Water use estimation in agriculture and forestry: Accurate data for improved management and W-E-F trade-offs

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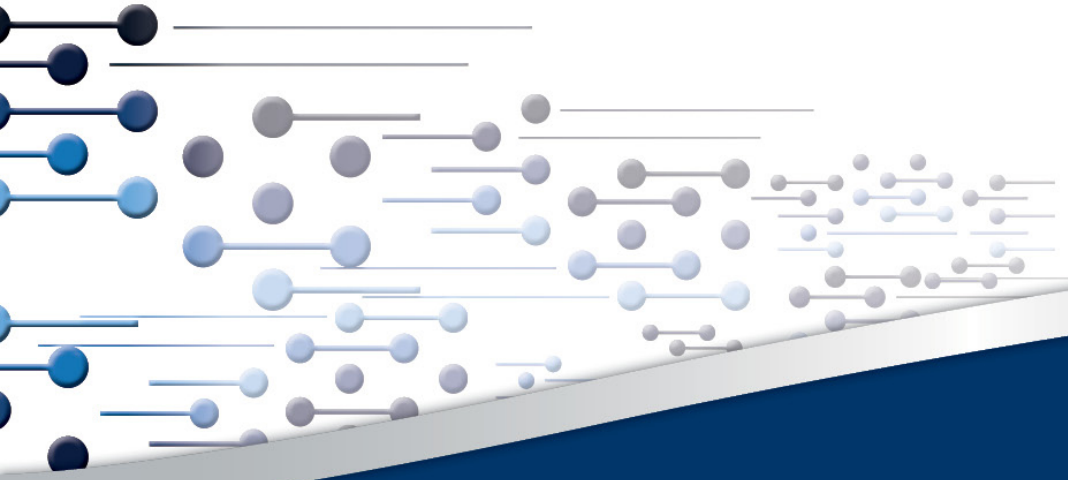

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GIGO

- Garbage in, garbage out (GIGO) refers to the fact that faulty input data (“garbage in”) will produce faulty output (“garbage out”).
- W-E-F trade-off decisions require data that is both **appropriate** and **accurate**.

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Data strategy (water)

- Increasing competition for water resources in SA = Increasing tension on W-E-F nexus
- Agricultural water use is substantial (>60%)
- To manage well we must measure well
- Importance of accurate water use data
- Upscaling from field to catchment = impact & appropriate management unit
- Improved W-E-F trade-off decisions based on catchment priorities
- Also possible improvements in WP
- Where do we focus?
- What tools do we have?
- What do the results show?

