

**Summary of Alabama Stream Habitat and Fish Inventories
on the Bankhead, Conecuh, and Talladega National Forests, 2009**



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Introduction

In February 2007, the National Forests in Alabama (NFA) requested assistance from the USDA Forest Service, Southern Research Station, Center for Aquatic Technology Transfer (CATT) in development of a Forest-level stream monitoring program. Biologists and hydrologists from the CATT, NFA, Daniel Boone National Forest, and Regional Office met following the Southern Region Fish meeting in Asheville, NC in April 2007 to discuss the monitoring framework and sample design. The CATT and NFA produced a stream monitoring field guide based on these discussions (Appendix A).

CATT field crews and NFA personnel used the methods outlined in the field guide to perform stream inventories at ten sites per year in the summers of 2007 and 2008 (Roghair et al. 2007 and 2008). In 2009, the NFA again requested assistance with data collection for their stream monitoring program. The CATT deployed 1 biologist and 4 technicians to the Bankhead National Forest and the Shoal Creek Ranger District on the Talladega National Forest from 28 – 30 July 2009, and 4 biologists to the Conecuh National Forest and the Oakmulgee, Shoal Creek, and Talladega Ranger Districts on the Talladega National Forest from 2 – 4 September 2009, to quantify stream habitat conditions and collect fish assemblage information.

Methods

Site Selection

Sites were selected in accordance with a stratified random sampling design. Personnel from the NFA randomly selected ten 6th level Hydrologic Unit Codes (HUC) from a set of all HUCs containing National Forest System (NFS) property. Next, a single National Hydrography Dataset (NHD) stream reach was randomly selected from each of the 10 HUCs (Appendix A). The NHD is a digital spatial dataset of water surface features, such as streams, that uniquely identifies stream segments or “reaches”. The reach identification number changes are based on three rules (USGS 2000): 1) the underlying feature rule breaks reaches between these feature types: stream/river, artificial path, canal/ditch, and pipeline; 2) the confluence-to-confluence rule breaks reaches based on confluences, heads (stream source), and mouths (stream enters large water body); and 3) the branched path rule breaks reaches at areal features (e.g. lake, pond, swamp, marsh) thus avoiding the need to define flow channels within the areal feature.

All reaches selected by the NFA for sampling met the following criteria: 1) drained an area 13-26 km²; 2) was at least partially on NFS managed lands; 3) suitable for sampling (i.e. accessible, perennial, depth suitable for wading). Habitat attributes were recorded throughout the entire length of selected reaches (or that portion managed by NFS); sites for fish sampling were centered in the reach.

Habitat Inventory

A two-person crew performed a stream habitat inventory on the full length of the NHD reach, or the portion on NFS managed lands. The crew estimated or measured several stream habitat attributes:

- Type of habitat unit
- Length of habitat unit
- Substrate
- Large wood
- Photographs
- GPS coordinates

In addition, we noted stream features including:

- Waterfalls
- Tributaries
- Side channels
- Braided channels
- Seeps (springs)
- Landslides
- Bridges
- Fords
- Dams
- Culverts

Habitat inventory methods are described in detail in Appendix A.

Fish Inventory

A four-person crew collected fish assemblage information using a DC backpack electrofisher. Sample reaches were centered within the NHD reach. If the average wetted width was less than or equal to 3.0 m or greater than or equal to 7.5 m the reach length was 120 m or 300 m, respectively (Appendix A). In all other cases sample reach length was 40-times the average wetted width. Average wetted width was calculated by taking width measurements in representative fast and slow-water habitat units within each reach (in 2007, only fast-water units were measured for average width). We did not move reaches to avoid road or trail crossings. Crews attempted to apply standard effort of approximately 1 sec/m² of wetted stream habitat. We recorded the following data:

- Species name
- Counts of adult, age-0, and voucher specimens
- Sample reach length, electrofishing time (sec), and voltage
- GPS coordinates of start and end location

Results

The CATT and ANF personnel completed habitat and fish inventories on 10 streams (Table 1). We inventoried habitat on a total of 8.6 km of stream, electrofished a total of 1.7 km of stream, and captured 50 fish species (Table 2). The data collected by the CATT can be used to describe stream condition on the NFA and serve as a baseline for future comparisons.

Data Availability

Habitat and fish data collected in 2009 are ready for migration into the Natural Resource Information System water module (NRIS). We will format the data according to the Regional NRIS Water standards and migrate the data as the new NRIS water module comes online. As data are migrated into NRIS Water the CATT will coordinate development of custom query and reporting tools for the NFA. In the interim, the CATT is available to assist with data analysis and report preparation. John Moran, NFA Fish Biologist, received a copy of all data in electronic format.

