U. S. LOTIC WETLAND ECOLOGICAL HEALTH ASSESSMENT FOR LARGE RIVER SYSTEMS (Survey) USER MANUAL (Current as of 6/6/2018)

The user manual is intended to accompany the *U. S. Lotic Ecological Health Assessment For Large River Systems (Survey) Form* for the rapid evaluation of riparian areas along large river systems (those with channels wider than 15 m [50 ft]). Another form entitled the *U. S. Lotic Wetland Ecological Health Assessment For Streams and Small Rivers (Survey)* is available for use on smaller rivers and streams.

ACKNOWLEDGEMENTS

Development of these assessment tools has been a collaborative and reiterative process. Many people from many agencies and organizations have contributed greatly their time, effort, funding, and moral support for the creation of these documents, as well as to the general idea of devising a way for people to look critically at wetlands and riparian areas in a systematic and consistent way. Some individuals and the agencies/organizations they represent who have been instrumental in enabling this work are Dan Hinckley, Tim Bozorth, and Jim Roscoe of the USDI Bureau of Land Management in Montana; Karen Rice and Karl Gebhardt of the USDI Bureau of Land Management in Idaho; Bill Haglan of the USDI Fish and Wildlife Service in Montana; Barry Adams and Gerry Ehlert of Alberta Sustainable Resource Development; Lorne Fitch of Alberta Environmental Protection; and Greg Hale and Norine Ambrose of the Alberta Cows and Fish Program.

BACKGROUND INFORMATION

Introduction

Public and private land managers are being asked to improve or maintain lotic (riparian) habitat and stream water quality on lands throughout western North America. Three questions that are generally asked about a wetland site are: 1) What is the potential of the site (e.g., climax or potential natural community)? 2) What plant communities currently occupy the site? and 3) What is the overall health (condition) of the site? For a lotic (flowing water) site, the first two questions can be answered by using the U. S. Lotic Wetland Inventory Form along with a document such as *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995), *Classification and Management of USDI Bureau of Land Management's Riparian and Wetland Sites in Eastern and Southern Idaho* (Hansen and Hall 2002), *Classification and management of upland, riparian, and wetland sites of USDI Bureau of Land Management's Miles City Field Office, eastern Montana USA* (Hansen and others 2008), or a similar publication written for the region in which you are working.

For riparian areas along rivers approximately 15 m (50 ft) or more in width, this is a method for rapidly addressing the third question above: What is the site's overall health (condition)? It provides a site rating useful for setting management priorities and stratifying riparian sites for remedial action or more rigorous analytical attention. It is intended to serve as a first approximation, or coarse filter, by which to identify riparian areas along rivers in need of closer attention so that managers can more efficiently concentrate their efforts. We use the term riparian health to mean the ability of a riparian area (including the channel and its riparian zone) to perform certain functions. These functions include sediment trapping, bank building and maintenance, water storage, aquifer recharge, flow energy dissipation, maintenance of biotic diversity, and primary production. Excellent sources of practical ideas and tips on good management of these streamside wetland sites are found in *Caring for the Green Zone* (Adams and Fitch 1995), *Riparian Areas: A User's Guide to Health* (Fitch and Ambrose 2003), and *Riparian Health Assessment for Streams and Small Rivers* (Fitch and others 2001).

Flowing Water (Lotic) Wetlands vs. Still Water (Lentic) Wetlands

Cowardin and others (1979) point out that no single, correct definition for wetlands exists, primarily due to the nearly unlimited variation in hydrology, soil, and vegetative types. Wetlands are lands transitional between aquatic (water) and terrestrial (upland) ecosystems. Windell and others (1986) state, "wetlands are part of a continuous landscape that grades from wet to dry. In many cases, it is not easy to determine precisely where they begin and where they end."

In the semi-arid and arid portions of western North America, a useful distinction has been made between wetland types based on association with different aquatic ecosystems. Several authors have used ***lotic*** and ***lentic*** to separate wetlands associated with running water from those associated with still water. The following definitions represent a synthesis and refinement of terminology from Shaw and Fredine (1956), Stewart and Kantrud (1972), Boldt and others (1978), Cowardin and others (1979), American Fisheries Society (1980), Johnson and Carothers (1980), Cooperrider and others (1986), Windell and others

(1986), Environmental Laboratory (1987), Kovalchik (1987), Federal Interagency Committee for Wetland Delineation (1989), Mitsch and Gosselink (1993), and Kent (1994).

Lotic wetlands are associated with rivers, streams, and drainage ways. They contain a defined channel and floodplain. The channel is an open conduit, which periodically or continuously carries flowing water. Beaver ponds, seeps, springs, and wet meadows on the floodplain of, or associated with, a river or stream are part of the lotic wetland.

Lentic wetlands are associated with still water systems. These wetlands occur in basins and lack a defined channel and floodplain. Included are permanent (i.e., perennial) or intermittent bodies of water such as lakes, reservoirs, potholes, marshes, ponds, and stockponds. Other examples include fens, bogs, wet meadows, and seeps not associated with a defined channel.

Functional vs. Jurisdictional Wetland Criteria

Defining wetlands has become more difficult as greater economic stakes have increased the potential for conflict between politics and science. A universally accepted wetland definition satisfactory to all users has not yet been developed because the definition depends on the objectives and the field of interest. However, scientists generally agree that wetlands are characterized by one or more of the following features: 1) ***wetland hydrology,*** the driving force creating all wetlands, 2) ***hydric soils,*** an indicator of the absence of oxygen, and 3) ***hydrophytic vegetation,*** an indicator of wetland site conditions. The problem is how to define and obtain consensus on thresholds for these three criteria and various combinations of them.

Wetlands are not easily identified and delineated for jurisdictional purposes. Functional definitions have generally been difficult to apply to the regulation of wetland dredging or filling. Although the intent of regulation is to protect wetland functions, the current delineation of jurisdictional wetland still relies upon structural features or attributes.

The prevailing view among many wetland scientists is that functional wetlands need to meet only one of the three criteria as outlined by Cowardin and others (1979) (e.g., hydric soils, hydrophytic plants, and wetland hydrology). On the other hand, jurisdictional wetlands need to meet all three criteria, except in limited situations. Even though functional wetlands may not meet jurisdictional wetland requirements, they certainly perform wetland functions resulting from the greater amount of water that accumulates on or near the soil surface relative to the adjacent uplands. Examples include some woody draws occupied by the *Fraxinus pennsylvanica*/*Prunus virginiana* (green ash/chokecherry) habitat type and some floodplain sites occupied by the *Artemisia cana*/*Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type or the *Pinus ponderosa*/*Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type. Currently, many of these sites fail to meet jurisdictional wetland criteria. Nevertheless, these sites do provide important wetland functions and may warrant special managerial consideration. The current interpretation, at least in the western United States, is that not all functional wetlands are jurisdictional wetlands, but all jurisdictional wetlands are functional wetlands.

Lotic (Riparian) Ecological Health of River Systems

As noted above, the health of a lotic site (a wetland, or riparian area, adjacent to flowing water) may be defined as the ability of that system to perform certain wetland functions. These functions include sediment trapping, bank building and maintenance, water storage, aquifer recharge, flow energy dissipation, maintenance of biotic diversity, and primary biotic production. A site's health rating may also reflect management considerations. For example, although *Cirsium arvense* (Canada thistle) or *Euphorbia esula* (leafy spurge) may help to trap sediment and provide soil-binding properties, other functions (i.e., productivity and wildlife habitat) will be impaired; and their presence should be a management concern.

No single factor or characteristic of a wetland site can provide a complete picture of either site health or the direction of trend. The lotic ecological health assessment is based on consideration of physical, hydrologic, and vegetation factors. It relies heavily on vegetative characteristics as integrators of factors operating on the landscape. Because they are more visible than soil or hydrologic characteristics, plants may provide early indications of riparian health as well as successional trend. These are reflected not only in the types of plants present, but also by the effectiveness with which the vegetation carries out its wetland functions of stabilizing the soil, trapping sediments, and providing wildlife habitat. Furthermore, the utilization of certain types of vegetation by animals may indicate the current condition of the wetland and may indicate trend toward or away from potential natural community (PNC).

In addition to vegetation factors, an analysis of site health and its susceptibility to degradation must also consider physical factors (soils and hydrology) for both ecologic and management reasons. Changes in soil or hydrologic conditions obviously affect the function of a wetland ecosystem. Moreover, degradation in physical factors is often (but not always) more difficult to remedy than vegetative degradation. For example, extensive incisement (down-cutting) of a stream channel may lower the water table and thus change site potential from a *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type to a *Bromus inermis* (smooth brome) community type or even to an upland (non-riparian) type. Sites experiencing significant hydrologic, edaphic (soil), or climatic changes will likely also have new plant community potential.

This river ecological health assessment attempts to balance the need for a simple, quick index of health against the reality of an infinite variety of wetland situations. Although this approach will not always work perfectly, we believe in most cases it will yield a usefully accurate index of riparian health. Some more rigorous methods to determine status of a river's channel morphology are Dunne and Leopold (1978), Pfankuch (1975), and Rosgen (1994, 1996, 1998, 2006). These relate their ratings to degree of channel degradation, but do not integrate other riparian functions into the rating. Other methods are available for determining condition from perspectives that also include vegetation, most notably the USDI Bureau of Land Management (BLM) proper functioning condition (PFC) methodology (1998).

This method is not designed for an in-depth and comprehensive analysis of ecologic processes. Such analysis may be warranted on a site and can be done after this evaluation has identified areas of concern. Nor does this approach yield an absolute rating to be used in comparison with streams in other areas or of other types. Comparisons using this rating with streams of different types (Rosgen 1996), different orders (size class), or from outside the immediate locality should be avoided. Appropriate comparisons using this rating can be made between segments of one stream, between neighboring streams of similar size and type, and between subsequent assessments of the same site.

A single evaluation provides a rating at only one point in time. Due to the range of variation possible on a riparian site, a single evaluation cannot define absolute status of site health or reliably indicate trend (whether the site is improving, degrading, or stable). To monitor trend, ecological health assessments should be repeated in subsequent years during the same time of year. Evaluation should be conducted when most plants can be identified in the field and when hydrologic conditions are most nearly normal (e.g., not during peak spring runoff or immediately after a major storm). Management regime should influence assessment timing. For example, in assessing trend on rotational grazing systems, one should avoid comparing a rating after a season of use one year to a rating another year after a season of rest.

