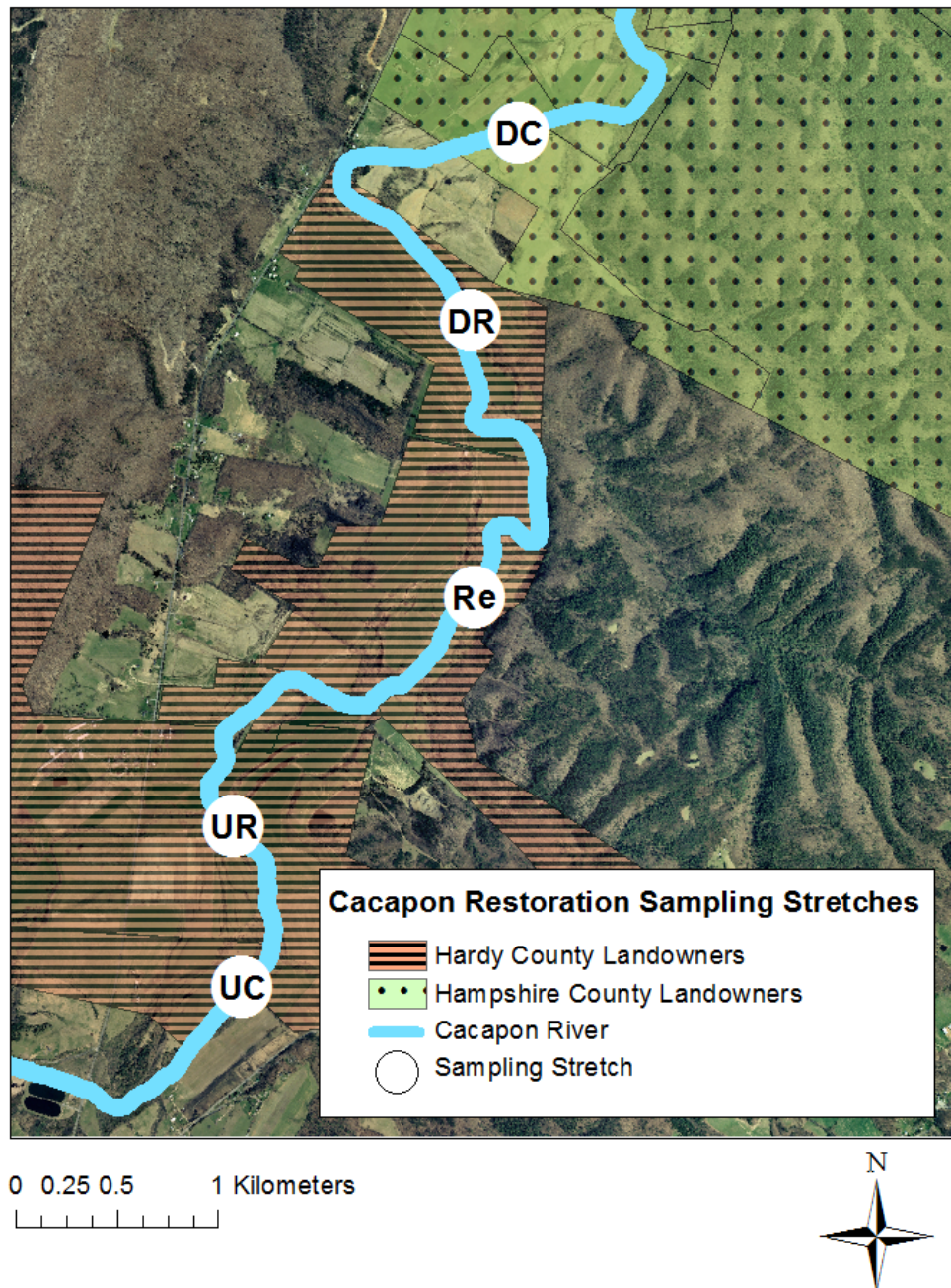


Appendix I: Map of the restoration reach, two control reaches, and two reference reaches in the Cacapon River. Upstream control (impaired reach, but not receiving restoration) denoted 'UC' (39°5'47.95"N, 78°34'28.26"W), downstream control denoted 'DC' (39°7'48.99"N, 78°33'19.10"W). Upstream reference (unimpaired, natural reach) denoted 'UR' (39°5'57.81"N, 78°34'26.39"W), downstream reference denoted 'DR' (39°7'22.21"N, 78°33'25.15"W). The restoration reach denoted 'Re' (39°6'38.77"N, 78°33'32.70"W).



