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Advantages and Disadvantages of Irrigation Mosaics as an Alternative to Traditional forms of Irrigation in Northern Australia

Freeman Cook
Senior Principal Research Scientist
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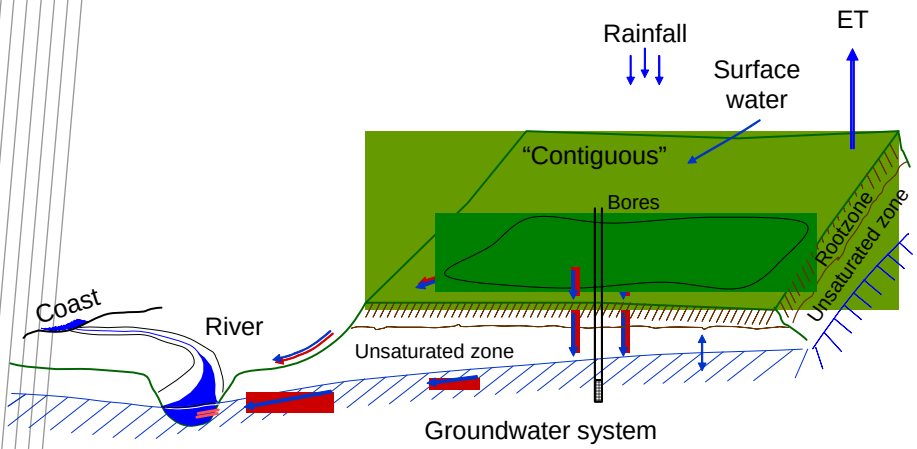
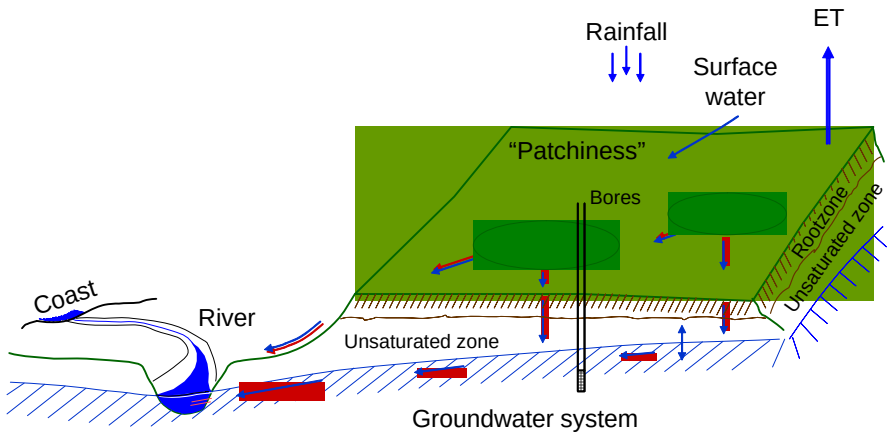
What are Irrigation Mosaics?

