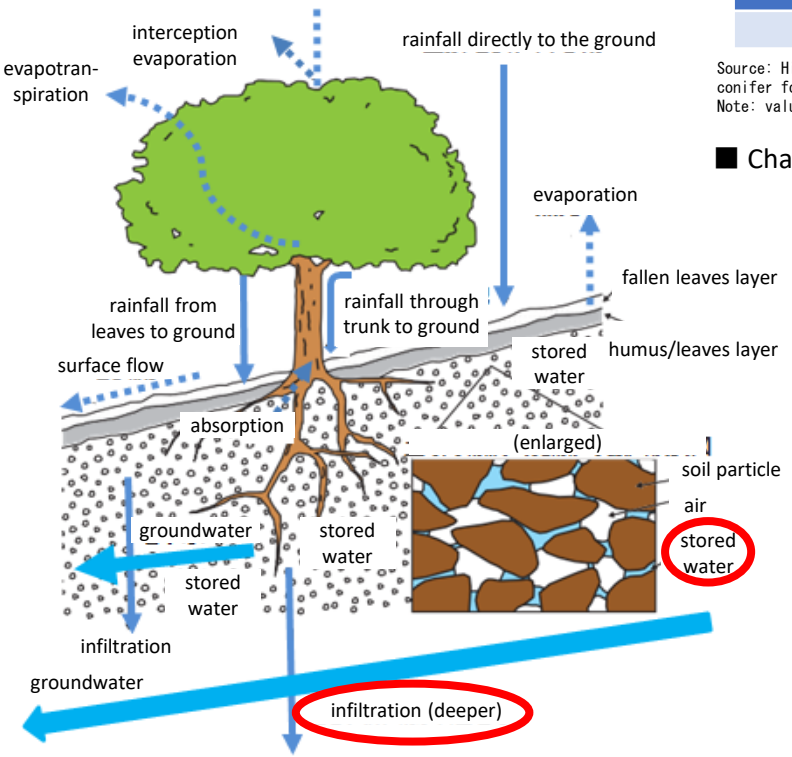
Flood mitigation and water resource conservation functions of forests

○ The soil in forests has a well-developed granular structure based on abundant fallen leaves, branches, and decomposed humus, and it has high infiltration and water-holding capacity. In addition, soil swelling and softness are enhanced by penetration and perforation of the root system. As a result, even though some of the rainwater may return to the atmosphere through canopy interception and evapotranspiration, rainwater that reaches the forest floor can infiltrate into the soil and deeper bedrock cracks, where it can be stored for a long period of time.

○ This reduces the surface flows during heavy rainfall, peak flows and mitigates flooding, and allows the reserved water to gradually flow downstream as groundwater or river water for effective use. (As an example of contrast, in grasslands, the infiltration capacity of the soil is relatively low, and precipitation that exceeds the water holding capacity is discharged as surface runoff, making it impossible to use as a water resource and increasing the risk of flooding).

■ Water resource conservation function of forests (water infiltration in forests)



Source: Japan forestry development and extension association "Seminar on forests No.1: Forests that nurture water, water that nurtures forests"

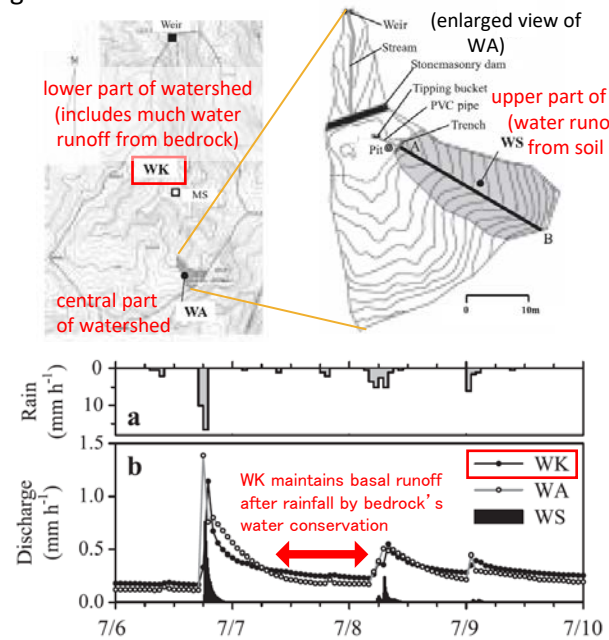
■ Infiltration capacity by land condition

