

The effectiveness of schools-based National Arbor Week activities in greening of urban homesteads: A case study of Grahamstown, South Africa

Fiona Parkin^a, Charlie Shackleton^a, and Ingrid Schudel^b

^aDepartment of Environmental Science, Rhodes University, Grahamstown 6140, South Africa

^bEnvironmental Education & Sustainability Unit, Rhodes University, South Africa

Abstract

Arbor Day, or Week, is a well-established greening initiative worldwide, focusing on tree planting and the benefits thereof. Frequently most effort is targeted at institutions such as schools and community groups. Yet there has been limited assessment of the success of Arbor Day, or Week, activities both at the schools, or the wider dissemination in neighbouring communities and suburbs. The objective of this study was to determine the influence of school-based Arbor Week activities on learners' home-based practices regarding tree planting and urban forestry. Learners from three schools in Grahamstown, South Africa, with good Arbor Week participation, were assessed on their tree planting knowledge. The learners' parents were also interviewed to determine whether the information obtained by the learners at school was taken home. A control group consisting of people with no children or very young children was also assessed. This study found that Arbor Week activities were, for the most part, successfully taught in the case study schools, and most of the learners stated that their knowledge of trees and their benefits came from their school activities. However, many learners could not remember the activities in which their schools partook the previous year. Whilst most learners were aware of the importance of trees, few had encouraged tree planting at home. However, over one-fifth of adults claimed that their knowledge of the benefits of trees was as a consequence of Arbor Day activities when they were young. Numerous constraints to tree planting were provided by learners and both the adult groups, the two most frequent being limited space and falling leaves making their yards untidy. External organisations should become more actively involved and provide much needed support systems if greening initiatives are to reach the wider community.

Keywords: Environmental education; Transfer of knowledge; Tree planting; Urban greening

Introduction

Urban sprawl is one of the biggest environmental problems facing many cities worldwide (Cilliers et al., 2004; Graham et al., 2004). It is estimated that 65% of the world's population will be living in urban areas by the year 2030 (Cilliers et al., 2004). Many developing countries, such as South Africa, are experiencing rapid urban expansion due to poverty and few job opportunities in the rural areas. This expansion occurs at the periphery of the city (peri-urbanisation) (Graham et al., 2004). During the course of peri-urbanisation, natural landscapes and vegetation in and around cities are largely destroyed as land is cleared for new housing and infrastructure.

Consequently, trees and tree products (such as fuelwood, wild fruits, and medicinal products) are removed by the ever-increasing urban population (Cilliers et al., 2004; Berry et al., 2005; Shackleton et al., in press). Deforestation and the clearance of natural vegetation has numerous negative environmental impacts such as the loss of biodiversity and genetic resources, soil degradation, the depletion of water resources, the disturbance of microclimates, and the disruption of the carbon cycle (Bewket, 2003).

Urban forestry and greening is a mitigatory measure to many of the environmental problems associated with expanding urban areas (Long and Nair, 1999). For example, urban forests can help to reduce stormwater runoff, improve air quality, reduce noise pollution, provide wildlife habitats, as well as providing shade in the city and thereby saving on energy costs (Summit and Sommer, 1998; Akbari, 2002; De Sousa, 2003; Kollin, 2005). Associated health, psychological and financial benefits from urban forestry also exist (Kaplan, 1995a; Long and Nair, 1999; Bodin and Hartig, 2003). Urban forests and forestry are not restricted to large blocks of trees, but also include trees planted in public parks, along sidewalks, as well as in individual gardens (Long and Nair, 1999). It may seem as though these individual activities are inconsequential, but collectively they constitute a significant tree planting effort (Long and Nair, 1999; Smith et al., 2006). The opportunity to increase the areas and quality of urban forests exists by providing the public with the knowledge of the potential positive impacts they could have on urban environments and livelihoods. In suburbs of low economic status, the planting or maintenance of trees can provide opportunities for income generation through the sale of tree products such as fruits, medicines, dyes and fuelwood (Long and Nair, 1999; Madaleno, 2000; Shackleton et al., in press).

The culture of urban greening has been promoted and practiced for over a century in most parts of the world, although more formalised programmes in Europe and the United States really only accelerated from the 1960s onwards (De Sousa, 2003; Konijnendijk et al., 2006). Surveys of urban populations confirm the positive attitudes they have to green spaces and urban forestry (Kaplan, 1995b), such that estimates of willingness to pay can be higher than the real costs of maintaining trees and green belts within the urban environment (e.g., Tyrväinen, 2001; Maco and McPherson, 2003), and suburbs and properties with good urban forestry attract higher land values (Iverson and Cook, 2000; Laverne and Winson-Geideman, 2003). African countries are also engaged with urban forestry and urban greening efforts (e.g., Popoola and Ajewole, 2002; Guthrie and Shackleton, 2006), often, but not solely, linked with promoting urban agriculture or plantations for tangible goods (e.g., Kalipeni and Zulu, 2002).

