Corporate Social Responsibility and Environmental Management
Corp. Soc. Responsib. Environ. Mgmt. (in press)
Published online in Wiley InterScience
(www.interscience.wiley.com) **DOI**: 10.1002/csr.102

Accounting for Suburban Tree Information Systems

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ABSTRACT
Suburban trees are things of wonder and of utility, yet accounting has systematically failed to account for them despite the availability of information technologies that could assist in trees' measurement. Taking a utilitarian view of the value of trees, this paper posits a way of accounting for suburban tree information systems, which not only follows the traditional accounting practices of the Australian Standards Setting Board, but also encompasses the idea of sharing ideas from the disciplines of the environmental sciences and computerized informational systems. By using information technologies, local councils and business entities may be able to account for suburban trees as non-current assets, and thereby improve the lot of conscripted investors who seek information for decision-making and accountability. Copyright © 2006 John Wiley & Sons, Ltd and ERP Environment.

Received 21 April 2005; revised 22 June 2005; accepted 26 July 2005
Keywords: suburban trees; AASB; Australia; value of trees; non-current assets; current value method; environmental science

Introduction

THIS PAPER FOCUSES ON DEVELOPING AN ACCOUNTING AND INFORMATION SYSTEM OF SUBURBAN-tree accounting for Australian local councils, public utilities and business entities for the use of multiple stakeholders and, in particular, the suburban dwellers of Australia. Despite the relative openness of Australia (Bharuha and Kent, 1998) and its status as the world's tenth largest OECD economy (European Parliament, 2004) and the world's sixth largest country by land area (Geoscience Australia, 2004), it has been remarkably slow to develop an innovative and expansive approach to account for its environment. In part, this approach may be explained by the narrowness of the composition of the Australian Accounting Standards Board (Brown, 2006) and its unwillingness to tackle major issues of community obligations, but in truth the lack of ideas may stem from Australians' lack of knowledge about themselves and their environment (Greer, 2004).

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Australia's area of mainland and small fringing islands covers some 7692024 sq km, and while its total population is small (20 million people) its population density is very small (fewer than 2.5 people per square kilometre) (Geoscience Australia, 2004). Yet this average population density figure is slightly misleading since most Australian residents live in a suburb near the coast rather than in a country town or a mining community (Australian Bureau of Statistics, 2003), which, of course, means that the population density in suburbs is relatively high.

Within these suburbs, a great many trees grow, and this paper devotes its pages to examining how accountants of business firms and local governments, the gatekeepers of local environmental issues in Australia (Burritt, 1999), can account for the trees that reside in their Australian suburbs. This examination takes into account the instruments of the environmental sciences – image processing, geographic information systems, photogrammetry and their allied techniques: remote sensing, satellite technology, productivity indices and data processing – which may assist accountants to accurately measure the service potential of suburban trees.

Quite naturally, the subject of suburban trees touches upon the issue of environmental accounting, which has become an area of interest since the 1970s, gaining particular attention during the 1990s with the Kyoto protocol (Gibson, 2000). Environmental accounting has many meanings. In one sense, it conveys an instrumental purpose, accounting or reporting for internal decision-making, such as cost estimations and investment appraisals. This is predominantly carried out for financial and management accountants. In another sense, it accounts for the use of natural resources as externalities, providing social information to both internal and external stakeholders of the reporting entity. Here, voluntary disclosures of environmental information may be used by the entity to legitimize its actions to a discerning public or simply to satisfy the expectations of key stakeholders. In yet another sense, it informs internal and external users about the financial valuation of aspects of the natural environment. This may be reported at the macro-level on national accounts (Gibson, 2000) as well as at the micro-level in entities' annual reports, but the key purpose is to assist in the value of land and thereby calculate macro-issues such as national wealth or micro-issues such as consideration for purchase transactions.