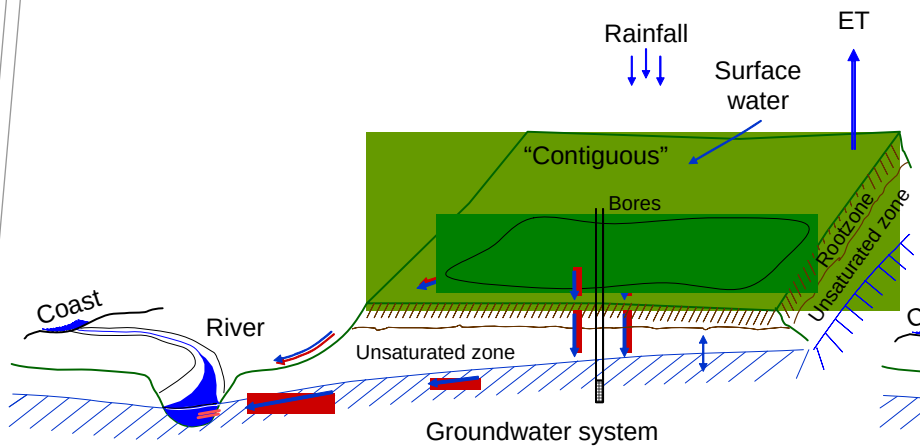




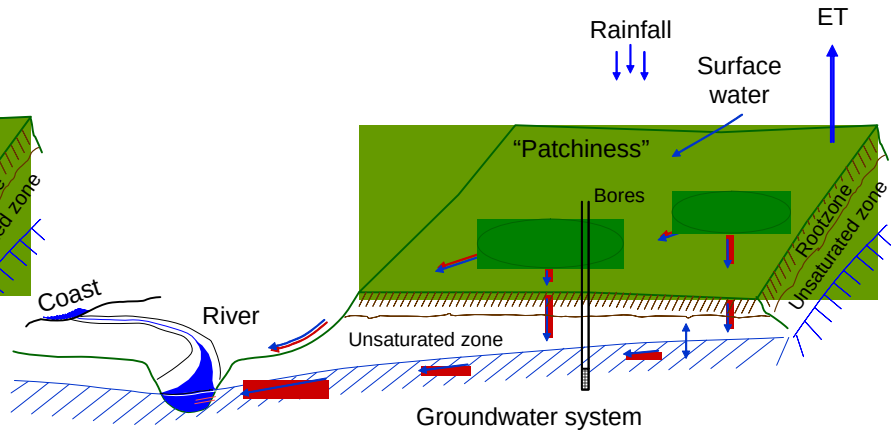
- Traditional irrigation systems consist of
  - One large patch
  - Source from dams, bores and off-takes often from existing river systems supplemented by dams
  - Canals and other delivery infrastructure
  - Irrigation of total area within scheme
  - Can result in undesirable environmental effects

- Irrigation mosaics
  - Numerous small patches
  - Source from small dams, bores or existing river systems
