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Discriminating impacts of geomorphological and human factors on vineyard soil erosion (Burgundy, France)

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The Burgundy vineyards have been recognized for the high diversity of Terroirs, controlled by complex interactions between natural features, historical parameters and soil management practices. Vineyards are known to undergo substantial soil loss in comparison with other types of agricultural land. Hydric erosion on vineyards is controlled by complex interactions of natural and anthropogenic factors leading to intra-plot spatial heterogeneities of topsoil at a scale of a metre. Studying the relationship between soils and their degradation is crucial in this situation where soil sustainability is threatened. This study explores the relative influences of historical and present-day anthropogenic factors and geomorphological processes controlling soil erosion on vineyard hillslopes. The selected area was located in the Monthelie vineyard (Côte de Beaune, France) where intensive erosion occurred during high-intensity rainfall events. Soil erosion quantification was performed at a square-metre scale using dendrogeomorphology. This method is based on the measurement of the unearthing of the stock located on the vine plants, considered as a passive marker of soil-surface vertical displacement since the year of plantation. The obtained maps, together with various complementary datasets, such as geological and geomorphological data, but also historical documents (cadastral plans, cadastral matrices and old aerial photographs) allow landscape evolution to be assessed. The combination of all these data shows that spatial distribution and intensity of erosion are controlled mainly by lithology and slope value. However, our study highlights that the sediment dynamics in this vineyard plot is highly related to historical former plot limits and present-day management practices. Nonetheless, quantification of sediment dynamic for the last decade reveals that the impacts of historical structures are disappearing gradually, in response to present-day management practices and geomorphological factors. Finally, this study shows that it is crucial to take into account the pre-plantation history of vineyard plots in order to increase our understanding of sediment dynamics on vineyard hillslopes.