This study focuses on these instrumental, informational and valuation aspects of environmental accounting. It does not focus on ecopreneurship (Isaak, 1998), which suggests an increasing need for environmental responsibility in entrepreneurship. Nor does it seek innovation in an entrepreneurship, which strikes for a union between conservation and stock market capitalism (Volery, 2002). Rather, it provides a means of delivering accounting stewardship of a suburb's natural resources, which could be utilized by accountants, so that the community can be informed of the accounting of suburban trees. The Australian Bureau of Statistics (2003) already recognizes the complex relationship between the environment and the economy:

> The environment provides the raw materials and energy for the production of goods and services that support our lifestyles, but it also sustains damage through the activities of households and businesses. The national accounts are sometimes criticised for including the value of goods and services produced and the income generated through the use of environmental assets, but not reflecting the economic cost of depleting those assets or the damage that arises from economic activity (Australian Bureau of Statistics, 2003; p. 1).

However, behind this recognition lies a milieu of unresponsive accounting practice towards environmental issues. Accountants are not, according to some (Gray *et al.*, 1996), an innovative group. They are reluctant to perform new initiatives without guidance (Brown, 2006) and they are generally too busy with conventional work to take on environmental accounting initiatives with any gusto (Gibson, 2000). Some accounting researchers go so far as to say that most accountants do not consider environmental

DOI: 10.1002/csr

issues relevant to their profession (Medley, 1997). By adopting a very narrow procedural definition of environmental accounting, financial and management accountants are able to eschew their responsibility to account for trees by pointing to the lack of guidance on these matters from the International Accounting Standards Board (IASB) or the Australian Accounting Standards Board (AASB). Indeed, Brown and Shardlow (2005) found that the very narrow composition of IASB's membership and its funding by multinational corporations, Big Four accounting firms and elite stock exchanges ensured that critical issues, such as credible environmental standards, would seldom be considered. Critical accounting literature has, of course, detected the roots of this neglect and put forward the idea of advancing the craft of accounting so that it accounts for externalities by opening up new fields of interest (Cooper *et al.*, 2003) and research (Everett, 2004). This paper contends that by sharing the technical systems of other professions the accounting profession could enhance its environmental reputation by reporting on this important environmental issue. As such, this paper could be of interest to the business community, councils and local governments, accounting standard setters, environmental groups, householders and those with a desire to be more informed about environmental issues.

A fundamental assumption taken by this study is that the accounting profession generally takes a marginalist, neo-classical interest in the natural environment. Accordingly, this paper adopts a utilitarian view of trees rather than an aesthetic or ornamental one to accommodate the accounting profession's view of the world. The non-utilitarian aesthetic qualities of the natural environment have been studied in a number of accounting contexts (Medley, 1997) and raise importance issues about non-environmental values. For example, environmental aesthetics extols the decorative, ecological, ornamental and spiritual qualities of trees, which accounting professional bodies have always been reluctant to recognize, disclose or measure (the lack of both Australian and international environmental accounting standards on these values is resoundingly silent). Aesthetics is a field of philosophy that studies ways in which humans experience things through their senses (Carlson, 2002). It is especially concerned with the appreciation of particular items, objects and matter when they strike the senses in an agreeable manner (Carlson, 2002). Whilst important in their own right, non-environmental issues fall outside the main scope of this study; the full beam of the utilitarian viewpoint is given scope instead.

The structure of the paper is as follows. The following section explains the value of trees through a utilitarian lens. The next section considers the categorization of suburban trees as non-current assets and the way in which suburban trees satisfy the three major elements of the non-current asset definition. This section also examines the application of AASB 1015 and AASB 1021, and five possible measurements for suburban trees: historical cost, current value, net market value, replacement cost and deprival value. The fourth section argues how data gathering techniques from the environmental sciences and computerized informational systems may provide the accountant with the apparatus to measure the current values of suburban trees accurately. A summary is presented in the last section.

The Value of Trees

Trees, of course, are things of wonder (Monbiot, 2004), but this paper emphasizes their utility. There is a considerable literature within the arboreal scientific community that extols the benefits of trees (Chase-Dunn and Weeks, 2004; Isaak, 1998; Norton, 2003; Nowak, 2002). Trees benefit suburbs through energy conservation, erosion prevention, pollution removal, shelter, soil enhancement, storm water retention and windbreaks (UWC, 2004; Haines, 2001; Sungei Bulch Nature Park, 2000).