Pre-Assessment Preparation

The river ecological health assessment process incorporates data on a wide range of biological and physical factors. The basic unit of delineation upon which an assessment is made is referred to as a ***polygon.*** Polygons are delineated on topographic (topo) maps by marking the upper and lower ends before evaluators go to the field. (The widths of most riparian zones are unknown before the inventory and cannot be pre-marked.) On topographic maps, polygons are numbered sequentially proceeding downstream. It is important to clearly mark and number polygons on the topo map. Polygons must be clearly marked and numbered. Polygons are numbered pre-field (in the office) with consecutive integers (1, 2, 3 . . .). In cases where field inspection shows the need to change the delineation or to subdivide the pre-drawn polygons, additional polygons should be numbered using alpha-numerics (e.g., 1a, 1b, 2a, 2b, etc.). Combination of delineated polygons will be field identified as the hyphenated tags of both combined parts (e.g., 1-2, 2-3, etc.).

Upper and lower polygon boundaries are placed at distinct locations such as fences, stream confluences, or river meanders that can hopefully be recognized in the field. If aerial photos are available, pre-field polygon delineations may be based on vegetation differences, geologic features, or other observable characteristics.

Once in the field, evaluators will verify (ground truth) the office-delineated polygon boundaries. If the pre-assigned numbers are used, be sure the inventoried polygons correspond exactly as drawn originally. Evaluators are allowed to move polygon boundaries, create new polygons, or consolidate polygons if the vegetation, geography, location of fences, or width of the wetland zone warrant. If polygon boundaries are changed, the changes must be clearly marked on the field copies of the topographic maps. The original polygon numbers should be retained on the map for cross-reference.

The outer boundaries of riparian polygons are at the wetland vegetative type outer edges. These boundaries are sometimes clearly defined by abrupt changes in the geography and/or vegetation, but proper determination often depends on experienced interpretation of more subtle differences.

Identification of plant communities by vegetation type (such as Hansen and others 1995, Hansen and others 2008, Hansen and Hall 2002, etc.) will be useful both in site selection and, later, in determining appropriate management. These communities may be in a mosaic difficult to map. An area may have a mix of herbaceous communities, shrubs, and forest.

These communities have diverse resource values and may respond differently to a management action, but it is seldom practical to manage such communities separately. Community composition can be described as percentages of component types. Management actions can then be keyed to the higher priority types present.

Selection of a Reach to Evaluate

Two considerations in determining appropriate reach size and location for river ecological health assessments are: 1) the need for the reach boundaries to be relocated for future repeatability, and 2) the need to include adequate area and channel length to ensure a representative sample of the variability within the system.

The above needs can be met by basing reach size and location on a map grid which is related to the average width of the floodplain being assessed. Future reassessment of the site requires the ability to relocate the same site. Due to the dynamic nature of most river systems, it is impractical to tie long-term reference points to many physical features found on a floodplain landscape. Instead, a reach can be bounded by the upstream and downstream sides (or east-west, depending on which direction is most nearly perpendicular to the valley) of a square in a map grid. The size of the grid squares can be based on the average width (to the closest 0.4 km [0.25 mi]) of the floodplain over a 16.0 km (10 mi) section which includes the site in question. For example: If the average floodplain width is 1.1 km (0.69 mi), then lay out a 1.2 km (0.75 mi) grid on the map system which aligns with the established Public Land Survey section and quarter-section lines. The assessed reach should extend laterally away from the river to the floodplain/upland boundary on each side. The map should show the river channel and lateral extent of the riparian zone. The evaluator should sketch the general position and extent of important riparian plant communities.

In most cases, polygons should be at least 0.8 km (0.5 mi) in length. Because along most river systems the channel acts as a barrier to movement, polygons will usually be limited to the riparian zone on a single side. If the evaluator determines that cross-channel access is not restricted, both sides may be included in a single polygon.

In addition to reach length, riparian zone width must be considered. The outer boundaries of riparian polygons are at the wetland vegetative type outer edges. These boundaries are sometimes clearly defined by abrupt changes in the geography and/or vegetation, but proper determination often depends on experienced interpretation of more subtle differences. The area to be assessed includes any terraces dominated by facultative wetland and wetter plant species (Lichvar 2012), the active floodplain, streambanks, and areas in the channel with emergent vegetation (Figure 1). Reference to the NWI list of plants found in wetlands should not be necessary to determine the area for evaluation. The evaluator should simply focus on that area which is obviously more lush, dense, or greener by being closer to the stream.

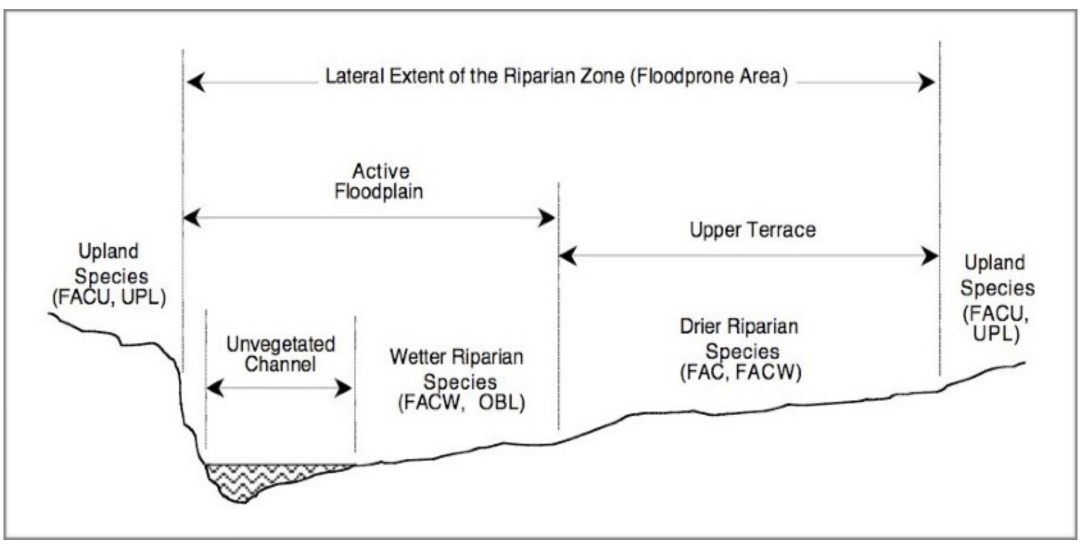

Figure 1. A schematic example of a typical riparian zone cross section showing near-channel landform features. ***NOTE:*** FAC (facultative), OBL (obligate), UPL (upland), etc. refer to categories of frequency a species is found on wetland (Lichvar 2012).

DATA FORM ITEMS

Record ID No. This is the unique identifier allocated to each polygon. This number will be assigned in the office when the form is entered into the database.

Administrative Data
A1. Agency or organization collecting the data.

A2. Funding Agency/Organization.

A3a. BLM (Bureau of Land Management) State Office.

A3b. BLM Field Office/Field Station.

A3c. BLM Office Code (recorded in the office).

A3d. Is the polygon in an active BLM grazing allotment (recorded in the office)?

A3e, f. For BLM polygons, the BLM Office Code, whether the polygon is in an active BLM grazing allotment, and the Allotment Number is supplied by the BLM. These items are entered into the computer in the office; the computer then references a master list of Allotment ID's to complete the remaining Allotment information. Because some polygons incorporate more than one Allotment, space is provided to enter two sets of Allotment information. The master Allotment list is periodically updated by the BLM National Applied Resource Sciences Center to make needed corrections.

A4. USDI Fish and Wildlife Service Refuge name.

A5. Indian Reservation name.

A6. USDI National Park Service Park/National Historical Site name.

A7. USFS (Forest Service) National Forest name.

A8. Other location.

A9. Year the field work was done.

A10. Date of field work by day, month, and year.

A11. Names of all field data observers.

NOTE: Information for items **A12a-h** is found in the office; field evaluators need not complete these items.

A12. The several parts of these items identify various ways in which a data record may represent a resampling of a polygon that may have been inventoried again at some other time. The data in this record may have been collected on an area that coincides precisely with an area inventoried at another time and recorded as another record in the database. It may also represent the resampling of only a part of an area previously sampled. This would include the case where this polygon overlaps, but does not precisely and entirely coincide with one inventoried at another time. One other case is where more than one polygon inventoried one year coincides with a single polygon inventoried another year. All of these cases are represented in the database, and all have some value for monitoring purposes, in that they give some information on how the status on a site changes over time. ***This is done in the office with access to the database; field evaluators need not complete these items.***

A12a. Has any part of the area within this polygon been inventoried previously, or subsequently, as represented by any other data record in the database? Such other records would logically carry different dates.

A12b. Does the areal extent of this polygon exactly coincide with that of any other inventory represented in the database? In many cases, subsequent inventories only partially overlap spatially. The purpose of this question is to identify those records that can be compared as representing exactly the same ground area.

A12c. Does this record represent the latest data recorded for this site (polygon)?

A12d. If A12b is answered Yes, then enter the record ID number(s) of any other previous or subsequent re-inventories (resampling) of this exact polygon for purposes of cross-reference.

A12e. Enter the years of any records recorded in item A12d as representing other inventories of this exact polygon.

A12f. Even though this polygon is not a re-inventory of the exact same area as any other polygon, does it share at least some common area with one or more polygons inventoried at another time?

A12g. Enter the years of any other inventories of polygons sharing common ground area with this one.

A12h. If A12f is answered Yes, then enter the record ID number(s) of any other polygon(s) sharing common ground area with this one.

A13a. Has a management change been implemented on this polygon?

A13b. If A13a is answered Yes, in what year was the management change implemented?

A13c. If A13a is answered Yes, describe the management change implemented.

Location Data
B1. State in which the field work was done (recorded in the office).

B2. County or municipal district in which the field work was done (recorded in the office).

B3. This field for allotment, range, or management unit is intended for entities other than the BLM to use for grouping polygons by management unit. The BLM management units are grouped using the grazing allotment information in A3 above.

