

*Full Length Research Paper*

# Is there no urban forestry in the developing world?

Charlie M. Shackleton

Department of Environmental Science, Rhodes University, Grahamstown 6140, South Africa.  
E-mail: [c.shackleton@ru.ac.za](mailto:c.shackleton@ru.ac.za). Tel: +27-46-603-7001. Fax: +27-622-9319.

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**Urban forestry and greening offer a multitude of benefits to the inhabitants of towns and cities. However, the nature and magnitude of these frequently depend upon the context. Yet, at first glance, the developing world context around urban forestry debates seems to be poorly represented in the international peer-reviewed literature. This is examined in this paper, followed by a brief outline of ten key research areas for urban forestry in the developing world. A survey of the peer-reviewed literature confirms that almost 80% of articles come from the developed world context. This correlates with the greater availability of research finance and personnel from developed regions. However, there are urban forestry questions and issues that require examination in the developing world because they cannot simply be transferred from knowledge gleaned from and tested in a developed world context. Ten of these are briefly outlined as a catalyst towards greater attention to urban forestry in the developing world and their contributions to global debates and models.**

**Key words:** Developing world, forestry, greening, research needs, financial resources.

## INTRODUCTION

Urban forestry relates to the establishment, promotion, maintenance and management of trees in urban and peri-urban landscapes (Shackleton, 2006). Typically, most urban forestry research and interventions relate to public spaces, although the contribution of trees in private gardens to the overall environmental health and biodiversity of the suburb or town is gaining recognition (Doody et al., 2010; Goddard et al., 2010; Lubbe et al., 2010). Zipperer et al. (1997) argue for the consideration of the benefits of trees and treed areas in terms of ecological patches and to ignore the distinction between private and public space. This is appealing in terms of considering the benefits of trees in urban landscapes, but it ignores the fact that private and public spaces have different management authorities and financing mechanisms and that access to private spaces can be constrained.

According to Konijnendijk et al. (2006), the term 'Urban Forestry' was first used in the late 1800s by municipal parks officials referring to the silvicultural context, that is, the care of individual trees in urban space. The modern

term, however, has embraced the broader social and economic dimensions, and includes planted trees and natural landscapes within the urban limits. A widely used definition states that urban forestry is "the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits that trees provide society" (Konijnendijk et al., 2006). Interestingly, this definition does not include the ecological benefits which are the subject of much research internationally (Shackleton, 2006).

Although there is much international research on urban forestry issues, contributions from developing world countries in the peer-reviewed literature and seminal texts seem limited. Why is it so, especially when a visit to most cities in the developing world indicates that many of them boast a vast array of urban forests, street trees and open spaces? The city of Bangalore in India, home to eight million people, is known as the garden city for this very reason (Nagendra and Gopal, 2010). In South Africa, Johannesburg tourism boasts that the city has the

world's largest human-made forest ([www.joburg.org.za](http://www.joburg.org.za)) (Johannesburg tourism, 2010). These two examples indicate that there is incongruence between the reality on the ground in the cities of the developing world and the relative absence of urban forestry research and understanding from these cities in the peer-reviewed literature. It may well be that urban forestry is happening and that there is some research support to initiatives in developing world countries, but their absence from the international literature constrains the ability to make informed comparisons and identify general lessons.

Within the context of the foregoing, this paper presents a desktop analysis of the geographic coverage of peer-reviewed literature on urban forestry and greening over the last few years. It goes on to consider research issues and topics that potentially have greater relevance in or are unique to the developing world contexts, thereby requiring that such research be situated in developing world cities. This comment piece is intended to profile some of the specific needs of and opportunities for urban forestry research in developing regions, and in doing so stimulate debate and a wider range of topics which include those from a developing world perspective.

## MATERIALS AND METHODS

Data on the number and location of studies on urban forestry, urban greening and urban nature-based recreation were collected from three sources. The first and second each involved inspection of an international and widely accessible journal that specialises in urban landscape issues; the first being *Urban Forestry and Urban Greening* and the second was *Landscape and Urban Planning*. For each issue the title and abstract of each article published since 2001 was read (and, if necessary, the entire article) to determine whether it dealt with urban greening, forestry or nature-based tourism, and if it did, then the location of the study site. Multi-country reviews and laboratory-based studies were excluded. The search covered the period 2002 until the end of January 2010 (and included the in press articles that were online at that time). The start year corresponded to when the journal *Urban Forestry and Urban Greening* was launched.

