SEDIMENT DELIVERY

IN THE

NORTH FORK OF CASPAR CREEK

FINAL REPORT

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by

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SUMMARY

Sediment delivery was estimated for 13 tributary watersheds and the North Fork of Caspar Creek. The ratio of sediment to erosion averaged 16.4%, ranging from 1.0% to 89.7%. Because the data were so highly skewed their median is a better indicator of central tendency than their mean. The median delivery ratio was 6.3%. The ratios were accurately ($R^2 = 91.5\%$) estimated by a 2-variable linear equation. However, the coefficients of the variables in the equation have signs contrary to their physical effects on delivery of eroded material to a stream. The analyses suggest that more research is needed into estimating sheet erosion and stream channels as sediment sources. Compared to the earlier study in the South Fork of Caspar Creek (Rice et al. 1979) logging of the North Fork resulted in erosion that was about half as large and a sediment delivery ratio that was also about half of the 1979 estimate.

INTRODUCTION

It is said that experience is the best teacher. However, experience tells us what has happened, not what will happen. This phenomenon has resulted in a few deviations from the original study plan. The study design was based on investigations involving larger watersheds and less intensive sampling. As a result, many road drainage structures served more than one plot and sediment from different components (cut, fill, surface, and drain) of many plots was delivered to different watersheds. Road plots, therefore, had to be disaggregated and plot-based sampling abandoned when estimating road-related erosion. Aspect had been found to be related to erosion in earlier plot-based studies (Furbish and Rice 1983, Rice and Datzman 1981). However, after reviewing the terrain it was concluded that average watershed aspect would not be a useful descriptor of a watershed. The unexpectedly dense slash and regrowth encountered during the first day of field work demonstrated clearly that the study lacked the resources to make on-the-ground measurements of flow path conditions. Consequently, the distances were estimated from maps and field observations and verified by GIS. GIS was also used to estimate various area and channel disturbance variables. The anticipated information on in-channel sediment sources was not available and could not be included.

METHODS

Sampling

Harvest area sampling was not completely according to the study plan. Because of inadvertent measuring of extra plots it was based on a total of 175 rather than 168 plots. When combining tributary watersheds a slight departure from strict random sampling was employed. After the original random selection was made (for example six MUN plots used in the JOH estimate) subsequent selections were made at random from the preceding selection.

The final sampling of the road system yielded only 129, rather than the planned 143 plots. All or part of many road plots did not drain into the watersheds assumed by the original sampling plan. The same problem plagued the pre-selected alternate plots. Consequently, estimates of the individual components of road-related erosion for individual watersheds were based on from one to fifteen measurements. As indicated above, these data had to be handled differently. First, the erosion amounts in yd^3/mi for each component were summed. For headwaters watersheds these estimates were multiplied by the total mileage and converted to yd^3/ac of watershed. Erosion rates of tributary watersheds were weighted in proportion to their road mileages and summed before converting to yd^3/ac for the larger watersheds. These data were added to the harvest area estimates and the volume of major (BIG) erosion events tallied throughout the study to give the estimates of watershed erosion rates.

Erosion measured in a census of BIG events (Table 1) was added to the watershed estimates based on random sampling. The census included 101 events that occurred during only 13 of the 51 storms making up the sediment estimates. It had been intended that only failures displacing more than 10 yd^3 would be measured. As it turned out, some features as small as 2 yd^3 were tallied and included in the study. Thirty-four of the 101 features measured, averaging 5.18 yd^3, were less than 10 yd^3. The census was mainly conducted in conjunction with post-storm channel surveys. It is possible that these data may have resulted in double counting but that appears unlikely. Only two of the random plots fell within a WLPZ. Considering the importance of stream-side erosion as a sediment source the inclusion of the census data seemed warranted.

Variables

In addition to the 32 variables listed in Table 1 twenty other measures were tested in a correlation matrix (and occasionally in regressions) as possible predictors of delivery ratios. With the exception of erosion-weighted Class 2 distance (WTDCLAS2) none of the twenty showed sufficient promise to warrant inclusion in later analyses. For the most part the twenty were permutations of, or surrogates for, the 18 site descriptors used in the analyses described below.