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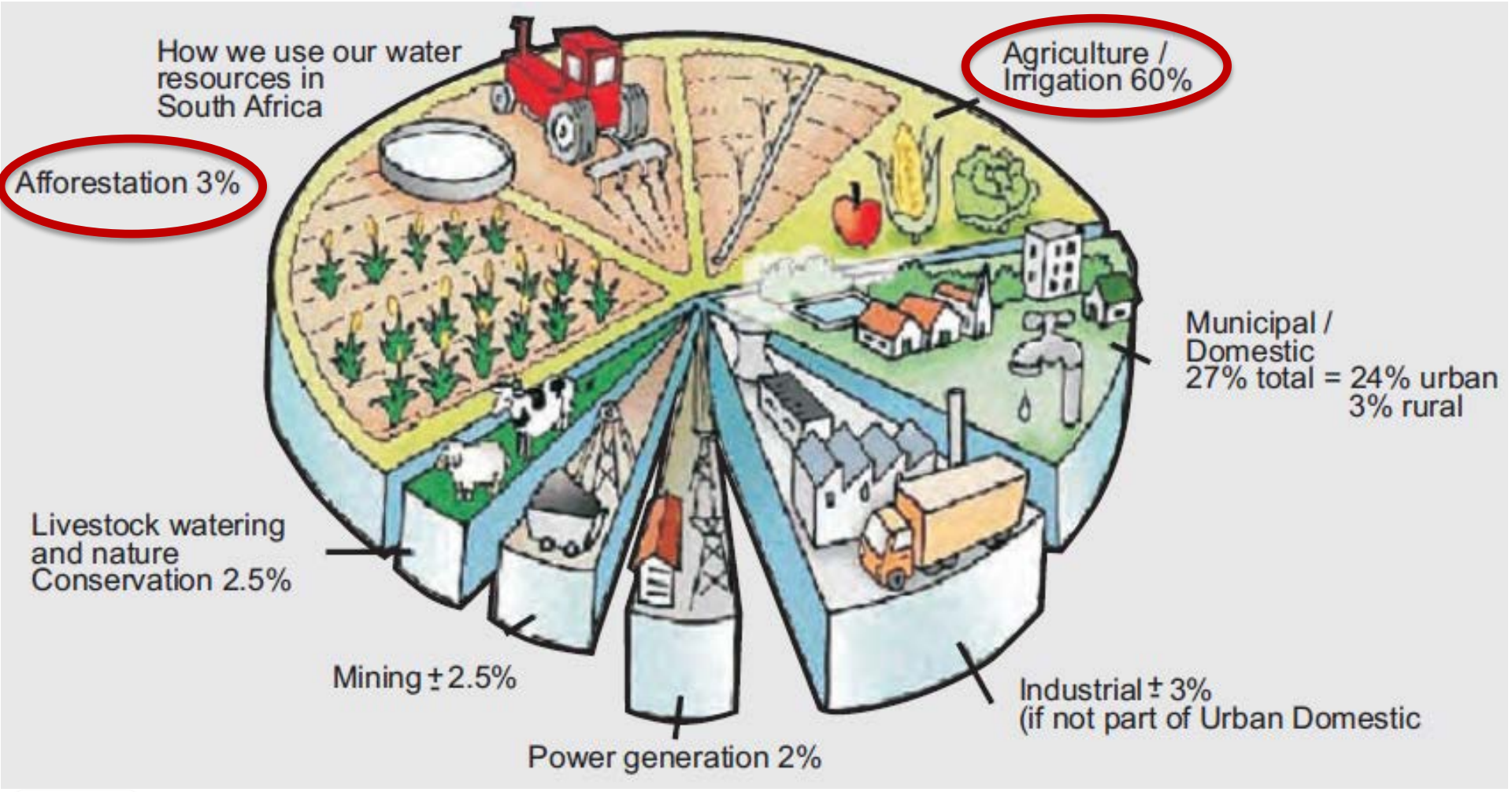
Water use by sector



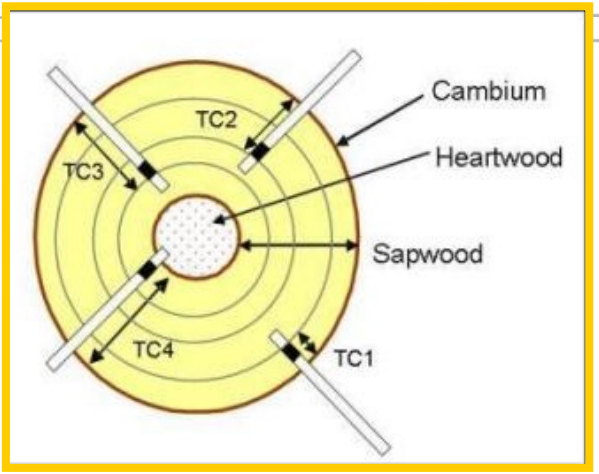
• Source: Dept. Water and Sanitation, NWRS-2.

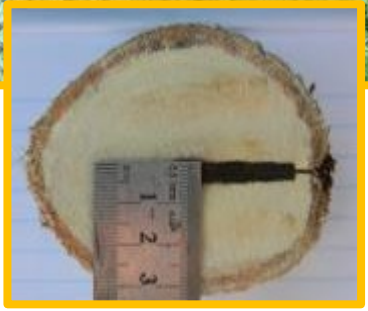
Focus area:
Irrigated agriculture

Focus Area:
Plantations, forests and trees

Focus area:
Invasive alien plants

Tool:
Transpiration measurements (tree)