  - Delivery infrastructure localised
  - Possibility to avoid irrigation of unsuitable areas
  - It may be possible to minimise some adverse effects of irrigation

Why Irrigation Mosaics?



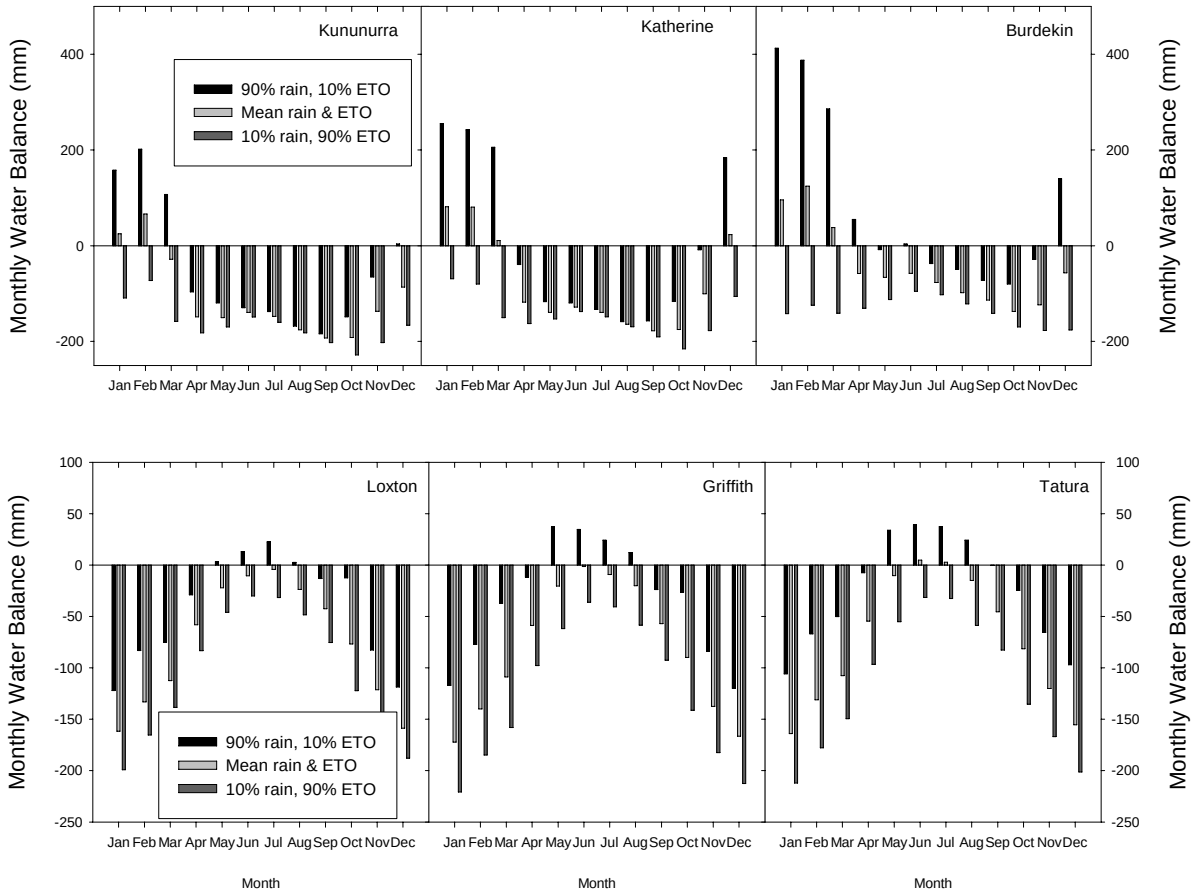
- Irrigation often not suitable for all areas within scheme
- Water-table rise and salinisation often problems
- Lack of flexibility to respond to climatic changes
- System less adaptable as large 'sunken' cost



