ESTIMATING CHANNEL AND GULLY EROSION

Channel erosion is a general term for erosion occurring when water moves within a stream, gully, or other defined channel. Erosion can occur along banks, channel bottoms, and in gully headcuts. Similar erosion can occur along roads (in ditches and road cuts) and on construction sites. The Gully Erosion Calculation Spreadsheet found in eFOTG Sec. IV, C. Tools, NE-Gullies.xls can be used to estimate soil loss from gully erosion or it can be done manually using the procedure described below. These procedures are designed for field office use on individual fields and relatively small-scale operations. For larger situations, the Resource Conservation Staff is available for consultation and technical assistance.

The method used in these cases is to compute the volume of material eroded and the time period involved. Volume is determined by finding the three dimensions of length, width, and depth. Width in this case is called lateral recession, and refers to how much the bank has receded or cut back. For example, an eroding section of streambank 300 feet long (length) and six feet deep (depth) is cutting back or receding at a rate 0.5 feet per year (width). The volume voided annually is:

$$300'\text{x } 6'\text{x } 0.5' = 900 \text{ ft}^3/\text{yr}$$

In cases of gully erosion, the volume voided from the gully sides is usually computed separately from the gully head cut. This is because headcutting usually occurs at a faster rate than lateral recession. The two volumes are then added to give a total volume voided. For eroding stream channels, if the channel bed is eroding and the channel is deepening, it should likewise be computed as a separate volume and added to the bank erosion.

For measuring voiding along streambanks or in gullies, refer to Tables 5 and 6 and Figure 3, "Channel Erosion Code Areas."

1. Use the map to determine the correct code number for your county, and then turn to the sheet "Clues for Recognizing Gully and Streambank Erosion."
2. Decide if your erosion is "slight," "moderate," or "severe" in intensity. Refer to Table 5, where matching the code number with intensity will result in a lateral recession rate. For example, a Code 2 combined with "slight" intensity results in a range of lateral recession between 0.05 ft/yr and 0.2 ft/yr. You then choose an appropriate value within these limits for your particular field situation.
3. Volume voided can now be computed by multiplying eroding bank length x bank height x selected lateral recession rate. Answer will be in cubic feet per year, as shown by the-previous example in paragraph two.
4. Refer now to Table 6, "Suggested General Weight/Volume by Soil Type." This will give a volume/weight value for the soil type appropriate to your situation. This value is then multiplied by the volume to give pounds eroded annually. The answer is divided by 2,000 to convert to tons per year eroded.

Example:

A cultivated field selected for conservation treatment contains a gully, which measures 400 feet long and averages 6 feet deep. The location is Cass County, on an upland slope. Field inspection of the gully reveals a total from both sides of 300 feet of eroding bank (200' from one side, 100' from the other). The overfall or headcut is 10 feet wide, 5 feet deep, and receding at the rate of 2 feet/year.

Looking at the sheet "Clues for Recognizing Gully and Streambank Erosion" and comparing to this field situation, the intensity of erosion is determined to be "slight."

1. From the map Figure 3 "Channel Erosion Code Areas," Cass County is in the Code 3 area. Going to Table 5, Code 3 with an intensity of "slight" allows a range between 0.1 and 0.3 ft/yr. for lateral recession. A specific rate of 0.2 ft/yr. is selected.

