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People and sustainable land management: assessment of stakeholders knowledge of the nature of landuse/cover change in Abuja, Nigeria

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Abstract Nature of Landuse/Land cover (LULC) changes has been assessed for many ecosystems, but there is limited knowledge on how different stakeholders perceive such changes. Information on this is required before sound interventions to address adverse impacts of the changes can be introduced. This paper utilised secondary and questionnaire survey data, complimented with focus group discussion, to assess how different stakeholders (famers, forestry workers, construction workers, artisans, resource managers, civil servants and private sector workers) perceive LULC changes induced by urban growth in rural (Karshi and Orozo) and urban (Karu and Nyanya) areas of Abuja Municipal Area Council (AMAC) of Federal Capital Territory, Nigeria. LULC change data revealed declines in cultivated areas, grasslands and bare lands, and corresponding expansion of built-up and vegetated areas over 1987–2014. Different stakeholders in both rural and urban locations of the area are generally aware of the nature of the changes. Those in rural locations have some very close interactions with features such as soil, water, and vegetation and are aware of the kinds of their changes. The urban dwellers are largely aware of changes in human aspects of the LULC. The respondents generally indicated that vegetation cover has been declining due to urban growth in the study area but secondary data analysis revealed opposite trend. Appropriate recommendations were given to improve soil, water and vegetation management in the study area.

Keywords Land management · Sustainability · Landuse · Land cover · Change · Stakeholders · Perception

Introduction

In confronting the challenges to planning and management of socio-ecological systems, dealing with a variety of actors or stakeholders such as scientists, policy makers private sector actors, and community-based resource users is unavoidable. By incorporating the stakeholders' perceptions and values, and by seeking to involve them in decision-making processes, conservation plans and efforts will likely better achieve desired goals and targets (Young et al. 2013; Villamor et al. 2015). Cash et al. (2003) have argued that scientific information that we feed into planning and assessing exercises is likely to be effective in influencing the public only if that information is perceived by the relevant stakeholders as legitimate, credible and acceptable.

The fact that different stakeholders (for example: farmers, settlement developers, wood collectors, resource managers, policy makers, private sector, etc.) need to necessarily be integrated into processes

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aimed at achieving sustainable land management has been well recognised in the literature on sustainable development (Beierle 1997; Grimble and Wellard 1997; Healey 2002; Hurni 2002; The World Bank 2006; Hamilton and Wills-Toker 2006; Apata et al. 2009; Eppink et al. 2012; Schwilch et al. 2012). However, before such integration can be possible, what the people know and perceive about the land must first be very well understood. A major issue that needs to be addressed before sustainable land management could be achieved is landuse/land cover (LULC) change which is seen as a necessary manifestation of human development processes and can thus be used to evaluate the extent to which human activities are jeorpardising or promoting sustainable land management (Eniolorunda et al. 2016).

LULC has for long been changing in the world. Available records indicate that the area under crop cultivation in the world has increased globally from an estimated 300–400 million ha in 1700 to 1500–1800 million ha in 1990, a four-and-a-half to fivefold increase in three centuries and a 50% net increase just in the twentieth century (Goldewijk and Battjes 1997). The area under pasture increased from around 500 million ha in 1700 to around 3100 million ha in 1990 (Goldewijk et al. 2001). Forest area decreased from 5000–6200 million ha in 1700 to 4300–5300 million ha in 1990. Steppes, savannas, and grasslands also experienced a rapid decline, from around 3200 million ha in 1700 to 1800–2700 million ha in 1990 (Ramankutty and Foley 1999; Goldewijk et al. 2001). Nowadays, current rates, extents and intensities of Land use/land cover change are far greater than ever in history, resulting in unprecedented changes in ecosystems and environmental processes at local, regional and global scales (Lambin et al. 2003). These changes are particularly more noticeable in developing nations which are characterized by rampant urban sprawling, land scarification and transformation of agricultural land to shrimp farming ecosystems with quite enormous cost to the environment at local, regional and global levels (Alves and Skole 1996; Sankhala and Singh 2014). It is therefore indispensable to examine issues related to changes in LULC, so that their effect on terrestrial ecosystem can be discerned, and sustainable land use planning can be formulated (Muttitanon and Tripathi 2005).

LULC change is caused by a variety of factors. In the literature, two categories of causative factors are

recognised, proximate (direct, or local) and underlying (indirect or root). The first category explains how and why local LULC are modified directly by humans, while the second explains the broader context and fundamental forces underpinning these local actions. In general, proximate causes operate at the local level (individual farms, households, or communities) and underlying causes originate from regional (districts, provinces, or country) or even global levels, though complex interplays between these levels of organization are common. The most important proximate factor causing LULC is population growth which always increases the need to bring more lands under human control (cultivation, settlement development, mining, industrialisation, etc.). One case in which to easily see the way in which population growth is causing LULC change is in urban growth which results specifically into clearance of lands for settlement development (houses, schools, markets, industries etc.), as well as modification of lands to suit the various needs of urban dwellers (transportation routes, drainages, urban greens, parks, open fields, etc.). Thus, urbanisation can be regarded as one of the major causes of LULC change.

LULC change is widely considered as a very serious environmental problem as it is ranked as the second most important human cause of global warming (Hansen et al. 2010; Harris et al. 2012; Houghton et al. 2012). Recent estimates showed that it has caused the release of about 0.9 ± 0.5 GtC year^{-1} of CO_2 to the atmosphere (Gasser and Ciais 2013). With advances in techniques for monitoring such changes (especially remote sensing and GIS technologies), large research information is now available on causes, nature, extent and consequences of urban development on LU/LC for many areas. It should be noted here that most of the completed research works on urban growth-induced LULC change focused mainly on the assessing the nature and extent of the LULC changes, their drivers and their societal and biophysical impacts.

In order to design and implement measures to mitigate LULC changes or adapt to their negative impacts, it is important to understand how stakeholders perceive them (Meyfroidt 2012; Onate and Peco 2005; Karselaers et al. 2013; Ariti et al. 2015). This is especially needed because stakeholders typically base their decisions on their perception of the drivers and impacts of LULC change and utilise such perceptions

in taking decisions on how to adapt to them. Currently, there is very little information about how different stakeholders perceive the nature and causes of LULC changes. Where peoples' views are sought by research workers on LULC changes, farmers were often the ones mainly contacted perhaps because they are thought to be the most visible actors on the land (Adimassu et al. 2012; Garedew et al. 2009; Mengistu et al. 2012; Meshesha et al. 2012; Molla 2014), while other stakeholders, such as non-farm workers, institutions and businesses have not been considered. There is therefore currently limited scientific knowledge on how different stakeholders perceive nature and pattern of LULC change.

This study hence seeks to advance an understanding in this regard by investigating how different stakeholders in Municipal Area Council of Abuja Federal Capital Territory (FCT) perceive the nature of urban-growth induced LULC changes in the area.