Arbor Day is an example of a well-established urban greening initiative observed in many countries throughout the world. It originated in 1872 in the United States of America as a result of a Nebraskan newspaper publisher who persuaded authorities that planting trees would play an important role in greening and enriching what was then known as the “great American desert” (Kasrils, 1999). Arbor Day has been celebrated in South Africa since 1983 (Department of Water Affairs and Forestry, 2004). In 1999, the national government recognised its importance and extended Arbor Day into National Arbor Week (NAW), running annually from the 1–7 September. Every year during NAW two trees, one common and one rare species, are highlighted to raise public awareness about trees and tree planting. According to the Department of Water Affairs and Forestry (2004) NAW activities intend to (i) promote a better understanding of trees, especially indigenous trees, (ii) highlight the important role trees play in sustainable development, the livelihoods of people and their environment, (iii) encourage communities to participate in various greening activities within their own surroundings, and (iv) raise awareness of South Africa's urban greening initiatives.

Schools are often a primary target of urban greening initiatives (Guthrie and Shackleton, 2006), including Arbor Day, because (i) the youth are the next generation, (ii) they are readily receptive to new ideas, and (iii) a large number of people (i.e. children) can be reached and potentially influenced at the same time. However, the question remains as to whether the information delivered to children during these NAW activities is acted upon by the children through the transfer of the new awareness and knowledge to their home environment; or whether it is forgotten during the rest of the year. According to Chapman and Sharma (2001), environmental education is important on three fronts. Firstly, it provides environmental awareness that creates a will to act; secondly, it provides the environmental understanding that enables the formulation of action plans; and finally, it produces environmental skills that enable action plans to become a success. However, although people may be environmentally educated and aware, many do not engage in proactive behaviour, termed the “attitude-action gap” by Kollmuss and Agyeman (2002). There are numerous factors that constrain the implementation of environmental knowledge through practical actions, including institutional factors, economic factors, levels of environmental knowledge and awareness, motivation, values, attitudes, responsibility and priorities (Kollmuss and Agyeman, 2002). Many of these factors are relevant with regards to promoting urban tree planting, but have never been assessed in relation to NAW activities in South Africa or elsewhere. Whilst it is appreciated that working with children and young people can produce better levels of participation and willingness than working with adults when tree planting is concerned (McIvor, 1999), the success of NAW activities as a vehicle for urban forestry has rarely been evaluated, certainly not in South Africa. It is simply assumed that the educational message delivered at the school grounds regarding urban forestry will be carried home and scaled up, as well as acted upon as the young people become adults.

Within the context of the above the objective of this study was to determine the influence of school-based NAW activities on learner's home-based practices with regards to tree planting as a means of urban greening. The key questions were to determine: (i) whether or not the NAW activities held in schools create awareness about tree planting among learners, (ii) whether or not the NAW message is taken home to the families, and (iii) do the families act on this knowledge in terms planting trees at home? If not, what are the constraints?

Study area

The study was conducted in three schools in Grahamstown (33°17'60S and 26°31'60E) situated in the Makana Municipality of the Eastern Cape province of South Africa. The Eastern Cape is the poorest province in South Africa, with large areas, mainly semi-arid, of extensive agriculture, other than the metropolitan centres. Almost two-thirds (63.4%) of the population is rural (Stats SA, 2001). The Makana region is also predominately agricultural, dominated by cattle and game farms. The mean annual rainfall is approximately 580 mm. The natural vegetation consists of shrubby grassland on the hilltops and dense woody thicket in the valleys.

Grahamstown is a medium-sized town of approximately 60,000 people and is the administrative centre of the Makana district. Having been founded as a military base during the colonial frontier wars of the early 1800s, it is now a well-known educational centre, with a university and more than 20 private and State schools. This makes Grahamstown an ideal location for this project as it provides ample opportunities to engage with school learners and determine their knowledge of tree planting and the level of influence they may have on home-based urban forestry activities.

The eastern section of the town is dominated by low-income and informal housing areas, which are expanding with the urbanisation of workers from the surrounding agricultural areas and the former black homelands of the apartheid era. Mean household size is 5.2 people (Møller, 2001). The economic base of the town is insufficient to meet expectations and unemployment is approximately 30% (Møller, 2001), which is higher than the national average. In response, households engage in a number of informal enterprises to generate any possible cash income. The town authorities are hard pressed to address the infrastructural backlogs of the apartheid era, and simultaneously meet the demands posed by the rapid expansion. Consequently, urban forestry and aesthetics receive a very low priority in terms of budget allocation and human resources.

Methods

The approach used was aimed at assessing the respondents' knowledge on the importance of trees and tree planting by means of a questionnaire, which included both open and closed questions. Additionally, the questionnaires aimed to determine whether learners use this new knowledge to try to influence their parents' tree planting activities. Interviews were conducted with the help of a translator, and the responses were recorded by the interviewer. Respondents were interviewed individually so that they did not influence one another's responses. Data were collected by conducting surveys at the three schools with learners, and at the household level with the learners' parents as well as a control group (adults without children of school going age).

For the learners, three State schools were identified in Grahamstown on the basis of a previous study (Guthrie and Shackleton, 2006) which identified those schools that engaged in the most activities during NAW (including speeches, lessons, posters and planting activities) aimed at urban forestry and raising awareness of the value of trees. These schools were chosen as it was assumed that schools that had few or no Arbor Week activities would have the least influence on the learners' attitudes and actions regarding tree planting. Grade 7 learners (approximately 13–14 years old) were the target group for this survey. In common with work elsewhere (Smith-Sebasto and Semrau, 2004) this was regarded as an especially receptive group to environmental initiatives; being old enough to understand the issues and still potentially enthusiastic enough to want to make a difference. Ten learners were randomly selected from each school, giving a sample size of 30 learners; 19 girls and 11 boys. The parents of these learners formed the second group of respondents. The purpose of this was to determine whether the information obtained by the learners at the schools was taken home and acted upon at the household level. The sample size for this group was 29 as one parent declined to be interviewed. The final group of selected respondents was a control group, consisting of 30 adults living in the vicinity of the schools (10 at each location) who had no children, or very young children who had not yet been taught about tree planting through Arbor Week activities. The same method was used by Kruger (1992) when assessing the influence that children have on decision-makers in their homes. Thus, the total sample size for this survey was 89 respondents.

