Yellowstone elk die early from excessive fluoride

February 11, 2004 -- By Evelyn Boswell, MSU News Service
Elk that graze near the hot pools and geysers of Yellowstone National Park are dying about five years earlier than elk that live elsewhere in the park, says Robert Garrott, ecology professor at Montana State University-Bozeman.

Blame it on fluoride.

Fluoride is found naturally in the park, and elk take it in every time they eat and drink in the geothermal areas, said Garrott who is heading an ongoing study of the relationship between fluoride and early elk deaths. That's especially the case during the winter when the elk escape deep snow by congregating around the hot pools.

Geysers, mud pots and hot pools are generally concentrated in the west central part of the park known as the Madison-Firehole area. Fluoride originates in geothermal features and magma that lies close to the surface. Combined with abrasive silica dust that is abundant in the volcanic soils of the area, it destroys the elks' teeth.

"In ungulates, tooth wear dictates longevity," Garrott said.

The elk's teeth slowly wear away in irregular patterns over many years, Garrott said. The elk may seem fine for a while, but the fluoride eventually catches up with them.

"It is only as they get older, say eight-plus years, that the wear progresses to the point that they are inefficient in eating," Garrott said. "They crop and chew food fine, but their teeth don't break plant tissues down well because of wear. This fluoride toxicosis results in early old age, or, in other words, a reduced life span."

Elk in the Madison-Firehole area generally die by the time they're 15 years old, Garrott said. However, elk that winter farther north in the Lamar River valley can live to be in their mid-20s. Elk that can't eat properly become weak and susceptible to wolves.

If humans were to consume fluoride at as high a level as the elk do, they would have some tooth problems, too, Garrott said. As it is, the amount of fluoride used to treat water for human consumption is "much, much lower" than the levels found at Yellowstone Park.

"Low levels of fluoride actually help teeth stay healthy. Hence, fluoride is added to toothpaste, and your dentist uses a fluoride treatment on your teeth as part of routine cleaning," Garrott said.

Garrott's fluoride study stemmed from a research project that looked at the effects of the 1988 fires on Yellowstone. While working on that project, he noticed that he wasn't seeing any elk that he considered old in the non-migratory herd that lived in the Madison-Firehole area. When a severe winter killed a number of adult elk, his research team was able to retrieve their lower jaws. The discovery of odd wear patterns and badly worn teeth led the researchers to examine soil, water and plants. Then they compared the non-migratory elk with the migratory elk.

"You start a project with a major theme, but when you get into a system, a lot of other things pop up when you're grunting around with the elk," Garrott said.

A related MSU study showed that arsenic is found in high concentrations in the geothermal areas, too.

"How arsenic may contribute to the short life spans of this particular herd (the non-migrating herd) is not known, and we were not able to answer this from Ben Kocar's study," said William Inskeep, professor in the Department of Land Resources & Environmental Sciences at MSU and co-director of the university's Thermal Biology Institute.

The arsenic study was led by Benjamin Kocar when he was a master's degree student at MSU. Kocar is now a doctoral student at Stanford University. His findings will be published this year in the journal, "Environmental Toxicology and Chemistry." Garrott and Inskeep were both involved in the study.

The fluoride and arsenic studies could lead to new projects, Garrott said. He, a prospective graduate student and Tim McDermott of the Thermal Biology Institute have submitted a proposal to the Environmental Protection Agency for a study that would let them look for unique microbial populations in the stomachs of elk living around Yellowstone's geothermal features. Garrott said the elk in the non-migrating herd seem to have evolved so they can handle the arsenic.