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Impacts of vegetation expansion and engineered instream wood structures in a montane gravel-bed river, Oregon, USA

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To restore salmon populations, the Middle Fork John Day River in northeastern Oregon has been reshaped by extensive restoration actions. One restoration goal is to improve pool habitat and fish cover at pools for juvenile salmon. Restoration led to an unintended experiment that allows comparison of the effects of passive and active restoration approaches. Passive restoration (removal of cattle grazing) since 2000 unexpectedly led to rapid expansion of *Carex nudata*, a native tussock sedge. *C. nudata* grows on the edges and middle of the active gravel-cobble bed, stabilizing the bed in places and focusing erosion in other places. *C. nudata* has resulted in island formation, bank erosion, and bed scour. Active restoration, in the form of log structures constructed since 2008, aims to maintain and deepen pools and provide cover for fish. In general the structures have maintained pools dug when they were constructed. Some pools have shallowed slightly, some have deepened slightly, and some have shifted laterally. *C. nudata* induces numerous small pocket pools with cover from overhanging sedge leaves. In contrast, log structures maintain larger and deeper pools, and provide cover both overwater and within the water column. Log structures provide cover for about 5-6% of the river area, while *C. nudata* provides cover for about 7-12%. The log structures are intended to grow from additional transported wood, but little growth has occurred to date because of low wood supply. There is no direct interaction between *C. nudata* and the log structures. *C. nudata* expansion is not inhibited by the structures, and it does not grow on the structures. The effects of *C. nudata* expansion are more sustainable than the log structures, which have an expected life span of 20-40 years. These results show that regrowth of native vegetation can play a significant role in restoration, and that response of native vegetation should be incorporated into restoration planning and design.