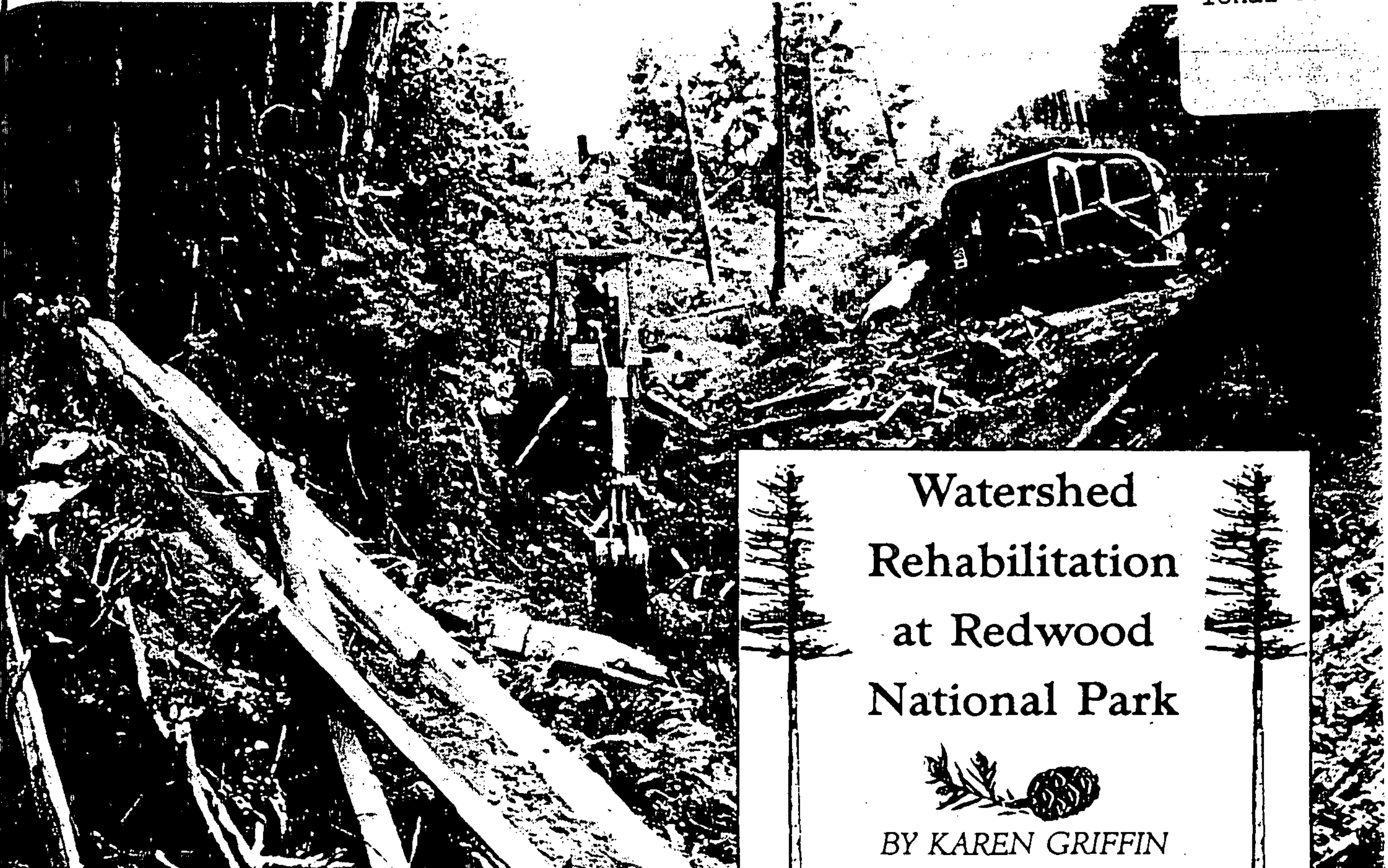


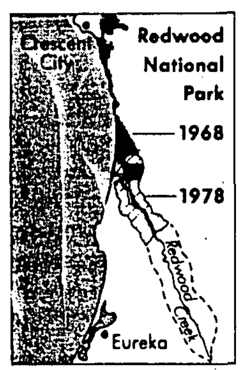
Watershed Rehabilitation at Redwood National Park

BY KAREN GRIFFIN

SINCE the time when dinosaurs roamed the planet, redwood forests have thrived in environments such as those now found along California's north coast. Recently, however, logging and other land uses have drastically transformed these lands. Old-growth redwood forest ecosystems have been altered to the point that there are serious concerns they can again support a redwood forest community as complex and naturally diverse as those that were cut for lumber. Left to its own devices, deforested and eroding land should slowly recover, but not to its former state or stable condition, at least not during our children's or their children's lifetimes. At Redwood National Park an effort of unprecedented scale is taking place, designed to give nature a head start in restoring logged land. Lessons learned during this restoration program could be useful to those interested in helping to heal other wounded, but still living, lands.

