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Islands of Fertility Revisited: Desertification in the US Southwest

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The concept of Islands of Fertility (IoF) has played a central rôle in the understanding of desertification, especially in the US Southwest since the landmark Science paper of Schlesinger et al. in 1990. While studies that focus on the plant-interspace scale tend to provide information which supports the straightforward concept of IoF, studies at larger spatial and temporal scales suggest that processes are more complicated.

An increasing number of studies suggest that the accumulation of resources under shrubs as IoF is not unidirectional. This "leakiness" of IoF acts during events of a whole range of sizes, and in some cases behaviour has been reported that is the opposite of that generally considered to promote desertification, such as the initiation of nutrient-laden runoff beneath shrubs. Accentuated leakiness could occur as a result of changes of dominant process or as a result of extreme events, which thereby produce a significant reorganization of resources through the landscape. Over longer timescales, as individual plants die or die back in periods of drought, resources will also subsequently be released. Leakiness in this respect may also explain the reversibility of shrubland invasions, which has been documented in the Holocene, but is difficult to explain using the original IoF approach.

Scale is also important in terms of the spatial organization of processes and patterns in the landscape. Once ephemeral channels of all sizes start to develop, discontinuous flows can lead to the formation of larger vegetated patches – and thus IoF of differing dimensions. In endorheic areas, sinks can form in hollows and playas at even larger scales. These scale differences may be one reason why nutrient fluxes observed at the plant-interspace scale are fundamentally different from those observed at landscape scales.

We argue therefore that the IoF concept needs to be refined, and put into an explicit scale-related framework in order to explain the range of observed patterns of desertification in the US Southwest. The balance and connectivity of different driving processes within and between IoF is central to this refinement.