B4a. For lotic polygons the area is usually listed as a stream name, or other local designation that identifies the area where the inventory is conducted. If possible, use a name that is shown on the 7.5 minute topographic map.

B4a. For lotic polygons the area is usually listed as a stream name, or other local designation that identifies the area where the inventory is conducted. If possible, use a name that is shown on the 7.5 minute topographic map.

B4b. Record the stream with which the inventoried lotic wetland flows into.

B4c, d. Polygons are grouped together for management purposes. For example, all polygons around Henry's Lake in the Idaho Falls Field Office could be identified as Group Name: Idaho Falls Field Office; Group Number: 1 (recorded in the office).

B5. Polygon number is a sequential identifier of the portion of the area assessed. This is referenced to the map delineations. Sequences normally progress from upstream to downstream.

B6a. Upper end elevation (feet or meters).

B6b. Lower end elevation (feet or meters).

B7. Stream gradient (percent).

B8a. Record the latitude and longitude of the polygon, along with the GPS projection and accuracy. Record the degrees, minutes, and seconds, along with decimal degrees. ***NOTE: All of North America is latitude = North, and longitude = West.***

B8b. Record any comments pertaining to the "other" location.

B9. Identify and record the hydrologic unit code(s) (HUC) associated with the reach of stream contained in the polygon. The HUC data is obtained from the US Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2012). Based on the finest level of resolution available from the USGS for the stream reach, the levels of HUC information are entered by the computer onto the form. The USGS has divided the nation into successively smaller hydrologic units, based on drainage basins and watersheds. These units fit into hierarchical levels, uniquely identified by a pair of digits for each successive level (i.e., an eight-digit number identifies a drainage at the fourth (subbasin) level; and a twelve digit HUC identifies one at the sixth (subwatershed) level (Figure 2).

As defined by the USGS (2012), a ***hydrologic unit*** is "a drainage area delineated to nest in a multi-level, hierarchical drainage system. Its boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters. A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, non-contributing, and diversions to form a drainage area with single or multiple outlet points. Hydrologic units are only synonymous with classic watersheds when their boundaries include all the source area contributing surface water to a single defined outlet point."

Provision is made on the data form for multiple HUC units, because a polygon may include all, or part, of more than one HUC unit (especially when finer levels, such as the subwatershed [sixth] level, are identified).

The HUC data provided includes these items:

- HUC identification number to as many digits as have been delineated by USGS, down to the sixth level (12 digits);
- River miles of the stream from this HUC unit that fall within this polygon;
- Percent of the polygon stream reach that is located in this HUC unit (e.g., 100 percent if the entire polygon is all in one HUC unit;
- Name of the region (first level of the HUC) (and its size in square miles);
- Name of the subregion (second level of the HUC) (and its size in square miles);
- Name of the basin (third level of the HUC) (and its size in square miles);
- Name of the subbasin (fourth level of the HUC) (and its size in square miles);
- Name of the watershed (fifth level of the HUC) (and its size in square miles); and
- Name of the subwatershed (sixth level of the HUC) (and its size in acres).

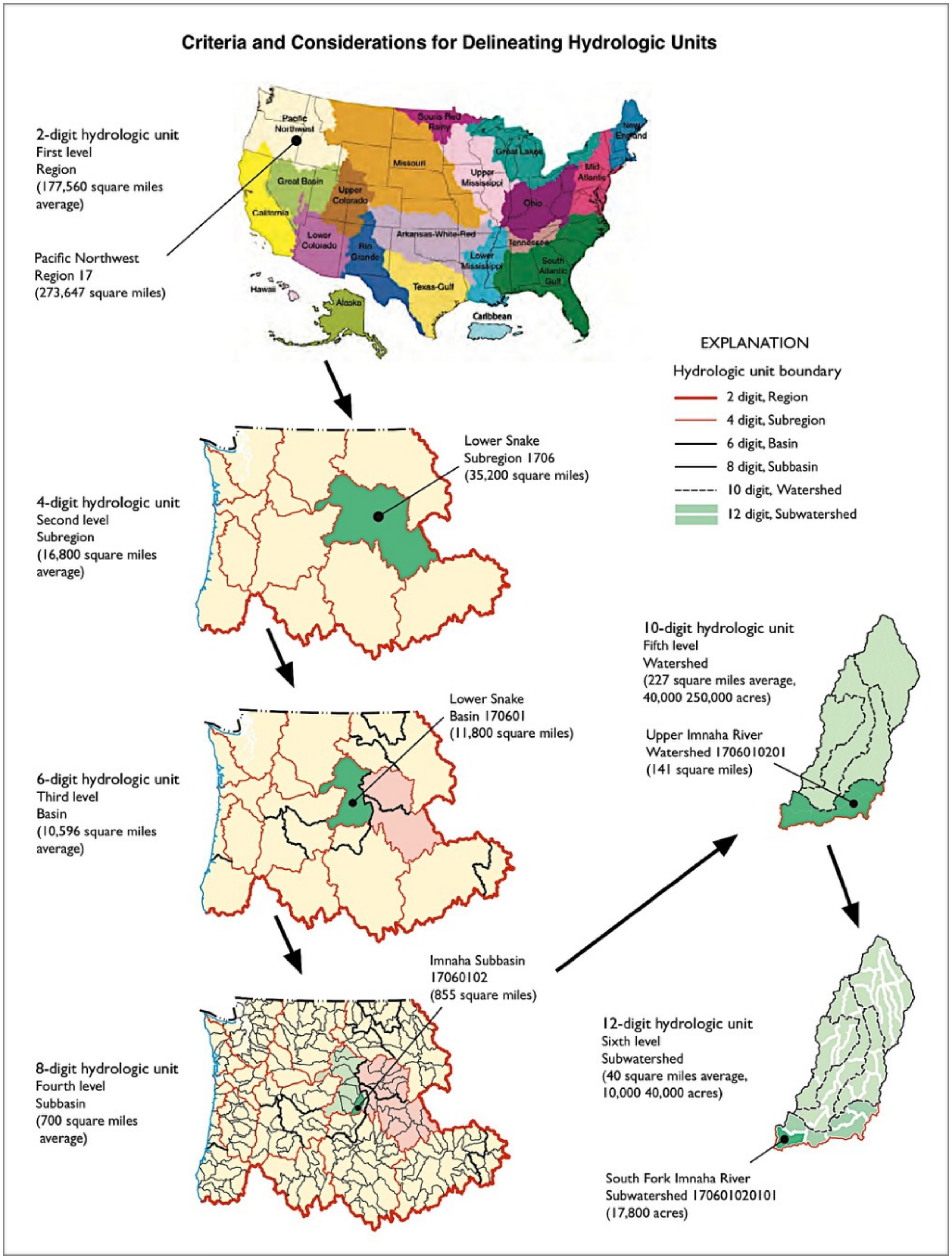

Figure 2. Hierarchy for the six nested levels of hydrologic units, as they are successively subdivided, and the numbering scheme increases by two digits for each level of greater resolution (adapted from the USGS 2012)

Selected Summary Data

C1. Wetland type is a categorical description of predominant polygon character. Select from the following list of categories that may occur within a lotic system the one that best characterizes the majority of the polygon. Evaluators will ***select only one category*** as representative of the entire polygon. If significant amounts of other categories are present, indicate this in the last item, Comments and Observations, or consider dividing the original polygon into two or more polygons.

Category Description
River. Rivers are generally larger than streams. They flow year around, in years of normal precipitation and when significant amounts of water are not being diverted out of them. Those watercourses having bankfull channel widths greater than 15 m (>50 ft) will be classified as rivers for the purpose of this inventory.
Upland. This designation is for those areas which are included in the inventoried polygon, but which do not support functional wetland vegetation communities. Such areas may be undisturbed inclusions of naturally occurring high ground, or such disturbed high ground as roadways and other elevated sites of human activity.
Other. Describe the water source.

C2. The size (acres/hectares) of polygons large enough to be drawn as enclosed units on 1:20,000 or 1:50,000 scale maps is determined in the office using a planimeter, dot grid, or GIS. For polygons too small to be accurately drawn as enclosed units on the map, and that are represented by line segments on the map along the drainage bottom, polygon size is calculated using polygon length and average polygon width (items C5 and C6).

C3a-d. Evaluators may be asked to survey some areas that have not been determined to be wetlands for the purpose of making such a determination. Other polygons include areas supporting non-wetland vegetation types. A “Yes” answer indicates that no part of the polygon keys to a riparian habitat type or community type (HT/CT). Areas classified in item C8 as any vegetation type described in a riparian and/or wetland classification document used in the region where you are working are counted as functional wetlands. Areas listed as UNCLASSIFIED WETLAND TYPE are also counted as functional wetlands. Other areas are counted as non-wetlands, or uplands. The functional wetland fraction of the polygon area is listed in item C3c in acres and as a percentage of the entire polygon area in item C3d.

C4. On larger river systems the length of channel in the polygon is equal to the polygon length. Channel length—the length of channel contained within or adjacent to the polygon—is measured by scaling from the map. This data is considered accurate to the nearest 0.16 km (0.1 mi).

C5. In some cases, the polygon record is used to characterize, or represent, a larger portion of a stream system. The length represented by the polygon is given. For example, a 0.8 km (0.5 mi) polygon may be used to represent 6.4 km (4 mi) of a stream. In this case, 0.8 km (0.5 mi) is the channel length of the polygon (item C5), and 6.4 km (4 mi) is entered in item C5.

C6a. Record ***average*** width of the polygon, which may correspond to the width of the riparian zone. In the case of very wide systems where the polygon inventoried does not extend across the full width of the riparian zone (e.g., area with riparian vegetation communities lies outside the polygon), record the average width of the polygon inventoried and make note of the situation in the comments.

C6b. Record the range of width (ft/m), narrowest to widest, of the riparian zone in the polygon.

