Genetic diversity of willows in southeastern Australia

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Pilot study

1. Quantify level of genetic differentiation among catchments
2. Determine the power of molecular fingerprinting to track seed movement across the landscape
3. Assess relative importance of vegetative versus seed reproduction
4. Quantify the spatial scale of seed dispersal
5. Revisit the appropriate landscape scale for effective willow eradication and invasion risk assessment

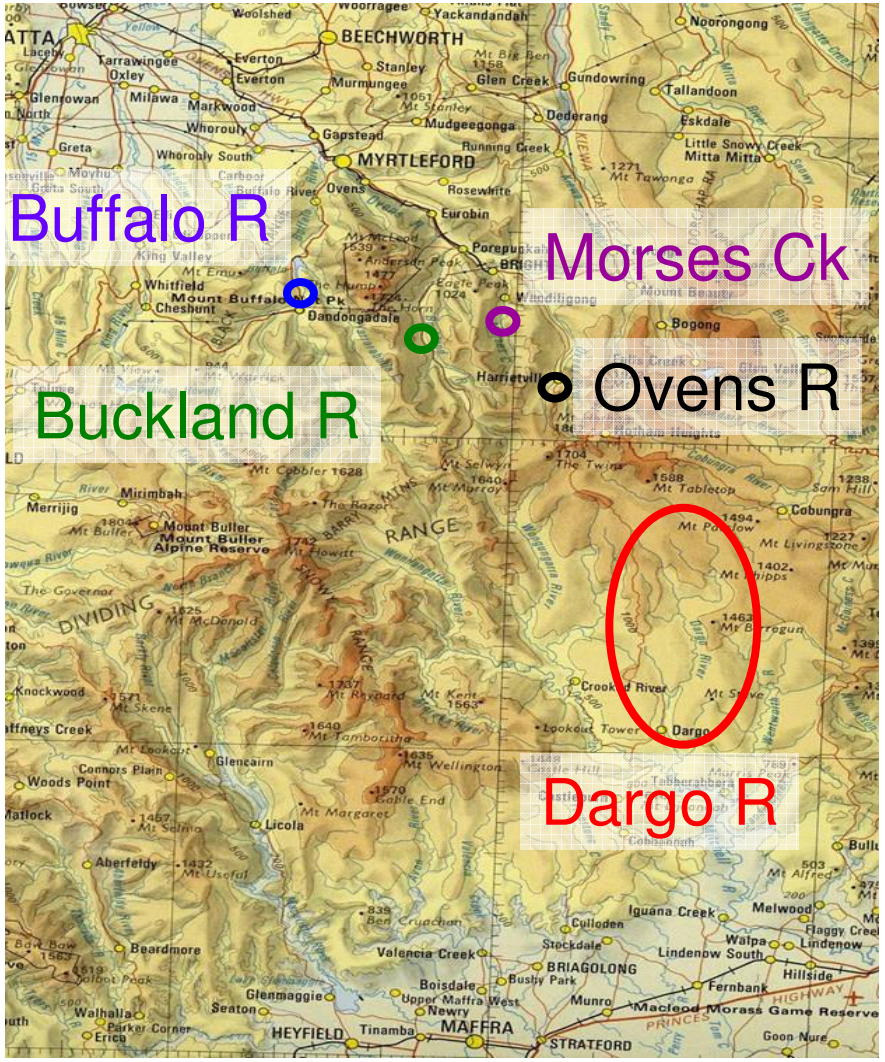
East Gippsland study area

Sampling

- 50 mature trees in four putative source catchments
- 30 mature trees and 38 seedlings in one target catchment (Dargo River)

