Title: Soil nitrogen dynamics in stands of *Populus deltoides* ssp. *wislizenii* and *Tamarix chinensis* with differing flood regimes.

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Abstract: The biotic structure and function of semi-arid riparian forests around the world are strongly organized by flood pulses. Flow management has reduced the exchange of water, energy, and materials from rivers and floodplains, caused declines in native plant populations, and advanced the spread of non-native plants. Naturalized flow regimes are regarded as a means to restore degraded riparian areas around the world. We examined the effects of flood regime on litter production and soil nitrogen dynamics in riparian forests along the middle Rio Grande of New Mexico dominated by native *Populus deltoides* ssp. *wislizenii* and non-native *Tamarix chinensis*. Feedbacks between litter production and soil inorganic nitrogen determined the degree of nitrogen accumulation within all riparian study sites. *P. deltoides* and *T. chinensis* flood sites had consistently lower potential net nitrogen mineralization rates than their respective non-flood sites. Flood regime also promoted differences in riparian soil nitrogen concentrations within stands dominated by each species, but flood effects contrasted across species. *P. deltoides* flood sites had low soil nitrogen concentrations, likely due to increased nitrogen uptake by plant and microbial communities, denitrification, and nitrogen export to surface and ground water that are associated with flooding. Litter production was suppressed at *P. deltoides* flood sites relative to *P. deltoides* non-flood sites, although roots from *P. deltoides* flood sites showed a greater capacity to take up inorganic nitrogen. *P. deltoides* non-flood sites had higher soil nitrogen concentrations compared to *P. deltoides* flood sites due to elevated nitrogen inputs associated with increased litterfall and the lack of transport associated with flooding. In contrast, *T. chinensis* flood sites were characterized by greater litter production, nitrogen inputs via litterfall, and concentrations of soil inorganic nitrogen relative to *T. chinensis* non-flood sites. *T. chinensis* has the ability to produce adventitious roots at the elevation of floodwaters, an adaptation that may help to support leaf production during inundation. Litter production at *T. chinensis* non-flood sites was potentially limited by increased competition for nitrogen between plants and microbes, as inferred from soil C:N molar ratios much greater than 25:1. The practice of spring-time naturalized flows within the rivers of semi-arid regions ought to continue when adequate water supplies permit. Flood events associated with these flows promote increased recruitment of native plant seedlings, as well as increased mobilization of nutrients at a time most conducive to plant growth. However, flood inundation may be less important for the preservation of mature forests dominated by *P. deltoides* than the maintenance of shallow groundwater tables that have been shown to support high leaf production. Flood inundation, particularly if long in duration, also promotes increased losses of soil nitrogen and reduces leaf and litter production within stands of *P. deltoides*. Additional research is required to determine the thresholds at which extended flood duration does more harm than good for the conservation of *P. deltoides* along rivers of the U.S.