Analytical Procedures

The analysis consisted of winnowing candidate dependent variables with three successive regression analyses. The dependent variables investigated were delivery ratios using erosion estimates based on: [1] only road and harvest plots (RD&HV DR); [2] road and harvest plots plus all features displacing more than 200 yd^3 (RDHV&200); [3] all measured erosion (DELIVERY); [4] all measured erosion minus sheet erosion (DR_WO_SH), to see if the seemingly high estimates of sheet erosion were biasing the analysis). A logarithmic model of [3] was also tested, as was one that included only the 11 watersheds having some logging disturbance (to see if the control watershed data was biasing the results). The first step in the analysis of each of the four dependent variables was a stepwise regression on all 18 candidate variables (with F to enter set at 1.0). In the second step the best 12 or fewer (if less than 12

entered) independent variables entering the stepwise regression were then used in an all possible subsets regression analysis. At this step the differences between [1] and [2] were trivial; consequently, [2] was not included in the final analyses or reported in APPENDIX II. The choice of a final model was intended to be based partly on Mallows' Cp and partly on a conservative reading of R^2 s. However, the minimum Cp's were, with one possible exception, associated with unrealistically large equations, considering the small sample size. Furthermore, most regression coefficients had signs contrary to the presumed physical effect of the variable. Presumably, the regression models are fitted to the idiosyncrasies of the data rather than any physical relationship the variables have with the efficiency of sediment delivery. Consequently, in the third step of each analysis models with 2, 3, and 4 predictors were computed to display possible solutions (APPENDIX II).

The three steps described above were also followed in two additional sets of analyses beginning with 18 random variates as independent variables. In one series of analyses DELIVERY was regressed against random normal deviates and in a second series the natural logarithm of DELIVERY was regressed against log-normal deviates.

RESULTS

The average erosion rate in the study watersheds was 31.79 yd³/ac (Table 2). Two thirds of it was measured on harvest area plots — almost equally divided between sheet erosion and other erosion processes. About 22% of the erosion was measured on road plots. The remaining 11% came from the inventory of BIG events that had been made during the course of the study. Slightly less than half of the BIG event volume came from features displacing more than 200 yd³/ac. None of the erosion measurement techniques ([1]-[4]) was comparable to the CSES measurements. The average erosion rate exclusive of sheet erosion of 21.41 yd³/ac is based on measurements which are fairly comparable to the measurements made in a 1970's study that yielded 14.2 yd³/ac rate (Rice and Datzman 1981). The erosion rate in the South Fork of Caspar Creek in that earlier study, however, was 42.9 yd³/ac (Rice et al. 1979). Changes in silvicultural system, yarding methods, and road location may have resulted in the logging-related erosion in the North Fork of Caspar Creek in the 1990's being half the rate measured in the South Fork in the 1970's. Differences in climatic stress may also account for some of the differences.

High delivery ratios were associated with two of the three control watersheds having essentially no logging (Figure 1). The third control, IVE, had a delivery ratio comparable to the logged watersheds. That anomaly is likely due to road drainage. IVE is the only watershed in the study in which road-related erosion exceeded harvest area erosion. The influence of logging disturbances on delivery ratios also eliminated the expected decrease of delivery ratio with watershed area (Figure 2).

