Earth Sciences

Richard Monastersky reports from Phoenix at the annual meeting of the Geological Society of America

They didn't carry out the trash

Late in the fall of 1777, George Washington led a band of 11,000 ragged and recently defeated American soldiers to Valley Forge, Pa., where they weathered an unusually harsh winter and prepared for the springtime continuation of the U.S. War for Independence. In search of clues to the lifestyle of the soldiers at Valley Forge, archaeologists and historians are interested in studying the buried remains of the huts that housed the threadbare army.

But a primary problem in this quest is actually locating the hut remains in the Valley Forge National Historic Park, as it is now known. In the 1960s, Boy Scouts camped in the park, digging trenches and altering the landscape. Moreover, a parking lot and other new structures now dot the modern park.

As an alternative to digging up large sections of the park, geophysicist Jay Parrish of Bowling Green (Ohio) University is testing nondestructive remote sensing and biogeochemical techniques for locating the hut remains. By digitizing and enhancing a 1950 black-and-white air photo of the park that predates the Boy Scout jamborees, Parrish has been able to trace linear patterns, which may correspond to lines of huts.

He has also found that the grass in certain locations contains excessive amounts of calcium and potassium. Parrish reasons that these areas might overlie the former hearths of the huts. Instead of venturing out into the snow, soldiers probably threw trash, including food bones, into the hearths — a practice that would enrich the hearths in these elements.

Currently, an archaeological crew is randomly digging in a small section of the park. When they are finished, Parrish will match his findings with theirs to determine whether his techniques can predict the location of the hut remains.

Periodic mass extinctions at random

Gazing into the rock and fossil record, some geologists and paleontologists have found various periodicities to the mass extinctions that punctuate the earth's history. These extinctions wiped out 50 percent to 95 percent of the species living at the time, and they seem to repeat with an interval of 26 million to 30 million years. To explain the apparent pattern, scientists have invoked cyclic meteor showers, galactic rotation and other periodic events. But more recently, paleontologist Steven Stanley of Johns Hopkins University in Baltimore theorized that *random* catastrophic events could generate periodic mass extinctions.

Michael L. McKinney of the University of Tennessee in Knoxville now reports that computer models support Stanley's theory. McKinney's model simulates the diversity of species through time, and into the model he incorporates a random series of environmental upheavals.

Scientists have compiled a long list of events — such as comet impacts, rises in sea level and massive volcanic eruptions — that could individually stimulate extinctions. Since these events are often unrelated to each other, says McKinney, it is safe to assume that the total list of catastrophic events would form a random pattern.

As expected, McKinney found that a single event drastically reduces the number of different species. But following this first event, the system is temporarily "immune" to random cataclysms. According to McKinney, the species that survive a mass extinction are particularly hardy and are "resistant" to subsequent random changes. Moreover, after an extinction, there are simply fewer species left to die out.

"Therefore," he says, "until many species have evolved, including extinction-'prone' types, any intervening catastrophes would have little effect." After each extinction, the biological community requires a distinct recovery period before it is again ready to go out with a bang.

Environment

Last stage of Love Canal cleanup

Ten years ago, groundwater contaminated with dioxin and other toxins from the Love Canal chemical-disposal site seeped into the basements of Niagara Falls, N.Y., homes and brought the hazards of poorly managed industrial wastes to the national consciousness. Now the Environmental Protection Agency (EPA) has decided how to go about its final phase of the Love Canal cleanup.

The agency has announced that it plans to incinerate contaminated sediments dredged from Love Canal sewers and creeks and then to deposit the nontoxic residue at the Love Canal site. According to J. Winston Porter, EPA's assistant administrator for solid waste and emergency response, about 35,000 cubic yards of sediment will probably be treated, making this the largest-scale application ever of the "thermal destruction" technique.

EPA estimates that the program will take about five years and will cost $26 million to $31 million. Federal and state officials have already spent about $200 million for the Love Canal cleanup and for the relocation of about 1,000 families that had been living in the area.

EPA had proposed earlier to burn only a portion of the contaminated soils and to store the rest at the site in a 25-foot-high facility the size of three football fields. But engineering problems, coupled with strong lobbying efforts from environmental and other groups, persuaded EPA officials to alter their plans.

Porter says that a fenced area enclosing 20 to 30 acres around the disposal site will probably remain uninhabitable for the foreseeable future. "But outside that immediate contained area," he says, "we're certainly hopeful that people can eventually live there." New York state will decide on the habitability of this region next year.

Searching for the condors' next home

Now that scientists have captured all of the wild California condors, in hopes that the endangered birds will prosper and multiply in captivity (SN: 4/25/87, p.263), some researchers are turning their attention toward the habitat to which the condors may someday return. Geographers Frank Davis and Joseph Scepan of the University of California at Santa Barbara and Linda L. Blum of the National Audubon Society, who is working in the U.S. Fish and Wildlife Service's Ventura, Calif., office, are developing a habitat database that may help them understand the environmental factors important to the species' survival in the wild.

Using a computerized mapping system, the researchers are able to search for relationships between the 15-year-old record of condor sightings and environmental variables such as terrain, vegetation and land use. Davis argues that instead of releasing the condors where the last wild ones were found — as was once proposed — the computer system, suitably updated with changes in land use, could be used to determine the best spots for the condors' return to the wild. Land-use changes are particularly important to the birds' ability to forage; cow- and game-containing rangeland in parts of California is being converted — at a rate as high as 21,000 acres per year — to irrigated agricultural and residential property, according to the researchers. Their database may also provide environmental clues to the birds' decline.

Davis says that no one had tried before to systematically link changes in distribution of the past 15,000 condor sightings with geographic and ecological information because the ability to display that large amount of data geographically had been crude at best. But with the advances in computer mapping in the last decade, he says, this and many other applications are becoming possible.