Literature review

Urban growth is known to exert enormous pressure on LULC through processes such as removal of vegetation cover, replacement of existing vegetation types, reforestation and creation of hardened/paved/concrete surfaces, among others. Such processes can cause some changes to the LULC with consequences to human survival. When towns develop, lands are taken for settlement development to accommodate more housing demands of urban dwellers. Satellite towns also develop to meet with housing needs of those that serve the towns but are less capable of competing for houses in them (Watson 2009). Thus, with town and satellite down development, massive transformations in LULC are introduced which could no doubt have some serious consequences for global environmental change. To continue living in the midst of such changes, stakeholders in cities affected by the changes must as of necessity find means of adapting to them.

In general terms, the ways in which urban development cause LULC changes have been documented for many areas in the world (see for instance: El-Raey et al. 1995; Samant and Subramanyan 1998; Fasal 2000; Liu et al. 2000; Gar-On Yeh and Xia 2001; Selcuk et al. 2003; Ifatimehin and Ufuah 2006; Zubair 2006; Rajeshwari 2006; Fan et al. 2007; Mengistu and Salami 2007; Kaswanto and Arifin 2010; Prakasam 2010; Belal

and Moghanm 2011; Tefera 2011; Rawat et al. 2013; Molla 2014; Sankhala and Singh 2014; Aroengbinanga and Kaswanto 2015; Hegazy and Kaloop 2015; Omer et al. 2015). Such studies have documented that urban growth causes changes in different LULC types, though the nature and extent of the changes differ clearly from an urban area to another.

Turner II et al. (1995) have developed a cause-cover relationship model in which they try to explain the nature and drivers of LULC change in a broad context. They explained that population pressure, state politics, market incentives, climate variations and access to land and water resources are the driving forces of LUCC. They further posited that land use changes resulting from these driving forces will cause cumulative transformation in forms of modification (e.g., changes in fallow cycles, levels of input, rotation systems, agricultural land intensification), conversion (e.g., deforestation for cultivation) and maintenance of land cover (e.g., the upkeep and repair of soil terraces, of improved pasture, or of irrigation systems). These forms of transformation have impacts on the immediate physical system such as vegetation, soil, hydrology, etc. at the local scale, but become globally significant by widespread cumulative occurrence (e.g., climate change) which also impact on the driving forces (Turner II et al. 1995; Lambin et al. 2000).

A number of studies (Adams 1986; Swindell 1986; Adeniyi 1993; Reenberg et al. 2010; Mohammed 2002; Lambin et al. 2003; Ojo et al. 2009; Hersperger et al. 2010; Ghosh et al. 2012; Iliya and Baba 2013; Eniolorunda et al. 2016) have shown that the fundamental basis of LUCC are agriculture and population growth. However, in and around major built-up areas, activities related to urban growth (bush clearance for constructions, excavation of materials for buildings, blasting of rocks to obtain gravels for building foundations, construction of many types of (residential, industrial, institutional and commercial) complexes and urban greening are considered as additionally important drivers of LULC change (see for instance: Ujoh 2009; Ejaro 2009; Idoko and Bisong 2010; Kwabe 2010; Ujoh et al. 2010; 2011; Chima 2012; Ejaro and Abubakar 2013; Ade and Afolabi 2013; Adepoju et al. 2013; Usman 2013; Enedah et al. 2015).

The Federal Capital Territory Abuja is an 8000 km^2 piece of land located at the centre of Nigeria, comprising of six main administrative divisions (called Area Councils), with a Capital City (designated

as the Federal Capital City, FCC) that houses nearly all the Federal Establishments (and hundreds of private ones) located within one (the Abuja Municipal Area Council, AMAC) of the six. This designation has been shown to be the major stimulant for influx of people from different parts of the country to different areas of the FCT, but especially the AMAC. To accommodate such a mass movement of migrants, massive provision of infrastructure became inevitable which has been encouraging large scale residential, commercial, institutional and industrial activities (Chima 2012; Mahmoud et al. 2016). For these to be done, massive clearance of vegetation cover (woodland, shrub land and grassland) to prepare land for physical development as well as destruction of hills and rock outcrops to obtain materials for construction became inevitable (Adepoju et al. 2013). Balogun (2001) has shown that quite a large number of inhabitants of the Abuja FCT predominantly still depend on land resources (soil and vegetation in particular) for survival (as farmers, livestock herders, wood collectors, etc.) despite the fact that the territory is now the capital city of the country. Thus, even though their lands are gradually and rapidly being consumed by urban development, they are left with no option than to look for 'free' lands to continue with their land-based activities like farming, livestock rearing and wood collection. This implies that both urban developers and traditional land users are in form of a competition over similar pieces of lands in Abuja FCT, a competition that was never anticipated at the beginning or in the future of the city's history (Mabogunje 1976; Obateru 2004). As lands for activities like farming and wood collection become increasingly scarce, local people in the territory are now left with little option than to seek for livelihood in informal sector.

Abubakar (2014) has argued that FCC being the most rapidly growing city in Africa, is not just a modern capital city of Nigeria but one that is being contested by the elites who desire to realize their modernist vision of an orderly and beautiful city and the poor who struggle to stitch together a living largely in the informal sector. In Nigeria, the Abuja city is regarded is the major destination of large number of unemployed and other people seeking opportunities from the numerous public and private establishments that dot its landscape. It is also considered as a safe destination for Nigerians that have been facing security challenges in different parts of the country.

Consequently, its population has for long been expanding. In 2011, the population of Abuja was put at 2,291,413, with tremendously high population growth rate of 5.2% per annum which is predicted to remain at this rate up to at least the year 2025 (UNFPA 2012). Over 1995 and 2012, the extent of built-up area was said to have grew by over 400% which made the city to have the fastest growth rate in Africa (Abubakar 2014). Expectedly, a number of research workers have observed this urban expansion to have resulted into tremendous LULC changes (Ujoh 2009; Ejaro 2009; Ejaro and Abubakar 2010; Idoko and Bisong 2010; Kwabe 2010; Ujoh et al. 2010, 2011; Chima 2012; Ade and Afolabi 2013; Adepoju et al. 2013; Usman 2013; Enedah et al. 2015). The nature of LULC and their changes in Abuja FCT are thus issues that have attracted substantial attention of research workers and so far hundreds of research works have been completed on them. The extents to which different stakeholders in the area (land developers, farmers, wood collectors, artisans, urban and rural dwellers, etc.) perceive such issues however remain largely not documented.

To understand the knowledge of different stakeholders of the nature of LULC and changes induced by urban growth, a conceptual framework is needed which focuses on understanding the nature of the changes by the stakeholders. Accounting for the nature of LULC change in the study area is conceptually simple and Fig. 1 gives a graphical representation of the conceptual framework for this study. It could be seen from the figure that four broad LULC classes are recognisable in the area (vegetated, elevated, lowlands and cultural). Three major drivers, namely (1) decision to transform the area into federal capital, (2) demands for more houses, offices and industrial spaces to accommodate the needs of a typical Federal Capital and (3) demands for more water, soil and vegetation by increasing population attracted to the region have combined to be increasing the demands for more land resources leading to the various stakeholders into taking LULC change decisions. The decisions could be towards decreases or increases in the various LULC types depending upon the circumstances under which they were taken.