Redwood National Park, established in 1968, originally incorporated 58,000 acres of old-growth coastal redwood forest and associated streams and seashores. Primeval redwood groves are found along the coastal strip and streamside alluvial flats in the lower one-third of the Redwood Creek basin. In hindsight, what the 1968 park design lacked was a watershed perspective. Even though the groves of the world's tallest trees were protected from being logged, they weren't protected from the effects of logging upstream.

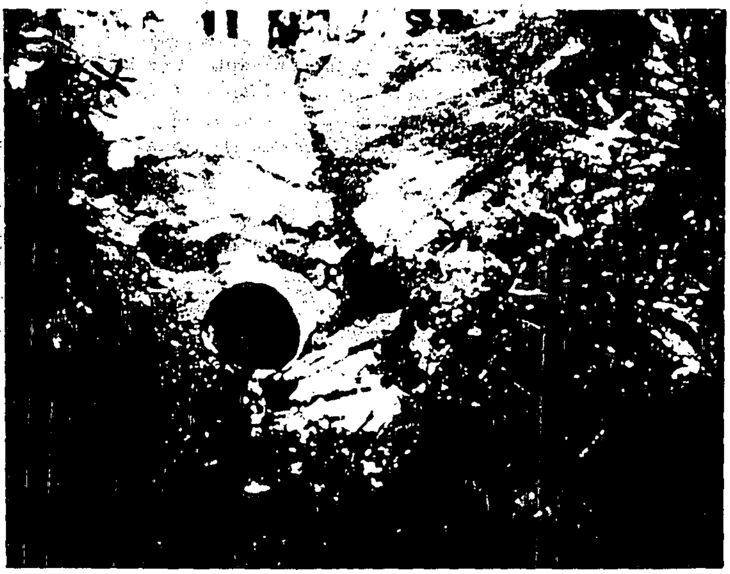
Adverse timber harvest impacts are magnified by the setting. The park's proximity to the boundaries of three crustal plates has resulted in myriad faults and active uplifting. Bedrock is composed of soft, fine-grained, marine sedimentary rocks, often sheared beyond recognition by tectonic processes. The area receives 80 to 100 inches of rain annually, mostly during intense winter storms. Erosion rates are naturally high. Over geologic time, a dynamic equilibrium was maintained between uplift and erosion rates. Streams evolved to store and transport sediment loads carried to them. The redwood-forest biological community thrived in this environment. ►



Karen Griffin is a physical-science technician in the watershed rehabilitation program at Redwood National Park in Northern California. The worst thing I've heard anyone say about the mammoth restoration efforts going on there was from one fellow who groused, "What the Feds are doing is proving that if they spend enough money then, by God, they can do restoration." I suspect he may have had a case of budgetary jealousy. The backhoe in the photo above is from a 10-year-old project. Nowadays, they have been replaced by giant excavators with buckets big enough to scoop up a Volkswagen bug. I think the Park Service is also revising for all of us the old adage about what an ounce of prevention is worth — in hilly terrain with heavy rainfall, it is worth tons of cure.
—Richard Nilsen

Griffin K. Spring 1990.

Main HR Files



Restoration before, during, and after:
A logging road and culvert (left) is removed (below). The same site (right) three years after road removal. The crews at Redwood National Park make an interesting distinction — they refer to all their work as rehabilitation, and leave the "restoration" to Mother Nature.

But just outside park boundaries, this long-standing, natural equilibrium was decisively tipped in favor of erosion. Earthmovers cut logging roads to get at valuable trees. Soils and hillslope drainages were disrupted as bulldozers constructed earthen mounds upon which loggers dropped brittle redwood trees. Logs were mostly dragged down-slope by tractors to loading areas, but if slopes were too steep for bulldozers, logs were dragged by cable to hilltop areas where log trucks were loaded for trips to sawmills. Steep, mountainous areas devoid of vegetative cover lay bare and unprotected against intense rainfall. In critical places 10 to 20 inches of rich topsoil, the active biotic layer, were flushed away down gullies. During major storms, water, mud, and logging debris spewed down drainages too small to handle the newly diverted runoff. Fill that had been pushed into streams to build roads washed out. The frequency of landslides and earthflows accelerated dramatically throughout the basin.

Downstream, in the park, giant redwoods toppled as sediment accumulated and floodwaters undercut stream banks. Fish spawning gravels were buried under sediment and summer water temperatures climbed, while the cutting of marketable timber continued to threaten park resources. Following a hotly contested conservation battle, the Congress enacted legislation, signed into law by President Jimmy Carter in 1978, to expand the park by 48,000 acres. National Park Service management policies typically dictate that parklands be preserved in their present state for future generations. At Redwood, however, Congress authorized the National Park Service to rehabilitate the more than 36,000 acres of clear-cuts added to the park.