The average delivery ratios were greatly influenced by the high delivery ratios of the unlogged watersheds (Table 2). They ranged from 34.1% for the ratios based on only plot data to 16.4% for ratios based on all erosion data. The median delivery ratios are probably better indicators of central tendency. They were much more consistent — ranging from 6.3% to 9.3%. More applicable to delivery ratios from logging-related disturbances are the averages of the
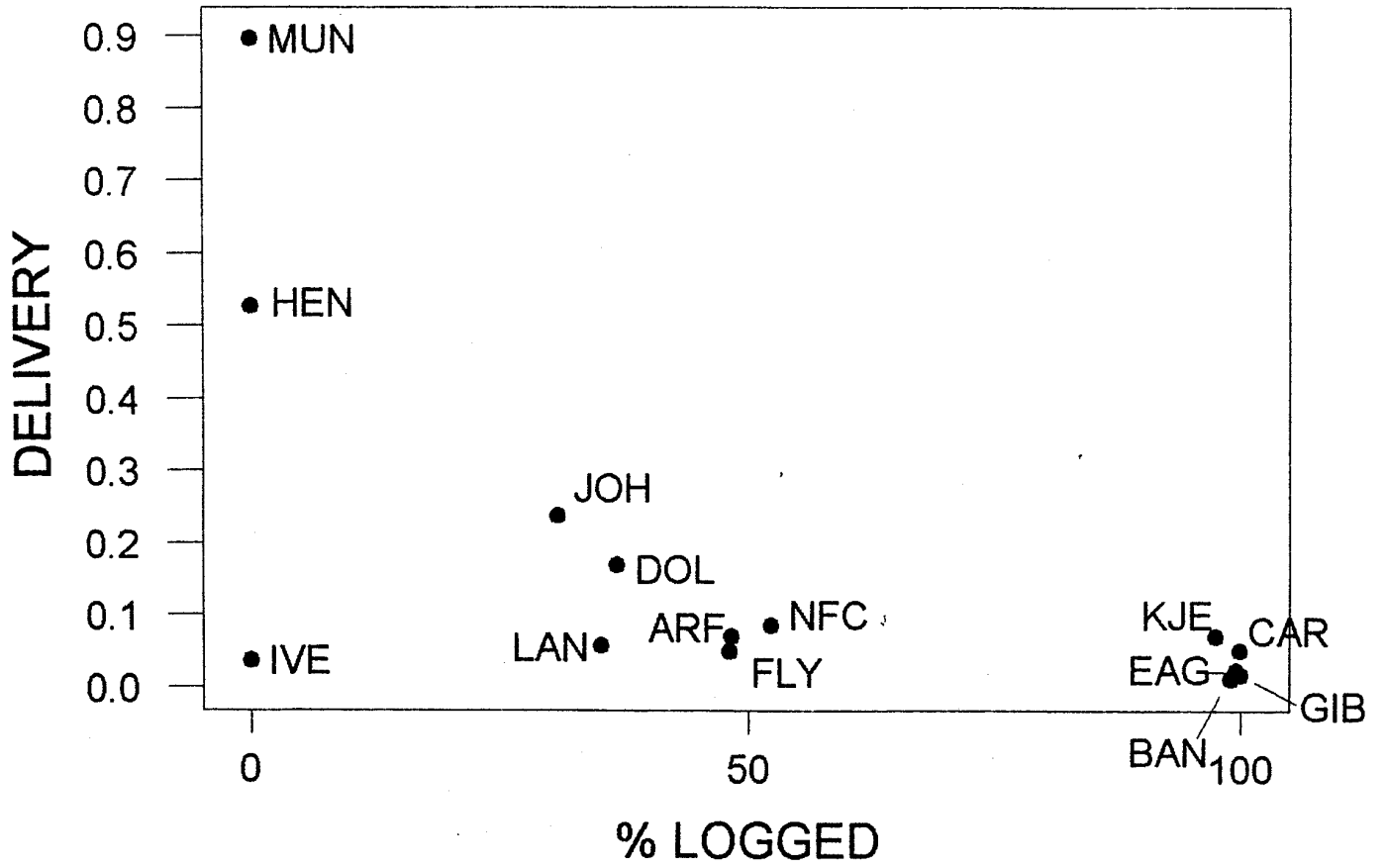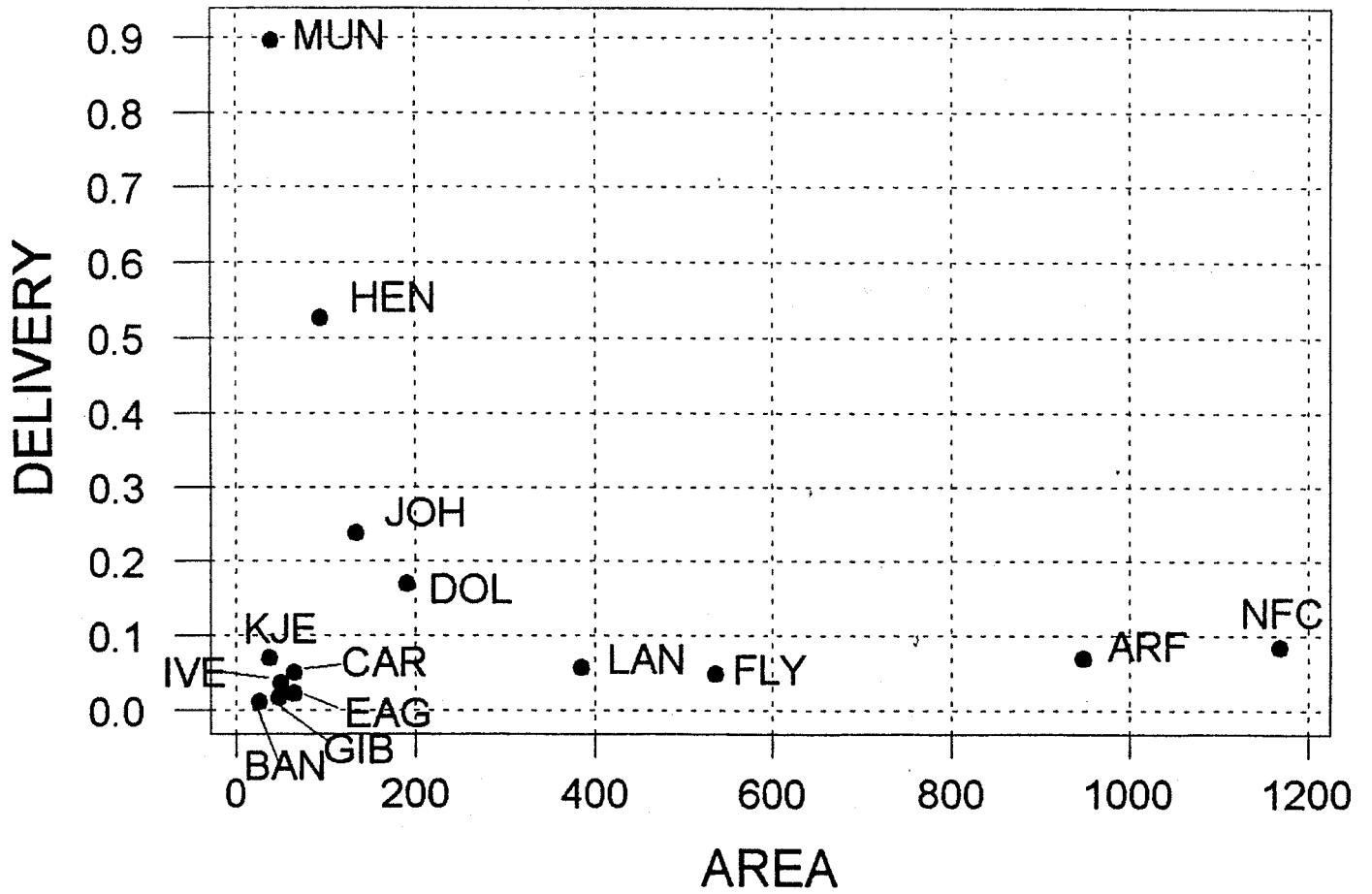
FIGURE 1.