The third source was a direct search using the "SCOPUS" international search engine for the following logical string: "Urban (forestry or greening or nature) and published after 2001". This yielded over 12,000 scientific articles. The number of articles per year was recorded as a measure of the rate of growth in research in the discipline. This search was then further refined by restricting it solely to those journals in the list that had over 100 published articles since 2001, which provided 13 journals and just over 2,000 articles. Thereafter, the title and abstract of each was read (and if necessary the article), in the manner described previously.

For each of the geographic zones delimited, a profile of the resources available for research was obtained from the UNESCO 2007 survey which was released in late 2009. This includes financial and human resources in absolute terms, relative to national GDP and proportion of world totals. Given the wide range in scales between variables, data were normalised to scale them between zero and one by dividing by the highest number and then correlations were tested between the proportion of articles published on urban forestry and urban greening and the research profile per zone.

## RESULTS

### Growth in urban forestry research

The unrestricted search using the "SCOPUS" database provided 12,637 papers since 2001, with considerable annual growth in the number of articles over the period (Figure 1). The overall growth was 194%, averaging approximately 28% per year.

### Geographic location of urban forestry and greening research

The majority of the published work was conducted in developed countries (Table 1), led by Europe and then North America. Only 21.4% of articles emanated from developing regions. Reporting by broad regions inevitably masks the high intra-regional variability. For example, China dominated the developing country returns, accounting for 64% of their combined total. India, with an almost equivalent population size and a strong scientific community, registered only two articles. Africa fared poorly, and all but one came from South Africa. Thus, excluding China, the other developing world countries account for only 12.1% of the published journal articles, of which only one was from an African country other than South Africa.

The proportional share of total publications per region was positively correlated with the regional share of world expenditure on research, as well as the proportion of the world's researchers (Table 1). Thus, the more research funds and personnel a region enjoys relative to others, the greater was their relative share of publications on urban greening and forestry. Intra-regional measures such as the proportion of GDP expenditure on research or the number of researchers per population were not correlated with research output on urban forestry and greening.

## DISCUSSION

The results of this review unequivocally show that (i) there is a rapid growth in the publication of urban forestry research internationally, (ii) it is concentrated in the developed world, and (iii) it is correlated to relative shares of world expenditure on research generally and the number of researchers. This last possibly comes as no surprise because arguably the same could be said for almost any research discipline because the developed world countries have greater research expertise and financial and technological resources (UNESCO, 2009). However, whilst this discrepancy is valid for many research disciplines, not all are equally pertinent to developed and developing country contexts. For example, research into the effects of life style induced

**Table 1.** Percentage (and number in brackets) of articles on urban forestry and urban greening (published between January 2002 and January 2010) from selected sources across different geographic regions and their associated 2007 research profile (UIS, 2009).

Status	Region	Source journals			All sources combined (%)	Urbanised (%)	Percentage of GDP on research	Percentage of population in research	World share of researchers (%)	World share of research expenditure (%)
		Urban forestry and urban greening (n=176)	Landscape and urban planning (n=223)	Others ("SCOPUS") (n=173)						
Developed	Western Europe	58.5 (103)	34.5 (77)	17.3 (30)	36.7	76.6	1.8	0.252	18.9	22.9
	Eastern Europe	1.7 (3)	1.8 (4)	0 (0)	1.2	65.9	1.1	0.273	8.6	4.3
	North America	18.2 (32)	26.5 (59)	41.6 (72)	28.5	81.8	2.6	0.465	22.2	34.7
	Australia/New Zealand /Taiwan /Hong Kong/ Singapore	11.4 (20)	19.3 (43)	4.0 (7)	12.2	82.1	2.7	0.555	12.9	14.7
	Asia (developing)	4.5 (8)	11.7 (26)	28.3 (49)	14.5	38.2	1.4	0.094	31.4	18.4
Developing	South and Central America	0.6 (1)	3.1 (7)	3.5 (6)	2.4	69.3	0.7	0.051	3.6	2.9
	Africa	4.0 (7)	0.9 (2)	0 (0)	1.5	38.8	0.4	0.017	2.3	0.9
	Middle East	1.1 (2)	2.2 (5)	5.2 (9)	2.8	53.4	0.1	0.020	0.3	1.2
Correlation between regional percentage and regional attributes						r = 0.492	r = 0.681	r = 0.488	r = 0.688	r = 0.892
						n.s	n.s	n.s	p<0.05	p<0.001

heart complaints is currently hardly pressing in the developing world, and in the opposite direction research into public health programmes around malaria control may be of interest but of little relevance in the developed world.