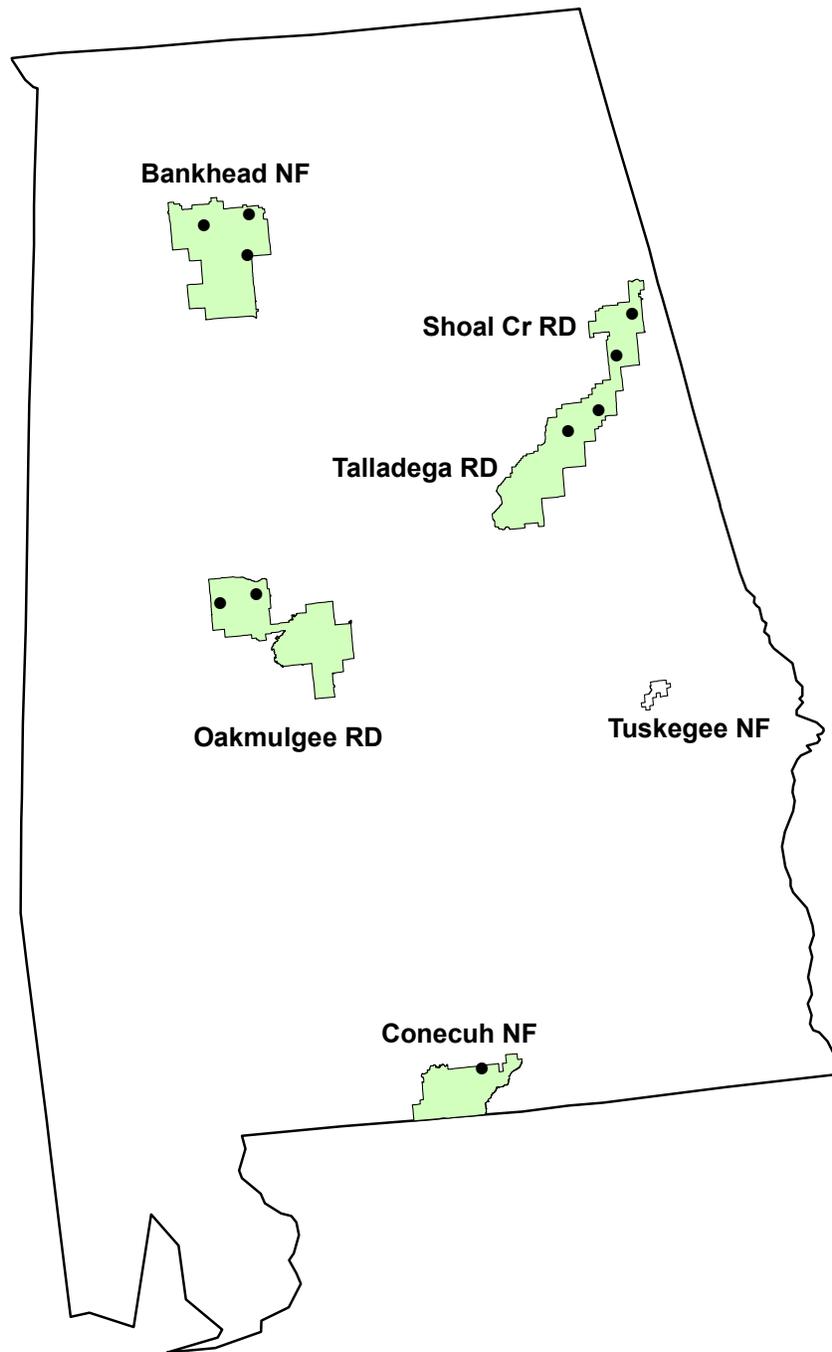


Figure 1. National Forests and Ranger Districts in Alabama. The CATT visited the Bankhead and Conecuh National Forest and the Oakmulgee, Shoal Creek, and Talladega Ranger Districts on the Talladega National Forest in summer 2009 (dots represent 2009 inventoried site locations).

Table 1. Average wetted stream width and reach length for electrofishing and stream habitat inventories on National Forests in Alabama, 2009.

District	Stream	NHD Reach	Avg Width (m)	Efish (m)	BVET (m)
Bankhead	Hagwood Creek	3160110000351	5.8	231	1,668
Bankhead	Indian Creek	6030002002781	4.7	187	609
Bankhead	Inman Creek	3160110000487	4.8	191	345
Conecuh	Camp Creek	3140103001446	3.6	145	1,277
Oakmulgee	Elliotts Creek	3160113000270	1.9	120	559
Oakmulgee	unnamed trib to Affonee Creek	3150202001257	3.0	120	198
Shoal Creek	Chulafinnee Creek	3150108000327	4.2	168	1,478
Shoal Creek	Little Shoal Creek	3150106002219	3.9	155	479
Shoal Creek	Marys Creek	3150105001758	4.2	168	988
Talladega	Cheaha Creek	3150106000093	5.8	232	992
Total				1,716	8,593

Table 2. Fish species captured on the National Forests in Alabama, 2009 (see Table 1 for inventoried stream reaches).