The data were summarised in an Excel spreadsheet and then tested for normality. The count data were subjected to analysis of variance (ANOVA). Where significant differences were present, a post-hoc pairwise comparison was carried out using least significant differences. The percentage data were arcsine transformed and then subjected to a Fisher Exact test for chi-squared analysis, and then a Smirnov test for pairwise comparisons.

Results

Awareness of national arbour week as a greening initiative

The survey showed that 80% of the learners were aware of NAW and what it entails. Of those who were aware of NAW, the majority (87.5%) stated that they had learnt about it at school. Whilst learners did identify other sources of information pertaining to NAW these were reported less frequently than school-based NAW activities. These other sources included television (29%), home (29%), radio (20%), library (8%), and posters (8%). When questioned whether their school had held NAW activities the previous year 54% of the respondents stated that their school had, 40% stated that they had not, 3% could not remember, and 3% were at different schools (therefore not applicable to this study). According to the principal of each school, each school had held NAW activities the previous year. The learners stated that the most common activities held were tree planting (87.5%) and lessons on trees and the environment (37.5%). Other activities included speeches (12.5%), posters (6.3%), and the watering of trees (6.3%).

Of the 29 parents surveyed, 66% knew about NAW and what it involves. The parental respondents stated having learnt about NAW from a variety of sources, namely from their own school days (21%), television (21%), radio (14%), at work (7%), the national Working for Water project, word of mouth, children, newsmedia, and a local non-governmental organisation (3.4% each). According to these respondents 79% of their children had never shown an interest in tree planting nor suggested that the family engage in tree planting at home or elsewhere. Parents stated that those children that did show an interest in tree planting acquired it from school activities. The survey showed that 57% of the adult control group were aware of NAW, but that not all of these respondents knew what NAW involved. For this group, information about NAW was also obtained from a variety of sources, including from their own school days (34%), television (25%), radio (18%), NAW activities (10%), work (7%), magazines and word of mouth (3% each). Although there was a decreasing level of awareness of NAW from the learners, to their parents to the control group, the difference was not significant (Fisher Exact Test=3.79; $p>0.05$).

Importance of trees

With respect to the importance of trees, both to the environment and to humans, the majority of learners had been taught in school (87%), whilst other sources of information included home (16%), library (13%), television (10%), and radio (7%). Learners stated that trees are important for environmental reasons as they provide habitats and food for wildlife, as well as for aesthetic purposes (Table 1). The parent respondents stated that trees are important to the environment as they provide food for animals (52%), prevent soil erosion (21%), and provide habitats for animals (18%). According to the control group reasons why trees are important to the environment included the provision of food and habitats for animals (63%), and the prevention of soil erosion (38%). There was no significant difference in the number of responses listed between the control group and the parent group. However, the number of responses per learner was significantly lower than for both adult groups ($F=4.83$; $p<0.01$).

When the respondents were asked why trees are important for humans and society the answers were much more varied (Table 1). The most frequently cited functions of trees listed included the provision of end products such as paper and furniture, the improvement of air quality, and the provision of shade and of food. There was no significant difference in the number of responses between the control group and the parent group. However, the number of responses given by the learner group was significantly lower than both the control and parent group ($F=5.40$; $p<0.01$).

With respect to the planting of trees, most of the learner respondents (94%) thought it was important to plant trees, whilst 3% stated it was not always of major importance because some trees are dangerous to humans and the environment, and the remaining 3% said that it was not at all important to plant trees. From those respondents that thought it was important to plant trees, 55% believed that it was better to plant indigenous species, whilst the remaining 45% believed it was better to plant exotic species. The main reason given by those respondents who believed it is more advantageous to plant indigenous species was that exotic species consume too much water. Those respondents who favoured exotic species stated it was so that people could benefit from different trees and the products that they supply, such as fruit and medicine. When the parents were asked whether they thought it is important to plant trees, 93% stated that it was. Of these respondents, 45% believed that indigenous species should be planted, 22% believed exotic species should be planted, and 33% stated that both indigenous and exotic species should be planted. The majority of the control group respondents (97%) believed that it was important to plant trees. Of this group, 69% believed that it is better to plant indigenous trees, 7% believed exotic trees should be planted, 17% said both indigenous and exotic trees should be planted, and 7% were unsure. The main reason given by the respondents as to why indigenous species should be planted over exotic species was that the latter consume large volumes of water.

