100 Most Cited Articles in Urban Green and Open Spaces: A Bibliometric Analysis

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Abstract:

Researchers have contributed significantly to the development of the subject of urban green and open spaces (UGOS) in both practical and fundamental aspects. As the number of citations indicates a paper and author’s competency, the online web of science (ISI) was browsed to identify the 100 most cited papers in the field of UGOS from 1980 to 2013. Papers were analyzed for authorship, journal sources, publishers, institutions, countries, year of publication, categories, and author keywords. The total number of citations was compared to the average number of citations per year. From 1105 UGOS papers returned, the maximum number of citations was 212. The top 100 most cited were published from 1988 to 2011, with the majority in 2007. A remarkable distinction was found in the comparison of total citations and average citations per year. As total linear trend indicates a significant growth in influential articles, urban green and open spaces are a developing subject in landscape and urban planning. This study gives an insight into the readership of UGOS by highlighting key papers.

Keywords:

Open space; green space; citations; landscape; urban planning; bibliometric

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**Introduction**

In the context of urban studies, a great number of terms and definitions refer to “urban green and open space” (UGOS) such as open space, green space, public space, and urban greenery. Parks and public gardens, as the most well-known UGOS, are associated with amenity green spaces, having a high quality of landscape design and maintenance. On the other hand, experimental green spaces are often referred to as green feel, which users consciously or unconsciously experience within a certain area. Therefore, the constitution of UGOS varies among different groups of people, for example, between citizens and researchers, where human influences convert natural areas into urban areas, as UGOS is a reflection of human demand for greenery. They can vary from a simple playing field to natural landscape or highly maintained environment and are mostly provided with open access to public, although they may be privately owned.

For the purpose of this study UGOS contains all types of public or private open spaces in urban areas which are completely or mostly covered with vegetation. Water bodies such as rivers, streams and lakes are included but not all green areas outside urban borders. Furthermore, these UGOS play a key role to improve the environment through landscape enhancement, better air quality, and noise reduction, which result in the enhancement of well being and quality of citizens’ life (1); (2).

As a type of bibliometric method, citation indices trace the references in a published paper (3). It exhibits how many times a specific article has been cited in other articles (4). The avenues to evaluate citation tracking have been significantly raised in the past years (3, 5). The frequency of citation of the publication is assumed to display the impact of the publication, but not essentially their quality (6). Evidently, citation count alone is not sufficient to provide a complete criteria for judging scientific paper quality, in particular when there exist numerous mechanisms to boost the citation of a paper (7, 8). It should be added that rather than alternative metrics, citations remain a main indicator of the importance of a research output (9-11).

In this study, top-cited articles (12), classic papers (13), top publications (14) or most frequently cited articles (15) in different categories related to UGOS have been studied (16). For a long time now, bibliometric studies have been widely applied to evaluate research papers by measuring scientific preferences (for example, Saracevi & Perk, 1973) and different aspects have been studied such as: annual publication outputs, authors, language, categories, journals, publishers, contributing institutes, and countries, and keywords (17). This study not only evaluates the publication characteristics: language, annual publications, countries, and institutional contributions, and Web of Science categories, but also evaluates researchers’ trends and emphasis by analyzing author keywords in UGOS topic. The result shows the top-cited articles in the field of UGOS.

**Methods and Materials**

The Institute of Scientific Information (ISI) in 1962 launched the Science Citation Index for scientific journals in a consistent and systematic manner in order to measure citation numbers. A paper quality is best recognized by citation count (18). According to the number of times a paper has been cited by other authors, the scientific impact of that paper, author, or journal can be
evaluated (19). In this bibliometric research, we analyze citation indices to determine the key papers in urban green and open spaces.

