

Supply and demand for water use by new forest plantations

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¹ Industry & Investment New South Wales (I&I NSW)

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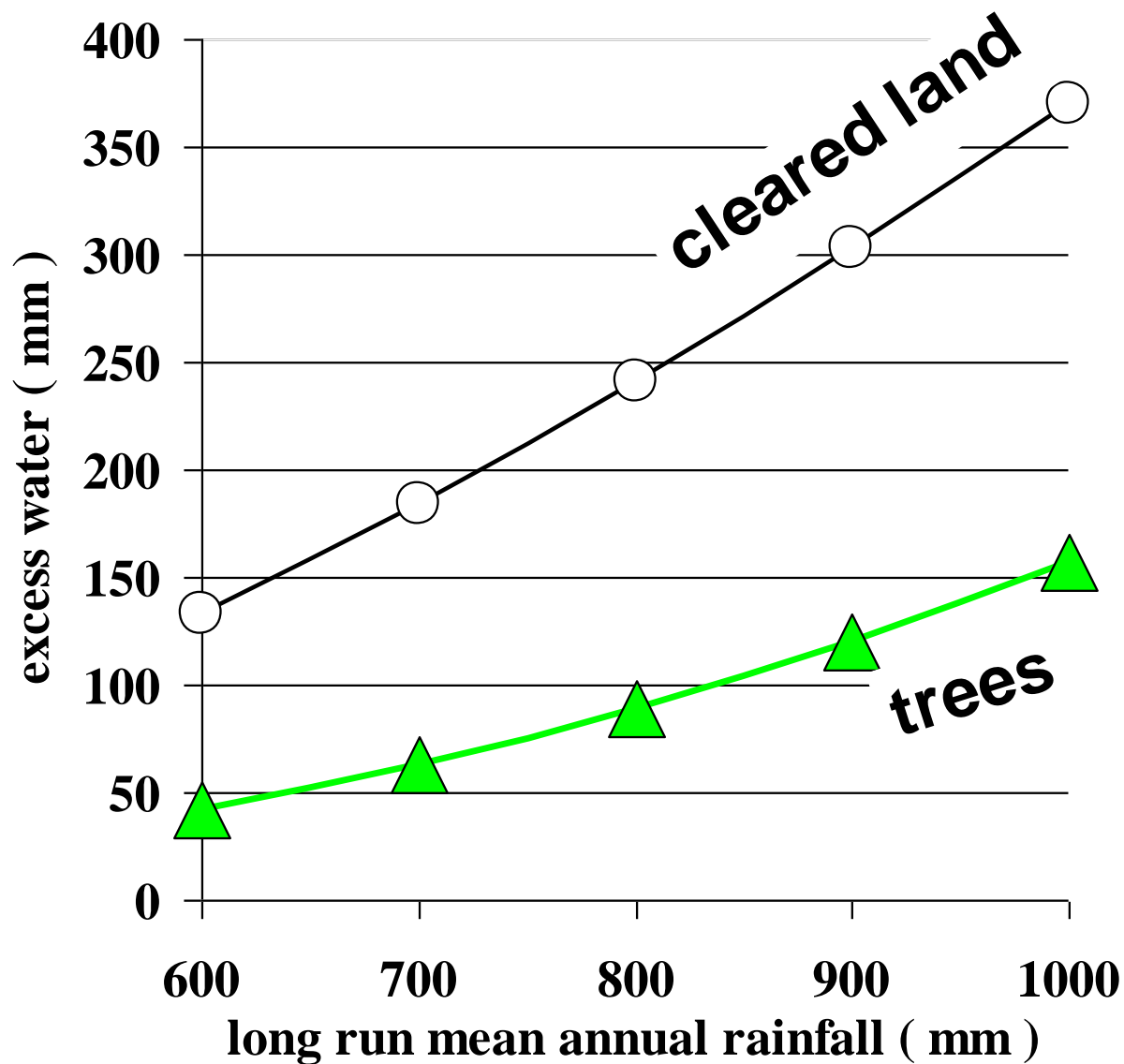
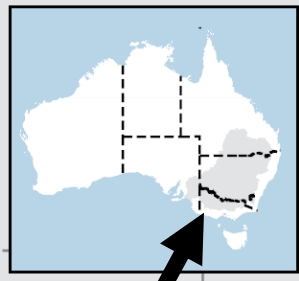


Figure 1. Excess water as a function of rainfall and annual evapotranspiration for different vegetation types (based on Zhang, Dawes and Walker, 2001)

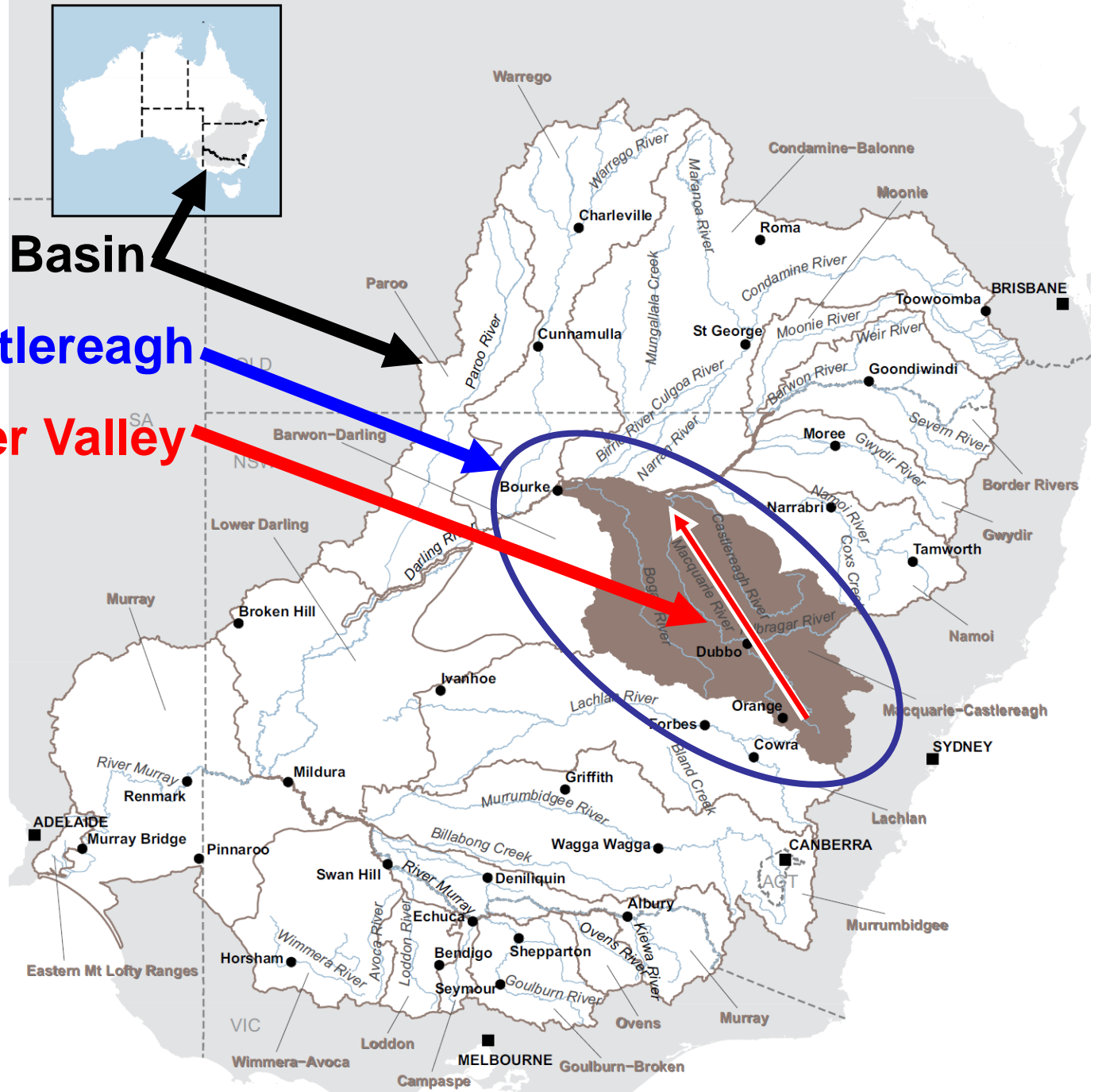
Context:



Murray Darling Basin

Macquarie-Castlereagh

Macquarie River Valley



Map source:

http://download.mdba.gov.au/FactSheet_MacqCastle.pdf

Bourke

ECR

WL

S&D

IRR

MCD

Dubbo

MCUS

MCU

Orange

UC6

UC8

UC10

Bogan River

Macquarie River

Castlereagh River

Talbragar River



Water sources **Rainfall** **Water yield**
 (mm / yr) (GL / yr)

