

Investigating the effect of forest stand age on slope stability in terms of root reinforcement in the Ikawa Artificial Forest, central Japan

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The slope stability is an important issue to be concerned about preventing landslides. Roots have been widely recognized that it contributes to improve slope stability through its mechanical effect. The relationship between the development of the root network and soil strength in terms of the slope stability was also widely understood. The root tensile strength increases the shear strength of soil to prevent slope failure. However, roots are a part of vegetation growing gradually during its life. As a result, the shear strength of soil, which is reinforced by the root network, may also increase gradually with time. Previous studies have tried to evaluate the contribution of vegetation on the slope stability by interpreting the spatial distribution of underground roots and physical tests of the individual root. However, such studies cannot evaluate contribution of vegetation on the slope stability in hillslope-scale, because of difficulty in interpretation of root network in wide areas. Therefore, this study investigates the effects of root reinforcement at different life stages of forest stand scale on slope stability in Ikawa Artificial Forest, central Japan. GIS analysis and a distributed landslide model was applied to evaluate the root reinforcement. In this study, the effect of root reinforcements was quantified as an increase in apparent cohesion, which is total of root and soil cohesions). For that purpose, cohesion at different life stages of forests was estimated by back calculation based on landslide occurrences in Ikawa period 1975 –2003. The results show that quantification of mechanical effect of forest stand age was significantly influenced by temporal changes of root reinforcement. Temporal changes in cohesion of forest age stands also affect temporal changes on slope stability. Root reinforcement is still low when forest stand age less than 10 years old. As consequence, many landslides occur in this forest stand stage. While, root reinforcement affects significantly to prevent landslide when forest stand age more than 10 years old.

Keywords: Cohesion, Slope stability, Distributed landslide model