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Ecosystem feedbacks arising from wind and water transport in drylands: Results from field experiments and modeling

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The importance of abiotic transport due to the action of wind and water has been increasingly understood as a crucial aspect of ecosystem evolution in drylands impacting vegetation structure, topographic characteristics, and soil properties. Several lines of evidence from field experiments and modeling exercises indicate how transport results in important ecosystem feedbacks that lead to ecosystem stability thresholds and multiple stable states. Here, we outline the results of several field and modeling experiments that show the critical interactions that occur amongst wind and water transport and biological processes. Measurements of transport, fallout radionuclide tracing, deposition, and vegetation growth in several experiments shows clearly that manipulation of abiotic transport can result in significant alteration of a variety of ecosystem factors. Both simplistic and sophisticated modeling approaches indicate that transport can produce multiple stable states in dryland ecosystems, and thus can participate in large-scale ecosystem reorganization. These results also indicate that manipulation of transport might provide the opportunity to step ecosystems back from critical thresholds and begin the process of recovery from unwanted ecosystem states.