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Assessing Habitats Created by Installation of Drop Pipes[1]

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ABSTRACT

This research indicated that the Natural Resources Conservation Service (NRCS) installs many conservation practice structures that have unrecognized wetland and wildlife benefits. Drop pipes are common grade control structures that can have significant benefits beyond erosion and sediment control. In North Central Mississippi, the installation of drop pipe structures replaces eroding gullies with riparian habitats. Four created habitat types are: upland meadow, saturated emergent wetland, scrub-shrub wetland, and intermittent riverine wetland. The vertebrate communities were assessed using multiple collecting techniques within terrestrial sites undergoing gully erosion and the four drop pipe created habitat types. A total of 100 species were identified in all habitat types. The highest species richness occurred in the scrub-shrub and intermittent riverine wetlands. The installation of these structures can be modified to more effectively facilitate scrub-shrub and intermittent riverine wetland habitat creation and longevity by planning for larger pool areas, deeper water depths (≥30 cm), and installation of stiff grass hedges to promote sedimentation outside the habitat area.

Locations:

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Research Center
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Dept of Agronomy
Louisiana State
University
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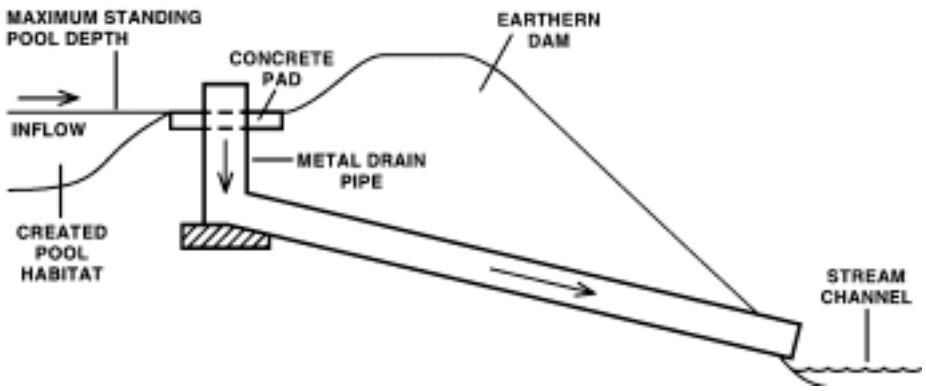
ARS, National
Sedimentation
Laboratory
University of
Mississippi
Oxford MS

USFWS
Hadley
MA

BACKGROUND

The Demonstration Erosion Control (DEC) project targeted 15 watersheds in North Central Mississippi for the installation of intensive land treatment and channel stabilization practices to be evaluated for performance. Over 2,000 drop structures were planned for installation as part of the DEC project. Nineteen sites were selected in which the vertebrate communities were studied (four of each created habitat type and three gully sites). A typical structure installation is illustrated in Figure 1.

Figure 1. Cross-section of typical drop pipe structure and created habitat.



HABITAT CLASSIFICATION

In general, habitats created by drop pipe installation are small terrestrial or wetland habitats located in the riparian zone of incised streams. Habitat characteristics (in order of importance) used for classification were pool depth, vegetative structure, and area. Wetland habitats were classified by the Cowardin classification. The final categories included temporarily flooded upland meadow (UM), saturated emergent wetland (SAT), scrub-shrub wetland (SS), and intermittent riverine wetland (IR). Sites exhibited a continuum from small terrestrial habitats (upland meadows) to larger permanent wetlands (intermittent riverine wetlands). All habitats received water from precipitation and storm runoff from a watershed that normally included surrounding agricultural fields.

The active gully erosion sites (GULLY) were located in the riparian zone of agricultural fields adjacent to incised streams. The gullies were still actively eroding despite riparian vegetation being established in the vicinity. Vegetative structure in gully sites was intermediate between that exhibited by upland meadows and saturated emergent wetlands. Small transient pools formed within the gullies and possessed water depths similar to pools occurring within upland meadows.

SAMPLING

The project involved sampling fish, amphibians, reptiles, mammals, and birds. A variety of sampling techniques were used including seines, baited hoop nets, dipnets, Sherman folding live traps, pitfall traps, night sampling, and bird counts from fixed sampling points. With all sampling techniques, captured animals were identified, counted, and released. Vertebrate sampling was conducted in all study sites from 12 December 1994 to 31 August 1995.