FIGURE 2.

eleven watersheds containing some logging. They averaged 7.6% based on all erosion data and 11.6% when sheet erosion was excluded. Their medians were similar to their means, ranging from 5.66% to 8.85%. The delivery ratio of 11.3% at the North Fork weir based on all data except the sheet erosion is most nearly comparable to the 22.4% measured at the South Fork weir during the earlier Caspar Creek study (Rice et al. 1979).

All of the regression equations predicting delivery ratios from site and disturbance variables were highly significant, as were almost all of their regression coefficients. However, the same can be said for the two sets of regressions using random normal or log-normal deviates as independent variables! The regressions using random variables as predictors did have lower coefficients of determination (R^2) than the equations based on field data. They were never higher than 80% while all of the R^2's of comparable equations based on field data were larger than 90%. However, focusing on the 2-variable equation predicting DELIVERY (the one most likely to be realistic), the ratio of its R^2 to the R^2 of the equation based on two random deviates is 1.39. This suggests that about 72% of the fit to DELIVERY could be due to random variability.

Regardless of the role that random noise may have played in the regression results, as stated above, most regression coefficients made no physical sense. For example an equation for the 14 watersheds with DELIVERY as a dependent variable was:

$$DELIVERY = 1.49 - 0.00314 * \%CLASS3 - 3.6910 * FLOSLOPE$$

This equation suggests that sediment delivery decreases as the proportion of headwaters streams disturbed by logging increases and that it increases as the slope of the flow path from disturbances becomes gentler. From these and similar results it must be concluded that, however well these equations fit the data, the goodness of fit is due to something other than the conditions expressed by the variables in the equations.