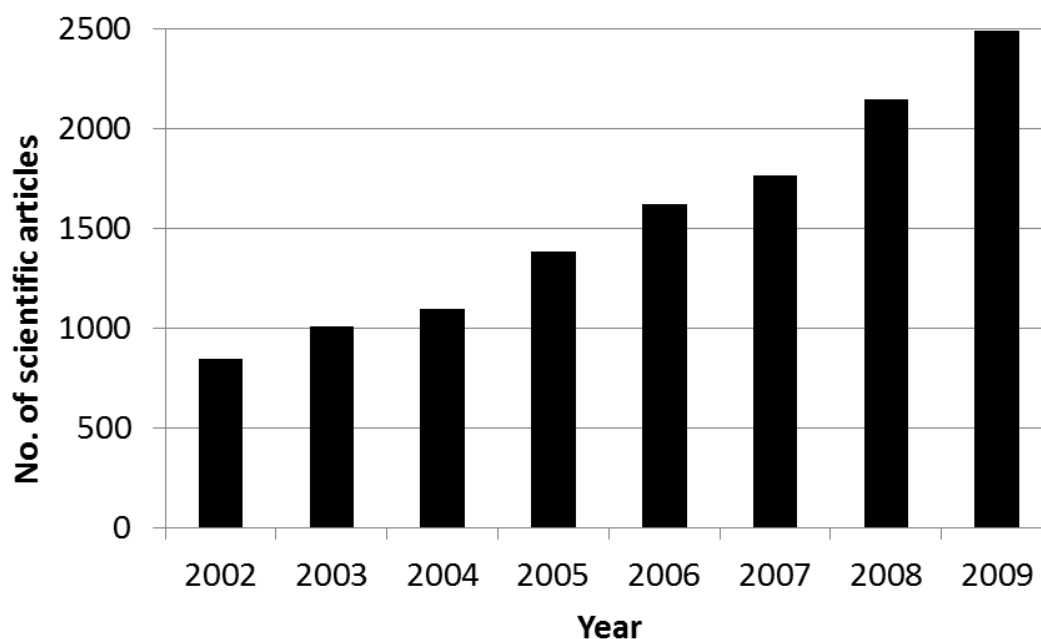
Secondly, although research infrastructure and expertise may be low in certain developing regions and countries, that does not mean research is absent, but rather much of it is executed by non-nationals. For example, over 70% of peer-reviewed papers in the biological disciplines carried out in Swaziland or Lesotho are

written by scientists from other nations.

Consequently, the paucity of research output around urban greening issues in the developing world means that not only is it not being pursued by in-country nationals, but also that it is not a priority for visiting scientists from elsewhere. Does it mean that researchers generally (irrespective of country of origin) feel urban forestry research in developing countries is of little relevance? That would be axiomatic when a case can be made that urban forestry research in the developing world and emerging economies is as relevant as it

is in the developed (Elmendorf, 2008; Gudurić et al., 2011), and probably extremely urgent in face of rapid expansion of many developing world cities.

Many of the broad understandings around urban forestry from the developed world are transferable to developing world contexts with appropriate adaptation, because the basic needs of people and the environment are the same (Matsuoka and Kaplan, 2008). The nature and extent of such adaptations require consideration because of the significant differences in social and economic



**Figure 1.** Number of articles published per year since 2001 as retrieved from the “SCOPUS” database to the search string of “Urban and forestry or greening or nature”.

contexts. But, the general benefits of trees in cooling the urban environment (McPherson and Simpson, 2003) apply equally in the cities of Asia, Africa and Latin America as they do in Europe and North America where most of the research has been done. The same can be said about many aspects, for example, biodiversity and aesthetic benefits, dampening of noise pollution, reducing storm water runoff, capturing of particulates (Soares et al., 2011) and so on. Thus, allowing for adaptations for the local context, the primary need in terms of these aspects is not more research in a developing country, but more application of what is already known so the benefits are integrated into urban policies, planning and implementation.

