SEMP Task 1-2.6: Ratio of Current to "Undisturbed" Soil Loss Rates Across Fort Polk Training Lands

This task examines the estimated current rate of soil loss across Fort Polk training lands[1] as compared to estimated soil loss rates if the land was in its natural forested condition. The task is designed to answer the question "Are allowable soil loss rates being exceeded?" The ratio of current to undisturbed soil loss rates, or C:U, and associated geographic information system (GIS) images depicting soil loss rates are used to indicate the effectiveness of land rehabilitation and management activities and to identify areas potentially in need of rehabilitation. Smaller C:U ratios (i.e., values close to 1) indicate that current erosion rates are similar to naturally occurring erosion rates at Fort Polk. Where C:U ratios are higher, current erosion rates exceed natural erosion rates. For example, a C:U of 1.55 indicates that current erosion rates are 55% higher than rates of erosion occurring due to natural processes. Increased erosion rates can result from loss of ground cover associated with intensive military training activities, removal of vegetation and ground cover for construction of facilities, or other activities that increase exposure of bare soil.

To evaluate soil loss rates at Fort Polk, a performance target (Green rating) was established for a C:U ratio less than or equal to 1.20 for at least 80%of training lands, and less than or equal to 1.55 for at least 90% of training lands. If the C:U ratio is less than or equal to 1.20 for less than 80% of training lands or less than or equal to 1.55 for less than 90% of training lands, soil loss rates are given an Amber performance rating. To maintain an Amber rating, the C:U ratio must also be less than or equal to 1.20 for at least 60% of training lands and less than or equal to 1.55 for at least 80% of training lands. If the C:U ratio is less than or equal to 1.20 for less than 60% of training lands or less than or equal to 1.55 for less than 80% of training lands, then a Red performance rating is assigned. Table 1-2.6a lists the performance target criteria for monitoring task 1-2.6.

Table 1-2.6a. Performance target criteria for the ratio of current to undisturbed soil loss rates across Fort Polk training lands.

Performance Level	Ratio of C:U Soil Loss Rates Across Training Lands		
	C:U ≤ 1.20	*f*	C:U ≤ 1.55
Green	≥ 80% of training lands	AND	≥ 90% of training lands
Amber (must meet both criteria)	< 80% of training lands	OR	< 90% of training lands
	≥ 60% of training lands	AND	≥ 80% of training lands
Red	< 60% of training lands	OR	< 80% of training lands

The Revised Universal Soil Loss Equation (RUSLE), developed by the U.S. Department of Agriculture , was used to estimate current and "undisturbed" soil erosion rates in tons per acre per year. The RUSLE is an empirical model that estimates soil erosion by raindrop impact and surface runoff based on four physiographic and climatic factors, a cover factor(c-factor), and a management practice factor, which was not applicable to military training lands. The four physiographic and climatic factors remain relatively constant through time and are not influenced by land use a landscape scale. The c-factor represents the effects of vegetation and

[1] Fort Polk training lands included in the analysis were the Main Post, including the Intensive Use Area (IUA) of the Vernon Unit of the Kisatchie National Forest (KNF), and the Limited Use Area (LUA) of the KNF, located in Vernon Parish; and the Peason Ridge Training Area, located approximately 15 miles north of the Main Post in Vernon, Natchitoches and Sabine Parishes.

soil cover to reduce soil erosion and is the factor most altered by military land use. Accordingly, it is the variable that was estimated under current training land conditions and "undisturbed" forest conditions to generate the soil loss estimates used to determine the C:U.

To estimate current soil loss rates on Fort Polk training lands, measurements of vegetation and soil cover were taken at numerous locations across the installation in late summer and fall of 2008. Those measurements were used to calculate c-factor at each location. Using those c-factor values, statistical models to predict c-factor across training lands were developed based on the correlation between measured c-factor and indices of vegetative cover derived from satellite imagery. Current soil loss rates, C, were then estimated using the RUSLE and location-specific values for the four physiographic and climatic factors, and the c-factor estimates.

Comparable estimates of soil loss rates under undisturbed forest conditions, U, were then derived. To establish a soil erosion threshold for "undisturbed" conditions, the maximum c-factor (i.e., the highest erosion rate) for typical forested conditions on Fort Polk training lands was identified. At locations where the c-factor values exceeded the "undisturbed" c-factor threshold (i.e., areas with a reduced amount of vegetative cover relative to undisturbed conditions), the c-factor values were adjusted to the threshold value. By adjusting high c-factor values to the threshold value, areas with reduced vegetative cover were "restored" to an "undisturbed" forest condition for purposes of the analysis. Soil loss rates for undisturbed conditions, U, were then estimated using the same methodology applied to estimate the current (2008) soil loss rates.