Alao (2009) has documented how mass housing drive has been causing substantial transformations in LULC of Abuja. Such a large housing provision scheme requires large expanse of land to be cleared
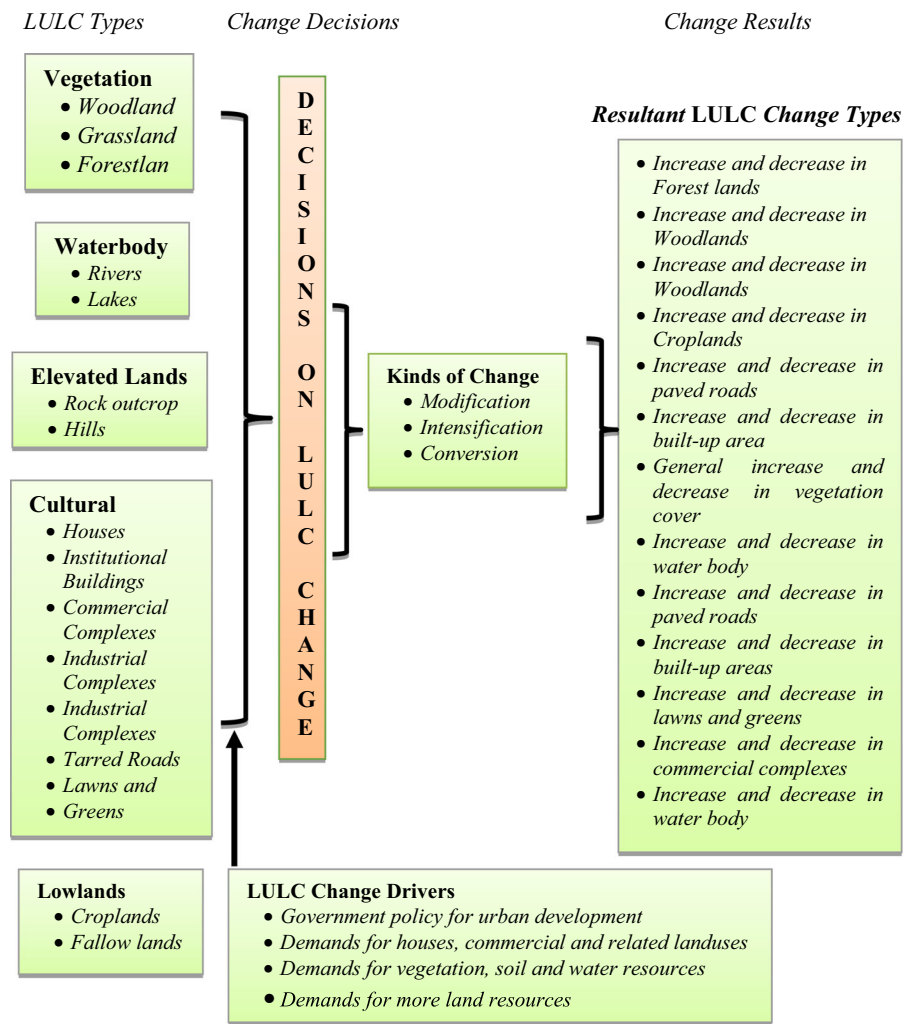
LULC Types   *Change Decisions*   *Change Results*

Vegetation
- *Woodland*
- *Grassland*
- *Forestlan*

Waterbody
- *Rivers*
- *Lakes*

Elevated Lands
- *Rock outcrop*
- *Hills*

Cultural
- *Houses*
- *Institutional Buildings*
- *Commercial Complexes*
- *Industrial Complexes*
- *Industrial Complexes*
- *Tarred Roads*
- *Lawns and*
- *Greens*

Lowlands
- *Croplands*
- *Fallow lands*

DECISIONS ON LULC CHANGE

Kinds of Change
- *Modification*
- *Intensification*
- *Conversion*

Resultant LULC Change Types

- *Increase and decrease in Forest lands*
- *Increase and decrease in Woodlands*
- *Increase and decrease in Woodlands*
- *Increase and decrease in Croplands*
- *Increase and decrease in paved roads*
- *Increase and decrease in built-up area*
- *General increase and decrease in vegetation cover*
- *Increase and decrease in water body*
- *Increase and decrease in paved roads*
- *Increase and decrease in built-up areas*
- *Increase and decrease in lawns and greens*
- *Increase and decrease in commercial complexes*
- *Increase and decrease in water body*

LULC Change Drivers
- *Government policy for urban development*
- *Demands for houses, commercial and related landuses*
- *Demands for vegetation, soil and water resources*
- *Demands for more land resources*

Fig. 1 Conceptual framework for explaining types of LULC and nature of their changes

which in most cases cause the farmers and rural dwellers to be evicted and displaced from their lands (Fowler 2008). As they are so displaced, they move to other yet-to-be developed portions within the territory and clear new lands for both farming and housing development. Many mass housing sites now dot the FCT landscape but are comparatively more noticeable in the FCC than outside it. Though urban expansion has been noted to be occurring more progressively around the FCC, evidences from the literature have shown that similar (though largely uncoordinated) trend has been going on in the city's periphery and even in rural locations of the territory (Ade and Afolabi 2013; Ujoh et al. 2011; Chima 2012; Enedah et al. 2015). While such result into tremendous LULC

changes, they particularly lead to emergence of slum like development in the many locations around the FCC (Adepoju et al. 2013).

The works of Adeponle (2013) and Staab (2015) have revealed that the FCC is a city that is growing faster than the provisions of its master plan. This has been turning into an environmental embarrassment, with developments springing up in gross violation of zoning and other planning codes. Recent survey report by Ezeamaka and Oluwole (2016) has shown that over 65% of recreational facilities in the City have been fully developed, but with only about 11% of the recreational sporting facilities developed in line with the Master Plan. Trends such as this typically results into unpredictable LULC alterations.

Bloch et al. ([2015](#)) have observed that as land cover expands due to urban expansion in Nigeria, the urban edge is in constant redefinition which frequently redefines urban boundaries, and what is categorised as 'urban' and 'rural', which creates complicated linkages between urban change, spatial expansion and urban governance. The emerging reality is that there is a mismatch between the extent of the land cover occupied by the built fabric, and the existing administrative and institutional boundaries of Nigerian municipalities. In Abuja FCT, urban expansion is simply not constrained within municipal limits but often overlap or spill over between various rural and urban locations.

