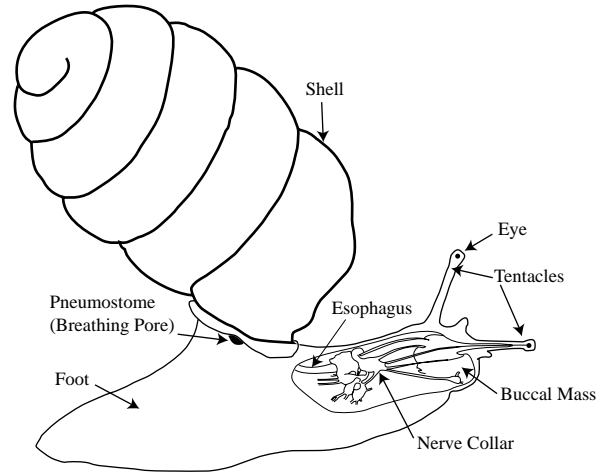




Recolonization of Burned Aspen Groves by Land Snails

by Dorothy E. Beetle



Land mollusks play an important role in forest productivity, although they usually pass unnoticed. They are part of the invertebrate fauna that busily convert leaf litter and fallen logs into soil nutrients. Litter in aspen groves provides habitat for these snails that feed on living and dead vegetative material. In turn, snails are included in the diet of small mammals and birds.

The mollusks of Yellowstone are not unique to the area, being found in suitable habitats elsewhere. Even in suitable habitats their distribution is spotty. Early malacologists who collected in Yellowstone listed the species they found, without further data. Others who were studying a particular genus noted which of its species were found in the park. In my experience, deciduous forest trees such as aspen generally have a greater abundance and variety of snails than coniferous forests on more acidic soils. The limited cover of sage-grassland also has fewer species than aspen stands.

A Primer on Snail Ecology

Most Yellowstone mollusks are tiny, ranging in size from 1.5 mm to nearly 30 mm. Within their thin shells, land snails have a fleshy mantle covering a coiled

body. The body contains a digestive, circulatory, and nervous system, and reproductive organs. The animal glides along over a mucus trail it secretes, using the muscular contractions of its foot (*see diagram*). The mouth, enclosed in a buccal sac, contains a tough muscular radula that bears many rows of minute, pointed teeth. The radula rasps back and forth over food to break it into tiny pieces to swallow. As the teeth are worn, they are discarded and the radula unrolls a bit to bring new teeth to bear on the food. Eye spots on the antennae are sensitive to light and movement. The land snails are hermaphrodites with male and female organs which exchange sperm. Most lay eggs, but *Oreohelix* is an exception. Its young are retained in the oviduct until attaining 3 to 4 mm in diameter; then they are born alive. Under the stress of brief confinement and being held overnight for identification, eight adults birthed 54 young *Oreohelix*. *Oreohelix* grows very slowly, requiring about 5 years to attain a size of 20 or more millimeters.

The length of life for the various species of land snails is rarely recorded in the literature. However, with unfavorable moisture and temperature conditions, they go into a resting period that may extend for months. The aperture of the shell is

glued by mucus to a bit of leaf or bark. I have kept *Oreohelix* alive in containers for as long as eight years, including rest periods. In the laboratory, the tiny *Pu-pilla* have been maintained for several years.

Snail movement by itself is very slow. There is very little chance that, by themselves, snails could move across a pine forest or sagebrush-grassland to another aspen grove. Their small size allows for some passive dispersal by wind or heavy rains. Under favorable moisture conditions, small snails may climb into the hair of mammals or feathers of birds and be carried from one grove to another.

Sampling for Snail Survival After the Fires

The fires of 1988 that raged across considerable acreage in Yellowstone National Park raised the question of survival of mollusks in the burned aspen groves. Since no preburn data exist, I planned a five-year study of snail populations in both burned and unburned aspen groves. Sampling was done in 1989 and selected sites were examined in 1990, 1991, and 1994 to determine survival and population regrowth.