Table 1-2.6 below presents the results of the analysis of C:U erosion rates at Fort Polk. The mean C:U ratio across all Fort Polk training lands in 2008 was 1.07. A total of 94.1% of training lands had a C:U ratio less than or equal to 1.20, and 97.8% of training lands had a C:U ratio less than or equal to 1.55, indicating that overall 2008 erosion rates did not significantly exceed erosion rates for undisturbed forest lands. The overall mean C:U ratio for Peason Ridge Training Area was slightly higher (1.12) than the mean C:U for the Fort Polk Main Post and Vernon Unit (1.06). In addition, two watersheds at Peason Ridge Training Area, Lyles Creek and Sandy-Odom Creek, showed mean C:U ratios greater than 1.20.

Figure 1-2.6a provides a graphic presentation of the mean C:U ratios for each of the watersheds occurring on Fort Polk training lands. The watersheds are listed by mean C:U ratio in descending order. As described above, C:U ratios close to 1 indicate that estimated current erosion rates are close to estimated erosion rates for natural, or undisturbed, forest conditions. Higher C:U ratios indicate that current erosion rates exceed naturally occurring rates. Increased erosion rates may be due to military training use, construction activities, and/or other activities that remove vegetative cover.

Figure 1-2.6b displays C:U erosion rates and watershed boundaries on the Fort Polk Main Post (including the Vernon Unit) and Peason Ridge Training Area. The training lands are depicted in Green, Amber or Red based on the C:U ratio performance ratings described above. Areas shown as Amber and Red generally represent locations that are used intensively for live fire or maneuver training. Potential erosion problem areas located within the North and South Fort cantonment areas are also shown as Amber and Red on Figure 1-2.6b.

Table 1-2.6b. Mean C:U ratios and mean soil loss rates (tons/acre/year) for current (actual) training land conditions and "undisturbed" forest conditions at Fort Polk.

		Ratio of Current to Undisturbed Soil Loss Rates (C:U)					Mean Soil Loss (tons/acre/year)	
Watershed Name	Acres	Mean	Rank	%<=1.2	%>1.2 - <=1.55	%>1.55	Actual 2008	Undisturbed 2008
Lyles Creek	3,127	1.230	1	80.1%	6.4%	13.5%	4.75	2.92
Sandy-Odom Creek	10,968	1.175	2	85.2%	4.3%	10.4%	4.96	3.54
Kisatchie Creek	811	1.137	3	91.1%	1.9%	7.0%	1.86	1.03
POLK-Mill Creek	306	1.121	4	82.2%	9.6%	8.1%	2.61	2.00
Zourie Bayou Creek	1,387	1.120	5	88.2%	4.4%	7.4%	3.25	2.34
Big Creek	4,349	1.112	6	91.9%	2.8%	5.3%	2.30	1.77
Thompson Creek	1,539	1.099	7	91.5%	2.9%	5.6%	1.03	0.66
East Fork Sixmile Creek	14,563	1.097	8	92.8%	2.9%	4.4%	1.86	1.48
Birds Creek	15,262	1.095	9	92.3%	2.5%	5.3%	2.70	2.17
Big Brushy Creek	7,743	1.085	10	93.5%	2.2%	4.4%	1.42	1.08
Dowden Creek	6,724	1.083	11	90.7%	4.0%	5.3%	2.54	2.08
Tenmile Creek	3,650	1.057	12	94.2%	2.7%	3.0%	1.04	0.79
West Fork Sixmile Creek	16,077	1.056	13	94.6%	2.3%	3.1%	1.57	1.32
Floctaw Creek	4,723	1.052	14	93.7%	2.7%	3.5%	3.49	3.15
Anacoco Creek	3,450	1.051	15	94.0%	3.1%	3.0%	1.81	1.54
Martin-Prairie Creek	4,418	1.049	16	95.3%	2.0%	2.8%	1.97	1.72
Ouiska-Chitto Creek	20,545	1.047	17	95.8%	1.6%	2.5%	2.38	2.07
PR-Mill Creek	695	1.046	18	91.9%	5.9%	2.2%	3.72	3.39
Bundick Creek	8,704	1.045	19	97.1%	0.9%	2.1%	0.98	0.75
Liberty Creek	2,472	1.043	20	95.8%	1.3%	2.9%	2.85	2.48
Comrade Creek	3,093	1.040	21	94.6%	2.9%	2.5%	1.30	1.12
Burton Creek	925	1.038	22	94.0%	3.6%	2.4%	4.11	3.81
Little Brushy Creek	4,458	1.028	23	95.8%	2.9%	1.2%	1.22	1.11
Drakes Creek	22,973	1.025	24	98.0%	0.7%	1.3%	1.01	0.90
Black Creek	3,911	1.007	25	99.2%	0.3%	0.5%	0.17	0.14
Six Mile Creek	1,629	1.006	26	99.2%	0.3%	0.5%	0.40	0.38
Hurricane Branch	513	1.004	27	99.0%	0.2%	0.8%	0.40	0.39
Boggy Creek	647	1.003	28	99.6%	0.2%	0.2%	0.19	0.19
Little Sixmile Creek	3,508	1.002	29	99.6%	0.3%	0.0%	0.79	0.79
Spring Branch Creek	1,237	1.001	30	99.9%	0.1%	0.1%	0.55	0.54
Sum/Weighted Means	174,409	1.068		94.1%	2.2%	3.7%	2.03	1.63
Weighted Means - FPVU		1.057		95.2%	1.9%	3.0%	1.73	1.44
Weighted Means - PR		1.116		89.2%	3.9%	6.9%	3.29	2.45

Figure 1-2.6a. Mean 2008 C:U ratios for watersheds occurring on Fort Polk training lands.

