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Assessment the Status of Urban Trees and Their Role in Environmental Services in Umdorman Locality, Sudan

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Abstract

This research implemented in Umdorman locality, Sudan. The objectives of this research are to (a) assess the urban trees status such as species, density, distribution and regulation; (b) draw a map of geographical distribution of the trees in the locality; (c) assess the role of urban trees that cover Umdorman and their role in improvement of the microenvironment; (d) determine the empty area capacity to establish a new urban forests. This research used the Google earth program to identify trees points, Excel file to save the coordinates as decimal degrees DD units (X=longitude and Y= latitude), the research found 22364 trees. The ArcMap software v 10.2 was used to analyze points and extract into maps. Eventually, the results showed the dominant trees species are *Conocarpus erectus*, *Azadirachta indica* and *Albizia lebbeck*, respectively (5580, 3426 and 2510 tree), as well as to other twelve trees species. The proportion area that is full of trees less than the proportion area that was empty. Thus, the research suggested planting other trees to cover the empty areas.

Keywords

Urban Trees, Ecosystem Services, Google Earth, ArcMap, Sudan

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1. Introduction

In general, dry areas suffer from a lack of renewable natural resources (water resources, arable land, natural vegetation cover) and thus lack of food, fodder and fuel, forcing citizens to misuse their lands, deforestation, and environmental degradation and desertification [1]. As with so many other environmental problems, there are many things causing trouble to a tree. Environmental change as a case of human interference has been a continuous phenomenon in the ecosystem balance in the 20th. During 1990-2010, Sudan lost about 8.4% of its forest cover 6.432.000 ha [2]. The fact is that: high urban populations place increased stress on natural resources. New housing in new residences can be needed in urban areas continuously as the population increases. On the other hand, to plan and execute new settlement areas, we need to use land that may be a forest, agricultural land or others, which are the approximate cause lead to urban deforestation [3]. Generally, Deforestation is categorized as one of the most challenges the world face today; it has a crucial geographical dimension and component [4].

The urban forest is the collection of trees, shrubs, groundcovers and wetlands on a public, private and institutional land within a Local Government Area. Urban

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forests provide critical ecosystem services such as air and water filtration, shade, habitat, oxygen, carbon sequestration and nutrient cycling. Maximum mid-day air temperature reductions due to trees are in the range of 0.04°C to 0.2°C per cent canopy cover increase. Below individual and small groups of trees over grass, mid-day air temperatures at 1.5 m above ground are 0.7°C to 1.3°C cooler than in an open area. Reduced air temperature due to trees can improve air quality because the emissions of many pollutants and/or ozone-forming chemicals are temperature dependent [5]. Trees affect air quality through the direct removal of air pollutants, altering local microclimates and building energy use, and through the emission of volatile organic compounds (VOCs), which can contribute to O_3 and $PM_{2.5}$ formation [6]. Trees remove gaseous air pollution primarily by uptake via leaf stomata, though some gases are removed by the plant surface. For O_3, SO_2 and NO_2, most of the pollution is removed via leaf stomata. Once inside the leaf, gases diffuse into intercellular spaces and may be absorbed by water films to form acids or react with inner-leaf surfaces [7]. Urban forests have been around for generations but only recently have they become valued for providing more than aesthetic and recreational values. Cities around the world now regard trees and other vegetation as critical urban infrastructure as important to how a city functions as roads or public transport and particularly vital to the health and wellbeing of communities. The benefits of urban forests span environmental, economic, cultural and political domains. These benefits are interrelated, with each cumulatively feeding into the creation of resilient and sustainable urban landscapes. Environmental benefits of the urban forest include: (a) providing shade and cool our cities; (b) reducing stormwater flows and nutrient loads; (c) reducing air pollution, air-borne particulates and greenhouse gas emissions; (d) Providing habitat and enhance levels of biodiversity [5]. Urban forests have many positive impacts for the community by forming shared points of reference within the urban environment and allowing daily interaction with nature, a creation of local identity, improving community cohesion, encouraging outdoor activity, reconnecting children with nature, reducing sun exposure, reducing heat-related illnesses and improving mental wellbeing. Some of the economic benefits of an urban forest include reducing energy costs, increasing property values, avoiding costs of infrastructure damage and renewal, decreasing health costs, marketing the City and Storing and sequestering carbon [8]. During photosynthesis, trees convert carbon dioxide and water into sugar and oxygen and store carbon within their biomass. Urban trees therefore make an impact in absorbing carbon from the atmosphere [9]. Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to cities [10-11]. The benefits of urban trees are not only well recognized by the academic community, but by municipalities and institutions around the country and the world [12].

