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Human and climate influence on slope stability in the Northern Apennines during the Mid-Late Holocene.

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The Eneolithic and the Early Bronze Age have been characterized by a generalized slope instability, testified in Europe by frequent slope movements and colluvial deposits, due to the progressive forest clearing and treeline lowering. The causes can be identified both in the impact of increasing human activities and in the effect of the climatic deterioration after the Holocene Optimum. The increase of human activity impact, the reduction of forest cover and the acceleration of the sedimentation rate since the Early Bronze Age were outlined by recent studies in the Po plain. Also for the Northern Apennines a phase of slope instability is known, as revealed by many paleosols and paleosurfaces buried by colluvial deposits; however, the presence of mesolithic archaeological evidences in the buried soils suggested to collocate the lowering of the treeline and the slope instability in the Apennines in an earlier period.

The aim of this study is the reconstruction of the paleoenvironment and of the slope instability phases in the Northern Apennines since the Holocene Optimum through the analysis of soil data coming from field observation, soil micromorphology, GIS processing, dendrochronological and anthracological analyses. The study area is located on the northern slope of Mt Cusna (2120 m a.s.l.), above 1700 m. The present vegetation is characterized by a deciduous forest dominated by Fagus sylvatica, up to 1700 m (potential treeline: about 1730 m). The areas above the treeline host herbaceous vegetation and Vaccinium-dominated heathland. The area was settled during the Boreal and Atlantic by mesolithic hunters; occasional frequentation in the Subboreal, Iron Age and Roman Age has been recorded.

In the area Entisols, Spodosols and Inceptisols can be observed. Paleosols, relict and buried by colluvial deposits, also occur, with frequent sedimentological and pedological discontinuity and stone lines (Mt. Cusna paleosurface); recent soils are developing on these colluvial deposits. A previous dating of the charcoal fragments found in the buried soils led to collocate the forest clearing in the Boreal, during the first anthropic frequentation phase.

Our study outlined the past occurrence of the treeline up to 2000 m a.s.l. The AMS dating to 3920-3700 y cal BP of a Laburnum charcoal fragment found in the buried soil allowed to assign the fire event to the Subboreal. The treeline lowering and the end of the slope stability period would thus have occurred during the second anthropic frequentation phase in the Early Bronze Age, and not during the Mesolithic as previously supposed.

A subsequent period of slope instability occurred in successive phases throughout the Late Holocene up to the Modern Age. Dendrochronological analysis on tilted and half buried old-growth trees allowed to date in historical times (mid 18th century AD) some of the colluvial layers, according with other studies that suggest a phase of instability which continued until recent times.