Family	Scientific Name	Common Name	District				
			Bankhead	Conecuh	Oakmulgee	Shoal Creek	Talladega
Anguillidae	<i>Anguilla rostrata</i>	American eel		X			
Aphredoderidae	<i>Aphredoderus sayanus</i>	Pirate perch			X		
Catostomidae	<i>Erimyzon oblongus</i>	Creek chubsucker	X		X		
Catostomidae	<i>Hypentelium etowanum</i>	Alabama hog sucker	X			X	X
Catostomidae	<i>Moxostoma poecilurum</i>	Blacktail redhorse				X	
Centrarchidae	<i>Lepomis auritus</i>	Redbreast sunfish	X			X	
Centrarchidae	<i>Lepomis cyanellus</i>	Green sunfish	X		X	X	X
Centrarchidae	<i>Lepomis gulosus</i>	Warmouth	X		X	X	
Centrarchidae	<i>Lepomis macrochirus</i>	Bluegill	X			X	
Centrarchidae	<i>Lepomis megalotis</i>	Longear sunfish	X			X	X
Centrarchidae	<i>Lepomis microlophus</i>	Redear sunfish				X	
Centrarchidae	<i>Lepomis miniatus</i>	Redspotted sunfish		X	X		
Centrarchidae	<i>Micropterus coosae</i>	Redeye bass				X	X
Centrarchidae	<i>Micropterus punctulatus</i>	Spotted bass				X	
Centrarchidae	<i>Micropterus salmoides</i>	Largemouth bass			X		
Cottidae	<i>Cottus carolinae</i>	Banded sculpin				X	
Cyprinidae	<i>Campostoma oligolepis</i>	Largescale stoneroller	X			X	
Cyprinidae	<i>Cyprinella callistia</i>	Alabama shiner				X	X
Cyprinidae	<i>Cyprinella gibbsi</i>	Tallapoosa shiner				X	
Cyprinidae	<i>Cyprinella trichroistia</i>	Tricolor shiner				X	X
Cyprinidae	<i>Cyprinella venusta</i>	Blacktail shiner		X			
Cyprinidae	<i>Luxilus chrysocephalus</i>	Striped shiner	X		X		
Cyprinidae	<i>Lythrurus atrapiculus</i>	Blacktip shiner		X			
Cyprinidae	<i>Lythrurus fasciolaris</i>	Scarlet shiner	X				
Cyprinidae	<i>Nocomis leptocephalus</i>	Bluehead chub				X	
Cyprinidae	<i>Notropis asperifrons</i>	Burrhead shiner	X			X	
Cyprinidae	<i>Notropis chrosomus</i>	Rainbow shiner				X	
Cyprinidae	<i>Notropis stilbius</i>	Silverstripe shiner				X	
Cyprinidae	<i>Notropis xaenocephalus</i>	Coosa shiner				X	
Cyprinidae	<i>Pteronotropis hypselopterus</i>	Sailfin shiner		X			
Cyprinidae	<i>Rhinichthys atratulus</i>	Blacknose dace	X				
Cyprinidae	<i>Semotilus atromaculatus</i>	Creek chub	X			X	
Esocidae	<i>Esox americanus</i>	Redfin pickeral		X	X		
Esocidae	<i>Esox niger</i>	Chain pickeral			X		

Table 2 Continued.

Family	Scientific Name	Common Name	District				
			Bankhead	Conecuh	Oakmulgee	Shoal Creek	Talladega
Fundulidae	<i>Fundulus notatus</i>	Blackstripe topminnow	X				
Fundulidae	<i>Fundulus olivaceus</i>	Blackspotted topminnow	X		X	X	
Fundulidae	<i>Fundulus stellifer</i>	Southern studfish				X	
Ictaluridae	<i>Ameiurus natalis</i>	Yellow bullhead	X			X	
Ictaluridae	<i>Noturus gyrinus</i>	Tadpole madtom			X		
Ictaluridae	<i>Noturus leptacanthus</i>	Speckled madtom				X	
Percidae	<i>Etheostoma artesiae</i>	Redspot darter	X				
Percidae	<i>Etheostoma coosae</i>	Coosa darter				X	X
Percidae	<i>Etheostoma douglasi</i>	Tuskaloosa darter	X			X	
Percidae	<i>Etheostoma jordani</i>	Greenbreast darter				X	
Percidae	<i>Etheostoma stigmaeum</i>	Speckled darter	X		X		
Percidae	<i>Etheostoma swaini</i>	Gulf darter			X		
Percidae	<i>Percina kathae</i>	Mobile logperch	X			X	
Percidae	<i>Percina nigrofasciata</i>	Blackbanded darter		X		X	
Percidae	<i>Percina palmaris</i>	Bronze darter				X	
Petromyzontidae	<i>Petromyzontid spp.</i>	lamprey ammocoete			X	X	

