SUPPLEMENTARY INFORMATION FIGURE CAPTIONS

Supplementary figure 1. (A) Distribution of slopes for Volcano Hill geomorphic surfaces. Slopes were created from a 10m digital elevation model (DEM). Symbols indicate the slope class for traps, dams and nail lines. [* trap; ^ dam; + nail line]

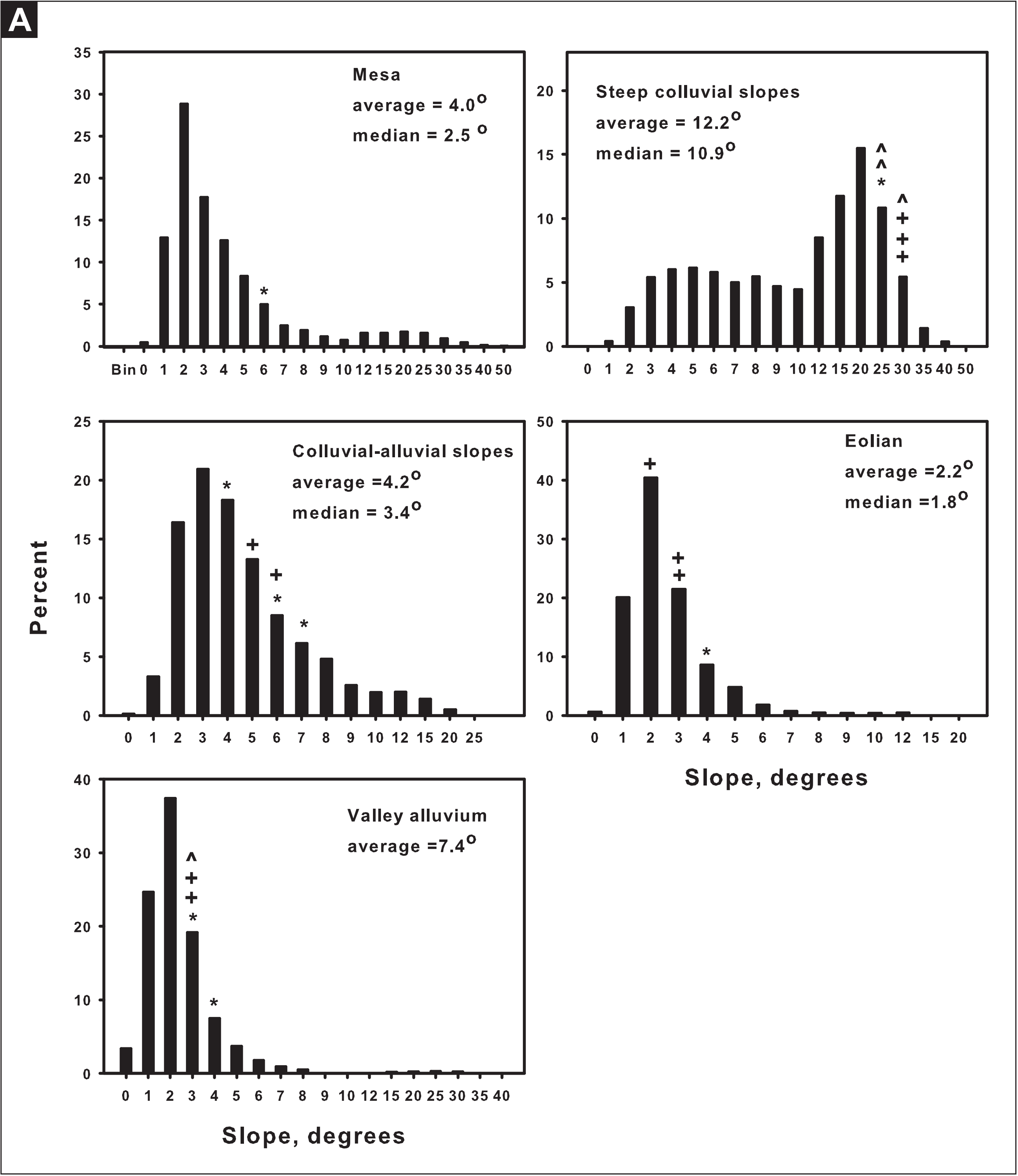
Supplementary figure 1. (B) Distribution of slopes for Arroyo Chavez geomorphic surfaces. Slopes were created from a 10m digital elevation model (DEM). Symbols indicate the slope class for traps, dams and nail lines. [* trap; ^ dam; + nail line]

Figure 2. Conceptual schematic of cascades. The percentages indicate the how much of the flux out of SRU passes through a cascade.

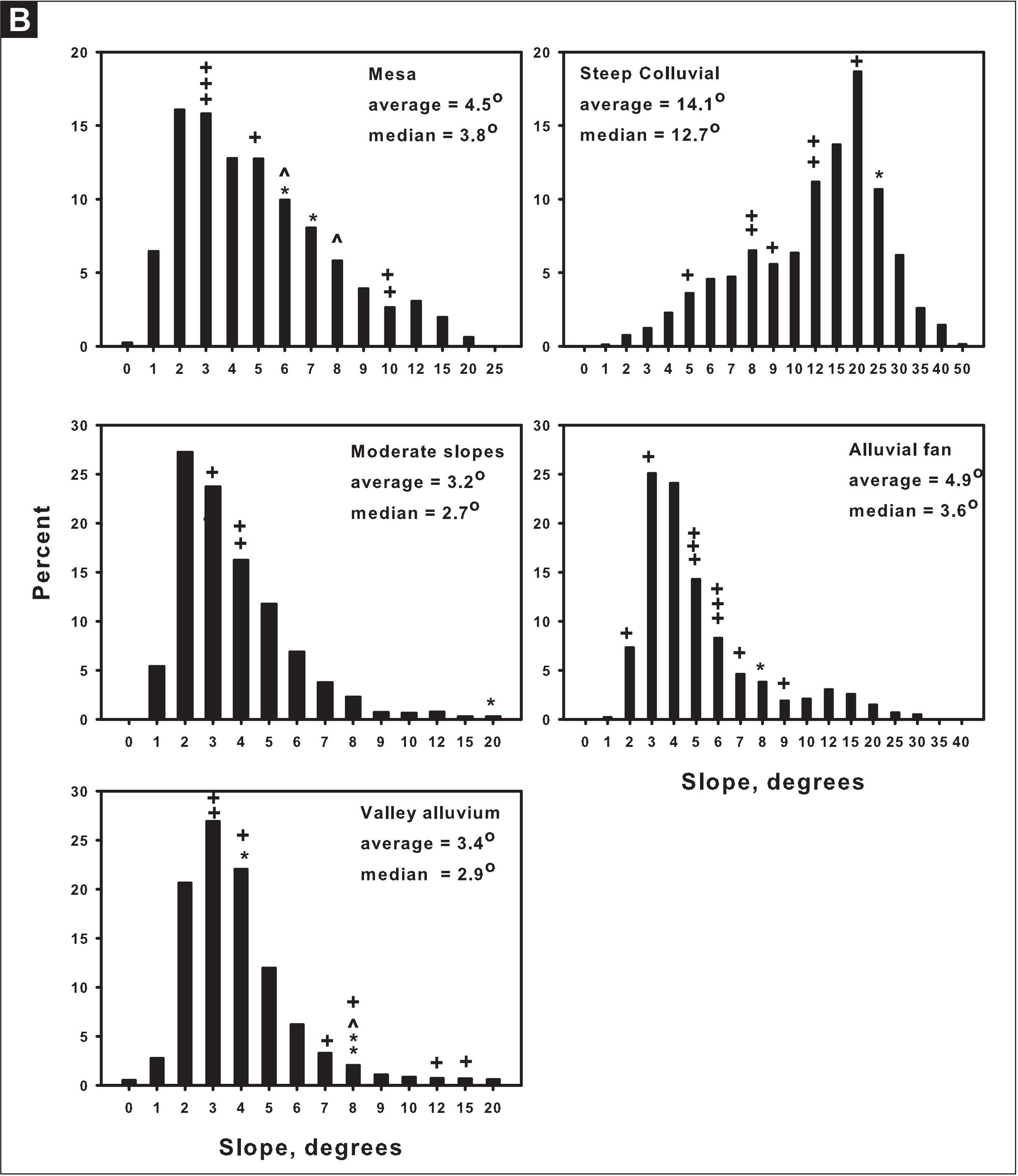
Supplementary figure 3. Average median grain size (D_{50}) and percent fines (silt and clay) for geomorphic surfaces, channel bed and banks, and fluvial samples for A) Volcano Hill Wash and B) Arroyo Chavez.