A printout from the naturalist's office

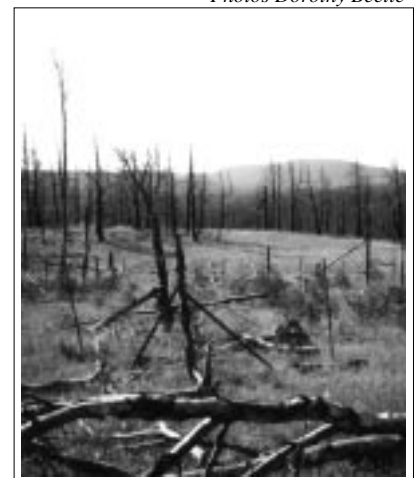
showed where aspen had occurred before the fires. Groves were located in the northernmost portion of Yellowstone, particularly around Mammoth Hot Springs, Bunsen and Sepulcher peaks, and on both sides of the road east to the Lamar Valley. Scattered aspen grew north of the West Entrance beyond Duck Creek. Quite a few of the aspen marked on the printout were remnant strings of aspen too open to offer the cover needed by snails, or were small, isolated clones. Using the Yellowstone map showing burned areas, 18 sites were selected and sampled in 1989.

Eight sites were chosen for subsequent study. Those selected were several mildly burned groves, an unburned hillside, another where all the trees were killed and many blown over by a jet wind during the fire, plus a completely destroyed grove. A site near Mammoth Hot Springs was contiguous to unburned aspen from which migration might occur. We obtained snails for identification by handpicking and gathering leaf litter. Snails live in the leaf litter and can be obtained by sifting through fine mesh screens.

Variation Among Different Groves

An extensive aspen forest on the slope of Sepulcher Peak had escaped the flames. *Oreohelix subrudis*, plus seven other species of snails, were present in the leaf litter and under logs in 1989. *Oreohelix* were abundant and extended downslope into the sagebrush. The snail population had not changed by 1994.

Beyond Mammoth Hot Springs was an aspen forest, some of which had been lightly burned. The thick ground cover held eight species in 1989; a sample of snail population before the fire. In 1990, a low spot in this grove held standing water in which a freshwater snail, *Lymnaea (Fossaria) modicella* was active. Freshwater snails have a body similar to land mollusks and come to the surface to breathe. This *Lymnaea* has been found previously in park waters and may live in the overflow from the spring where the water has cooled. In 1994, the water was gone. While the land snails were all present, no *Lymnaea* were seen. They probably had burrowed deeply into the mud.



Some of the sites sampled include, clockwise: A string of live aspen lightly burned in the Lamar Valley; an enclosure along Bunsen Peak road (1994); same road showing bare foreground where fallen trees had burned to ash; and a completely destroyed grove with numerous dead *Oreohelix* shells (no recovery by 1994).

Although the strings of aspen near Crystal Creek in the Lamar Valley were quite open, seeps on the hillside kept the ground boggy. Here we found the largest number of snail species (11) of any site sampled in 1989. We were surprised to find a freshwater snail, *Physa megalochlamys*, which has a limited distribution, in the small creek. No additional mollusks were found in 1990, although *Oreohelix subrudis* was under logs with a dark-banded form that has been called *O. subrudis obscura*. By 1994, the hillside was considerably drier, and *Physa* was now absent. Aspen suckers seen previously had been grazed to the ground. The mollusk population had declined.

A grove along the Bunsen Peak road had suffered a hot burn. Standing trees had been partially burned through the

trunks, yet managed to leaf out in 1989. Where trees had fallen during the fires, they had burned to ash, leaving only outlines of their forms. Tangles of aspen suckers had sprung up. Only three species of snails were present in 1989. By 1994, the badly burned aspen trees had died and suckers had been grazed to the ground by ungulates. Without the aspen litter the mollusks had died out.

The hillside beyond Floating Island Lake had a mix of large aspen and pine. A light burn had left live trees with charred bases. Previously fallen trees, a tangle of aspen suckers and many shrubs made walking difficult. Damp conditions and abundant litter offered good snail habitat. Five species were found on uncharred rotten logs and a few on charred ones. These species were found again in 1994.