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- Dolloff, C. A., D. G. Hankin, and G. H. Reeves. 1993. Basinwide estimation of habitat and fish populations in streams. General Technical Report SE-83. Asheville, North Carolina: U.S. Department of Agriculture, Southeastern Forest Experiment Station.
- Roghair, C. N., C.W. Krause, and C. A. Dolloff. 2007. Summary of Alabama Stream Habitat and Fish Inventories on the Bankhead, Conecuh, and Talladega National Forests, 2007. Unpublished Report. Blacksburg, Virginia: U.S. Department of Agriculture, Forest Service, Center for Aquatic Technology Transfer.
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Appendix A : Field Methods

Characterization of substrate and large woody debris within selected stream reaches on the National Forests in Alabama



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Introduction

In summer 2007, resource managers on the National Forest in Alabama requested that the USFS Center for Aquatic Technology Transfer (CATT) complete stream inventories to characterize the fish community and stream habitat within selected stream reaches. The NF in Alabama randomly selected 10 6th level HUCs from a set of all HUCs containing NFS property. Next, a single NHD stream reach was randomly selected from each of the 10 HUCs. Stream reaches had to meet the following criteria: 1) reach drains an area 5-10 mi²; 2) reach is at least partially on NFS managed lands; 3) reach suitable for sampling (i.e. accessible, perennial, wadable). The fish sample site is centered on the middle of the randomly selected stream reach. Habitat attributes are recorded for the entire reach (or that managed by NFS). Our goal is to provide the NF in AL with data needed to assess the effectiveness of management strategies outlined in their Forest Plan.

We developed this document to guide classroom and field instruction and to serve as a post-training reference for field crews. It includes an overview of the inventory, defines habitat attributes, instructs how and when to measure attributes, and provides reference sheets for use in the field. Each trainee should receive a copy of this manual and is encouraged to take notes in the spaces provided.

References cited in this manual:

- Armantrout, N. B., compiler. 1998. Glossary of aquatic habitat inventory terminology. American Fisheries Society, Bethesda, Maryland.
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Changes to BVET inventory in 2009

Attribute	Action	Reason
Recording start & end of fish sample reach in habitat data	Removed	Habitat data from the NHD reach as a whole is used when interpreting fish assemblage data.
Photos	Modified	Take photos from the downstream end looking upstream; and from the upstream end looking downstream.
Fish Assemblage methods	Added	Electrofishing methods added to clarify overall procedure.
Fish Assemblage methods	Removed	Vouchering a form I male crayfish from efish reaches was removed as we have not had any success in capturing these.

Other minor changes, mostly modifications in terminology and definitions to provide increased clarity, are found throughout the manual.

Outline of Habitat Inventory

The inventory is comprised of the following steps:

- 1) Enter 'header' information in the data sheet
 - 'Header' information includes date, stream, start location, crew, etc. and is **vitaly** important to record for future reference
- 2) Navigate to downstream end of NHD reach or NFS boundary using GPS or maps
 - Note that this is not the same as the downstream end of the fish sampling reach
- 3) Proceed upstream recording attributes for each habitat unit and stream features as encountered
- 4) End at upstream end of NHD reach or NFS boundary
 - Note that is not the same as the upstream end of the fish sampling reach

The following sections describe the BVET habitat inventory in detail:

Section 1: Getting Started – equipment lists, header information, starting the inventory

Section 2: Habitat Attributes – definitions, how to estimate or measure, when to record

