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**Abstract** In the 21st century, diminishing water resources have become a global concern. The Taihang Mountain area plays an important role in the sustainable development of the Bohai coastal area in Beijing, Tianjin and Hebei because of its special geographical location and features; but due to drought and deficiency of water, the Taihang Mountain area is faced with the dual problems of poverty and ecological vulnerability. It seems particularly important to develop and utilize the water resources in a sustainable manner as water is one of the key factors in promoting local economic development and improving the ecological environment. This paper investigates, from the perspective of water cycle and water transformation, the seepage recharge mechanism in slopes and river valleys, taking into account the hydrological features of the Taihang Mountain area and the hydro-geological features of slopes and river valleys in the area. Based on analysis of the formation process and characteristics of shallow groundwater resources, this paper puts forth the idea of "weak water consolidation" for sustainable development of water resources, and three groundwater development and utilization techniques in respect of seepage through rock-soil interfaces and weathered rock fissures in slopes and seepage in river valleys, offering a powerful support to the economic development and environmental improvement in the Taihang Mountain area.

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## Research on Shallow Groundwater Recharge and Control in Taihang Mountain Area of North China

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**Keywords:** Shallow Groundwater; Seepage recharge; Weak water consolidation; Utilization and control techniques; Taihang Mountain area of North China

**Abstract.** In the 21st century, diminishing water resources have become a global concern. The Taihang Mountain area plays an important role in the sustainable development of the Bohai coastal area in Beijing, Tianjin and Hebei because of its special geographical location and features; but due to drought and deficiency of water, the Taihang Mountain area is faced with the dual problems of poverty and ecological vulnerability. It seems particularly important to develop and utilize the water resources in a sustainable manner as water is one of the key factors in promoting local economic development and improving the ecological environment. This paper investigates, from the perspective of water cycle and water transformation, the seepage recharge mechanism in slopes and river valleys, taking into account the hydrological features of the Taihang Mountain area and the hydro-geological features of slopes and river valleys in the area. Based on analysis of the formation process and characteristics of shallow groundwater resources, this paper puts forth the idea of "weak water consolidation" for sustainable development of water resources, and three groundwater development and utilization techniques in respect of seepage through rock-soil interfaces and weathered rock fissures in slopes and seepage in river valleys, offering a powerful support to the economic development and environmental improvement in the Taihang Mountain area.

### Geographical and Hydrological Features of Taihang Mountain Area

**Geography** The Taihang Mountain area stretches in the north-south direction in the west of Beijing and Tianjin municipalities and the North China Plain. It forms the division between the eastern and western moisture gradient areas and the southern and northern thermal gradient areas in China, and the transitional area between the North China Plain and the Loess Plateau and the eastern and western economic areas. It is an important ecological shelter and water source for Beijing, Tianjin and Hebei.

**Rainfall and Runoff** Influenced by monsoons and atmospheric circulations, the Taihang Mountain area has an average yearly rainfall of 500-600mm, with distinct seasonal features. More than 70% of the rainfalls take place from June to September, mostly in the form of heavy rain. It features clear difference in rainfalls in different years and continuous rainfalls and droughts. The soil in the area is thin and lean. It has low vegetation coverage and poor rainwater storage capacity. "There is flooding when it rains but there is drought when it doesn't rain". Since the 1950s, a large number of controllable reservoirs have been built in the Taihang Mountain area. These reservoirs control 85% of the mountain area and 70% of the incoming water into the area, bringing remarkable benefits to the agricultural and industrial development in the plain area and to water supply in cities [1]. Nevertheless, the situation of "there is flooding when it rains but there is drought when it doesn't rain" has not been basically solved.