Appendix II: Rapid visual habitat assessment (RVHA) scores, following Barbour et al. (1999), for the five Cacapon restoration project sampling reaches, taken Summer 2009. The metrics for riffle-dominated rivers include: epifaunal substrate and available cover (EPI), embeddedness (EMB), velocity and depth combinations (VDC), sediment deposition (SDE), channel flow status (CFS), channel alteration (CAL), frequency of riffles (FRI), bank stability (BST), vegetative protection (VPR), and riparian zone width (RZW). Upstream control (impaired reach, but not receiving restoration) denoted 'UC', downstream control denoted 'DC'. Upstream reference (unimpaired, natural reach) denoted 'UR', downstream reference denoted 'DR'. The restoration reach denoted 'Re'.

Reach	EPI	EMB	VDC	SDE	CFS	CAL	FRI	BST	VPR	RZW	Total
UC	13	16	16	16	12	17	13	13	10	13	139
UR	14	14	15	15	14	17	13	17	17	16	152
Re	12	15	18	17	14	17	13	9	13	8	136
DC	16	13	12	16	13	17	13	13	14	9	136
DR	14	16	14	18	19	17	13	16	18	18	163

Appendix III: Plantings in zone A (water edge to top of bank) and zone B (above bank) of the Cacapon River, West Virginia, USA restoration reach. Woody vegetation species were planted to establish a riparian buffer, to reduce erosion and runoff on the newly constructed banks. The number of each species planted on the right and left banks (when facing downstream) are given. A species listed as a pollinator species (Pol. spp) provides food for honeybees and other economically important pollinators.

Species- Zone A	No. planted		Tree/ Shrub	Pol. spp?
	Right	Left		
Sycamore ( <i>Platanus occidentalis</i> )	25	0	Tree	no
Cottonwood ( <i>Populus deltoides</i> )	26	24	Tree	no
River birch ( <i>Betula nigra</i> )	0	0	Tree	no
Elderberry ( <i>Sambucus canadensis</i> )	50	50	Shrub	yes
Black Willow ( <i>Salix nigra</i> )	0	25	Tree	no
Silky cornel ( <i>Cornus amomum</i> )	25	25	Shrub	yes
Streamside alder ( <i>Alnus serrulata</i> )	40	30	Shrub	no
Buttonbush ( <i>Cephalanthus occidentalis</i> )	99	51	Shrub	yes
Total	265	205		

Appendix III cont.

Species - Zone B	No. Planted		Tree/Shrub	Pol. spp?
	Right	Left		
Redbud ( <i>Cercis canadensis</i> )	70	30	Shrub	yes
Winterberry ( <i>Ilex verticillata</i> )	60	40	Shrub	yes
Spicebush ( <i>Calycanthus floridus</i> )	70	30	Shrub	yes
Serviceberry ( <i>Amelanchier leavis</i> )	0	0	Tree	yes
Swamp White Oak ( <i>Quercus bicolor</i> )	100	48	Tree	no
Swamp Oak ( <i>Quercus palustris</i> )	60	40	Tree	no
Bailey Red Snowberry ( <i>Symphoricarpus orbiculatus</i> )	0	0	Shrub	no
Nannyberry ( <i>Viburnum lentago</i> )	0	0	Shrub	yes
Ninebark ( <i>Physocarpus opulifolius</i> )	0	0	Shrub	yes
Shrubby St. johnswort ( <i>Hypericum prolificum</i> )	0	0	Shrub	yes
Gray dogwood ( <i>Cornus racemosa</i> )	60	40	Shrub	yes
Persimmon ( <i>Diospyros virginiana</i> )	75	0	Tree	no
Choke cherry ( <i>Prunus virginiana</i> )	60	40	Shrub	yes
Black haw ( <i>Viburnum prunifolium</i> )	60	40	Shrub	yes
American basswood ( <i>Tilia americana</i> )	80	40	Tree	yes
Wild plum ( <i>Prunus americana</i> )	50	0	Shrub	yes
Virginia rose ( <i>Rosa virginiana</i> )	0	0	Shrub	yes
Smooth arrowwood ( <i>Viburnum recognitum</i> )	0	0	Shrub	yes
Rough arrowwood ( <i>Viburnum dentatum</i> )	68	32	Shrub	yes
Black chokeberry ( <i>Aronia melanocarpa</i> )	0	0	Shrub	yes
Meadowsweet ( <i>Spiraea alba</i> )	0	0	Shrub	yes
Steeplebush ( <i>Spiraea tomentosa</i> )	0	0	Shrub	yes
Fringetree ( <i>Chionanthus virginicus</i> )	0	0	Shrub	yes
Wild crabapple ( <i>Malus coronaria</i> var. <i>coronaria</i> )	67	0	Shrub	yes
Hawthornes ( <i>Crataegus</i> spp.)	0	0	Tree	yes
Total	880	380		