Section 3: Wrapping Up – what to do when the inventory is completed

Appendix: field guide, random number tables, equipment checklist

Outline of Fish Assemblage Inventory

Reach Layout Methods

- Find 1 – 2 representative areas (measure both fast and/or slow water units) and determine the average **wetted** width by making several measurements and computing the average. Measure width perpendicular to flow.
 - If the average wetted width is less than or equal to 3.0 m, then the reach length will be 120 m
 - If the average wetted width is greater than or equal to 7.5 m, then the reach length will be 300 m
 - If the average wetted width is between 3.0 and 7.5 m, then reach length is 40-times the average wetted width, example: average wetted width = 5 m; reach length = $5 \times 40 = 200$ m
- As the crew electrofishing walks upstream, one crew member measures distance with a hipchain enabling the mid and endpoint to be determined during electrofishing.
- **Be sure you have recorded the average wetted width and reach length on the datasheet**
- Do not move reaches to avoid road or trail crossings – this is part of the range of conditions that may be encountered due to the random site selection, be sure to document these features fully with photos and written descriptions
- Where possible, begin reaches at the downstream end of a habitat unit, end points should be at the exact distance as described above
- In large streams make sure the reach includes at least part of a fast water habitat unit and part of a slow water habitat unit

Efish Methods

Objectives:

- 1) determine relative abundance
- 2) determine catch-per-unit-effort (CPUE)

note: we are not attempting to estimate population size or density for individual species, only assessing the fish community

Methods:

Based on sampling strategies discussed and approved by R8 and SRS personnel in March, 2005:

- single-pass backpack electrofishing with DC unit
- one shocker, 3 netters
- no blocknets
- electrofishing effort will be equal to 1.0 seconds for each 1.0 m² of wetted area
 - o note: this will standardize our effort and remove the potentially confounding effect of changes in wetted width relative to the bankfull channel width in wet or dry years
 - o derived Warren et al. data on electrofishing effort in MS streams
- fish older than age-0 will be counted and released at the site, except for a voucher specimen for unidentified species; **endangered species lists will be reviewed before sampling**
- record age-0 fish presence for each species, if possible
- keep all relic mussel shells encountered; note location where found in habitat data

Section 1: Getting Started

Equipment List

hipchain	clipboard
extra string for hipchain	BVET manual and field guide
datalogger	felt bottom wading boots or waders
GPS unit	bug spray
topographic map	water
camera	water filter
backpack	lunch
pencils	1 st aid kit
flagging	rain gear
markers	toilet paper
waterproof backup datasheets	radio/cell phone

The crew consists of two individuals, the ‘observer’ and the ‘recorder’. The observer wears the hipchain. The recorder wears the data logger and carries other equipment in the backpack. The duties of each individual are listed below.

Duties

Observer	Recorder
Designate habitat units	Classify and count LW
Measure distance	Photo-documentation
Classify substrates	Document stream features
Identify stream features	Record data

Although the crew has assigned duties, they should not hesitate to consult with each other if they have questions or feel that a mistake may have been made. Working as a team will provide the best possible results.

Header Information

Header information is **vitaly important** for future reference. Take the time to record all categories completely and accurately.

Stream Name	Full name of stream
District	National Forest District name
Quad	USGS 1:24,000 quadrangle name
Date	Record date(s) of inventory
Recorder	Full name of recorder
Observer	Full name of observer
GPS	record at start and end locations; AL standard: UTM, NAD 1983, zone 16N
Location	Detailed written description of start point, include landmarks, road #, etc.
Notes	Record signs of activity in area, water conditions, other pertinent information

Starting the Inventory

After the crew has organized their gear and recorded all the header information they are ready to begin the habitat inventory. Proceed to the start point and record the Garmin GPS waypoint number in the waypoint field for the first habitat unit. The observer should enter the stream slightly downstream of the starting point, tie off the hipchain, progress upstream to the starting point, reset the hipchain to zero and begin walking upstream through the first habitat unit. As the observer moves upstream they scan the wetted stream channel to determine the most common substrates and also scan the channel for stream features. When they reach the upstream end of the habitat unit they stop, report the distance, then turn to face the unit and report the dominant and subdominant substrate classes.

As the observer moves upstream through the unit, the recorder follows behind, recording the amount of LW in the habitat unit. The recorder also assigns a number to the habitat unit. The recorder also scans the channel for stream features and stops the observer to document features when necessary.

The crew continues upstream recording data for every habitat unit and stream feature encountered.

Definitions of habitat attributes, how to measure and when to record them, and what to do when stream features or the end point is encountered are covered in the following sections.