Upper catchment watersheds

UC10	1000	199	→
UC8	800	452	→
UC6	600	339	→

Mid-catchment watersheds

MCU	700	116	→
MCUS (salty)	600	38	→
MCD	600	150	→

Water users	Water use (GL / yr)	
UHS	27	Urban and other high security
IRR	333	Irrigation industry
S&D	27	Stock & Domestic
WL	405	Wetland environs
ECR	502	Effluent creeks and evaporation

Total 1294

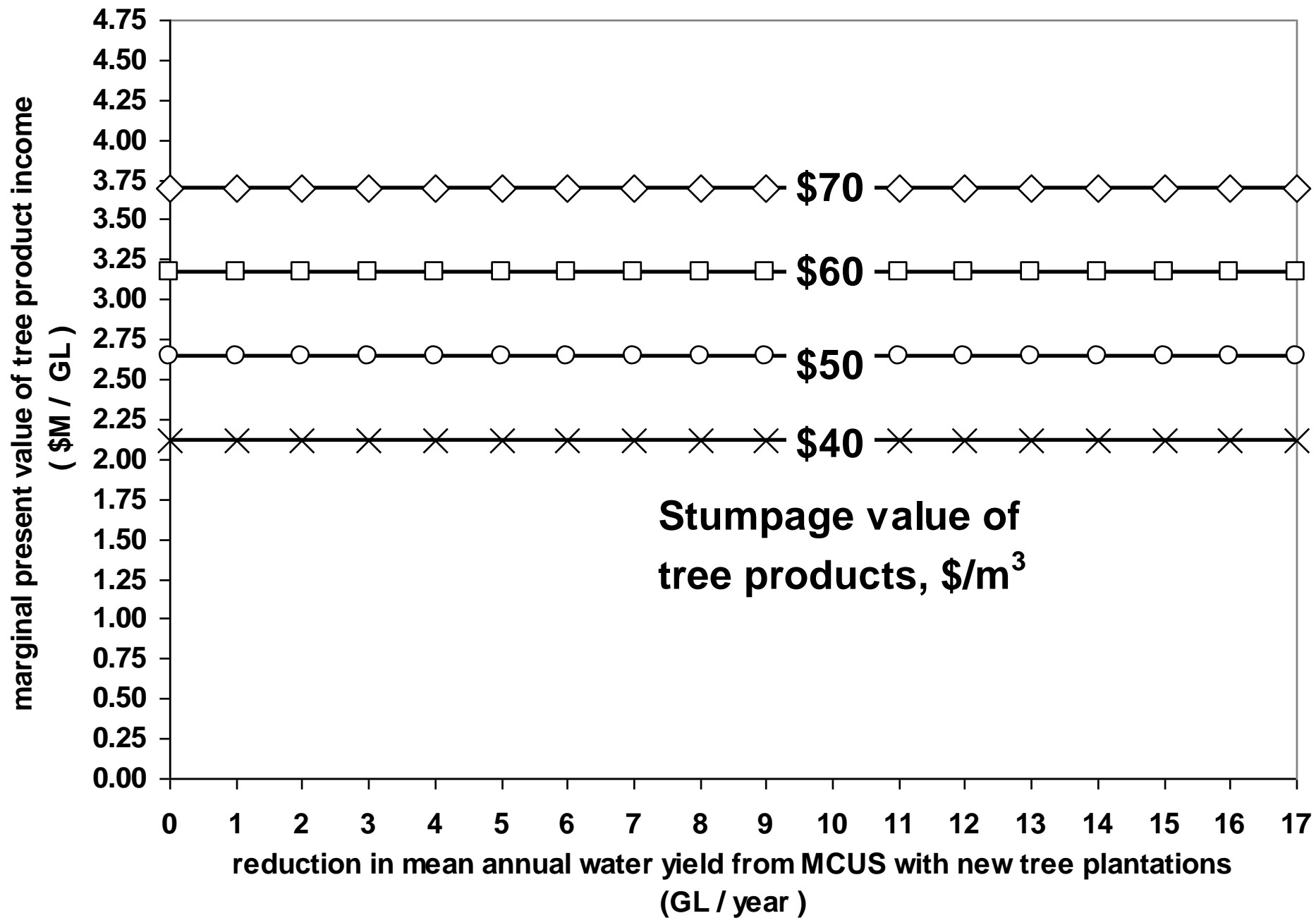
Total 1294

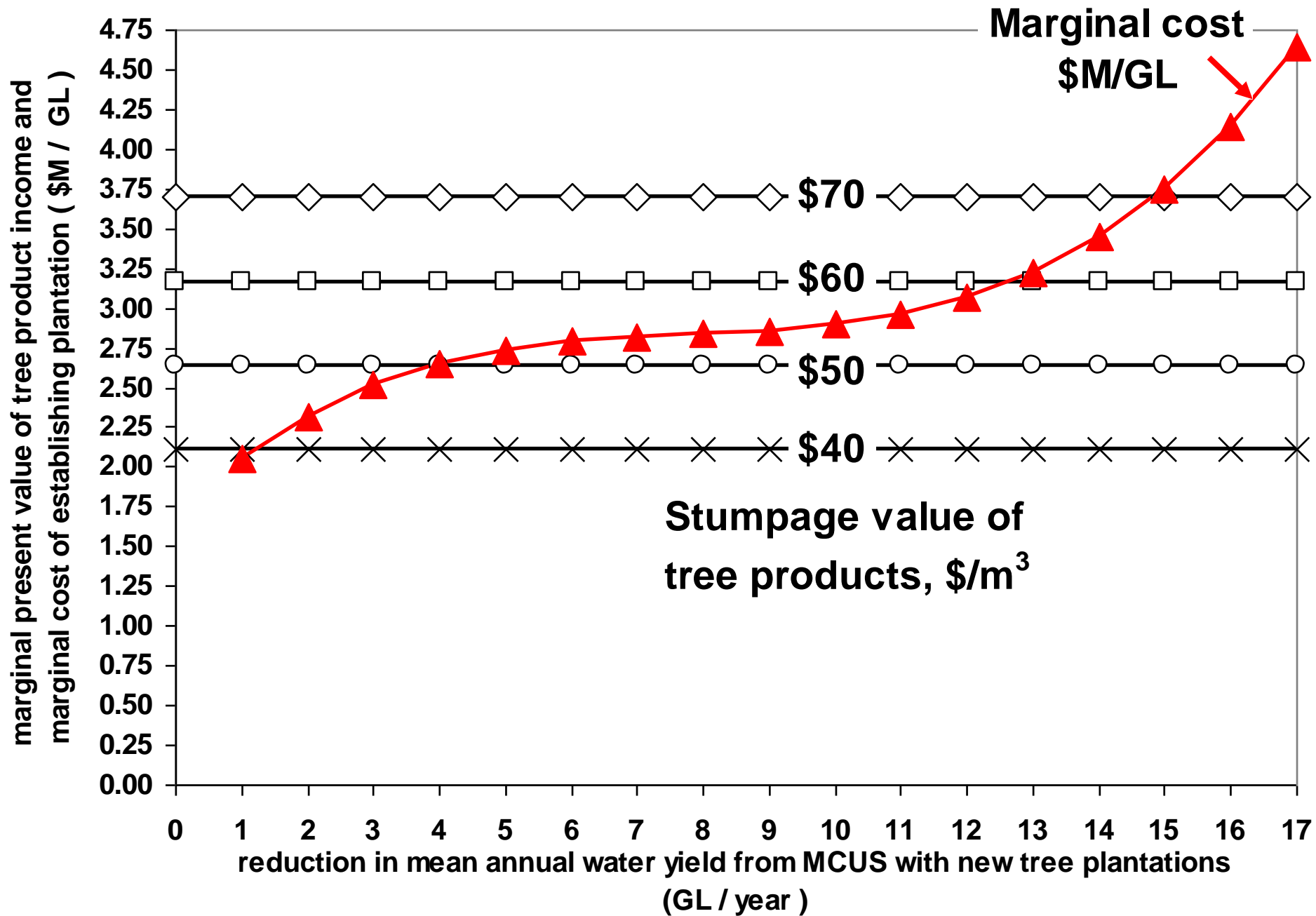
Table 1. Parameters for wood production and additional forest water use by rainfall zone