ANALYSIS

Mean species richness, overall relative abundance, and habitat relative abundance were examined to evaluate differences in vertebrate communities among the habitat categories. Mean species richness is the mean number of species. Overall relative abundance is the percent of captures calculated from the total captures from all habitats, which allows comparisons of vertebrate relative abundance between habitat categories. Habitat relative abundance is the percent of captures calculated from the total captures within a habitat category; it allows the determination of the numerically dominant vertebrate class within each habitat category.

RESULTS

A total of 100 species were identified from 4,276 captures in all habitat types. A single reptile and bird species were captured exclusively in gully erosion sites, not drop pipe created habitats. Representatives of one amphibian species, nine mammal species, and 14 bird species were captured in both gully erosion sites and drop pipe created habitats. An additional five fish species, 11 amphibian species, 13 reptile species, six mammal species, and 40 bird species were captured only in drop pipe created habitats (Table 1). Intermittent riverine wetlands contained 28 species of aquatic vertebrates, which was also the total number of aquatic vertebrate species captured within all habitat types. Scrub-shrub wetlands contained 16 species of aquatic vertebrates, while gully erosion sites, upland meadows, and saturated emergent wetlands contained 2, 3, and 3 aquatic vertebrate species, respectively (Table 1). Habitat type significantly influenced mean vertebrate species richness. Mean species richness of all habitat categories were significantly different from each other except gully erosion sites and saturated emergent wetlands. Upland

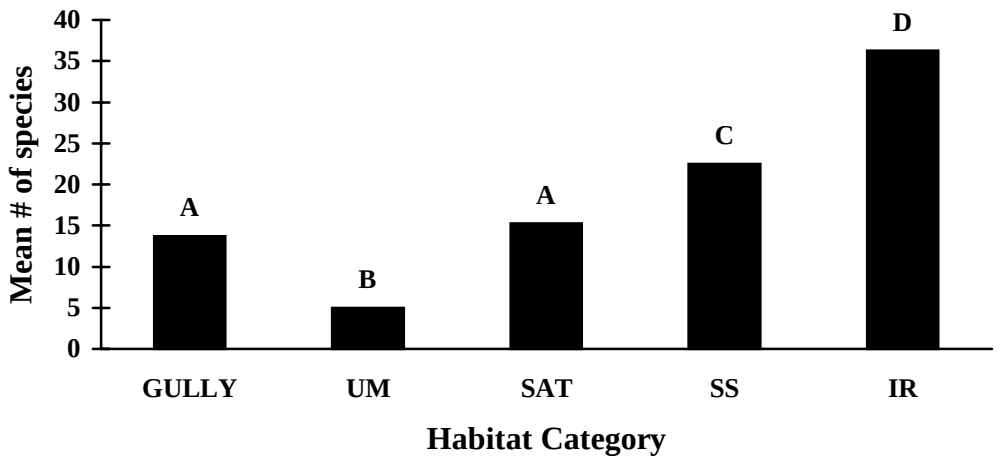
Table 1. Species list of all vertebrates captured within terrestrial sites undergoing gully erosion and all drop pipe created habitats. Additionally each species is classified according to its preference for aquatic (A) or terrestrial (T) systems. Habitat abbreviations are as follows: GULLY – terrestrial sites undergoing gully erosion, UM – upland meadows, SAT – saturated emergent wetlands, SS – scrub-shrub wetlands, and IR – intermittent riverine wetland.

Common name	Aquatic/ Terrestrial	GULLY	UM	SAT	SS	IR
Fish						
Black crappie	A					X
Blackspotted topminnow	A					X
Bluegill	A					X
Green sunfish	A					X
Golden shiner	A					X
Amphibian						
American toad	A				X	X
Bullfrog	A			X	X	X
Cricket frog (Acris)	A					X
Eastern narrowmouth toad	A		X		X	X
Green frog	A				X	X
Green treefrog	A				X	X
Grey treefrog	A				X	X
Mole salamander	A					X
Red-spotted newt	A				X	X
Spring peeper	A				X	X
Southern leopard frog	A		X		X	X
Toad species (Bufo)	A	X	X			
Woodhouse's toad	A			X	X	X
Unidentified salamander	A				X	
Unidentified tadpoles	A	X				
Reptile						
Diamondback watersnake	A				X	X
Eastern box turtle	T			X	X	X
Eastern garter snake	T				X	
Eastern coachwhip	T					X
Eastern mud turtle	A					X
Ground skink	T		X	X	X	X
Mississippi ringneck snake	T					X
Red-eared slider	A				X	X
Rough earth snake	T		X			
Skink species (Eumeces)	T			X	X	
Six-lined racerunner	T					X
Snapping turtle	A					X
Speckled kingsnake	T	X				
Western cottonmouth	A			X		X
Yellowbelly watersnake	A				X	X
Mammal						
Armadillo	T	X	X			X
Beaver	A					X
Cotton mouse	T	X	X	X	X	X
Coyote	T					X
Golden mouse	T	X			X	X
Hispid cotton rat	T	X	X	X	X	X
House mouse	T	X	X	X	X	X
Least shrew	T		X	X	X	X
Pine vole	T	X	X	X	X	X
Rabbit species (Sylvigagus)	T			X	X	
Raccoon	T				X	X
Shorttail shrew	T	X	X	X	X	X
Southeastern shrew	T			X	X	X
White-footed mouse	T	X	X	X	X	X
Whitetail deer	T	X			X	

