Evaluating the effect of plant root architecture on soil reinforcement and slope stability is an important issue for the improved mitigation of shallow landslides. Nevertheless, few studies have examined tree root architecture on steep slopes where root systems tend to be asymmetric. Using a modelling approach based on the finite element method, we aimed at examining how tree root system asymmetry affects soil strength and slope stability. We designed a three-dimensional slope using ABAQUS© software. Based on ground truth data, root system architecture for silver fir (*Abies alba* Mill.) and Norway spruce (*Picea abies* (L.) Karst), two of the most common species in European mountain forests, was generated using DigR and Xplo software (http://amapstudio.cirad.fr/) and was then embedded in the soil of mid-slope. Three root system asymmetry types were examined: a constant total biomass: skewness to upslope, axisymmetric, and skewness to downslope. The likelihood of failure of the slope, as well as stresses and strains within the soil medium and roots, were then computed and visualized. Root system asymmetry had a significant effect on the efficiency of the slope stabilization. Within a root system, roots skewed upslope and downslope differed in their mechanical response and strategy of reinforcement.

Drought effects on forest health and growth in the western part of the Eurasian steppe region. Popa, I., Neagu, S., Leca, S., Nechita, C., Badea, O. (*Forest Research and management Institute, Romania; popaicas@gmail.com; stefanneagu@yahoo.com; leca_d_stefan@yahoo.com; nechitadendro@gmail.com; badea63@yahoo.com*).

Regional warming and consequent higher water deficits along with air pollution are most likely the main driving forces behind forest health and growth dynamics. They are more important in the case of forest ecosystems existing under marginal or restricted ecological conditions such in the western part of the Eurasian steppe (east and south of Romania). Information on recent climate change dynamics in this region confirm higher temperatures by 0.7–0.8 °C and less precipitation by 20–80 mm during the period from1981–2010 when compared with 1961–1990 reference period. During the last decade (2001–2010), the precipitation amount was even higher compared with the same reference period by 37–60 mm. The direct consequences upon forest health are represented by the high number of damaged trees (crown defoliation above 25%) during 1992–2001 period, consistently above 50%, and in several extreme years above 75% (1992, 1994, 1995, 1998, and 2000). Since the year 2006, forest health recovered gradually, fluctuating within a more or less stable interval of 31–35%. The relation between the forest growth and crown defoliation parameter along with climate allow formulating predictions on potential changes of forest ecosystems. In this region, it has been found that forest ecosystems reduced their growth by 13–22% as a consequence of the recent climate fluctuations.

Simulating forest dynamics and vulnerability of cork oak woodland production systems: a new index for vulnerability assessment and control. Ribeiro, N.C.A. (*University of Evora, Portugal; nribeiro@uevora.pt*).

The cork oak (*Quercus suber* L.) woodland production system value is closely related with sustained production from its components. Considering this fact, cork oak woodlands are vulnerable with respect to soil loss, crown cover reduction, and lack of regeneration. Ruptures in the balance between the agro-silvo-pasture components can result in high tree mortality risk by lack of fire protection or increased grazing intensity. The vulnerability control of these forest structures is closely related with the continuous crown cover management and soil protection, therefore the success of natural or artificial regeneration is the driver for system resilience and elasticity. In our present work, a new computer-assisted vulnerability assessment system is used to evaluate risk, define critical thresholds with respect to stand stability, and establish consistency in providing goods and services, and hence, the economic viability of these managed systems. For that purpose, a new index for vulnerability as a function of erosion risk index, soil limitations class, stand structure index, and crown cover stability index is presented. These new developments in the cork oak tree spatial growth simulator CORKFITS are used to simulate system response to a set of natural regeneration timing and intensity combinations in order to find the solution for vulnerability control for cork oak stand areas in the case study region.

Impacts of natural forest landslides in a rural community of Morretes, pr-Brazil. Rosot, N., Correa, C.C. (*Federal University Of Paraná, Brazil; ncrosot@ufpr.br; cmcamargocorrea@gmail.com*), Rosot, M. (*EMBRAPA, Brazil; augusta_rosot@hotmail.com*).

Landslides in steep forest hills are relatively common in the mountainous regions of Brazil, especially in the months of greatest rainfall. However, in 2011 a landslide caused major flooding and silting in a rural community located in Morretes, State of Paraná, southern Brazil. Rainfall of 400 mm in only 3 days was responsible for the displacement of blocks of large rocks and soil over a rural area of 125 ha, destroying more than 50 homes, rural roads, and a concrete bridge on a nearby highway. Large trees typical of humid tropical forests were dragged to the lower parts of the valley, causing the damming of rivers and flooding. Families were removed to nearby locations, but now, 2 years after the tragedy, they are returning to areas considered at risk. To enable the resumption of productive activities, and at the same time reduce risk and minimize the effects of landslides, government agencies and educational and research institutions developed a program to rehabilitate the affected areas. Actions being carried out include mapping, monitoring, and containment of the slopes, as well as providing support to the local community.

Rehabilitation process of natural mixed forest after wind disturbance by typhoon in Hokkaido, Japan in northern, Hokkaido. Takahashi, M., Kuramoto, S., Ishibashi, S., Iida, S., Furuya, N. (*Forestry and Forest Products Research Institute, Japan; martaka@ffpri.affrc.go.jp; shkura@ffpri.affrc.go.jp; sa9267@ffpri.affrc.go.jp; iida34@ffpri.affrc.go.jp; nfuruya@ffpri.affrc.go.jp*).

The objective of this study was to investigate structural history and the rehabilitation process of the natural mixed forest in Hokkaido, Japan that successfully recovered after wind disturbance by typhoon in 1954 and salvage logging. Multitemporal aerial photo interpretation was used for three dimensional analyses of structural transformation of the target area. Ground plot surveys and tree ring analyses were also conducted. As a result, we investigated that rapid recovery was caused by (1) favorable growth of small to middle sized trees that was consistent even after wind disturbance and salvage logging, (2) rapid growth of juvenile and small size trees that survived from wind disturbance, and (3) regeneration of light-tolerant species. The recovery patterns were affected by the degree of damage by wind disturbance. Significantly damaged areas were mainly recovered by light-tolerant species. On the other hand, lightly damaged areas were mainly recovered by small to middle sized survived trees. Different recovery patterns caused the different species mixture based on the patches and the degree of damage. Multitemporal aerial photo interpretation can provide structural transformation of natural mixed forest, and it is useful for natural forest management.