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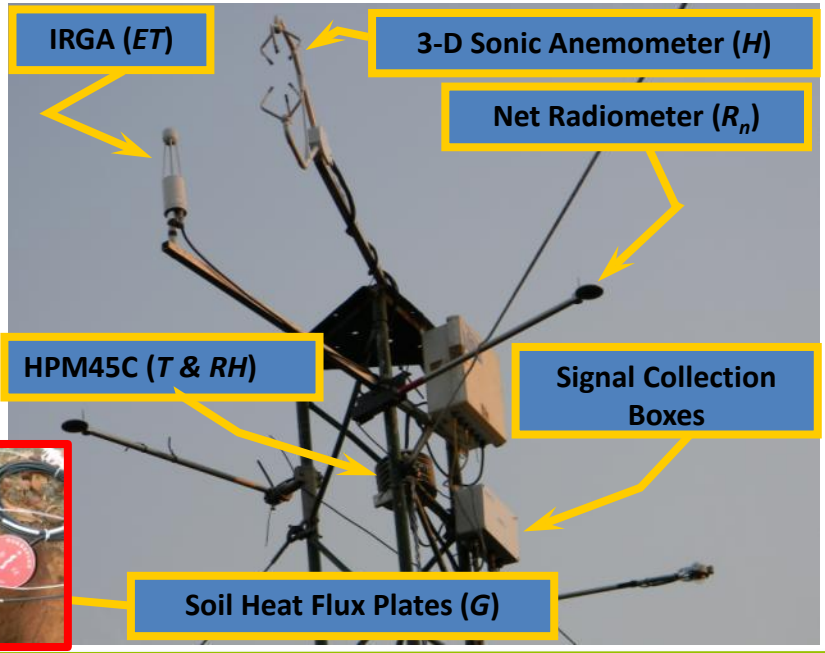
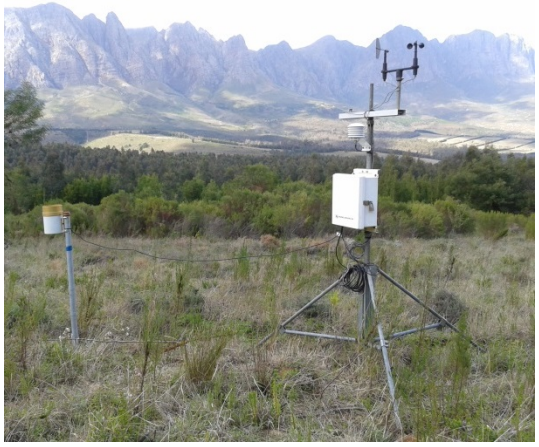
Tool:
Total evaporation measurements

