

Erosion From Burned Watersheds in San Bernardino National Forest¹

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In September of 1979 a series of fires in the mountains above San Bernardino denuded about 3700 acres of valuable watershed. The Harrison Canyon watershed, within one of the burns, had not suffered a major fire since 1953. More than 90% of its area burned in the Shadow Branch 3 fire. The dominant vegetation was mature chamise with scattered pockets of scrub live oak. Mild Santa Ana conditions existed at the time of fire, resulting in an intensive burn.

The watershed drains into a debris basin operated and maintained by the San Bernardino County Flood Control District. The basin was constructed in the mid-1940's, and was neither designed nor intended to protect an urban area. The area below Harrison Canyon and the debris basin was developed in the early 1960's over the objections of the Flood Control District. Hampshire Avenue was to function as a flood channel carrying overflow from the basin to the East Twin Creek flood channel. Harrison Basin had never spilled in its 35 years of operation.

The development below the basin was typical urban residential, including an elementary school. More homes were located above the basin, adjacent to a gorge cut by the intermittent stream draining Harrison Canyon.

Following the fire, an interdisciplinary survey team reviewed the burned area. The team was an interagency effort with the Forest Service, California Department of Forestry, Soil Conservation Service, County Flood Control District, and the City of San Bernardino participating. Because of the location of the fire, a decision was made to seed the burn with coated Wimmera rye grass applied at a rate of 16 pounds per acre (8 pounds per acre of live seed). Seed was sowed by helicopter in early December.

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Abstract: Following a brush fire in September of 1979, a residential area of San Bernardino was subjected to a series of flood events brought on by intense rains from subtropical storms. A majority of the debris from the small watershed above the residential area came from alluvium probably stored in the channel for hundreds of years. Erosion from the valley slopes was probably insignificant compared to channel scour. The interagency cooperation during burn rehabilitation and flood-fighting is discussed, as is the current status of the damaged homes and those homes still threatened by future flood events.

Fall and early winter were very dry in Southern California, with less than one-half inch of rain. The first major storm was in mid-January when nearly 7.5 inches of rain fell over an eight-day period. Maximum one-day precipitation was 2.28 inches. Runoff filled the Harrison Canyon debris basin and sent debris down Hampshire Avenue. The street was filled, debris was deposited on lawns, and some vehicles were slightly damaged, but no homes were involved.

Before the debris basin could be cleaned out, a second intense storm struck, dropping three inches the first day and three and a half inches the second day. Since the debris basin was already filled, all of the runoff was deposited in Hampshire Avenue, damaging about 30 homes on Hampshire and Golden Avenues. Sediment was about eight feet deep in Hampshire Avenue. A massive cleanup effort was organized, using the resources of Federal, State, and local agencies, plus hundreds of volunteers.

As residents were cleaning their neighborhood and preparing to make repairs to their homes, a third storm struck in mid-February, depositing nearly 13 inches of rain over a nine-day period and again filling and overflowing the debris basin. A total of 32 homes along Hampshire and Golden Avenues were now involved in the debris flows. Another massive cleanup effort was mounted to clear the debris. Some of the homes were abandoned, and a sandbag wall was constructed parallel to Hampshire to protect the homes should another flood occur.

A fourth major storm in early March again filled the debris basin and damaged additional homes to bring the total number damaged to 41. The sandbag wall was completely buried. At this time, all homes were abandoned because of the recurring floods and the extensive structural damage suffered by many of them.

By the time the third storm struck, the burn rehab team had been reactivated to pursue courses of action within the burned watershed. Again, it was a multi-agency effort of the Forest Service, Soil Conservation Service, State of California, County of San Bernardino, City of San Bernardino, and the U.S. Army Corps of Engineers. Efforts

were concentrated on stopping erosion with gully plugs and sandbag wall using a soil-cement mixture to act as streambank protection. Another effort at seeding the watershed was made. All of the remedial treatments were recognized as stop-gap measures pending major structural improvements.

The gully plugs and sandbag wall were constructed using contributed and volunteer labor. The response of the community was overwhelming. Literally hundreds of volunteers showed up to help in the canyon and along Hampshire and Golden Avenues.

At the height of activity, 200 people, YACC, CCC, Inmate Crews, CETA and volunteers, were working in the canyon. Their equipment included seven cement mixers, one dozer, two jeeps, and one fire engine. BLM provided portable toilet facilities. Cement was delivered in bulk and stored in an underground facility built by the city. The cement was removed with a front-end loader, put into trailers, and hauled by jeep to the crews working in the canyon. Rebar was delivered to the city yards where it was cut to length, then delivered to the job site.

All in all, the wall cost about \$500,000. Funds were provided by Federal, County, and City agencies. The State provided conservation camp crews and California Conservation Corps crews. No estimate was made of the value of the volunteer labor force.

No accurate records exist of the volume of sediment produced from Harrison Canyon, but estimates place the figure between 200,000 and 250,000 cubic yards, and all of this from a watershed of less than 400 acres (320,000 cubic yards per square mile).

During the burn rehabilitation survey in September, we had estimated a sediment yield of about 36,000 cubic yards from Harrison Canyon (65,000 cubic yards per square mile). The actual yield was about five times greater than anticipated.

Most of the sediment that came from the watershed was alluvium stored in the canyon bottom. There is now extensive rilling and gullying on the valley sides, but the incised channel has grown from six feet deep and ten feet wide to over 35 feet deep in places, and up to 125 feet wide. The alluvium is probably on the order of several hundred years old. It is poorly consolidated and readily collapsed during runoff events. In fact, it collapsed when there was no runoff.

The remedial treatments constructed in the canyon survived the remainder of the winter, but the anticipated major structural improvements failed to materialize. The Federal Emergency Management Agency purchased the homes on Hampshire Avenue on the condition the seller would deed them over to the city and the city would remove the homes and create a floodway. The city is in the process of having the homes removed now.

Most of the public's attention was focused on the homes along Hampshire Avenue, but the residents above the debris basin also suffered. The only road providing access on the west side of the canyon was washed out during the third event, while people on the east side of the canyon progressively lost their landscaping, support for their driveways, and finally their driveways. At least two, and probably more, homes are in danger of suffering structural damage as the gorge gradually widens. While the residents along Hampshire have at least been compensated for their losses, those above the debris basin are on their own.

The real lesson to be learned here is not that debris flows follow fire. The fire-flood sequence in chaparral has been recognized for years. The problem is the urban/wildland interface and ignorance of basic physical processes. By allowing people to develop floodplains, the government is implying it is safe, when in fact it is not. If there had been no homes below Harrison Canyon, damage would have been minimal. Some orange groves and a road might have been damaged or destroyed, and someone's income disrupted, but the human suffering and total dollar damage would have been insignificant compared to what transpired. Floods are only one part of the interface problem. That was brought home very forcefully last November when the Panorama fire destroyed 284 homes. Most of them were located in a typical urban setting, not scattered through the chaparral. That fire has stimulated renewed interest in the greenbelt concept. Whether that concept will be pursued and become an actuality remains to be seen.

Interestingly, one of the first things we faced following the Panorama fire was a proposal to develop an orange grove and construct homes immediately adjacent to National Forest lands. These homes would be subject to both fire and flood should they be built. In fact, the Sycamore fire of last November scorched some of the trees in the grove. The final decision on the fate of this new development has not yet been made.