Rodents and telescopes: A squirrelly issue

Rising nearly 11,000 feet, snow-capped Mt. Graham stands in striking contrast to the desert landscape of southeastern Arizona. Life on Mt. Graham became separated from that on nearby summits more than 11,000 years ago with the melting of glaciers that bridged the mountain with its neighbors during the last Ice Age. That separation created a "sky island" – an ecosystem so isolated that it harbors several flora and fauna that appear genetically distinct from similar species found anywhere else.

But in recent years the sky island has become an island of controversy, as two groups of researchers bitterly debate the merits of construction on a portion of the mountaintop. The lightning rod for the struggle is a unique, 3-pound rodent known as the Mt. Graham red squirrel, an animal placed on the endangered species list in 1987 when the creatures numbered about 328. Today, its population has declined to an estimated 132.

In court hearings and congressional testimony, many biologists and environmentalists have maintained that any project that diminishes the squirrel's prime habitat of old-growth fir and spruce might lead to the animal's extinction. But their opponents, who claim the project's limited size would have a negligible effect on the species, represent neither loggers nor real estate developers. They are fellow scientists.

Since 1980, astronomers at the University of Arizona in Tucson, in collaboration with the Vatican and the Max Planck Institute for Radioastronomy in Bonn, Germany, have planned to place seven large telescopes on Mt. Graham, whose clarity of view and isolation from light pollution have prompted many astronomers to call it one of the premiere U.S. outposts for observing the heavens.

Activity in Congress last week further fueled the controversy. The General Accounting Office (GAO), Congress' investigative arm, told a House subcommittee hearing that serious flaws existed in a 1988 report by the U.S. Fish and Wildlife Service, which had concluded that the telescope project on Mt. Graham's Emerald Peak would not endanger the red squirrel. In directing his staff to conclude that Emerald Peak is one of two "reasonable and prudent" Mt. Graham sites for the telescopes, report coordinator Michael J. Spear, the Fish and Wildlife Service's southwest regional director, overlooked scientific evidence indicating that the telescopes and related road construction could indeed threaten squirrel survival, according to the GAO.

The charge has particular significance for Arizona legislators, who say the 1988 report prompted them to push through special legislation permitting the University of Arizona to build three telescopes on Emerald Peak without further federal study. Last summer, the university built a 2-mile-long road, covering 5.5 acres or about 65 percent of the total area it intends to use for three of the seven telescopes.

GAO's investigation found that Spear inappropriately considered nonbiological information – such as the importance of the telescopes for future research – in reaching his conclusion. The GAO noted that the 1988 report supported construction of an 8.6-acre, three-telescope complex on Emerald Peak despite the contrary opinion of Spear's own field biologists and the conclusion of a 1987 draft biological study by his agency.

At the hearing, Spear admitted he might have erred in using what he called "common sense" to reach his conclusion. He told Congress that if the area on Emerald Peak had been intended for housing rather than telescopes, he would not have approved the plan. But he defended his decision, maintaining that the project's small size, combined with stipulated precautions such as road closing and reforestation, would sufficiently protect the squirrel.

Several members of the Arizona congressional delegation who have vigorously supported the telescope project requested late last week that the Fish and Wildlife Service "update" its biological opinion on Mt. Graham.

Although the GAO had recommended updating the report, the approach taken by the Arizona legislators puzzled both the Service and subcommittee staffers because under the Endangered Species Act, only the Forest Service – as owner and manager of Mt. Graham – can request such a review. A spokesman in Spear's Albuquerque, N.M., office said that until the Forest Service formally requests a "reinitiation of consultation," an update probably cannot proceed.

In the meantime, the University of Arizona has announced that if delays continue, its partners may pull out. The project's three instruments include the university's Columbus telescope, featuring two 8-meter mirrors arranged like binoculars; the Max Planck Institute's 10-meter Submillimeter Telescope; and the Vatican's 1.8-meter Advanced Technology Telescope. Peter G.T. Mezger, director of the Max Planck Institute for Radioastronomy, told SCIENCE NEWS the institute has begun to explore alternative sites in Chile. But Mezger says such negotiations could take years, and for now, like others, he'll play the waiting game. – *R. Cowen*

News of the week continued on p.11

Ringing to the beat of the solar cycle

The sun apparently changes its tune in time with the rise and fall in sunspot number and magnetic activity marking the solar cycle. Careful measurements of the acoustic frequencies at which the sun oscillates reveal that these frequencies increase slightly as the solar cycle goes from a minimum to a maximum. A detailed analysis of the data may provide important clues toward identifying the activities inside the sun responsible for the solar cycle.

"These are the most accurate measurements of the sun's acoustic modes that have been made so far," says Kenneth G. Libbrecht of the California Institute of Technology in Pasadena. "These new measurements clearly show that [acoustic] frequencies change with time, presumably owing to changes in the structure of the sun during the solar cycle." Libbrecht and Martin F. Woodard report their findings in the June 21 NATURE.

Ever since scientists learned more than a decade ago that the sun rings like a bell, they have suspected that fluctuations in the sun's interior during a solar cycle would affect the characteristic frequencies at which the sun vibrates. But previous measurements failed to pinpoint the changes.

Libbrecht and Woodard tracked the sun's oscillations for a four-month period in 1986, as the solar cycle reached its minimum, and for a similar period in 1988, as the cycle rose towards its peak. They discovered that the sun's acoustic vibration frequencies systematically increased by about one part in 10,000. The data also suggested that the structural changes responsible for these frequency shifts are concentrated in the sun's outermost layers.

"It is our view that the [acoustic] frequencies are responding to changes in the strength of solar magnetic activity near the sun's surface," the researchers assert. But the origin of the changes isn't known yet.

"In the past there have been too few data to enable us to piece together a coherent picture of these frequency changes," Douglas Gough of the University of Cambridge in England comments in the same issue of NATURE. "It is likely that both magnetic activity and structural changes in the superficial layers of the sun are merely symptoms of a more deeply seated dynamical process."

Gleaning information about what happens in the sun's outer layers, Gough adds, "is an important step towards discovering the underlying mechanism that controls the solar cycle."

– *I. Peterson*