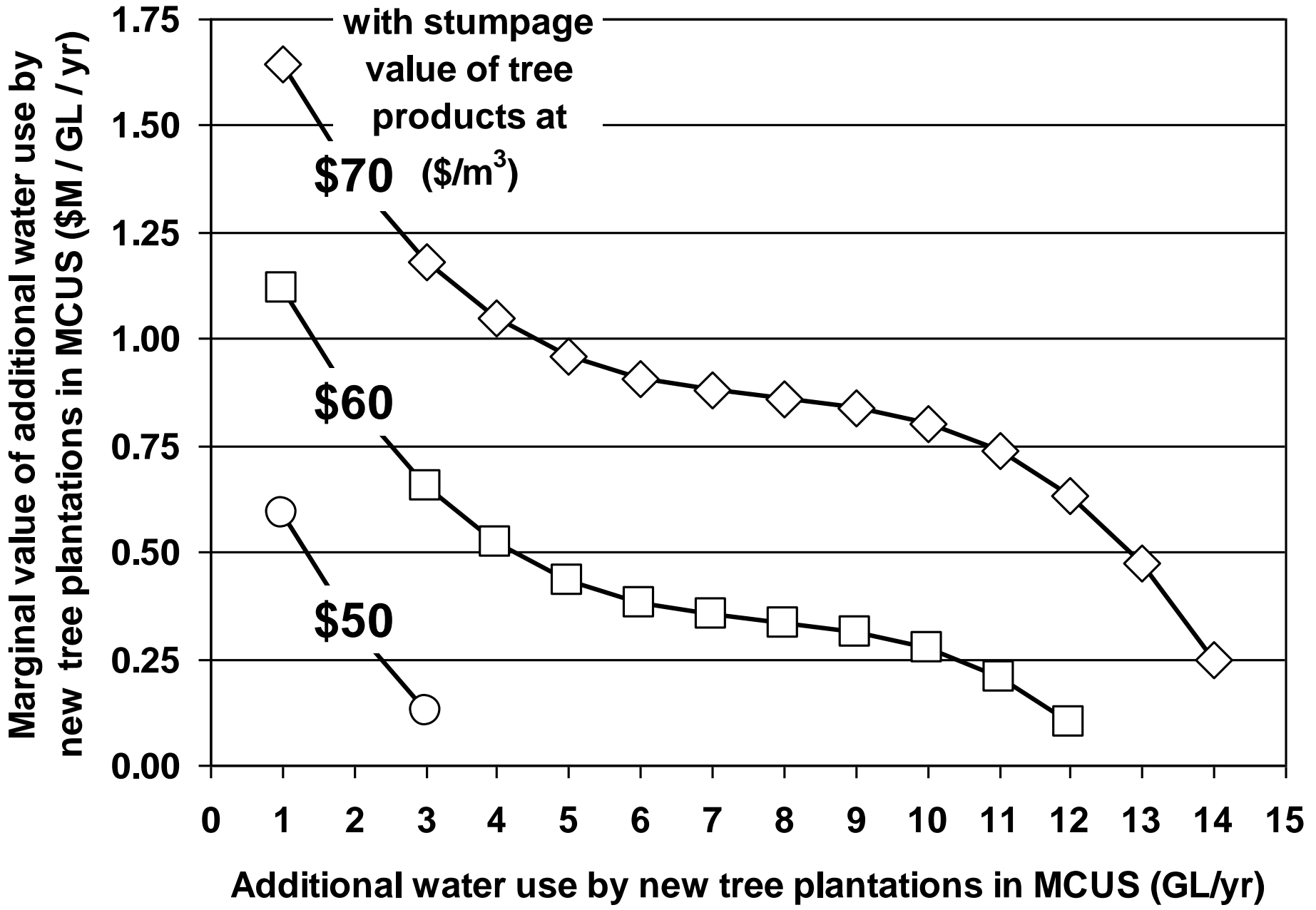
Mean annual rainfall (mm)	MAI* in wood product (m³/ha)	Additional water use (ML/ha) by new tree plantation**	Land / Water use ratio of plantation (ha/GL)
600	8.0	0.597	1675
700	10.5	0.784	1276
800	13.0	0.970	1031
900	15.5	1.157	864
1000	18.0	1.343	744

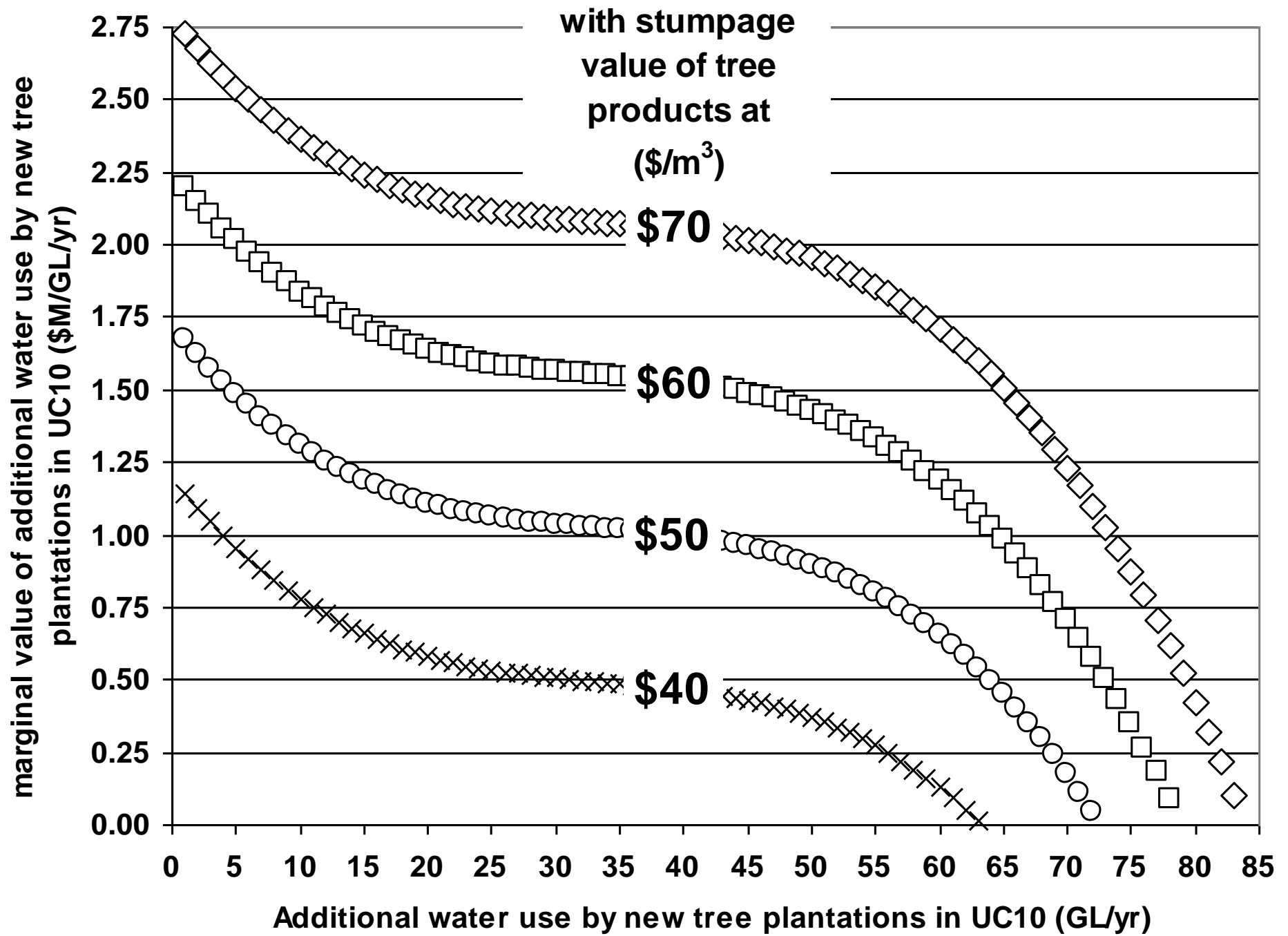
*** MAI = mean annual increment, a linear function of mean annual rainfall in the study area**