Ade and Afolabi ([2013](#)) blamed the trend of urbanization in Abuja and its environs on the massive human migration that have been occurring since 1991 when the movement of most government agencies from the Nigeria's former capital city of Lagos was completed. This increase has been putting pressure on LULC not only within the FCC but the surrounding settlements as well, thereby posing a threat to the limited land resources. They employed Landsat ETM images of 1987 and 1999 and Nigeriasat 1 image of 2007 to analyse the physical expansion of the FCC over 1987–2007 period, and found out that the built-up area increased from 8% in 1987 to 22% in 2007, rock-outcrop decreased from 74 to 37%, vegetation decreased from 40 to 17%, while the area occupied by water body has remained constant overtime. They projected that the population of the city will grow by 37% by 2020 which will continue to encourage massive LULC changes.

Ejaro and Abubakar ([2013](#)) noted that human migration is the primary factor for rapid urbanization of Abuja, leading to overstretching of infrastructural facilities and services with many observable problems across the territory being inadequate good quality housing, poor waste management, inadequate electric power supply, inadequate good quality domestic water supply, inadequate and unaffordable health care facilities, poor environmental health and traffic congestion on the Abuja city-Nyanya-Maraba-Keffi road.

Usman ([2013](#)) utilised Landsat TM and ETM + images for the 1986, 1990, 2001, 2006 and 2011 and Artificial Neural Network algorithm and regression techniques to carryout urban Land cover classification in Abuja FCT. The results of the analysis showed that the built up area increased by about 207%

from 1986 to 2011, which led to reduction in vegetated areas leading to the problem of urban heat island. Also, the work of Enedah et al. ([2015](#)) has revealed that physical development has significantly transformed the urban landscape of FCT, Abuja. The highest rate of urban growth of 40% was observed during 1990–2002 period but the rate slowed down to 19% over 2002 and 2014 period.

Mahmoud et al. ([2016](#)) employed Landsat TM and ancillary datasets to assess LULC change in Abuja FCC over 1986 and 2014 period. Logical transitions to the urban category were modelled for predicting future scenarios for the year 2050 using the embedded land change modeler (LCM) in the IDRISI GIS software package. The result showed that urban areas increased by more than 11% between 1986 and 2001, and by 17% between 2001 and 2014. The LCM model projected LULC changes that showed a growing trend in settlement expansion, which might take over allotted spaces for green areas and agricultural land if stringent development policies and enforcement measures are not implemented.

It is clear from the literature review that on both global scales in general and at the level of Abuja FCT in particular, it is well recognised that urban growth causes tremendous LULC changes. Though the magnitude of the changes observed may vary with the techniques used in assessing the changes, there is apparently a consensus among the different researchers that urban growth opens opportunities for mass in-migration of human beings which creates demands for more spaces for residential, commercial, industrial, institutional, recreational and even agricultural uses. These demands result into LULC change decisions, with the nature of the resulting change typically varying with the circumstances within which the decisions are taken.

Study area

Abuja is located in the centre of the country in the Guinea savannah between latitudes 8°25′N and 9°25′N and longitudes 6°45′E and 7°45′E and occupies an area of about 8000 km^2. It is one of the fastest growing urban and regional areas in the third world, designed as the capital city of Nigeria in 1976, though the seat of the country's government could not be moved there until 1991 (about 25 years ago). For

administrative reasons, the FCT is divided into 6 political units (called Area Councils) namely Abaji, Bwari, Gwagwalada, Kwali, Kuje and Municipal Area Councils (Fig. 2). Because most of the public establishments are located in the AMAC, the Council has been witnessing tremendous physical growth since 1991. Expectedly, this has resulted into massive changes in LULC, as observed by a number of research workers (Ade and Afolabi 2013; Ujoh et al. 2011; Chima 2012; Usman 2013; Enedah et al. 2015). Though large research information is available on the nature, extent and impact of such changes, information is not available on how stakeholders perceive and adapt to them.

Abuja provides a good testing ground for a study of this kind because it is one of the most rapidly transforming physical landscapes in the world. As noted by Adama (2007), the area in which Abuja is

located has indeed undergone spatial, economic, socio-cultural and political transformations. Over the past 40 years, the round huts that dotted the landscape have been replaced by modern buildings made of glass or concrete, and the narrow passages and footpaths that served streets have given way to paved streets and boulevard. The population grew from 97,513 in 1976 to 378,671 in 1991 and 1,400,000 in 2006 (NPC 2012). At national growth rate average of 3.2%, the population is projected to be 1,815,000 by 2015. However, based on the FCT growth rate of about 5.2% per annum, the figure is expected to have risen to 2,292,413 by 2015. The rapid population growth of the FCT is certainly not that of dwellers of the newly-built city alone, but satellite towns as well. Infact, while the so-called newly built city is generally low in density, the satellite towns are in general usually high to very high in density with high human dwelling per
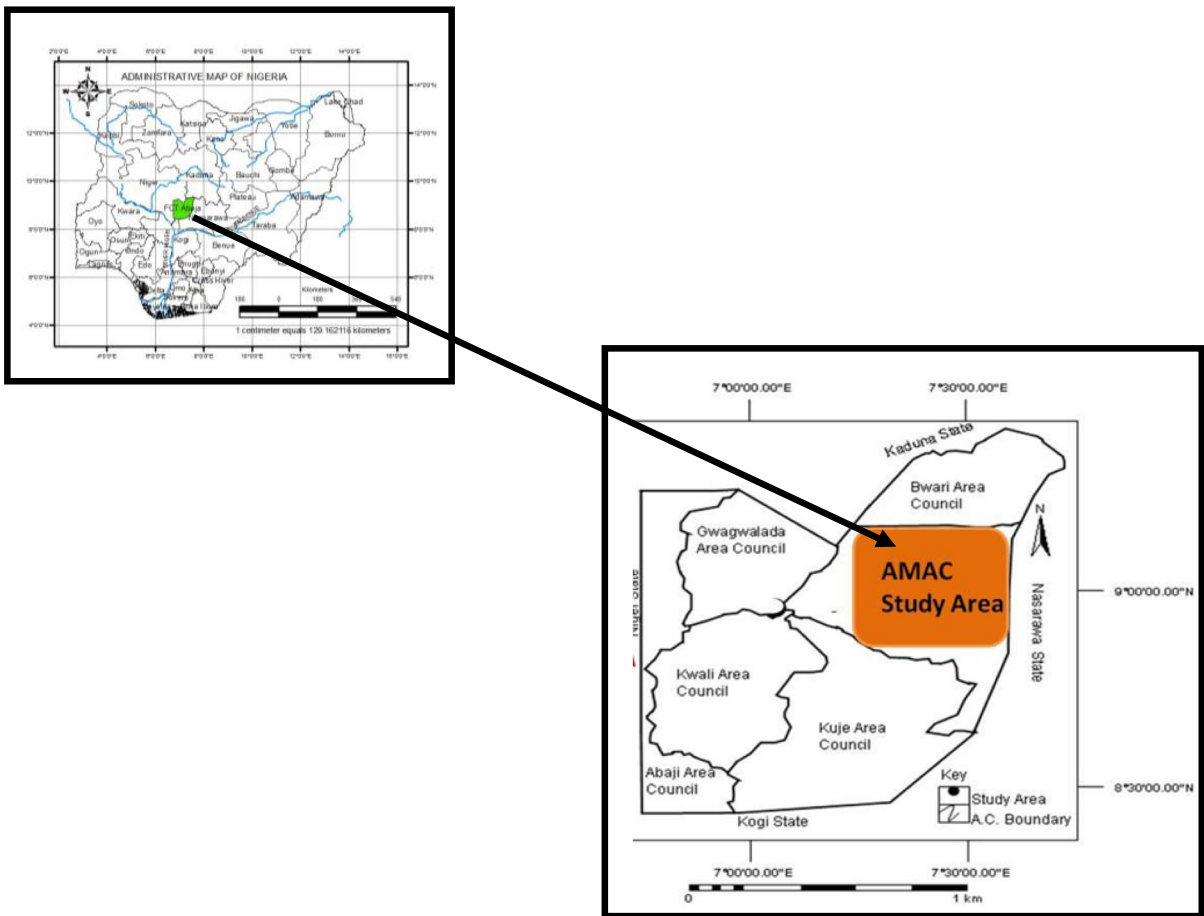