DISCUSSION

The paradox of highly significant regression equations composed of seemingly meaningless regression coefficients likely is explained by two characteristics of the data. First, the small sample size made it more likely that the data selection methods would latch on to peculiarities of these data. Second, the watersheds are likely too similar; reducing the variability that would be found in both dependent and independent variables making it difficult to identify relationships that might be found in a larger sample of forested watersheds. It is unlikely that the very high delivery ratios of HEN and MUN contributed to the failure to find useful relationships since the regressions using only data from the 11 watersheds containing logging disturbances yielded similarly paradoxical results.

The high delivery ratios of the unlogged watersheds suggests that there is an ambient sediment load resulting from in-channel processes that needs to be measured in order to accurately estimate the sediment delivery due to management-related watershed disturbances. Sheet erosion is the most difficult of the erosional mechanisms to estimate by field observations. The large proportion of the total erosion attributed to sheet erosion points to the need for plot

studies of this process in areas disturbed by logging. Estimating how much of a mass movement has left the site is much more difficult than measuring the cavity created. The latter measurement was used here because of incomplete recording of local deposition. Possibly better results would have been obtained if estimates of how much erosion had left each site had been used. However, since these data only contributed about 10% of the erosion total it is questionable that delivery ratios would be changed much.

This study was an opportunistic one capitalizing on the existence of the pool of high quality data being generated by the cumulative effects study in the North Fork. An approach having a better chance of discovering widely applicable relationships would use watersheds having a wide range of site conditions as well as disturbance histories. Such a study would run the risk of only detecting meteorological differences and would be expensive and logistically difficult. A more practical approach might be to take measures to insure that all watershed experiments include estimates of sediment delivery. Over time, these estimates might form a data base from which some generalizations could be made.

Only the first of the study's three objectives has been achieved. Delivery ratios have been determined for the 14 North Fork watersheds using various methods of estimating erosion. Excluding the control watersheds, all values are very much less than those indicated by the frequently misapplied Roehl (1962) curves. Apparently, forest soils, typical logging disturbances, and the complexity of forested terrains conspire to slow or stop the movement of displaced soil from the disturbance site to the stream.

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Table 1. Description of variables used in analyses.

AREA — Watershed area — acres.

HARVEST — Erosion estimate based on harvest area random plots — yd^3/ac.

ROADS — Erosion estimate based on random plots on roads and landings — yd^3/ac.

>200 YDS — Gross erosion from events displacing more than 200 yd^3 measured during post-storm inventories which served as a basis for BIG — yd^3/ac.

BIG — Gross erosion (the volume of the eroded cavity) resulting from a census of "large" erosional events measured mainly during 51 post-storm inventories of channel conditions — yd^3/ac.

NO_SHEET — Total erosion from all sources minus sheet erosion estimates (EROSION - SHEET) — yd^3/ac.

SHEET — Sheet erosion estimated on harvest area plots — yd^3/ac.

RD&HARV — Total erosion estimated from road, landing, and harvest area plots (HARVEST + ROADS — yd^3/ac.

RDHV&200 — Total erosion estimated from road, landing, and harvest area plots, plus erosion from events displacing more than 200 yd^3 (ROADS + HARVEST + >200 YDS) — yd^3/ac.

EROSION — Estimated erosion from all sources (ROADS + HARVEST + BIG) — yd^3/ac.

SEDIMENT — The sum of all of the storm-based suspended sediment data measured at gaging stations for hydrologic years 1986— 1995 (converted from kg/ha assuming a specific weight of 74 lb/ft^3). For all watersheds except NFC this value was multiplied by 1.33 to correct for the unmeasured bedload. The NFC suspended sediment discharged was increased by the volume of material that accumulated in the weir ponds, suspended sediment as well as bedload — yd^3/ac.

RD&HV DR — SEDIMENT/(RD&HARV)

RH&200DR — SEDIMENT/(RDHV&200)

DELIVERY — SEDIMENT/EROSION

DR_WO_SH — SEDIMENT/(NO_SHEET)

Table 1 (cont.). Description of variables used in analyses.

% LOGGED The percent of the watershed area that was logged during the study.

% CLASS3 The percent of the total Class III watercourse length in a watershed that was within a logged area.

