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History of vegetation, lake fluctuations and climate since the last interglacial recorded in the sediments from Stoneman Lake, Arizona, USA

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Long and continuous lake sedimentary records offer enormous potential for interpreting the paleoenvironmental histories of the past. An increasing number of studies of this type are revolutionizing our understanding of terrestrial climate and the environmental changes that have occurred during recent glacial - interglacial cycles. However, the sedimentary records that contain multiple glacial-interglacial cycles are very scarce in continental basins. A ∼73m sediment core was recently obtained from Stoneman Lake, Arizona, containing a unique record of the last ∼1.5 Ma. Here we show a detailed pollen study of the topmost ∼10m of the record, covering the last climatic cycle since the last interglacial period (MIS 5-1; last ∼125,000 years), with the goal of broadening our knowledge of the paleoenvironmental history of the arid North American Southwest in the past and to understand how terrestrial environments might adapt in the context of current global warming. This study shows that warmest conditions during the period of study were reached during the last interglacial (MIS5e), deduced by the abundance of pollen types from plants that today exist at lower elevations. These include Pinus edulis and other associated low elevation thermophilous plants such as Juniperus, Ambrosia, Amaranthaceae, Asteraceae and Artemisia. A climatic cooling subsequently occurred; coldest conditions were reached within the Last Glacial Maximum and higher-elevation colder indicators such as Picea and Abies, associated with pelagic algae such as Pediastrum, increased in the studied record. Warming during the deglaciation is evidenced in this record by a shift of vegetation towards higher altitudes and the substitution of the subalpine species for a montane forest with Pinus ponderosa and Quercus as the main constituents, which remained abundant throughout the Holocene. This study shows that orbital-scale climate changes (mostly precession and eccentricity changes) forced vegetation and lake-level oscillations, documenting that insolation had a main role in controlling environmental change in this area.