Table 1. The importance of trees to the environment and humans listed by three respondent groups (% of respondents)

Benefit/function	To the environment			To humans		
	Learner	Parent	Control	Learner	Parent	Control
Habitat for other species	58	18	33			
Prevent soil erosion	0	21	38			
Aesthetic	7	3	0	3	9	8
Provide food for other species or people	37	52	30	14	10	13
Improve air quality	0	6	0	27	14	7
Timber for houses				3	3	4
Firewood for energy				11	5	6
End products (e.g. paper, furniture)				26	20	15
Medicinal products				5	3	9
Shade				9	27	21
Windbreak				3	9	16
Other				3	3	3
Total number of reasons provided	3	5	3	11	11	11
Mean number of reasons per respondent (\pm SD)	1.3 \pm 0.4	2.1 \pm 0.7	1.9 \pm 0.8	2.2 \pm 1.2	3.0 \pm 1.6	3.4 \pm 1.5

Tree planting activities at home

When the learners were asked if their parents were interested in tree planting 57% claimed that they were. As an index of support for their answer learners were asked how many trees they have in their gardens at home. When the parents were asked the same question, the responses differed greatly from those given by the learners (Table 2), with learners reporting higher numbers of trees than reported by their parents. There was a significant difference ($\chi^2=136.1$; $p<0.0001$) between all the response groups when asked how many trees they had in their home gardens.

Table 2. The number of trees in home gardens as reported by three respondent groups

Number of trees	Learner (%)	Parent (%)	Control (%)
0	0	34	47
1	27	14	21
2	17	11	13
3	13	11	7
4	0	11	3
5	23	3	3
6	0	0	3
7	0	3	0
8	0	7	0
9	0	0	3
10	0	0	0
11	0	0	0
12	0	3	0
Many ("too many to count")	20	3	0

Of the trees planted in the parents' gardens, 41% were planted by the household head or spouse, 41% by the previous owners, and 18% by other family members. The most common reason (44%) for planting specific species was the planting of fruit trees for the fruit they yield. Other reasons given included: the species being the only one available at the time, to provide shade, to provide a windbreak, for aesthetic purposes, for diversity and for sentimental value. From the control group, 62% of the trees were planted by the household owners, 19% by family members, 6% by previous owners, and 13% unknown. Respondents who had planted the trees themselves stated numerous reasons for planting particular species, namely to acquire the fruit, to provide shade, to provide a windbreak, for medicinal purposes, limited choice, and aesthetics. The trees were obtained from many sources, such as neighbours, friends, nurseries, family homesteads, work, and the wild.

Constraints to tree planting

In free response format the respondents identified numerous constraints to tree planting (Table 3). There was a significant difference ($F=26.2$; $p<0.001$) in the number of constraints given per response group. The learner group gave a total of nine possible constraints; each learner listed $0.5 (\pm 0.73)$ constraints. The parent group gave a total of 16 possible constraints, with an average of $1.5 (\pm 0.98)$ constraints per parent. The control group gave 20 possible constraints, with an average of $2.4 (\pm 1.18)$ constraints

Table 3. The constraints to tree planting around the home

Constraint	Learner (%)	Parent (%)	Control (%)
Limited space	29	20	11
Falling leaves make yards untidy	21	7	17
Roots cause cracks in houses	7	7	17
Lack of knowledge	0	14	8
Animals eat trees	0	11	6
Trees use too much water	7	5	3
Lack of interest	0	11	1
Time consuming	7	2	0
Cultural beliefs	0	0	7
Drought (trees die)	7	0	0
Lots of trees already	7	0	0
People do not care	7	0	0
Vandalism	7	0	0
Don't know where to obtain trees	0	2	3
Trees cause damage if they fall	0	2	3
People steal fruit	0	0	4
Allergies	0	2	1
Burglars hide in trees	0	2	1
Children climb trees and hurt themselves	0	0	3
Poor soil	0	2	1
People prefer to plant vegetables	0	2	0
Rented properties	0	2	0
Some trees are poisonous	0	2	0
Birds eat fruit and make a mess	0		1
People cut them down for firewood	0	0	1
Roots damage underground pipes	0	0	1
Snakes hide in trees	0	0	1
Some people don't like trees	0	0	1
Total number of constraints	9	16	20
Number per individual (\pm SD)	0.5 (\pm 0.73)	1.5 (\pm 0.98)	2.4 (\pm 1.18)

Discussion

Effectiveness of Arbor Week activities in schools

The majority of the learners were aware of NAW and what it entails. Although numerous sources of information were mentioned, lessons and activities within the school were by far the most prevalent. However, when the learner respondents were questioned about their school's activities during Arbor Week the previous year a large portion of them stated that they did not partake in any activities. Yet, the principals of the schools stated categorically that their schools had participated in Arbor Week activities the previous year. The study carried out by Smith-Sebasto and Semrau (2004) showed similar results when learners were assessed before and after lessons aimed at increasing pro-environmental feelings. No significant difference was found in the learners' pre-test and post-test attitudes, indicating that the lessons were ineffective. However, other studies have shown that lessons and activities aimed at increasing learners' environmental knowledge and improving environmental attitudes and behaviour have had positive results (Le Maitre et al., 1997; McIvor, 1999). It is possible that the nature of the NAW activities in which learners partake and the direct benefits derived from tree planting influence the success of such projects. For example, learners in rural Haiti planted trees in their home gardens and sold the fruit at local markets to pay for their school fees (McIvor, 1999). This financial aspect acted as a major incentive contributing to the success of the project.

