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Effects of forest plantation practices on runoff and downstream environment

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Sixty-five percent of Japanese land is covered by forests. More than 40% of the forest consists of Japanese cedar and cypress plantation. Because plantations typically concentrate in headwater watersheds which are an important reservoir basin to the densely populated region in downstream, water resources in Japan primarily depend on water supply from the headwaters covered by forest plantations. Despite the importance of forest management, the area of abandoned forest plantation has been increased because of declining domestic forest industry and market due to low timber prices, high labor cost, and shortage of forest operators. Due to the low light conditions, understory vegetation cover tends to be sparse in the dense, unmanaged plantations, particularly Japanese cypress forests. Under such forest, infiltration exceeds overland flow and resultant soil surface erosion occurs. Such overland flow and soil erosion affect runoff and water quality at the downstream counterparts. Therefore, unmanaged and devastated plantations hamper the functions of forest for regulating discharge and recharge of water resources. Increasing the frequency of drought and flashy flood due potentially to global climate change also threatens the stable water supply and flood management in watersheds.

Forest thinning is essential for maintaining forest stand conditions and hydrological processes in devastated plantation forests. Recent studies demonstrated that intensive 50-60% thinning can increase infiltration rate and reduce the opportunities of overland flow and soil surface erosion by recovering understory vegetation. Thinning generally reduces canopy interception and evapotranspiration. Thus, net precipitation reaching ground surface after thinning increases compared to the pre-thinning condition. Such increases in effective rainfall promote greater amount of groundwater recharge after the thinning. However, no quantitative assessment has been conducted for evaluating the effects of intensive thinning (removal of stems > 50%) on runoff and sediment discharge at a watershed scale. This project specifically aims to examine the influence of intensive thinning practice on the variation of low flow (drought period) discharge. I present some results obtained through this project.

Keywords: Water Cycle, Forest Plantation, Runoff