Alongside the topics and concerns in common between the developing and developed world are some equally pressing issues and questions that cannot be just transplanted because the context is important. Consequently, there are certain topics where the work will have to be replicated, or originate, within developing countries. I propose ten key areas (in no order of priority) as a means of stimulating debate around urban forestry research needs in the developing world. They might not be unique to the developing world, but their nature, magnitude and intensity, and importantly, their interactions, make them more of a challenge in the developing world and hence require research solutions from developing world contexts.

1. High rates of urbanisation: The high rates of urbanisation in the developing world offer opportunities

and challenges to urban forestry, and a rich context in which research can offer solutions and guidelines. The constraints relate to the ever-changing landscape, the increasing pressures on undeveloped land, and the difficulty in mobilising community participation because the constant influx of people means the nature and sense of community is rapidly changing. On the other hand, planners have the opportunity to be proactive in planning green areas and spaces for street trees in the new suburbs (Jim and Liu, 2001), rather than retrospectively in old suburbs or narrow streets where space can be a constraint (Nagendra and Gopal, 2010).

2. High levels of biodiversity: Generally, the developing world has higher levels of biodiversity than the developed world. Consequently, this requires different approaches in incorporating and conserving such a wide array of biodiversity within urban settings. This demands different perspectives on the extent and nature of urban green spaces and forestry in cities because of the richer variety of biodiversity. For example, the size and connectedness of spaces will require a different configuration in species rich regions than in species poor ones. The range of species considered for street tree planting should also be correspondingly greater if a representative suite of tree species (and other taxa dependent upon them) is to be maintained. The horticultural and arboricultural aspects of these different species need to be determined.

3. Cultural identity and preferences: Linked to the higher biodiversity is the need to know about the aesthetic and cultural preferences of local urban residents. These

cannot be simply transplanted from the developed world to a developing country. Indeed, in many cities of the developing world, the tree plantings in the centre are dominated by alien species planted during the colonial period (McConnachie et al., 2008; dos Santos et al., 2010). They contribute little to conservation of local biodiversity, and offer limited connection to local cultures and preferences. Using species that are known or have specific meaning to new urban migrants may potentially reduce the feelings of alienation and promote a more rapid appreciation of their new surroundings and home, promoting a sense of community and place (Mazumdar and Mazumdar, 2009). Hence, the relative benefits and costs of indigenous and alien species need to be evaluated (Shackleton, 2006). The same applies to activities within urban parks. There are areas of potential conflict of interest between different user groups within parks, and cultural norms and expectations must be defined in context rather than transplanted from knowledge and training elsewhere (Hunter, 2001).

4. Consumptive uses of urban forest products: With high influxes of people, many of whom have yet to establish an urban livelihood, there is potentially significant demand for consumptive goods from green spaces and trees, which differs from the largely recreational and psychological uses in the developed world (Hunter, 2001). For example, it is not uncommon to see women in developing world cities collecting branches for fuel wood. Similarly, open spaces with little signs of management easily become targets for cutting of timber for construction of shelters or fences. In such situations, coppice forests are common, but management and biodiversity implications are unknown (Nielsen and Møller, 2008). Other potential products include edible fruits, bark and roots for medicines, animal fodder, and reeds or other fibres for thatching or weaving. Such resources, whether in private or public spaces, are vital safety-nets in times of stress for rural communities of the developing world (Paumgarten, 2005), but it is unknown to what extent they play a similar role for urban ones. The extent to which such materials are harvested from or used in the urban setting is practically unknown, as is also their impact on urban green spaces and species. Without quantification and understanding of these needs, how can city planners know what species to provide and in what volumes to meet these sorts of consumer demands? Moreover, the consumptive use of such tree products has direct links to attainment of the Millennium Development Goals, and hence the potential contributions of urban forestry to poverty alleviation need elucidation (Shackleton, 2006).

