Virginia Save Our Streams Habitat Assessment

Acknowledgments

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Habitat Concepts

- In the truest sense, "habitat" incorporates all aspects of physical and chemical constituents along with the biotic interactions of the subwatershed.

- In these protocols, the definition of "habitat" is narrowed to the quality of the instream conditions and riparian habitat at the monitoring site.

Implementation Guidelines

- Walk the entire site before beginning the assessment program.
- The assessment reach is 100 meters (m), starting at your sampling riffle and working upstream.
- Channel width is the space available to hold water and indicating frequent water movement (look for indicators). It is *not* wetted area nor bankfull (Rosgen).
- Consider the stream bank to be the relatively steep surface that connects the available stream channel to the floodplain.
- Habitat assessment is to be performed once each year at your regular monitoring site.
- When in doubt – ask if stream conditions are truly available and suitable for habitat.

Remember – it may be easier to eliminate category choices (for example if the stream definitely isn't poor or optimal, concentrate on determining whether it fits into the suboptimal category or the marginal category.)

Equipment Checklist

- Data sheets, clipboard, pencil
- Metric measuring tape (100 meters)
- Metric (metal) measuring tape (5 meters)
- Volumetric measuring device or system
- Topographic map
- Engineering scale or ruler

Site or Reach ID:		Stream Name:
Latitude:		Longitude:
Watershed:		
Date:	Time:	Investigators:
Weather last 72 hours		
Description of Site Location		
Description of 100 meter assessed		
Predominant Surrounding Land Use		
Average Stream Width:		Average Stream Depth:
Stream Velocity (measured or defined as slow, moderate, or fast):		
Other Notes:		

Site or Reach ID used to identify the site you are scoring. If this habitat assessment is completed at a regularly monitored site, please use that site identification.

Description of site location – please provide directions to the site so that someone else might be able to find it!

Description of 100 meter assessed – note the downstream point of the assessed section (should be the riffle that is biomonitored) and any changes to the length of the assessed section of stream.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover (attachment sites for macro-invertebrates and overhead cover for fishes)	Greater than 70% stable habitat; mix of snags, submerged logs, undercut banks, cobble or other stable habitat (logs and snags are not new fall).	40-70% mix of stable habitat; presence of additional substrate that may not yet be prepared for colonization.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	18	13	8	3

#1 – Epifaunal Substrate & Available Cover

- Why is this important?
  - As variety and abundance of cover decreases:
    - Habitat structure becomes monotonous
    - Diversity decreases
    - Potential for recovery following disturbances decreases

- Definition of terms
  - Epifaunal – organisms that live on aquatic substrate
  - Substrate – organic & inorganic material in streambed

- Extent
  - 100 meters upstream from top of riffle
  - Width of riparian zone based on vegetation

- Includes the relative quantity and variety of natural structures in the stream:
  - Cobbles – Do not count cobbles that are embedded
  - Large rocks
  - Fallen trees - Do not count logs/snags that are new fall or transient
  - Logs and branches - Do not count logs/snags that are new fall or transient
  - Undercut banks

- Provides for aquatic macrofauna:
  - Refugia (hiding places)
  - Feeding sites
  - Sites for spawning or nursery functions

- Variety or abundance of submerged structures in the stream serves to:
  - Provide a large number of niches
  - Increase habitat diversity

- Riffles and runs
  - Offer a diversity of habitat through a variety of particle size
  - Help keep water oxygenated
  - Provide most stable habitat in many small, high gradient streams
  - Are critical for maintaining a variety and abundance of insects in high gradient streams

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
2. Embeddedness	Gravel, cobble, and boulder particles in riffles and runs are 0-25% surrounded by fine sediment (e.g. – sand or silt).	Gravel, cobble, and boulder particles in riffles and runs are 25-50% surrounded by fine sediment (e.g. – sand or silt).	Gravel, cobble, and boulder particles in riffles and runs are 50-75% surrounded by fine sediment (e.g. – sand or silt).	Gravel, cobble, and boulder particles in riffles and runs are >75% surrounded by fine sediment (e.g. – sand or silt).
SCORE	18	13	8	3

#2 – Embeddedness

- Refers to the extent to which rocks – gravel, cobbles, and boulders – and snags within riffles and runs are covered by or sunken into the silt, sand, or mud of the stream bottom.

- Why is this important? Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish – shelter, spawning, and egg incubation – is decreased.

- Embeddedness is a result of large-scale sediment movement and deposition.

- To avoid confusion with sediment deposition – habitat parameter #4 – observations of embeddedness should be taken in the upstream and central portions of riffles and cobble substrate areas.

- The rating of this parameter may be variable depending on where the observations are taken.

