Project Summary
Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Geomorphic and hydrogeological influences on bull trout spawning habitat

Discipline: Natural
Type of Project: Research
Funding Agency: USGS
Other Partners/Cooperators: University of Montana
Effective Dates: 5/1/2011 – 12/31/2012
Funding Amount: $17,978

Investigators and Agency Representative:
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Project Abstract: The purpose of this agreement is to investigate the influence of geomorphology, groundwater, and hyporheic flows on bull trout spawning habitat in the North Fork of the Flathead River Basin (NFFRB). Bull trout are a thermally-sensitive, threatened species, native to the Pacific Northwest, and they spawn in the fall in mountain-sourced, cold-water, gravel-bedded streams. Understanding the physical and hydrological parameters facilitating bull trout spawning habitat will contribute to informed assessments of vulnerability to climate change and other disturbances as well as habitat protection and rehabilitation. The NFFRB study area provides a unique and diverse set of physical and hydrologic conditions and life history patterns compared to systems elsewhere in bull trout's range in the Pacific Northwest, which will produce unique insight into the parameters influencing bull trout spawning habitat.

Bull trout spawning and occurrence are influenced by both local habitat features (e.g. channel width, gradient, hyporheic flows, and presence of woody debris) and watershed-scale factors (e.g. elevation, geomorphology, population connectivity, and groundwater flows) in controlling bull trout occurrence (e.g. Rich et al., 2003). Connectivity and diversity of complex habitats over large spatial scales are also important to bull trout populations (e.g. Muhlfeld and Marotz, 2005).

Groundwater can provide a source of thermal refugia for cold water fishes (e.g. Weaver and White, 1985; Nielsen et al., 1994; McCullough et al., 2009), but little is known about the direct role and significance of groundwater in bull trout spawning habitat. Studies of the Swan River Basin of northwestern Montana found that groundwater input is associated with the downstream extent of bounded alluvial valley segments (BAVS: alluvial valleys with upstream and downstream knickpoints), and that BAVS in turn influence bull trout spawning (Baxter and Hauer, 2000). In contrast, studies in the Bitterroot Mountains of western Montana found that bull trout redds were associated with unbounded alluvial valley segments (no downstream knickpoint) near the confluence of the spawning tributary with the mainstem river (Rich et al., 2003). Several studies have also found local-scale geomorphic complexity and hyporheic flow dynamics to be associated with bull trout spawning habitat viability (e.g. Rieman and McIntyre, 1993; Baxter and Hauer, 2000).

The objective of this research is to test findings of previous studies in the context of the NFFRB. Local and watershed-scale features and their interconnectedness will be evaluated and correlated with redd location data to identify the physical and hydrologic relationships and processes influencing bull trout spawning habitat in the NFFRB.

Outcomes with completions dates: This research is expected to continue from the present through 2012 in three steps. First, DEM terrain analyses, continued background research, and field methods refinement will continue until July, 2011. Second, field work will begin in July as stream flow decreases and will continue until early November, 2011 after the bull trout have finished spawning. Finally, from November, 2011 to May, 2012, data will be analyzed and interpreted. Deliverables will include a Master's thesis for Jared Bean, submission for publication to a peer-reviewed journal with all PIs as co-authors, and presentations at regional and/or national conferences.

Keywords: geomorphology, groundwater, hyporheic flows, bull trout, spawning habitat, North Fork of the Flathead River Basin, USGS, University of Montana