- Irrigation can avoid unsuitable areas
- Water-table rise and salinisation can be controlled
- More flexibility to respond to climatic changes
- Can use an adaptive management

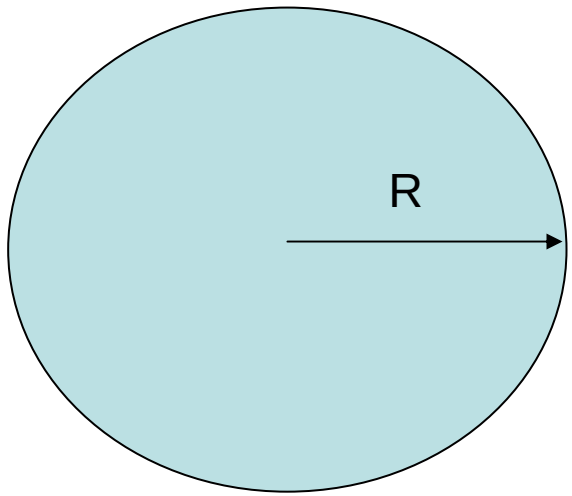
Why Consider Irrigation Mosaics for Northern Australia

- Climate is very different from Southern Australia
- Opportunity to design more sustainable and environmentally sensitive developments



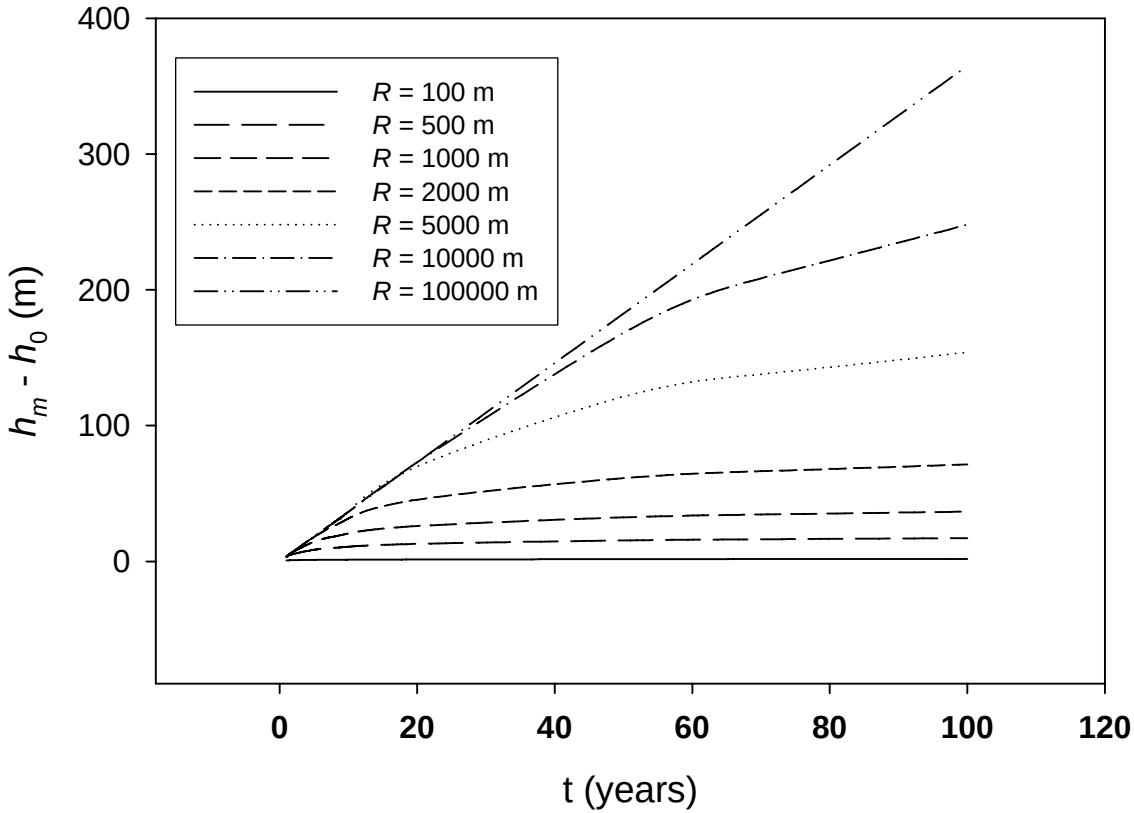
Bio-Physical Aspects

- Investigation of Biophysical Properties as Related to Irrigation Patch Size
  - Water-table rise
  - Water-table spreading
  - Solute spreading
  - Evaporative demand
- Can learn about all irrigation systems



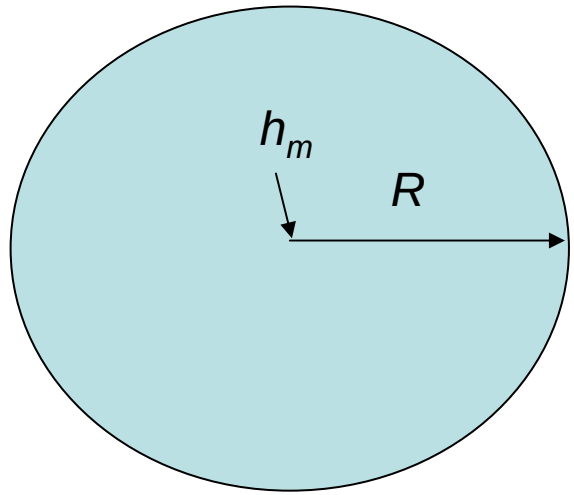
Water-Table Rise

- The rise in the water-table above the initial level with years of irrigation.
  - I = 1 mm/day recharge
  - No sinks
  - No slope on aquifer