%CLASS2 The percent of the total Class II watercourse length in a watershed that was within a logged area.

%CLAS2&3 The percent of the total Class II and III watercourse length in a watershed that was within a logged area.

%TRACTOR The percent of the watershed area that was tractor yarded.

%RDS&LAN The percent of the watershed that was occupied by roads and landings.

%RDLA&SK The percent of the watershed occupied by roads, landings, and skid trails.

BARE The percent of the harvest area having exposed bare soil.

SLOPE The average slope of harvest area plots — slope angle in degrees.

%>22.5 The percent of the harvest area plots having slopes steeper than 22.5^{o}.

HC<-.002 The percent of the harvest area plots with horizontal curvatures less than -0.002.

ROCK The average value of the CSES variable WEAKROCK for harvest area plots.

HUE The average Munsell hue of the subsoil at road and landing plots using the CSES coding. The average hue of the other 13 watersheds was assigned to HEN which had no roads draining to its gage.

RISK Average Critical Site risk of harvest area plots [road plot risk not used because of plots delivering sediment to more than one watershed] (Lewis and Rice 1989).

WTDCLAS2 The weighted average of the distances from harvest area plots to a Class II or I watercourse. Plot erosion values were used as weights.

GAGEDIST The average distance from harvest area plots to the gaging station. Map distances to as Class I or II watercourse were determined by GIS and the in-stream distances scaled of a 1:3539 scale map with a map measuring wheel — feet.

FLOSLOPE The average slope of the flow path from plots to the first Class I or II watercourse. GIS distances on a 1:3539 scale map — tangent of slope angle.

Table 2. Statistical properties of variables used in analyses.

Descriptive Statistics of FINAL DATA.MTW 96-10-17

Variable	N	Mean	Median	Tr Mean	StDev	SE Mean
AREA	14	271.0	80.8	216.6	367.3	98.2
HARVEST	14	21.52	20.00	18.32	21.11	5.64
ROADS	14	6.96	5.43	6.60	5.24	1.40
>200 YDS	14	1.710	0.000	1.367	2.628	0.702
BIG	14	3.309	1.927	3.040	3.060	0.818
NO_SHEET	14	21.41	20.41	19.85	15.67	4.19
SHEET	14	10.38	7.41	9.61	9.31	2.49
RD&HARV	14	28.48	24.31	26.03	23.46	6.27
RDHV&200	14	30.19	26.61	28.03	24.20	6.47
EROSION	14	31.79	27.59	29.76	24.04	6.42
SEDIMENT	14	1.971	1.780	1.933	1.238	0.331
RD&HV DR	14	0.341	0.070	0.204	0.680	0.182
RH&200DR	14	0.337	0.067	0.201	0.681	0.182
DELIVERY	14	0.1637	0.0629	0.1154	0.2510	0.0671
DR_WO_SH	14	0.2352	0.0929	0.1633	0.3609	0.0964
% LOGGED	14	53.3	48.2	53.9	39.4	10.5
% CLASS3	14	64.2	73.5	66.5	38.6	10.3
%CLASS2	14	47.5	36.2	47.1	42.9	11.5
%CLAS2&3	14	59.1	64.0	60.6	38.7	10.4
%TRACTOR	14	10.51	9.13	8.64	11.43	3.05
%RDS&LAN	14	4.316	3.390	4.105	3.054	0.816
%RDLA&SK	14	5.116	4.176	4.909	3.610	0.965
BARE	14	5.42	3.65	4.55	5.72	1.53
SLOPE	14	25.502	25.835	25.527	2.260	0.604
%S>22.5	14	68.77	73.03	69.34	18.68	4.99
HC<-.002	14	41.83	40.75	42.14	10.55	2.82
ROCK	14	0.3070	0.3165	0.2915	0.3032	0.0810
HUE	14	3.1081	3.1040	3.1173	0.1823	0.0487
RISK	14	0.01970	0.02054	0.01956	0.00885	0.00236
WTDCLAS2	14	816.7	762.3	791.8	306.0	81.8
GAGEDIST	14	2390	1602	2193	1834	490
FLOSLOPE	14	0.3061	0.3199	0.3120	0.0473	0.0126

Table 2 (cont.). Statistical properties of variables used in analyses.