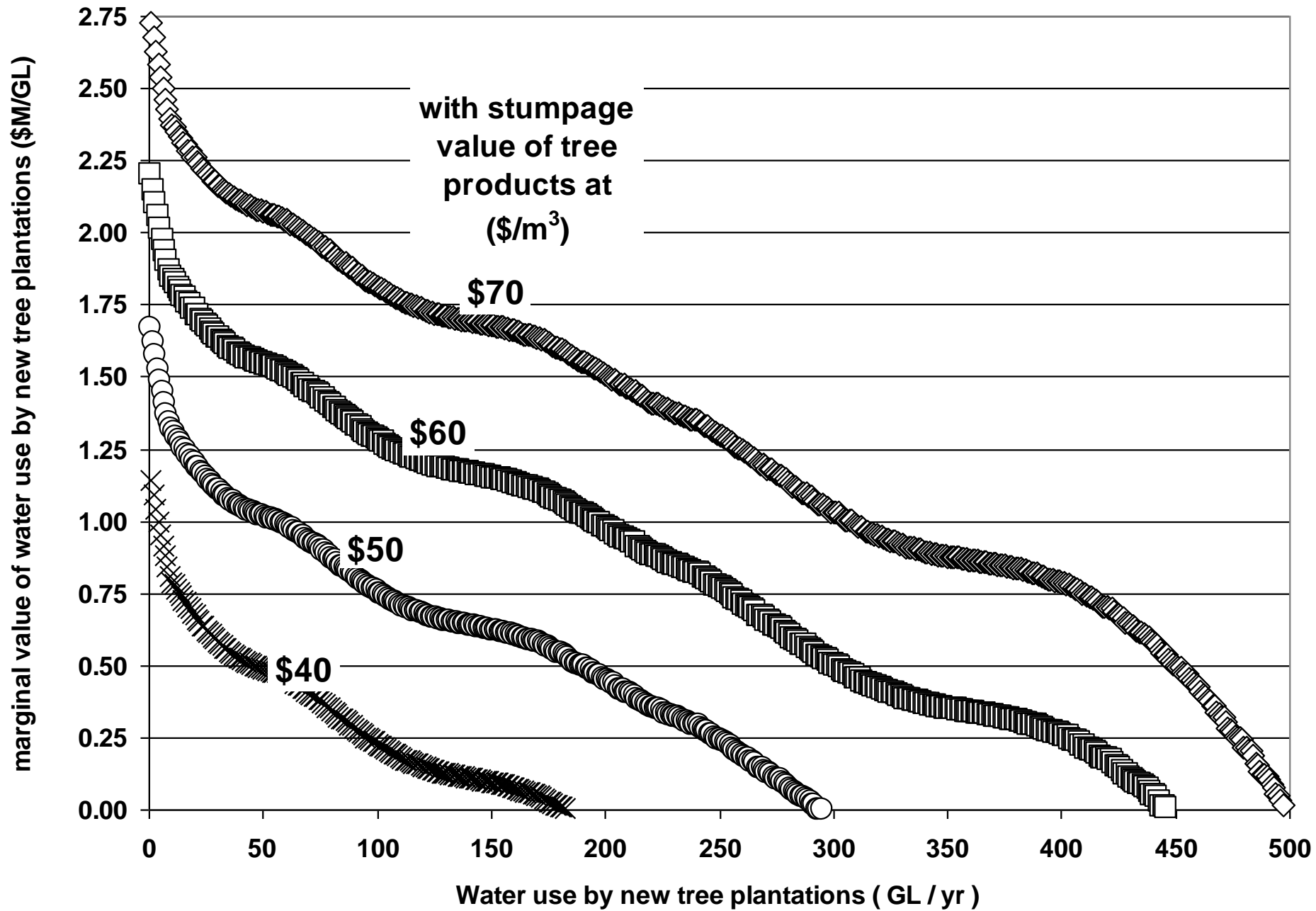
**** values for 600-700mm areas approximated from South Australia's Approval Process For Plantation Forestry under the Natural Resources Management Act 2004. Government of South Australia, Department for Water (2010).**

