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Hydrological Significance of Mountains

No one will argue that mountains, natural "water towers," are of the highest hydrological importance as sources of fresh water. On the one hand, mountains accelerate the water cycle, intercepting air circulation and contribute to air condensation into clouds. On the other hand, the highlands serve as a natural storage of water, are characterized by more frequent precipitations, and lessen water losses. Based on these aspects, the hydrological significance of mountains is obvious because of the heightened amount of fresh water that accumulates in mountainous areas, and the drier the climate becomes, the more the value of mountains increases.

To begin with, mountain rivers, groundwater, and fresh meltwaters are the key constituents of the world's freshwater stocks, and all these are highly centered in mountainous regions. It is estimated that 32% of the global release of fresh water is from mountains, which makes the runoff twice as important in the lowlands (López, and Justribó 233). Logically, the role of mountains increases regionally, since their discharge can appear as a single freshwater source that replenishes surrounding watersheds. Nevertheless, the discourse on mountains as a source of fresh water should mainly focus on the storage and regulatory effects of the highlands. Precisely, regardless that mountains feature an insignificant proportion of world river basins, the headwaters of all major rivers are located here, starting from the Rio Grande to the Nile (Macchi

1). From the latter perspective, these are the mountainous areas that guarantee water supply to downstream regions and, as a result, form the world's freshwater stocks.

At the same time, mountain rivers and groundwater are not merely stored in mountainous regions, but are continuously being refilled and filtrated. The regulatory function of mountains lies in their contribution to the hydrological cycle, as the quantity of precipitation is significantly higher in the highlands due to the effects of orography and elevation, which are experienced in more upper-altitude regions (López, and Justribó 224). In turn, the water received from rainfalls is then stored in solid forms of snow and ice, and undergoes decreased losses due to the processes of evapotranspiration (because of colder temperatures in the mountains) and infiltration (owing to poor soils and steep slopes) (López, and Justribó 224). Lastly, all this fresh water is then released to lowland areas as melt-off with the advent of warmer weather. To exemplify the importance of mountains as sources of fresh water, one should take into account the case study of the High Atlas Mountains in Morocco. According to Brahim et al., the High Atlas can be viewed as the core freshwater recharge area for the adjacent plains primarily because of its snowmelt that constitutes 25% of the total streamflow in the area (Brahim et al. 4788). In spite of the fact that snow rarely covers mountains, and that the level of precipitation varies here, fresh meltwaters from the northern slopes of the High Atlas Mountains significantly enriches the runoff of the whole downstream regions.

To add more concerning the value of a mountain watershed, it is necessary to notice that the level of significance of mountains as sources of fresh water differs depending on climate zones. The core of this difference lies in the humidity of a particular climate zone, as the drier the climate is, the higher the necessity of mountain freshwater runoff. Based on the latter, semi-arid and arid areas are of the highest dependence on mountains, as approximately 70-90% of its fresh

water comes from mountains (N'da et al. 755). For the most part, the latter concerns the areas contiguous to the Mediterranean basin. The maximum value of mountains in dry climate zones also explains why highlands there are mostly referred as "wet islands." Logically, the expanded practice in these regions is upstream water storage in dammed reservoirs; these store melt-off and streamflow for further use in agriculture purposes (N'da et al. 755). To compare arid and semi-arid regions, humid temperate zones are less dependent on mountains, yet they still provide about 30% to 60% of the stock of fresh water (López, and Justribó 223). The most explicit example is the Rhine basin, which is significantly replenished by the Alps' annual flows (nearly 50% of fresh meltwaters in summer and approximately 30% in other seasons), regardless of its location in a temperate climate zone. Following the latter logic, the level of a mountain's significance as a source of fresh water is likely to be the least in tropical climate zones, including the Amazon and Oricono regions. Because of elevated humidity in these particular zones, regular rainfalls provide the necessary amount of fresh water in the area.

To summarize, mountains are indeed of paramount importance as sources of fresh water. Frequently called "water towers," highlands contribute to water resources on Earth, enhancing the hydrological cycle, storing water in the most natural ways, regulating, and filtering current freshwater stock. Importantly, the level of significance of mountains as a source of fresh water is different based on climatic conditions. While tropical and temperate climate zones are moderately dependent on mountains, arid and semi-arid regions rely on them more.

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