(mm/hr)

forestland	After-logging site	grassland	bareland
258	158	128	79

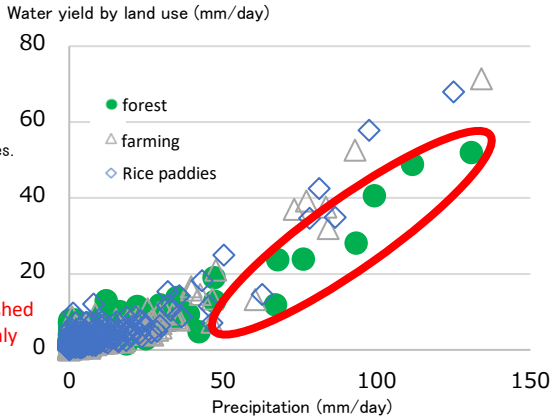
Source: Hiroshi Murai "Comparison of hydrological characteristics of broadleaf forest land, conifer forest land, and grassland"
Note: values where rainfall continues for a certain period and infiltration capacity stabilizes.

■ Change of runoff volume over time in the same watershed



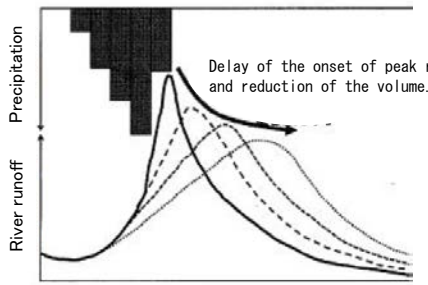
Source: Kenichiro Kosugi, "Evaluation of the role of soil layer and permeable base rock in the water source recharge function of forests.

■ Comparison of water runoff to rainfall



Source: Forestry Agency "Survey on Ariake Sea and other enclosed sea areas and forests "commissioned project report

■ Decrease in peak runoff with development of forest soil



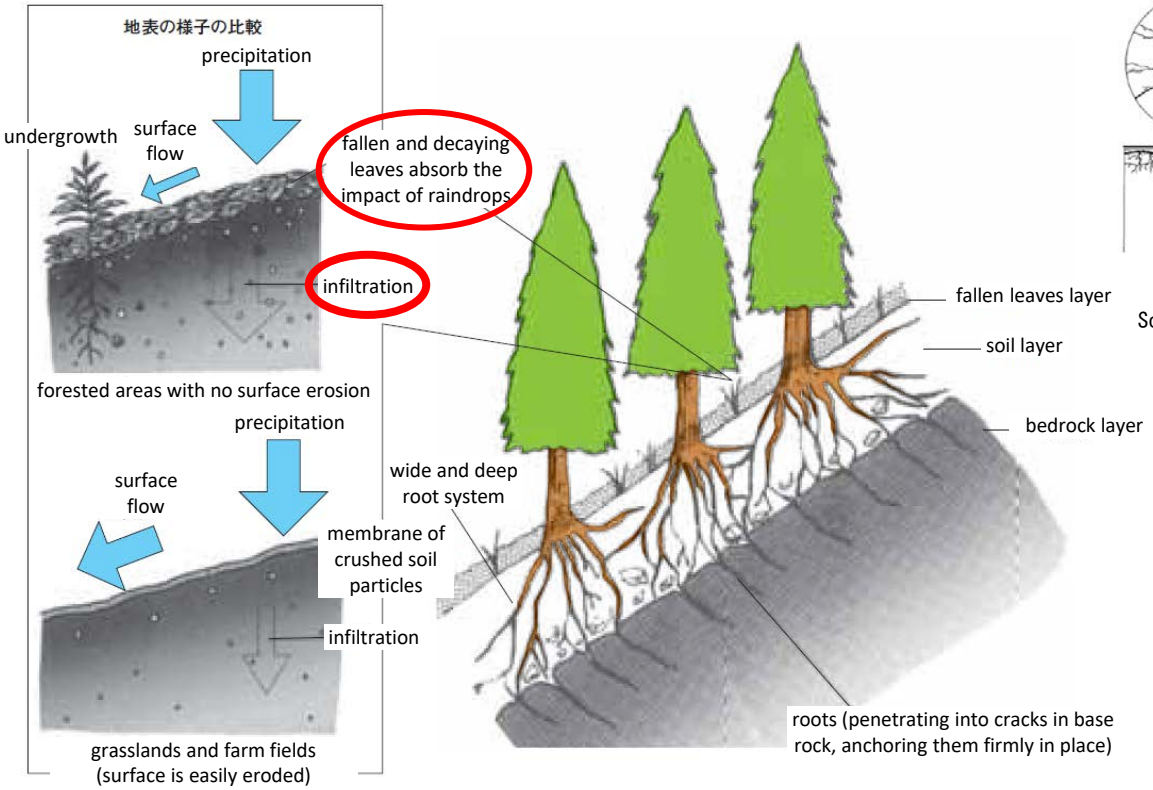
Source: Koji Tamai "The 'flood disaster mitigation function' of forests."