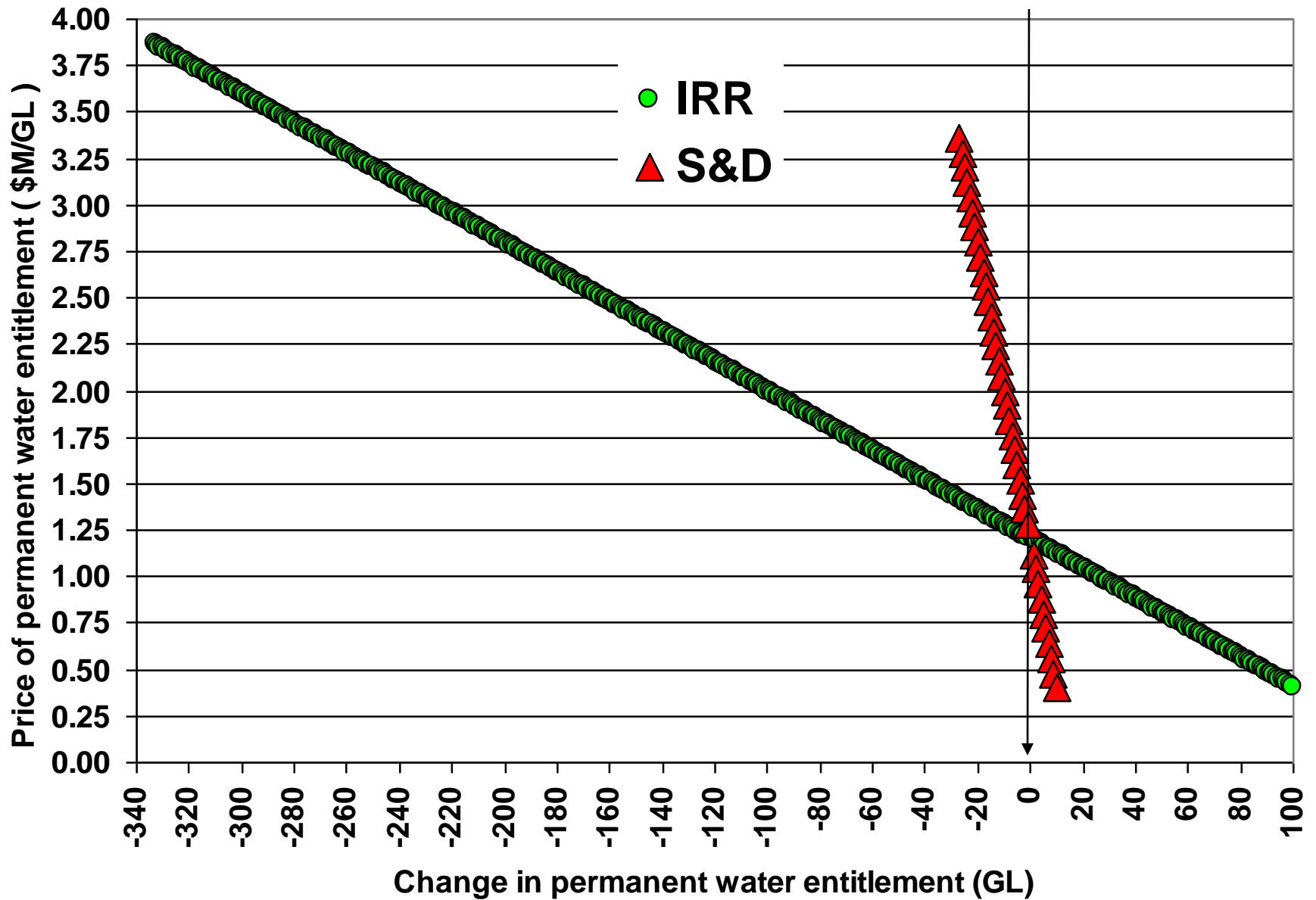




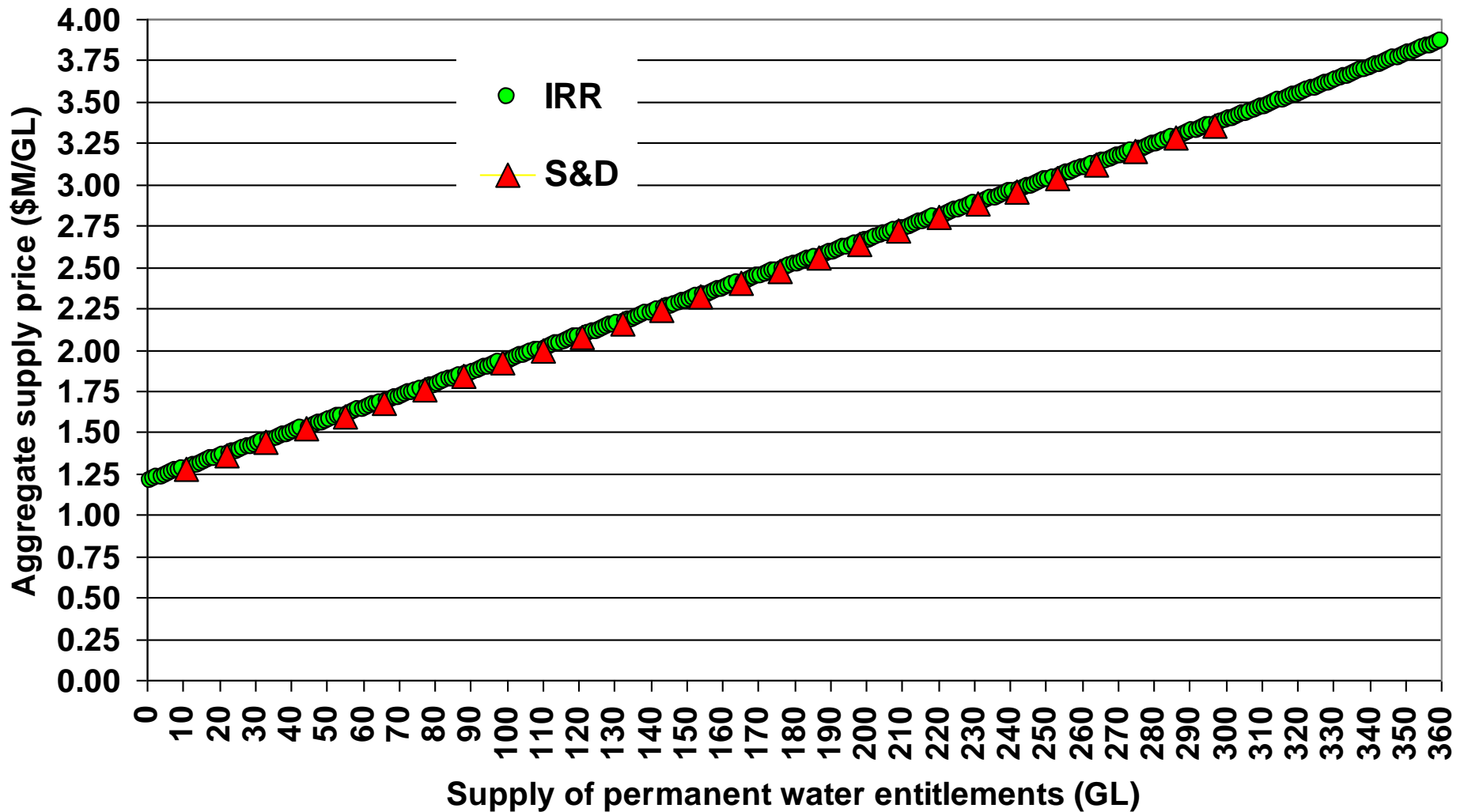




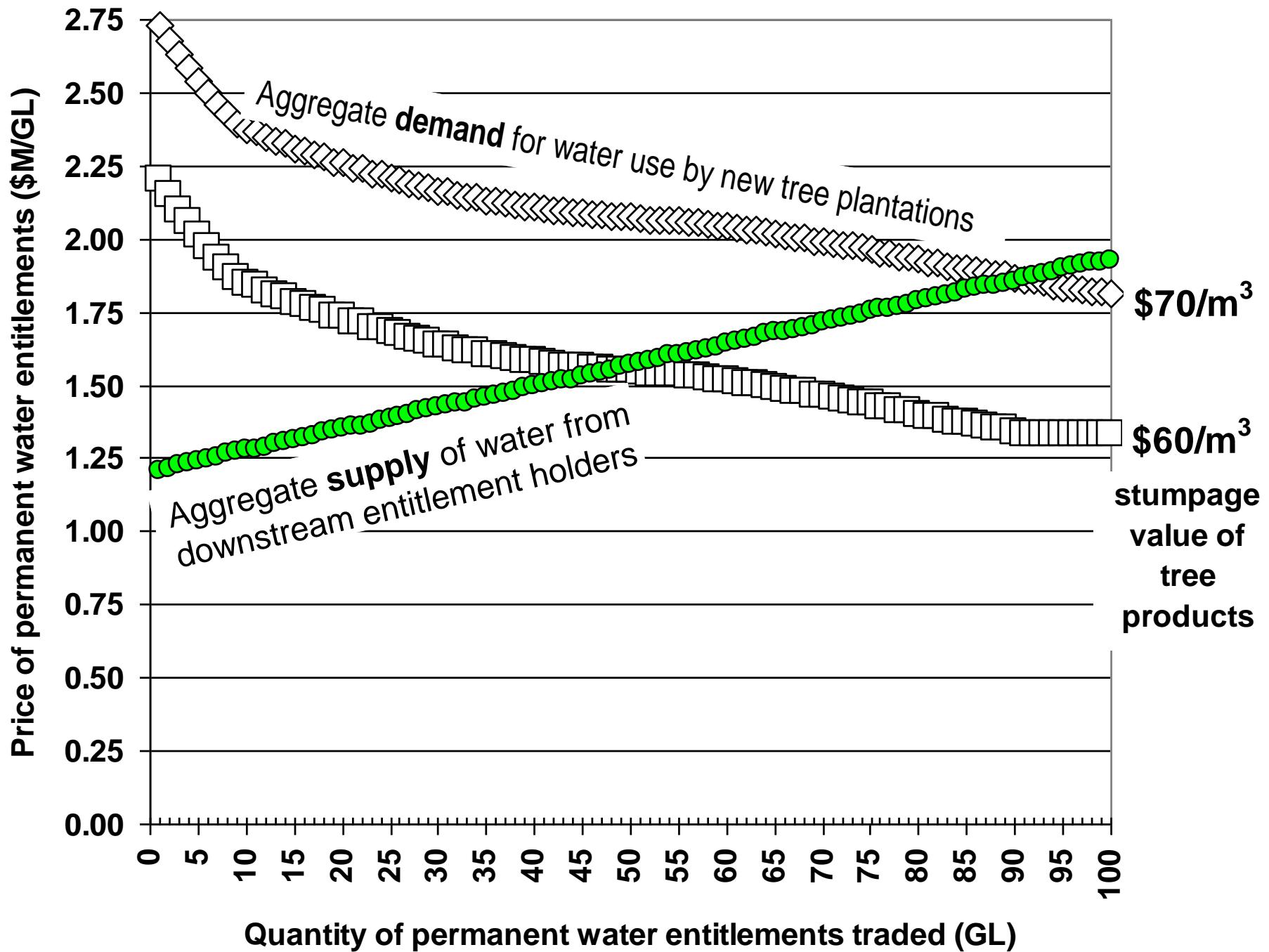




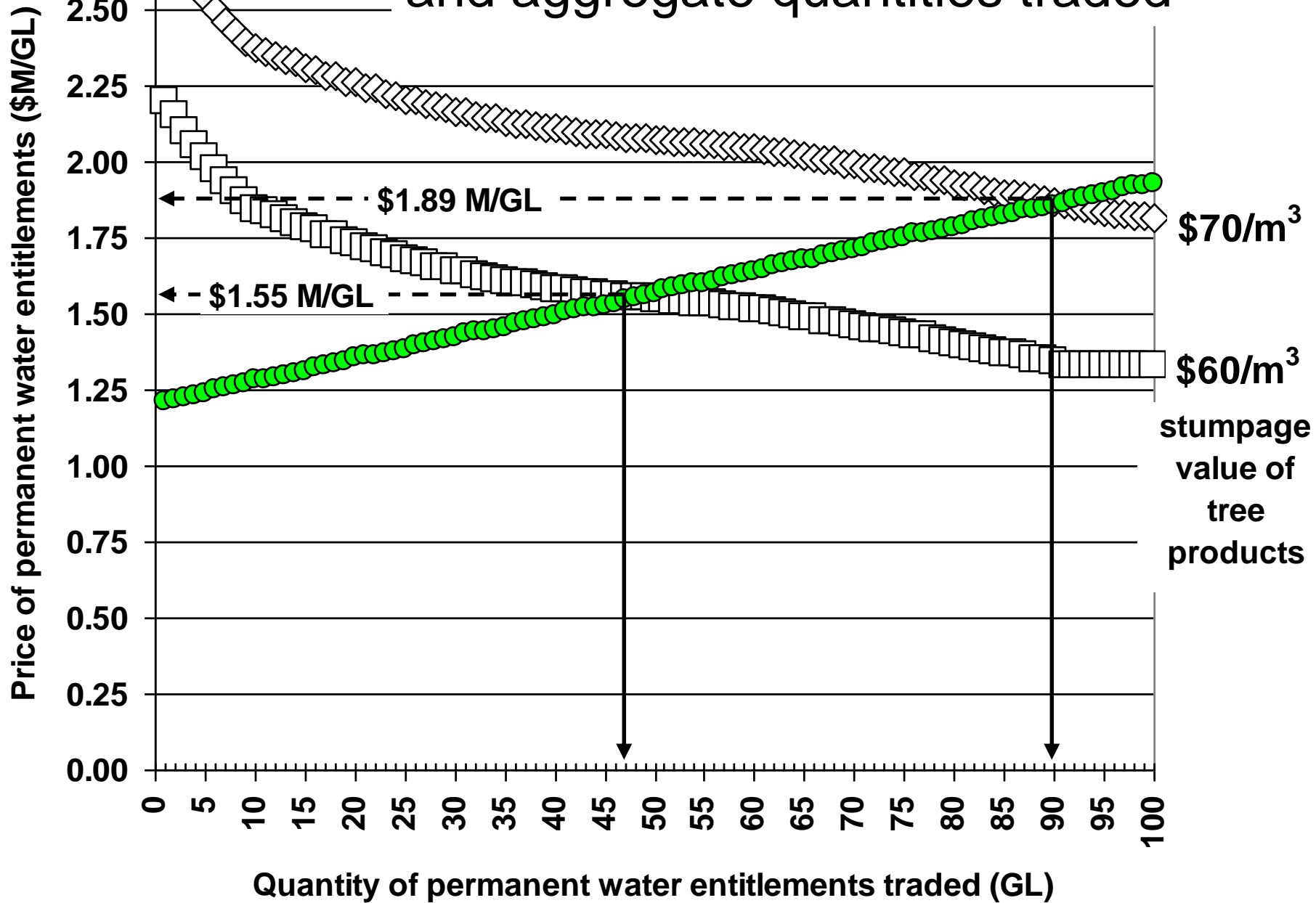
Assumed demand for changes in permanent entitlements to water by downstream **IRR** and **S&D** sectors initially holding entitlements of **333** and **27 GL**, respectively.