Table continued from previous page Common name	Aquatic/ Terrestrial	GULLY	UM	SAT	SS	IR
Bird						
American crow	T			X	X	X
American goldfinch	T		X		X	X
American robin	T				X	X
American tree sparrow	T			X	X	X
Barn swallow	T					X
Belted kingfisher	A					X
Blue grosbeak	T	X			X	X
Blue jay	T				X	X
Blue-winged warbler	T					X
Brown-headed cowbird	T	X				
Brown thrasher	T				X	X
Carolina chickadee	T			X	X	X
Carolina wren	T			X	X	X
Cerulean warbler	T					X
Chimney swift	T				X	
Cliff swallow	T					X
Common grackle	T				X	
Common yellowthroat	T	X		X	X	X
Dark-eyed junco	T	X				X
Dickcissel	T			X		X
Downy woodpecker	T				X	
Eastern bluebird	T	X		X	X	X
Eastern kingbird	T				X	X
Eastern meadowlark	T	X	X	X		X
Eastern phoebe	T					X
Field sparrow	T	X	X	X	X	X
Gray catbird	T					X
Great blue heron	A				X	X
Green-backed heron	A				X	X
Hairy woodpecker	T			X	X	X
House sparrow	T			X		X
Indigo bunting	T	X	X	X	X	X
Killdeer	T					X
Loggerhead shrike	T				X	
Northern cardinal	T	X		X	X	X
Northern mockingbird	T			X		X
Northern oriole	T					X
Northern parula	T			X		
Northern rough-wing swallow	T					X
Red-tailed hawk	T					X
Red-wing blackbird	T	X	X	X	X	X
Ruby-crowned kinglet	T				X	
Ruby-throated hummingbird	T	X		X	X	X
Solitary vireo	T			X		
Song sparrow	T	X		X	X	X
Tennessee warbler	T					X
White-eyed vireo	T	X				X
White-throated sparrow	T			X		X
Wood duck	A				X	X
Yellowbreasted chat	T		X	X		X
Yellow billed cuckoo	T					X
Yellow-rumped warbler	T					X
Yellow warbler	T					X
Unidentified wren species	T	X				X

meadows had the lowest mean species richness of all habitat types. Mean species richness of saturated emergent wetlands was not significantly greater than gully erosion sites, while mean species richness of scrub-shrub wetlands and intermittent riverine wetlands was significantly higher (Figure 2).

Figure 2. Mean species richness of each habitat category. Letters indicate significant difference at the 0.05 level.



For all vertebrate captures combined, intermittent riverine wetlands had the highest overall relative abundance. Overall relative abundance of all vertebrate classes decreased from intermittent riverine wetlands to its lowest value at upland meadows and then increased slightly in gully erosion sites. Trends in overall relative abundance for each vertebrate class varied among the five classes, with the highest values being observed in the scrub-shrub and intermittent riverine wetlands (Table 2). Table 3 shows the habitat relative abundance of each vertebrate class in all habitat types. Mammals and birds had greater than 90% combined habitat relative abundance within gully erosion, upland meadow, and saturated emergent wetlands. In contrast, within scrub-shrub and intermittent riverine wetlands the combined habitat relative abundance of mammals and birds was less than 45%.

Table 2. Overall relative abundance and total captures (in parentheses) of all vertebrate classes in each habitat type.

	GULLY	UM	SAT	SS	IR
Fish	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	10.8 (461)
Amphibian	0.05 (2)	0.12 (5)	0.05 (2)	18.4 (787)	13.4 (572)
Reptile	0.05 (2)	0.07 (3)	0.12 (5)	0.37 (16)	2.4 (103)
Mammal	4.7 (201)	1.47 (63)	7.5 (320)	9.2 (393)	7.7 (328)
Bird	1.9 (80)	0.96 (41)	4.21 (180)	5.2 (224)	11.4 (488)
All Vertebrates	6.7 (285)	2.6 (112)	11.9 (507)	33.2 (1420)	45.7 (1952)

Table 3. Habitat relative abundance for each vertebrate class.

