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The influence of LAI on evapotranspiration and its response to soil moisture for larch plantation on a slope of the semiarid region of Northwest China

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Severe soil erosion and water shortage are key factors limiting the sustainable development of the dry northwest China. Mainly for controlling the soil erosion, a massive afforestation has been carried out there since several decades. However, a remarkable water yield reduction caused by afforestation was observed in scales from stand to watershed. This can threaten the safety of water supply in this region. Thus, it is very necessary to guide the forestry development and forest/vegetation management based on the understanding of the interaction between vegetation structure dynamics and the hydrological processes in ecosystems, from the viewpoint of maintaining certain water yield of forest land and the keeping the forest stability against drought stress. On a slope with semiarid climate in the Liupan Mountains of northwest China, a series of larch plantation plots were set up for doing ecohydrological study. The spatio-temporal variation of leaf area index (LAI) and other vegetation structure parameters of the larch plantation within the growing season and along the slope were monitored; meanwhile the water cycling processes (such as canopy interception, floor evapotranspiration, tree transpiration, runoff generation) and soil water storage were measured. The ecohydrological analysis of monitored data showed firstly that there was a big variation of LAI along slope position and with time in growing season, and the soil water storage is one main driving force for the LAI variation. On other hand, LAI played a key role for the magnitude of canopy interception and tree transpiration, which are the main components of ecosystem evapotranspiration, and further for the soil moisture dynamics and water yielding. LAI is a very important parameter of forest ecosystem to linking the so-called ecological processes and hydrological processes, and some quantitative relations between the LAI and the hydrological processes were developed. This may be helpful to promote the ecohydrological study in the dryland regions of northwest China.