drying platform before entering the chamber. The soil from the chamber is constantly changed. To carry the branches to the lodge, beavers use small affluents and create small channels (up to several km long). Beavers build dams in order to ensure a steady depth of the water, enough for storing food at the bottom of the water, so that the ice won't impede their access to it, and maintain at the same time the level of the entrance underwater. The stores are stuck with boulders. The dams are built where there is already a natural obstacle, a large boulder, a fallen trunk, and so on. The building material is made from branches, orientated against the current, mud, and others. On average, they are 22.75 (76 ft) long, but records 600 m (2,000 ft) long and 4 m (13 ft) tall have been found. To anchor the structure, beavers first locate branches on the bottom of the water. If the water bed is wide, the beavers tilt the dam into the opposite direction of the water current, to give it increased resistance against the current. Using a lot of wood, they raise the dam on the entire width of the water until reaching the right height, and then they cover the holes with mud and stones. In order to increase resistance, beavers consolidate the downward part of the dam with branches strutted in the water bed under a specific angle. The dams are regularly repaired. Soon, on the upward part of the river a quiet slop forms, where beavers will make their lodges. The dams regulate the course of the mountain rivers, as they are usually build upward on the rivers. More families can settle along a river. Downward, the water level is stabilized and the vegetation has water for all the summer. This determines the installation of forests of Magnolia and of water oak ("Quercus niger"). Of this fact, fish, water birds, hoofed mammals, rabbits, and rodents take advantage. The retained sediments form excellent pastures for deer, elk, bisons. In the mountain rivers, beavers' work determines the appearance of plankton, due to the higher temperatures, followed by the appearance of fish and fish eating species: herons, gulls, otters. In Alabama and Georgia, beavers have saved crop lands from erosion. Specialists say that beavers' dams also help purify the water and combat drought. Still, in some cases the dams can flood crops, roads, properties or rearrange hydroelectrical installations, affecting draining or irrigation channels. Beavers work at night for building them, but also during the day if it is quiet. They can prolong or close the dam, depending on their needs. There is a myth that should be forgotten: the beaver does not use its flattened tail as a trowel when lining the dams with mud. In Wyoming, researchers released 5

males and 5 females in an area where beavers lacked for a long period. When they returned one year later, the beavers had made 5 colonies and had built 55 dams. The beaver families are territorial, marking their territories with the product of two pairs of anal glands. The first pair produces an oil, the second the so-called "castoreum", used in past times in the perfume industry (just like musk or civet perfumes). The oil is used for smearing the fur and for turning it impermeable. Beavers can resist up to 15 minutes in apnea (without breathing) and can make 750 m (0.5 mi) underwater. The eyes, the ears (which are 3 cm (1.2 in) long) and the nose are upward on the same line, an adaptation to aquatic life, like in the case of hippopotamuses. They propel in the water with the tail for rapid swimming, which is also used as a rudder. The flattened tail is covered by horny scales, it is 22-45 cm (0.6-1.5 ft) long and 11-18 cm (4.5-7 in) wide. The swimming speed is 7 km (4.2 mi) per hour. The tail is also used as tripod while cutting trees; beavers also splash the water with the tail, when being attacked, as an alarm signal. The tail contains tendons and stores fat reserves. The sole is 20 cm (0.6 ft) long and the toes are webbed, an adaptation for swimming. The fifth toe, which is shorter, is used for taking care of the fur. Beavers have a nictitant membrane, so that they can see underwater; they have special valves that close the ears and nose underwater. They distinguish colors and see as equal in the water as on ground. Beavers have whiskers, like cats (and rats). These large rodents can breathe normally with their mouth open, an important issue when they have to build the lodge, the dam, or carry stores of branches for the winter. On the ground, beavers can gallop, but they rarely go further than 200 m (660 ft) away from the water edge. During the winter, beavers eat only stored bark and twigs, while in other seasons, they eat aquatic plants (water lilies, pondweed or "Potamogeton", and others); but their base food remains the wood, the preferred being willow ("Salix"), poplar ("Populus"), birch ("Betula"), and ash ("Fraxinus"). Beavers also eat fruits and ground plants and they even attack gardens