Surface erosion prevention and sediment runoff control functions of forests

○ In forests, the canopy catches rainfall and forms a tree-trunk flow, while the understory vegetation and fallen leaves absorb the impact of precipitation on the soil, thereby facilitating rainwater infiltration into the soil and preventing surface erosion.

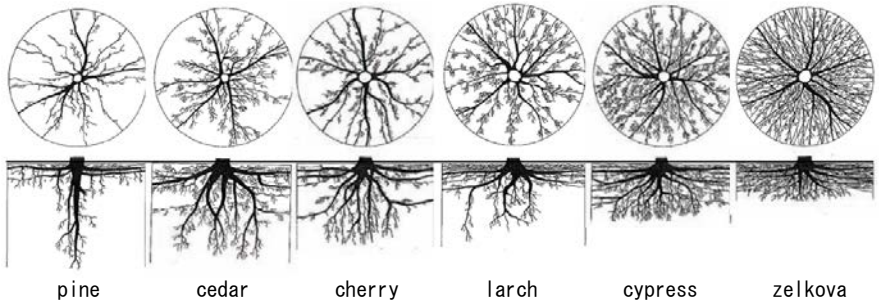
○ In addition, the root systems of trees are thick to support the massive above-ground portion of the tree, reaching at least 1 meter and as deep as 4 meters. The tree's thin roots extend over a wide area on the upper ground as well, and the piling effect of longitudinal extension and horizontal soil-binding forces provide a high level of protection against soil runoff and collapse. (In contrast, grasses have a root system of about 0.5 m, which is less effective in binding than that of trees, and thus has a lower anti-collapse function.)

■ Mountain disaster prevention and soil conservation function of forests



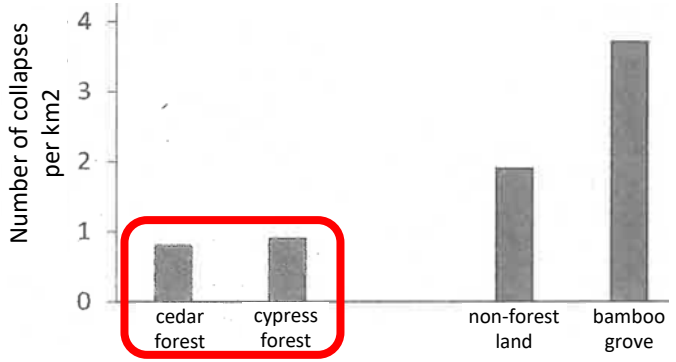
Source: Japan forestry development and extension association "Seminar on forests No.2: Life and forests"

■ Root system of trees



Source: Kari Sumi "Illustration of tree root systems.

■ Comparison of the number of collapses in the Northern Kyushu heavy rainfall in July 2017



Source: Koji Tamai "Considering the disaster prevention and mitigation functions of forests, based on disasters that have occurred in recent years"