Fig. 2 Location of Abuja Municipal Area Council (AMAC) in Abuja FCT, Nigeria

house, and in most cases with more than one household encountered in a single housing unit. In addition, majority of the inhabitants of the satellite towns are low and medium income earners that have activities related to landuse and land cover (farming, wood collection, wild foods gathering, construction workers, stone crushing, charcoal production, wood-crafts making, etc.) as their primary or secondary occupation (Sheriff 2012).

AMAC has a total of twelve wards, namely City Centre, Garki, Gui, Gwagwa, Gwarimpa, Jiwa, Karshi, Kabusa, Karu, Nyanya, Orozo and Wuse. The scope of this study extends to four of the wards (Karshi, Karu, Nyanya and Orozo) considered as the most densely populated and the ones in which the primary occupation of majority of the dwellers have something to do directly with the LULC. They are also the ones in which the residents have very high interactions with LULC, being predominantly engaged in activities that relate directly to such features. Infact published research information on LULC changes in Abuja FCT have identified such locations as the ones with very high rate of the changes. Within each of the four wards, the focus is on the residents that have been staying in the area for at least the past 25 years. This was deliberately decided upon because of the need to specifically target those with long-time personal experience on LULC around the area where they dwell.

Methodology

Research design

The methodology for this study was designed after that of Ariti et al. (2015). As a first step in the conduct of this study, past works on LULC change in the study area were assembled and reviewed to obtain information on the nature, pattern and extent of the changes. Discussions were held with officials of AMAC Department of Agriculture and Natural Resources on the current distribution and changes in the LULC of the area. LULC statistics were obtained from the literature for 1987, 2001, 2003, 2006 and 2014.

Data about the people's knowledge and adaptation to LULC change in the study area were collected from fieldwork using household survey, field observations, as well as focus group discussions with people that

have been living in the study area for at least the past 30 years, since the base year for the study was 1987 being the oldest for which data on the area's LULC are available. This was deliberately done in order to ensure that only those with sufficient knowledge on pre-1987 LULC change issues were involved in the household survey and focused group discussions.

Stakeholders for the study were chosen purposively from four main wards (Karu, Karshi, Nyanya and Orozo) which are the main ones around which massive LULC changes were observed in previous studies conducted in the study area (Ejaro 2009; Idoko and Bisong 2010; Kwabe 2010; Ujoh et al. 2010, 2011; Chima 2012; Ade and Afolabi 2013; Adepoju et al. 2013; Zubair et al. 2015; Enedah et al. 2015; Mahmoud et al. 2016). In addition, they represent the most densely populated wards with majority of the residents having as their primary occupation activities that relate directly to landuse and land cover.

In each ward, stakeholders for questionnaire survey and focussed group discussions were purposively chosen, as the target was deliberately on those with long term residential history (having been staying in the area for at least the past 25 years). This was to ensure that only those with potentially rich experience on landuse and land cover change in the area were involved in the study.

Sampling frame and sample determination

The sampling frame for the study was first determined by consulting records on household statistics of each of the four wards selected for the study. The records were obtained from the AMAC's Primary Health Care Department. The household sizes of the four wards vary between about 20,000 and 44,000. For practical purposes, it became quite necessary for a fraction rather than the total household sizes to be used in this study and thus sampling was inevitably required here. Using Yamame formula of sample size determination (Yamane 1967), the household statistics of each ward was used in calculating the sample size to be used in the study (Table 1).

Questionnaire design and administration

This study used a number of instruments in data collection process and these included the questionnaire, handheld camera, and observation data sheet.

Table 1 Distribution of stakeholders and sample size by ward, as determined using the formula of Yamane (1967)

Ward name	Settlement type	Household size	Calculated sample
Karshi	Largely rural	10,787	85
Nyanya	Largely urban	11,805	117
Karu	Largely urban	28,517	249
Orozo	Largely rural	2954	63

These instruments were required in the collection of primary data during field survey. The observation sheet was used to capture data on number of LULC features from each ward. Data sheet was also useful in the extraction of secondary data from the data bases or publications. The camera was used to capture some important geographical features relevant to the objectives of the study as at the time of the field survey. This methodological approach was adapted after that of Inkani (2014).

The questionnaire used in the study was structured in such a way as to capture information required to address the working objective of the study. The questionnaire variables were both closed and open-ended, with the former meant to extract information from the stakeholders fitting to some expected framework. On the other hand, the open-ended questions were expected not only to provide the required information but also to solicit for additional insight on the variables of concern. For response control, research assistants recruited for the work were trained on how to handle open-ended questions in administering the questionnaires in the field. The questions in the questionnaire were designed to assess the stakeholder perception of LULC dynamics, their drivers and its impacts. The questionnaire contained two main parts (a) background information about the stakeholders, and (b) land-use history of the study area, driving forces of LULC, impacts of land-use change, and the adaptation mechanisms used by the stakeholders in response to LULC changes.

During the reconnaissance survey, it was established that the literacy level varies with some of the target stakeholders not literature enough to read and comprehend the content of the questionnaire prepared. Thus, an approach was adopted that involved administration of the prepared questionnaire to those who could read and write while for those not literate enough, the contents of the questionnaire were used as an interview checklist guide, with the responses received during an interview with a given respondent entered directly on the questionnaire as they were received. Deliberate efforts were made to ensure that the entire key stakeholders in the study area were covered in the social survey conducted. Selection of the stakeholders was done purposively to ensure that the number targeted for each ward was actually covered in the survey. The survey was conducted between February and April 2015.