1.1. Problem Statement and Justification

Generally, urban growth becomes the main category that causes land use change, which has occurred under certain causes related to the human activities such as cutting trees and eradicating forests for urban growth. In many developing countries, urban development often occurs as the result of rural-urban migration. Carbon emissions contribute to warming, that one of the biggest problems facing the world. Deforestation, especially trees is one of the biggest causes of carbon emissions in the atmosphere. Umdorman city contains a large number of factories that emit carbon, as well as carbon emissions from car exhausts. There is a problem of planting trees (urban growth) in the study area, which contributed to the desertification and sand crawling, especially in the northern and western parts. Particularly, there is lack of urban forests/trees in most towns of Umdorman locality.

1.2. Objectives

The objectives of this research are to (a) assess the urban trees status such as species, density, distribution and regulation; (b) draw a map of geographical distribution of the trees in the locality; (c) assess the role of urban trees that cover Umdorman and their role in improvement of the microenvironment; (d) determine the empty area capacity to establish a new urban forests or plant trees in the locality. Urban trees improve air quality, cool local air temperatures, filter and retain storm water, sequester carbon, and contribute to healthier and more beautiful cities [13]. In addition to providing clear benefits to humans, trees provide essential habitat and food sources for wildlife in a landscape increasingly fragmented by urban development. Even small urban parks provide significant habitat for local and migrating birds [14]. Several studies in the USA have analysed the effect of tree cover on the price of residential house sales, finding that values of properties in tree lined areas may be up to 6% greater than in similar areas without trees [15]. (Wolf, 1998

1.3. Study Area

Umdorman is the largest city in Sudan. it is a largest part in Khartoum state is. It is located along the west bank of both the Nile River and White Nile. Located between latitude 32°07 to 32°36 N and longitude 15°11 to 15°41 E (Figure 1). Umdorman locality consists of 11 administrative units. Based on the division of Sudan into plant regions, Umdorman is

located within the desert and semi-desert regions. Umdorman is one of the hottest cities in the world with a temperature of 53°C (127°F) in the summer. The annual mean temperature is 37°C (99°F) with six months of the year at a mean monthly temperature of less than 38°C (100°F). It is noted that there is no month of the year in which the temperature does not fall below 30°C (86°F), which is not recognized in major cities with desert climate similar to Riyadh, Baghdad and Phoenix, Arizona, but the temperature in Umdorman decreases Noticeable during the night hours to reach about 15°C (59°F). Umdorman suffers of obvious environmental problems such as problem of waste transport, sewage problem, storm water drainage, and other natural problems such as floods, dust, desert encroachment and soil erosion on the banks of the Nile. Social problems are homelessness and street children as a result of the waves of refugees in the city due to wars and fighting at home and in neighboring countries and rural to town migration, resulting in the spread of informal housing on the periphery of the city and hawkers in the markets.