Section 2: Stream Attributes

Unit Type (see abbreviations)

Definitions:*

Unit Type	<i>Abbreviation</i>	Definition
Riffle	R	Fast water, turbulent, gradient <12% ; shallow reaches characterized by water flowing over or around rough bed materials that break the surface during low flows; also include rapids (turbulent with intermittent whitewater, breaking waves, and exposed boulders), chutes (rapidly flowing water within narrow, steep slots of bedrock), and sheets (shallow water flowing over bedrock) if gradient <12%
Cascade	C	Fast water, turbulent, gradient ≥12% ; highly turbulent series of short falls and small scour basins, with very rapid water movement; also include sheets (shallow water flowing over bedrock) and chutes (rapidly flowing water within narrow, steep slots of bedrock) if gradient ≥12%
Run	RN	Fast water, non-turbulent, gradient <12% ; deeper than riffles with little or no surface agitation or flow obstructions and a flat bottom profile
Pool	P	Slow water, surface turbulence may or may not be present, gradient <1% ; generally deeper and wider than habitat immediately upstream and downstream, concave bottom profile; includes dammed pools, scour pools, and plunge pools
Glide	G	Slow water, no surface turbulence, gradient <1% ; shallow with little to no flow and flat bottom profile
Underground	UNGR	Stream channel is dry or not containing enough water to form distinguishable habitat units

*modified from Armantrout (1998)

How to estimate:

Habitat units are separated by ‘breaks’. Breaks can be obvious physical barriers, such as a debris dam separating two pools or a small waterfall separating a pool and riffle, or may be less obvious transitional areas. Questions often arise as to whether a break is substantial enough to split two habitat units and where the exact location of the break occurs. When in doubt, the observer should consult with the recorder and the team should ‘think like a fish’. To determine if a break should be made, consider whether a fish would have to make an effort to move across the break and into the next habitat unit. If not, then it is probably a single habitat unit.

The channel may have both pool and riffle type habitat in the same cross-sectional area. Determine the predominate habitat type and record it as the unit type. For example if an area contains both pool and riffle, but the majority of the flow is into and out of the pool habitat, then call a pool.

Questions also often arise as to the minimum size of individual habitat units. Generally, if a habitat unit is not at least as long as the wetted channel is wide, then do not count it as a separate habitat unit. This rule may need to be adjusted for streams wider than 5 m. Use best professional judgment in such cases.

See the section 2.1 for a list of features that should also be recorded while performing the inventory.

When to record: every habitat unit

Unit Number (#)

Definition:

Count of habitat units of similar types, used to determine location of paired sample units

How to estimate:

When counting habitat units, group pools and glides (slow water) together, and group riffles, runs, and cascades (fast water) together. For example, consider the following sequence of habitat units:

Pool – Riffle – Pool – Pool – Riffle - Cascade – Riffle - Glide – Riffle – Pool – Run – Pool – Riffle

Habitat units in this sequence would be counted in the following manner (similar types are shaded same color):

Unit Type	Unit Number
P	1
R	1
P	2
P	3
R	2
C	3
R	4
G	4
R	5
P	5
RN	6
P	6
R	7

In the above example, the crew has counted six slow water (pool/glide) units and seven fast water (riffle/run/cascade) units.

When to record: every habitat unit; not recorded for features such as falls, tributaries, side channels, culverts, etc.

Distance (m)*Definition:*

Number of meters from the start of the inventory to the upstream end of the habitat unit or distance from the start of the inventory to upstream end of a feature, used as spatial reference for data analysis and to locate features in the future.

How to estimate:

The observer walks upstream in the middle of the stream channel with a hipchain measuring device. When they reach the upstream break between habitat units or the upstream end of a feature they stop and report the distance to the recorder.

Care should be taken to keep the hipchain string in the middle of the stream, especially around bends and meanders. If the hipchain should break, retreat to the location where the break occurred, tie off the hipchain, and continue. If the hipchain is reset for any reason be sure to note it in the comments.

When to record: every habitat unit and feature

Dominant and Subdominant Substrate (1-9)

Definitions:

Dominant Substrate: size class of stream bed material that covers the greatest amount of surface area within the wetted channel of the habitat unit

Subdominant Substrate: size class of stream bed material that covers the 2nd greatest amount of surface area within the wetted channel of the habitat unit

How to estimate:

The following size classes are used to categorize substrates*. The substrate 'Number' is entered into the dominant and subdominant substrate columns on the datasheet.

Type	Number	Size (mm)	Description
Organic Matter	1		dead leaves, detritus, etc. – not live plants
Clay	2		sticky, holds form when rolled into a ball
Silt	3		slippery, does not hold form when rolled into a ball
Sand	4	silt – 2	grainy, does not hold form when rolled into ball
Small Gravel	5	3-16	sand to thumbnail
Large Gravel	6	17-64	thumbnail to fist
Cobble	7	65-256	fist to head
Boulder	8	>256	larger than head
Bedrock	9		solid rock, parent material, may extend into bank

* these size classes are based on the modified Wentworth scale

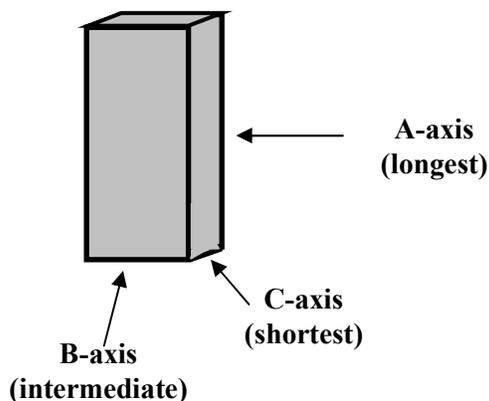
As the observer walks through the unit they scan the substrate. When they reach the upstream end of the unit they stop, turn to face the unit, and determine the dominant and subdominant substrate classes.

