BIOLOGY

From our reporter at the annual meeting of the American Institute of Biological Sciences at Corvallis, Ore.

Rooted to a cold reality

Before the deadly cold of winter settles on the far north, birds and animals migrate, hibernate or put on an extra layer of insulation. But trees and other perennial plants must stay rooted to the frozen soil. What mechanisms, plant physiologists have wondered, have plants evolved for surviving the physiological insult of severely cold temperatures? A researcher from the University of Minnesota's Laboratory of Plant Hardiness reported this week the two main mechanisms of ice formation in cold-hardy plants.

Physical chemist Michael J. Burke, as hardy himself as the trees that survive Minnesota's −40 degrees C. temperatures, made the report. (He tells, with a smile, of yearly snow camping and cross-country skiing trips through the frozen lakes of northern Minnesota to collect plant specimens for his experiments.) He and others at the University of Minnesota have found that there are really no complicated or mysterious adaptations at work in cold-hardy plants (those that can survive at −40 degrees C). The water in those plants reacted in two classical ways—as an ideal aqueous solution and as a supercooled liquid.

The addition of salt to water to form a solution will depress its freezing point; every winter driver knows that. And the water in trees, Burke says, acts just like a classical salt solution becoming more concentrated as the temperature drops, in order to prevent freezing. But this principle alone would not account for survival to −40 degrees C. A second principle, supercooling of water, is at work, Burke says. Very pure water, without dust or dirt particles upon which ice crystals can form, can be supercooled to −40 degrees C. before it will freeze. Burke and colleagues found that 175 of 350 species of deciduous trees they studied had pure enough water in their woody tissues to allow supercooling to −40 degrees C. The salts in the fluids depressed the freezing point by another 5 degrees C. allowing the trees to survive to about −45 degrees C.

These theoretical explanations are corroborated by nature, Burke says. The deciduous trees that can supercool water to about −45 degrees C. coincidentally stop growing above a latitude across central Minnesota—a latitude where the mean winter minimum routinely drops below that temperature. The deciduous trees and conifers that survive above that latitude have evolved different mechanisms for dealing with the cold, he says.

A salty surprise for sheep killers

The sight of a coyote loping down the rocky hills toward a vulnerable flock of sheep is enough to generate murderous thoughts in the most mild-mannered sheep rancher. Such facts have been translated, traditionally, into the setting of traps, the planting of poisons and the loading of shotguns. But none of these predator-control techniques over the decades have proven very effective.

Recognizing these control failures, a team of behavioral ecologists from Eastern Washington State College in Cheney has devised a system for modifying the predatory behavior of coyotes—teaching them, in other words, to dislike the taste of sheep flesh.

Carl R. Gustavson, Dan J. Kelly and J. Garcia described field tests of the system during a session on animal behavior. On a sheep ranch in southeastern Washington, they scattered sheep carcasses and baits made of sheep flesh laced with lithium chloride. They had found in earlier laboratory tests that ingestion by a coyote of about six grams of the salt laced in sheep flesh would cause such severe nausea that the animal (after one or at most two feedings) learns to hate the taste of sheep flesh and will fail to attack and kill sheep even when given the opportunity. Lithium chloride does not seem to harm the animals even at such high levels, Gustavson says. By scattering the experimental bait, the team was able to decrease sheep kills on the Washington ranch by about 50 percent.

What remains, he says, is to work out the details of the system—how many baits must be placed, exactly when during the breeding season placement is most effective, and how often baits should be placed, among these details.

Alligator love

Before two zoologists went off to the swamps of southern Florida to watch the courtship of "Blue-tag," "Toothy," "Tumor-tail" and their reptilian friends, the courtship behavior of the American alligator was an unstudied phenomenon. But the knowledge of this loud and complicated affair, now well documented by the team, might turn out to have some major implications for the survival of dwindling alligator populations.

Leslie D. Garrick of the New York Zoological Society and Jeffrey W. Lang of the University of Minnesota spent the spring of 1974 at Gatorama, an alligator farm and tourist spot in south-central Florida. There, they recorded the previously unstudied details of alligator courtship, the loud slapping of heads against the water surface and "unbelievably primal bellowing" that signals the beginning of the courtship ritual. This is followed by the emitting of "chumpf-chumpf" sounds, bubble blowing, riding of the courters on each other's backs, geysering (spouting water through the nostrils) and other complex and playful patterns. The animals, after minutes or hours of courtship, finally copulate.

Besides studying courtship, Garrick and Lang also filmed the details of nesting, hatching and maternal behavior. They are finishing a movie which Garrick hopes will help to teach the public (particularly in the South where alligators are indigenous) about the country's largest reptiles. Due to the destruction of their natural habitat by housing and land developments, alligators have become something of a nuisance in some populated areas and are considered a threatened species. By knowing the details of their courtship and breeding patterns, Garrick says, it should be possible to make wiser land-use decisions for preserving their natural habitats and perhaps to prevent the extinction of this dinosaurian relative.

Geese: Unpinning the pecking order

Geese, like many other birds and animals, maintain social hierarchy in their populations by establishing "pecking order." But in certain cases, pecking orders may be replaced by chaos.

Zoologist Robert E. Otis of Ripon College in Ripon, Wis., and colleagues W. C. Johnson and D. F. Cowan studied pecking orders in semi-wild Canada geese at Kellogg Bird Sanctuary in Battle Creek, Mich. It had been supposed for decades, Otis says, that if a bird were dominant at one activity, such as at the feeding trough, that the same bird would be dominant at the watering source and in choosing nesting sites and in other avian activities. This, the team found out, is not necessarily true—the head goose at one activity can be dethroned at another.

The whole pecking order, in fact, can be dissolved if the birds are overcrowded. Doubling the population density of certain test groups resulted, the team found, in a loss of ranking order, an increase in aggression and in social disorganization. Return to uncrowded conditions brought the return of social order and ranking.

This finding may help to explain social disorganization sometimes observed at bird sanctuaries during migration, Otis says, when hundreds of thousands of geese and other birds funnel down from Canada and the northern United States to feed at a few small bird sanctuaries en route.