During the process of photosynthesis, trees take in carbon dioxide, use it to grow and produce oxygen as waste (Stewardwood, 2004). As a consequence, trees help to maintain low levels of carbon dioxide, thereby reducing the greenhouse effect, which threatens to make the Earth uncomfortably warm (Volery,

DOI: 10.1002/csr

2002). They do this by holding carbon within their structure, where it remains until the tree decays or burns (CoolCommunities, 2004). This is a particularly important function, considering the intense burning of fossil fuels, made from decayed plants, in suburban areas by business activities, which releases massive quantities of carbon dioxide into the atmosphere. It is, of course, this release of carbon dioxide, one of the main greenhouse gases, into the atmosphere that increases the heating of the planet caused by the greenhouse effect (Bharuha and Kent, 1998).

In addition to reducing carbon dioxide, trees reduce air pollutants such as lead and sulphur dioxide from industrial and vehicular emissions (Abdulla, 1999). They remove the atmosphere's dust by filtering and trapping it on the leaves to be washed away by rain to the soil. In roads without trees the amount of dust can be four times higher than those with trees (Stewardwood, 2004). During photosynthesis, trees give off oxygen; e.g., a single mature beech tree may meet the daily oxygen requirement of ten people; 2700 saplings could do the same (Stewardwood, 2004).

Trees also provide wind-breaks and shelter. Energy savings are made on both summer and winter fuel expenses by the planting of suburban trees (National Arbor Day Foundation, 2004). During summer, the shade from trees reduces the need for air-conditioning, and in winter trees break the force of winds, reducing heating costs. Some studies have shown that parts of cities without cooling shade from suburban trees can be very hot, with temperatures as much as 12 degrees Fahrenheit (6.7 degrees Celsius) higher than surrounding areas (National Arbor Day Foundation, 2004).

Suburban trees also diffuse road traffic and engine noise. The energy of the sounds may be partly absorbed by the flexible leaves and deflected by branches and trunks. A belt of trees 30 metres wide may decrease noise levels by 21 decibels (Stewardwood, 2004). Noise reduction, as with the qualities of wind breaking, air quality improvement and global warming defences, represents a positive externality, which essentially means that third parties benefit from the activities of a transaction that were struck by other parties. Conversely, the lopping of all trees, in a suburb, for example, may impose costs to the community (Haines, 2001). However, this paper argues that positive externalities, such as the growing of trees, generates a sharing event for immediate and distant stakeholders, which, in turn, imposes a duty on reporting entities to provide important and relevant information to these stakeholders.

Accounting for Suburban Tree Information Systems

Knowing the value of suburban tree assets serves a range of needs for the business community, including the provision of useful information about acquisition, maintenance, pricing and replacement of suburban trees and the improvement of financial reporting and performance measurement of local government and business entity financial reports. These benefits lead to effective tools for planning of urban ecosystems, the prevention of millions of dollars of damage to infrastructure of trees by implementing better design processes and mitigation methods, and savings in insurance costs. In recent times, for example, the cost of the bush fires to infrastructure around Sydney in 2002 were thought to be around A$70 m (BBC, 2002).

Moreover, it is, of course, local councils, public sector utilities and business entities where the vast majority of local environmental issues are made (Burritt, 1999), and who hold the key to developing Australia's ecologically sustainable development (ESD).

> ESD is widely interpreted as making sure that the needs of future generations are taken into account present planning and decision making; incorporating long-run economic, ecological and social considerations in decision-making; and recognising the interrelated and overlapping implementation of sustainability at the local level (Burritt, 1999, p. 57).

DOI: 10.1002/csr

Some environmentalists note that any initiative in environmental accounting normally follows the path of traditional accounting to accommodate the Australian accounting standards developed by the Australian Accounting Standards Board (AASB) (Gibson, 2000). It is conventional wisdom that these standards are consistently and logically formulated, provide comprehensive guidance and enable users to better understand standards (Hoggett *et al.*, 2003), although there is some disquiet among some in the accounting profession and business community who suggest that the AASB is too easily influenced by powerful lobby groups (Hoggett, 1998; Brown, 2006).