Appendix IV: List of aquatic macroinvertebrates collected from all sampling reaches in the Cacapon River with associated functional feeding groups (Mandaville 2002).

Taxon	Genera	FFG	Total	Taxon	Genera	FFG	Total
Aeshnidae	1	PR	2	Lepidostomatidae	1	SH	1
Amphipoda	1	CG	51	Leptoceridae	1	PR	21
Ancylidae	2	SC	56	Leptohyphidae	1	CG	116
Athericidae	1	PR	217	Leptophlebiidae	1	CG	19
Baetidae	3	CG	2272	Lestidae	2	PR	4
Baetiscidae	1	CG	4	Leuctridae	3	SH	145
Blephariceridae	1	SC	5	Limnephilidae	4	SH	34
Brachycentridae	3	SH, CF	78	Lymnaeidae	1	CG	72
Caenidae	1	CG	428	Molannidae	1	SC	1
Cambaridae	2	CG	12	Nemouridae	2	SH	61
Capniidae	3	SH	253	Odontoceridae	1	SC	1
Chaoboridae	1	PR	1	Oligochaeta	1	CG	116
Chironomidae	4	CG	3293	Perlidae	6	PR	115
Coenagrionidae	3	PR	117	Perlodidae	4	PR	38
Corbiculidae	1	CF	376	Philopotamidae	2	CF	1389
Corydalidae	3	PR	702	Physidae	1	CG	8
Dryopidae	1	SC	22	Planorbidae	1	SC	2
Elmidae	3	SC	4417	Pleuroceridae	1	SC	673
Empididae	1	PR	64	Polycentropodidae	1	PR	22
Ephemerellidae	6	CG, SC	2710	Polymitarcyidae	1	CG	17
Ephemeridae	2	CG	17	Potamanthidae	1	CG	228
Gerridae	1	PR	12	Psephenidae	2	SC	2095
Gomphidae	4	PR	78	Pteronarcyidae	1	SH	17
Gyrinidae	2	PR	52	Pyalidae	1	SC	2
Haliplidae	1	SH	1	Rhyacophilidae	1	PR	14
Heptageniidae	2	SC	2374	Sialidae	1	PR	36
Hirudinea	1	PR	12	Simuliidae	1	CF	2065
Hydroarachnidia	1	PR	1	Sphaeriidae	1	CF	90
Hydropsychidae	2	CF	2509	Tabanidae	1	CG	1
Hydrophilidae	1	CG	2	Taeniopterygidae	2	SH	27
Hydroptilidae	1	SC	31	Tipulidae	2	SH,CG	114
Isonychiidae	1	CF	2420	Uenoidae	1	SC	351
Isopoda	1	CG	2	Veliidae	1	PR	2

CG=Collector-gatherer

CF=Collector-filterer

PR=Predator

SC=Scraper

SH=Shredder

Appendix V: Pearson's correlation coefficients and associated permutational p-values (1000 randomizations) for relations between fish (Daniels et al. 2002) and macroinvertebrate indices of biotic integrity metrics and nonmetric multidimensional scaling (NMDS) ordination for the communities sampled during the summers of 2009 and 2010 from the Cacapon River, West Virginia, USA.