Supplementary figure 4. Infiltration versus runoff yield and infiltration versus sediment concentration for (A, B) Volcano Hill Wash and (C, D) Arroyo Chavez. Infiltration was measured with single-ring infiltrometers, explained in Supplementary Table 2. Data for each trap is shown in Supplementary Table 7A,B. In Arroyo Chavez, the t4 sediment trap was not used in the line of best fit shown in supplementary figure 3 C, D. [Note, the regression model was not significant for either watershed at $p = 0.05$].

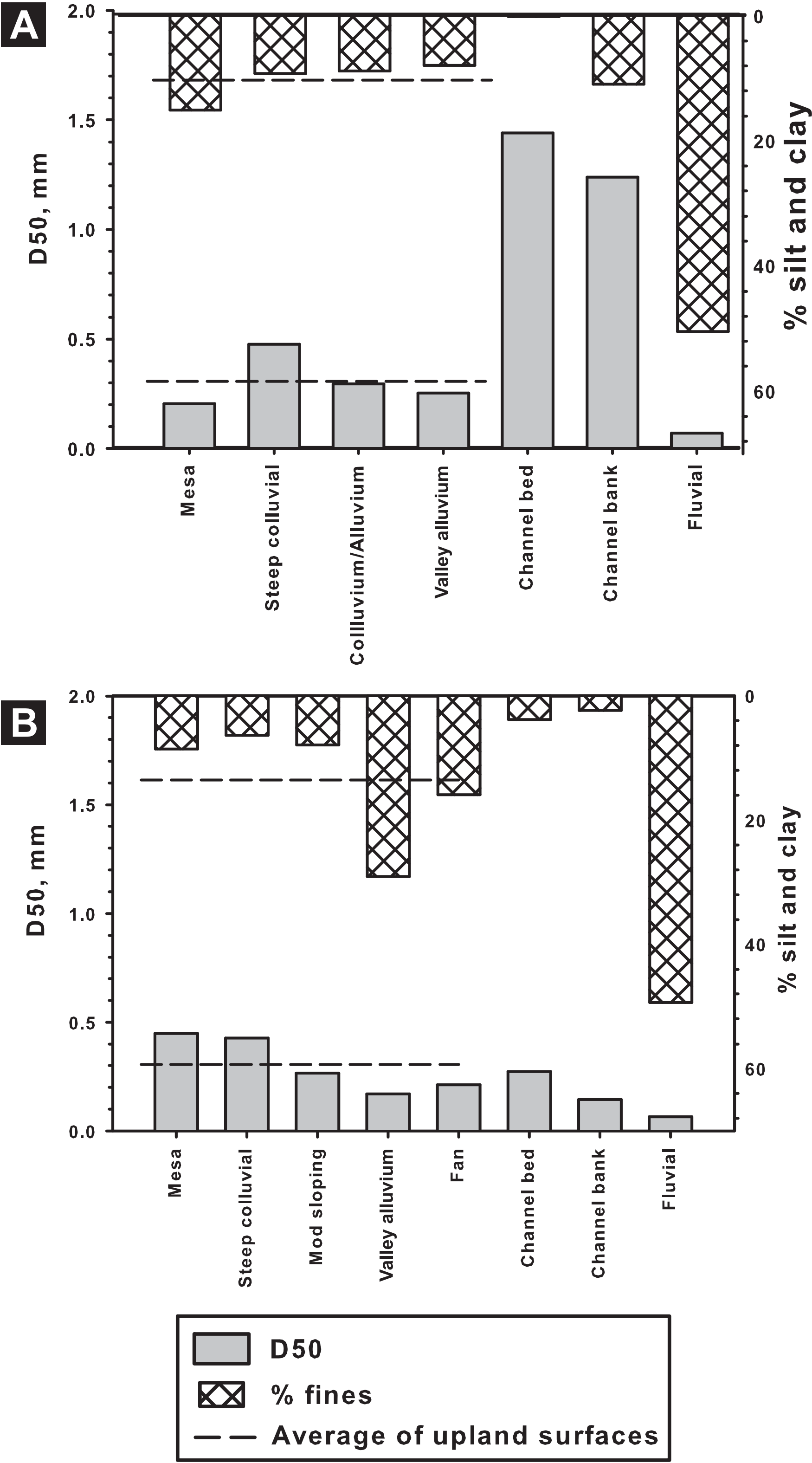
Supplementary figure 5. First order subbasins and intervening contributing areas constructed from GIS for: (A) Volcano Hill Wash and (B) Arroyo Chavez. Intervening contributing areas are between the first order basins and the next downstream stream order intersection.

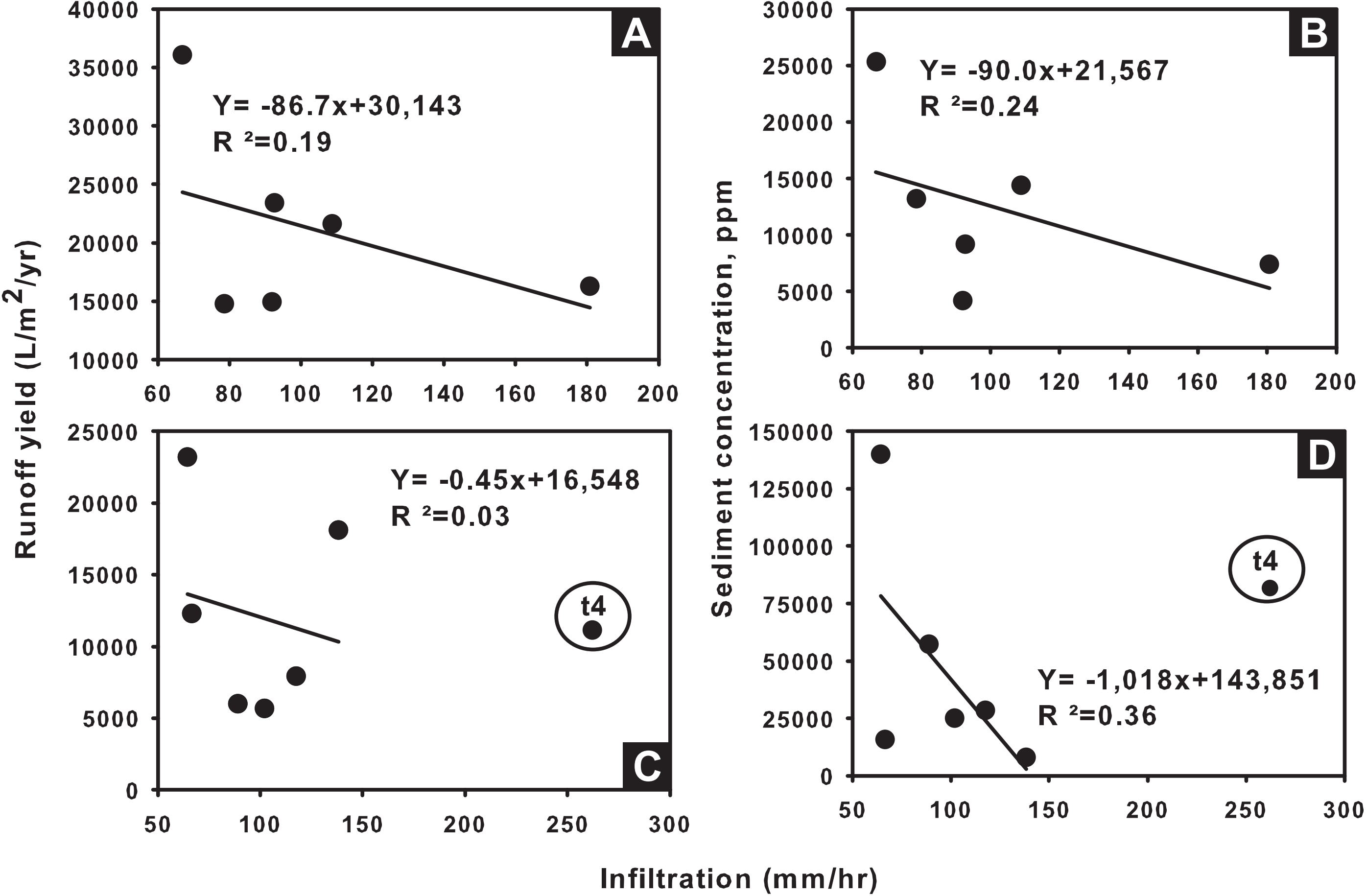


A
Mesa
average = 4.0°
median = 2.5 °
Steep colluvial slopes
average = 12.2°
median = 10.9°
Colluvial-alluvial slopes
average =4.2°
median = 3.4°
Eolian
average =2.2°
median =1.8°
Valley alluvium
average =7.4°
Percent
Slope, degrees
Bin

