

and were accompanied by increases in the concentrations of major ions (K^+ , Ca^{2+} , Mg^{2+}). This indicates that the upper soil horizon could be equally important in providing nutrients/solutes to the ecosystem especially for sites that have low weathering rates. The sources of nutrients in the upper horizon are mainly leached from canopies and forest litter. The concentrations of K^+ , Ca^{2+} , Mg^{2+} and Na^+ at BTEW were generally lower than those reported for catchments of different lithologies.

Total ionic contents were higher in the stormflow samples than in the baseflow: 181.4 vs. 162.3 $\mu\text{eq/l}$ in C1 and 189.9 vs. 150.4 $\mu\text{eq/l}$ in C2. This showed that stormflow components were more dominant than baseflow for delivering ions into the streams. The sum of cations exceeded the anions during both baseflow and stormflow conditions. The anionic deficits vary from 10.3 to 37.4% and most probably are due to unanalyzed organic compounds. In both catchments, the baseflow was dominated by Mg^{2+} with slight differences in the cationic sequence as follows:

C1: $Mg^{2+} > Ca^{2+} > K^+ > Na^+ > NH_4^+ > H^+$;
C2: $Mg^{2+} > K^+ > Ca^{2+} > Na^+ > NH_4^+ > H^+$

With Mg^{2+} , Ca^{2+} and K^+ dominating the cations, the weathering sources could be attributed to micas and plagioclase which are common minerals in metamorphic rocks. The sequence shifted slightly during storms with K^+ becoming more dominant than Ca^{2+} , and H^+ took over from NH_4^+ . K is a major element in plant tissues and could be easily leached from the organic horizon. The two catchments shared similar anionic sequences with HCO_3^- dominating the baseflow and NO_3^- the stormflow as follows:

Baseflow: $HCO_3^- > NO_3^- > Cl^- > SO_4^{2-} > PO_4^{3-}$;
Stormflow: $NO_3^- > HCO_3^- > Cl^- > SO_4^{2-} > PO_4^{3-}$

HCO_3^- is the by-product of silicate weathering from the deeper soil layer whereas NO_3^- was entrained from the upper soil during storms.

It is evident that stream chemistry is influenced by the paths by which water travels to the stream channel. The slower path at the deeper soil profile carries ions from the weathering front whereas the more rapid flow is dominated by ions derived from organic matter in the upper soil horizon.

Hydrologic Effects of Forest Harvest in Northwestern California, USA

Robert Ziemer

USDA Forest Service, 1700 Bayview Drive, CA 95521
Arcata, USA

Tel: +01-707-825-2936, FAX: +01-707-825-2901, Email:
rrz7001@axe.humboldt.edu

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Streamflow, suspended sediment, and bedload have been monitored since 1962 in the 473-ha North Fork and the 424-ha South Fork of Caspar Creek. These watersheds are about 7 km from the Pacific Ocean, on the Jackson Demonstration State Forest, 10 km south of Fort Bragg, California, USA. About 35% of the slopes are less than 17° and 7% are steeper than 35° . Elevation ranges from 37 to 320 m. The soils of the basins are well-drained clay-loams, 1 to 2 m in depth, and are derived from Franciscan graywacke sandstone and weathered, coarse-grained shale of Cretaceous Age. About 90% of the average annual precipitation of 1200 mm falls from October through April. Snow is rare and rainfall intensities are low.

Prior to treatment, the watersheds supported a 90-year-old second-growth forest composed of coast redwood (*Sequoia sempervirens* (D. Don) Endl.), Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), and grand fir (*Abies grandis* (Dougl. ex D. Don) Lindl.). From 1963 to 1967, both forested watersheds were measured in an "untreated" condition. In 1967, logging roads were built in the South Fork. From 1971 through 1973, about 65% of the stand volume was selectively cut from the South Fork watershed, while the North Fork remained as an untreated control. Logging began in the North Fork in 1985 and ended in 1991. The timber volume removed from the North Fork watershed approximated that cut from the South Fork in the early 1970s, but clearcutting rather than selective harvest was used. The size of clearcut blocks in the North Fork ranged from 9 to 60 ha and occupied 35% to 100% of individual tributaries.