C7. List the riparian habitat type(s) and/or community type(s) found in the polygon using a manual for identifying types in the region in which you are working, such as *Classification and Management of Montana’s Riparian and Wetland Sites* (Hansen and others 1995), *Classification and Management of USDI Bureau of Land Management’s Riparian and Wetland Sites in Eastern and Southern Idaho* (Hansen and Hall 2002), *Classification and management of upland, riparian, and wetland sites of USDI Bureau of Land Management’s Miles City Field Office, eastern Montana USA* (Hansen and others 2008), or a similar publication written for the region in which you are working. If the habitat type cannot be determined for a portion of the polygon, then list the appropriate community type(s) of that portion. If neither the habitat type nor community type can be determined for any portion of the polygon (or in areas where the habitat and community types have not been named and described), list the area in question as unclassified wetland type and give the dominant species present. Indicate with the appropriate abbreviation if these are habitat types (HT), community types (CT), or dominance types (DT), for example, PSEMEN/CORSTO HT. For each type listed, estimate the percent of the polygon represented. If known, record the successional stage (i.e., early seral, mid-seral, late seral, and climax), or give other comments about the type. As a minimum, list all types which cover 5% or more of the polygon. The total must approximate 100%. Slight deviations due to use of class codes or to omission of types covering less than 5% of the polygon are allowed. ***NOTE:*** For any area classified as an unclassified wetland type, it is important to list any species present which can indicate the wetness or dryness of the site.

NOTE: Open water in the polygon that does not have emergent vegetation, but that is less than 2 m (6.6 ft) deep is counted as a type called Open Water.

C8a-c. Fire plays an important role on shaping our landscape. Fire can dramatically alter the vegetational expression of a polygon, especially woody vegetation. This question pertains to the more recent fire history and the affect on the polygon.

C9. Answer “Yes” if the polygon contains habitat type(s) and/or community type(s) dominated by tall woody vegetation (i.e., trees).

FACTORS FOR ASSESSING LARGE RIVER FLOODPLAIN HEALTH

Some factors on the evaluation will not apply on all sites. For example, sites without potential for woody species are not rated on factors concerning trees and shrubs. Vegetative site potential can be determined by using a key to site type (e.g., Hansen and others 1995, 2008; Hansen and Hall 2002; Thompson and Hansen 2001, 2002, 2003, or another appropriate publication). On severely disturbed sites, vegetation potential can be difficult to determine. On such sites, clues to potential may be sought on nearby sites with similar landscape position.

Most of the factors rated in this evaluation are based on ocular estimations. Such estimation may be difficult on large, brushy sites where visibility is limited, but extreme precision is not necessary. While the rating categories are broad, evaluators do need to calibrate their eye with practice. It is important to remember that a health rating is not an absolute value. The factor breakout groupings and point weighting in the evaluation are somewhat subjective and are not grounded in quantitative science so much as in the collective experience of an array of riparian scientists, range professionals, and land managers.

The evaluator must keep in mind that this assessment form is designed to account for most sites and conditions in the applicable region. However, rarely will all the questions seem exactly to fit the circumstances on a given site. Therefore, try to answer each question with a literal reading. If necessary, explain anomalies in the comment section. Each factor below will be rated according to conditions observed on the site. The evaluator will estimate the scoring category and enter that value on the score sheet.

1. Cottonwood Regeneration from Seed. (***NOTE:*** In this item do not include the species *Populus tremuloides* (quaking aspen), which is included in the next item below.

Reproduction success can be determined by estimating the established seedling and sapling cover expressed as percentage of the overall cover of the species on the site. (***NOTE:*** If no potential for cottonwoods exists on the polygon (such as when it is on the outside of a long meander curve where depositional material is not expected, or there are no such trees on similar site positions nearby) replace both Actual Score and Possible Score with NA. Count plants installed by human planting, if they are successfully established, which means they have survived at least one full year after planting. To be successfully established the new plants need to have at least one complete growing season on the site. Many newly established plants do not survive the first growing season. ***NOTE:*** *Use judgement and caution in counting occasional seedlings in precarious positions where they have little potential for survival due to natural physical jeopardy (e.g., at water's edge along outside curve).*

> **Scoring:** (*If the site has no potential for cottonwood, replace both Actual Score and Possible Score with NA. If the evaluator is not fairly certain potential exists for cottonwood, then enter NC and explain in the comment field below.*)
> **6** = More than 15% of the cottonwood cover is seedlings and/or saplings.
> **4** = 5% to 15% of the cottonwood cover is seedlings and/or saplings.
> **2** = Up to 5% of the cottonwood cover is seedlings and/or saplings.
> **0** = None (the site has the potential for cottonwood cover, but seedlings and/or saplings are absent from the site).

2. Regeneration of Other Native Tree Species. As succession progresses on a riparian site, the pioneer cottonwood and shrub communities are replaced by later seral communities (if river dynamics allow enough time). If the site is not de-watered or otherwise disturbed, this progression is often to communities dominated by other native tree species. Depending upon dynamics of the system (how fast the channel migrates laterally), the potential may exist for equilibrium at different locations along the river between younger (those dominated by young cottonwoods and willows) communities and older communities (with aging cottonwoods and later seral species such as *Pinus ponderosa* var. *scopulorum* [ponderosa pine], *Pseudotsuga menziesii* var. *glauca* (Douglas fir), *Acer negundo* [box elder], and *Fraxinus pennsylvanica* [green ash]). ***NOTE:*** Seedlings and saplings of these species include individuals which are less than 3 inches (7.5 cm) in dbh. If the polygon is a newly formed island where all plant communities are in an early successional stage and where no later successional species are expected to be present at this time, replace both Actual Score and Possible Score with NA.

The health of a population can be based on current regeneration success without having to determine the exact potential distribution between cottonwoods/poplars and the other tree species on a site. This regeneration success can be determined from the seedling and sapling canopy cover expressed as a percentage of the overall cover of the group of tree species on the site other than cottonwoods/poplars. Count plants installed by human planting, if they are successfully established, which means they have survived at least one full year after planting. To be successfully established the new plants need to have at least one complete growing season on the site. Many newly established plants do not survive the first growing season.

Scoring: (*If the site has no potential for other native tree species, replace both Actual Score and Possible Score with NA. If the evaluator is not fairly certain potential exists for other native tree species, then enter NC and explain in the comment field below.*)
3 = More than 5% of the other (non-cottonwood) tree cover is seedlings and/or saplings.
2 = 1% to 5% of the other (non-cottonwood) tree cover is seedlings and/or saplings.
1 = Less than 1% of the other (non-cottonwood) tree cover is seedlings and/or saplings.
0 = None (the site has the potential for native trees other than cottonwood, but seedlings and/or saplings of these species are absent from the site).

3. Regeneration of Preferred Shrub Species. Another indicator of a river system's ecological stability and, therefore, health is the presence of enough shrub regeneration to maintain the lifeform population along the river over the long-term. Ecological stability is used in the broad sense that over the reach as a whole there is an equilibrium of community composition and structure.

The following species are excluded from the evaluation:

- *Artemisia cana* (silver sagebrush), including subsp. *cana* and *viscidula*;
- *Artemisia frigida* (fringed sagewort);
- *Crataegus* species (hawthorn);
- *Gutierrezia sarothrae* (broom snakeweed);
- *Opuntia* species (prickly pear);
- *Rosa* species (rose);
- *Sarcobatus vermiculatus* (greasewood);
- *Symphoricarpos* species (snowberry);
- *Yucca glauca* (soapweed); and
- all non-native species (e.g., *Tamarix* species [saltcedar; tamarisk], *Caragana arborescens* [Siberian pea tree], etc.).

These are species that may reflect long-term disturbance on a site, that are generally less palatable to browsers, and that tend to increase under long-term moderate-to-intense grazing pressure; ***AND*** for which there is rarely any problem in maintaining presence on site. Examples of the latter include *Artemisia cana* (silver sagebrush) and *Sarcobatus vermiculatus* (greasewood). Both are considered climax species in many riparian situations and rarely have any problem maintaining a presence on a site. Only under extreme long-term grazing pressures will these species be eliminated from a site. On the other hand, *Elaeagnus angustifolia* (Russian olive) and *Tamarix* species (saltcedar; tamarisk) are especially aggressive, undesirable exotic plants.

The main reason for excluding these plants is they are far more abundant on many sites than are species of greater concern (i.e., *Salix* species [willows], *Cornus sericea* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], and many other taller native riparian species), and they may mask the ecological significance of a small amount of a species of greater concern. ***FOR EXAMPLE:*** A polygon may have *Symphoricarpos occidentalis* (western snowberry) with 30% canopy cover showing young plants for replacement of older ones, while also having a trace of *Salix exigua* (sandbar willow) present, but represented only by older mature individuals. We feel that the failure of the willow to regenerate (even though there is only a small amount) is very important in the health evaluation, but by including the snowberry and willow together on this polygon, the condition of the willow would be hidden (overwhelmed by the larger amount of snowberry).

For shrubs in general, seedlings and saplings can be distinguished from mature plants as follows. For those species having a mature height generally over 1.8 m (6.0 ft), seedlings and saplings are those individuals less than 1.8 m (6.0 ft) tall. For species normally not exceeding 1.8 m (6.0 ft), seedlings and saplings are those individuals less than 0.45 m (1.5 ft) tall or which lack reproductive structures and the relative stature to suggest maturity. Count plants installed by human planting, if they are successfully established, which means they have survived at least one full year after planting. To be successfully established the new plants need to have at least one complete growing season on the site. Many newly established plants do not survive the first growing season. (***NOTE:*** Evaluators should take care also not to confuse short stature resulting from intense browsing with that due to young plants.)

Scoring: (*If the site has no potential for shrubs [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA. If the evaluator is not fairly certain potential exists for preferred shrubs, then enter NC and explain in the comment field below.*)
6 = More than 5% of the preferred shrub species cover is seedlings and/or saplings.
4 = 1% to 5% of the preferred shrub species cover is seedlings and/or saplings.
2 = Less than 1% of the preferred shrub species cover is seedlings and/or saplings.
0 = None (the site has the potential for preferred shrub species, but seedlings and/or saplings of preferred shrubs are absent from the site).