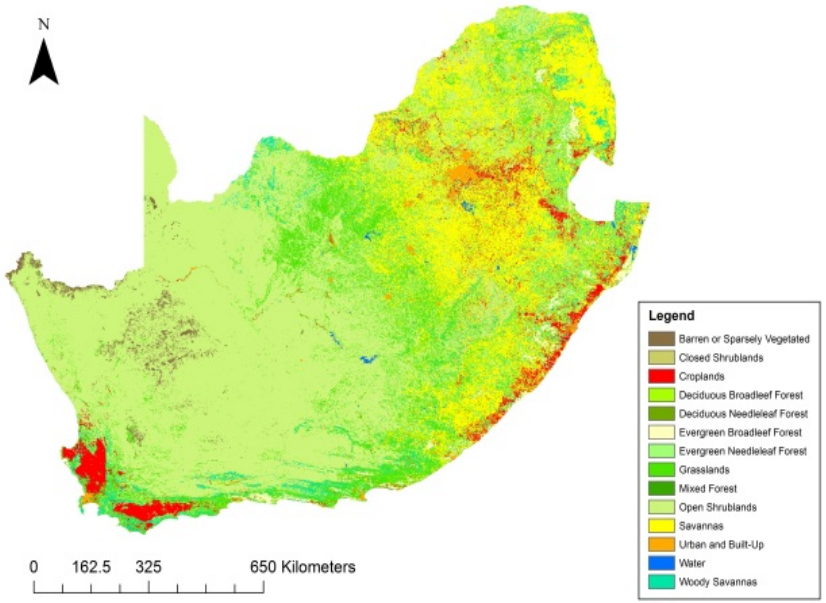


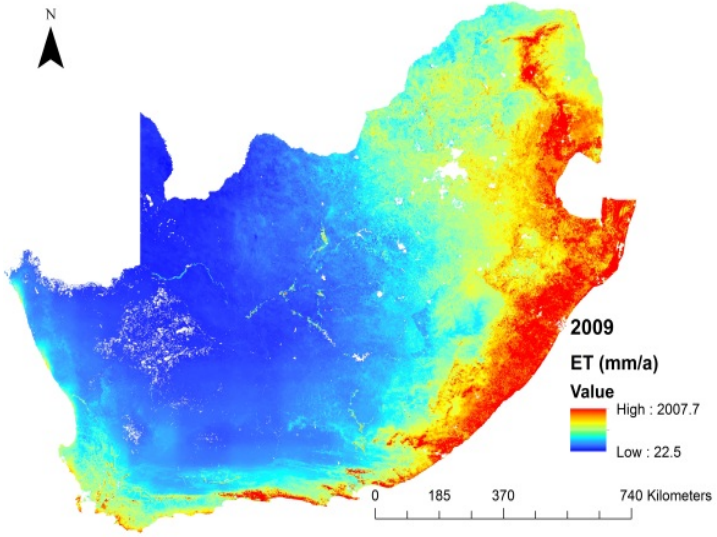
$$R_n - G - H - LE = 0$$

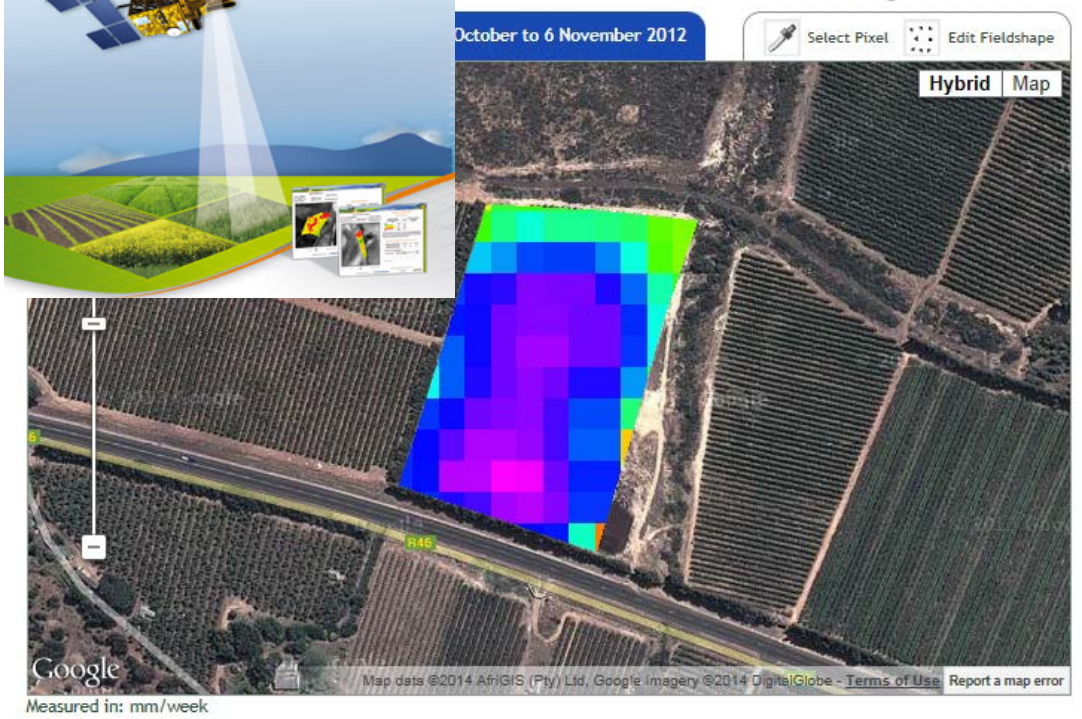
$$LE(ET) = R_n - G - H$$



Tool:
Remote sensing & earth observation







Measured in: mm/week

fruitlook.co.za

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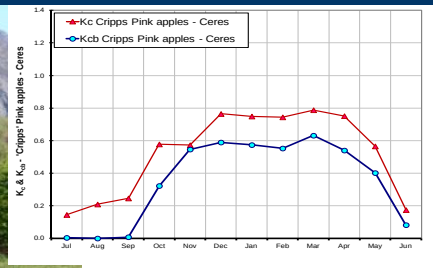
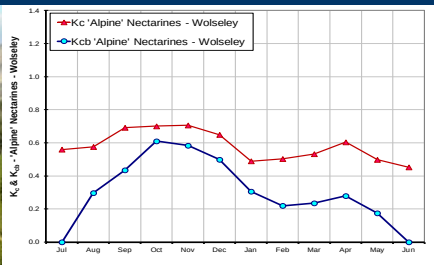
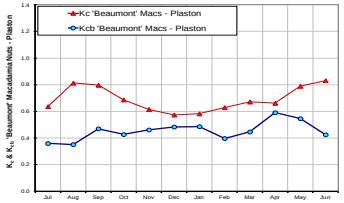
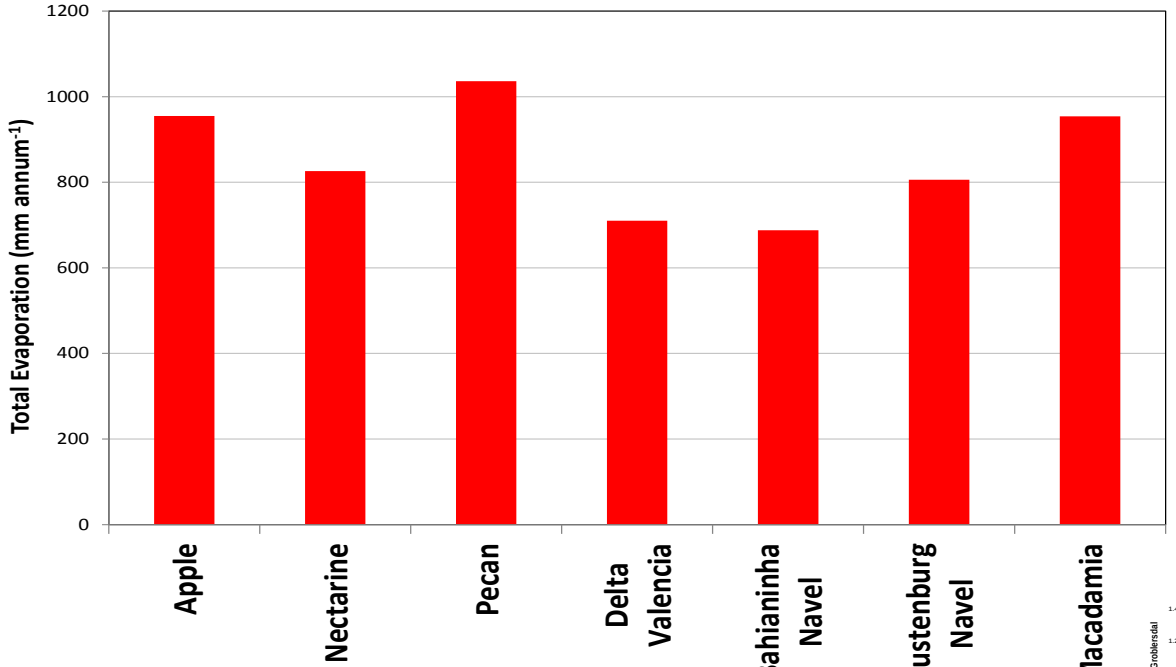
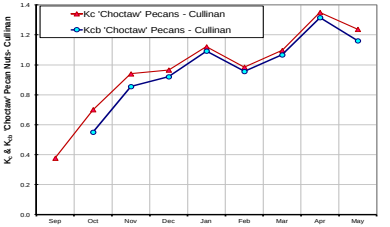
Results: Water use of irrigated fruit tree orchards