The data utilized in this research were derived from the online Web of Science (the Tomson Reuters) on 29 August 2014. In order to find proper keywords an email survey was conducted, with 30 emails sent to experts as respondents and relevant keywords of UGOS investigated. Collected data were analyzed qualitatively and extracted keywords applied to search top articles from Web of Science core collection in terms of topic (including four sections: title, abstract, author keywords, and keyword plus) within the publication year limited to the period from 1980 to 2013, indices: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, these keywords were searched: (“green space*”), (greenspace*), (“urban space*” AND green*), (“urban space*” AND open), (“open space*”), (“green infrastructure*” AND Urban), (“public space*”) or (“urban green*” NOT greenhouse). A total of 9,058 publications met the selection criteria. However, these publications contained some documents not closely related to UGOS, therefore the result was refined by Web of Science Categories: Urban Studies. A total of 1,105 documents were therefore determined.

Citation statistics produced for a time frame shorter than three years may not be sufficiently stable (20, 21). Therefore, the documents from 2012 to 2014 were put aside. Furthermore, since the target of the data collection is the 100 most-cited articles most relevant to UGOS and, all 1105 documents were arranged according citations, and their abstracts studied. From 139 first documents, 39 which were not specific to UGOS were excluded, to reach 100 most cited articles that were analyzed statistically by Microsoft Excel. The details of the data collection process are illustrated in Fig.1.

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**Figure 1: Data collection process to search UGOS related researches**

Click here to View figure

**Figure 2: Number of papers per year**

Click here to View figure
Results and Discussion

Paper and authors’ citations

Table 1 presents the list of 100 most-cited papers in urban green and open spaces that give an idea of readership. The paper by Chiesura (22), which explains the role of urban parks in a sustainable city, appears to be the most important, with a total of 212 citations. The nearest competitor is a literature review (23) about promoting the ecosystem and human health by using green infrastructure in urban areas, with a total of 183 citations. Besides that, the first and third top cited articles are review papers. These results are on the corresponding general belief that review articles had the highest number of citations (24, 25).

Table 1: Top 100 article in urban green and open spaces (UGOS)

<table>
<thead>
<tr>
<th>No.</th>
<th>First Author</th>
<th>No.</th>
<th>First Author</th>
<th>No.</th>
<th>First Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chiesura, 2004</td>
<td>61</td>
<td>Eliasson, 2007</td>
<td>41</td>
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<tr>
<td>2</td>
<td>Tzoulas, 2007</td>
<td>58</td>
<td>Fabos, 2004</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Burgess, 1988</td>
<td>58</td>
<td>Jorgensen, 2002</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Luttik, 2000</td>
<td>58</td>
<td>Grahn, 2010</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Valentine, 1996</td>
<td>58</td>
<td>Sandstrom, 2006</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ruddick, 1996</td>
<td>57</td>
<td>Khakee, 2006</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pauleit, 2005</td>
<td>57</td>
<td>Breffle, 1998</td>
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<tr>
<td>8</td>
<td>Tratalos, 2007</td>
<td>55</td>
<td>Daniels, 1991</td>
<td>37</td>
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<tr>
<td>9</td>
<td>Whitford, 2001</td>
<td>55</td>
<td>Comber, 2008</td>
<td>36</td>
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<tr>
<td>10</td>
<td>Bengston, 2004</td>
<td>54</td>
<td>Troy, 2008</td>
<td>35</td>
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</tr>
<tr>
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<td>Tyrvainen, 2007</td>
<td>85</td>
<td>Gunnarsson, 2007</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Tyrvainen, 1997</td>
<td>53</td>
<td>Linehan, 1995</td>
<td>35</td>
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</tr>
<tr>
<td>13</td>
<td>Bowler, 2010</td>
<td>53</td>
<td>Balram, 2005</td>
<td>34</td>
<td></td>
</tr>
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<td>14</td>
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<td>34</td>
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</tr>
<tr>
<td>15</td>
<td>Anderson, 2006</td>
<td>52</td>
<td>Arendt, 2004</td>
<td>34</td>
<td></td>
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<tr>
<td>15</td>
<td>Jackson, 2003</td>
<td>51</td>
<td>Bondi, 1998</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Tyrvainen, 1998</td>
<td>50</td>
<td>Lyytimaki, 2009</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Yeoh, 1998</td>
<td>49</td>
<td>Maruani, 2007</td>
<td>32</td>
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<tr>
<td>19</td>
<td>Atkinson, 2003</td>
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<td>Dobbs, 2011</td>
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<tr>
<td>19</td>
<td>Zerbe, 2003</td>
<td>47</td>
<td>Nagendra, 2010</td>
<td>30</td>
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<td>21</td>
<td>Morancho, 1998</td>
<td>46</td>
<td>Gordon, 2009</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>
The top 100 papers were published between 1988 and 2011 (Fig 2). During this period the number of papers increased consistently from 1 to 5. This number remained unchanged between 2000 and 2002. The trend is unsteady until the two years of 2006 and 2007 which showed the highest number of top-cited papers with 11 and 13 instances. The citation rate gradually decreased over the years that followed. This reduction over the last few years would seem logical because citation of scientific papers normally starts one or two years after publication and reaches peak after about 10 years (26). All in all, total linear trend indicates an increasing consideration for UGOS.