School activities could aim to be more participatory, thereby encouraging learners to become more involved in the process. Schools expect to be provided with trees by the government during Arbor Week. However, Guthrie and Shackleton (2006) found that the provision of trees by government is generally ineffective, and that schools that do receive trees usually get them from non-governmental organisations (NGOs) and private donors, or they buy their own. As many schools in South Africa do not have the financial capacity to purchase trees many an Arbor Week passes with no trees

being planted (Guthrie and Shackleton, 2006). One possible solution to this problem is for schools to grow their own seedlings throughout the year, allowing them to have trees to plant during Arbor Week. If an initiative such as this were successful, schools could possibly sell trees to neighbouring communities or nurseries, thereby generating income to cover the costs of growing the seedlings, or donate them towards a more community-wide greening initiative. This continuous involvement and participation in growing trees could help the Department of Water Affairs and Forestry achieve their aim to make every day an Arbor Day. However, Anyonge et al. (2001) state that schools are not ideal for the mass production of seedlings as school holidays may fall over crucial times in seedling production. Instead, they suggest school nurseries and agricultural compounds for community-focused training and method demonstration.

Transfer of knowledge

It was found that there was a low transference of the knowledge regarding the benefits of tree planting and urban forestry from the learners to their parents, in that the majority of parents stated that their children did not discuss NAW with them, or encourage them to plant trees (at home or elsewhere). Yet, the adult groups showed significantly more knowledge regarding tree planting and the benefits derived from trees than the learners. This may be a result of the adult respondents being more comfortable in the interview situation, or the knowledge that comes with age and experience, as well as being responsible for the household in general, and thus the selection and maintenance of gardens and trees. Most of the parents stated that their children had never shown an interest in tree planting, or had never prompted them to do so. Only 3.4% said that their child had informed them about NAW. Generally children are perhaps unlikely to have widespread influence their parent's perceptions with regard to tree planting (Kruger, 1992). However, under certain circumstances they might. For example, McIvor (1999) suggests that if children are motivated, intimately involved in projects, and are able to realise the tangible benefits that can be obtained from tree planting they may press their parents to do so, especially where there is a financial reward from the tree products.

Application of knowledge and constraints

As the transfer of knowledge from learners to parents was seemingly low, it is not possible to assess whether families act on the knowledge that was assumed would be brought home from school by the learners. However, approximately two-thirds of the respondents were aware of Arbor Week and what it entails. Interestingly, 21% and 34% of the parents and control group respectively, stated that they had learnt about NAW during their own school days. This indicates that although this study has shown minimal influence of learners on current home-based tree planting knowledge and activities, that approximately one-fifth to one-third of current learners might be expected to engage in tree planting as a result of NAW activities when they become adults and establish their own homesteads. This would be over and above those that plant trees without having had the benefit of going to school or exposure to NAW through school activities. Most of the respondents recognise at least some of the benefits provided by trees for both humans and the environment, and therefore realise the importance of planting trees, although the “knowledge-action gap” remains.

There was a significant difference between all the response groups when they were questioned about the number of trees in their home gardens. This is particularly interesting as the learners and their parents were reporting on the same home garden. Some learners may have been uncomfortable in admitting that they had no trees or very few trees. The number of trees in each home garden ranged from none to “too many to count”. The respondents that had no trees stated that the reason for this was that they either did not have a garden or they did not have enough space in their garden to plant trees, paralleling work from rural systems reporting the lack of land and limited resources as a deterrent to tree planting, rather than a lack of knowledge regarding the benefits of trees (Amacher et al., 1993; Thangata and Alavalapati, 2003; Paumgarten et al., 2005). Overall, the respondents were undecided as to whether it is more beneficial to plant indigenous or exotic trees, focussing rather on the purpose for which they were planting it, rather than promotion of general biodiversity. The main reason given by respondents who thought it would be more beneficial to plant indigenous trees was that exotic species consume large quantities of water; possibly indicating the success of the national Working for Water programme aimed at eradicating invasive alien plants (van Wilgen et al., 1998; Binns et al., 2001). Those who thought exotic species should be planted stated that they provide a wider diversity of end products. Respondents planted both exotic and indigenous species in their home gardens, mainly as their choice of trees was limited. Over two-thirds of the adult respondents stated that the household owner or family members were responsible for planting the trees in their home garden. Trees were usually planted with a specific function in mind, i.e. to provide fruit, shade, windbreaks, medicine and cultural purposes.

Respondents gave numerous and widely varying constraints to tree planting, some of which have simple solutions, such as sweeping up leaves and securing properties against wandering livestock, trespassers and vandals (although this is not always financially viable). There has been well-documented conflict where livestock and trees are concerned, as noted by Phillips et al. (1989) and Guthrie and Shackleton (2006). Adequate fencing would be the easiest way to solve the problem, but this is a costly solution that many people cannot afford, but there are other means of protection, such as old drums, stacks of old tyres or pyramids of cement blocks around the tree until it reaches a safe height (Paumgarten et al., 2005). Additionally, fences need constant maintenance if they are to be effective. Limited space and infrastructural damage caused by roots are more complex challenges, although some respondents indicated that parks and green spaces should be created to allow people to enjoy the benefits of trees without the risk of damage to their houses. These areas could also be used for educational purposes, and would be accessible to all members of the community, but would require designated authorities or institutions to take care of them. There was concern regarding high water bills associated with planting trees as they consume large quantities of water. Simple technologies such as catching roof rainwater could be used to limit the need for tap water (Anyonge et al., 2001). Droppelmann and Berliner (2003) suggest runoff-water harvesting to limit the inter-annual rainfall variability that accompanies rain-fed systems.

