Predicting the effects of climate change on *Elatine gussonei*, an endemic species

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The Maltese Waterwort (*Elatine gussonei*) is an amphibious species endemic to the Maltese Islands and Lampedusa. It colonises temporary freshwater rockpools that alternate two stable ecological states: a dry period between April to September, and a wet season between October to March.

Since this plant has an annual life cycle, representation during one year depends on reproductive success during the previous year. Attainment of reproductive success is dependent on the duration of the longest hydroperiod, giving the plant sufficient time to complete its life cycle.

The hydrological cycles of the pools were modelled using nine geological parameters and twelve meteorological variables. These were used to construct predictive equations for the 'longest hydroperiod duration', 'hydroperiod index', and 'number of hydroperiods' given a specific geomorphological context. The annual rainfall was expressed as eight separate variables, as the total annual rainfall is a meaningless predictor in the context of these pools. The variables with greatest predictive power were water volume and maximum water depth of a pool, and the amount of rainfall in January-February and number of heavy showers during a single wet season.

The hydrological predictions were subsequently used as inputs for a population model of *Elatine gussonei* (including seed bank dynamics), the parameters of which were obtained from experimentation and field observation. Both predictive models were based on data collected over seven years, and validated during an eighth year.

The combined models were used to predict the mean time to extinction (T_e) of this species under various climatic scenarios. Apart from being tested and validated using current meteorological conditions, the models were used to predict the T_e under three scenarios ('Pessimistic', 'Optimistic', 'Most Optimistic') based on IPCC predictions applicable to the central Mediterranean. Results suggested that a succession of 11 'Pessimistic' years (relatively drier conditions) would reduce hydroperiod durations sufficiently to compromise successful reproduction and sustainable interannual population maintenance.