Ks = 1 m/day

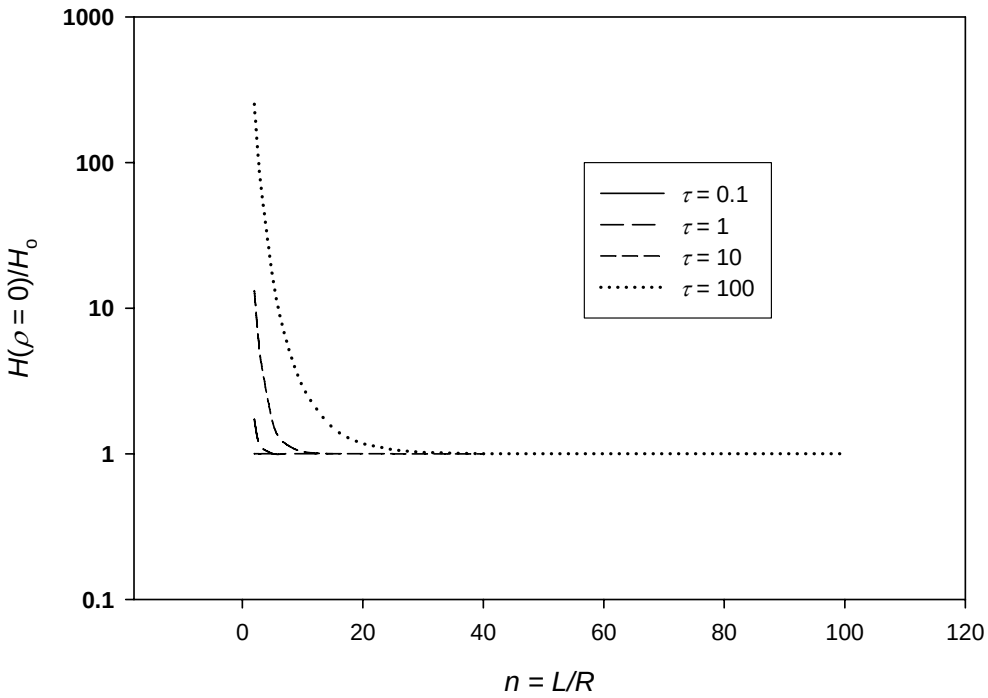
Sy = 0.1 m^3 m^{-3}

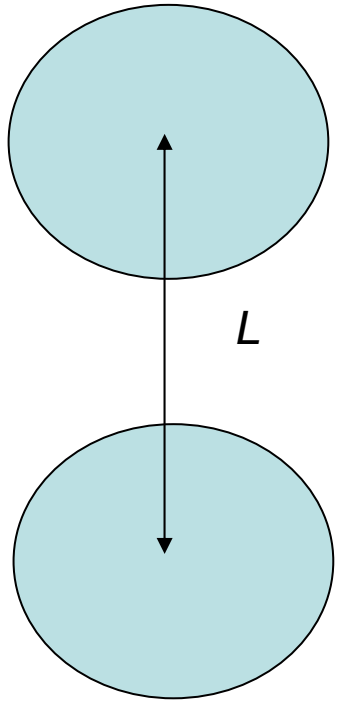


Water-Table Rise

- Spacing of the irrigation patches is critical as well as size

Array of Patches

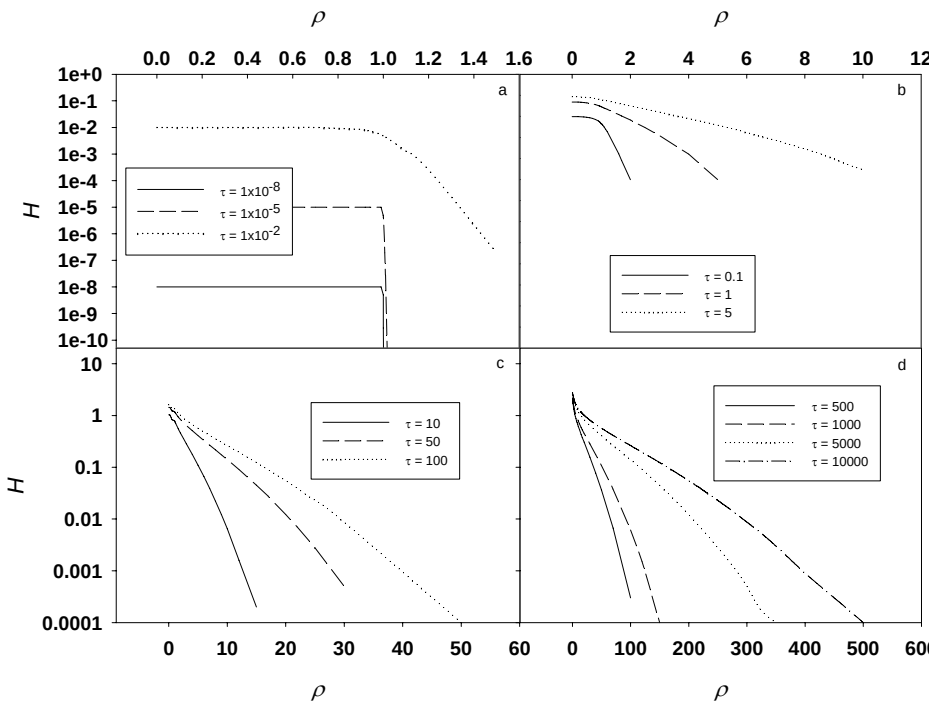




