An overview of the impacts of invasive plant species on water resources and river systems in South Africa

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Outline

- Introduction
  - Water-use by plants
  - Riverine environments
- Findings
  - Water-use
  - Underestimation of riparian invasions
- Riparian invasions
- NEM:BA an opportunity?
Introduction

- The last national level assessment of impacts was published in 1998 (Versfeld study)
  - Total area invaded 10.08 million ha
  - Condensed (equiv. dense) area: 1.74 million ha
  - Reduction in mean annual runoff (MAR): 3 303 million m³/yr (6.67% of pre-development runoff)
- Based on single biomass model and reconnaissance mapping data
- Update needed
Water-use

- Dryland invasions vs non-dryland
  - Limited vs **not-limited** by water availability
- Riparian – floodplain
  - Flow regime - perennial to ephemeral
- Groundwater – non-riparian within rooting depth
  - Deep sands: Zululand & Cape coast, inland
  - Azonal vegetation types
  - Land types with deep soils
Riverine environments

- Traditional view: aquatic and associated systems as separate
- Developing view:
  - An integrated system
    - Longitudinal (hydro-geomorphology)
    - Lateral – linked to adjacent systems
    - Vertical – surface and sub-surface (hyporhoeos)
    - Temporal
    - Fluxes of water, sediment, OM, nutrients, organisms, ...
  - The whole is more than the sum of the parts (complex)
Riverine environments (cont)

- This complex interconnected environment
- Generates different suites of ecosystem services
  - Regulating sediment flux
  - Retarding flood flows and absorption of energy
  - Nutrient assimilation & flushing
  - Processing of chemicals & flushing
  - Regulation of harmful algae & microbes
  - Water, food, fibre & medicines
  - Habitat for biodiversity & basis of trophic networks
  - Recreation and amenity value
Findings
NIAPS mapping
Reduction (%)
## Top 10 taxa

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Total condensed area (ha)</th>
<th>Reduction (million m³/yr)</th>
<th>Percent of total reduction</th>
<th>Reduction (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia mearnsii &amp; allies</td>
<td>474 489</td>
<td>483.23</td>
<td>33.47</td>
<td>101.84</td>
</tr>
<tr>
<td>Pinus spp.</td>
<td>132 937</td>
<td>272.31</td>
<td>18.86</td>
<td>204.84</td>
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<tr>
<td>Eucalyptus spp.</td>
<td>273 573</td>
<td>217.37</td>
<td>15.06</td>
<td>79.46</td>
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<tr>
<td>Chromolaena odorata</td>
<td>101 992</td>
<td>100.29</td>
<td>6.95</td>
<td>98.33</td>
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<tr>
<td>Hakea spp.</td>
<td>36 344</td>
<td>72.20</td>
<td>5.00</td>
<td>198.67</td>
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<tr>
<td>Solanum mauritianum</td>
<td>40 413</td>
<td>58.20</td>
<td>4.03</td>
<td>144.00</td>
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<tr>
<td>Lantana camara</td>
<td>32 328</td>
<td>40.29</td>
<td>2.79</td>
<td>124.61</td>
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<tr>
<td>Acacia cyclops</td>
<td>54 679</td>
<td>28.95</td>
<td>2.01</td>
<td>52.95</td>
</tr>
<tr>
<td>Populus spp.</td>
<td>58 082</td>
<td>26.89</td>
<td>1.86</td>
<td>46.29</td>
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<tr>
<td>Salix babylonica</td>
<td>37 555</td>
<td>22.48</td>
<td>1.56</td>
<td>59.86</td>
</tr>
</tbody>
</table>
Summary

- Total condensed area 1.50 (1.3-1.7) million ha
- Total reduction 1 444 (1 304-1 598) mill m³/yr (2.88% of MAR)
- Equivalent to 97 mm/yr
- Most invasions in E Cape, KZN, Mpumalanga
- Most affected Biome:
  - Forest – issues of data resolution
  - Grasslands – greatest volume
  - Indian Ocean Coastal Belt – highest percentage
Underestimation of impacts

- Riparian invasions comprise only:
  - 4.6% of *A. mearnsii* vs 20%?
  - 4.4% of *Eucalyptus* vs 50%?
  - 5.2% of *Populus* vs 80%?
  - 5.5% of *Salix* vs 80%?

- Adjusting these percentages adds 1,000 mill m$^3$/yr (70%)
Riparian invasions
Riparian mapping

Primary catchments

NIAPS Riparian
% cover

0

0.1 - 100
Summary

- Riparian invasions
  - Pervasive (>30% of rivers)
  - Water impacts per ha 1.5-2.0 times dryland invasions
  - Extend down perennial river systems into arid zone
  - Degrade and displace native species & ecosystem processes
  - Alter sediment dynamics
    - Typically channel incision (disconnecting)
    - Complicates rehabilitation
  - Affect many NFEPA A, AB and B systems
  - Alter ecosystem generation & benefits
NEM:BA an opportunity

- The new legislation is not tied to agriculture
- The new legislation focuses on impacts on:
  - Biodiversity
  - Ecosystem integrity
- Impacts on river conservation priorities?
- Give emphasis to riparian invasions
- Prioritise riparian clearing
  - Biodiversity considerations
  - Ecosystem services
Acknowledgements

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