4. Standing Decadent and Dead Woody Material. (*Skip this item if the site lacks trees or shrubs; for example, the site is a herbaceous wet meadow or cattail marsh.*) The amount of decadent and dead woody material on a site can be an indicator of the overall health of a riparian area. Large amounts of decadent and dead woody material may indicate a reduced flow of water through the stream (de-watering) due to either human or natural causes. De-watering of a site, if severe enough, may change the site vegetation potential from riparian species to upland species. In addition, decadent and dead woody material may indicate severe stress from over browsing. Finally, large amounts of decadent and dead woody material may indicate climatic impacts, disease and insect damage. For instance, severe winters may cause extreme die back of trees and shrubs, and cyclic insect infestations may kill individuals in a stand. In all these cases, a high percentage of dead and decadent woody material reflects degraded vegetative health, which can lead to reduced streambank integrity, channel incisement, and excessive lateral cutting, besides reducing production and other wildlife values.

The most common usage of the term ***decadent*** may be for over mature trees past their prime and which may be dying, but we use the term in a broader sense. We count decadent plants, both trees and shrubs, as those with 30% or more dead wood in the upper canopy. In this item, scores are based on the percentage of total woody canopy cover which is decadent or dead, not on how much of the total polygon canopy cover consists of dead and decadent woody material. Only decadent and dead standing material is included, not that which is lying on the ground. The observer is to ignore (not count) decadence in poplars or cottonwoods which are decadent ***due to old age*** (rough and furrowed bark extends substantially up into the crowns of the trees) (species: *Populus deltoides* subsp*. monilifera* [Great Plains cottonwood]*, P. angustifolia* [narrowleaf cottonwood]*,* and *P. balsamifera* [black cottonwood]), because cottonwoods/poplars are early seral species and naturally die off in the absence of disturbance to yield the site to later seral species. The observer is to consider (count) decadence in these species if apparently caused by de-watering, browse stress, climatic influences, or parasitic infestation (insects/disease). The observer should comment on conflicting or confounding indicators, and/or if the cause of decadence is simply unknown (*but not due to old age*). Do not count plants installed by human planting, that are less than one year old, as dead/decadent.

Scoring:
3 = Less than 5% of the total canopy cover of woody species is decadent and/or dead.
2 = 5% to 25% of the total canopy cover of woody species is decadent and/or dead.
1 = 25% to 50% of the total canopy cover of woody species is decadent and/or dead.
0 = More than 50% of the total canopy cover of woody species is decadent and/or dead.

5a. Browse Utilization of Available Preferred Trees and Shrubs. (*Skip this item if the site lacks trees or shrubs; for example, the site is a herbaceous wet meadow or cattail marsh, or all woody plants have already been removed.*) Livestock and/or wildlife browse many riparian woody species. Excessive browsing can eliminate these important plants from the community and result in their replacement by undesirable invaders. With excessive browsing, the plant loses vigor, is prevented from flowering, or is killed. Utilization in small amounts is normal and not a health concern, but concern increases with greater browse intensity.

Several shrub genera (*Artemisia* species [sagebrush], *Sarcobatus* species [greasewood], *Symphoricarpos* species [snowberry], *Rosa* species [rose], *Crataegus* species [hawthorn], and *Tamarix* species [saltcedar; tamarisk]) are excluded from the evaluation of establishment and regeneration. These are species that may reflect long-term disturbance on a site, that are generally less palatable to browsers, and that tend to increase under long-term moderate-to-intense grazing pressure; ***AND*** for which there is rarely any problem in maintaining presence on site. *Elaeagnus angustifolia* (Russian olive), *Rhamnus cathartica* (common buckthorn), and *Tamarix* species (saltcedar; tamarisk) are considered especially aggressive, undesirable exotic plants.

As discussed above, the main reason for excluding these plants is they are far more abundant on many sites than are species of greater concern (e.g., *Salix* species [willows], *Cornus sericea* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], and many other taller native riparian species), and they may mask the ecological significance of a small amount of a species of greater concern. ***FOR EXAMPLE:*** A polygon may have *Symphoricarpos occidentalis* (common snowberry) with 30% canopy cover showing young plants for replacement of older ones, while also having a trace of *Salix exigua* (sandbar willow) present, but represented only by older mature individuals. We feel that the failure of the willow to regenerate (even though there is only a small amount) is very important in the health evaluation, but by including the snowberry and willow together on this polygon, the condition of the willow would be hidden (overwhelmed by the larger amount of snowberry).

Consider as available all tree and shrub plants to which animals may gain access and that they can reach. For tree species, this means mostly just seedling and sapling age classes. When estimating degree of utilization, count browsed second year and older leaders on representative plants of woody species normally browsed by ungulates. Do not count current year's use, because this would not accurately reflect actual use when more browsing can occur later in the season. Browsing of second year or older material affects the overall health of the plant and continual high use will affect the ability of the plant to maintain itself on the site. Determine percentage by comparing the number of leaders browsed or utilized with the total number of leaders available (those within animal reach) on a representative sample (at least three plants) of each tree and shrub species present. Do not count utilization on dead plants, unless it is clear that death resulted from over-grazing. ***NOTE:*** If a shrub is entirely mushroom/umbrella shaped by long-term intense browse or rubbing, count browse utilization of it as heavy.

> **Scoring:** (*Consider all shrubs within animal reach and seedlings and saplings of tree species. If the site has no woody vegetation [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA.*)
> **3** = None (0% to 5% of available second year and older leaders of preferred species are browsed).
> **2** = Light (5% to 25% of available second year and older leaders of preferred species are browsed).
> **1** = Moderate (25% to 50% of available second year and older leaders of preferred species are browsed).
> **0** = Heavy (More than 50% of available second year and older leaders of preferred species are browsed).

5b. Live Woody Vegetation Removal by Other Than Browsing. Excessive cutting or removing parts of plants or whole plants by agents other than browsing animals (e.g., human clearing, cutting, beaver activity, etc.) can result in many of the same negative effects to the community that are caused by excessive browsing. However, other effects from this kind of removal are direct and immediate, including reduction of physical community structure and wildlife habitat values. ***Do not include natural phenomena such as natural fire, insect infestation, etc. in this evaluation.***

Removal of woody vegetation may occur at once (a logging operation), or it may be cumulative over time (annual firewood cutting or beaver activity). This question is not so much to assess long-term incremental harvest, as it is to assess the extent that the stand is lacking vegetation that would otherwise be there today. Give credit for re-growth. Consider how much the removal of a tree many years ago may have now been mitigated with young replacements.

Four non-native species or genera are excluded from consideration because these are aggressive, invasive exotic plants that should be removed. They are *Elaeagnus angustifolia* (Russian olive), *Rhamnus cathartica* (common buckthorn), *Caragana arborescens* (common caragana), and *Tamarix* species (saltcedar; tamarisk).

Determine the extent to which woody vegetation (trees and shrubs) is lacking due to being physically removed (i.e., cut, mowed, trimmed, logged, cut by beaver, or otherwise cut from their growing position). The actual timeframe is not as important as the actual ecological effect. Time to recover from this kind of damage can vary widely with site characteristics. What we really need to measure is the extent ***today*** of any damage remaining to the vegetation structure as a result of the woody removal. We expect that the woody community will recover over time (re-grow), just as an eroding bank will heal with re-growing root mass. This question simply asks how much woody material is still missing from what should be there? --as judged by indications, such as stumps and other clues to what was removed. The amount of time since removal doesn't really matter, if re-growth has been allowed to progress. If 20 years after logging, the site has a stand of sapling spruce trees, then it should get partial re-growth credit, but not full credit, because the trees still lack most of their potential habitat and ecological value. (***NOTE:*** In general, the more recent the removal, the more entirely it should be fully counted; and conversely, the older the removal, the more likely it is to have been mitigated by re-growth.)

This question is really looking at volume (three dimensions) and not canopy cover (two dimensions). For example, if an old growth spruce tree is removed, a number of new seedlings/saplings may become established and could soon achieve the same canopy cover as the old tree had. However, the value of the old tree to wildlife and overall habitat values is far greater than that of the seedling/saplings. It will take a very long time before the seedlings/saplings can grow to replace all the lost habitat values that were provided by the tall old tree. On the other hand, shrubs, such as willows, grow faster and may replace the volume of removed plants in a much shorter time. Answer this question by estimating the percent of woody material that is missing from the site due to having been removed by human action. Select a range category from the choices given that best represents the percent of missing woody material.

Scoring: (*If the site has no trees or shrubs **AND** no cut plants or stumps of any trees or shrubs [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA.*)
3 = None (0% to 5% of live woody vegetation expected on the site is lacking due to cutting).
2 = Light (5% to 25% of live woody vegetation expected on the site is lacking due to cutting).
1 = Moderate (25% to 50% of live woody vegetation expected on the site is lacking due to cutting).
0 = Heavy (More than 50% of live woody vegetation expected on the site is lacking due to cutting).

6. Total Canopy Cover of Woody Species. Woody species play a critical role in river bank integrity. Natural river banks are protected by large bank rock (e.g., boulders and cobbles) and by woody vegetation. On floodplains comprised primarily of fine textured materials—which are typical of many western rivers—river banks are protected only by the woody vegetation. In these cases, it is critically important to manage for healthy woody vegetation. Woody vegetation also traps sediment, helps to reduce velocity of flood waters, protects the soil from extreme temperatures, and provides wildlife habitat. ***NOTE:*** Unlike other items dealing with woody plants, this item focuses on how much of the total polygon is covered by woody plants.

Scoring:
3 = More than 50% of the total area is occupied by all woody species.
2 = 25% to 50% of the total area is occupied by all woody species.
1 = 5% to 25% of the total area is occupied by all woody species.
0 = Less than 5% of the total area is occupied by all woody species.

7. Invasive Plant Species (Weeds). Invasive plants (weeds) are alien species whose introduction does or is likely to cause economic or environmental harm. Whether the disturbance that allowed their establishment is natural or human-caused, weed presence indicates a degrading ecosystem. While some of these species may contribute to some riparian functions, their negative impacts reduce overall site health. This item assesses the degree and extent to which the site is infested by invasive plants. The severity of the problem is a function of the density/distribution (pattern of occurrence), as well as canopy cover (abundance) of the weeds. In determining the health score, all invasive plant species are considered collectively, not individually. A weed list should be used that is standard for the locality and that indicates which species are being considered. Space is provided on the form for recording weed species counted. Include both woody and herbaceous invasive plant species. ***Leave no listed species field blank, however;*** enter 0 to indicate absence of a value. (A blank field means the observer forgot to collect the data; a value means the observer looked.)