Descriptive Statistics of FINAL DATA.MTW 96-10-17

Variable	Min	Max	Q1	Q3
AREA	25.9	1169.2	46.9	422.3
HARVEST	0.58	80.87	5.87	28.28
ROADS	0.00	18.25	3.86	10.03
>200 YDS	0.000	7.546	0.000	3.799
BIG	0.000	9.851	0.733	5.769
NO_SHEET	0.95	60.50	9.00	32.63
SHEET	0.45	29.57	2.91	15.43
RD&HARV	0.58	85.80	12.10	43.26
RDHV&200	0.58	85.80	12.10	46.74
EROSION	1.39	86.55	13.85	48.38
SEDIMENT	0.258	4.143	1.000	2.912
RD&HV DR	0.010	2.307	0.037	0.199
RH&200DR	0.010	2.307	0.037	0.199
DELIVERY	0.0104	0.8968	0.0318	0.1856
DR_WO_SH	0.0140	1.3194	0.0400	0.2560
% LOGGED	0.0	100.0	23.0	99.1
% CLASS3	0.0	100.0	39.9	100.0
%CLASS2	0.0	100.0	7.8	100.0
%CLAS2&3	0.0	100.0	31.3	100.0
%TRACTOR	0.00	43.44	2.17	13.01
%RDS&LAN	0.000	11.170	2.665	5.368
%RDLA&SK	0.000	12.720	2.924	6.864
BARE	0.00	21.30	1.87	6.25
SLOPE	21.000	29.700	23.918	26.742
%>22.5	30.77	100.00	57.05	78.34
HC<-.002	20.00	60.00	36.72	46.76
ROCK	-0.2000	1.0000	0.0975	0.4850
HUE	2.6920	3.4145	3.0192	3.2582
RISK	0.00296	0.03810	0.01539	0.02246
WTDCLAS2	334.0	1597.1	604.9	1025.5
GAGEDIST	768	6387	1073	3217
FLOSLOPE	0.1763	0.3657	0.2808	0.3388

APPENDIX I - Data Used in Analyses c

WATERSHD	AREA	HARVEST	ROADS	>200 YDS	BIG	NO SHEET	SHEET
ARF	948.46	20.4747	9.4907	2.49880	4.54320	24.5866	9.9220
BAN	25.87	20.5877	4.1911	0.00000	0.00000	18.5108	6.2680
CAR	65.51	9.5166	4.4779	0.00000	3.93830	11.5318	6.4010
DOL	190.44	20.7743	2.8624	0.00000	0.97670	21.3864	3.2270
EAG	66.00	80.8669	4.9294	0.00000	0.75760	60.4969	26.0570
FLY	535.49	25.3241	14.8481	3.67890	5.65280	32.5670	13.2580
GIB	49.03	40.8745	11.6483	7.54640	9.85110	32.8039	29.5700
HEN	95.65	0.5794	0.0000	0.00000	1.95500	2.0254	0.5090
IVE	51.10	2.2779	7.1723	0.00000	1.89820	9.3734	1.9750
JOH	134.86	7.0652	5.9223	0.00000	1.69810	7.8716	6.8140
KJE	37.90	37.1443	18.2526	0.00000	0.65960	34.1065	21.9500
LAN	384.58	19.5289	4.7580	4.16040	6.11570	19.4266	10.9760
MUN	40.35	0.6915	0.1557	0.00000	0.54520	0.9464	0.4460
NFC	1169.20	15.5453	8.7893	6.06060	7.74120	24.0658	8.0100

	RD&HARV	RDHV&200	EROSION	SEDIMENT	RD&HV DR	RH&200DR	DELIVERY
ARF	29.9654	32.4642	34.5086	2.39167	0.07981	0.07367	0.069306
BAN	24.7788	24.7788	24.7788	0.25838	0.01043	0.01043	0.010427
CAR	13.9945	13.9945	17.9328	0.89189	0.06373	0.06373	0.049735
DOL	23.6367	23.6367	24.6134	4.14276	0.17527	0.17527	0.168313
EAG	85.7963	85.7963	86.5539	1.83945	0.02144	0.02144	0.021252
FLY	40.1722	43.8511	45.8250	2.23847	0.05572	0.05105	0.048848
GIB	52.5228	60.0692	62.3739	1.03615	0.01973	0.01725	0.016612
HEN	0.5794	0.5794	2.5344	1.33646	2.30663	2.30663	0.527328
IVE	9.4502	9.4502	11.3484	0.40084	0.04242	0.04242	0.035321
JOH	12.9875	12.9875	14.6856	3.48527	0.26836	0.26836	0.237326
KJE	55.3969	55.3969	56.0565	3.88400	0.07011	0.07011	0.069287
LAN	24.2869	28.4473	30.4026	1.72007	0.07082	0.06047	0.056576
MUN	0.8472	0.8472	1.3924	1.24870	1.47391	1.47391	0.896797
NFC	24.3346	30.3952	32.0758	2.72079	0.11181	0.08951	0.084824