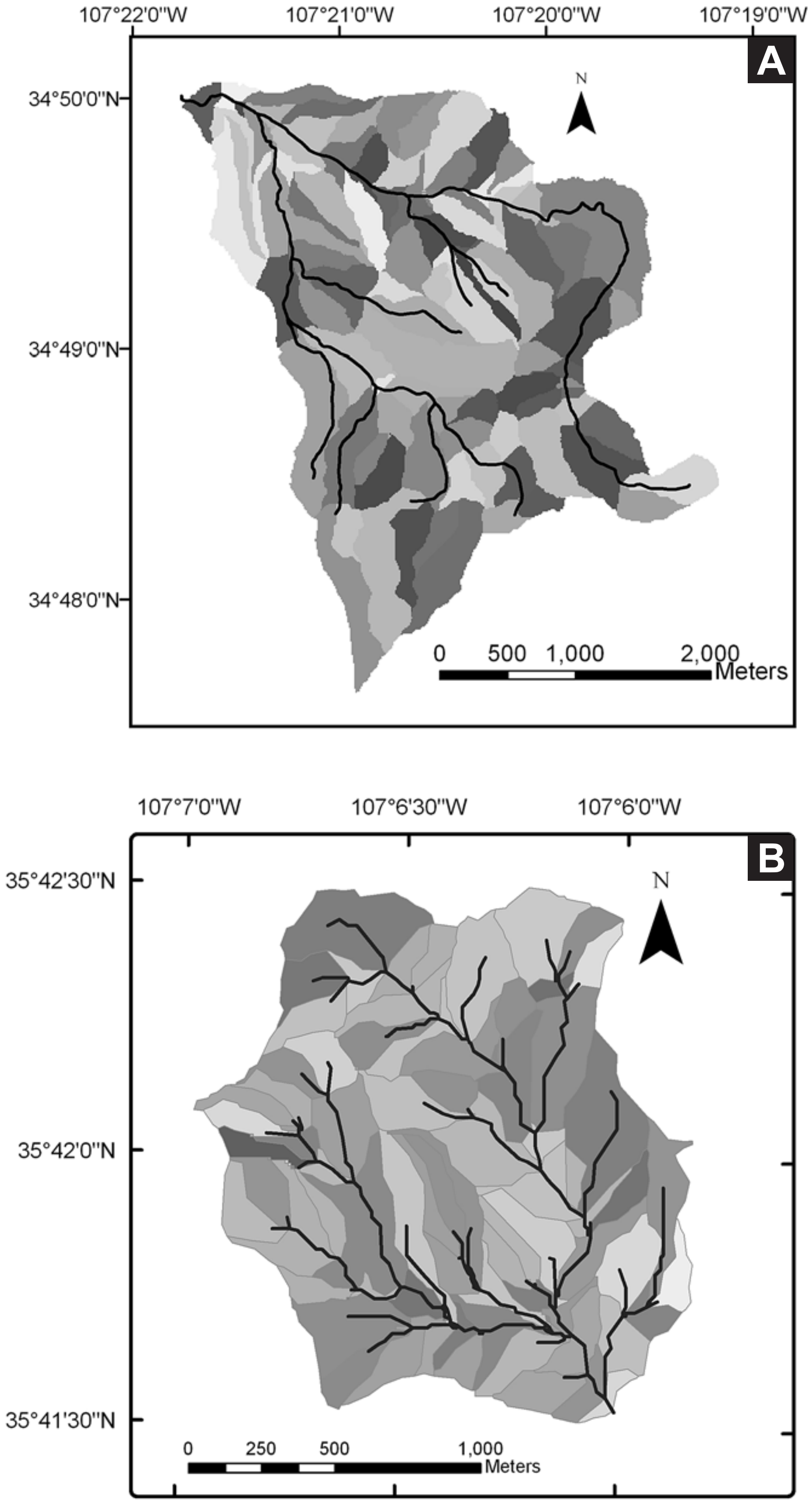

B
Mesa
average = 4.5°
median = 3.8°
Steep Colluvial
average = 14.1°
median = 12.7°
Moderate slopes
average = 3.2°
median = 2.7°
Alluvial fan
average = 4.9°
median = 3.6°
Valley alluvium
average = 3.4°
median = 2.9°
Percent
Slope, degrees


SRU 1
cascade B
70%
SRU 3
cascade A
30%
SRU 2


A
D50, mm
% silt and clay
2.0
1.5
1.0
0.5
0.0
0
20
40
60
Mesa
Steep colluvial
Collluvium/Alluvium
Valley alluvium
Channel bed
Channel bank
Fluvial
B
D50, mm
% silt and clay
2.0
1.5
1.0
0.5
0.0
0
20
40
60
Mesa
Steep colluvial
Mod sloping
Valley alluvium
Fan
Channel bed
Channel bank
Fluvial
D50
% fines
Average of upland surfaces



A
Y= -86.7x+30,143
R ²=0.19
B
Y= -90.0x+21,567
R ²=0.24
C
Y= -0.45x+16,548
R ²=0.03
t4
D
Y= -1,018x+143,851
R ²=0.36
t4
Runoff yield (L/m2/yr)
Sediment concentration, ppm
Infiltration (mm/hr)


107°22'0"W
107°21'0"W
107°20'0"W
107°19'0"W
A
N
34°50'0"N
34°49'0"N
34°48'0"N
0
500
1,000
2,000
Meters
107°7'0"W
107°6'30"W
107°6'0"W
B
N
35°42'30"N
35°42'0"N
35°41'30"N
0
250
500
1,000
Meters

SUPPLEMENTARY TABLE DR1. LITERATURE REVIEW ON SEDIMENT BUDGET STUDIES COMPLETED OVER A RANGE OF SPATIAL AND TEMPORAL SCALES WITH ERRORS REPORTED FOR EACH STUDY.

Continent	Spatial scales	Time scales	Methods	Sediment budget errors cited in the literature on sediment methods and results. [The error is described in bold in parenthesis; nr = not reported]
North America (Leopold et al., 1966; Dietrich and Dunne, 1978; Trimble, 1983; Sutherland, 1991; Allmendinger et al., 2007) **South America** (Meade et al., 1990; Trauth et al., 2003) **Europe** (Macaire et al., 2002; Gruszowski et al., 2003; Belyaev et al., 2005; Evans and Warburton., 2005; Houben et al., 2006; Rommens et al., 2006; Van der Perk and Jetten, 2006) **Asia** (Schick and Lekach, 1993; Oguchi, 1997) **Africa** (Dunne, 1979; Sutherland and Bryan; 1991; Wijdenes, and Bryan, 2001; Walling et al., 2003; Garcin et al., 2005), **Australia** (Loughran et al., 1992; Brizga and Finlayson, 1994; Page et al., 1994; Wasson et al., 1998; Wallbrink et al., 2002) **Antarctica** (Pollard and DeConto, 2003)	**m^2** (Brunton and Bryan, 2000) **ha** (Sutherland, 1991; Wijdenes and Bryan, 2001; Wallbrink et al., 2002; Polyakov et al., 2004; Evans and Warburton., 2005; Hart and Schurger, 2005) **10 - 100's km^2** (Trimble, 1983; Oguchi, 1997; Slaymaker et al., 2003; Walling et al., 2003; Garcin et al., 2005) **>1,000 km^2** (Meade et al., 1990; Brizga and Finlayson, 1994; Houben et al., 2006)	**days** (Page et al., 1994; Springer et al. 2001; Van der Perk and Jetten, 2006) **months** (Sutherland and Bryan, 1991; Polyakov et al., 2004; Belyaev et al., 2005) **years** (Leopold et al., 1966; Schick and Lekach,1993; Gruszowski et al., 2003; Rovira et al., 2005) **centuries** (Trimble, 1983; Wasson et al., 1998) **millennia** (Oguchi, 1997; Macaire et al., 2002; Slaymaker et al., 2003; Houben et al., 2006; Rommens et al., 2006)	**field measurements** (Leopold et al., 1966; Sutherland and Bryan, 1991; Evans and Warburton, 2005; Rovira et al., 2005) **radionuclides** (Ritchie et al., 1974; Sutherland, 1991; Wallbrink et al., 2002; Walling et al., 2003) **multiple geochemical fingerprints** (Walling and Woodward, 1992; Nimz, 1998; Wasson et al., 2002; Gruszowski et al., 2003; Walling, 2005) **pond and lake sedimentation** (Foster et al., 1988; Erskine et al., 2002; Phippen and Wohl, 2003) **sediment cores** (Slaymaker et al., 2003; Belyaev et al., 2005; Houben et al., 2006; Rommens et al., 2006), **models** (Belyaev et al., 2005) **maps and photogrammetry** (Brizga and Finlayson, 1994; Wasson et al., 1998; Garcin et al., 2005)	Allmendingetr et al., 2007 **(50 to >100%)**; Belyaev et al., 2005) **(presented errors for ^{137}Cs ±17%)**; Brizga and Finlayson, 1994 **(nr)**; Brunton and Bryan, 2000 **(nr)**; Dietrich and Dunne, 1978 **(nr, except for measurements on hollows where uncertainty is plotted)**; Dunne, 1979 **(nr)**; Erskine et al., 2002 **(nr)**; Evans and Warburton., 2005)**(±4% to over ±1,000%)**; Foster et al., 1988 **(nr)**; Garcin et al., 2005) **(volume estimates ±10%);** Graf, 1987 **(±10% to ±50%)**; Gruszowski et al., 2003 **(nr)**; Houben et al., 2006 **(nr)**; Leopold et al., 1966 **(qualitative)**; Loughran et al., 1992 **(nr)**; Macaire et al., 2002 **(nr)**; Oguchi, 1997**(nr)**; Page et al., 1994 **(±10%)**; Phippen and Wohl, 2003) **(nr)**; Pollard and DeConto, 2003 **(nr)**; Polyakov et al., 2004 **(nr)**; Ritchie et al., 1974 **(nr)**; Rommens et al., 2006)**(<±1% to ±191%)**; Rovira et al., 2005) **(±15 to ±56%)**; Schick and Lekach,1993 **(overestimation of sediment loads in the first decade of study by a factor of 2 to 4)**; Slaymaker et al., 2003 **(nr)**; Springer et al. 2001**(nr)**; Sutherland and Bryan, 1991 **(sediment output 6% greater than inputs minus storage)**; Sutherland, 1991) **(statistical errors reported with respect to Cesium-137 activity in the samples but not for the sediment budget)**; Trauth et al., 2003 **(±10 to ±15%)**; Trimble,1983 **(nr)**; Van der Perk and Jetten, 2006**(nr)**; Wallbrink et al., 2002)**(± 10%, uncertainties in lab analysis is presented as one standard error)**; Walling and Woodward, 1992 **(nr)**; Walling et al., 2003 **(nr)**; Walling, 2005 **(10%)**; Wasson et al., 1998 **(±6 to ±76%)**; Wijdenes and Bryan, 2001 **(qualitative assessment of errors)**