The site's health rating on this item combines two factors: weed density/distribution class and total canopy cover. A perfect score of 6 out of 6 points can only be achieved if the site is weed free. A score of 4 out of the 6 points means the weed problem is just beginning (i.e., very few weeds and small total canopy cover [less than 1%]). A moderate weed problem gets 2 out of 6 points. It has a moderately dense weed plant distribution (a class between 4 and 7) and moderate total weed canopy cover (between 1% and 15%). A site scores 0 points if the density/distribution is in class 8 or higher, or if the total weed canopy cover is 15% or more.

7a. Total Canopy Cover of Invasive Plant Species (Weeds). The evaluator must evaluate the total percentage of the polygon area that is covered by the combined canopy of all plants of all species of invasive plants. Determine which rating applies in the scoring scale below.

Scoring:
3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with total canopy cover less than 1% of the polygon area.
1 = Invasive plants present with total canopy cover between 1% and 15% of the polygon area.
0 = Invasive plants present with total canopy cover more than 15% of the polygon area.

7b. Density Distribution of Invasive Plant Species (Weeds). The evaluator must pick a category of pattern and extent of invasive plant distribution from the chart below (Figure 3) that best fits what is observed on the polygon, while realizing that the real situation may be only roughly approximated at best by any of these diagrams. Choose the category that most closely matches the view of the polygon.

Scoring:

3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with density/distribution in categories 1, 2, or 3.
1 = Invasive plants present with density/distribution in categories 4, 5, 6, or 7.
0 = Invasive plants present with density/distribution in categories 8, or higher.

CLASS	DESCRIPTION OF ABUNDANCE	DISTRIBUTION PATTERN
0	No invasive plants on the polygon	
1	Rare occurrence	
2	A few sporadically occurring individual plants	
3	A single patch	
4	A single patch plus a few sporadically occurring plants	
5	Several sporadically occurring plants	
6	A single patch plus several sporadically occurring plants	
7	A few patches	
8	A few patches plus several sporadically occurring plants	
9	Several well spaced patches	
10	Continuous uniform occurrence of well spaced plants	
11	Continuous occurrence of plants with a few gaps in the distribution	
12	Continuous dense occurrence of plants	
13	Continuous occurrence of plants associated with a wetter or drier zone within the polygon.	

Figure 3. Invasive plant species class guidelines (figure adapted from Adams and others [2003])

NOTE: Prior to the 2001 season, the health score for weed infestation was assessed from a single numerical value that does not represent weed canopy cover, but instead represents the fraction of the polygon area on which weeds had a well established population of individuals (i.e., the area infested).

8. Disturbance-Increaser Undesirable Herbaceous Species. Areas with historically intense grazing often have large canopy cover of undesirable herbaceous species, which tend to be less productive and which contribute less to ecological functions. A large cover of disturbance-increaser undesirable herbaceous species, native or exotic, indicates displacement from the potential natural community (PNC) and a reduction in upland health. These species generally are less productive, have shallow roots, and poorly perform most upland functions. They usually result from some disturbance, which removes more desirable species. Invasive plant species considered in the previous item are not reconsidered.

A list of disturbance-increaser undesirable species that are counted is presented below. Other disturbance-increaser undesirable species may also be present on a site, but consistency and comparability will be maintained by always counting the same set of species.

Achillea millefolium (common yarrow)	*Agropyron repens* (quackgrass)	*Antennaria* species (everlasting; pussytoes)
Artemisia ludoviciana (cudweed sagewort)	*Descurainia sophia* (fixweed)	*Fragaria virginiana* (wild strawberry)
Juncus balticus (Baltic rush)	*Lepidium perfoliatum* (clasping pepperweed)	*Medicago lupulina* (black medick)
Mentha arvense (field mint)	*Plantago major* (common plantain)	*Poa pratensis* (Kentucky bluegrass)
Potentilla anserina (silverweed)	*Sisymbrium* species (tumblemustard)	*Taraxacum officinale* (common dandelion)
Thlaspi arvense (field pennycress)	*Trifolium* species (clover)	*Verbascum thapsus* (common mullein)

Scoring:
3 = Less than 5% of the reach covered by undesirable herbaceous species.
2 = 5% to 25% of the reach covered by undesirable herbaceous species.
1 = 25% to 50% of the reach covered by undesirable herbaceous species.
0 = More than 50% of the reach covered by undesirable herbaceous species.

9. River Bank Root Mass Protection. Vegetation along river banks performs the primary physical functions of stabilizing the soil with a binding root mass and of filtering sediments from overland flow. Few studies have documented depth and extent of root systems of plant species found in wetlands, however flow energies commonly experienced by rivers are effectively resisted only by the deep and extensive roots provided by tree and shrub species. Natural rivers typically move dynamically across their valley bottom. The vegetation roots serve to slow this lateral movement to a rate that allows normal floodplain ecosystem function, such as development of mid and later seral vegetation communities for habitat values. For this reason there needs to be good root mass protection well back from the immediate toe of the current bank position.
In situations where you are assessing a high, cut bank (usually on an outside bend), the top may be upland, but the bottom is riparian. Do not assess the area that is non-riparian. In cases of tall, nearly vertical cut banks, assess the bottom portion that comes in contact with floodwaters. Omit from consideration those areas where the bank is comprised of bedrock, since these neither provide binding root mass, nor erode at a rate that is normally a concern. In assessing root mass protection along a river, consider a band that extends back approximately 15 m (50 ft) from the bank top. (This is a rule of thumb for guidance that requires only estimated measurements.) The bank top is that point where the upper bank levels off to the relatively flat surface of a floodplain or terrace. This question is most critically assessed along straight reaches and outside curves, therefore do not get too concerned with trying to find the exact location of the bank top along inside curve point bar positions. ***NOTE:*** *Rip-rap does not substitute for, act as, nor preclude the need for deep, binding root mass.*

Scoring:
6 = More than 85% of the river bank has a deep, binding root mass.
4 = 65% to 85% of the river bank has a deep, binding root mass.
2 = 35% to 65% of the river bank has a deep, binding root mass.
0 = Less than 35% of the river bank has a deep, binding root mass.

10. Human-Caused Bare Ground. Bare ground is soil not covered by plants, litter or duff, downed wood, or rocks larger than 6 cm (2.5 in). Hardened, impervious surfaces (e.g., asphalt, concrete, etc.) are not bare ground—these do not erode nor allow weeds sites to invade. Bare ground caused by human activity indicates a deterioration of riparian health. Sediment deposits and other natural bare ground are excluded as normal or probably beyond immediate management control. Human land uses causing bare ground include livestock grazing, recreation, roads, and industrial activities. The evaluator should consider the causes of all bare ground observed and estimate the fraction that is human-caused.

River channels that go dry during the growing season can create problems for polygon delineation. On most rivers, the area of the channel bottom is excluded from the polygon. (***NOTE:*** *The whole channel width extends from right bankfull stage to left bankfull stage; however we need to include the lower banks in all polygons, therefore consider for exclusion ONLY the relatively flat and lowest area of the channel—the bottom.*) This allows data to be collected on the riparian area while excluding the aquatic zone, or open water, of the river. The aquatic zone is the area covered by water and lacking persistent emergent vegetation. Persistent emergent vegetation consists of perennial wetland species that normally remain standing at least until the beginning of next growing season, e.g., *Typha* species (cattails), *Schoenoplectus* species (bulrushes), *Carex* species (sedges), and other perennial graminoids.

In many systems, large portions of the channel bottom may become exposed due to seasonal irrigation use, hydroelectric generation, and natural seasonal changes such as are found in many prairie ecosystems. In these cases, especially along prairie rivers, the channel bottom may have varying amounts of herbaceous vegetation, and the channel area is ***included*** in the polygon as area to be inventoried. Typically, these are the pooled channel river type that has scour pools scattered along the length, interspersed with reaches of grass, bulrush, or sedge-covered channel bottom. If over half (>50%) the channel bottom area has a canopy cover of persistent vegetation cover (perennial species), taken over the entire length of the polygon as a whole, then the entire channel qualifies for inclusion within the inventoried polygon area. If you are in doubt whether to include the channel bottom in the polygon, then leave it out, but be sure to indicate this in the comment section. This is important so that future assessments of the polygon will be looking at the same area of land.

Scoring:
6 = Less than 1% of the polygon is human-caused bare ground.
4 = 1% to 5% of the polygon is human-caused bare ground.
2 = 5% to 15% of the polygon is human-caused bare ground.
0 = More than 15% of the polygon is human-caused bare ground.

NOTE: Questions 11 and 12 below generally must be answered in the office using maps and other data.

11. Removal or Addition of Water from/to the River System. Proper functioning of any riparian ecosystem depends, by definition, upon the system supply of water. The degree to which this lifeblood is artificially manipulated by removal or addition from/to the system is directly reflected in a reduction of riparian functions (e.g., wetland plant community maintenance, channel bank stability, wildlife habitat, overall system primary production). The extent of this alteration of the system can be estimated by determining the fraction of the average river flow, which is removed or added during the critical growing season each year. This determination can be based upon gauging station records as they relate to historic flow records established before construction of diversions. This question only deals with water volume changes. The question of dams controlling the timing of peak runoff is taken care of in the next question.

Scoring:
9 = Less than 10% of average river flow volume during the critical growing season is changed.
6 = 10% to 25% of average river flow volume during the critical growing season is changed.
3 = 25% to 50% of average river flow volume during the critical growing season is changed.
0 = More than 50% of average river flow volume during the critical growing season is changed.

12. Control of Flood Peak and Timing by Upstream Dam(s). Natural riverine ecosystems adapt to, and depend upon, the volume and timing of annual peak flows, which are determined by the watershed water yield and variability of the local climate. Humans have installed dams on many rivers for agricultural and industrial purposes and to mitigate the damages caused by the natural flooding to human development on the floodplain. The dams affect the functional health of the natural system. In this context, the health of the river system relates directly to the fraction of the watershed which remains undammed. Thus, this item includes all tributaries which flow into the river upstream of the reach being assessed.