	DR_WO_SH	% LOGGED	% CLASS3	%CLASS2	%CLAS2&3	%TRACTOR	%RDS&LAN
ARF	0.09728	48.250	74.171	38.349	65.795	9.0377	3.3200
BAN	0.01396	98.950	100.000	100.000	100.000	16.0467	3.1600
CAR	0.07734	99.850	100.000	100.000	100.000	11.9948	4.7700
DOL	0.19371	36.650	53.545	16.578	44.459	8.9788	3.3000
EAG	0.03041	99.400	100.000	100.000	98.949	22.0518	6.2600
FLY	0.06873	48.070	73.010	34.030	62.296	9.2197	3.5500
GIB	0.03159	100.000	100.000	100.000	100.000	43.4428	9.9100
HEN	0.65985	0.010	0.000	0.000	0.000	0.0000	0.0000
IVE	0.04276	0.000	0.000	0.000	0.000	0.0000	2.3800
JOH	0.44277	30.710	70.400	10.360	48.031	3.3347	5.0700
KJE	0.11388	97.390	100.000	100.000	100.000	10.3665	11.1700
LAN	0.08854	35.080	53.150	20.290	41.799	2.8913	2.7600
MUN	1.31942	0.020	0.000	0.000	0.000	0.0000	1.3200
NFC	0.11306	52.340	73.960	45.562	66.165	9.7132	3.4600

APPENDIX II (cont.) - Data Used in Analyses

WATERSHD	%RDLA&S	BARE	SLOPE	%>22.5	HC<-.002	ROCK	HUE
ARF	4.0775	4.225	26.58	91.36	45.68	0.358	3.1282
BAN	3.7785	10.350	29.70	100.00	60.00	0.000	3.2500
CAR	6.3041	4.230	23.82	54.55	45.55	0.273	3.1000
DOL	4.0908	3.550	25.87	78.26	30.43	0.130	3.4145
EAG	8.5418	12.730	25.36	72.73	36.36	-0.091	3.3330
FLY	4.3502	4.890	26.74	77.36	41.51	0.472	2.9000
GIB	12.7205	21.300	21.00	40.00	40.00	-0.200	3.1111
HEN	0.0000	1.470	25.07	73.33	20.00	0.333	3.1081
IVE	2.3800	2.000	28.00	70.00	60.00	1.000	2.6920
JOH	5.1716	0.947	23.95	57.89	36.84	0.368	3.2830
KJE	11.5248	2.889	25.80	60.00	50.00	0.600	3.0000
LAN	3.1053	3.643	26.31	78.57	42.86	0.524	3.0684
MUN	1.3200	0.000	22.08	30.77	38.46	0.231	3.1000
NFC	4.2617	3.665	26.75	78.00	38.00	0.300	3.0256

WATERSHD	RISK	WTDCLAS2	GAGEDIST	FLOSLOPE
ARF	0.02053	681.82	6387	0.3376
BAN	0.03310	733.82	917	0.2901
CAR	0.02055	1067.42	1700	0.3212
DOL	0.02162	1046.09	2659	0.2934
EAG	0.02160	790.88	1327	0.3187
FLY	0.01618	602.77	4088	0.3486
GIB	0.00296	856.80	1116	0.3424
HEN	0.01589	334.05	1505	0.2812
IVE	0.02410	605.66	1438	0.3657
JOH	0.00905	895.12	1786	0.2796
KJE	0.03810	1018.63	944	0.2714
LAN	0.01623	563.49	2927	0.3374
MUN	0.01390	1597.06	768	0.1763
NFC	0.02192	639.57	5903	0.3223