Suburban Trees as Non-Current Assets

Under the Australian conceptual framework, it is possible to categorize suburban trees as assets: 'future economic benefits controlled by the entity as a result of past transactions or other past events' (SAC 4, 2003). Trees satisfy all the elements of this definition: they provide future economic benefits, they are controlled by an entity and they are a result of past transaction or other past events. Indeed, they create a 'future economic benefit' not just because they can be measured and accounted for in agency financial statements but also because they can provide a 'service potential', conserving energy, preventing erosion, reducing pollution, providing shelter and wind-breaks and enhancing soils. Trees have the capacity, therefore, to provide benefits other than cash to the entity that controls them. SAC 4's definition does not imply that assets necessarily generate cash flows nor that the objectives of the agency that controls suburban trees be commercial. Thus, just as weapons permit the Department of Defence to meet its mission of defending Australia and its national interests, so might trees permit local councils to meets its aims of reducing pollution or enhancing soils or some other service potential. The fact that an asset cannot be sold does not, in itself preclude it from providing future economic benefits to the agency.

Trees are also controlled. 'Control' is the capacity of an agency to benefit from a non-current asset, such a suburban tree, or to deny or regulate the access of others to that benefit. Local councils, for example, do not have to own assets (trees) but they must control them in order to meet their objectives. Trees are also a result of a transaction or event giving rise to control of the future economic benefits embodied in it. A transaction or event giving rise to control need not be one where equal value is exchanged between parties; suburban trees, for example, might be bought at a peppercorn price. Additionally, where a tree is given free of charge to an agency, the gifting is the event that gives rise to control of future economic benefits.

Categorizing suburban trees as non-current assets necessarily invokes the standards of the Australian Accounting Standards Board. Table 1 depicts two standards that would directly impact on suburban trees' values (AASB 1015, 1999) and depreciation (AASB 1021, 1999). Again, the categorization of suburban trees as non-current assets does not raise difficulties in applying the spirit of these standards, but in the case of AASB 1021 would involve considerable reflection on deciding the most suitable depreciation method to apply to suburban trees.

The Measurement of Suburban Trees Through Information Technology

Generally, there are many alternative valuation methods for measuring non-current assets, including historical cost, fair cost, fair market value, deprival value, current cost, net realisable value and replacement cost. These possibilities are summarized in Table 2 and expounded below.

Historical Cost Method

In one sense, the growing of trees is like the erection of buildings. Once erected, service benefits ensue in the form of carbon dioxide absorption by trees, and costs are incurred: for example, maintenance and

DOI: 10.1002/csr

AASB	Issue	Suburban tree application
AASB 1015 'Acquisition of Assets'	Non-current assets have a value in use and represent a store of economic benefits.	Trees satisfy all the characteristics of non-current assets, displaying all their tangible qualities: physical substance; value in use and store of value.
Under AASB 1021 'Depreciation'	Permits four depreciation methods: straight line, units of production, reducing balance and sum-of-years' digits, the latter two being accelerated depreciation methods.	Depending on the nature of the tree and its location and purpose, any of the four depreciation methods may be appropriate for suburban trees.

Table 1. AASB 1015 and AASB 1021

Measurement method	Issue	Suburban tree application
Historical cost	Costs of asset are calculated on original or historical cost.	Biological change and price changes make this method problematic.
Current value	Recognizes the increasing value of assets by incorporating current as distinct from historical value.	Enables an assessment of the existing service potential or future economic benefits of suburban trees.
Net market value	Requires self-generating and regenerating assets to be measured at net market value on the open market.	Service potential of suburban trees is not readily captured by a sophisticated liquid market.
Replacement cost	Calculates a compensatory value of assets.	Studies have found it is possible to approximate the value of trees based on tree characteristics.
Deprival value	Adopts three distinct methods of valuation if asset is deprived.	Enables possible suburban tree evaluations given set scenarios.

Table 2. Measurement techniques of suburban trees

damage. A body of accounting research has looked at measurement issues of forestry self-generating and regenerating assets (Gibson, 2000). It found that the historical cost method had a number of shortcomings, including dispensing with accretion in value through natural events such as biological change, paying no heed to price changes, providing irrelevant and unreliable information, failing to reflect on the relative value of comparable trees and ignoring accountability obligations. It saw the historical cost method of valuing trees as essentially providing irrelevant and unreliable information. However, they found that the shortcomings of the cost-based methods could be overcome by representing trees at their current value.