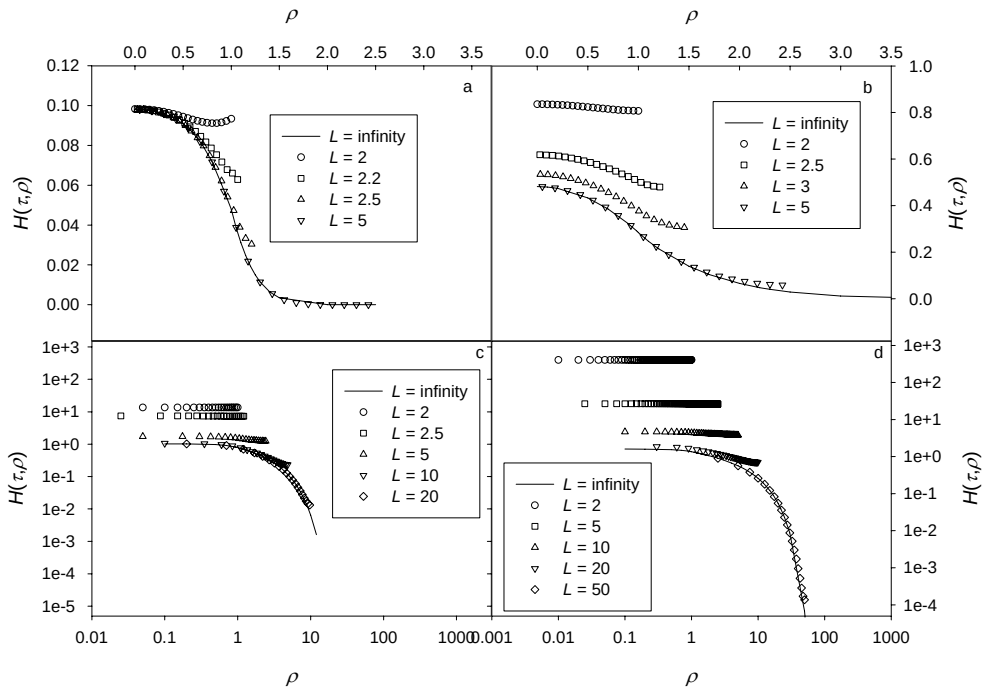
Water-Table Spreading

- For single patches the area affect by water- table spreading increases as *R* increases.
- For an array of patches the impact is increased due to overlap of the water-tables
- Spacing of patches is important