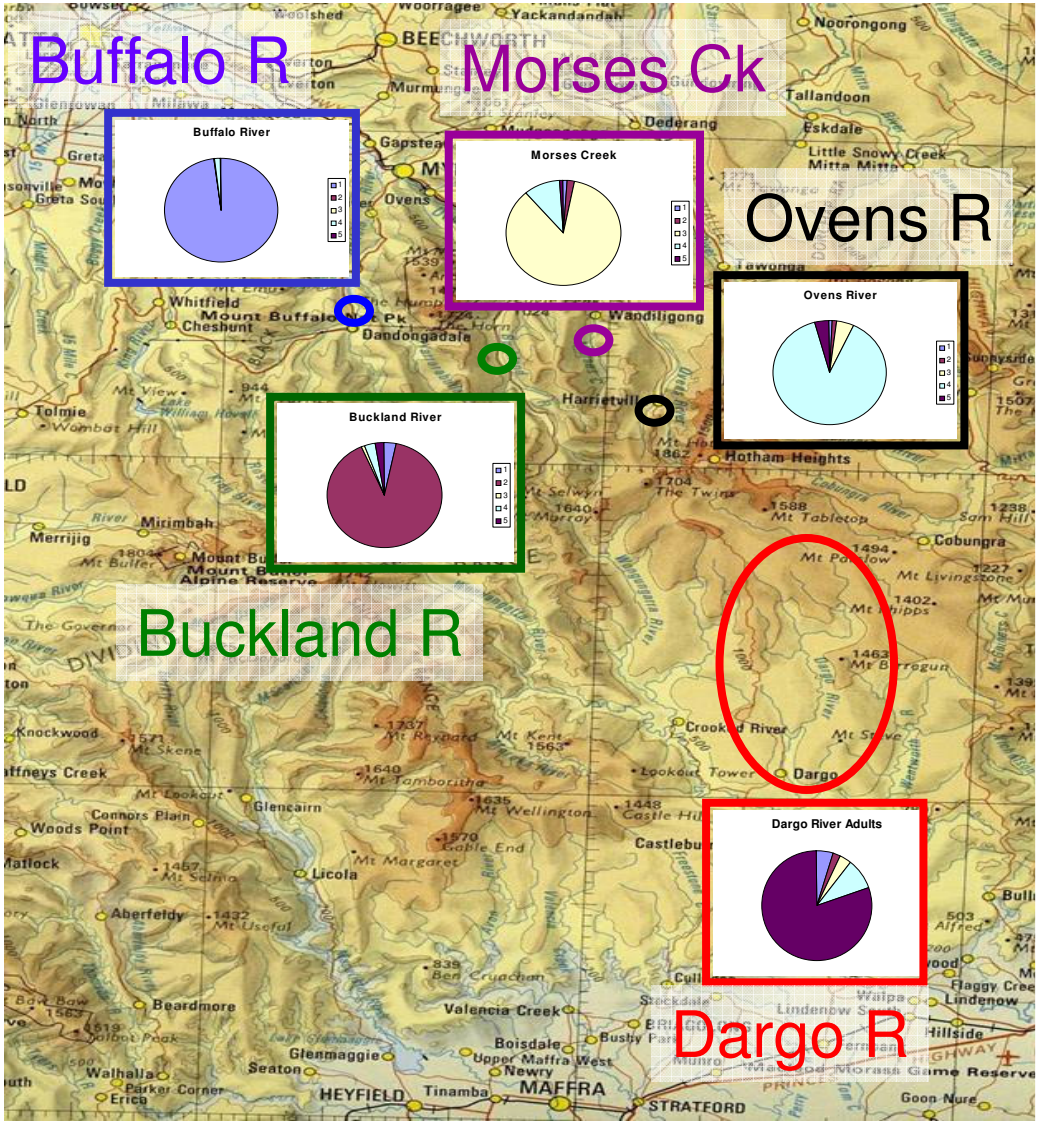
Fingerprinting

- Individuals genotyped with two marker systems (SSRs and AFLPs)