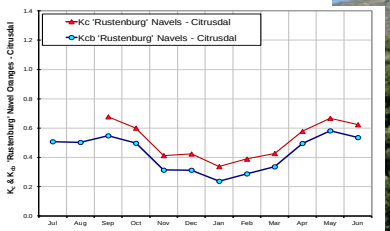


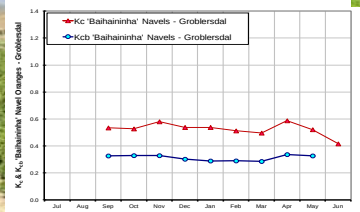


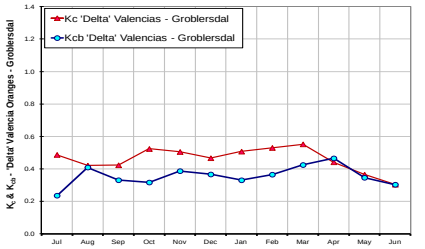












Results:
Transpiration, growth & WUE of trees

Tree Species Group	1-yr Water-use (L)	1-yr Stem Mass Increment (g)	WUE (g stem wood / L water transpired)
Indigenous trees	3343 (± 1242)	6090 (± 4762)	1.95 (± 0.88)
Eucalyptus clones	10300 (± 2890)	20345 (± 6118)	2.01 (± 0.49)
Eucalyptus grandis	7994 (± 5995)	20874 (± 14361)	2.91 (± 0.99)
Pinus species	7488 (± 4473)	14877 (± 7357)	2.20 (± 0.64)