Table 2 ranks the authors according the total citations they have received. It also demonstrates the two top cited articles for each author. Jim, CY with 269 citations is placed first, followed by Tyrvainen, L with 248 and after him Ennos, AR obtained with 247 citations.

While our top 100 papers have 226 authors, only 20 authors wrote more than one article (see Table 3). Jim, CY is the highest ranked with five publications and a total of 269 citations which contain one paper with single author and four papers as first author. Tyrvainen, L; Pauleit, S; Chen, WY; Ennos, R and Handley, JF each contributed three papers. According to Table 2, single authors (Jim, CY; Tyrvainen, L and Kong, FH) published only three articles.
Table 2: The first 10 authors with the most citations

<table>
<thead>
<tr>
<th>Rank</th>
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<th>Number of publications</th>
<th>Total citations</th>
<th>First article citations</th>
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<td>66</td>
<td>61</td>
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<tr>
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<td>Tyrvainen, L</td>
<td>3</td>
<td>248</td>
<td>85</td>
<td>85</td>
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<tr>
<td>3</td>
<td>Ennos, AR</td>
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<td>247</td>
<td>101</td>
<td>97</td>
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<tr>
<td>4</td>
<td>Niemela, J</td>
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<td>238</td>
<td>183</td>
<td>55</td>
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<tr>
<td>5</td>
<td>Hitchmough, J</td>
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<td>238</td>
<td>183</td>
<td>55</td>
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<tr>
<td>6</td>
<td>Chiesura, A</td>
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<td>212</td>
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<td>7</td>
<td>Jorgensen, A</td>
<td>2</td>
<td>201</td>
<td>97</td>
<td>55</td>
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<tr>
<td>8</td>
<td>Chen, WY</td>
<td>3</td>
<td>157</td>
<td>66</td>
<td>50</td>
</tr>
<tr>
<td>9</td>
<td>Davies, RG</td>
<td>2</td>
<td>156</td>
<td>98</td>
<td>58</td>
</tr>
<tr>
<td>10</td>
<td>Fuller, RA</td>
<td>2</td>
<td>156</td>
<td>98</td>
<td>58</td>
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</tbody>
</table>