Aggregate supply of permanent water entitlements assumed to be the horizontal sum of marginal costs to downstream entitlement holders giving up their entitlements



Equilibrium water prices and aggregate quantities traded

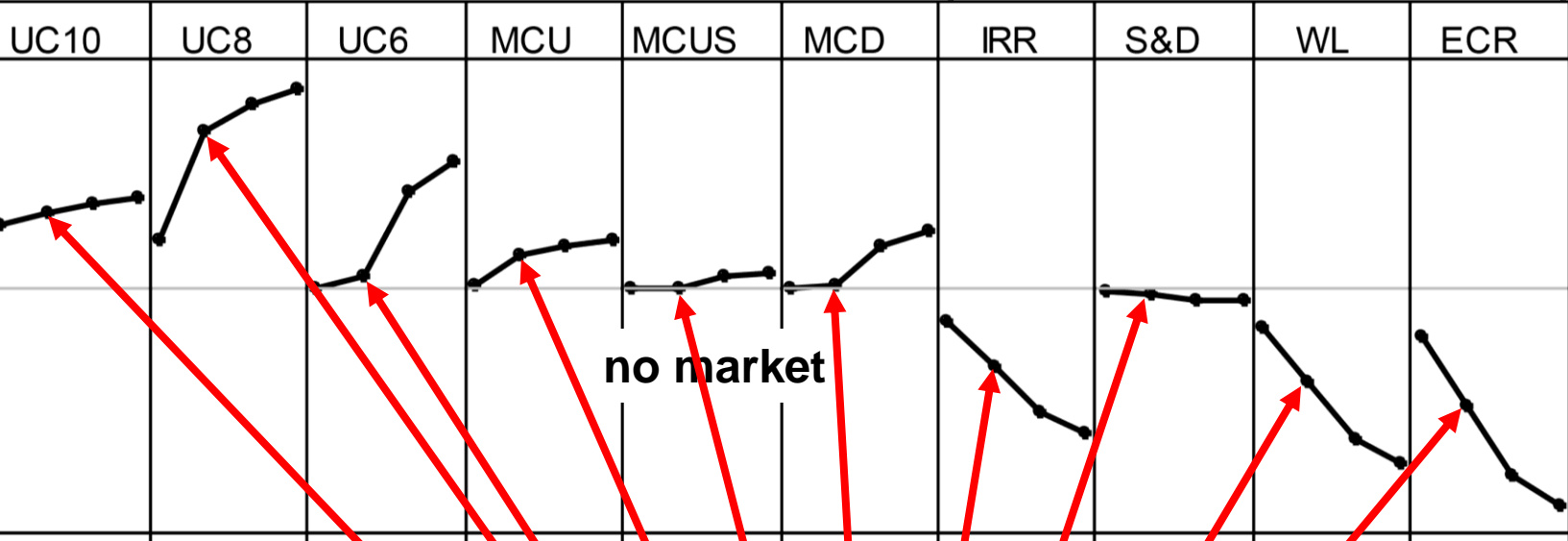


Upstream Watersheds

Upper-catchment

mid-catchment

Downstream Water Uses



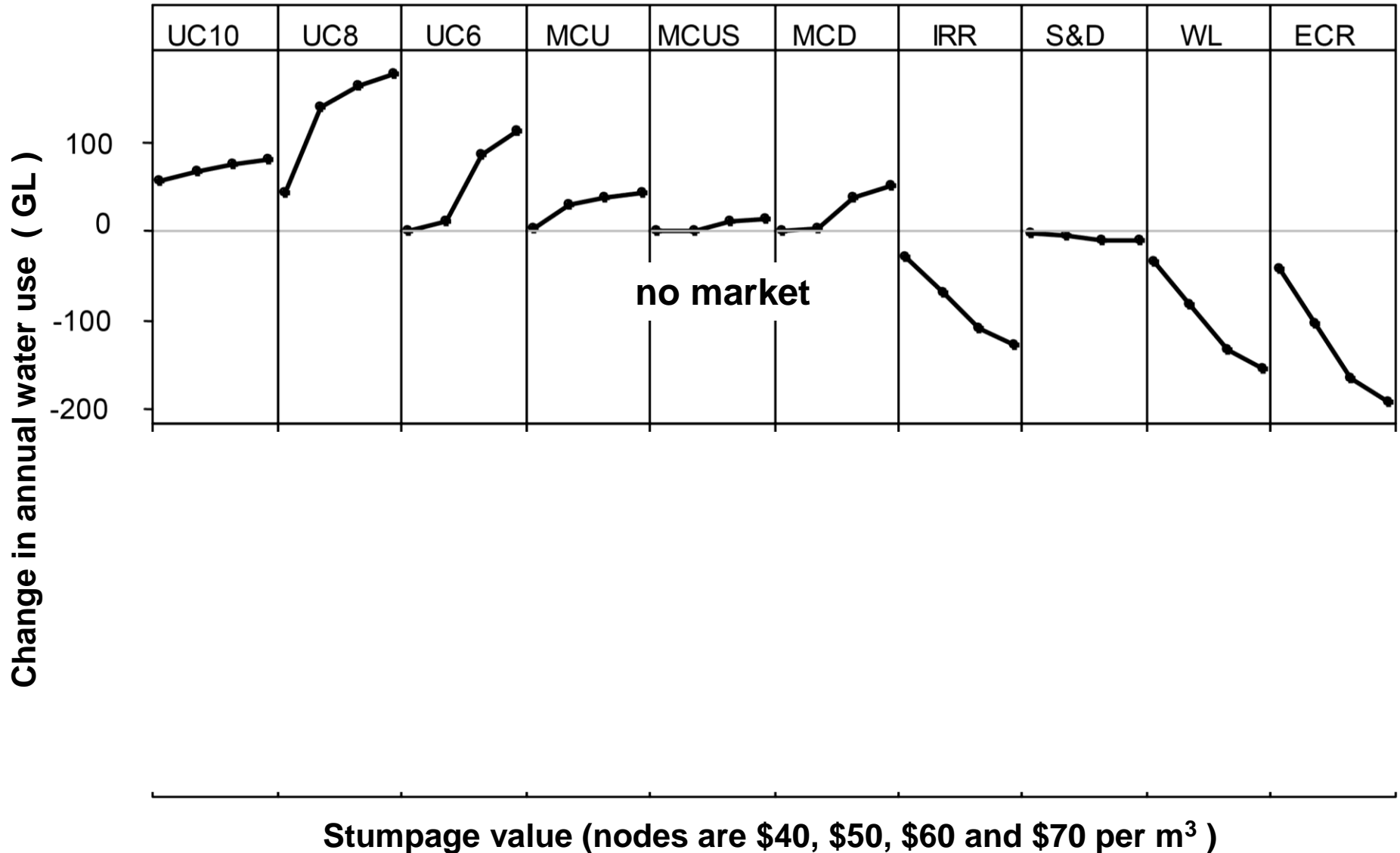
no market

Change in annual water use (GL)