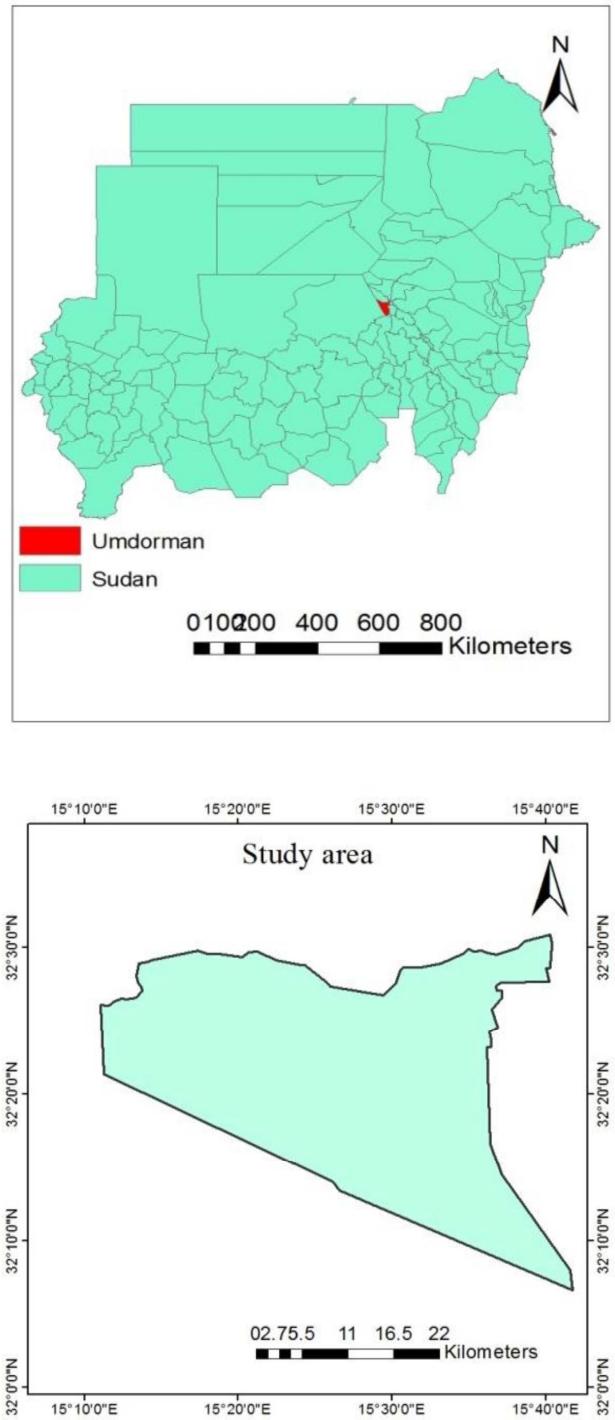

Figure 1. Map of Umdorman locality.

2. Material and Methods

The materials, which we need, are Google earth program, Excel file and ArcMap software. The first step, open Google earth and zoom in Umdorman locality to select the coordinates of trees points. Second step, save the coordinates in Excel file in decimal degrees unit (X and Y). The third step opened ArcMap then display points from Excel to ArgMap to analyze these points, and then extract its map to show distribution and density of trees in area (Figure 2).

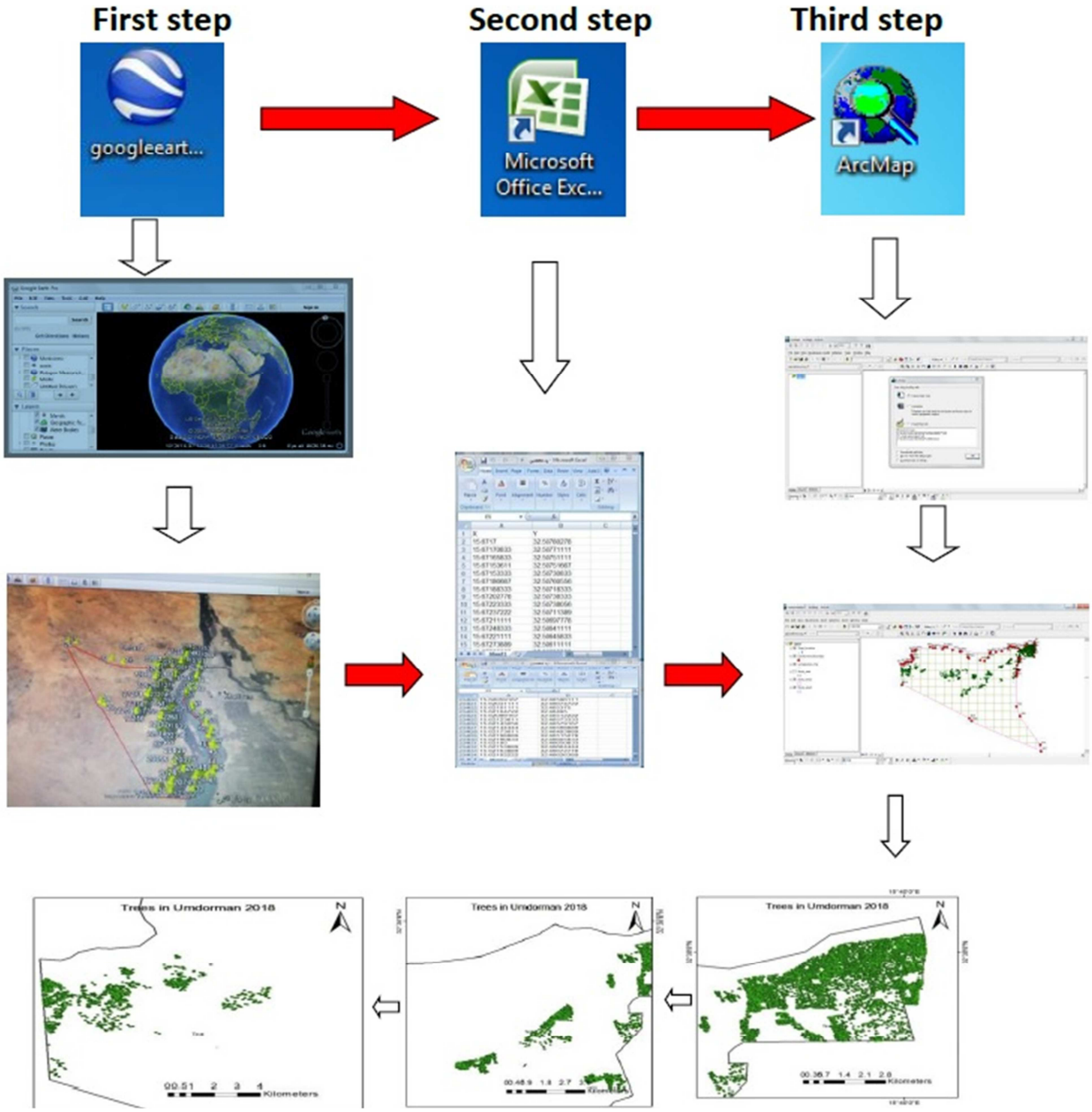

Figure 2. This diagram display the methods that implemented in the study.