Lack of education, knowledge and interest in tree planting were cited as other widespread constraints. Erskine (1991) states similar findings with the adoption of tree planting and agroforestry among low-resource farmers in southern Africa. Many respondents did not know from where they could obtain seedlings to plant and donations were erratic (Guthrie and Shackleton, 2006). It was not clear if respondents would be willing to pay for seedlings. Some respondents bought seedlings from local nurseries, while others obtained them from friends, neighbours and family homesteads. Böhringer and Ayuk (2003) state that two types of support, termed ‘hard’ and ‘soft’ support, should be available to smallholder farmers from governments, NGOs, and the private sector. The latter refers to information, training and advice,

whilst the former refers to material inputs such as tree seed, tools, fencing, and inoculum. These support systems could be implemented at a community level, acting as an incentive to encourage people to plant trees for urban greening. Amacher et al. (1993) found that assistance in obtaining trees and protection for existing trees was required among communities. Urban forestry initiatives can be successful when certain factors are in place, such as the provision of trees at low or no cost, social involvement, and education on planting and maintenance of trees (Summit and Sommer, 1998).

Comparisons between developed and low-income or developing countries suggests that urban greening in the former is dominated by aesthetic, psychological and ecological service functions (e.g., Kaplan, 1995a; Tyrväinen, 2001), whereas in the latter by more direct-use values (e.g., Parikesit et al., 2001). Our study has indeed shown that a significant proportion of the respondents listed one or more direct-uses for consumptive goods as a primary benefit from trees. However, such comparisons need to distinguish between public and private green space. Thus, private green space in developed countries or cities may also frequently include a component allocated to tangible goods such as edible fruits (Smith et al., 2006; Daniels and Kirkpatrick, in press). Our study focussed on private space, and only the tree component of such space. It is wholly probable that many of the respondents also make use of the public green spaces in and around Grahamstown for recreational and aesthetic purposes. Moreover, there are probably also aesthetic components to their gardens, but not necessarily vested in the tree component, which requires time to establish and is perhaps less suited to small gardens in low-income suburbs. For example Kirkpatrick et al. (in press) found a positive influence of garden size and whether it was either largely an aesthetic garden or productive one. Relative income levels are perhaps of greater significance than the developing-developed country dichotomy. Within individual countries (e.g., Seeth et al., 1998) and even individual cities (e.g., Iverson and Cook, 2000) there are large differences in the nature of private green space, in which income differential frequently has significant explanatory power. Consequently, such a comparison would require compatible methods to be used to investigate use of and benefits received from public green spaces in South Africa and other developing countries, within the context of available finances. Currently there is little information for South Africa and similar countries.

Conclusion

Urban greening initiatives have the potential to mitigate many of the environmental problems associated with ever-increasing levels of urbanisation (Summit and Sommer, 1998; Akbari, 2002; De Sousa, 2003; Kollin, 2005). As it is estimated that 65% of the world's population will be living in urban areas by the year 2030 (Cilliers et al., 2004; Graham et al., 2004), it is essential that urban forestry and greening initiatives are scaled up and expanded to include more community members. National Arbor Week is potentially a useful vehicle to promote the importance of trees and the benefits that they provide. The activities that are carried out during Arbor Week need to be extended to become more frequent than just once a year, and expanded upon to increase participation levels beyond schools. This study has shown that although NAW is successfully taught in schools, the NAW activities in which schools partake are not having the desired affect on a considerable proportion of learners. Activities need to incorporate a larger section of society with increased participation. A key element may well be the need to make NAW fun and entertaining, especially for school learners, rather than pedantic and repetitive (Johnston, 1989). Participants could be encouraged to care for and study the trees during the whole year, rather than just one week of the year. Moreover, it is not just trees that are needed, but also

fencing and water storage facilities if NAW is to become a viable vehicle for promoting urban forestry.

It is the younger members of society who are the primary target for NAW activities in South Africa. This is important as it is assumed that it will ultimately improve proactive environmental attitudes of future generations. In this survey, 21% and 34% of the parent and control group, respectively, had learnt about NAW from their own school days, indicating some success of the potential permanency of the message. However, our study had similar findings to Kruger (1992) indicating that the children generally do not influence or encourage their parents to plant trees in their home gardens. There is a widespread lack of interest and sense of apathy among community members. Most people are aware of the benefits and products obtained from trees yet their behaviour is not proactive. There are numerous constraints preventing people from planting trees, but many of these are superficial and can be overcome with education, motivation, and support from external organisations. In South Africa, the provision of trees and other means of support from government are currently not as effective as they could be (Guthrie and Shackleton, 2006). NGOs and members of the private sector need to become more actively involved in community greening initiatives by providing 'hard' and 'soft' support.

Acknowledgements

Thanks are due to Mr. Scheepers, Mrs. Jones, and Mrs. Koliti for permission to carry out the study in their respective schools; to the students, their parents and members of the Grahamstown community who gave up their time to partake in this study. The authors are grateful to Gene Guthrie and Fiona Paumgarten for instructive comments and dialogue on earlier drafts of this work, as well as Rhodes University for funding.