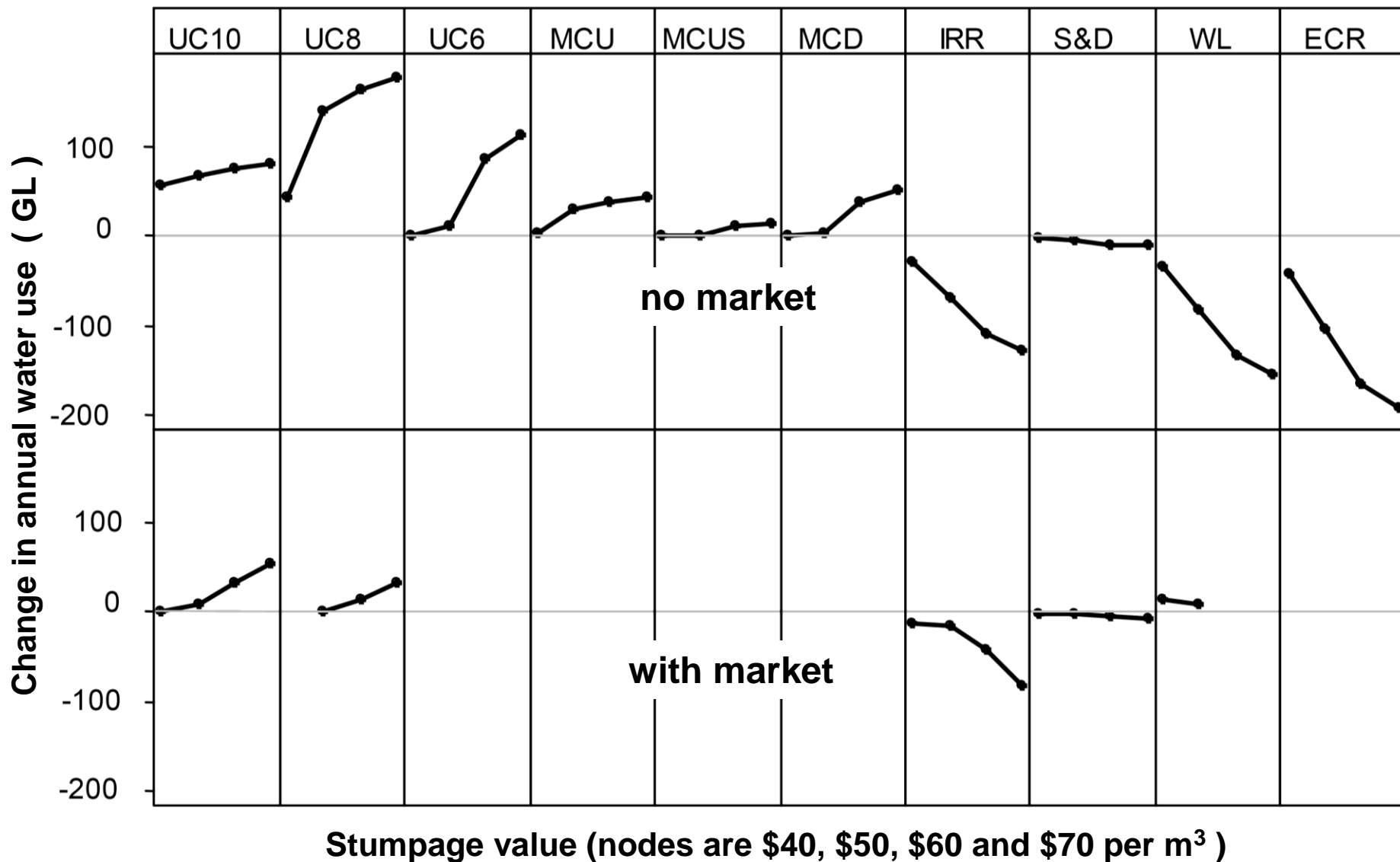
Changes in annual water consumption

Stumpage value (nodes are \$40, **\$50**, \$60 and \$70 per m³)