Estimate substrate size along the intermediate axis (b-axis). The b-axis is not the longest or shortest axis, but the intermediate length axis (see below). It is the axis that determines what size sieve the particle could pass through. Remember that your eyes are naturally drawn to larger size substrates. Be careful not to bias your estimate by focusing on the large size substrate.

Some units will contain a mixture of particle sizes. Consult with the recorder and use your best professional judgment to choose the dominant and subdominant sizes.

In units where the substrate is covered in moss, algae, or macrophytes classify the underlying substrate and make note of the plant growth in the comments. Only call organic substrate where there is dead and down leaves or other detritus covering the bottom of the unit.

When to record: every habitat unit



Large Wood (1-4 and rootwad)

Definition:

Count of dead and down wood within the bankfull channel of a habitat unit

How to estimate:

The recorder classifies and counts LW as they walk through the habitat unit. LW counts are grouped by the size classes listed below:

Category	Length (m)	Diameter (cm)	Description
1	1-5	10-55	short, skinny
2	1-5	>55	short, fat
3	>5	10-55	long, skinny
4	>5	>55	long, fat
RW	rootwad	rootwad	roots on dead and down tree

Only count woody debris that is:

- > 1.0 m in length and > 10.0 cm in diameter
 - within the bankfull channel
 - fallen, not standing dead
-
- Count rootwads separately from attached pieces of LW
 - Estimate the diameter of LW at the widest end of the piece
 - A piece that is forked, but is still joined counts as only one piece of LW
 - Only count each piece one time, do not count a piece that is in two habitat units twice
 - Enter the total count for each size category into the appropriate column on the datasheet

Where to estimate: every habitat unit

Photo (photo number)

Definition:

Photograph of stream feature

How to measure:

Take photo from the downstream end of the NHD reach looking upstream with observer in the picture for scale. Take photo from the upstream end of the NHD reach looking downstream with observer in the picture for scale. Also take photos of all features. Be sure to get entire width the stream in the photo.

Where to measure: start point, end point, stream features

Features

Definition: points on a stream that could potentially serve as landmarks, may be natural or manmade

How to measure: record the distance to the upstream end of a feature; record distance of **all features** (both stream and crossing features) in the regular habitat datasheet; also record additional measurements for crossing features in the crossing datasheet and take a photograph of all crossing features

Where to record: wherever found

Channel Feature	Abbreviation	What to Record
Waterfall ¹	FALL	Distance, estimated height
Tributary	TRIB	Distance, average wetted width, into main channel on left or right (as facing upstream)
Side channel ²	SCH	Distance, average wetted width, whether it is flowing into or out of main channel on left or right (as facing upstream)
Braid ³	BRD	Distance at start and distance at end; continue with normal inventory up channel with greatest discharge
Seep (Spring)	SEEP	Distance, left or right bank (as facing upstream), size, coloration
Landslide	SLID	Distance, left or right bank (as facing upstream), estimated size
Other	OTR	Distance, description of feature, <i>example:</i> start of fish sample reach; Big Gap campground on left; alligator slide here, etc.

1 must be vertical with water falling through air to be a waterfall and not a cascade, do not record unless >1m high

2 two channels, continue with normal inventory up channel with most volume

3 three or more channels intertwined, continue with normal inventory up channel with most volume

	Abbreviation	What to Record*
<i>Crossing Feature</i>		
Bridge	BRG	Distance, width, height, road or trail name and type (gravel, paved, dirt, horse, ATV, etc.), photo
Ford	FORD	Distance, road or trail name and type (gravel, paved, dirt, etc.), photo
Dam	DAM	Distance, type, condition, estimated height, dam use, name of road or trail, if applicable; include beaver dams, photo
Culvert	V	Distance, road or trail name, type, # of outlets, diameter/width, height, material, perch (distance from top of water to bottom lip of culvert, natural substrate (present or absent through length), photo

* photograph all crossing features with person and wading rod for scale, record 'Y' in 'Photo' column

We cannot stress enough the importance of fully and accurately describing features. This means getting out a quadrangle map and finding road, trail, and tributary names and recording them in 'Comments' and taking the time to describe the location of features in relation to landmarks found on quadrangle maps.