References

- Akbari, 2002 H. Akbari, Shade trees reduce building energy use and CO₂ emissions from power plants, *Environmental Pollution* 116 (2002), pp. 119–126.
- Amacher et al., 1993 G.S. Amacher, W.F. Hyde and M. Rafiq, Local adoption of new forestry technologies: an example from Pakistan's northwest frontier province, *World Development* 21 (1993), pp. 445–453.
- Anyonge et al., 2001 T.M. Anyonge, C. Holding, K.K. Kareko and J.W. Kimani, Scaling up participatory agroforestry extension in Kenya: from pilot projects to extension policy, *Development in Practice* 11 (2001), pp. 449–459.
- Berry et al., 2005 M.G. Berry, B.L. Robertson and E.E. Campbell, Impact of cutting and collecting of firewood associated with informal settlement in the south-eastern Cape coastal zone, *South African Journal of Botany* 71 (2005), pp. 179–190.
- Bewket, 2003 W. Bewket, Household level tree planting and its implications for environmental management in the Northwestern Highlands of Ethiopia: a case study in the Chemoga Watershed, Blue Nile Basin, *Land Degradation and Development* 14 (2003), pp. 377–388.
- Binns et al., 2001 J.A. Binns, P.M. Illgner and E.L. Nel, Water shortage, deforestation and development: South Africa's Working for Water programme, *Land Degradation and Development* 12 (2001), pp. 341–355.

Bodin and Hartig, 2003 M. Bodin and T. Hartig, Does the outdoor environment matter for psychological restoration gained through running, *Psychology of Sport and Exercise* 4 (2003), pp. 141–153.

Böhringer and Ayuk, 2003 A. Böhringer and E.T. Ayuk, Farmer nurseries as a catalyst for developing sustainable land use systems in southern Africa. Part B: Support systems, early impact and policy issues, *Agricultural Systems* 77 (2003), pp. 203–217.

Chapman and Sharma, 2001 D. Chapman and K. Sharma, Environmental attitudes and behaviour of primary and secondary students in Asian cities: An overview strategy for implementing an eco-schools programme, *The Environmentalist* 21 (2001), pp. 265–272.

Cilliers et al., 2004 S. Cilliers, N. Müller and E. Drewes, Overview on urban nature conservation: situation in the western-grassland biome of South Africa, *Urban Forestry and Urban Greening* 3 (2004), pp. 49–62.

Daniels and Kirkpatrick, in press Daniels, G.D., Kirkpatrick, J.B., in press. Comparing the characteristics of front and back domestic gardens in Hobart, Tasmania, Australia. *Landscape and Urban Planning*.

Department of Water Affairs and Forestry, 2004 Department of Water Affairs and Forestry, 2004. National Arbor Week 1–7 September. <http://www.dwaf.gov.za/events/arborweek/default2.htm> (accessed August 2006).

De Sousa, 2003 C.A. De Sousa, Turning brownfields into green space in the City of Toronto, *Landscape and Urban Planning* 62 (2003), pp. 181–198.

Droppelmann and Berliner, 2003 K. Droppelmann and P. Berliner, Runoff agroforestry—a technique to secure the livelihood of pastoralists in the Middle East, *Journal of Arid Environments* 54 (2003), pp. 571–577.

Erskine, 1991 J.M. Erskine, Agroforestry: its development as a sustainable, productive land-use system for low-resource farmers in southern Africa, *Forest Ecology and Management* 45 (1991), pp. 281–291.

Graham et al., 2004 J. Graham, P. Gurian, V. Corella-Barud and R. Avitia-Diaz, Peri-urbanization and in-home environmental health risks: the side effects of planned and unplanned growth, *International Journal of Hygiene and Environmental Health* 207 (2004), pp. 447–454.

Guthrie and Shackleton, 2006 G. Guthrie and C.M. Shackleton, Urban–rural contrasts in Arbor Week in South Africa, *South African Journal of Science* 102 (2006), pp. 14–18.

Iverson and Cook, 2000 L.R. Iverson and E.A. Cook, Urban forest cover of the Chicago region and its relation to household density and income, *Urban Ecosystems* 4 (2000), pp. 105–124.

Johnston, 1989 M. Johnston, Involving the public. In: B.G. Hibberd, Editor, *Urban Forestry Practice*, Forestry Commission Handbook, HMSO, London (1989), pp. 26–34.