Current Value Method

The current value method recognizes the increasing value of the tree by reflecting the tree's performance and accountability in each period. Some researchers used air pollution control, carbon storage and sequestration, energy conservation, future benefits and stormwater runoff reduction as proxies for performance and accountability of trees (Haines, 2001). This current cost based method may enable users of information to better assess the existing service potential or the future economic benefits of trees,

DOI: 10.1002/csr

including the service potential or future economic benefit from natural growth. Additionally, the current value method may avoid the problem of cost allocation faced by the historical cost method. However, a criticism of the current value method is that it requires comprehensive records of the trees, which need to be categorized and identified according to age, quality and service output. Nevertheless, comprehensive tree data techniques caught by satellite imagery, remote sensing, aerial surveys and geographic information systems (see below) could assist in this calculation. Current value methods also require the establishment of reliable measurement techniques such as independent assessment, historic performance and sampling, although, in truth, this is a difficulty faced in measuring many non-current assets.

Net Market Value Method

AASB 1037 applies to self-generating and regenerating assets that are not used for the purpose of aesthetics, ecology, environment, heritage or recreation (*Accounting Handbook*, 2003). This standard requires self-generating and regenerating assets to be measured at net market value, which attempts to capture the value of biological transformation. Net market value enables the financial performance statement to reflect a relevant measure of the periodic performance of suburban trees. Keys (1998), however, considered a number of difficulties with its use, including the short term cycle of some trees and the difficulty of separating the relationship between trees and the land upon which they grow. Most suburban trees, however, have a reasonably long term cycle, and many accountants already possess a reasonable basis for separating the value of self-generating and regenerating assets from non-self-generating and regenerating assets. A fundamental difficulty is that this standard refers to commercial assets such as crops or the produce of trees, such as fruit, whose value can be determined on the open market. The service potential of suburban trees is not readily captured by a sophisticated liquid market.

Replacement Cost Method

Another measurement alternative is the replacement cost method. One method of estimating the compensatory value of urban trees in the United States is by counting the number of trees (for example, in Nowak's (2002) study, 3.8 billion) and approximating the average compensatory value for each tree (again, in Nowak's (2002) study, US$630). The compensatory value of trees was calculated based on tree condition, location, species and trunk size; and the average replacement cost and size was acquired from an external body called the International Society of Arboriculture. The replacement cost method was used for the urban forest of the state of Atlanta in the United States of America. Nowak (2002) found the replacement cost at US$3.7 billion and that the urban forest removed 1196 metric tons of air pollution at an estimated value to society of US$6.5 million.

Deprival Value Method

Some accountants note that issue of Australian government accounting policy statements recently required government departments and agencies to adopt deprival value methods for valuing assets (Hope, 1999). These statements provide three distinct methods of valuation depending on the action that would be taken if a government entity were deprived of an asset: current replacement cost method if the asset is replaced with the same or a similar asset; market value method if the asset in not replaced and is being held for sale and net present value method if the asset is destroyed and not replaced.

These alternative measurement methods open up a great many possibilities for the recording of suburban trees as non-current assets, and may ultimately assist in the overall function of fixed asset management, which manages, purchases, maintains, values and occasionally disposes fixed assets, as well as providing important information to key Australian stakeholders.

DOI: 10.1002/csr

Data Gathering Techniques for the Current Value Method of Suburban Trees

Of all the evaluation methods open to accountants to report on suburban trees, this study suggests the adoption of the current value method. As explained in the previous section, the current cost based method enables preparers and users of information to better assess the existing service potential or the future economic benefits of trees, including the service potential or future economic benefit from natural growth. By adopting the techniques of other professions, the benefits of the current cost based method could be fully utilized.

Under this evaluation method, accountants could periodically and accurately evaluate suburban trees using sampling plots randomly distributed over the suburb by particular species. From a mosaic of aerial photos covering the entire suburb, plots could be randomly selected and then measured. These aerial surveys could collect images from remote sensing equipment on aircraft or satellites using photogrammetry. Images could be collected by aerial surveys for photogrammetry and by remote sensing equipment on aircraft or satellites for image processing.

