Willows on the Lower River Murray, SA

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Research scope

This research concentrates on willows (*Salix* taxa) on the Lower River Murray (LRM), South Australia. There is a need to ascertain willow distribution patterns within both the riparian and floodplain habitats of the LRM as this information will help to determine and further investigate what some of the mechanisms (biotic/abiotic) might be that are shaping these patterns.

Results to date

A taxonomic survey of the diversity of *Salix* taxa along the LRM and surrounding Riverland region found 7 *Salix* taxa. Namely weeping willow (*S. babylonica* ♀), golden weeping willow (*S.´ chrysocoma* ♂), crack willow (*S. fragilis* ♂), basket willow (*S.´ rubens* ♀), tortured willow (*S. matsudana* ♀), pencil willow (*S. humboldtiana* ♂) and 'Matsudana Hybrid' (*S. matsudana´ alba* ♂). Each taxa is represented by either wholly male or female trees. Naturalised populations of weeping willow, crack willow, golden weeping willow and basket willow were identified in the study area. A few individuals of tortured willow and pencil willow were identified in riverfront private residences and stands of male 'Matsudana Hybrids' were common throughout the Riverland where they are used as shelterbelt trees around orchards and/or vineyards. At present no 'Matsudana Hybrids' have been found on the main river channel. Of the 5 most common taxa, weeping willow, golden weeping willow and 'Matsudana Hybrid' flower early in spring (late August to mid-September) whereas crack willow and basket willow both flower later (late September – early October). No evidence of seed release or seedlings was observed and the spread of the 4 naturalised taxa seems to be via asexual (vegetative) means following deliberate introductions. Pollination between current taxa appears prevented due to asynchronous flowering times and spatial separation (i.e. > 5 km preventing cross-pollination via bees, wasps, beetles and to some extent wind).

The distribution of *S. babylonica* along weir pools of the LRM was determined to assess whether presence and abundance corresponded to the water regime gradients created by weir operations. Results indicate that their abundance was rare and generally not uniform along the banks of weir pools. Nonparametric multiplicative regression analysis found that the likelihood of their occurrence tends to increase with increasing distance downstream of a weir. Since increasing distance downstream of a weir corresponds to diminishing amplitudes in water level fluctuations, their increased probability of occurrence in regions immediately upstream of weirs suggests a preference for water regimes that are relatively stable (i.e. low fluctuations).

The implication that *S. babylonica* distribution may be limited by highly variable, fluctuating water regimes was further examined. An experiment was designed to simulate the characteristic water regimes found along weir pool gradients (i.e. low, medium and high daily water level fluctuations) and test their influence on the establishment and growth of propagules. Results suggest that all growth parameters measured were not influenced by the fluctuating water regimes, but that elevation played a more significant role instead. In particular, growth was significantly reduced at elevations that top-flooded and waterlogged establishing propagules. Up to 75% of plants died and leaf development was considerably reduced at these lower elevations. When growing under favourable conditions (i.e. higher elevations), establishing propagules employed a growth strategy that suggests high growth rates were maintained via considerable and rapid leaf expansion.

A further long term seasonal investigation into the possible factors influencing the absence of *S. babylonica* from floodplains, but presence along riverbank edges appears to be linked to specific components of their water relation's characteristics such as a sensitivity to water stress, a lower photosynthetic capacity compared to native trees, a dependence on continual water sources and inefficient long term water use.

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Implications for management

Hybridisation between *Salix* taxa may provide a stimulus for increased invasiveness since hybridisation can lead to new adaptive traits that are more compatible with colonised habitats. For example, 'Matsudana Hybrids' were initially developed in New Zealand over 25 years ago for the commercial horticultural industry and subsequently introduced to Australia for the same purposes approximately 15 years ago. 'Matsudana Hybrids' were highly recommended to commercial growers as shelterbelt trees because of properties such as rapid growth, resistance to pest, disease and fire, as well as high salt and water stress tolerance. If some of the possible biotic and/or abiotic factors (e.g. water stress and/or salinity sensitivity), that currently constrain willow distribution were alleviated via interbreeding it is feasible that considerable expansion of *Salix* populations on the LRM and Riverland may occur.

Related publications

Gehrig, S. L., Walker, K. F. and Ganf, G. G. (March 2006). River Red Gum and Willow Monitoring (Chapter 4: p. 74-83). in "River Murray Monitoring Report – Below Lock 1, 2002 – 2004. Department of Land, Water and Biodiversity Conservation.

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