Scoring:
9 = Less than 10% of the watershed upstream of the reach is controlled by dams.
6 = 10% to 25% of the watershed upstream of the reach is controlled by dams.
3 = 25% to 50% of the watershed upstream of the reach is controlled by dams.
0 = More than 50% of the watershed upstream of the reach is controlled by dams.

13. River Banks Structurally Altered by Human Activity. Altered river banks are those having impaired structural integrity (strength or stability) due to human causes. These banks are more susceptible to cracking and/or slumping. Count as river bank alteration such damage as livestock or wildlife hoof shear and concentrated trampling, vehicle or ATV tracks, and any other areas of human-caused disruption of bank integrity, including rip-rap or use of fill. The basic criterion is any disturbance to bank structure that increases erosion potential or bank profile shape change. One large exception is lateral bank cutting caused by stream flow, even if thought to result from upstream human manipulation of the flow. The intent of this item is to assess only direct, on-site mechanical or structural damage to the banks. Each bank is considered separately, so total bank length for this item is approximately twice the reach length of channel in the polygon (more if the river is braided). ***NOTE:*** Constructed river banks (especially those with rip-rap) may be stabilized at the immediate location, but are likely to disrupt normal flow dynamics and cause erosion of banks downstream. In assessing structural alteration, consider a band along the river bank approximately 4 m (13 ft) wide back from the bank toe. As with deep, binding root mass, this question is most critically assessed along straight reaches and outside curves, therefore do not get hung up trying to find the exact location of the bank top along inside curve point bar positions.

Scoring:
6 = Less than 5% of the bank is structurally altered by human activity.
4 = 5% to 15% of the bank is structurally altered by human activity.
2 = 15% to 35% of the bank is structurally altered by human activity.
0 = More than 35% of the bank is structurally altered by human activity.

14. Human Physical Alteration to the Rest of the Polygon. Within the remainder of the polygon area, outside the river bank area that was addressed in the previous question, estimate the amount of area that has been physically altered by human causes. The purpose of this question is to evaluate physical change to the soil, hydrology, etc. as it affects the ability of the natural system to function normally. Changes in soil structure will alter infiltration of water, increase soil compaction, and change the amount of sediment contributed to the water body. Every human activity in or around a natural site can alter that site. This question seeks to assess the accumulated effects of all human-caused change. Count such things as:

- **Soil Compaction.** This kind of alteration includes livestock-caused hummocking and pugging, recreational trails that obviously have compacted the soil, vehicle and machine tracks and ruts in soft soil, etc.
- **Plowing/Tilling.** This is disruption of the soil surface for cultivation purposes.
- **Hydrologic Change.** Include area that is physically affected by removal or addition of water for human purpose. The physical effects to look for are structures, such as water diversions, ditches, and canals that affect the drainage pattern; as well as erosion due to reduced or increased water; bared soil surface that had water cover drained away; or area now flooded that previously supported a drier vegetation type.
- **Human Impervious Surface.** This includes roofs, hardened surfaces like walkways and roads, boat launches, etc.
- **Topographic Change.** This is the deliberate alteration of terrain for human purposes. It may be a result of earth moving by mining or construction activities, for aesthetic reasons (i.e., landscaping), or other reasons.

Scoring:
3 = Less than 5% of the polygon is altered by human causes.
2 = 5% to 15% of the polygon is altered by human causes.
1 = 15% to 25% of the polygon is altered by human causes.
0 = More than 25% of the polygon is altered by human causes.

15. Floodplain Accessibility within the Polygon. Many of the most important functions of a riparian ecosystem depend upon the ability of the channel to access its floodplain during high flows. This access is restricted by levees and other human constructed embankments, such as roadbeds. Evaluators should determine what fraction of the historic 100 year floodplain within the polygon remains unrestricted by such embankments. This can usually be determined by comparing the area within the embankments (as shown on the latest photos or maps available).

Scoring:
6 = More than 85% of the floodplain is accessible to flood flows.
4 = 65% to 85% of the floodplain is accessible to flood flows.
2 = 35% to 65% of the floodplain is accessible to flood flows.
0 = Less than 35% of the floodplain is accessible to flood flows.

Calculating the River Health Score

To arrive at the overall site health rating, the scores are totaled for all the factors, and that total is divided by the possible perfect score total. An example score sheet is shown below.

Vegetation Factors	**Actual Pts**	**Possible Pts**
1. Cottonwood Regeneration	2	6
2. Regeneration of Other Native Tree Species	2	3
3. Regeneration of Preferred Shrub Species	4	6
4. Standing Decadent and Dead Woody Material	2	3
5a. Browse Utilization of the Preferred Trees and Shrubs	2	3
5b. Live Woody Vegetation Removal by Other Than Browsing	3	3
6. Total Canopy Cover of Woody Species	3	3
7a. Total Canopy Cover of Invasive Plant Species (Weeds)	2	3
7b. Density/Distribution of Invasive Plant Species (Weeds)	2	3
8. Disturbance-Increaser Undesirable Herbaceous Species	2	3
Vegetative Score:	**24**	**36**

Soil/Hydrology Factors	**Actual Pts**	**Possible Pts**
9. River bank Root Mass Protection	4	6
10. Human-Caused Bare Ground	6	6
11. Removal or Addition of Water from/to the River System	6	9
12. Control of Flood Peak and Timing by Upstream Dam(s)	3	9
13. River Banks Structurally Altered by Human Activity	4	6
14. Human Physical Alteration to the Rest of the Polygon	2	3
15. Floodplain Accessibility within the Polygon	6	6
Soil/Hydrology Score:	**31**	**48**
TOTAL SCORE:	**55**	**81**

Health Rating Formula: Health Rating = (Total Actual Score) / (Total Possible Score) x 100%
Rating = (55) / (81) x 100% = 68%

Health Category: 80 to 100% = Proper Functioning Condition (Healthy)
60 to less than 80% = Functional At Risk (Healthy, but with Problems)
Less than 60% = Nonfunctional (Unhealthy)

Because of their size and the cumulative effects from upstream and downstream impacts, management of individual reaches along a river may be more difficult to implement than actions appropriate for smaller riparian areas. This characteristic of river systems argues for the larger watershed approach, which is increasingly being taken to address riverine ecosystems.

A manager should realize that while certain factors affecting function of the river on the site may be outside their control, the system health is nevertheless degraded by such factors as Removal or Addition of Water from/to the River System and Control of Flood Peak/Timing by Upstream Dam(s), even though these are occurring off his property upstream. A managers only recourse may be to work together for a more cooperative, integrated approach to management of the whole system.

While a less than perfect score is not always cause for great concern, and an area rating at 80% is considered to be functioning properly, the scores of individual factors on the form can be useful in detecting strengths or weaknesses of a site. A low score on any factor may warrant management focus. For example, the sample shown above has low scores for Cottonwood Regeneration from Seed, Removal or Addition of Water from/to the River System and Control of Flood Peak/ Timing by Upstream Dam(s) (items 1, 13, and 14). Of these factors, a manager might bring improvement to item 1 by changing timing of grazing.

ADDITIONAL MANAGEMENT CONCERNS

The following items do not contribute to a site's ecological health assessment rating. Rather, they may help to quantify inherent physical site characteristics that reveal structural weaknesses or sensitivities or to assess the direction of change on a site. These data can be useful for planning future site management.

16. Trend. Select the ***one category*** (Improving; Degrading; Static; or Status Unknown) which best indicates the current trend of the vegetative community on the polygon to the extent possible. Trend refers, in the sense used, not specifically to successional pathway change, but in a more general sense of apparent community health. By definition, trend implies change over time. Accordingly, a trend analysis would require comparison of repeated observations over time. However, some insights into trend can be observed in a single visit. For example, the evaluator may notice healing (revegetating) of a degraded streambank and recent establishment of woody seedlings and saplings. This would indicate changing conditions that suggest an improving trend. If such indicators are not apparent, enter the category status unknown.

17. Vegetation Use By Animals. Record the category best describing the vegetation use by animals (Platts and others 1987).

Code	Category Description
0% to 25%	Vegetation use is light or none. Almost all plant biomass at the current development stage remains. Vegetative cover is close to that which would occur without use. Unvegetated areas (such as bedrock) are not a result of land uses.
26% to 50%	Vegetation use is moderate. At least half the potential plant biomass remains. Average stubble height is more than half its potential at the present stage of development.
51% to 75%	Vegetation use is high. Less than half the potential plant biomass remains. Plant stubble height is usually more than 5 cm (2 in) (on many ranges).
76% to 100%	Vegetation use is very high. Only short stubble remains (usually less than 5 cm [2 in] on many ranges). Almost all plant biomass has been removed. Only the root systems and parts of the stems remain.

18. Susceptibility of Parent Material to Erosion. The soils derived from shale or having a large clay content are highly susceptible to compaction and trampling when wet. There is evidence that trampling by hooves and subsequent loss of herbaceous vegetation when soils are wet are major contributions to site degradation. In contrast, those sites having soils derived from sandstone or any of the hard metamorphosed rock found in the Rocky Mountains commonly have a fine sandy loam to loam texture and are more resistant to damage when wet. Intermediate of these soils are those having textures of clay loam to loam. Texturing the soil by the ribboning technique or by feel will be required for this determination. Rate the polygon soil according to one of these categories based on indicators as described above.

Scoring:
3 = Not susceptible to erosion (well armored).
2 = Slightly susceptible to erosion (moderately armored).
1 = Moderately susceptible to erosion.
0 = Extremely susceptible to erosion.

19. Percent of Streambank Accessible to Large Animals. Record the percent of streambank length accessible to large hooved animals (livestock and wildlife). In general, only consider topography (steep banks, deep water, etc.) and dense vegetation as restricting access. Fences, unless part of an exclosure, do not necessarily restrict livestock access even though they may appear to be doing so at the time.

20. Break Down the Polygon Area into the Land Uses Listed. Name any Others Observed.

21. Break Down the Area Adjacent to the Polygon into the Land Uses Listed. Name any Others Observed.

22. Comments and Observations. Add any necessary commentary to explain or amplify the data recorded. Do not leave this space blank. Describe any unique characteristics of the site and other observations relating to the vegetation or to the physical conditions of the site. Each item in the health rating has a small space provided for specific information to enlighten the score given. This larger space is the place for more general commentary to help the reader understand the larger context of the data. Such things as landscape setting and local land use history are appropriate.