Accountants could also employ the science of photogrammetry, which is the science of taking measurements from photographs or images to generate maps. The remote sensors are the actual instruments, such as sophisticated cameras, that gather spectral (colour, hue, intensity) information about objects, such as trees, from a distance. Photogrammetry also makes use of the stereographic view to calculate heights of trees, buildings and mountains. This is invaluable information for accountants. Sophisticated cameras may take the form of digital cameras that can take photographs of objects of only a few feet in width from altitudes of more than 19 km.

Remote sensing scanners record the reflective intensities for particular visible and invisible (infrared, microwave) wavelengths (bands) of the electromagnetic spectrum. The data for the particular wavelengths is recorded separately and therefore can be manipulated using image processing computer programs. By using ratios, combinations of the various bands are filtered, producing what is called a 'false coloured' image indicating various natural phenomena such as type of trees, crops or soils. Multispectral scanners, a special type of sensor, provide data electronically for multiple portions of the electromagnetic spectrum; image processing software may improve the quality of the images to assist in automated information gathering (Costa, 2004; Ferreira and Huete, 2004).

In addition datasets about suburban trees have to be verified on the ground. This work may, for example, capture tree measurements such as age, diameter at 1.30 m from the ground, basal diameter and total height, which are helpful to the accountant in building an index that summarizes the productivity of the area.

Spectral vegetation indices may also be used by the accountant to effectively monitor and discriminate the major types of trees within a suburb (Ferreira and Huete, 2004). Two techniques are the normalized difference vegetation index (NDVI) and soil adjusted vegetation index (SAVI) to depict major categories of vegetation (Ferreira and Huete, 2004). These types of technique have been used to map zones of vegetation communities on the Amazon, achieving an accuracy of 95% (Costa, 2004). The maps determine the spatial distribution and time of inundation and zonation of different vegetated areas in the floodplain.

Some geo-environmentalists advocate the use of remotely sensed data for the study of city regions by using data from satellite imagery. Specifically, a Landsat TM imagery uses a spatial resolution of 30 m (Chase-Dunn and Weeks, 2004). Higher resolution imagery may be gained by advanced space-borne thermal emission and reflection radiometer (ASTER) imagery, which has three spectral bands in the visible–near-infrared (VNIR) range at a spectral resolution of 15 m (Chase-Dunn and Weeks, 2004). The image is a two-dimensional array of pixels, which captures radiant energy from a ground area that is

DOI: 10.1002/csr

equal to the image's spatial resolution. Each image's brightness is assigned a digital number, which represent relative reflectance across bands of light yields. Particular types of land cover, such as suburban trees, have a unique spectral signature for a particular season. With many bands (i.e. higher spectral resolution), it may be possible for accountants not only to pick up individual suburban trees but to differentiate the diverse range of types of tree. SPOT imagery, from France, has spatial resolution of 2.5–20 m. More bands do not necessarily imply a better resolution. Spatial resolution is affected by the type of scanner used and the distance from the earth where the image is taken. Image processing was effectively used during the Cold War by the West to estimate the crop yields in the Soviet Union.

Accountants could also use geographic information system (GIS) technology to measure tree cover (Haines, 2001). GIS is software that stores spatial information. Minimally, it uses north and south coordinates and a height coordinate of the object. Each object has many attributes which may be caught and then classified by the GIS system. For example, a tree may be classified according to its type, height, diameter, age, planting cost, last pruning, litter-removal cost, part of tree cluster and root protrusion at a certain date. In years to come a tree may be resurveyed. The difference in size, maintenance cost etc can be analysed and plotted on maps. The application of GIS to the management of urban street trees has been called for by Godfrey (2002) and Zahoor (2003) and may be used by accountants to identify policy issues, acquire necessary GIS data (such as aerial photographs and property boundaries), determine ecostructures, conduct field inventory and digitize trees before running the suburban tree analysis. In a GIS the vegetation classification created by image processing techniques, can be incorporated and added to topographic information. The combined datasets can be analysed. For example, accountants may consider 'Where are the Norfolk Pines that were planted 10 years ago and that have not reached 10 m height?' or 'What spatial distribution of the number of dollars is spent in relation to a certain type of tree?'.