	GULLY	UM	SAT	SS	IR
Fish	0	0	0	0	23.6
Amphibian	0.7	4.5	0.4	55.4	29.3
Reptile	0.7	2.7	1	1.1	5.3
Mammal	70.5	56.3	63.1	27.7	16.8
Bird	28.1	36.6	35.5	15.8	25

DISCUSSION

The three factors used to classify habitat categories - pool depth, vegetative structure, and area - are all factors known to influence vertebrate habitat use. The larger habitat area and more successionally advanced vegetative structure of the gully erosion sites when compared to the upland meadow sites explains the higher mean species richness and overall relative abundance of all vertebrate classes in the gully erosion sites. The continuous increase in species richness and overall relative abundance of all vertebrate classes from gully erosion sites and saturated emergent wetlands to intermittent riverine wetlands was a combined result of increases in pool depth, vegetative structure, and area. The observed change in habitat relative abundance can be attributed to an increase in pool depth which influences water residency time and enables greater utilization of scrub-shrub and intermittent riverine wetlands by aquatic vertebrates.

Regardless of the habitat type incidentally created by drop pipe installation, the structure is still ecologically advantageous because of its erosion reduction properties that protect downstream resources. The results of this work suggest that when focusing on habitat creation, the development of upland meadows is the least advantageous. Despite the lack of an increase in mean species richness, the creation of saturated emergent wetlands is more acceptable because overall relative abundance for all vertebrates is greater than gully erosion sites. Of the four possible habitats, targeting installation design to allow for the development of scrub-shrub and intermittent riverine wetlands will provide the greatest ecological benefits for riparian zone vertebrates identified in this study. Riparian zones of deeply incised streams within North Mississippi are lacking wetland habitats because channel incision severs the typical floodplain-stream interaction. Wetland creation within riparian zones of incised streams will result in a needed landscape feature for vertebrates living in this impacted area. Drop pipes do not solely function as erosion control structures but as a habitat creation system to assist in the restoration of riparian zones impacted by both channel incision and gully erosion.

APPLICATION TO FIELD

This work illustrates the varied and often-overlooked benefits associated with a common conservation practice: the installation of a grade control structure. The increased diversity and abundance of vertebrate species is a significant ecological benefit that should be recorded and relayed to the cooperator.

Until research is conducted to determine the life expectancy and successional stages of drop pipe created wetland habitats, planners and designers should attempt to increase longevity of created scrub-shrub and intermittent riverine wetland habitats by maximizing pool areas, increasing pool depths, and providing filter strips of native vegetation around pools. Increasing the longevity of these created wetland habitats should provide increased habitat benefits for riparian vertebrates identified in this study.

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REFERENCES used in original paper

Cowardin, L. M., Carter, V., Golet, F. C., and LaRoe, E. T. (1979) “Classification of wetlands and deep water habitats in the glaciated northeast,” U.S. Fish and Wildlife Service, Washington, DC.

Grissinger, E. H., Murphey, J. B., and Coleman, N. L. (1985) “Planned gully research at the USDA Sedimentation Laboratory,” Proceedings of the Natural Resources Modeling Symposium, USDA Agricultural Research Service, Publication ARS-30, pp. 475-478.

Jandel Corporation. (1994) “SigmaStat for Windows version 1.0 statistical software,” San Rafael, CA.

Miller, C. R., Woodburn, R., and Turner, H. R. (1962) “Upland gully sediment production,” IASH Publication, No. 59, pp. 83-104.

Ramser, C. E. (1932) “Gullies: how to control and reclaim them,” Farmer’s Bulletin, USDA, No. 1234, Washington, DC, pp. 1-34.

Shields, F. D., Jr., Knight, S. S., and Cooper, C. M. (1995a) “Rehabilitation of watersheds with incising channels,” Water Resources Bulletin, Vol. 31, No. 6, pp. 971-982.

Shields, F. D., Jr., Knight, S. S., and Cooper, C. M. (1995b) “Incised stream physical habitat restoration with stone weirs,” Regulated Rivers: Research and Management, Vol. 10, pp. 181-198.

Weller, M. W. (1988) “Issues and approaches in assessing cumulative impacts on waterbird habitat in wetlands,” Environmental Management, Vol. 12, No. 5, pp. 695-701.

Woodburn, R. (1949) “Science studies a gully,” Soil Conservation, Vol. 15, No.1, pp.11-13, 22.