5. Trees, spaces and spirituality: In many developing countries, there are cultural and religious beliefs around particular individual trees, species or places (Philpot, 2004; Ouinsavi et al., 2005; Dafni, 2007). They are revered and venerated in rural and urban settings. How

can the bio-centric spirituality associated with these tree species and natural places be incorporated into zonings and plantings within urban centres? What density and distribution of revered species and places are required to meet local needs? How can these be used to promote conservation of biodiversity more generally? How can these trees be identified and conserved in advance of urban development? Additionally, religious sites generally are frequently surrounded by trees or forests (Ishii et al., 2010). Thus, although the trees or forests *per se* might not be venerated, tree and green spaces are vital components of the overall experience at religious sites, and so combining these cultural, religious and aesthetic needs can potentially provide a stronger basis for the promotion and care of urban trees and forests.

6. Urban livestock: The role of livestock in urban agriculture can be extensive in cities of the developing world (Losada et al., 2000; Wolf et al., 2003). This has implications for how open spaces might be planned and used, as well as the need for sustainable supplies of fodder within reasonable proximity. For example, thought will need to be given to either (i) mechanisms to prevent livestock access or (ii) the choice of species planted will need to be determined by their tolerance of browsing. Alternatively, it may require that young saplings are protected until they attain a height beyond which local livestock browse. Multi-purpose fodder trees will need to be considered.

7. Citizen mobility and green space accessibility: In comparison to the developed world, many cities in developing nations have either inadequate public transport networks or low levels of private mobility. This potentially changes the spatial dynamics required of public open spaces provided by city planners. It means that access to green belts and large parks is reduced, especially for poor communities. For example, Ward et al. (2010) reported how visitation rates to national botanical gardens in South Africa were compromised because the gardens were not located on public transport routes. Consequently, a more dispersed model of public green space distribution might be required. This would come with trade-offs regarding size and connectivity.

8. Weak environmental planning and accountability: Although there are exceptions, environmental planning and accountability generally in the developing world is frequently regarded to be weaker than that in the developed world. This is particularly marked in urban areas, where planners and implementation agencies are swamped by rapid rates of urbanisation and keeping up with basic infrastructure development takes up a large proportion of municipal budgets (Tuts, 1998). Whilst there are always limits to any budget, the environment for urban forestry and green space planning, implementation and maintenance is thus more restricted. Consequently, there is a significant requirement for research into how the benefits of urban forestry can be delivered and

assured under the constraints of weak governance and limited resources. Simply transplanting models from the developed world are unlikely to succeed.

9. Engendering participation: Participation in conservation and resource management is widely advocated in rural areas of the developing world, with some pioneering examples of community-based management (Fabricius et al., 2004). Similarly, participation is widely encouraged in urban planning, zonation and environmental issues in the developed world (Bond and Thompson-Fawcett, 2007), with a degree of positive correlation between the level of participation and urban greening outcomes (Baycant-Levent and Nijkamp, 2009). There is little doubt of similar benefits in the developing world, but the methods, tools and approaches to engender participation are typically different. This is for a number of reasons, not least being the more limited transport access to venues, lower literacy levels, reduced time of settlement in the urban area, the need for multilingual information and the differing expected benefits from the outcomes. Additionally, the resources available to implement and support participatory approaches may be more limited (Tuts, 1998). Hence, there is rich scope for innovation and testing of tools and models to foster participation in urban forestry initiatives, as has been examined in Europe (Janse and Konijnendijk, 2007), that will require some degree of being home grown within developing world contexts.

10. Cost-effective and appropriate monitoring: Last, there is a need for better information about urban forestry within cities of the developing world. As observed at the start of this article, street trees and green spaces can be observed and enjoyed in most cities of the developing world. But there is a marked dearth of information available for both research and for decision-making (this is also lamented in the developed world (Baycant-Levent and Nijkamp, 2009)). Many municipalities do not know the extent or quality of public green spaces under their jurisdiction or the number, density, distribution and variety of street trees within the urban limits. Consequently, it is almost impossible to develop and interrogate arguments around their value and function. Inventory techniques are well established in the developed world, but there is a need to adapt them to developing world contexts, along with development of suitable data storage and monitoring systems.

## Conclusion

In conclusion, the results show that whilst there is significant growth in the publication of urban forestry research, it is concentrated in countries of the developed world probably due to their greater share of world expenditure on research generally and the number of researchers. Whilst certain dimensions of urban forestry approaches and knowledge are transferable from the

developed to the developing world, there are several research domains that require context specific research. It is intended that in presenting these, that this article may be a catalyst for increased research around urban forestry in the developing world, as well as debates around key research areas.

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