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A Novel Framework for the Assessment of Heat-Wave Risks and Nature-Based Solutions (NBS) Impacts

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Current climate change projections show that the probability of occurrence and the magnitude of heat-wave events are increasing worldwide. These events have to be considered as higher risks for territories and ecosystems, especially where vulnerability is high. The occurrence of heat waves translates into several potential damages such as an increase in fatalities and production losses, degradation of natural and cultural heritages, or the triggering of other hazards such as wildfires. The overlap of all these consequences may lead to both relevant economic losses and additional CO₂ emissions affecting our resilience and exacerbating in turn climate change.

In this context, we propose a novel framework for the assessment of risks resulting from heat waves with the aim of quantifying the main contributions to economic losses and CO₂ emissions. This framework follows the conceptual definition of risk provided by the Intergovernmental Panel on Climate Change (IPCC) as the product of hazard, exposure, and vulnerability components. The newly-proposed formulation of these components includes the concept of Nature-Based Solutions (NBS) as strategies carried out to enhance our adaptive capacity in a sustainable and cost-effective way. Since NBS consist of natural features that are also exposed to heat waves, the entire life cycle of NBS is considered (i.e., the implementation, maintenance, and possible restorations). The proposed framework stands as a tool for assessing the local impacts of already-implemented or designed NBS in the current and future climate scenarios.