Table 3: Authors with 2 publications and more

<table>
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<tr>
<th>Rank</th>
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<th>Number of publications</th>
<th>Single Author</th>
<th>First Author</th>
<th>Collaborative Authors</th>
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<tr>
<td>2</td>
<td>Tyrvainen, L</td>
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<td>1</td>
<td>2</td>
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<tr>
<td>3</td>
<td>Pauleit, S</td>
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<td>4</td>
<td>Chen, WY</td>
<td>3</td>
<td>____</td>
<td>____</td>
<td>3</td>
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<tr>
<td>4</td>
<td>Ennos, R</td>
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<td>____</td>
<td>____</td>
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<tr>
<td>4</td>
<td>Handley, JF</td>
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<td>____</td>
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<td>8</td>
<td>Kong, FH</td>
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<td>Jorgensen, A</td>
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<tr>
<td>11</td>
<td>Niemela, J</td>
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<td>____</td>
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<td>11</td>
<td>Zipperer, WC</td>
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<td>____</td>
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<td>11</td>
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<td>____</td>
<td>____</td>
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<td>11</td>
<td>Nakagoshi, N</td>
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</table>
Journal Sources and Publishers

Results showed that these papers were published in 16 journals. The most popular journal was *Landscape and Urban Planning* with a total of 62 citations. This is more than nine times the citation number of its nearest competitor. Seven papers were published in the journal of *Urban Geography* and six in both journals of *J AM Planning Assoc*. Total citations and also impact factor of each journal were extracted from the website of the Journal Citation Report on 5/10/2014 and presented in Table 4. The journal impact factor is one of the most important measures that indicate the journal’s significance within the related fields (27). The impact factor was first introduced by Garfield and Sher (1963) and has been widely applied to evaluate and rank journals (17). According to Table 4, the average impact factor is 1.46 which indicates the majority of these papers were published in the journals with high impact factors. Therefore, in order to attain a high number of citations, it is essential to publish papers in the English language as it appears to be a unique literary language used in UGOS and also to choose a high impact factor journal, which is advanced in science and continued development (28).

Table 5 shows the publishers of 100 top articles. From all of the publishers, *Elsevier Science BV* individually published 64% of papers and the other 15 publishers only contributed to 36% of papers.

### Table 4: Journal source

<table>
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<tr>
<th>Journal Source</th>
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<th>Rank</th>
<th>Total Citations</th>
<th>Impact Factor</th>
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</thead>
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<td>Landscape and urban planning</td>
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<td>1</td>
<td>6203</td>
<td>2.606</td>
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<tr>
<td>Urban geography</td>
<td>7</td>
<td>2</td>
<td>923</td>
<td>1.746</td>
</tr>
<tr>
<td>Journal of the American planning association</td>
<td>6</td>
<td>3</td>
<td>1725</td>
<td>1.489</td>
</tr>
<tr>
<td>URBAN studies</td>
<td>6</td>
<td>3</td>
<td>4896</td>
<td>1.33</td>
</tr>
<tr>
<td>URBAN FORESTRY &amp; URBAN greening</td>
<td>5</td>
<td>5</td>
<td>821</td>
<td>2.133</td>
</tr>
<tr>
<td>Journal of real estate finance and economics</td>
<td>2</td>
<td>6</td>
<td>1103</td>
<td>0.697</td>
</tr>
<tr>
<td>Rank</td>
<td>Publisher</td>
<td>Number of Papers</td>
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<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------</td>
<td>------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ELSEVIER SCIENCE BV</td>
<td>64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>V H WINSTON &amp; SON INC</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ELSEVIER GMBH, URBAN &amp; FISCHER VERLAG</td>
<td>5</td>
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<tr>
<td>4</td>
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<td>CARFAX PUBL CO</td>
<td>4</td>
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<td>ACADEMIC PRESS INC ELSEVIER SCIENCE</td>
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</tr>
</tbody>
</table>
Countries and Institutes

The result shows that most of the papers originated from 22 countries, with the majority originating from the USA [37] followed by UK [19]. Table 6 shows the countries that have at least two papers. Previous authors have hypothesized that American authors are biased toward locally published papers when citing references (29) which may possibly explain our findings. If continents are analyzed, 40 papers come from Europe, 39 from North America and 21 from Asia Pacific (Table 6).

