Scoping Study
Economic Value of Irrigation in Urban Green Open Space

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Objective

- CRC for Irrigation Futures national Workshop in Sydney 2004 identified a need to establish appropriate technical, social and economic indices that define irrigation efficiency in an urban context
- Solutions for urban irrigation need to be developed not only in a technical context but also in social, economic and political contexts.
- The purpose of this paper is to report on a framework for quantifying these non-technical benefits (social, environmental, non-market values)

Acknowledgements

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  - Ed Mosley – Melbourne University
  - Dena Fam – University of Western Sydney
- Fam, et al. 2008, *Irrigation of Urban Green Spaces: a review of the environmental, social and economic benefits*, CRC for Irrigation Futures, Technical Report 04/08, April. www.irrigationfutures.org.au
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- Project management: Ian Atkinson (CRC Irrigation Futures) and Jolyon Burnett (Irrigation Australia Limited)

Green Open Space in Urban Areas – A Public Policy Issue

- Market Failure – Positive Externalities
  - Benefits not reflected in market prices
  - The good (green open space) is underprovided
- Market Failure – Public Good
  - Non-rivalry – one more person visiting a park will not diminish the space available for others
  - Non-exclusive – once green open space is provided it is not possible (in a cost effective way) to exclude people from enjoying the benefits
  - No incentive for private sector to provide green open space and consequently it's underprovided

Benefits from Urban Green Open Space

- Social values – difficult to quantify
- Environmental values – difficult to quantify
- Financial – mix of observed values, some difficult to quantify
- Heritage – difficult to quantify

Social Benefits from Green Open Space

- Depression/mental health
  - Viewing green space reduces depth of depression
  - Exercising in green space improves self-esteem, anger-hostility, confusion bewilderment
- Preventative health care
  - Outdoor exercise decreases exposure to obesity, coronary heart disease, hypertension, etc
- Recreational & Sporting Use
  - Green space encourages children to be more active and increases curiosity and creativity
  - Green space provides a venue for relaxation, exercising pets, informal social interaction

Social Benefits from Green Open Space - examples

Category of Benefit	Connection to green open space	Basis for benefit estimation	Per unit measure of benefit
Depression and mental health	Viewing green space reduces depth of depression in 65% of patients	800,000 people affected, costing $390 million per annum	Potential saving of $750 per annum per person in medical costs
Preventative health care	Improved health through 1% of inactive adult population becoming sufficiently active	50,000 people affected costing $8 million per annum	Potential saving of $160 per annum per person in health costs
	Parks within one mile radius of home	Proximity to a park increases exercise events by 36 minutes per week.	Potential saving of $65 per annum per person in health costs
Sport	Green space provides a venue for viewing sporting activities, building community cohesion	Admission fees paid by 7 million people to watch sporting events	$294.4 million per annum
	Improved health and fitness for participants.	Costs to maintain sporting fields	$6,900 per ha per annum

Environmental Benefits from Green Open Space

- Air quality
- Climate modification
  - evapotranspiration which cools the air and shading which prevents solar radiation
- Education and information
- Habitat & wildlife
- Hydrological cycle
  - Turfgrass filters sediment and nutrient runoff
  - Canopy reduces water runoff into stormwater
  - Deep root systems reduce salinity
- Soil stability – reduced soil erosion

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Environmental Benefits from Green Open Space - examples

Category of Benefit	Connection to green open space	Basis for benefit estimation	Value of benefit
Clean air	Trees reduce air pollution	Value of each large mature tree.	$20 per tree per annum (US$18)
	Trees reduce utility expenses	Value of each large mature tree.	$50 per tree per annum (US$45)
	Trees reduce stormwater runoff	Value of each large mature tree.	$63 per tree per annum (US$57)
	Trees create aesthetic benefit	Value of each large mature tree.	$93 per tree per annum (US$83)
	Trees provide carbon sequestration services	1 m circumference eucalypt: 322 kgs per tree per annum	Between $1.61 and $6.44 per tree per annum

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Commercial Benefits

- Asset values
  - Parks have an intrinsic real estate value
  - Parks add to the value of neighbouring houses
  - Parks add value to property taxes
- Employment
  - Green open space increase the attraction of a city to the skilled workforce
  - Improves staff morale; provides a venue for staff events
- Industry
  - Employment & income in parks & gardens, sport, turf, etc
- Tourism
- Reduced energy costs

Commercial Benefits - examples

Category of Benefit	Connection to green open space	Basis for benefit estimation	Value of benefit
Maintenance and management	Botanic gardens employment nationally	Wages paid to 1,129 staff to manage 2,971 ha	$53.3 billion total or $17,950 per ha per annum (2007 CPI adjusted)
Community events	Visitors are attracted to events held in parks	Tourists' expenditure	approx $100 per day per person
Property value	Increase in property value due to neighbouring parks	Observed differential in property values	10% increase in value per property affected
Business sales	Lifestyle horticulture sector including landscaping, parks and gardens, golf courses, nursery sales, irrigation equipment.	Turnover	$9 billion per annum
Employment	Urban parks create employment for complementary industries to provide goods and services	Wages paid to staff in direct and complementary industries	$4.1 billion

Benefits from Urban Green Open Space - Case Studies

- Traditional cost benefit framework
- For each set of indicators (social, environmental, economic) estimate the change in benefits from an increase in the area, quality or access to green open space
- Benefits with and without program/policy
- Costs with and without program policy
- Net benefits from change – marginal analysis
- Not measuring employment and income impacts – useful for indicating size/contribution of an industry

