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Woody plant encroachment in southwestern US: Drivers, feedbacks, and conceptual models

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Many grass-dominated ecosystems in dryland regions have experienced increasing woody plant density and abundance during the past century. An example is the Chihuahuan Desert in the southwestern US, which experienced different stages of shrub encroachment in the past 150 years. We synthesize recent developments in the roles and feedbacks of abiotic and biotic drivers of shrub encroachment in the Chihuahuan Desert using an ecosystem dynamics context through intercomparison of Long Term Ecological Research (LTER) sites. Experimental and modeling studies support a conceptual framework which underscores the roles of erosion and fire in woody plant encroachment. Collectively, research at the Jornada LTER provided complementary, quantitative support to the well-known fertile-islands framework. Studies at the Sevilleta LTER expanded the framework, adding fire as a major disturbance to woody plants. Conceptual models derived from the synthesis may guide management interventions aimed at reducing or mitigating undesirable ecosystem state change elsewhere in the world.