Challenges

- Distinguishing from Parameter #4: Sediment Deposition
- Developing a sense of the term – visual and other clues
- Being consistent in making observations
- Extent – 100 meters upstream from top of riffle
- Estimating percentages – avoid visual bias

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
3. Velocity/Depth Regime	All four velocity/depth combinations present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 combinations are present.	Only 2 of the 4 combinations are present.	Dominated by 1 velocity/depth regime.
SCORE	18	13	8	3

#3 – Velocity/Depth Regime

- Patterns of velocity & depth relationships are important to habitat diversity. The best streams in most high gradient regions will have all 4 patterns present:
  - Slow & deep
  - Slow & shallow
  - Fast & deep
  - Fast & shallow

- Why is this important?
  - The occurrence of these 4 patterns relates to the stream's ability to provide and maintain a stable aquatic environment.
    - Dispersion of energy
    - Movement of materials
    - Distribution of nutrients, oxygen

- How deep is deep water?
  - The general guideline is 0.5 meter depth to separate shallow from deep. In smaller streams – this guideline may not be applicable and you should look for areas that are deeper than the average stream depth.

- How fast is fast water?
  - The general guideline is 0.3 meters per second to separate fast from slow.

- Extent upstream
  - How far do you have to go to find riffles and runs, pools and glides?

- Identifying features – where does a riffle turn into a run, and a pool transition to a glide?

- Measuring depth and velocity
  - Equipment needed
  - Units – use metric or convert metric to standard

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increases in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	18	13	8	3

#4 – Sediment Deposition

- Measures the amount of sediment that has accumulated in channel.

- Why is this important? High levels of sediment deposition are symptoms of an unstable and continually changing environment that becomes unsuitable for many organisms.

- Examines the changes that have occurred to the stream bottom as a result of deposition.
  - Deposition (accumulation) occurs from large-scale movement of sediment.
  - Sediment deposition may cause the formation of islands, point bars (deposits on the inside of a meander), or shoals.
  - Deposition may fill in runs and pools.
  - Deposition occurs when the energy of the flow decreases.
  - Usually deposition is evident in areas that are obstructed by natural features (such as bends) or manmade structures (such as bridges) or debris.

Challenges

- Distinguishing between a stream's natural, balanced deposition pattern and a pattern that is out of balance
- Measuring the deposits
  - Areal extent
  - Location
  - Size and percentages of particles
- Evidence of new deposition compared to what and when?
  - Effect of water level on perceived size of deposits

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
5. Channel Flow Status	Water reaches base of both banks, and minimal amount of channel substrate is exposed.	Water fills over 75% of the available channel; or less than 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	18	13	8	3

#5 – Channel Flow Status

- Refers to the degree to which the channel is filled with water.

- Why is this important?
  - Cobble substrates can become exposed, reducing the areas of good habitat.
  - Channel flow is especially useful for interpreting biological conditions under abnormal or low flow conditions.
- The flow status will change as the channel enlarges (e.g. aggrading stream beds with actively widening channels).

- The flow status will change as flow decreases (e.g. as a result of dams, diversions, or drought).

Challenges

- Traversing 100 meters upstream

- Delineating the stream channel – think of available channel width below floodplain

- Estimating percentage of channel filled with water and over what area?

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channel straightening or dredging absent or minimal; stream with normal pattern	Some channel straightening present, usually in areas of bridges; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channel straightening may be extensive. Man-made materials – hard engineering, large rocks, cement channels, pipes, riprap, etc. present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks covered with man-made materials including hard engineering, large rocks, cement channels, pipes, riprap, etc.; over 80% of reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	18	13	8	3

#6 – Channel Alteration

- A measure of large-scale changes in the shape of the stream channel.

- Why is this important?
  - "Engineered" streams have far fewer natural habitats for fish, plants, and macroinvertebrates than do naturally meandering streams.
  - "Engineered" streams have unnatural shape, energy distribution, structures, flow regimes, and "behavior" – they solve and create problems.

- Human impacts include:
  - Stream straightening
  - Stream deepening
  - Stream diversion
  - Stream channelization

- Signs of "engineered" streams:
  - Artificial embankments
    - Riprap
    - Gabions
  - Presence of dams, bridges, or other large structures
  - Very straight channel over significant distance
  - Evidence of channel scouring
  - Other changes that do not appear "natural"

Challenges

- Traversing 100 meters upstream

- Identifying mitigating effects over time – has Nature reasserted itself to some degree?

- Restrictions to access to examine the stream bottom or to observe biota

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
7. Frequency of Riffles (or bends) Measure distance between riffles – top of downstream riffle to the bottom of upstream riffle. If there are more than two riffles, take the average distance.	Occurrence of riffles relatively frequent. The distance between the riffles divided by the width of the stream is less than 7.	Occurrence of riffles infrequent. The distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat The distance between riffles divided by the width of the stream is between 15-25.	Generally all flat water or shallow riffles - poor habitat. The distance between riffles divided by the width of the stream is greater than 25.
SCORE	18	13	8	3

#7 – Frequency of Riffles

- A way to measure the sequence of riffles and thus the heterogeneity present in a stream.

- For high gradient streams where distinct riffles are uncommon, a run/bend ratio can be used as a measure of meandering or *sinuosity*.