2. Volume voided can now be computed.

   A) Side walls

   $300' \times 6' \times 0.2' = 360\ ft^3/yr$

   B) Headcut

   $10' \times 5' \times 2' = 100\ ft^3/yr.$

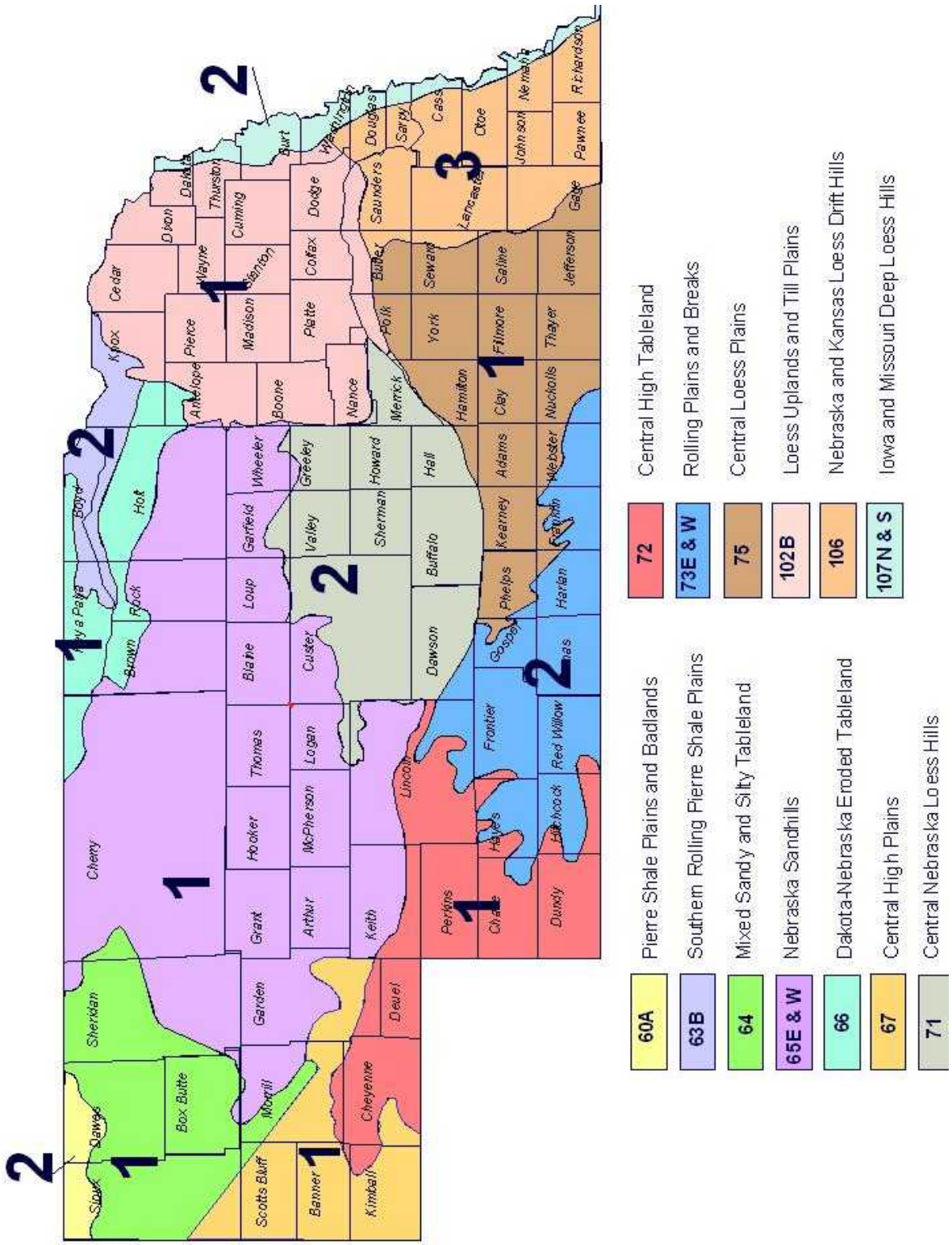
   C) Total Volume Voided

   $360\ ft^3/yr + 100\ ft^3/yr = 460\ ft^3/yr$

3. Convert to tons, using the value of 90 lbs./ft^3 for "silty or clayey upland" from Table 6:

   $460\ ft^3 \times 90$ lbs. /ft^3 = 41,400 lbs / 2,000 lbs/ton = 20.7 or 21 tons/yr eroded

Figure 3:
Channel Erosion Code Areas



CLUES FOR RECOGNIZING GULLY AND STREAMBANK EROSION

Slight - There are patches of bare bank, but lateral recession of the bank is not very obvious. It would be difficult to measure over a period of one or two years. Trees can be established within the gully or along the channel, and there is little or no overhang of vegetation at the top of the bank.

Gully headcutting is defined, but advancement is not obvious.

Moderate - Streambank erosion is characterized by bare sections of actively erosion banks. These sections may be continuous, or intermittent with stable bank sections. Gully erosion also shows similar activity, which can occur on one or both sidewalls. The headcut is well defined, bare, and steeply sloping or vertical. Headcutting rate shows visible advancement when compared with aerial photos of 3-5 years previous.

There are freshly exposed tree roots, overhanging vegetation, and exposed cultural features such as drain pipe or fence posts. Changes in other cultural features adjacent to channels can be noted such as missing fence corners or realignment of roads and cropping patterns.

Severe - Streambank erosion is characterized by meandering streams having major washouts and block slumps in addition to the characteristics of moderate erosion. Alterations in cultural features are obvious, including deterioration of bridge abutments. Change of stream channel course is sometimes an indication of severe erosion. In many cases, severe localized bank erosion can result from channel straightening, both up and down stream from the straightened section.

Gully headcutting and lateral recession is indicated by raw, steep banks. Headcutting has obviously occurred since the previous year. Patches of recently eroded material can be temporarily deposited along the channel bottom.

Table 5. Gully Erosion – Suggested Lateral Recession Rates

Lateral Rates of Recession (ft/yr)

Code	Slight	Moderate	Severe
1	0.05 – 0.1	0.1 – 0.4	0.4+
2	0.05 – 0.2	0.2 – 0.6	0.6+
3	0.1 – 0.3	0.3 – 0.8	0.8+

Table 6. Suggested General Weight/Volume by Soil Type

Soil Type	Weight/Volume ($lbs./ft^3$)
Silty or clayey alluvial	80
Silty or clayey upland	90
Sandy	100
Bedrock (siltstone, shale)	150