SUPPLEMENTARY TABLE DR2. DATA-COLECTION METHODS USED IN QUANTIFYING THE SEDIMENT BUDGET FOR VOLCANO HILL WASH AND ARROYO CHAVEZ, 1995-98 [LOCATION OF COLLECTION DEVICES IS SHOWN IN FIGURES 4a,b]

Measurement Type	Design and Computation	Number installed in Volcano Hill Wash	Number installed in Arroyo Chavez	Reference
Channel erosion and deposition	Repeat surveys at monumented channel cross sections using a survey level or total station. One or more cross sections were monumented at a reach for a given stream order, but at selected locations it was only feasible to put in one cross section. Channel cross-sectional area is the area of the channel below the two highest points on the left and right bank. These highest points usually correspond to the elevation of the alluvial valley. Changes in cross-sectional area were determined as the difference between the resurvey and the original survey. Positive changes (increases in cross-sectional area) indicate erosion and negative differences indicate deposition. The change in cross-sectional area was averaged for each stream order as follows: $\overline{\mathrm{Xm}}_j = \left[\frac{\sum_{i=1}^{n}\left(\frac{\overline{\Delta \mathrm{XS}_1}}{ND}\right)*365}{\mathrm{n}}\right]$ Where $\overline{\mathrm{Xm}}$ = average change in cross-sectional area for stream order *j* (m^2/yr); $\overline{\Delta \mathrm{XS}_1}$ = average change in channel cross-sectional area for reach *i* (m^2); ND is the number of days between resurveys; n = total number of reaches for a given stream order. The average change in cross-sectional area for stream order j was converted to a mass by multiplying by the average sediment density for stream order *j* (kg/m^3).	50	36	Leopold et al., 1966; Harrelson et al., 1994
Channel scour and fill	Scour chains, 1.22 meters long, 12.7 mm thick, were placed vertically in a hole dug in the channel bed with the top chain link at or slightly above the bed surface. Depth of scour was measured from the elevation of the channel bed of the initial survey to the elevation of the bend in the resurveyed scour chain. Fill was measured as the vertical elevation difference from the bend in the chain to the channel bed. The depth of scour and fill (m) were measured in the thalweg and the area of scour and fill for the entire cross section was approximated to be triangular (m^2), with maximum scour and fill in the thalweg approaching zero at the channel sides. Because the net change in the elevation of the channel bed is determined from channel cross section resurveys, to avoid duplication, if the channel bed lowered during the study period, the amount of scour and fill was measured relative to the final survey, and if the channel aggraded over time, the amount of scour and fill and was measured relative to the initial survey. Therefore, scour and fill have the same value. The change in cross-sectional area from scour and fill was averaged for each stream order as follows: $\mathrm{SC}j \text{ or } \mathrm{FL}j = \left(\frac{\overline{\mathrm{SCj}} \text{ or } \overline{\mathrm{FLj}}}{\mathrm{ND}}\right) * 365$ Where SC*j* = the scour area per year for stream order *j* (m^2/yr); FL*j* = the fill area per year for stream order *j* (m^2/yr); $\overline{\mathrm{SC}}$j = average scour for stream order *j* (m^2); $\overline{\mathrm{FL}}$j = average fill for stream order *j*, (m^2); ND = number of days between surveys. The average change in cross-sectional area for stream order *j* was converted to a mass by multiplying by the average sediment density for stream order *j* (kg/m^3).	5	4	Leopold et al., 1966
Eolian	A 56-cm-diameter, 18.9-L plastic bucket attached to a fence post where the bottom of the bucket was placed at a distance of 2 m above the ground. A wire net filled with marbles was placed ¼ of the distance from the top of the bucket. At collection, the marbles were rinsed and the wash was collected in the bucket, transferred, and later dried. The eolian material deposited in each watershed was calculated as follows: $\mathrm{Te} = \frac{\frac{\sum_{i=1}^{n}\left(\frac{\mathrm{Emi}}{\mathrm{ND}}\right)}{n}}{\mathrm{Ab}} * 365$; Where Te = total eolian deposition ($\frac{\mathrm{kg}}{\mathrm{m^2.yr}}$) for a given basin; Emi = total eolian mass deposited (kg) for the collection period in eolian trap *i*; ND= number of days eolian trap *i* operated; *n*=number of eolian collectors; Ab=area of collection bucket (0.246 m^2).	3	8	Reheis and Kihl (1995)
Infiltration	Infiltration (mm/hr) was measured using a single-ring infiltrometer made of steel or polyvinylchloride (PVC), 20-cm-diameter by 20-cm length cylinder. The cylinder was pushed into the ground and water was poured into the cylinder. A falling head test was performed where the depth of water in the cylinder was measured over time with a ruler placed along the side of the cylinder. As the water depth approached the ground surface, additional water was added until a steady infiltration rate was observed. Measurements were made in the bounded area of sediment traps.			(Wu and Pan, 1997; Dunne and Leopold, 1978)