Take photos of all crossing features!

Section 3: Wrapping Up

End the inventory where:

- Forest Service property ends
- End of NHD reach in encountered

Record the following in the Comments:

- Time and date
- Reason for ending the inventory
- Detailed written description of location using landmarks for reference
- GPS waypoint from Garmin

When you return to home base:

- Immediately download the data and check file to be sure all data downloaded
- Check header information to be sure it is complete
- Note in all files if more than one file was used during the inventory
- Save to the computer and create a backup copy
- Document any photographs
- If using paper, make a photocopy of the data and store in secure location
- Record on master list that inventory is complete, with data and names of crewmembers

Section 4: Summary

Before starting: 1) fill in header information; 2) record the GPS waypoint from the Garmin at the start of the reach

Record for every habitat unit:

- Unit Type
- Unit Number
- Distance
- Dominant Substrate
- Subdominant Substrate
- Large Wood

Record features and full feature descriptions wherever they are encountered. Photograph all crossings!

When end of inventory is reached, record reason for ending, date, and time, be sure data is saved in safe location, and record inventory start and end points on master maps.

Appendix: Field Guide, Random Numbers Table, Equipment Checklist

Record for every habitat unit:

- Unit Type:** pool, riffle, run, cascade, glide, feature (see below)
- Unit Number:** group pools & glides; group riffles, runs, cascades
- Distance:** (m) at upstream end of unit
- Dominant Substrate:** (1-9) covers greatest amount of surface area in unit
- Subdominant Substrate:** (1-9) covers 2nd most surface area in unit
- Large Wood:** (1-4, RW) count of dead and down wood in the bankfull channel

Unit Types

- Riffle (R)** fast water, turbulent, gradient <12%; includes rapids, chutes, and sheets if gradient <12%
- Cascade (C)** fast water, turbulent, gradient ≥12%, includes sheets and chutes if gradient ≥12%
- Run (RN)** fast water, little to no turbulence, gradient <12%, flat bottom profile, deeper than riffles
- Pool (P)** slow water, may or may not be turbulent, gradient <1%, includes dammed, scour, and plunge pools
- Glide (G)** slow water, no surface turbulence, gradient <1%, shallow with little flow and flat bottom profile
- Underground (UNGR)** distance at upstream end, why dry

Substrates

1. **Organic Matter**, dead leaves detritus, etc., not living plants
2. **Clay**, sticky, holds form when balled
3. **Silt**, slick, does not hold form when balled
4. **Sand**, >silt-2mm, gritty, doesn't hold form
5. **Small Gravel**, 3-16mm, sand to thumbnail
6. **Large Gravel**, 17-64mm, thumbnail to fist
7. **Cobble**, 65-256mm, fist to head
8. **Boulder**, >256, > head
9. **Bedrock**, solid parent material

End inventory

Where NHD reach ends or NFS boundary is encountered. Record time of day, detailed description of location, and GPS waypoint at endpoint, and be sure all header info is filled in on datasheets.

Features – don't forget to photograph!

- Waterfall (FALL)** distance, height
- Tributary (TRIB)** distance, width, in on L or R
- Side Channel (SCH)** distance, width, in or out on L or R
- Braid (BRD)** distance at downstream and upstream ends
- Seep or Spring (SEEP)** distance, on left or right, amount of flow
- Landslide (SLID)** distance, L or R, est. size and cause
- Other (OTR)** record distance, describe feature in comments
- Crossing Features:** Photograph and record the following:
 - Bridge (BRG)** distance, height, width, road or trail name & type
 - Dam (DAM)** distance, type, est. height, road or trail name & type
 - Ford (FORD)** distance, road or trail name & type
 - Culvert (V)** distance, type (pipe, box, open box, arch, open arch), size, material, natural substrate, perch (top of water to culvert) road or trail name

Large Wood

1. <5m long, 10-55cm diameter
 2. <5m long, >55cm diameter
 3. >5m long, 10-55cm diameter
 4. >5m long, >55cm diameter
- RW: rootwad – count separately from attached LW, record in comments do not record wood <10cm diameter, <1m length

Equipment Checklist

hipchain
extra string for hipchain
datalogger
GPS unit
camera
backpack
pencils
flagging
markers
waterproof backup datasheets
clipboard
field guide on waterproof paper
topographic maps
water
water filter
lunch
first aid kit
radio/cell phone
toilet paper
felt bottom wading boots
bug spray
raingear

Fill in as much header info as possible before leaving for the site, or on the way there