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CESU Final Report Summary for
Monitoring of Floodplain and Riverine Ecosystem Response to Flood Pulses on the Savannah River, GA/SC: Responses of floodplain invertebrates and fish - *W912HZ1020027*

Purpose: This project describes an effort to use invertebrates and fish to assess the biotic integrity of floodplain habitats of the lower Savannah River using a cost-effective indicator organism approach for the US Army Corps of Engineers and The Nature Conservancy. Examined if the primary reason that fish move onto floodplains is to exploit invertebrates as food, and like fish, the resident invertebrate community is strongly influenced by the character of flood pulses.

Location: To sample invertebrates and fish, three locations along the floodplains of each of the Savannah and Altamaha Rivers were selected. The Savannah 1 location was in Georgia's Yuchi WMA, the Savannah 2 location was in Georgia's Tuckahoe WMA, and the Savannah 3 location was in South Carolina's Webb WMA, just above the upper extent of tidal influence. The Altamaha 1 location was just downstream of the convergence of the Ocmulgee and Oconee Rivers in Bullard Creek Wildlife Management Area (WMA). The Altamaha 2 location was further downstream in the Big Hammock WMA.

Methods: Beginning in 2004, invertebrate sampling began, and in 2005, fish sampling began at the six sites. Sampling continued until 2008 for invertebrates and 2009 for fish. Pulses were released down the Savannah in spring 2005 and 2006, but not thereafter because of ongoing drought conditions. At each location, sampling was stratified to be conducted in representative low lying backwater swamps of the floodplain interior; these seasonally flooded locations held water between flood events, and were where aquatic invertebrates and fish accumulated. Initial samples were collected in late-February/early-March soon after floodplains began to be inundated. They then re-sampled in April, and a third time in May, provided significant amounts of water still remained. Most sampling was conducted between major flood events after water and aquatic organisms had settled back into low lying backwater swamps. For invertebrates, a Hess sampler (860 cm2, 500 µm mesh, Wildlife Supply Co., Buffalo, NY, U.S.A.) was used to quantitatively sample organisms in the water column and on the benthic substrate. Fish communities at each site were sampled with a backpack electroshocker (Smith-Root Inc., Model 12-B POW, Vancouver, WA) on a catch-per-unit-effort basis (numbers per 750 seconds of actual shocking time). Sampling was conducted 2005-2008 (historical information), and in 2010. In 2010, invertebrates were also sampled using the netting procedure outlined by USEPA (1997) for sampling macroinvertebrates in low gradient streams of the Atlantic Coastal Plain.

Results: Research over the past six years indicates that the aquatic fauna differs between floodplains along the Savannah and Altamaha Rivers. Differences are most pronounced for

Dytiscidae beetles, Planorbidae snails, and Esocidae fishes. Because these organisms appear to respond postively to winter/spring pulses induced by managed releases of water from the Strom Thurmond Dam, it suggests that past management practices contributed to the difference in floodplain communities and that current management practices might eventually restore Savannah Riiver floodplains to a more natural state.

The goal of the research was to develop user-friendly protocols that can be employed by non-specialists, but are buttressed by validation data. Data from 2010 indicate that this is a realistic objective. Preliminary data indicate that the time consuming Hess sampler can be replaced with a more user-friendly dip-net protocol because both procedures generate similar data for key indicator invertebrates. Because of their abundance, Dytiscidae beetles (especially in the genus Neoporus) may be especially useful bioindicators in the Savannah River system. More validation data could cement this idea, and new research on the ecology of the beetles might suggest mechanisms of beetle response to flood pulses. Planorbidae snails, because of large natural variation (both temporally and spatially), hold less promise, but as the beetles are predators and the snails are primary consumers, more research on the snails may be merited as their responses to pulses may be unique.

The impressive response by Esox fish to the 2009–2010 pulse in the Savannah River was especially encouraging. Most of these fish were juveniles (20–25 mm sl), although not newly hatched larvae. This indicates that in the first years of life, a critical period, floodplains may provide important nursery habitat for Esox. Recommended:
1) The sampling regime conducted in 2009–2010 be repeated to buttress findings from 2010 in terms of invertebrate response and dip-net sampling efficacy.
2) Dip-net invertebrate sampling and fish electro-shocking (but not time-consuming Hess sampling) be expanded to include more sites along the Savannah River. This will better enable generalization of findings.
3) Data be gathered on the ecology of Neoporus dytiscid beetles and Esox fish to better understand why these organisms seem to be strongly affected by flow regulation and how pulse releases may benefit them.

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