SUPPLEMENTARY TABLE DR2. CONTINUED

Measurement Type	Design and Computation	Number installed in Volcano Hill Wash	Number installed in Arroyo Chavez	Reference
Rainfall	Manual rain gages and automatic tipping bucket rain gages recording at 15-minute intervals, each mounted on poles approximately 1.5 m off the ground.	6	4	
Sheetwash	Sediment traps were made of sheet metal that was 85 cm long and 13 cm deep (fig.5b), with the exception of traps 5b and 7b in Arroyo Chavez, which were 65 cm long and 13 cm deep. To prevent precipitation from entering the trap directly, a lid made of sheet metal was fitted with a hinge to the back of the trap. One to three 1.27- cm-diameter holes were drilled into the side of the trap, and were connected by tubing to 18.9 L collection buckets. The traps were installed flush to the ground surface with the opening parallel to the slope contour. The contributing area was bounded with metal edging. Total station surveys of the traps were performed to determine their contributing area and ground surface slope. Sediment was collected in the buckets after one or more rainfall events during the study period. Each bucket was weighed in the lab to determine total runoff (sediment and water). Total runoff was converted to a volume (L) by assuming the density of the sediment-water mixture was 1.0 g/ ml. In the laboratory. After sitting for 1 month, water was decanted from the buckets and the sediment was oven dried for 24 h at 98°C. Samples of the water before decanting were taken, dried in a bowl, and weighed to determine the amount of sediment still remaining in suspension. This amount was extrapolated to the total volume of runoff and added to the total mass of sediment.	8	10	Gerlach, 1967; Gellis, 1998
Sheetwash	Straw dams made of straw bales were piled in a 1-m hole dug in the channel of zero-order drainages (fig. 5c). The bales were secured into the ground with steel rebar, and large rocks were piled on the downstream side of the straw bales to prevent the bales from toppling. The sediment pool on the upstream side of the straw bales was dug out, and four to six cross sections were monumented in the pool using steel rebar and surveyed periodically to quantify sediment deposition. The mass of sediment deposited behind the dams was determined as the product of the volume of deposited sediment (m^3) over time by the density of deposited sediment (kg/m^3). The contributing areas to the straw dams were surveyed with a total station. Sediment yield of each dam was computed as: $SY_d = \left[\frac{\left(\frac{TS_d}{ND}\right)*365}{Ad}\right]$ Where SY_d = sediment yield ($\frac{kg}{m^2.yr}$); TS_d = total sediment deposited behind dam *d* (kg); ND = total number of days operating; Ad= contributing area to the dam (m^2).	4	3	
Sheetwash	A 15-cm-long nail was put through a washer and driven in the ground with the top of the nail leaving a small measured distance above the washer, which was flush to the ground (fig. 5a). Deposition is the amount of sediment deposited over the washer. Erosion is the difference from the nail head to the top of the washer. The net change in the surface is the difference of the two. Each nail/washer was placed at set intervals and along major breaks in slope, and arrayed in a line. The measurements of erosion and deposition, which are made at a point, were extrapolated to halfway to the distance of the next nail/washer. The net amount of erosion and deposition for each line was weighted by the distance each nail/washer segment represents relative to the total distance of the line and summed.	14 lines	45 lines	Miller and Leopold, 1961; Leopold et al., 1966
Suspended-sediment concentration and loads	Isokinetic samplers and automatic samplers were used to collect suspended-sediment samples. Streamflow, sediment-data collection, and computation followed U.S. Geological Survey guidelines). Suspended-sediment loads were computed using the subdivision method and the USGS software Program GCLAS.	1 station	1 station	Carter and Davidian, 1968; Porterfield, 1972; Edwards and Glysson, 1999; McKallip et al., 2001).
Vegetative cover	A 100-cm diameter plastic hoop was placed on permanent markers (pins in the ground) to estimate vegetative cover percentage and species. In addition to the monumented measurements of vegetation, two random tosses of the hoop were made at each visit and an estimate of the entire vegetation density in the trap's contributing area was made.			

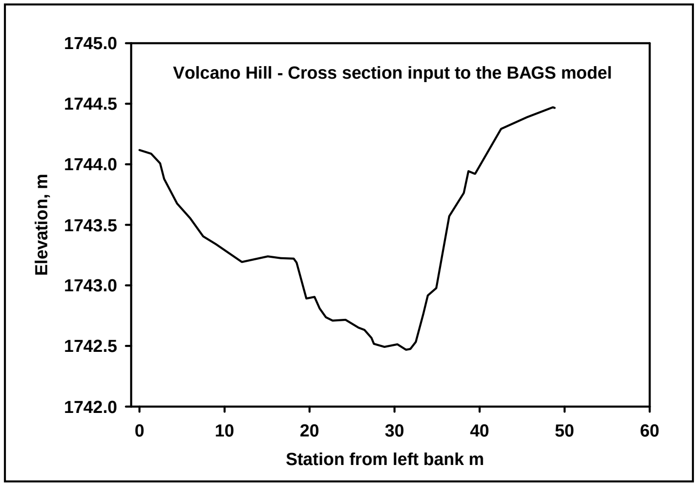
SUPPLEMENTARY TABLE DR3. CHANNEL, HYDROLOGIC, AND SEDIMENTOLOGIC DATA INPUT TO THE BEDLOAD ASSESSMENT FOR GRAVEL-BED STREAMS (BAGS) MODEL FOR (A) VOLCANO HILL WASH AND (B) ARROYO CHAVEZ.

(A) VOLCANO HILL WASH INPUT TO BAGS MODEL

VOLCANO HILL CHANNEL INPUTS	
Channel bed slope	0.0075
Minimum water discharge	0.01 m^3/s
Maximum water discharge	12.3 m^3/s
Left floodplain boundary	18.14 m
Left floodplain Manning's n	0.07
Right floodplain boundary	42.5 m
Right floodplain Manning's n	0.07

VOLCANO HILL CROSS SECTION GEOMETRY

Lateral distance from left bank (m)	Elevation (m)	Lateral distance from left bank (m)	Elevation (m)
0	1744.1	26.5	1742.6
1.4	1744.1	27.3	1742.6
2.4	1744	27.6	1742.5
2.9	1743.9	28.8	1742.5
4.4	1743.7	30.3	1742.5
5.9	1743.6	31.3	1742.5
7.5	1743.4	31.9	1742.5
9.0	1743.3	32.5	1742.5
12.0	1743.2	33.4	1742.8
15.1	1743.2	33.9	1742.9
16.6	1743.2	34.9	1743
18.1	1743.2	36.4	1743.6
18.5	1743.2	38.1	1743.8
19.6	1742.9	38.7	1743.9
20.6	1742.9	39.4	1743.9
21.2	1742.8	42.5	1744.3
21.9	1742.7	45.6	1744.4
22.7	1742.7	48.6	1744.5
24.2	1742.7	48.8	1744.5
25.8	1742.7		



VOLCANO HILL SURFACE GRAIN SIZE DISTRIBUTION

Size (mm)	% Finer	Size (mm)	% Finer
0.06	2.0	8.0	90.8
0.36	26.7	11.2	93.6
0.50	35.6	16.0	95.9
0.71	45.3	22.4	97.8
1.0	54.8	31.5	99.2
1.4	63.0	45.0	100
2.0	71.5	63.0	100
2.8	77.7	90.0	100
4.0	84.3	128	100
5.6	87.5	256	100

SUPPLEMENTARY TABLE DR3A. CONTINUED

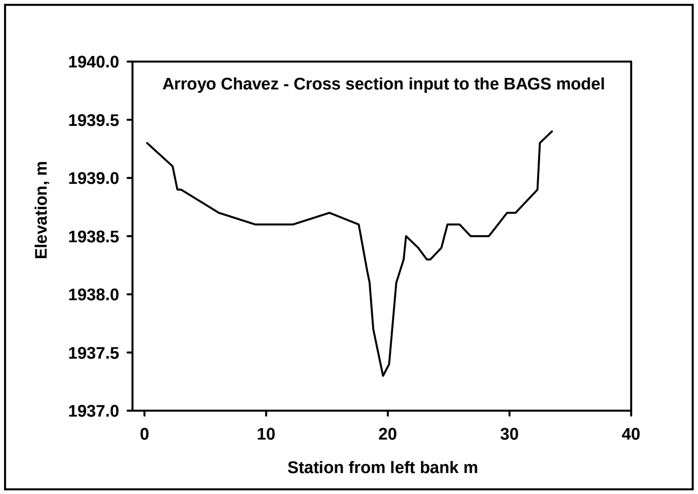
VOLCANO HILL - STATISTICS OF THE ABOVE GRAIN SIZE DISTRIBUTION	
Geometric mean (mm)	0.9
Geometric standard deviation	4.2
D10 (mm)	0.1
D16 (mm)	0.2
D25 (mm)	0.3
D50 (mm)	0.8
D65 (mm)	1.5
D75 (mm)	2.4
D84 (mm)	3.9
D90 (mm)	7.3
Main channel Manning's n	0.02

SUPPLEMENTARY TABLE DR3.
B) ARROYO CHAVEZ INPUT TO BAGS MODEL

ARROYO CHAVEZ CHANNEL INPUTS	
Channel bed slope	0.0108
Min. water discharge	0.01 m^3/s
Max. water discharge	8.24 m^3/s
Left floodplain boundary	17.4 m
Left floodplain Manning's n	0.07
Right floodplain boundary	21.5 m
Right floodplain Manning's n	0.07

ARROYO CHAVEZ CROSS SECTION GEOMETRY

Lateral distance from left bank (m)	Elevation (m)	Lateral distance from left bank (m)	Elevation (m)
0.2	1939.3	21.5	1938.5
2.3	1939.1	22.5	1938.4
2.7	1938.9	23.2	1938.3
3.0	1938.9	23.5	1938.3
6.1	1938.7	24.4	1938.4
9.1	1938.6	24.9	1938.6
12.2	1938.6	25.9	1938.6
15.2	1938.7	26.8	1938.5
17.6	1938.6	27.4	1938.5
18.3	1938.2	28.3	1938.5
18.5	1938.1	29.8	1938.7
18.8	1937.7	30.5	1938.7
19.6	1937.3	32.3	1938.9
20.1	1937.4	32.5	1939.3
20.7	1938.1	33.5	1939.4
21.3	1938.3		



