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Hydrological effects triggered by large-scale forest restoration in catchment scale, a case study in Daqing River Basin, North China

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Human activities have had a dramatic impact on the forest ecosystem, which has changed from initial overexploitation to the current regional restoration. Such kind of human interference with forest ecosystem aggravates the uncertainty on regional hydrology in the context of global climate change. Here we analyze the hydrology variation over 30 years in Daqing River Basin covered by the ecological restoration project, North China. We identified the influence of climate and human disturbance (ecological restoration project) on surface runoff and soil water. In addition, combined with the future plan of ecological restoration projects in the upper reaches and Xiong'an New Central Area construction in the lower reaches, regional hydrological effects and water demand gaps in the lower reaches under different restoration scenarios were analyzed. The results showed that since 1980's, the surface and soil water in Daqing River Basin had a sudden change in 1999, and the influence of human interference after the change was significantly higher than before, among which the influence of forest area and quality was the dominant contributors. The results of the scenario analysis show that under the existing regional ecological restoration projects and climate change trends, there will be about 1/6 water resource gap in the lower reaches of the basin by 2050, of which about 35% will be caused by ecological projects. Our research results show that changes in forest area and quality brought about by basin-level ecological restoration projects will significantly increase upstream evaporation and water conservation, thereby affecting the regional hydrological cycle and aggravating the conflict between supply and demand of water resources downstream.