- Why are riffles important? Riffles are a source of high quality habitat and diverse fauna, so the greater the frequency of riffles, the better the diversity of the stream community.

- Why is sinuosity important? A high degree of sinuosity provides for:
  - Diverse habitat and fauna
  - The stream to be better able to handle surges in water volume as a result of storms
  - The absorption of storm energy by the bends protects channel from excessive erosion
  - Refugia for fauna during storm events

Challenges

- Traversing 100 meters upstream

- Need ability to sketch the stream OR ability to read a topographic map (sinuosity)

- Measuring distances between riffles – top of riffle to top of riffle and varying stream widths

- Determining the ratios: distance between riffles divided by width of the stream

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream	Banks stable; evidence of erosion or bank failure absent or minimal. Less than 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious wearing away of bank; 60-100% of bank has erosional scars.
SCORE ____Left	9	6.5	4	1.5
SCORE ____Right	9	6.5	4	1.5

#8 – Bank Stability

- Measures whether the stream banks are eroded, or have the potential to erode.

- Why is this important?
  - Steep banks are more likely to:
    - Erode and collapse than gently sloping banks
    - Promote channel widening (changing flow regime)

  - Eroded banks indicate problems of:
    - Sediment movement and deposition
    - Scarcity of cover and organic input to stream

- Each bank is evaluated separately.
  - Left bank is on your left facing downstream
  - Right bank is on your right facing downstream
  - Use cumulative score (right + left)

- Signs of erosion:
  - Crumbling of stream bank
  - Undercutting of stream bank
  - Scarcity of or lack of vegetation
  - Exposed tree roots
  - Exposed soil (raw look)

Challenges

- Examining both banks over 100 meters

- Estimating percentages of erosion:
  - Severe
  - Healed

- Estimating degree of stability:
  - Unstable – moderately stable – mostly stable

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
9. Bank Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by vegetation, including trees, understory shrubs, wetland plants; vegetative disruption through grazing or mowing minimal or not evident.	70-90% of the streambank surfaces covered by vegetation but one class (trees, shrubs, grasses) of plants is not well represented.	50-70% of the streambank surfaces covered by vegetation; patches of bare soil or closely cropped vegetation common.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters (or less) in height – ex. Mowed or grazed.
SCORE ____Left	9	6.5	4	1.5
SCORE ____Right	9	6.5	4	1.5

#9 – Bank Vegetative Cover

- Measures the amount of vegetative protection afforded to the streambank and the near-stream portion of the riparian zone.

- Supplies information on the capability of the bank to resist erosion.

- Some stream banks may be covered by riprap or concrete – stabilized but offer nothing to fauna

- Why is this important? Root systems of plants growing on stream banks help to:
  - Hold soil in place, reducing erosion
  - Control instream scouring
  - Slow runoff from land into the stream
  - Provide habitat
  - Provide shade; moderate water temperatures

- What about native versus exotic species?
  - Exotic vegetation provides some protection and is better than no vegetative cover
  - Native vegetation – especially of diverse kinds – is superior to exotic
    - Woody vegetation – trees & shrubs
    - Herbaceous vegetation

- Evaluate each bank separately and record cumulative score (right bank + left bank).

Challenges

- Examining both banks over 100 meters

- Estimating percentages of cover and Identifying disruptions to vegetation

- Identifying native versus exotic species

- Determining degree of diversity of species

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roads, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ____Left	9	6.5	4	1.5
SCORE ____Right	9	6.5	4	1.5

#10 – Riparian Vegetative Zone Width

- Measures the width of *natural* vegetation from the edge of the stream bank out through the riparian zone.

- Why is this important? The vegetative zone:
    - Removes pollutants from runoff
    - Helps control erosion by reducing volume and velocity of runoff
    - Provides habitat for many kinds of organisms
    - Promotes biological diversity
    - Provides nutrient input to the stream
    - Provides shade – cools water

- For variable size streams, the specified width of a desirable riparian zone may also be variable; may best be determined by some multiple of stream width (e.g. 4x stream channel width).

- Evaluate each bank separately and add the scores (right bank + left bank).

- Threats to the vegetated riparian buffer:
    - Hardscaping – roadways, parking lots, hard-packed ground surfaces, riprap or concrete embankments
    - Buildings, levees, other structures
    - Golf courses, lawns, athletic fields, pasture or rangeland
    - Denuded areas – construction sites, timbered lands, agricultural lands

Challenges

- Evaluating both banks over 100 meters

- Ability to access, view, or examine one or both banks (e.g. private property, too much vegetation, safety issues)

- Measuring the zone – thick underbrush

Summary of Challenges to Habitat Assessment

- Subjectivity – in spite of the “matrix”
- Accessing the full reach of stream
  - Deep or swift water; barriers
- Estimating percentages – visual bias
- Developing a “sense” of the parameters
- Measuring and calculating parameters
- Need for equipment, assistance