- Kalipeni and Zulu, 2002 E. Kalipeni and L. Zulu, From top-down to bottom-up: the difficult case of the Blantyre city fuelwood project, *Journal of southern African Studies* 28 (2002), pp. 117–136.
- Kaplan, 1995a S. Kaplan, The restorative benefits of nature: toward an interpretive framework, *Journal of Environmental Psychology* 15 (1995), pp. 169–182.
- Kaplan, 1995b S. Kaplan, The urban forest as a source of psychological well-being. In: G.A. Bradley, Editor, *Urban Forest Landscapes: Integrating Multidisciplinary Perspectives*, University of Washington Press, Seattle (1995), pp. 100–108.
- Kasrils, 1999 Kasrils, R., 1999. Plant a tree. Heal our Land. Department of Water Affairs and Forestry.
<http://www.dwaf.gov.za/communications/ministerspeeches/kasrils/1999/plant%20a%20tree22.doc> (accessed August 2006).
- Kirkpatrick et al., in press Kirkpatrick, J.B., Daniels, G.D., Zagorski, T., in press. Explaining variation in front gardens between suburbs of Hobart, Tasmania, Australia. *Landscape and Urban Planning*.
- Kollin, 2005 C. Kollin, Making it official: Writing trees into ordinances to improve environmental quality, *American Forests* 110 (2005), pp. 22–25.
- Kollmuss and Agyeman, 2002 A. Kollmuss and J. Agyeman, Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behaviour?, *Environmental Education Research* 8 (2002), pp. 239–260.
- Konijnendijk et al., 2006 C.C. Konijnendijk, R.M. Ricard, A. Kenney and T.B. Randrup, Defining urban forestry—a comparative perspective of North America and Europe, *Urban Forestry and Urban Greening* 4 (2006), pp. 93–103.
- Kruger, 1992 Kruger, J., 1992. The influence of children on decision-makers in their homes: A case study in environmental education. Unpublished M.A. thesis. Rhodes University, Grahamstown.
- Laverne and Winson-Geideman, 2003 R.J. Laverne and K. Winson-Geideman, The influence of trees and landscaping on rental rates at office buildings, *Journal of Arboriculture* 29 (2003), pp. 281–290.
- Le Maitre et al., 1997 D. Le Maitre, C. Gelderblom, L. Maphasa, S. Yssel, M. van den Belt and T. Manuel, Communicating the value of fynbos: results of a survey of stakeholders, *Ecological Economics* 22 (1997), pp. 105–121.
- Long and Nair, 1999 A.J. Long and P.K.R. Nair, Trees outside forests: agro-, community, and urban forestry, *New Forests* 17 (1999), pp. 145–174.
- Maco and McPherson, 2003 S.E. Maco and E.G. McPherson, A practical approach to assessing structure, function and value of street tree populations in small communities, *Journal of Arboriculture* 29 (2003), pp. 84–97.
- Madaleno, 2000 I. Madaleno, Urban agriculture in Belém, Brazil, *Cities* 17 (2000), pp. 73–77.
- McIvor, 1999 C. McIvor, Children and tree planting in rural Haiti. In: C. McIvor, Editor, *The Earth in our Hands*, Save the Children Fund, London (1999).

- Møller, 2001 V. Møller, Living in Grahamstown East/Rini: A Social Indicators Report, Institute of Social and Economic Research, Grahamstown (2001).
- Parikesit et al., 2001 T.K. Parikesit, A. Tsunekawa and O.S. Abdoellah, Non-forest fuelwood acquisition and transition in type of energy for domestic uses in the changing agricultural landscape of the upper Citarum watershed, Indonesia, *Agriculture, Ecosystems and Environment* 84 (2001), pp. 145–258.
- Paumgarten et al., 2005 F. Paumgarten, C.M. Shackleton and M. Cocks, Growing trees in home-gardens by rural households in the Eastern Cape and Limpopo provinces, South Africa, *International Journal of Sustainable Development and World Ecology* 12 (2005), pp. 365–383.
- Phillips et al., 1989 P. Phillips, B. Munslow and P. O’Keefe, Sustainable solutions to land use conflicts, *Land Use Policy* 6 (1989), pp. 151–161.
- Popoola and Ajewole, 2002 L. Popoola and O. Ajewole, Willingness to pay for rehabilitation of Ibadan urban environment through reforestation projects, *International Journal of Sustainable Development and World Ecology* 9 (2002), pp. 256–268.
- Seeth et al., 1998 H.T. Seeth, S. Chachnov, A. Surinov and J. von Braun, Russian poverty: muddling through economic transition with garden plots, *World Development* 26 (1998), pp. 1611–1623.
- Shackleton et al., in press Shackleton, C.M., McConnachie, M., Chauke, M.I., Mentz, J. Sutherland, F., Gambiza, J., Jones, R., in press. Urban fuelwood demand and markets in a small town in South Africa: livelihood vulnerability and alien plant control. *International Journal of Sustainable Development and World Ecology*.
- Smith et al., 2006 R.M. Smith, K. Thompson, J.G. Hodgson, P.H. Warren and K.J. Gaston, Urban domestic gardens (IX): composition and richness of the vascular plant flora and implications for native biodiversity, *Biological Conservation* 129 (2006), pp. 312–322.
- Smith-Sebasto and Semrau, 2004 N.J. Smith-Sebasto and H.J. Semrau, Evaluation of the environmental education program at the New Jersey school of conservation, *The Journal of Environmental Education* 36 (2004), pp. 3–18.
- Stats SA (Statistics South Africa), 2001 Stats SA (Statistics South Africa), 2001. The People of South Africa—Population Census, 1996. <http://www.statssa.gov.za/census01/Census96/HTML/default.htm> (accessed August 2006).
- Summit and Sommer, 1998 J. Summit and R. Sommer, Urban tree-planting programs—a model for encouraging environmentally protective behaviour, *Atmospheric Environment* 32 (1998), pp. 1–5.
- Thangata and Alavalapati, 2003 P.H. Thangata and J.R.R. Alavalapati, Agroforestry adoption in southern Malawi: the case of mixed intercropping of *Gliricidia sepium* and maize, *Agricultural Systems* 78 (2003), pp. 57–71.

Tyrväinen, 2001 L. Tyrväinen, Economic valuation of urban forest benefits in Finland, *Journal of Environmental Management* 62 (2001), pp. 75–92.

Van Wilgen et al., 1998 B.W. Van Wilgen, D.C. Le Maitre and R.M. Cowling, Ecosystem services, efficiency, sustainability, and equity: South Africa's Working for Water programme, *Trends in Ecology and Evolution* 13 (1998), p. 378.