The information collected from each tree may include diameter class, height class, groundcover, health ownership and potential conflicts. Recording of environmental benefits of the trees may thus be performed by analysing *air pollution removal* using set removal rates and dollar benefits estimated on actual and external costs of atmospheric pollution, *carbon storage and sequestration* by using estimates of canopy cover and trunk diameter, *energy conservation* by calculating kilowatt hour savings and solar savings per household and working out the species, size, canopy shape, shading and leaf persistence of each tree, *future benefits* by looking at a tree's diameter, height and size and projecting its future tree canopy and *stormwater runoff reduction* by estimating water flow over land and the changes that would occur if all trees in the studied area were removed.

Accounting for Suburban Tree Information Systems

Accounting for suburban trees benefits reporting entities, accountants and stakeholders. By accounting for suburban trees within their control, entities (business entities, local councils and public sector utilities) have the means not only to add meaning to the non-current assets' element of their entity's balance sheet but also to recognize the serviceable benefits of suburban trees. The previous section revealed that the datasets required to carry out this accounting function are provided not by traditional reporting inputs but by GIS analysis. Thus, by adopting the data gathering techniques of environmental sciences and computerized information systems, perennial plants become things of relevance rather than irrelevance. This adoption also allows the environment to become relevant to, and part of, the accounting profession rather than distant or separate from it. However, it is, perhaps, stakeholders, the conscripted investors, who gain most when accounts are provided on their suburban trees. Stakeholders can make better informed decisions about the community they live in and, as Greer (2004) points out, learn more about themselves and their connection with trees.

DOI: 10.1002/csr

Acknowledgements

The authors would like to acknowledge the helpful advice of the editor and two anonymous reviewers of *Corporate Social Responsibility and Environmental Management*.

References

AASB 1015. 1999. *Accounting for the Acquisitions of Assets*. Accounting Standard of Australian Accounting Standards Board.

AASB 1021. 1999. *Accounting for Depreciation*. Accounting Standard of Australian Accounting Standards Board.

Abdulla S. 1999. More trees please. *Nature Science Update*. http://www.nature.com/nsu/990923/990923-4.html [11 November 2004].

Accounting Handbook. 2003. *Accounting Handbook* 1. CPA Australia–The Institute of Chartered Accountants in Australia–Prentice Hall–Pearson Education: Sydney, Australia.

Australian Bureau of Statistics. 2003. *Australian, National Accounts: National Income, Expenditure and Product 2003: National Feature Article – Accounting for the Environment in the National Accounts*. Australian Bureau of Statistics. http://www.abs.gov.au/Ausstats/abs@.nsf/0/5a0a96ef9e45d3b8ca256cae0016cae0016e525?OpenD [2 November 2004].

Bharuha N, Kent C. 1998. *Inflation Targeting in a Small Open Economy*, Research Discussion Paper 9807. Reserve Bank of Australia Economic Research Department.

BBC. 2002. *Australian Fire Damage Cost Rises*. http://news.bbc.co.uk/1/hi/business/1739918.stm [2 November 2004].

Brown AM. 2006. The financial milieu of the IASB and AASB. *Australian Accounting Review* **16**(1): 85–95.

Brown AM, Shardlow M. 2005. The conservative agenda of the IASB. *International Journal of Humanitarianism* **2**: 95–109.

Burritt R. 1999. Thinking local: towards an environmental standard. *Australian CPA* April: 57–59.

Carlson A. 2002. Environmental aesthetics. In *Routledge Encyclopedia of Philosophy*, Craig E (ed.). Routledge: London. http://www.rep.routledge.com/article/M047 [12 November 2004].

Chase-Dunn C, Weeks JR. 2004. *Measuring the Suburbanization of World Cities with Remote Sensing Data*. http://www.irows.ucr.edu/conferences/globgis/papers/Chase-Dunn_Weeks.htm [2 November 2004].

CoolCommunities. 2004. *Urban Shade Trees, Cool Communities*. http://www.coolcommunities.org/urban_shade_trees.htm [12 November 2004].

Cooper C, Neu D, Lehman G. 2003. Globalisation and its discontents: a concern about growth and globalization. *Accounting Forum* **27**(4): 59–364.

Costa MPF. 2004. Use of SAR satellites, for mapping zonation of vegetation communities in the Amazon Floodplain. *International Journal of Remote Sensing* **25**(10): 1817–1835.