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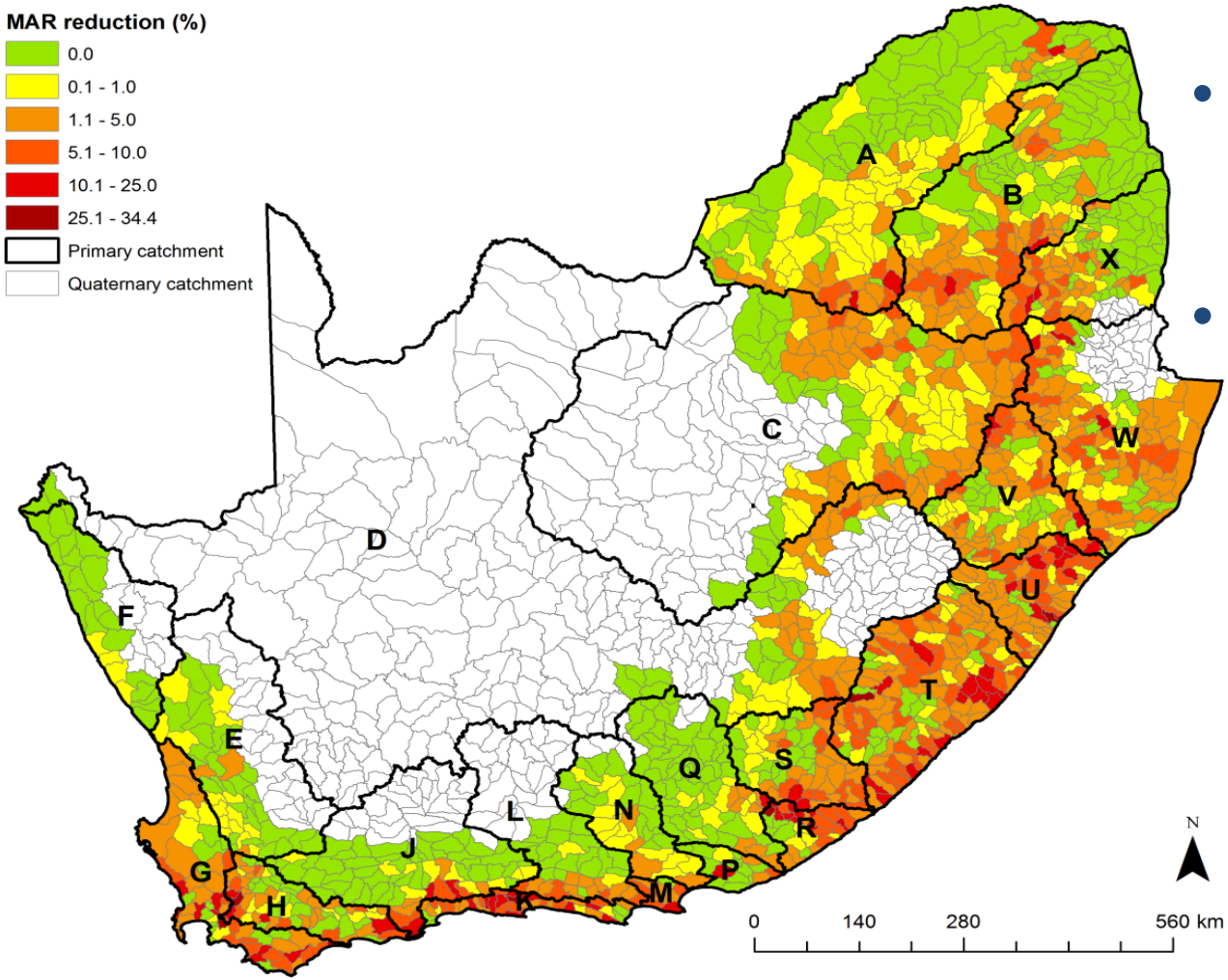
Results:
Water use impacts of IAPs



- Total condensed area = 1.5m ha
- Total MAR reduction = 1.4bn m^3/yr (2.9% of MAR / 97 mm/yr)

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Conclusions:

- Optimising W-E-F trade-off decisions requires appropriate & accurate water use data – **GIGO**!
- Agriculture can & must become more efficient in its use of water.
- Water use interventions in agric sector can augment water supplies and provide W-E-F “wiggle-room.”
- Requires on-going field measurements to accurately quantify crop and tree water use.
- Requires accurate data on crop areas (crop mapping).
- Requires improved modelling, validated with accurate field data, to upscale to appropriate management units
- Use research results in W-E-F decision-making
- Use comparative indices and tools such as:
  - Water Footprint assessments
  - Water productivity comparisons
  - Cost-benefit analyses

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Thank you

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