for obtaining them (beet is their favorite). They take the food to mouth by using their extremely dexterous fore limbs. The fifth finger is opposable to the others and the effect is increased by a callosity of the hand. The claws resemble nails. Using their large incisor teeth, an individual can bring down in 30 minutes a 12 cm (5 in) wide tree, cutting it in a ring. The largest trees brought down have 30 cm (1 ft) in diameter. Beavers consume the whole tree: leaves, buds, bark, cambium, roots. At the end of the summer and during the fall, they store branches at the bottom of the water, after making a deep hole on the bottom of the water. The hole is filled with branches on the water surface. Because of the cold water, food keeps its nutritional value, enabling the beavers to eat daily during the winter, when the surface is covered by snow and their activity impeded. A family can store up to 80 cubic meters of food. During severe colds, beavers pass into a lethargy stage, living from their body fat reserves, inside their lodges. Beavers' cecum has three lobes harboring microorganisms that digest cellulose; like other rodents, beavers also eat their first round of feces ("caecotrophy"). Beavers digest only about 33 % of the ingested cellulose, a small number compared to other herbivorous mammals. The incisor teeth of the beavers are 5 mm long and grow continuously. Their anterior face is covered by a tough enamel and the incisors are curved towards the inner part, so that they can act like chisels, penetrating the toughest wood. The breeding period occurs in January-February, and the mating games take place in the water for two weeks, but the female is receptive only for 12 hours. Mating takes place face to face underwater or under ice. Gestation lasts 100-110 days. In the period including April and May, the female gives birth to 1-9 offspring (on average 2-4). Their number is higher in food rich areas and in the case of younger females. They have a low rate of mortality. The young weigh 0.5 kg (1.1 pounds) at birth and have open eyes. The female has two pairs of mammary glands and they suckle 9 times a day. The milk is 50-75 % made of nutrients (27.3 % proteins, 60 % fats, 6.7 % sugars, and 6.1 % minerals). The offspring are cared by parents and by older brothers and weaned at 2-3 months. Infants are carried in the mouth, being grabbed by their nape. [img=3]At one year old, they are 6-12 kg (13-27 pounds) heavy, and growth stops at 4 years old. Adult beavers are 12-25 kg (maximum 40) (27-55 pounds, maximum 89) heavy, with a head-body length of 60-80 cm (2-2.6 ft) (males are bigger than females). Beavers are the second largest current rodents after the South American capybara. They remain in the parental lodge for two years, and, on the third year, they form their own family (even if they are sexually mature at the age of 1.5-2 years old). They can make on average 20 km (12 mi), in record cases up to 250 km (155 mi). These large rodents live 15-20 years.Beavers communicate through calls. They have two types of hair: a short fine hair, whose fibers interwine, producing an isolating layer against water and cold and long hairs, thicker, denser, protecting the soft hair below, dispersing the water and allowing them to swim in water, at about 0o C under ice. The long hairs are cylindrical in the American beaver and lance-shaped in the European beaver. The hair density is 10,000 per square cm: only sea otters have

denser fur. This explains their intensive poaching in the past, and once beaver skins were used as money in Canada. In the southern areas (like Alabama, Georgia and Mississippi) their winter fur is less qualitative. Beavers are also protected against the cold by a thick layer of fatty tissue located under skin. In the present, the beaver from the western Mongolia ("Castor fiber birulai") is menaced by extinction. The American beaver was introduced in Finland. The two species do not interbreed, but the American beaver, being more aggressive, rejects the European species which cedes its place. Beavers can reach 3,000 m in altitude (10,000 ft) in North America, being found even in dry areas, but they avoid tundra, high mountains, and dense coniferous forests. The main predators of the beavers are wolves and coyotes, occasionally the alligator, bear, lynx, wolverine, and otter (extremely rarely). Beavers defend themselves with their incisor teeth (less effective against wolves or bears). In northern areas, beavers can die during the winter because of hunger; floods and freezing conditions can keep them prisoners under the ice. Beavers can spread Giardia, a parasite protozoa, which installs itself in the human gut. Beavers can make docile pets. Native Americans often kept them in their camps. But, remember that they are continuously building, cutting the feet of the tables and chairs, and making small dams between the furniture pieces. Wooden fences and fruit trees will suffer, too.