SUPPLEMENTARY TABLE DR3B. CONTINUED

ARROYO CHAVEZ SURFACE GRAIN SIZE DISTRIBUTION	
Size (mm)	% Finer
0.06	0.05
0.36	21
0.5	26
0.71	28.5
1.0	31
1.4	36
2.0	41
2.8	49
4.0	58
5.6	67
8.0	79
11.2	89
16.0	96.4
22.4	100
31.5	100
45.0	100
63.0	100
90.0	100
128	100
256	100

ARROYO CHAVEZ STATISTICS OF THE ABOVE GRAIN SIZE DISTRIBUTION:	
Geometric mean (mm)	1.9
Geometric standard deviation	4.9
D10 (mm)	0.1
D16 (mm)	0.2
D25 (mm)	0.5
D50 (mm)	2.9
D65 (mm)	5.2
D75 (mm)	7.1
D84 (mm)	9.5
D90 (mm)	11.8
Main channel Manning's n	0.02

SUPPLEMENTARY TABLE DR4. GIS MODEL ACCOUNTING OF CELLS ALONG DRAINAGE PATHWAYS FROM GEOMORPHIC COMPONENTS TO OTHER GEOMORPHIC COMPONENTS AND STREAM ORDERS (m^2), AND FROM ONE STREAM ORDER TO OTHER STREAM ORDERS (m), IN (A) VOLCANO HILL WASH AND (B) ARROYO CHAVEZ

A) Volcano Hill Wash

	CELLS FROM								
	Mesa	Steep colluvial	Alluvial-colluvial	Eolian component	Valley alluvium	1st order channels	2nd order channels	3rd order channels	4th order channels
CELLS GOING TO									
Mesa		6,702	79,600						
Steep Colluvial	420,705		16,701						
Alluvial- colluvial	294,896	234,700		65,401					
Eolian component		81,097	108,256						
Valley alluvium		388,303	159,353	382,102					
Channel 1st order	188,805	2,285,185	824,597	416,393	163,099				
Channel 2nd order	114,697	674,303	652,501	18,400	156,899	11,844			
Channel 3rd Order		21,899	85,398	66,201	420,406	2,135	7,870		
Channel 4th Order					69,700	390	90	4,395	
Out of basin									450
Subtotal	1,019,103	3,692,190	1,926,406	948,497	810,104	14,370	7,960	4,395	450
Total area of cells, m^2*	8,423,475								
Error, m^2 †	196,525								
Percent error	2.3								

* The total area of Volcano Hill Wash was derived from the GIS and does not include the 0.68 km^2 draining to a stock pond.

† Error occurred as a result of cells incorrectly draining out of the basin across the divide.

B) Arroyo Chavez

	CELLS FROM								
	Mesa	Steep colluvial	Gently sloping	Fan	Valley alluvium	1st order channels	2nd order channels	3rd order channels	4th order channels
CELLS GOING TO									
Steep colluvial	211,800								
Gently	100	9,000			1,500				
Fan	22,100	98,700	86,900		9,580				
Valley alluvium	33,800	38,700	175,100	105,300					
1st order channels	127,200	75,200	156,600	73,600	305,400				
2nd order channels		25,200	2,300	45,600	281,320	3,500			
3rd order channels			1,800	11,600	179,100	1,100	3,080		
4th order channels					30,200	80	360	1,710	
Out of basin									270
Subtotal	395,000	246,800	422,700	236,100	807,100	4,680	3,440	1,710	270
Total area of cells, m^2	2,117,800								
Error, m^2†	7,800								
Percent error	0.4								

† Error occurred as a result of cells in correctly draining out of the basin across the divide.

SUPPLEMENTARY TABLE DR5. SUMMARY OF SOIL DENSITY MEASUREMENTS FOR THE GEOMORPHIC COMPONENTS IN: (A) VOLCANO HILL WASH AND (B) ARROYO CHAVEZ

A) Arroyo Chavez

Geomorphic Component	Number of samples	Average soil density (kg/m^3)	Range	Standard Deviation
Mesa	2	1,281	1,239-1,323	
Steep colluvial slopes	8	1,396	1,220-1,669	156
Alluvium/ Colluvium	8	1,488	1,091-1,746	221
Eolian	2	1,224	1,126-1,323	
Valley Alluvium	4	1,153	1,054-1,490	144

B) Volcano Hill Wash

Geomorphic Component	Number of samples	Average soil density (kg/m^3)	Range	Standard Deviation
Mesa	12	1,262	1,037-1,366	100
Steep Colluvial	4	1,251	1,217-1,289	38
Moderately sloping	2	1,229	1,113-1,345	
Fan	4	1,271	1,168-1,331	75
Valley Alluvium	6	1,341	1,143-1,492	130

SUPPLEMENTARY TABLE DR6. SUMMARY OF POSSIBLE MEASUREMENT UNCERTAINTY FOR VARIOUS MEASUREMENTS MADE IN THIS SEDIMENT BUDGET

Measurement Technique	Problem With Measurement Technique	Effect of Measurement Error on the Sediment Delivered out of the Watershed (+) Increases the amount (-) Decreases the amount
Nails	Freeze thaw of ground surface	+
Traps	Overflow of traps during runoff event	-
Dams	Overflow of dams during runoff event; bedload may be a percentage of the deposited sediment	+ / -
Suspended-sediment measurement at basin outlet	Estimation of sediment concentrations for missed events	Compared to computed loads, estimated suspended-sediment loads at Volcano Hill Wash were +59% and -34% and Arroyo Chavez were +51% and -50%
Suspended sediment	Automatic samples were not calibrated to cross-sectional samples	+ / -
Bedload	Bedload estimated with the BAGS model was not calibrated	+ / -
Sediment delivery	Extrapolation of sediment-delivery curve (SDR) to greater areas than was used in the construction of the SDR curve.	+ / -
Overall sediment budget	Extrapolating field measurements made at small scales to larger scales; effect of extrapolating results of 3-year study to longer periods of time	+ / -
GIS model	Effect of cells flowing out of the basin	-0.4 to -2.3%
Soil density	Soil density measurements are spatially and temporally variable	Average, range, and standard deviation of soil and channel density measurements are presented in Supplementary Tables DR5, DR7, DR8, and DR10.
Channel scour and fill	We recognize that scour and fill can be quite variable and that averaging one of more measurements and extrapolating this to that entire stream order can lead to errors.	+ / -
Eolian collection	Eolian material could have originated from within the drainage basin.	+

SUPPLEMENTARY TABLE DR7. SUMMARY OF SEDIMENT TRAP DATA FOR (A) VOLCANO HILL WASH AND (B) ARROYO CHAVEZ.

A) Volcano Hill Wash

Geomorphic component	Trap ID	Collection Dates Start	End	Number of sampled events	Number of estimated events	Slope of contributing area %	Average vegetation density (%)	Infiltration rate (mm/hr), (number of measurements)	Runoff yield (L/m^2)yr)	Total Rain fall (mm)	Contributing area (m^2)	Soil Density (kg/m^3)	Sediment concentration (ppm)	Sediment yield (kg/m^2·yr)	Erosion (mm/yr)
Valley alluvium	t1	6/6/1996	10/5/1998	37	2	5	4	67(1)	36,060	520	7.15	1,054	25,320	0.91	0.87
Steep Colluvial	t2	6/6/1996	10/5/1998	31	2	21	17	NA	5,780	596	4.79	1,669	8,740	0.05	0.03
Valley alluvium	t3	6/6/1996	10/5/1998	42	2	8	8	94(2)	22,050	520	6.40	1,490	9,170	0.22	0.14
Eolian	t4	6/6/1996	10/5/1998	34	2	6	19	94(2)	14,970	520	8.31	1,224	4,170	0.06	0.05
Alluvial-colluvial	t5	6/4/1996	10/5/1998	30	5	6	23	80(2)	14,760	566	9.73	1,314	13,200	0.20	0.15
Alluvial-colluvial	t6	6/4/1996	10/5/1998	36	1	10	10	NA	27,570	566	4.69	1,671	6,730	0.18	0.11
Alluvial-colluvial	t7	6/6/1996	10/5/1998	30	4	11	14	185(2)	16,300	566	6.57	1,498	7,410	0.12	0.08
Mesa	t8	6/6/1996	10/5/1998	33	1	11	33	109(3)	21,620	621	5.79	1,281	14,370	0.31	0.24
Average of all measurements							17	108(12)	20,060			1,371			
Range							0-70	57-209	5,780-36,060			1,054-1,746			
Standard Deviation				,			11	47	8,650			258			