Community	Metric	Vector $r^2$	P-value
Macroinvertebrate	Total genera	0.458	0.119
	Total taxa	0.348	0.212
	EPT taxa	0.425	0.143
	Percent EPT	0.114	0.658
	Percent Chironomidae	0.580	0.044
	Percent dominant 2 taxa	0.584	0.040
	Hilsenhoff Biotic Index	0.931	0.001
	Abundance	0.664	0.025
Fish	Total richness	0.425	0.150
	Benthic insectivores	0.010	0.967
	Water column spp.	0.290	0.282
	Terete minnows	0.416	0.141
	Percent dominant	0.436	0.126
	Percent <i>Catostomus</i>	0.001	0.902
	Percent generalist	0.223	0.386
	Percent insectivores	0.073	0.768
	Per. top carnivores	0.002	0.995
	Abundance	0.181	0.484
	Per. juv. and adult	0.420	0.134
	Percent anomalies	0.706	0.001

Appendix VI: List of fish species collected during electrofishing in the Cacapon River at all sampling reaches, 2009-2010.

Family	Common name	Scientific name	Total	Locations
Catostomidae	White sucker	<i>Catostomus commersoni</i>	49	All
Catostomidae	Northern hogsucker	<i>Hypentelium nigricans</i>	41	All
Catostomidae	Golden redhorse	<i>Moxostoma erythrurum</i>	9	UC, DC, DR
Catostomidae	Shorthead redhorse	<i>Moxostoma macrolepidotum</i>	3	DR
Centrarchidae	Rock bass	<i>Ambloplites rupestris</i>	43	All
Centrarchidae	Redbreast sunfish	<i>Lepomis auritus</i>	241	All
Centrarchidae	Green sunfish	<i>Lepomis cyanellus</i>	5	DC
Centrarchidae	Pumpkinseed	<i>Lepomis gibbosus</i>	6	UR, DC, DR
Centrarchidae	Bluegill	<i>Lepomis macrochirus</i>	11	UR, Re, DC, DR
Centrarchidae	Longear sunfish	<i>Lepomis megalotis</i>	4	UR, Re, DC
Centrarchidae	Smallmouth bass	<i>Micropterus dolomieu</i>	22	All
Centrarchidae	Largemouth bass	<i>Micropterus salmoides</i>	3	DC
Cottidae	Blue ridge sculpin	<i>Cottus caeruleomentum</i>	110	All
Cottidae	Potomac sculpin	<i>Cottus girardi</i>	32	UC, UR, Re, DR
Cyprinidae	Central stoneroller	<i>Camptostoma anomalum</i>	48	UC, UR, Re, DR
Cyprinidae	Spotfin shiner	<i>Cyprinella spiloptera</i>	20	UC, UR, Re, DC
Cyprinidae	Cutlips minnow	<i>Exoglossum maxillingua</i>	7	UR, Re, DR
Cyprinidae	Common shiner	<i>Luxilus cornutus</i>	3	Re, DR
Cyprinidae	River chub	<i>Nocomis micropogon</i>	2	UC, UR
Cyprinidae	Comely shiner	<i>Notropis amoenus</i>	33	UC, RF
Cyprinidae	Silverjaw minnow	<i>Notropis buccatus</i>	2	DR
Cyprinidae	Rosyface shiner	<i>Notropis rubellus</i>	186	All
Cyprinidae	Mimic shiner	<i>Notropis volucellus</i>	18	UR, Re, DR
Cyprinidae	Bluntnose minnow	<i>Pimephales notatus</i>	934	All
Cyprinidae	Blacknose dace	<i>Rhinichthys atratulus</i>	21	UC, UR, Re, DR
Cyprinidae	Longnose dace	<i>Rhinichthys cataractae</i>	35	UC, UR, Re, DR
Cyprinidae	Creek chub	<i>Semotilus atromaculatus</i>	48	UR, Re, DC, DR
Cyprinidae	Fallfish	<i>Semotilus corporalis</i>	77	All
Ictaluridae	Yellow bullhead	<i>Ameiurus natalis</i>	24	UR, Re, DC, DR
Ictaluridae	Margined madtom	<i>Noturus insignis</i>	8	All
Percidae	Greenside darter	<i>Etheostoma blennoides</i>	22	All
Percidae	Fantail darter	<i>Etheostoma flabellare</i>	63	All
Percidae	Tessellated darter	<i>Etheostoma olmstedii</i>	175	All
UC = upstream control (impaired reach)		DC = downstream control		
UR = upstream reference (natural reach)		DR = downstream reference		
Re = restoration reach		All= all five reaches		