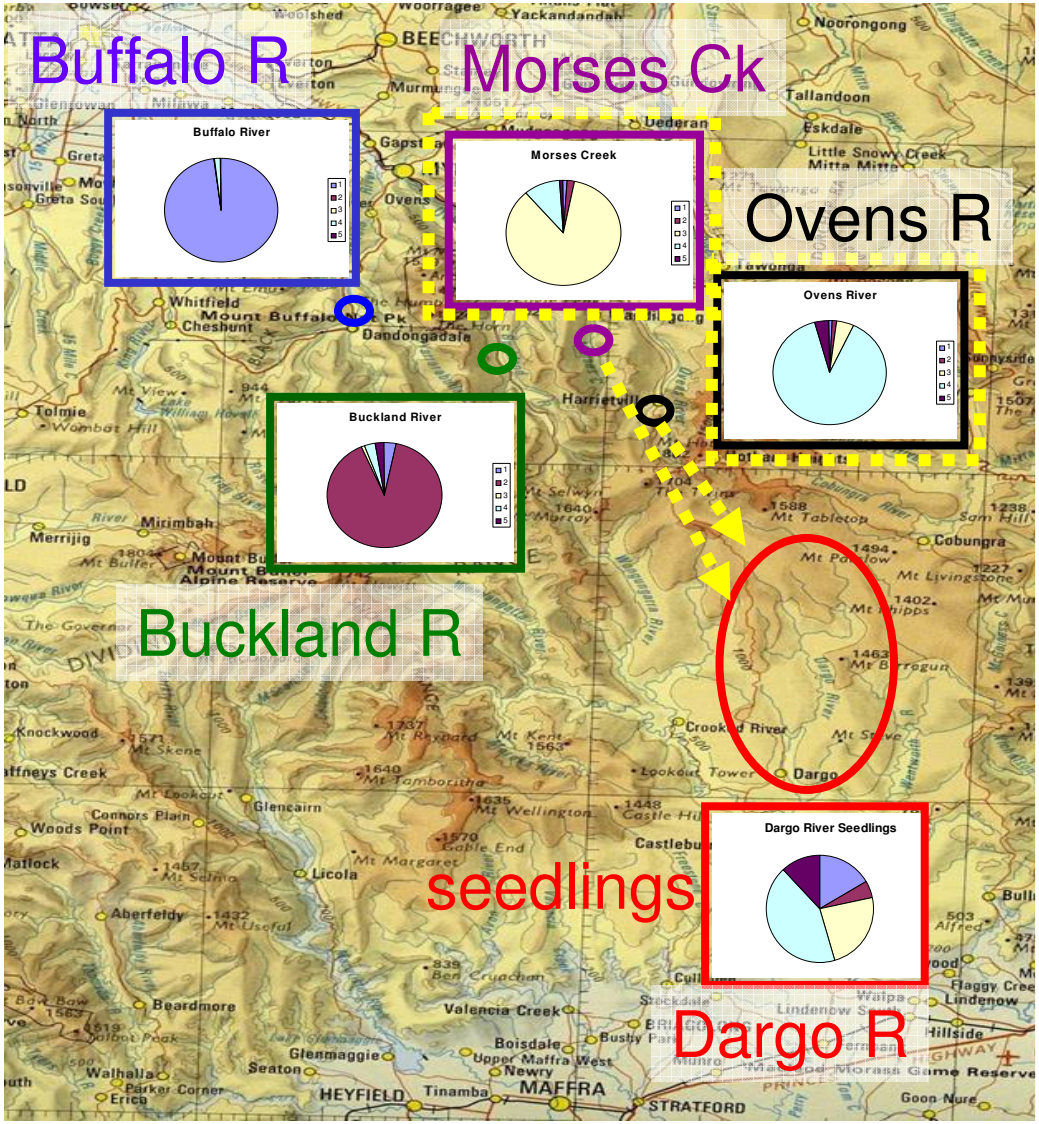
Structure analysis (Pritchard *et al.* 2000)

- Bayesian probability modelling
- Model I: no *a priori* information
  - adults fall into five genetic groups
  - general alignment with populations