European Parliament. 2004. *European Parliament Fact Sheet: Australia and New Zealand*. www.europarl.eu.int/factsheets/6_3_14-en.htm [12 November 2004].

Everett J. 2004. Exploring (false) dualisms for environmental accounting praxis. *Critical Perspectives on Accounting* **15**: 1061–1084.

Ferreira LG, Huete AR. 2004. Assessing the seasonal dynamics of the Brazilian Cerrado vegetation through the use of spectral vegetation indices. *International Journal of Remote Sensing* **25**(10): 1837–1860.

Geoscience Australia. 2004. *Areas of Australia, States, and Territories*. www.ga.gov.au/education/facts/dimensions/areadime.htm [2 November 2004].

Gibson K. 2000. Environmental accounting. In *Financial Accounting Professional Development*. ASCPA: Melbourne; Module 3.

Godfrey P. 2002. *Street Trees: Determining a Model, Process, and Architecture for Inventory and Maintenance*. http://gis.esri/library/userconf/proc02/pap0260/p0260.htm [2 November 2004].

Gray R, Owen D, Adams C. 1996. *Accounting and Accountability: Changes and Challenges in Corporate Social and Environmental Reporting*. Prentice-Hall: Wiltshire, UK.

Greer G. 2004. Slack and insufferable. *The Australian* 27 January: 11.

Haines DB. 2001. The *Value of Trees in City of New Berlin*. http://gis.esri.com/library/userconf/proc01/professional/papers/pap1021/p1021.htm [12 November 2004].

Hoggett J. 1998. *The Continued Politicisation of Accounting Standardisation in Australia*, BEA Conference, Perth, 1998.

Hoggett J, Edwards L, Medlin J. 2003. *Financial Accounting in Australia*. John Wiley and Sons: Australia.

Hope D. 1999. Valuing national assets: the deprival value framework. *Australian CPA* August: 58–59.

Isaak R. 1998. *Green Logic: Ecopreneurship, Theory and Ethics*. Greenleaf: Sheffield.

Keys R. 1998. Looking to SGARAs: new standards for 'self-generating and regenerating assets'. *Australian CPA* October: 56–58.

DOI: 10.1002/csr

Medley P. 1997. Environmental accounting – what does it mean to professional accountants? *Accounting, Auditing and Accountability Journal* **10**(4): 594–600.
Monbiot G. 2004. *Natural Aesthetes*. www.monbiot.com/archives/2004/01/03/natural-aesthetes/ [12 November 2004].
National Arbor Day Foundation. 2004. *The Value of Trees in a Community*. National Arbor Day Foundation: Nebraska City, NE. http://www.arborday.org/media/stormsectiong.html [2 November 2004].
Norton N. 2003. *The Value of Trees*. Trees Atlanta. http://www.treesatlanta.org/value.html [2 November 2004].
Nowak D. 2002. Compensatory value of urban trees in the United States. *Journal of Arboriculture* **28**(4): 194–199.
SAC 4. 2003. SAC 4: definition and recognition of the elements of financial statements. *Accounting Handbook*, Vol. 1. CPA Australia–The Institute of Chartered Accountants in Australia–Prentice-Hall–Pearson Education: Sydney, Australia; 63–95.
Stewardwood. 2004. *The Value of Trees*. Steward Community Woodland. http://www.stewardwood.org/woodland/tree_value.htm [12 November 2004].
Sungei Bulch Nature Park. 2000. *The Value of Trees*, Wetlands Publications 7, No. 3. www.sbwr.org.sg/wetlands/text/00-7-3-9.htm [12 November 2004].
UWC. 2004. *The Value of Trees*. http://www.botany.uwc.ac.za/Envfacts/facts/trees.htm [12 November 2004].
Volery T. 2002. An entrepreneur commercialises conservation: the case of Earth Sanctuaries Ltd. *Greener Management International, The Journal of Corporate Environmental Strategy and Practice* Issue **38**: 109–116.
Zahoor A. 2003. *The City of Coeur d'Alene, Idaho, Converts Urban Tree Inventory Into GIS*. Idaho Department of Lands. http://www.esri.com/news/arcnews/fall03articles/city-of-coeurdalene.html [2 November 2004].

DOI: 10.1002/csr