Logging-induced changes in the South Fork's peak streamflow were greatest for the first storms following lengthy dry periods. There was no significant change in the largest peakflows (>10-year return interval) after selectively logging the South Fork. Peak streamflows following clearcut logging in the North Fork behaved similarly. There was a mean increase of 17% for the class of peakflows with return intervals >0.45-year (>0.004 $\text{m}^3 \text{s}^{-1} \text{ha}^{-1}$). Annual runoff in the South Fork increased between 9% and 30% for the first 5 years after selective logging. This is equivalent to an average increase in water yield of 900 $\text{m}^3 \text{ha}^{-1}$. The increased annual water yield slowly returned to prelogging levels over the following 15 years. After

clearcut logging in the North Fork, the annual increase in water yield varied from 9% to 58% in the first 7 years, with an average increase of 945 m³ ha⁻¹. This result is similar to that observed following the removal of about the same volume of trees from the South Fork. However, 7 years after clearcutting, there is still no trend of return to prelogging levels.

Selection logging of the South Fork increased summer lowflow by about 0.3 l-s-1-km-2 for each of the first 3 years after logging, an increase of about 80% from that predicted by the pre-logging regression. This increased summer flow declined with regrowth of the vegetation so that within 7 to 8 years after logging, summer lowflow had returned to pre-logging levels. Clearcut logging about 50% of the North Fork produced minimum summer flows averaging 0.4 l-s-1-km-2 (146%) larger than predicted. The increased flow was greatest (250%) during the first 2 years after clearcutting, but 7 years after cutting, summer flow was still 112% above prelogging levels.

8.04.00 Natural disasters

Krottenthaler Graben Landslide - Disaster Documentation - An Approach To A Solution

Günther Bunza, Göttle, Albert

Bayerisches Landesamt für Wasserwirtschaft,
Lazarettstrasse 67 (Postfach 19 02 41), 80602
München, Germany

Tel: (089) 92 14-01, FAX: (089) 92 14-14 35, Email:
guenther.bunza@lfw.bayern.de

Keywords: Landslide case history; Ground water; Preventive measures

The "Krottenthaler Graben landslide" near Geitau, municipality of Bayrischzell, county Miesbach happened on 21 November 1996 at the north - exposed slope of the "Miesing massif" (1,861 m above sea level) orographically situated on the right of the so-called "Krottenthaler Graben". The main fracture area of the landslide lies at an altitude of 1,370 m above sea level, its lowest level at 965 m. The loose masses of a cone-shaped debris slope partly stocked with forest and dwarf mountain-pines were affected by these movements. In all, some two million cubic metres of material covering an area of approx. 50 acres started to move. Whereas between 1,030 m and 1,100 m above sea level the highly piled up masses blocked the Krottenthaler Graben for a short term, eastern parts of the masses were moving downwards the slope in a debris flow

manner (see also sketch referring to local and geological situation).

Triggering factors for the slope movement were:

- the saturated debris masses resulting from heavy summer rainfall
- the movement of previously occurring wet snow-falls
- the inflow of karst water and the damming up of water by aquiclude strata underneath.

In November and December 1996 the landslide was still very active, meanwhile it became stabilised. The water of the Krottenthaler Graben discharges without problems below the debris masses. A reactivation of the slope movement seems only possible when the prevalent coarse-grained material is highly soaked. Extreme conditions can, however, lead to the damming up of the Krottenthaler Graben, which may end in a breakthrough of debris flow extending to the valley floor, thus endangering the settlement at the foot of the debris cone and the trunk road B 307.

As a preventive measure the office for regional water management in Rosenheim arranged for the clearing of the retention basins downstream of existing torrent defence works and gravel traps in order to dispose of some 40,000 cubic metres of receiving volume. The costs of these measures amounted to about one million DM.

As further preventive measures the Bavarian State Office for Water Management (LfW) and the State Office for Geology (GLA) prepared an investigation and observation concept. The relevant investigations will be based on previously performed laser-scan air photography in 1998.

Urban growth and geodynamic processes in the high jungle of Peru

Raol C. Carreno, Susana Kalafatovich

Swiss Federal Institute of Technology - Lausanne (EPFL),
DGC-Ecublens, CH-1015 Lausanne, Switzerland
FAX: + 41 - 21 - 693 4153, Email: raul.carreno@epfl.ch

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The transition area between the andean mountain range and the amazonian plain of Peru is known as forest brow or high forest (*Ceja de selva o Selva alta*). This region is characterized by its relatively narrow valleys and their high slope. The soils plows not very stable and easily prone to erosion.

The climatic conditions and the abundance of humus favour the abundant vegetation and the high biological diversity.