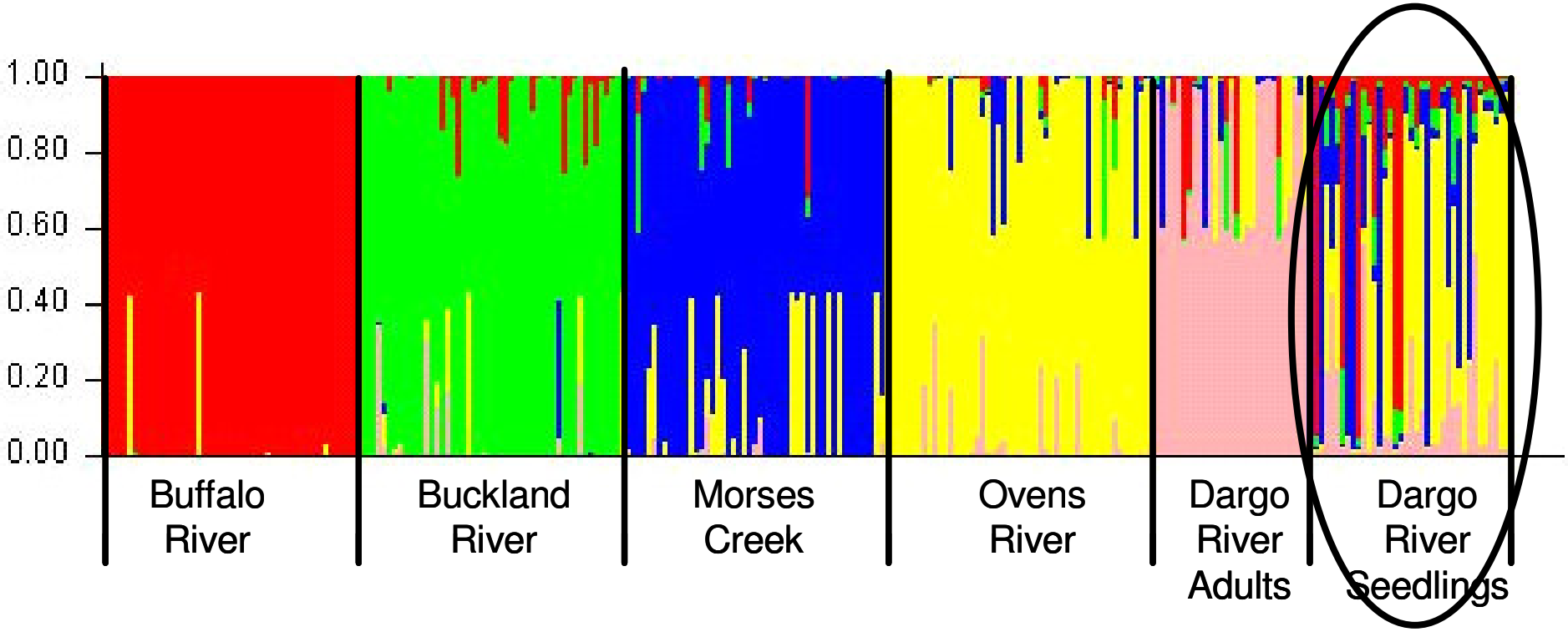


Structure analysis (Pritchard *et al.* 2000)

- Bayesian probability modelling
- Model I: no *a priori* information
  - adults fall into five genetic groups
  - general alignment with populations
  - Dargo seedlings mixed assignments
  - >70% not local origin
  - Ovens R and Morses Ck (>50km)



Seed or pollen?



- Model II: *a priori* population assignments
- Apparent pollen and seed movement across catchments is evident

Conclusions of pilot study

- AFLPs work well as genetic markers in *Salix cinerea* for measuring gene flow.
- Levels of genetic diversity are high
- Significant seed and/or pollen movement across the landscape (>70% Dargo seedlings have immigrant genes)
- Ovens River and Morses Creek contribute most seed/pollen to the Dargo River catchment > 50km!
- Need to scale up eradication efforts and coordinate across multiple catchments simultaneously

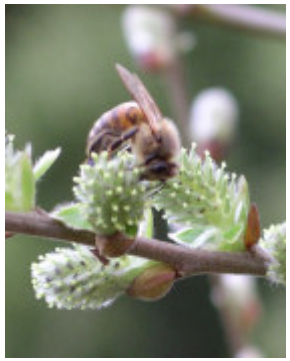
Willow Dispersal

- Scale of movement
  - Seed
  - Pollen
- Differences between species in relation to reproductive strategies
- Potential for spread
- Management implications

Reproduction

Sexual reproduction

- Millions of seeds produced
- Seeds are wind and water dispersed
- Seeds only last for 2 weeks
- Germination can occur within 24 hours
- Many seedlings die within months of germination



Asexual reproduction

- Fragility or brittleness
- Abscission point at base of twigs
- Spreads mainly downstream

Genetic diversity – large scale

- State wide sampling of *S. cinerea* and *S.* x *rubens* complex
- Genetic structure using SSR markers
  - Across the state
  - Within CMA regions
  - Within catchments
- Compare any structure with breeding strategies of species
- Implications for scale of management

45 sites, 1350 samples

Genetic diversity – fine scale

- Intensive sampling along a river system
- Genetic structure along the river
- Any difference in structure between reproductive strategies

Management

- Historical invasion patterns
- Current reproductive strategies
- Dispersal patterns of willow in terms of the scale of seed and pollen movement
- Identifying the most efficient geographical scale of control that will minimise the likelihood of reinfestation
- Providing more quantitative analysis of catchments that are most at risk of invasion in the future

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- East Gippsland CMA