Focus group discussion

The questionnaire for focus group discussions was designed on the basis of the responses from the field survey so as to capture the information already collected but from a different informed perspective from the communities. The perspective sought from the focus groups related to LULC issues.

Four focus group discussions were held during the field visit, one per each of the four wards, with selected representatives of the various stakeholders as a means of cross-checking the individual people responses (Stocking and Murnaghan 2001). Each group discussion lasted about one hour thirty minutes. In order to reduce bias due to male dominance in the discussion, three local people moderated the discussion. One was a female and two were male, (one of the men was primarily recording information). Issues under discussion related to knowledge and adaptation about use of LULC, observed changes before and after the creation of FCT, traditional practices relating to conservation of land resources to date.

Results and discussion

Profile of the Stakeholders

Across the four studied ward, the stakeholders are generally above 40 years, but with over 70% in each

falling within the age range of 40 and 59 years age bracket. Thus, they are considered as fairly old enough to have observed the changes in LULC that have been occurring in the study area. Given that Abuja FCT was created and designated as a Federal Capital in 1976 (Abubakar 2014), then anyone that is up to 40 years as at the time of this study, is considered as fairly old enough to have observed the changes in LULC that have been going on over time. Ujoh et al. (2011) have shown that since Abuja became Nigeria's Federal Capital Territory in 1976, it has been experiencing rapid expansion, urbanization and significant changes in its physical landscape. Over 90% of the stakeholders have lived in the study area for period ranging between 36 and 60 years which no doubt is expected to avail them an opportunity of observing changes in LULC around them since the commencement of active urban development in the study area.

Over 80% of the stakeholders are males, implying that male-headed households are the commonest across each of the four settlements. Also, across each of the four locations, at least 60% of the stakeholders are married, while over 80% of them belong to four main tribes (Hausa, Gbagyi, Fulani and Gwandara) whose primary occupational activities involve crop production, extraction of forest resources and rearing of animals (Balogun, 2001). In a typical African setting, being married implies that someone is duty bound to work and earn a living to sustain his/her immediate family. It can thus be said that the stakeholders by their gender, age, marital status and tribal affiliations are expected to have some very close interactions with LULC in the area and will hence most likely not be unaware of its changes.

In Karu and Nyanya settlements nearly all the stakeholders had some form of education, whether formal (through normal school structure) or informal (through informal contacts with educated ones) with the majority having experienced formal education beyond secondary school level. This observation is not unexpected given that the two are the most urbanized of all the settlements in the area council, with several opportunities for someone to acquire both formal and informal education. In addition the two settlements are populated by working class people engaged in both public and private sectors. On the other hand, over 80% of the stakeholders in the two other settlements (Karshi and Orozo, which are more of rural in nature) did not get educated beyond the secondary education

level. The fact that majority of the stakeholders in the study area have had some formal educational experience suggest that they are likely to generally be well informed about the happenings around their surroundings and hence have most likely been observing some LULC issues.

In the two urbanized settlements, majority of the stakeholders are in paid employments (in both public and private sectors) or into private lives as petty traders or business men/women offering services and selling items required by urban dwellers. On the other hand, majority of the stakeholders in the two other settlements are engaged in activities that depend largely on natural resources on the area (farming, wood collection and selling, livestock rearing and traditional medicine vendoring). Thus, in the latter settlements the stakeholders are most likely to be aware with changes in natural aspect of LULC while in the former they will most likely be conversant with changes in human aspect of LULC.

Over 70% of the stakeholders in Karu and Nyanya settlements earn above N200,000 per annum while over 80% of those in Karshi and Orozo earn less than N200,000 per annum. It will not be very difficult to associate the income disparity of the two categories of settlements to the fact that majority of those in the largely rural settlements not only depend largely on natural resources for survival (through activities like farming, livestock rearing, wood collection and selling, etc.) but also have little sources of securing extra income to supplement what they are getting from nature-based economic activities. In general however, it is clear from the data that over 90% of the stakeholders earn less than USD10 per day from their primary occupation which going by World Bank rating, place them on scale of those under absolute poverty. It is generally assumed that where the poor live, the environment suffers most as they tend to depend on it for survival (Kates and Haarmann 1992).

In terms of land ownership, in Karu and Nyanya, over 70% of the stakeholders acquired their lands through purchase or allocation by government, in the case of those in Karshi and Orozo over 80% of them got theirs through inheritance or rental. In Abuja FCT, land allocation system is still largely centered on urban lands as land development programmes involving both private and governmental institutions are largely centered around them. Hence, rural lands still remain largely under inheritance tenure system. During focus

group discussions, it was established that the majority of those renting rural lands are those in urban areas who do not have access to lands to put into cultivation in areas where they are residing. As they require such lands to produce food for consumption and sale to fellow urban dwellers (especially vegetable and live-stock products), they are in most cases left with no option than to go to rural areas and rent or purchase.

LULC change trend in the area

Though several studies have been conducted on LULC change assessment in different parts of Abuja FCT, those specifically focused on the Abuja Municipal Area Council are comparatively few and they include Ujoh et al. (2011), Chima (2012), Enedah et al. (2015) and Mahmoud et al. (2016). The three were accordingly examined here to understand the trends of LULC change over the area. The data used in these studies were for the years 1987, 2001, 2003, 2006 and 2014. Table 2 gives a summary of the results of the three studies.

It could be seen from the table that the proportion of the study area covered by cultivated lands declined from 25% in 1987 to 22% in 2001 and 11% in 2006. Though no data was given for years 2003 and 2014, this trend nevertheless indicate clearly that cultivated lands have declined tremendously since 1987 which perhaps reflect the extent to which lands are being taken up for urban development in the area. This is supported by the fact that over the same period, the

proportion of built up areas increased from 4% in 1987 to 19% in 2003, then to 28% in 2006 and 41% in 2014. At the same time, proportion of bare lands declined from 52% in 1987 to 43% in 2001, 38% in 2006 and 33% in 2014 which also suggests increased take up of hitherto bare lands by urban development processes in the area. Conversion of vegetated, cultivated and bare lands into built-up LULC types due to urbanisation processes in Abuja FCT has variously been noted as the major feature of development of the area for over 35 years now (Ejaro and Abubakar 2013; Abubakar 2014; Blosh et al. 2015; Mahmoud et al. 2016).

Idoko and Bisong (2010) have shown that over 1987 and 2004, overall vegetation cover area in Abuja FCT reduced by 85% while built-up area increased by 22% with farmland marginally increasing by about 0.1%. Similar observation was made by Daruwana (2011) who utilised IKONOS very high spatial resolution imagery to assess LULC change in Kubwa area of Abuja FCT and observed that in 1987 the residential areas covered 9.6% of the total land but increased to 43.8% in 1997. The commercial complexes increased from 0.6 ha in 1987 to 1.7 ha in 1997. Over the same period, area covered by public utilities and open spaces increased by about 4.4% each. However, agricultural land areas decreased over the period by about 56.7%. Both authors blamed rapid population increase due to migration of Nigerians from different parts of the country as the main river for the observed LULC changes.