B) Arroyo Chavez

Geomorphic component	Trap ID	Collection Dates Start	End	Number of sampled events	Number of estimated events	Slope of contributing area %	Average vegetation density (%)	Infiltration rate (mm/hr), (number of measurements)	Runoff yield (L/m^2)yr)	Total Rain fall (mm)	Contributing area (m^2)	Soil Density (kg/m^3)	Sediment concentration (ppm)	Sediment yield (kg/m^2 yr)	Erosion (mm/yr)
Mesa	t1	5/16/1996	10/02/1998	45	0	11	11	118(3)	7,930	687	36.7	1,301	28,550	0.23	0.17
Steep colluvial	t2	5/16/1996	10/02/1998	38	1	45	12	NA	12,310	687	7.9	1,254	13,900	0.17	0.14
Mesa	t3	5/16/1996	10/02/1998	47	2	10	21	89(3)	6,010	700	35.3	1,300	57,360	0.34	0.26
Fan	t4	5/16/1996	10/02/1998	50	1	14	42	270(3)	11,130	687	27.4	1,293	81,680	0.91	0.7
Valley alluvium	t5	5/16/1996	10/02/1998	58	0	13	6	69(3)	23,200	789	27.3	1,143	139,990	3.25	2.84
Valley alluvium	t6	3/5/1997	10/02/1998	33	0	14	17	NA		603	0.8	1,143		1.12	0.98
Valley alluvium	t7	5/16/1996	10/02/1998	31	5	6	33	138(3)	18,110	917	6.4	1,314	8.050	0.15	0.11
Moderately sloping	t8	5/16/1996	10/02/1998	43	7	7	24	99(2)	12,290	894	27.6	1,113	15,830	0.19	0.14
Moderately sloping	t9	3/5/1997	10/02/1998	27	3	NA	30	NA		790	1.7	1,113		0.26	0.2
Moderately sloping	t10	5/16/1996	10/02/1998	41	0	29	28	102(3)	5,670	1,016	21.8	1,345	25,100	0.14	0.11
Average of all measurements							20	128(21)				1,272			
Range							0-85	12-287				1,113-1,345			
Standard Deviation							16	80				78			

SUPPLEMENTARY TABLE DR8. SUMMARY OF EROSION MEASUREMENTS USING STRAW DAMS: (A) VOLCANO HILL WASH AND (B) ARROYO CHAVEZ.

A) Volcano Hill Wash

Geomorphic component	Site ID	Collection Dates Start	Collection Dates End	Drainage area, (m^2)	Sediment density (kg/m^3)	Sediment Yield ($kg/m^2/yr$)	Erosion (mm/yr)
Steep Colluvial	d1	7/27/1995	11/11/1998	5,172	1,451	0.04	0.03
Valley alluvium	d2	7/28/1995	11/11/1998	422	1319	0.39	0.30
Steep Colluvial	d3	8/7/1995	11/13/1998	4,999	1,378	0.06	0.04
Steep Colluvial	d4	7/8/1995	11/13/1998	2,507	1,317	0.02	0.02
Average of all measurements					1,373		
Range					1,287-1,563		
Standard Deviation					103		

(B) Arroyo Chavez

Geomorphic component	Site ID	Collection Dates Start	Collection Dates End	Drainage area, (m^2)	Sediment density (kg/m^3)	Sediment Yield ($kg/m^2/yr$)	Erosion (mm/yr)
Mesa	d1	8/1/1995	11/20/1998	2,276	1,307	0.38	0.29
Mesa	d2	8/1/1995	10/15/1998	1,354	1,222	0.62	0.50
Steep Colluvial	d3	8/1/1995	10/16/1998	541	1,247	1.33	1.1
Valley alluvium	d4	4/17/1996	11/4/1998	245	1,277	14.2	11
Average of all measurements					1,247		
Range					1,037-1,366		
Standard Deviation					100		

SUPPLEMENTARY TABLE DR9. SUMMARY OF NAIL/WASHER MEASUREMENTS IN: (A) VOLCANO HILL WASH AND (B) ARROYO CHAVEZ.

A) Volcano Hill Wash

Nail ID*	Geomorphic component	Collection Dates Start	Collection Dates End	Length line (m)	Number of nail/ washers on line	Ground-surface slope (degrees)	Net change in surface, (mm/year) ('+' is net erosion;'-' = net deposition)	Depositi on (mm/yr)	Standard deviation of deposition measurements (mm)	Erosi on (mm/ yr)	Standard deviation of erosion measurements, (mm)
n1	Steep Colluvial	11/17/1998	7/20/1995	57.7	19	---	0.5	0.5	4.6	1.0	2.4
n1	Steep Colluvial	11/17/1998	7/20/1995	60.5	19	---	-0.5	1.5	10.4	1.0	5.1
n2	Eolian	1/5/1999	7/25/1995	163.8	39	1.9	-0.3	1.7	8.9	1.4	6.9
n3	Valley alluvium	11/11/1998	7/28/1995	28.9	9	2.5	0.2	1.2	10.3	1.4	4.7
*n3	Valley alluvium	11/11/1998	7/28/1995	24.1	11	2.3	1.9	0.2	4.6	2.0	15.1
n4	Steep Colluvial	11/13/1998	8/7/1995	90.0	15	---	2.6	1.5	9.7	4.1	14.8
n5	Steep Colluvial	12/4/1998	8/29/1995	108.4	20	26.4	2.5	0.6	4.1	3.2	8.4
n6	Mesa	11/18/1998	8/29/1995	48.8	16	---	2.6	0.2	1.6	2.7	8.0
n7	Steep Colluvial	12/4/1998	8/29/1995	115.8	17	24.7	3.6	1.2	10.2	4.8	10.9
n8	Steep Colluvial	1/5/1999	8/7/1995	27.3	11	26.3	1.8	2.4	9.3	4.2	12.7
n9	Alluvial/colluvial	1/5/1999	3/22/1996	44.6	10	4.5	-0.9	1.9	17.8	0.9	2.3
n9	Alluvial/colluvial	1/5/1999	3/22/1996	43.8	16	5.4	0.8	1.6	5.2	2.4	13.6
n10	Eolian	9/21/1998	8/30/1995	136.4	27	2.7	-0.1	2.5	13.8	2.4	9.5
n10	Eolian	9/21/1998	8/30/1995	131.3	21	2.9	0.8	1.8	9.6	2.6	13.2

SUPPLEMENTARY TABLE DR9. CONTINUED. B) ARROYO CHAVEZ

Nail ID*	Geomorphic component	Collection Dates Start	End	Length line (m)	Number of nail/ washers on line	Ground-surface slope (degrees)	Net change in surface, (mm/year) ('+' is net erosion;'-' = net deposition)	Deposition (mm/yr)	Standard deviation of deposition measurements (mm)	Erosion (mm/yr)	Standard deviation of erosion measurements, (mm)
n1	Mesa	2/14/1996	11/16/1998	31.1	13	9.5	2.9	0.3	2.00	3.1	2.0
n1	Mesa	2/21/1996	11/16/1998	40.4	9	---	4.1	2.3	8.02	6.3	23.4
n1	Mesa	8/14/1995	11/16/1998	39.7	23	9.1	4.8	0.2	1.52	5.0	11.1
n2	Steep Colluvial	2/14/1996	11/16/1998	15.0	5	7.3	3.6	0.0	---	3.6	6.0
n2	Steep Colluvial	2/21/1996	11/16/1998	35.4	25	10.3	4.2	1.6	6.98	5.8	7.6
n2	Steep Colluvial	8/14/1995	11/16/1998	24.0	15	6.1	2.7	1.1	6.65	3.8	9.3
n2	Steep Colluvial	2/21/1996	12/15/1998	4.1	5	16.8	3.7	0.2	1.14	3.9	3.0
n3	Mesa	2/21/1996	1/12/1999	17.6	13	---	5.2	1.5	6.50	6.7	9.5
n3	Mesa	2/21/1996	12/15/1998	9.1	7	---	-0.6	5.8	12.5	5.2	8.6
n3	Mesa	2/21/1996	12/15/1998	32.7	21	5.0	1.3	3.7	11.7	5.0	14.0
n4	Mesa	8/1/1995	1/12/1999	28.6	3	---	1.2	1.8	10.3	3.0	6.1
n4	Mesa	2/21/1996	1/12/1999	27.8	11	2.2	-2.7	5.6	12.6	2.9	15.0
n4	Mesa	8/1/1995	1/1/1900	20.1	13	4.4	2.8	1.3	4.80	4.1	7.7
n4	Mesa	8/1/1995	1/12/1999	19.5	23	---	-2.1	7.0	22.5	4.9	15.8
n5	Steep Colluvial	4/9/1996	12/15/1998	44.3	18	7.1	0.7	2.4	12.4	3.1	9.9
n5	Steep Colluvial	4/9/1996	12/15/1998	55.1	20	4.3	4.2	1.8	15.9	6.0	9.5
n5	Steep Colluvial	4/9/1996	12/15/1998	24.6	15	10.6	2.1	1.8	6.74	4.0	0.4
n6	Fan	3/19/1996	2/9/1999	41.8	19	2.5	5.7	4.0	15.0	9.6	21.4
n6	Fan	3/19/1996	2/9/1999	70.1	15	5.7	1.7	1.2	7.70	2.9	6.9
n6	Fan	3/19/1996	1/12/1999	64.8	20	5.9	-1.0	6.0	17.9	5.0	8.8
n6	Fan	3/19/1996	2/9/1999	27.4	11	1.6	3.6	0.2	2.53	3.8	5.9
n6	Fan	3/19/1996	2/9/1999	82.2	18	6.0	0.6	2.8	10.6	3.5	8.6
n7	Fan	3/19/1996	2/9/1999	59.3	18	5.0	1.1	1.7	9.16	2.8	6.2
n7	Fan	3/19/1996	2/9/1999	59.1	20	6.1	2.1	3.1	11.6	5.3	12.4
n7	Fan	3/19/1996	2/9/1999	52.2	19	4.3	-0.4	3.4	17.5	2.9	13.6
n8	Steep Colluvial	4/18/1996	12/15/1998	100.6	22	8.9	-6.4	16.0	35.0	9.5	17.6
n9	Steep Colluvial	2/21/1996	2/12/1999	12.5	10	---	2.3	3.0	10.7	5.3	20.0
n9	Steep Colluvial	8/1/1995	2/12/1999	3.7	3	---	7.7	0.0	---	7.7	20.5
n9	Steep Colluvial	9/20/1995	2/12/1999	12.2	6	---	1.1	2.5	12.8	3.6	6.8
n10	Fan	9/20/1995	2/12/1999	16.9	5	---	3.5	1.0	12.0	4.5	7.9
n10	Fan	9/20/1995	2/12/1999	15.2	6	8.8	-0.7	5.4	20.8	4.7	10.8
n10	Fan	9/20/1995	2/12/1999	65.4	12	4.7	10.2	4.07	21.0	15	38.7
n11	Valley alluvium	9/20/1995	2/12/1999	125.6	29	3.4	2.0	1.6	9.4	3.6	9.6
n11	Valley alluvium	9/20/1995	2/12/1999	129.2	19	2.6	2.2	1.0	8.3	3.2	9.5