Single Patch

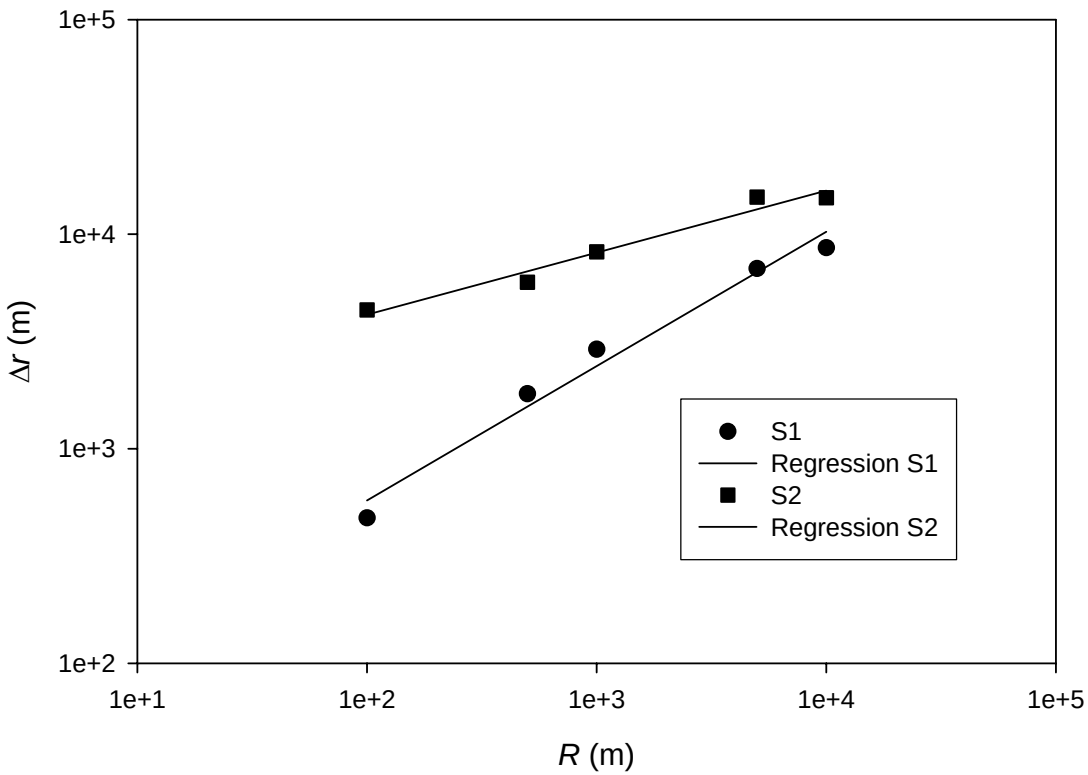


Array of Patches



Solute Spreading

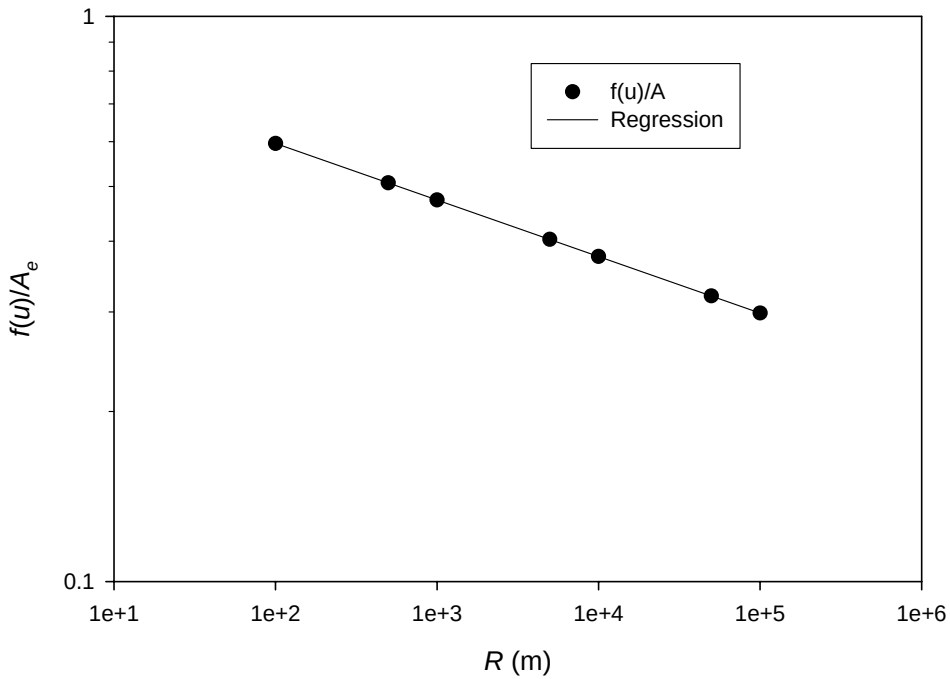
- For single patches
- $\Delta r = Rs - R$, Rs = radius of solute spread
- Solutes spread further under large patches
- With correct spacing irrigation mosaics could reduce ‘pollution’ of areas outside of the irrigated region



Evaporative Demand

- Advection – hot air from outside can lead to increased water loss for wet patches
- Not a lot of data on irrigation systems but quite extensive for water bodies

$f(u)/A_e$ is the wind factor for evaporation



Conclusions - Specifics

- Irrigation Mosaics provide an alternative to traditional irrigation schemes
  - Advantages of irrigation mosaics for bio-physical properties could be reduced water-table height, water-table spreading and solute spreading
  - These advantages are dependent on the spacing between, and size of the individual patches.
  - We have designed some tools which give insight into design of such mosaic systems
  - Increased evaporation is a biophysical disadvantage that has been determined
  - The social and economic advantages and disadvantages will need to be determined if such systems are to be adopted.

Conclusions - General

- The principles determined in this work are applicable to existing irrigation systems as well as mosaics
- They give insight into the performance of the biophysical system
- For a specific area the localised conditions would have to be taken into account and other tools used in conjunction with those so far developed
- There is still a lot more to do with development of analytical tools for this and related problems.

CSIRO Land and Water
Freeman Cook
Senior Principal Research Scientist

Phone: 07 3214 2840
Email: freeman.cook@csiro.au
Web: www.csiro.au/group

www.csiro.au

Thank you

Contact Us
Phone: 1300 363 400 or +61 3 9545 2176
Email: enquiries@csiro.au Web: www.csiro.au

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