Photograph Data
NOTE: Take a number of photos upstream and downstream at each end of every polygon. This applies even to situations where the polygon is at one end of an inventoried reach and one of the photos is taken into a non-inventoried area, as well as situations in which another polygon is adjacent to the one being inventoried.

When recording the photo number, also provide the compass bearing of the direction of view, so that future evaluations will be able to photograph the same ground—***Example:*** #0028 (245°), #0029 (98°). Care should be taken to minimize influence the photograph location by trampling.

E1. Photos at the ***upstream*** end of the polygon. Take photos looking upstream and downstream. (Remember to record the lat/long of the photo location.)

E2. Photos at the ***downstream*** end of the polygon. Take photos looking upstream and downstream. (Remember to record the lat/long of the photo location.)

E3. Additional photos of the polygon. (A number of photos can be taken at each location. Remember to record the lat/long of the photo location.)

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LARGE RIVER SURVEY ECOLOGICAL HEALTH ASSESSMENT
FIELD SCORE SHEET

1. Cottonwood Regeneration. **Score:_____** / 6

(*If the site has no potential for cottonwood, replace both Actual Score and Possible Score with NA. If the evaluator is not fairly certain potential exists for cottonwood, then enter NC and explain in the comment field below.*)

6 = More than 15% of the cottonwood cover is seedlings and/or saplings.
4 = 5% to 15%% of the cottonwood cover is seedlings and saplings.
2 = Up to 5% of the cottonwood cover is seedlings and saplings.
0 = None (the site has the potential for cottonwood cover, but seedlings and/or saplings are absent from the site).

2. Regeneration of Other Native Tree Species. **Score:_____** / 3

(*If the site has no potential for other native tree species, replace both Actual Score and Possible Score with NA. If the evaluator is not fairly certain potential exists for other native tree species, then enter NC and explain in the comment field below.*)

3 = More than 5% of the other (non-cottonwood) tree cover is seedlings and/or saplings.
2 = 1% to 5% of the other (non-cottonwood) tree cover is seedlings and/or saplings.
1 = Less than 1% of the other (non-cottonwood) tree cover is seedlings and/or saplings.
0 = None (the site has the potential for native trees other than cottonwood, but seedlings and/or saplings of these species are absent from the site).

3. Regeneration of Preferred Shrub Species. **Score:_____** / 6

(*If the site has no potential for shrubs [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA. If the evaluator is not fairly certain potential exists for preferred shrubs, then enter NC and explain in the comment field below.*)

6 = More than 5% of the preferred shrub species cover is seedlings and/or saplings.
4 = 1% to 5% of the preferred shrub species cover is seedlings and/or saplings.
2 = Some, but less than 1% of the preferred shrub species cover is seedlings and/or saplings.
0 = None (the site has the potential for preferred shrub species, but seedlings and/or saplings of preferred shrubs are absent from the site).

4. Standing Decadent and Dead Woody Material. **Score:_____** / 3

3 = Less than 5% of the total canopy cover of woody species is decadent and/or dead.
2 = 5% to 25% of total canopy cover of woody species is decadent and/or dead.
1 = 25% to 50% of total canopy cover of woody species is decadent and/or dead.
0 = More than 50% of total canopy cover of woody species is decadent or dead.

5a. Browse Utilization of Preferred Trees and Shrubs. **Score:_____** / 3

(*Consider all shrubs within animal reach and seedlings and saplings of tree species. If the site has no woody vegetation [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA.*)

3 = None (0% to 5% of available second year and older leaders of preferred species are browsed).
2 = Light (5% to 25% of available second year and older leaders of preferred species are browsed).
1 = Moderate (25% to 50% of available second year and older leaders of preferred species are browsed).
0 = Heavy (More than 50% of available second year and older leaders of preferred species are browsed).

5b. Live Woody Vegetation Removal By Other Than Browsing. **Score:_____** / 3

(*If the site has no trees or shrubs* ***AND*** *no cut plants or stumps of any trees or shrubs [except for the species listed to be excluded], replace both Actual Score and Possible Score with NA.*)

3 = None (0% to 5% of live woody vegetation expected on the site is lacking due to cutting).
2 = Light (5% to 25% of live woody vegetation expected on the site is lacking due to cutting).
1 = Moderate (25% to 50% of live woody vegetation expected on the site is lacking due to cutting).
0 = Heavy (More than 50% of live woody vegetation expected on the site is lacking due to cutting).

6. Total Canopy Cover of Woody Species. **Score:_____**/ 3

3 = More than 50% of the total area is occupied by woody species.
2 = 25% to 50% of the total area is occupied by woody species.
1 = 5% to 25% of the total area is occupied by woody species.
0 = Less than 5% of the total area is occupied by woody species.

7a. Total Canopy Cover of Invasive Plant Species (Weeds). **Score:_____**/ 3

3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with total canopy cover less than 1% of the polygon area.
1 = Invasive plants present with total canopy cover between 1 and 15% of the polygon area.
0 = Invasive plants present with total canopy cover more than 15% of the polygon area.

7b. Density/Distribution Pattern of Invasive Plant Species (Weeds). **Score:_____**/ 3

3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with density/distribution in categories 1, 2, or 3.
1 = Invasive plants present with density/distribution in categories 4, 5, 6, or 7.
0 = Invasive plants present with density/distribution in categories 8, or higher.

8. Disturbance-Increaser Undesirable Herbaceous Species. **Score:_____**/ 3

3 = Less than 5% of the reach covered by disturbance-increaser undesirable herbaceous species.
2 = 5% to 25% of the reach covered by disturbance-increaser undesirable herbaceous species.
1 = 25% to 50% of the reach covered by disturbance-increaser undesirable herbaceous species.
0 = More than 50% of the reach covered by disturbance-increaser undesirable herbaceous species.

9. River Bank Root Mass Protection. **Score:_____**/ 6

6 = More than 85% of the river bank has a deep, binding root mass.
4 = 65% to 85% of the river bank has a deep, binding root mass.
2 = 35% to 65% of the river bank has a deep, binding root mass.
0 = Less than 35% of the river bank has a deep, binding root mass.

10. Human-Caused Bare Ground. **Score:_____**/ 6

6 = Less than 1% of the polygon is human-caused bare ground.
4 = 1% to 5% of the polygon is human-caused bare ground.
2 = 5% to 15% of the polygon is human-caused bare ground.
0 = More than 15% of the polygon is human-caused bare ground.

11. Removal or Addition of Water from/to the River System. **Score:_____**/ 9

9 = Less than 10% of average river flow volume during the critical growing season is changed.
6 = 10% to 25% of average river flow volume during the critical growing season is changed.
3 = 25% to 50% of average river flow volume during the critical growing season is changed.
0 = More than 50% of average river flow volume during the critical growing season is changed.

12. Control of Flood Peak and Timing by Upstream Dam(s). **Score:_____**/ 9

9 = Less than 10% of the watershed upstream of the reach is controlled by dams.
6 = 10% to 25% of the watershed upstream of the reach is controlled by dams.
3 = 25% to 50% of the watershed upstream of the reach is controlled by dams.
0 = More than 50% of the watershed upstream of the reach is controlled by dams.

13. River Banks Structurally Altered by Human Activity. **Score:_____**/ 6

6 = Less than 5% of the bank is structurally altered by human activity.
4 = 5% to 15% of the bank is structurally altered by human activity.
2 = 15% to 35% of the bank is structurally altered by human activity.
0 = More than 35% of the bank is structurally altered by human activity.

14. Human Physical Alteration to the Rest of the Polygon. **Score:**_____/ 3

3 = Less than 5% of the polygon is altered by human causes.
2 = 5% to 15% of the polygon is altered by human causes.
1 = 15% to 25% of the polygon is altered by human causes.
0 = More than 25% of the polygon is altered by human causes.

15. Floodplain Accessibility within the Polygon. **Score:**_____/ 6

6 = More than 85% of the floodplain is accessible to flood flows.
4 = 65% to 85% of the floodplain is accessible to flood flows.
2 = 35% to 65% of the floodplain is accessible to flood flows.
0 = Less than 35% of the floodplain is accessible to flood flows.

ADDITIONAL MANAGEMENT CONCERNS

16. Polygon Trend. Select one: Improving, Degrading, Static, or Status Unknown **Trend:**______________________

17. Vegetative Use by Animals. Use the categories below to score the amount of utilization. **Score:**_____/ 3

3 = 0% to 25% available forage taken.
2 = 26% to 50% available forage taken.
1 = 51% to 75% available forage taken.
0 = 76% to 100% available forage taken.

18. Susceptibility of Parent Material to Erosion. **Score:**_____/ 3

3 = Not susceptible to erosion (well armored).
2 = Slightly susceptible to erosion (moderately armored).
1 = Moderately susceptible to erosion.
0 = Extremely susceptible to erosion.

19. Percent of Streambank Accessible to Livestock. **Percent:**_________

20. Break Down the Polygon Area into the Land Uses Listed (must total to approx. 100%):

No land use apparent: __________
Turf grass (lawn): __________
Tame pasture (grazing): __________
Native pasture (grazing): __________
Recreation (ATV paths, campsites, etc.): __________
Development (buildings, corrals, paved lots, etc.): __________
Tilled cropping: __________
Perennial forage (e.g., alfalfa hayland): __________
Roads: __________
Logging: __________
Mining: __________
Railroads: __________
Other: __________

Description of Other Usage Noted:____

21. Break Down the Area Adjacent to the Polygon Into the Land Uses Listed (must total to approx. 100%):

No land use apparent: __________
Turf grass (lawn): __________
Tame pasture (grazing): __________
Native pasture (grazing): __________
Recreation (ATV paths, campsites, etc.): __________
Development (buildings, corrals, paved lots, etc.): __________
Tilled cropping: __________
Perennial forage (e.g., alfalfa hayland): __________
Roads: __________
Logging: __________
Mining: __________
Railroads: __________
Other: __________

Description of Other Usage Noted:____

22. Comments and Observations. ____