Table 6: Number of publication of countries which have two or more publications

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of publications</th>
<th>Rank</th>
</tr>
</thead>
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</tr>
<tr>
<td>UK</td>
<td>19</td>
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</tr>
<tr>
<td>Sweden</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>China</td>
<td>7</td>
<td>3</td>
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<tr>
<td>Finland</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Australia</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Netherlands</td>
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<td>6</td>
</tr>
<tr>
<td>Denmark</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Canada</td>
<td>2</td>
<td>8</td>
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<td>Germany</td>
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<td>Japan</td>
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<td>8</td>
</tr>
</tbody>
</table>

The result also shows that from 80 universities and institutions that published top papers, 68 have merely a single paper and the others contributed two papers or more as shown in Table 7. University of Sheffield and University of Hong Kong are the most fruitful with five papers followed by US Forest Serv. and University of Massachusetts with three papers.

Table 7: Number of publication of institute which have two or more publications

<table>
<thead>
<tr>
<th>Rank</th>
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<th>Number of publications</th>
</tr>
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<tr>
<td>1</td>
<td>Univ Hong Kong</td>
<td>5</td>
</tr>
</tbody>
</table>
Document Types and Categories

The distribution of document types identified by ISI was analyzed. These papers consist of four document types, and articles are dominant with 83 documents, followed by review articles (9); Proceedings Papers [7] and editorial materials [1]. The distribution related to the language of the articles also was analyzed and all these papers are published in English (Table 7).

Regarding Web of Science categories (Table 8) all papers are categorized under urban studies because of the refinement during data collection. Environmental studies [77] and geography [69] are in the second and third ranks. This result indicates most papers are considered under two or more categories.

Table 8: Web of science categories

<table>
<thead>
<tr>
<th>Rank</th>
<th>Web of Science categories</th>
<th>Number of papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Urban Studies</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Environmental Studies</td>
<td>77</td>
</tr>
<tr>
<td>3</td>
<td>Geography</td>
<td>69</td>
</tr>
<tr>
<td>4</td>
<td>Ecology</td>
<td>62</td>
</tr>
<tr>
<td>4</td>
<td>Geography, Physical</td>
<td>62</td>
</tr>
<tr>
<td>6</td>
<td>Planning &amp; Development</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>Forestry</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Economics</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Plant Sciences</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Business, Finance</td>
<td>2</td>
</tr>
</tbody>
</table>

Author keyword
In recent years, bibliometric analysis of author keywords has been able to provide a reasonably sophisticated picture of the papers’ subjects (17). In order to illuminate research trends, frequency of author keywords should be analyzed quantitatively (table 9). Keywords according to the authors’ views were used not more than 19 times (green space*) which indicated that UGOS papers have involved a wide range of research focuses and diverse scientific literature. Except the author’s keywords “green space”, “open space” and “urban green space” related to the searching keywords, three most frequently applied author keywords are: “urban planning”[10], “urban park*”[6] and “land use”[6]. On the other hand, all of these key words are collocations of two or three words, therefore they have been separated and analyzed for the second round and this time the frequency of the first key word was urban [71].