Table 2 Nature of LULC changes in Abuja Municipal Area Council of Abuja FCT

Landuse/cover	Areal extent (Km^2) and proportion of total land area (%) for various years									
	1987		2001		2003		2006		2014	
	Km^2	%	Km^2	(%)	Km^2	(%)	Km^2	(%)	Km^2	(%)
Cultivated land	212.43	25.5	187.1	22.44	No data	No data	94.4	11.4	No Data	No Data
Built-up	33.6	4.03	154.4	18.52	183.4	19.1	235.0	28.2	509.6	41.4
Bare surface	436.45	52.4	362.5	43.48	No data	No data	460.2	37.7	275.4	33
Shrubland	78.62	9.43	175.1	21	No data	No data	261.6	24.5	352.6	27.2
Wetland	72.61	8.71	41.68	5	No data	No data	79.29	9.51	No data	No data
Transport	No data	No data	17.33	1.52	19.58	1.72	20.85	1.83	No data	No data
Water body	No data	No data	10.52	0.92	10.34	0.91	10.3	0.8	3.74	0.36
Parks/green spaces	No data	No data	15.02	1.32	17.35	1.53	21.68	1.91	No data	No data

Sources: Ujoh et al. (2011), Chima (2012), Enedah et al. (2015)

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Evidences from the literature have shown that most of the causes of LULC changes globally are directly connected to human population growth (Lambin et al. 2003; Ghosh et al. 2012). The Boserupian theory of LUCC was anchored on population growth as the main factor of agricultural expansion and intensification. In the study area, increase in population due to urban growth inspired by the designation of Abuja FCT as the host of nation's FCC has been blamed as the major LULC change driver (Ejaro and Abubakar 2013; Adepoju et al. 2013; Abubakar 2014; Mahmoud et al. 2016).

In sub-Saharan Africa, one major consequence of urban growth in emerging towns is massive urban forestry development as a result of planting of trees (especially exotic ones) to provide shade and modify micro-climate to increase the comfort of urban dwellers. Perhaps reflecting this, the proportion of land areas covered by vegetation in the study area increased from 9% in 1987 to 21% in 2001, 25% in 2006 and 27% in 2014. However, those of parks and garden grew by a very narrow margin and infact remained more or less the same over 1987–2014 period. The observed little or no change in the area covered by urban parks in the study area is not very surprising given that culture of patronage of gardens is very weak in many African cities due largely to apathy towards green-based recreation.

Urban development brings about massive development of road networks as a result of the need to enhance intra-city movement and also connect various activity centers. Proportion of lands covered by transport landuse in the area exhibited very narrow increase, by 0.1% only from 2001 to 2006. It should be noted that though the Abuja FCT was designated Federal Capital City in 1976, it was not until 1990 that the seat of the Federal Government moved into it and massive development of infrastructure (transport inclusive) followed this movement. However, till date roads and railway terminals have not yet been developed in the city while the city's only airport is located about 60 km away from it. It was thus not surprising that transport landuse occupy very small areal proportion and remained largely static in the study area.

Water bodies occupy very little areal proportion (less than 1%) and exhibited decrease over the study period. The decrease was however very progressive as from 2003, declining from 0.9 to 0.8% in 2006 and 0.3% in 2014. Beside reclamation of ponds and drainage through sand filling to prepare more lands for urban development, the decline in water bodies over time in the area may be a reflection of reduced rainfall amount due to climate change impact and high rate of building of physical structures like roads, houses, commercial complexes and institutional buildings in the study area. As urban development takes place, more compacted, tarred and built-up surfaces replace open spaces which could otherwise allow water infiltration and hence more water retention on the surface through reduced runoff. In a similar area, Butt et al. (2015a) attributed declines in surface water overtime to increased rate of water loss through accelerated surface runoff due to lack of plant roots to withhold the water. As the runoff exceeds recharge capacity of ground water, it results into the lowering of water table leading to loss of both surface and groundwater storage. Also, increased runoff leads to generation, transport and delivery of sediments which could lead to loss of surface water storage capacities through siltation of surface water bodies. The observed decline in water bodies over the study area is also in agreement with the findings of other research workers (Ali et al. 2008; Mendoza et al. 2011; Rawat et al. 2013; Butt et al. 2015b; Hegazy and Kaloop 2015).

In Mansoura and Talkha cities of Daqhalia Governorate of Egypt, Hegazy and Kaloop (2015) observed that due to urban growth, there was an expansion of built-up area by more than 30%, while cultivated lands declined by 33% over 1985 and 2010 period. However, proportion of barren lands increased slightly by 0.45% between 1985 and 2000, and 1.945% respectively between 2000 and 2010. In Ilorin area of Nigeria, Zubair (2006) observed that due to rapid urban growth, built-up land increased in areal extent by 8% between 1972 and 1986 but decreased by 1% between 1986 and 2001. Cultivated land on the other hands decreased by 17% between 1972 and 1986 and increased by 7% between 1986 and 2001. These thus suggest that urban growth does not have the same effect on LULCs in all areas.

Stakeholders' perception of LULC types and the nature of their change

The stakeholders interviewed were the head of the family and majority have been staying in the study

area for at least the past 36 years. Thus, they have all lived in the study area throughout the study period (1987–2014) and hence could answer questions about LULC for that period. Tables 3 and 4 give data on the extent to which the stakeholders know the LULC of the area and their changes.

It could be seen from the Table 3 that there is clear difference in the stakeholders' perception of the dominant land cover types between the two main categories of settlements studied, i.e. urbanised (Karu and Nyanya) and predominantly rural (Orozo and Karshi). The tendency is that the dominant LULC types that predominate around stakeholders' area of domicile are the ones they are mostly familiar with. While more than 85% of the stakeholders in the urbanised settlements mentioned human aspects of LULC (houses, tarred roads, institutional buildings, commercial complexes, lawns and green spaces) as the dominant ones, on the other hand, more than 80% of the stakeholders in the largely rural settlements mentioned nature-related LULC types (woodland, grasslands, water bodies, rocks outcrop, cropland and forestland) as the dominant ones. These suggest that stakeholders generally had a good perception of the dominant LULC patterns around them, as the major types they have identified are similar to the ones identified in the literature by different research workers that studied LULC in Abuja (Ade and Afolabi 2013; Idoko and Bisong 2010; Ujoh et al. 2011; Chima

2012; Usman 2013; Enedah et al. 2015; Mahmoud et al. 2016).