SUPPLEMENTARY TABLE DR9. CONTINUED B) ARROYO CHAVEZ

Nail ID*	Geomorphic component	Collection Dates Start	End	Length line (m)	Number of nail/ washers on line	Ground-surface slope (degrees)	Net change in surface, (mm/year) ('+' is net erosion;'-' = net deposition)	Deposition (mm/y)r	Standard deviation of deposition measurements (mm)	Erosion (mm/yr)	Standard deviation of erosion measurements, (mm)
n12	Mesa	2/21/1996	2/12/1999	11.0	8	---	0.9	1.0	6.9	2.0	2.2
n13	Valley alluvium	4/9/1996	12/9/1998	4.9	10	11.7	7.0	0.5	3.6	7.5	11.8
n13	Valley alluvium	4/9/1996	12/9/1998	13.2	6	2.7	0.1	1.0	5.1	1.2	3.0
n13	Valley alluvium	4/9/1996	12/9/1998	4.0	8	---	-0.1	9.2	31.5	9.2	16.3
n14	Moderately Sloping	9/26/1995	1/25/1999	239.3	36	2.7	1.6	1.4	10.7	3.1	7.9
n15	Moderately Sloping	9/26/1995	1/25/1999	243.8	26	2.6	0.6	2.1	13.3	2.7	8.0
n16	Valley alluvium	4/2/1996	12/9/1998	13.1	14	6.7	5.8	1.7	7.2	7.5	12.0
n16	Valley alluvium	4/2/1996	12/9/1998	8.8	9	14.7	7.6	0.3	1.6	7.9	12.1
n16	Valley alluvium	4/2/1996	12/9/1998	10.4	12	7.5	2.9	1.4	6.1	4.3	6.5
n17	Moderately Sloping	9/26/1995	1/25/1999	61.0	10	3.6	-0.3	1.7	8.4	1.4	3.6
n17	Moderately Sloping	9/26/1995	1/25/1999	61.0	10	3.4	1.6	1.8	6.2	3.3	6.7

*Several closely spaced nail lines were often installed and are shown as one nail id.

SUPPLEMENTARY TABLE DR10 SUMMARY OF CHANNEL CROSS-SECTION CHANGES, LISTED BY STREAM ORDER FOR A) VOLCANO HILL WASH AND B) ARROYO CHAVEZ

(A) Volcano Hill Wash

Site ID (fig. 4a)	Date: Initial survey	Date: Resurvey	Number of surveyed cross sections	Change in cross-sectional area (m^2/yr) (+ = deposition; - = erosion)	Standard deviation of changes in cross-sectional area *	Density of channel sediment (kg/m^3)	Channel width (m)	Channel depth (m)
4th order channels								
c1	6/28/95	5/28/98	3	0.03			40.6	1.6
c2	6/28/95	6/3/98	2	0.15			42.2	1.8
c3	6/28/95	6/1/98	1	0.11			23.1	1.8
average 4th order				0.09	± 0.31	1,545		
3rd order channels								
c4	6/28/95	6/3/98	2	-0.10			24.7	2.1
c5	7/5/95	6/4/98	2	0.16			24.1	1.9
c6	7/5/95	6/4/98	1	-0.10			41.8	2.1
c7	7/6/95	6/4/98	2	0.02			27.3	1.6
c20	7/28/95	07/16/98	3	0.28			9.2	1.3
c17	7/11/95	6/29/1998	2	-0.01			17.5	1.8
c10	7/17/95	6/22/98	2	-0.09			24.0	2.7
c11	7/17/95	07/16/98	2	-0.20			17.2	1.5
c12	7/18/1995	06/22/98	2	0.01			13.6	2.0
c18	7/11/95	6/29/1998	2	0.18			13.5	2.1
c19	7/24/95	7/7/98	2	-0.05			7.4	1.8
c8	7/24/1995	6/8/1998	2	-0.06			30.2	2.0
c9	7/24/1995	6/8/1998	2	-0.26			24.9	1.9
average 3rd order				-0.02	-± 0.20	1,558		
2nd order channels								
c14	7/6/95	7/2/98	2	-0.03			29.8	1.7
c15	7/6/95	7/2/98	2	0.04			9.6	2.1
c16	7/12/95	7/2/98	4	-0.10			9.5	2.3
c21	7/28/95	07/16/98	2	-0.04			2.7	0.7
c13	7/17/95	06/22/98	2	-0.13			13.3	3.5
average 2nd order				-0.05	-± 0.28	1,531		
1st order channels								
c23	7/12/95	7/7/98	3	-0.54			2.2	1.3
c22	7/28/95	07/16/98	2	0.09			9.3	0.6
average 1st order				-0.22	± 0.47	1,531		

* Standard deviation includes all cross sections used for a stream order.

SUPPLEMENTARY TABLE DR10 CONTINUED

B) Arroyo Chavez

Site ID (fig. 4b)	Date: Initial survey	Date: Resurvey	Number of surveyed cross sections	Change in cross-sectional area (m^2/yr) (+ = deposition; - = erosion)	Standard deviation of changes in cross-sectional area*	Channel width (m)	Channel depth (m)
4th order channels							
c1a	06/06/1995	7/20/1998	2	0.70		5.7	1.34
c1b	06/06/1995	7/20/1998	2	0.42		5.7	1.30
Average 4th order				0.56	± 0.25		
3rd order channels							
c2	6/8/1995	07/23/1998	3	-0.34		12.2	2.8
c3	6/8/1995	07/23/1998	2	0.03		11.7	4.0
c4	6/12/1995	8/11/1998	2	-0.10		9.9	4.8
c5	6/13/1995	8/11/1998	2	-0.41		13.8	4.2
c6	6/13/1995	08/19/1998	2	0.16		12.7	4.9
c10	3/27/1996	7/30/1998	1	-1.10		13.6	2.8
c11	3/27/1996	7/30/1998	1	-0.12		17.2	3.2
Average 3rd order				-0.27	± 0.38		
2nd order channels							
c7	6/20/1995	08/18/1998	2	-0.61		8.7	5.1
c8	6/21/1995	9/3/1998	2	0.15		8.9	3.5
c9	6/21/1995	08/19/1998	3	-0.48		13.5	4.8
c12	4/2/1996	11/2/1998	1	-0.54		15.3	1.7
c13	4/2/1996	11/2/1998	1	-0.40		2.5	1.4
Average 2nd order				-0.38	± 0.36		
1st order channels							
c14	06/06/1995	7/20/1998	2	0.21		7.8	1.0
c15	06/20/1995	08/18/1998	3	-0.81		4.0	4.5
c16	3/12/1996	9/3-11/2/1998	5	-0.01		7.8	2.6
Average 1st order				-0.20	± 0.81		

* Standard deviation includes all cross sections used for a stream order.