Table 9: The most frequently used author keywords

<table>
<thead>
<tr>
<th>No</th>
<th>Keywords</th>
<th>Number of repetitions</th>
<th>Rank</th>
<th>Separated Keywords</th>
<th>Number of repetitions</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>green space*</td>
<td>19</td>
<td>1</td>
<td>urban</td>
<td>71</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>urban planning</td>
<td>10</td>
<td>2</td>
<td>planning</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>open space*</td>
<td>7</td>
<td>3</td>
<td>green space*</td>
<td>31</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>urban park*</td>
<td>6</td>
<td>4</td>
<td></td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>urban green space*</td>
<td>6</td>
<td>4</td>
<td>landscape</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>land use</td>
<td>6</td>
<td>4</td>
<td>City*</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>urban forest</td>
<td>5</td>
<td>7</td>
<td>land</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>urban ecology</td>
<td>4</td>
<td>8</td>
<td>environment*</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>public health</td>
<td>4</td>
<td>8</td>
<td>ecology*</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>compact city</td>
<td>3</td>
<td>10</td>
<td>value*</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>environmental psychology</td>
<td>3</td>
<td>10</td>
<td>nature*</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Green Infrastructure</td>
<td>3</td>
<td>10</td>
<td>ecosystem*</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>13</td>
<td>urban forestry</td>
<td>3</td>
<td>10</td>
<td>conservation</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>Urban biodiversity</td>
<td>3</td>
<td>10</td>
<td>open</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>ecosystem services</td>
<td>3</td>
<td>10</td>
<td>hedonic</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>16</td>
<td>landscape ecology</td>
<td>3</td>
<td>10</td>
<td>greenway*</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>17</td>
<td>landscape metrics</td>
<td>3</td>
<td>10</td>
<td>public</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>18</td>
<td>Contingent</td>
<td>3</td>
<td>10</td>
<td>Design</td>
<td>8</td>
<td>17</td>
</tr>
</tbody>
</table>
Study Limitation

It should be noted that this study has some methodological limitations. Firstly, we applied online ISI web of knowledge, so the papers not indexed in this database are ignored. Secondly, all journals have specific approaches to reject or accept submitted manuscripts; therefore the particular journals which have stricter selection criteria may affect the quality of their publications. That is why 62% of 100 top cited articles have been found in one article. Thirdly, citation count might encounter some problems such as authors’ preference for self-citation, or cite free full access articles, review papers, well known authors, papers by colleagues as well as cite papers from the journal they are going to submit their work to. Finally, publication year influences citation index and the number of citations for each paper; therefore recent papers do not have sufficient time to reach a high citation rate in comparison with older ones.

Table 10: Comparison of average number of citations per year and total citation

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Year Published</th>
<th>Total citations</th>
<th>citation per year</th>
<th>Rank for total citations</th>
<th>Rank for citation per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoting ecosystem and human health in urban areas using green infrastructure: a literature review.</td>
<td>2007</td>
<td>183</td>
<td>26.14</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>The role of urban parks for a sustainable city.</td>
<td>2004</td>
<td>212</td>
<td>21.20</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Urban greening to cool town and cities: a systematic review of the empirical evidence.</td>
<td>2010</td>
<td>80</td>
<td>20.00</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Urban form, biodiversity potential and ecosystem services</td>
<td>2007</td>
<td>98</td>
<td>14.00</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Tools for mapping</td>
<td>2007</td>
<td>85</td>
<td>12.14</td>
<td>11</td>
<td>5</td>
</tr>
</tbody>
</table>
Conclusion

This study can be considered the first report on the top cited papers in UGOS. The priority of the papers was arranged according to the citations they have received. Total citations were extracted from Web of Science Core Collection Times Cited Count but analyzing merely total citation is a potential flaw as it gives a bias to the older papers because during a longer time they would have accumulated a high number of citations which may be of less significance and influence than a
more recent paper. Therefore, the average number of citations per year is used as a yardstick against which to reflect the importance of articles.

A comparison was made between the total number of citations and the average number of citations per year, of the top 10 articles (Table 10) emerging 42 and 86 ranking of total citations, between top 10 high ranks of average citation per year indicates how different these two criteria can be. From a total of 1,105 UGOS papers returned using our methods, the paper with the maximum number of average citations per year [26.14] was written by Tzoulas (23), which has the second highest number of total citations [183]. The second highest number of average citations per year is the paper written by Chiesura (22), which achieved first rank with a total citation of 212.

Conflicts of Interest

We confirm that no authorities have any conflict of interest in the process of producing this paper. No authors have a personal relationship with other organizations or people that could influence this research inappropriately and also there has not been any financial benefit attached to this paper.

References

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