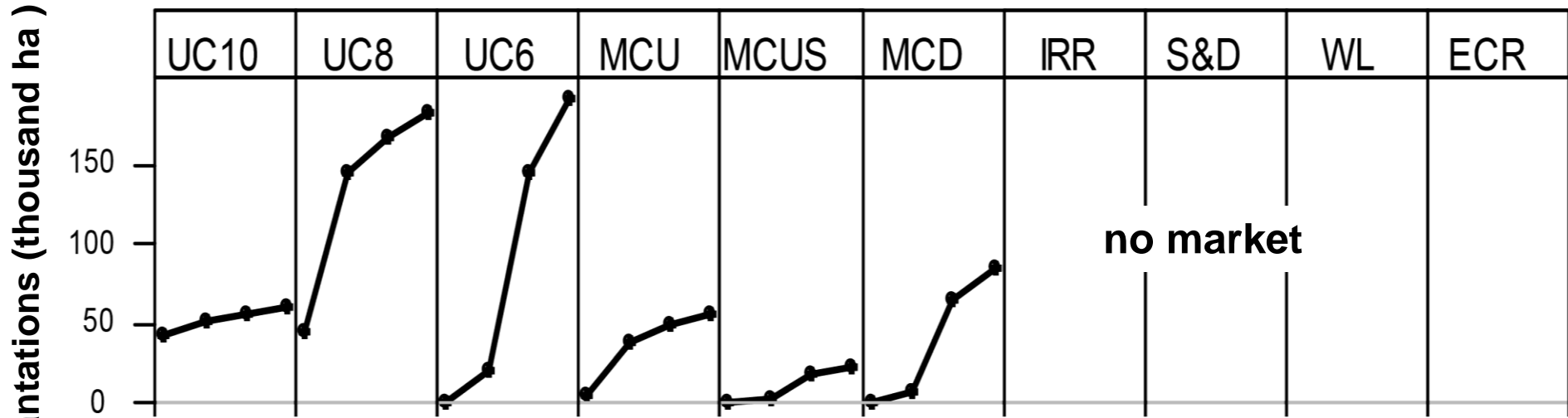
Changes in annual water use



Changes in annual water use

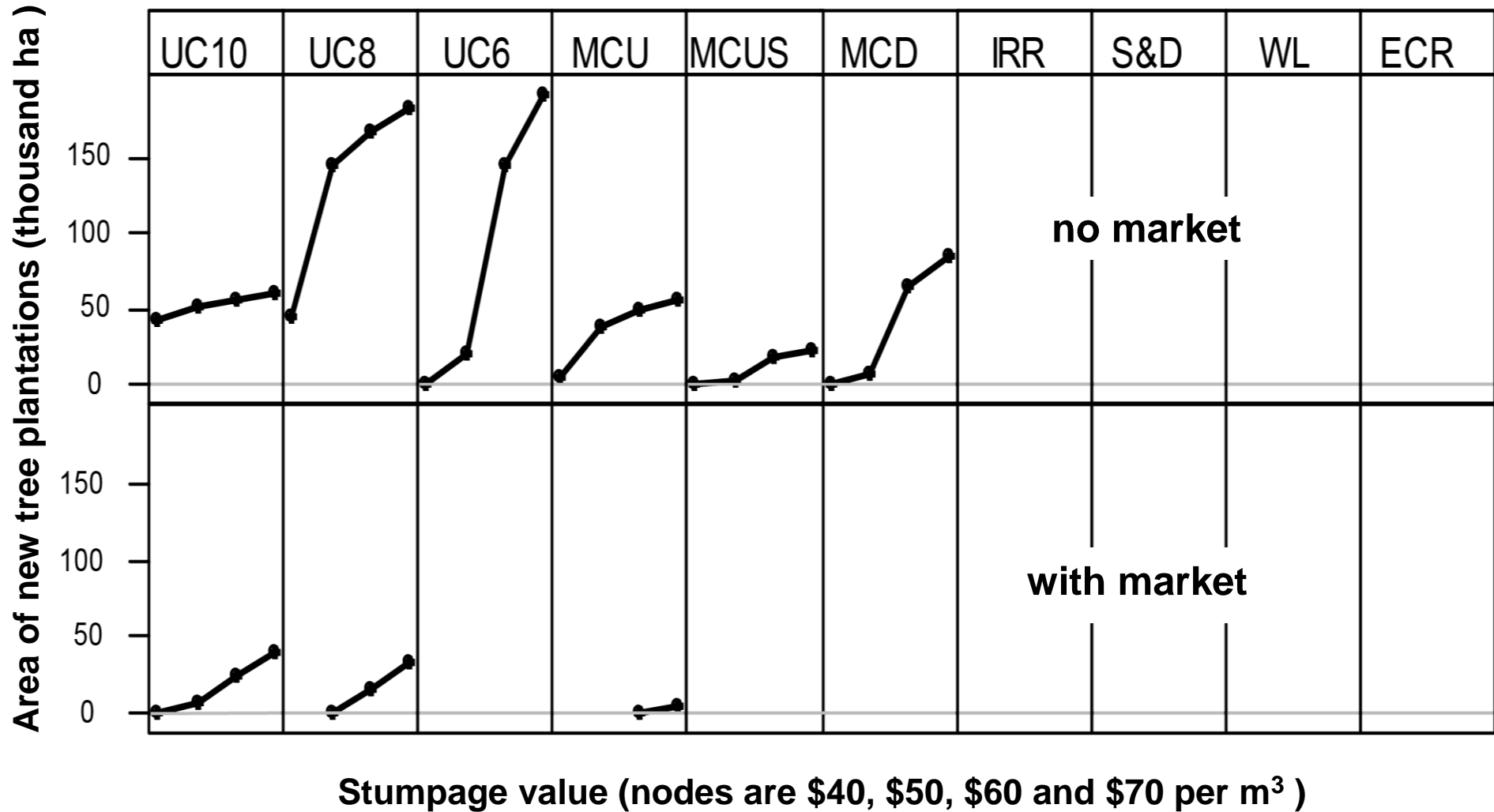


Areas of new tree plantations

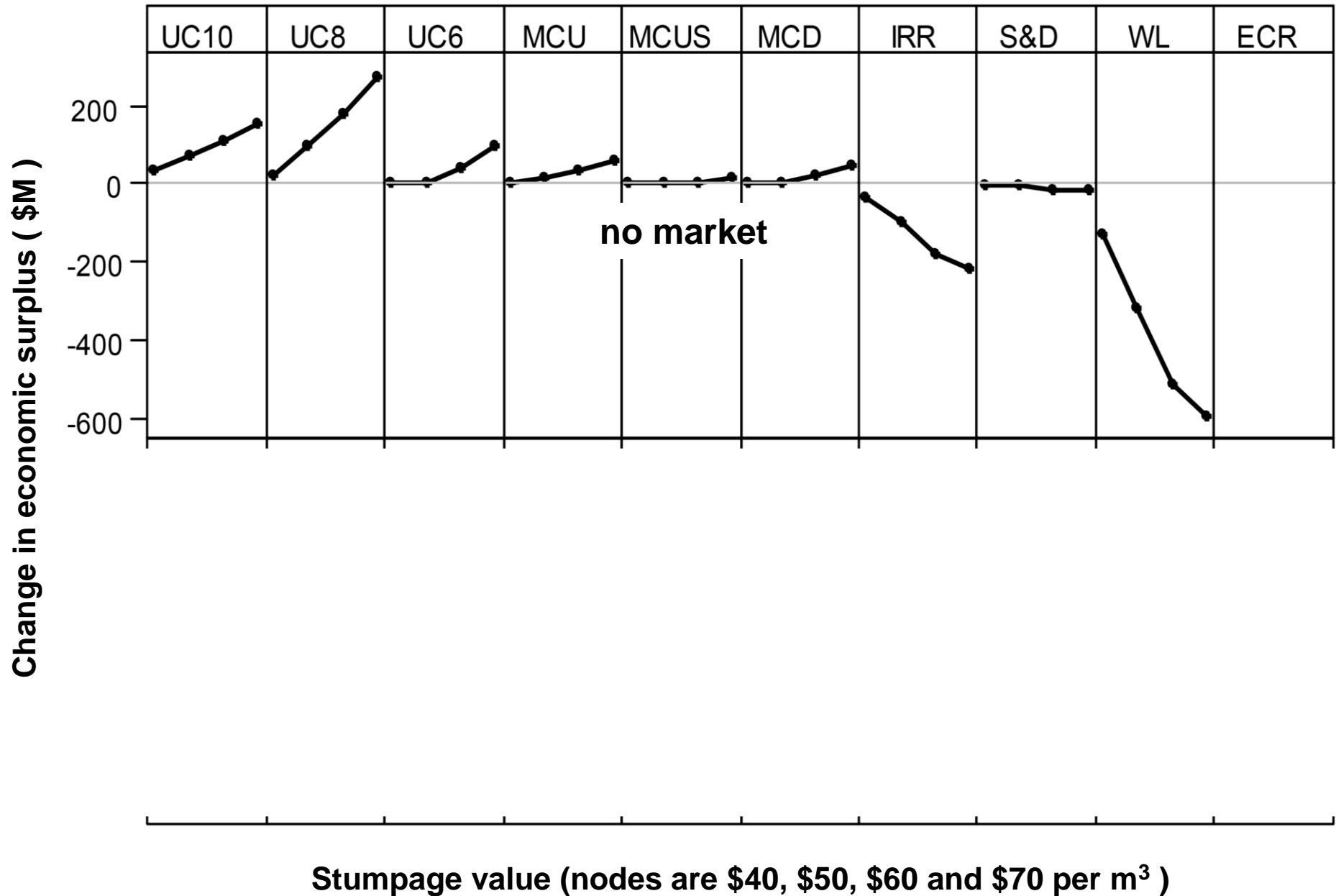


Stumpage value (nodes are \$40, \$50, \$60 and \$70 per m³)

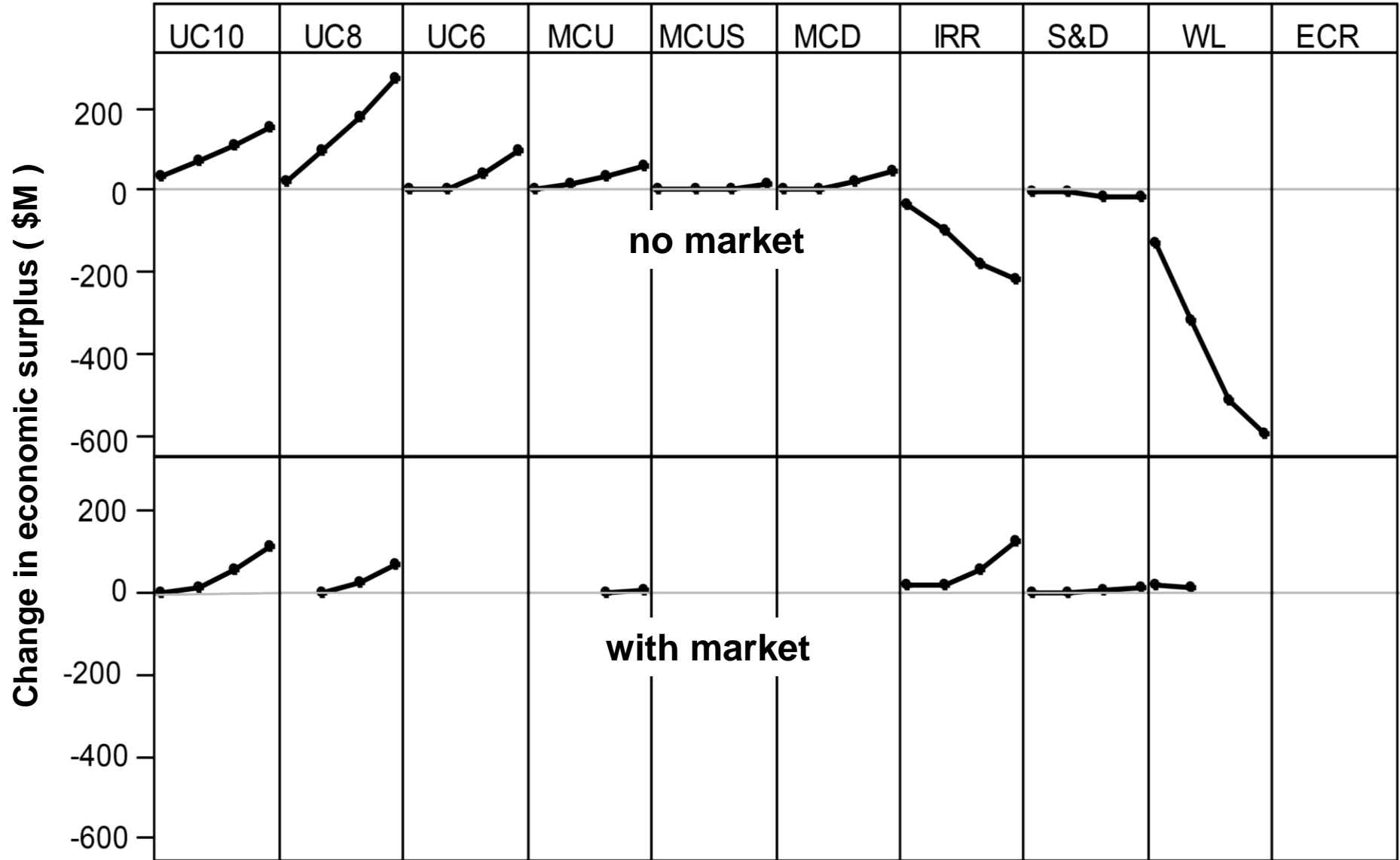
Areas of new tree plantations



Changes in economic surplus



Changes in economic surplus



Stumpage value (nodes are \$40, \$50, \$60 and \$70 per m³)

Summary

- In high rainfall districts, tree plantations are extravagant water users compared to other vegetative land covers.

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- Conflicts arise where a high rainfall district is both a source of valuable fresh river flows and the most profitable location for tree plantations.

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- In high rainfall districts, tree plantations are extravagant water users compared to other vegetative land covers.
- Conflicts arise where a high rainfall district is both a source of valuable fresh river flows and the most profitable location for tree plantations.
- This study quantitatively projects the economic, social and environmental consequences of new tree plantations **without** and **with** the requirement to purchase water rights from downstream holders of water entitlements.

- **Without the requirement to obtain water rights**, high-value tree products could induce expansion of plantation area and reduce river volumes reaching entitlement holders (including urban areas, irrigation industries, stock & domestic water users and environmental wetlands) without compensation for their losses.

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- **With the requirement to obtain water rights**, high-value tree products will induce growth in plantation areas wherever these are profitable using water entitlements purchased from less profitable downstream uses; meanwhile flows to environmental assets can be sustained.

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