Catchment experiments are normally limited by data scarcity at spatial and temporal scales. On the other hand, hillslope and catchment hydrological models can provide a valuable source of relevant outputs for decision makers. We developed a hillslope and catchment application of a widely tested and used, one-dimensional forest process-based model that quantifies water use and water use efficiency of forest plantations, native forest, and pasture. The model simulates vegetation growth and water-use efficiency at a monthly time step, and water-use, available soil water, drainage and runoff at a daily time step, for nominated spatial configuration of land use in the catchment, and it integrates these values for the entire catchment to predict streamflow. The model is being tested and validated in a 152 km² experimental catchment (and four sub-catchments) in northwest Tasmania, and in one 57 km² catchment (and two sub-catchments) in southwest Western Australia. Data inputs include precipitation, streamflow, soil moisture in transects to 3 m depth, and vegetation growth. The sub-catchments are being used as paired-catchments, and the model will be used to separate the treatment effect of vegetation from other sources of variation that affect flow. Historic stream flow at the large catchment scale prior to land use conversion to plantations allows pre-treatment calibration. The main data limitation appears to be variations in soils and rainfall across the catchment. This model is expected to be useful for simulating flows in paired catchments with substantial variations in non-treatment characteristics, i.e. rainfall, soils, vegetation, size and topography.