Behind park expansion was the conservation community's enlightened philosophy of looking at an entire watershed's dynamics, from ridgetop to ridgetop and from headwaters to the ocean. Reaching the goal of preserving the entire watershed fell short of the desired ideal. Political and economic constraints at the time made it impossible to include the upper two-thirds of the basin. Today, logging continues in the upper basin while the park monitors impacts on downstream park resources.

A watershed rehabilitation program was undertaken on the lands added to the park. Unlike the sites of most restoration efforts taking place today, this large tract of land is held by a single landowner (the public), without competing goals or multiple consumptive uses. The park's watershed rehabilitation team is made up of wildlife biologists, geologists, hydrologists, botanists, and archaeologists. When the program first started in 1977, state-of-the-art watershed rehabilitation consisted primarily of small-scale, labor-intensive techniques. Many of the check-dams, wooden terraces, flumes, and wattles installed in 1978 and 1979 are functioning today. Some washed out during the first big storm because of design failures or because they were located in remote areas and could not be routinely serviced. Although these structures are effective in slowing erosion, they are not designed to remove the massive potential sediment sources still perched on hillsides.

The sheer volume of soil and debris left from the logging called for earth-moving strategies that far surpassed anything attainable by a manual labor force. Some environmentalists cringed, but bulldozers and excavators which had created the mess in the first place were called back to clean it up. Studies comparing heavy-equipment costs versus labor-intensive treatments fueled a major change in the watershed rehabilitation program. There was a shift towards using heavy equipment to more completely excavate and reshape soil removed from drainages and road fills.

Eleven years ago, when the restoration began, there were 300 miles of haul roads and 3,500 miles of skid trails criss-crossing drainages. About half of those miles have been rehabilitated. Areas have been surveyed to determine which roads have failed and to prioritize those posing the greatest erosion threats. Each year, new areas are tackled. The first step is to interpret historical aerial photos for past land-use practices, such as the age of roads and the size of the logged tracts. Drainages and gross geomorphic features are studied in the office before fieldwork begins. Original stream courses must be identified before a road is "put to bed" and natural drainage patterns re-established. After this scientific, left-brained, data-gathering phase comes a more right-brained, artistic prescription phase. A complete excavation must be intuitively visualized before the first tractor rolls. The lay of the land guides this process. Once the rehabilitation site prescription is complete, a survey crew measures dimensions to calculate how many cubic yards must be moved. Work areas are laid out using stakes and flags.

During the dry summer season, bulldozers, hydraulic excavators, and dump trucks move earth until the physical landscape is once again in a stable configuration. Fill from the outboard edge of some road sections is stacked against the inboard cut-bank to completely recontour hillslopes. Topsoil is recovered from below the road fill and replaced on reconstructed hillslopes to help foster revegetation. Some road sections have seeps or springs that could saturate replaced fill and cause failures. Here, earth must be exported to a ridge or other stable fill site.

The process of road construction is reversed during stream-channel excavation. Culverts are removed and thousands of cubic yards of fill that were pushed into the channels to make flat road surfaces are removed, until the original stumps and stream-bottom deposits are encountered. Less erosion-prone roads are decompacted by bulldozers equipped with hydraulically operated, giant ripper teeth. Drains are placed every 100 feet to take water out of the former roadbed. After the heavy equipment moves out, hand crews complete the work. Bare earth surfaces are blanketed with straw mulch, or in some cases with compost. Native conifer seedlings are then planted.

Sites found falling apart in the winter rains, and reshaped by heavy earthmovers the following summer, are covered with a lush green mantle of nitrogen-fixing alder and wildflowers. The results of this work give hope that nature can quickly heal wounded landscapes if unimpeded by excessive erosion and repeated exploitation. Watershed rehabilitation is expensive. And it takes many human lifetimes for an old-growth forest to regrow and mature. Successful restoration of decimated lands should not be used as a justification for further destruction on this scale. Restoration should teach us to appreciate the land's complexity and the importance of good stewardship as a more effective management strategy for the future. ■

A redwood forest ecosystem. The vegetation is lush right to the high-water line, and the forest canopy provides shade to keep the stream cool enough in summer so that small salmon can thrive.

Each summer, a field seminar on watershed rehabilitation is presented at Redwood National Park in cooperation with Humboldt State University. Also, a number of park-published technical reports evaluate watershed rehabilitation progress and related research and monitoring programs. Many are available upon request. For more information, contact: Superintendent, Redwood National Park, 1111 Second Street, Crescent City, California, or telephone 707/464-6101.