3. Result and Discussion

The distributions of trees were not regulated with large empty areas and the trees have covered only the mid location of Umdorman as shown in Figure 3. Thus, trees have no any role to improve the microenvironment in Umdorman; the density is very low compared with total area. The most areas are empty must cover by new trees. Most trees were distributed on the roads, in front of and inside houses, govemental istitution and parks are *Conocarpus erectus*, *Azadirachta indica*, *Albizia lebbeck*, *Phoenix dactylifera*, *Peltophorum pterocarpum*, *Khaya senegalensis*, *Ficus benjamina*, *Termenalia cattapa*, *Eucalyptus spp*, *Sisyphus spina Christy*, *Acacia nilotica*, *Hyphaene thebaica*, *Pithecellobium dulce*, *Banalities eagyptiaca* and *Roystonea regia*, as shown in Table 1.

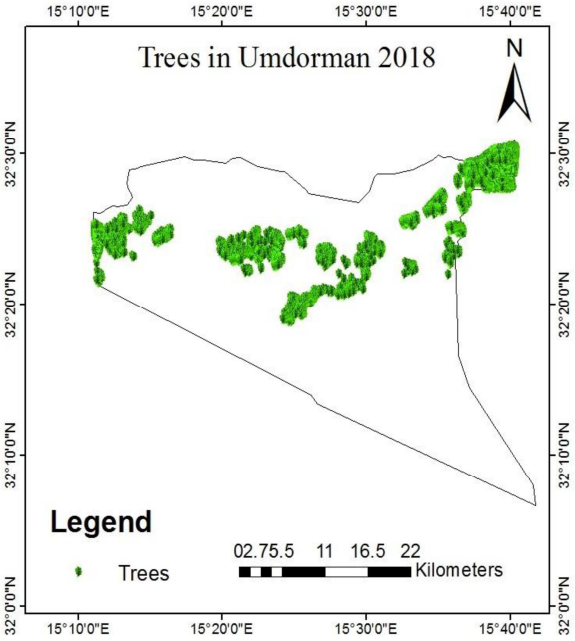

Figure 3. The distribution of trees in Umdorman locality.

Table 1 showed that the dominant trees species are *Conocarpus erectus*, *Azadirachta indica* and *Albizia lebbeck*, respectively (5580, 3426 and 2510 tree) as well as to other twelve trees species.

Table 1. The trees species type and number.

No	Trees types	Numbers
1	*Conocarpus erectus*	5580
2	*Azadirachta indica*	3426
3	*Albizia lebbeck*	2510
4	*Phoenix dactylifera*	1996
5	*Peltophorum pterocarpum*	1751
6	*Khaya senegalensis*	1530
7	*Ficus benjamina*	1250
8	*Termenalia cattapa*	983
9	*Eucalyptus.spp*	870
10	*Sisyphus spina christy*	627
11	*Acacia nilotica*	570
12	*Hyphaene thebaica*	390
13	*Pithecellobium dulce*	320
14	*Banalities eagyptiaca*	293
15	*Roystonea regia*	268

4. Conclusion

We encourage to the planting trees in roads, houses, governmental institutions and gardens. Work on increasing the trees in the area especially in the peripheral parts. The competent authorities should act as guidance and awareness of the importance of trees in reducing emissions to improving the microenvironment in Umdorman locality. Follow-up and protection of planted trees so that they can protect the area and get other benefits.

The selection of proper trees for a planting in any site must be we need to evaluative this site. Because, many trees were planted in urban areas are short-lived because many people skip the site evaluation process. Site evaluation can done during, driving around town to find out which species grow well in areas with similar site attributes. Visiting a local public garden or nursery is also a great way to learn about all the different species that are available and being grown locally. Collect specific information about growing and selecting trees in the area from books and web materials.

Selected trees must be able to resist the air temperature, drought, diseases, and poor soils. In the fact, fast-growing trees tend have a weak wood and they are typically shorter-lived under natural growing conditions. However, slow-growing trees take longer to reach their mature size, thus, have a strong wood.

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