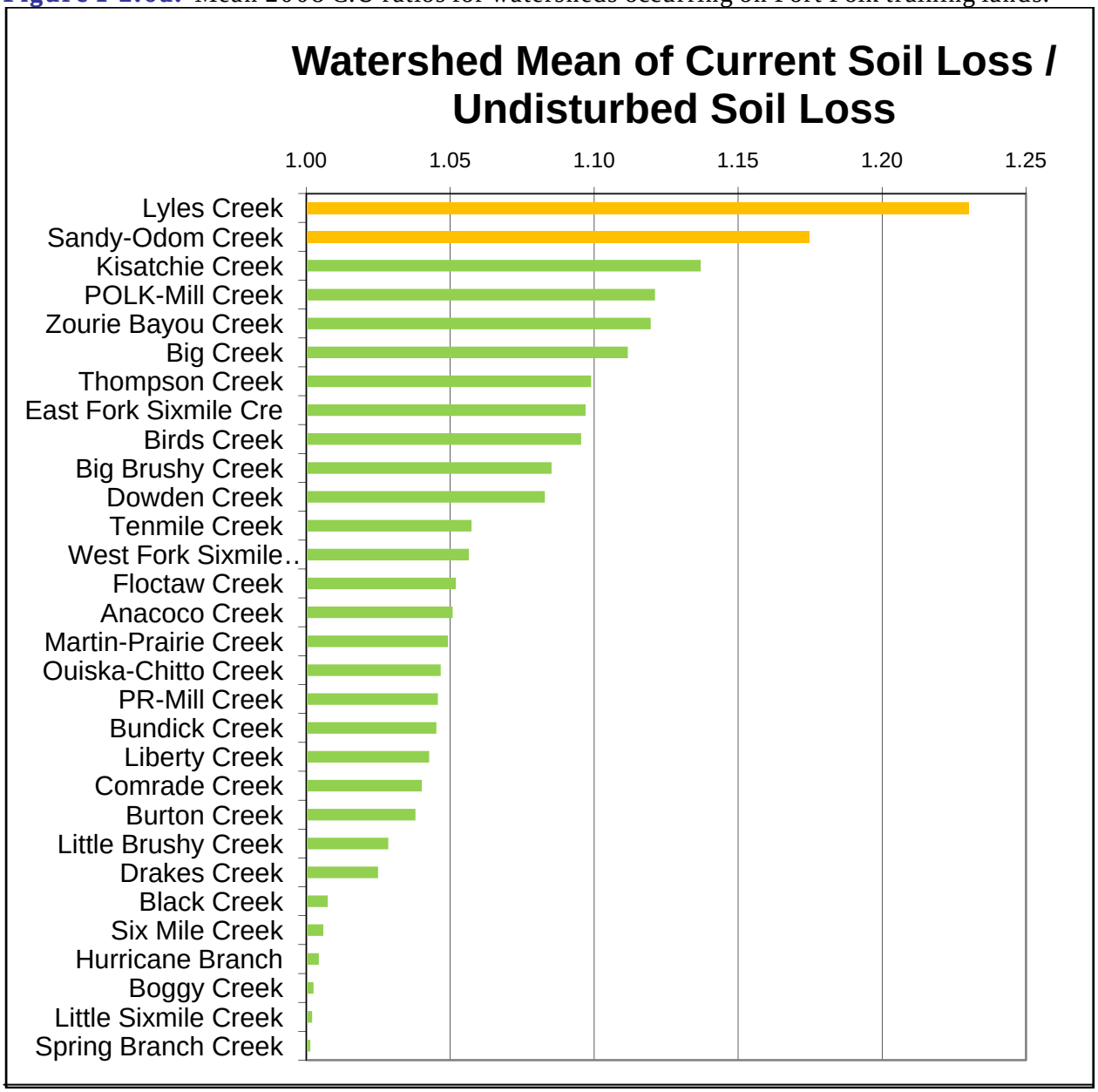

Figure 1-2.6b. 2008 C:U ratios on Fort Polk Main Post (including the Vernon Unit of the Kisatchie National Forest) and Peason Ridge Training Area (note that the two areas are depicted at different scales).