ABSTRACT

TITLE:	Controls on Rockfall Production: Chalk Cliffs, Buena Vista, Colorado
AUTHOR(S):	Kean, Jason W.; Coe, Jeffrey A.; Smith, Joel B.; McCoy, Scott W.; Cox, K.D.; Kenny, Dr. Ray
PRESENTED AT:	8th Annual Natural & Behavioral Sciences Undergraduate Research Symposium Program, Fort Lewis College, 2013

ABSTRACT: Chalk Cliffs, located 13 km southwest of Buena Vista, Colorado, are highly weathered, sparsely vegetated cliffs of quartz monzonite. Rockfall from the cliffs accumulates in channels below and provides material for frequent debris flows (~3 per year). The purpose of this study was to quantify the rates and controls on rockfall as part of a broader effort to understand debris-flow processes at Chalk Cliffs. Rockfall sediment accumulation and accompanying meteorological conditions were continuously monitored from November, 2011 to May, 2012. Data include measurements of: 1) air temperature; 2) rock temperature on a south-facing bedrock slope at 9 depths between 0 and 42 cm; 3) water volume from snow melt and rainfall; 4) wind speed; and 5) rockfall accumulation behind a 246-cm wide by 40-cm high fence. Daily rockfall volumes are estimated by digitizing photographs (3 per day) of the rockfall deposits retained by the fence. These daily estimates of rockfall volume are constrained by more precise volume measurements made at three-month intervals by stereo photogrammetry and by weighing all the accumulated sediment (D50 = 2 cm). Over the course of the monitoring period 330 kg (0.12 m3) of sediment accumulated behind the fence. This volume of sediment corresponds to an average of 5 mm of surface erosion in the 22 m2 source area. Temperature measurements show that the mean air temperature during this time was slightly above freezing (1.5 degree C), and that only the top 5 cm of the rock frequently spent time in the frost-cracking window (-3 to -10 degree C). Daily observations of rockfall show that the sediment came in pulses coinciding primarily with times when moisture was available from melting snow and the near-surface rock temperature was in the frost-cracking window. Smaller finer-grained pulses of sediment were also added during days with high winds (gusts > ~10 m/s). It is hoped that continued monitoring will help constrain a rockfall generation model for the site, which can, in turn, be used to investigate the long-term interplay between sediment supply from rockfall and sediment export by debris flows at Chalk Cliffs.