Case Studies - Ashfield & Mosman

Characteristics of Open Space	Ashfield	Mosman
Area public open space	5.7%	29.5%
Asset value of community land	$87 m	$232 m
Community land value per ha	$1.8 m	$3.0 m
Operational expense per ha	$41,930	$62,225
Water usage in parks and gardens	312 ML	526 ML
Number of trees in municipality	7,500	39,600
Ha of public space per 1,000 people	1.2	9.7
Population per km^2	4,800	2,900
No of dwellings adjoining parkland	264	509

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Case Studies – Ashfield & Mosman

- Mosman has 5 times more public open space than Ashfield when calculated as a percentage of total area.
- Mosman has 8 times more public open space per 1,000 people than Ashfield.
- Mosman's population density is 60 per cent lower than Ashfield's.
- Mosman community land is worth 40 per cent more than that in Ashfield.
- Mosman has almost twice as many homes adjoining parklands as Ashfield, reflected in real estate values more than 3 times higher.
- Mosman rates higher on all socio-economic and well-being indicators than Ashfield.

Social Indicators

Social Indicators	Ashfield	Mosman
Hypothetical increase in proportion of the population with access to/utilisation of green open space[a]	**5%**	**5%**
Depression & mental health:		
Estimated number of people suffering depression & mental health problems[b]	1,553	1,027
No. of depression sufferers with increased access to green open space	78	51
No. of depression sufferers who experience a significant reduction in depth of depression[c]	50	33
Reduction in depression related medical costs per annum ($m)[d]	0.038	0.025
Reduction in depression related lost productivity per annum ($m)[e]	0.152	0.104
Total potential annual benefit - depression & mental health ($m)	**0.190**	**0.129**
Obesity:		
Estimated number of obese people[f]	6,335	4,204
No. of obese people with increased access to green open space	317	210
No. of obese people who experience a significant reduction in weight[g]	206	137
Reduction in obesity related financial costs per annum ($m)[h]	0.241	0.160
Reduction in obesity related well being costs per annum ($m)[i]	1.093	0.725
Total potential annual benefit - obesity ($m)	**1.334**	**0.885**
Total potential annual benefit from increased provision/utilisation/access to green open space ($m)	**1.524**	**1.015**

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Environmental Indicators

Environmental Indicators	Ashfield	Mosman
Environmental value of existing trees in green open space		
Area of public open space (ha)[a]	48	252
Estimated number of trees in green open space[b]	7,500	39,686
Benefits of existing trees:		
Reduced air pollution ($m)[c]	0.153	0.812
Reduced utility expense ($m)[d]	0.384	2.029
Reduced stormwater runoff ($m)[e]	0.486	2.571
Aesthetic benefit ($m)[f]	0.707	3.743
Total annual benefit ($m)	**1.730**	**9.155**
Hypothetical increase in tree number/area of parks and gardens	**5%**	**5%**
Area of public parks and gardens (ha)[g]	48	39
Estimated number of trees in public parks and gardens	7,500	6,132
Hypothetical increase in number of trees	375	307
Benefits of increased tree numbers:		
Reduced air pollution ($m)	0.008	0.006
Reduced utility expense ($m)	0.019	0.016
Reduced stormwater runoff ($m)	0.024	0.020
Aesthetic benefit ($m)	0.035	0.029
Total annual benefit ($m)	**0.087**	**0.071**

Economic Indicators

Economic Indicators	Ashfield	Mosman
Asset value of green open space:		
Area of public open space - excluding national parks, etc (ha)[a]	47.7	39.0
Council valuation of public open space (community land) ($m/ha)[b]	1.8	6.3
Council valuation of green open space (community land) ($m)[b]	**87**	**245**
Green open space impact on house values:		
Median house price ($m)[c]	0.574	1.900
Estimated house price premium for proximity to parklands[d]	10%	10%
Number of residences adjacent to public open space[e]	264	509
Portion of house value attributable to green open space ($m)[f]	**15**	**97**
Total impact of green open space on asset values ($m)	**102**	**342**
Hypothetical increase in quality/area of parks and gardens:	**5%**	**5%**
Increase in capital value of community land ($m)[g]	0	0
Increase in capital value of houses ($m)	0.758	4.836
Total increase in capital values ($m)	0.758	4.836
Annualised measure of increase in capital value ($m)[h]	**0.057**	**0.364**

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Net Annual Benefits

Social, Environmental and Economic Indicators	Ashfield	Mosman
Hypothetical increase in quality/area/access to parks and gardens	5%	5%
Benefits ($m)		
Total Social Benefits	*1.524*	*1.015*
Total Environmental Benefits	*0.087*	*0.071*
Total Economic Benefits	*0.057*	*0.364*
Additional benefits from increased area/access to green open space	**1.668**	**1.450**
Costs ($m)		
Increase in maintenance costs per annum[d]	0.243	0.235
Other costs	0.000	0.000
Additional costs from increased area/access to green open space	**0.243**	**0.235**
Net Annual Benefits (Benefits - Costs, excludes capital and other costs)	**1.425**	**1.215**
Benefit Cost Ratio (excludes capital and other costs)	**6.9**	**6.2**

Conclusions

- Several areas identified for further research.
  - Estimating benefits from urban green open space
  - Relationship between access to green open space (from hospitals, nursing homes, workplaces, etc) and health and social outcomes
- Policy issues
  - Clear case of market failure in provision of green open space because of the non-market values it can provide
  - Poor recognition of benefits can lead to poor policy e.g. Grafton & Ward (2007) showed a loss of welfare of $245m in 2004 from mandatory water restrictions – could be avoided using appropriate price signals
- Consistent measurement of benefits – need to avoid double counting & inappropriate aggregation

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