When the stakeholders were asked to indicate the LULC changes they have observed over the study period (1987–2014), decreases in cropland, grassland, woodland, general vegetation cover and water bodies, due especially to take up of lands for urban development, were perceived correctly by most of the stakeholders across all the study locations. This perception is very much in line with the scientific data on LULC change in the area as documented in the literature by Ujoh et al. (2011), Chima (2012), Usman (2013) and Enedah et al. (2015). However, the perception of nature-related LULC changes was higher among the stakeholders in the predominantly rural locations. This may be because they have comparatively larger interactions with nature being primarily engaged in occupations that directly or indirectly depend on natural resources (land, water, vegetation in particular).

The perception of the stakeholders that the amount of vegetation cover has generally been declining overtime is at variance with the LULC changes identified by the main research workers that employed geospatial technologies to assess such change. Data obtained from the works of Ujoh et al. (2011), Chima (2012), Usman (2013) and Enedah et al. (2015) to the effect that the proportion of areas covered by vegetation in the study area increased from 9% in 1987 to

Table 3 Dominant landuse/cover types the stakeholders are aware of

LULC Type	No. and % of stakeholders per each ward							
	Karu		Nyanya		Karshi		Orozo	
	No.	%	No.	%	No.	%	No.	%
Woodland	97	38.96	45	38.46	83	97.65	60	95.24
Grassland	103	41.37	32	27.35	79	92.94	59	93.65
Cropland	23	9.24	58	49.57	80	94.12	61	96.83
Forestland	15	6.02	49	41.88	69	81.18	56	88.89
Waterbody	8	3.21	15	12.82	68	80	47	74.6
Rock outcrop	15	6.02	58	49.57	72	84.71	51	80.95
Hills	15	6.02	5	4.27	68	80	60	95.24
Houses	247	99.2	114	97.44	56	65.88	36	57.14
Institutional buildings	213	85.54	102	87.18	23	27.06	17	26.98
Commercial complexes	238	95.58	98	83.76	35	41.18	5	7.94
Industrial complexes	78	31.33	45	38.46	6	7.06	10	15.87
Tarred roads	232	93.17	112	95.73	42	49.41	23	36.51
Lawns and Green spaces	98	39.36	32	27.35	3	3.53	7	11.11

Table 4 Types of LULC changes the stakeholders are aware of

LULC change type	No. and % of responses for the various wards							
	Karu		Nyanya		Karshi		Orozo	
	No.	%	No.	%	No.	%	No.	%
Forest lands increasing	12	4.82	6	5.13	6	7.06	2	3.17
Forest land disappearing	56	22.5	38	32.5	74	87.06	59	93.65
Vegetation cover generally decreasing	196	78.7	89	76.1	68	80	60	95.24
Vegetation cover generally increasing	89	35.7	27	23.1	23	27.06	19	30.16
Woodlands increasing	12	4.82	13	11.1	13	15.29	26	41.27
Woodlands disappearing	214	85.9	16	13.7	74	87.06	60	95.24
Grasslands increasing	41	16.5	32	27.4	9	10.59	18	28.57
Grasslands disappearing	176	70.7	79	67.5	78	91.76	57	90.48
Cropland increasing	16	6.43	9	7.69	9	10.59	6	9.52
Cropland disappearing	202	81.1	94	80.3	63	74.12	52	82.54
Water bodies increasing	8	3.21	19	16.2	9	10.59	6	9.52
Water bodies decreasing	176	70.7	83	70.9	76	89.41	58	92.06
Paved roads increasing	205	82.3	104	88.9	23	27.06	13	20.63
Paved roads decreasing	8	3.21	11	9.4	5	5.88	2	3.17
Built-up areas increasing	226	90.8	109	93.2	32	37.65	16	25.4
Built-up areas decreasing	8	3.21	3	2.56	3	3.53	5	7.94
Rock outcrop disappearing	179	71.9	64	54.7	37	43.53	27	42.86
Rock outcrop re-appearing	6	2.41	2	1.71	2	2.35	0	0

21% in 2001, 25% in 2006 and 27% in 2014, is clearly at variance with the stakeholders' perception. In developing countries, the common trend in LULC is that of decline in forested area and expansion of cultivated lands as population increase. However, recent studies have shown that the changes may sometimes involve decline in cultivated areas, increase in population notwithstanding. For instance, in Ethiopia, Ariti et al. (2015) observed that following increase in population and family sizes in Rift Valley Region, average landholding per households decreased with each succession, which further aggravated deforestation and conversion of grasslands to croplands. In Simly Watershed area of Pakistan, Butt et al. (2015a) observed a significant shift from vegetation and water cover to agriculture, bare soil/rock and settlements cover over 1992–2012. In Mansoura and Talkha cities in Daqahlia Governorate, Hegazy and Kaloop (2015) also observed that between 1985 and 2010, the two towns have expanded rapidly with varying growth rates and patterns with built-up area having increased by more than 30% and agricultural land reduced by 33%. However in India, Rawat et al. (2013) observed that in Ramnagar town over

between 1990 and 2010, built-up area and bare sand surfaces have increased by about 8.88 and 3.98%, respectively, while areas under other land categories such as vegetation, agricultural land and water body have decreased by about 9.41, 0.69 and 2.76%, respectively. Likewise, Bansal et al. (2014) have shown that in Haryana area of India, over 1999–2005, the cropped land declined by 11%, while the area under rural settlements increased by 100%. Thus, the observation made in this study to the effect that the proportion of area subjected to cultivation has declined as a result of urban expansion is not surprising.

Conclusion

AMAC has faced tremendous LULC changes that have occurred over 1987–2014 period, involving declines in cultivated, grasslands and bare lands, and corresponding expansion of built-up and vegetated areas. These have caused massive alterations in human and physical landscapes that could lead to land degradation problems (especially loss of land

productivity, water shortage and decline in availability of wood and non-wood vegetation resources) in the area. Different stakeholders in both rural and urban locations of the area are generally aware of the nature of the changes, as their perceptions of the direction of LULC changes corresponded largely with the data obtained from data derived from remote sensing images in the literature. However, there are clear differences in the perceptions between the stakeholders on those issues, especially between those residing in rural and urban locations. Those in rural location have some very close interactions with environmental components of LULC features such as soil, water, and vegetation and are aware of the kinds of changes they undergo due to urban growth. On the other hand, the urban dwellers are largely aware of changes in human aspects of the LULC. However, the perception of the stakeholders on declines in vegetation cover due to urban growth in the study area is in disagreement with the data obtained in the literature which indicate opposite trend over the study period.

Increased urbanisation notwithstanding, a large number of the stakeholders in especially the rural locations in the study area still rely heavily upon land resources (soil, water, vegetation) for survival. In addition, the urban dwellers in the study area rely heavily on food produced in the rural locations in meeting much of their dietary needs. Thus, increasing land productivity, provision of alternative livelihood options and improved water supply are necessarily required to enhance the living standards of the stakeholders and enhance their capacities to adapt to LULC changes. In particular, efforts need to be made to raise the crop output of the lands being put to cultivation, especially through improved soil fertility maintenance so as to reduce the need to bring more lands into crop production.

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