LAND MOLLUSKS FOUND IN YELLOWSTONE'S ASPEN GROVES

Species Scientific Name

Common Name

<i>Oreohelix subrudis</i>	Subalpine snail
<i>Microphysula ingersolli</i>	Spruce snail
<i>Euconulus fulvus</i>	Brown hive snail
<i>Retinella (Nesovitrea) electrina</i>	Amberglass snail
<i>Hawaiiia minuscula</i>	Minute gem
<i>Zonitoides arboreus</i>	Quick gloss snail
<i>Vitrina alaskana</i>	Glass snail
<i>Deroceras laeve</i>	Meadow slug
<i>Discus cronkhitei</i>	Forest disc
<i>Discus shimiki</i>	Striate disc
<i>Punctum minutissimum</i>	Small spot
<i>Oxyloma retusa</i>	Blunt amber snail
<i>Catinella</i> spp.	Amber snail
<i>Pupilla muscorum</i>	Widespread column
<i>Vertigo modesta</i>	Cross vertigo
<i>Vertigo gouldi</i>	Variable vertigo
<i>Columella alticola</i>	Toothless column
<i>Vallonia cyclophorella</i>	Silky vallonia
<i>Vallonia gracilicosta</i>	Multirib vallonia
<i>Zoogenetes harpa</i>	Boreal top
<i>Cionella lubrica</i>	Shiny spire

FRESHWATER MOLLUSKS FOUND IN ASPEN GROVES

<i>Physa megalochlamys</i>	(No common name)
<i>Lymnaea (Fossaria) modicella</i>	Rock fossaria

On the south slope of Bunsen Peak, all the trees in what had been a large stand of aspen had been burned. Apparently a jet wind during the 1988 fires had broken many trees near the base and blown them over in the same direction. Only a few burned *Oreohelix* fragments were found in 1989. No snails were found in 1994.

One completely destroyed grove we examined was simply bare ground. No evidence of trees remained. Even tree roots below ground had been burned to ash so that we sank into ash were roots had been. Some fireweed had sprouted. This must have been an excellent habitat for snails prior to the fire. The grove lay in a hollow alongside a stream. Scattered over the ground were more burned *Oreohelix* shells than we found at any other site. No other snails were seen, although the fire probably destroyed any evidence of them due to their small size. Digging into the burn, we found one live *Discus cronkhitei* about 23 cm below the surface under a pile of rock. Five years later in 1994 there were no aspen suckers, only a few herbaceous plants. No live mollusks were present. As the area is surrounded by lodgepole pine and Dou-

glas-fir, it is most probable that the conifers will invade what was an excellent aspen grove.

A Summary of Snail Recolonization

A total of 21 land species and two freshwater snail species were identified in both burned and unburned sites between 1989 and 1994. Each site had a mix of different snails along with *Oreohelix*. The usual number of species present in any grove was 3 to 5. Only two damp sites held 8 and 11 species, numbers indicative of favorable litter, soil, and moisture.

The random distribution of species from one grove to another suggests that snails may have been brought into a site by animals or birds bedding or feeding there. It is also possible that in the past there was an extensive aspen forest and the groves we see now with their varying assemblages of mollusks are remnants.

In 1989, all the mollusks listed in the table were found in unburned sites. Burned groves held a few live species and fragments of others. From 1990 to 1991, where mature aspen had survived, mollusk populations had declined somewhat.

No new species were present, nor had burned groves added populations. After two dry years, by 1994, many aspen had died without replacement and snails were no longer present. No evidence of migration was found into burned groves.

Deterioration of aspen groves is a serious problem for the snail population. The limited expanse of aspen in Yellowstone before the fires indicates they are dying out. Aspen reproduces largely through suckers from its roots, while fire stimulates regrowth, extensive gnawing of tree trunks and grazing of aspen suckers by elk results in the decadence of aspen groves. This eliminates habitat for the mollusks. Aspen in drier areas may be replaced by sagebrush-grassland. In more moist areas, lodgepole pine and Douglas-fir could invade remnant aspen (Bartos and Mueggler 1979, DeBogle 1979). These plant associations would provide different habitat for other mollusks (Karlin 1961).

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Dorothy Beetle is a retired planetarium director who, in her spare time, has studied land and freshwater mollusks in Wyoming since 1949, publishing eight papers on these mollusks. She reported sifting through aspen leaf litter on her hands and knees to study these often overlooked animals.