Tree Root Architectural Patterns and Geotechnical Roles in Levees
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Tree root system architecture is an important factor in levee stability and intactness through direct and indirect influences on slope geomorphological processes. The purpose of this study was to determine key parameters of levee tree root system architecture, using a hierarchical tomographic approach.

We acquired in situ 3D tree root data by ground-based tripod LiDAR scanning after pneumatic excavation. Valley oak (Quercus lobata) and Fremont cottonwood (Populus fremontii), the two predominant native riparian species in the Central Valley of California, 20 trees in total, were excavated at three levee sites. At the single root scale, we retrieved essential root architectural characteristics. Root biomass and vector models were built as a basis for acquisition of critical parameters. We first analyzed root biomass spatial distribution and root directionality.

By using a linear regression model (LRM), we found tree root biomass decreased exponentially from the tree trunk to the furthest root extent. Moreover, root biomass distribution was significantly different between levee (upslope) and river (downslope) directions.

At the levee slope scale, root system spatial patterns were determined by vector analysis as symmetry or asymmetry of root systems in relation to the levee geometry. The linear mixed effect model (LME) was applied to estimate the general belowground biomass distribution, corresponding to the result of the single tree scale.

The application of these analyses to topographic features of levees, and related geotechnical questions will be discussed by Shih-Ming Chung, PhD candidate and Dr. Alison Berry.

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Shih-Ming Chung is pursuing his PhD in the Ecosystems and Landscape Ecology program at the University of California, Davis. He obtained his M.S. in Landscape Ecology at University of Amsterdam, in the Netherlands in 2007 and his B.S. in Civil Engineering at the National Taiwan University in Taiwan in 1999.

Mr. Chung has participated in several conferences and workshop related to levee safety, landscape evolution, ecological engineering and remote sensing; he has published several articles in peer-review journals, conferences, and workshops.

His recent research involved working with Dr. Alison Berry depicts the growth patterns of tree root growing on or near levees. Mr. Chung developed quantitative methods to illustrate biomass pattern and spatial configuration that will be incorporated into geotechnical models of levee slope erosion, stability, piping, and levee seepage. Critical to levee and bank stability and failure mechanisms, Mr. Chung is developing a parametric approach to study tree root biomass distribution and directionality.