The string swampland constraints require multi-field inflation

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An important unsolved problem that affects practically all attempts to connect string theory to cosmology and phenomenology is how to distinguish effective field theories belonging to the string landscape from those that are not consistent with a quantum theory of gravity at high energies (the "string swampland"). It was recently proposed that potentials of the string landscape must satisfy at least two conditions, the "swampland criteria", that severely restrict the types of cosmological dynamics they can sustain. The first criterion states that the (multi-field) effective field theory description is only valid over a field displacement ? ? ? ? (1) (in units where the Planck mass is 1), measured as a distance in the target space geometry. A second, more recent, criterion asserts that, whenever the potential V is positive, its slope must be bounded from below, and suggests |? V|/V c ? (1). A recent analysis concluded that these two conditio