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THE EFFECTS OF PERI-URBANIZATION ON PUGU AND KAZIMZUMBWI FOREST RESERVES, DAR ES SALAAM, TANZANIA

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ABSTRACT: *Although peri-urbanisation seems to be a driving force for city expansion in most cities of the developing world, the unguided nature and rapid rate of growth is increasingly raising a concern over the future sustainability of these cities. Peri-urbanization has been taking place at the expensive of rich agricultural hinterlands and depletion of natural resources. This type of urbanization culminates into conflict between natural resources conservation initiatives and human activities. This paper attempts to analyse the link between peri-urbanization processes and its effects on nearby forest reserves of Pugu and Kazimzumbwi in Dar es Salaam City. Empirical evidence for this paper was captured through analysis of aerial photographs covering a period between 1975 and 2012. Household interviews covering a total of 150 households were administered in three settlements of Buyuni, Chanika and Masaki. Literature review, focus group discussions, resource mapping were also used to capture population dynamics, quantify types and trends of forest ecosystem services over the period of 37 years. Empirical evidence shows that; while built up area increased from 2.4 to 19.1 percent, overall closed forest decreased by 57 percent within the same period. The decrease in forest cover has been accompanied by the decline in forest ecosystem services namely, the decline in number and type of plant and animal species and drying of water sources. In view of these effects, it has been recommended that the government in collaboration with key stakeholders should engage in developing guidelines for managing peri-urbanization processes and creating community awareness for sustainable development and co-existence of urbanization processes and forest reserves.*

KEYWORDS*:* Peri-Urbanization, Forest Reserves, Ecosystem Services, Dar Es Salaam, Tanzania

INTRODUCTION

Peri urbanization has been conceived as a process in which rural areas located on the outskirts of established cities become more urban in character be it physical, economic or social terms. The kind of transformation has been often in piecemeal fashion and fragmented. While in middle income countries it has been frequently stimulated by an infusion of foreign investment, industrial or manufacturing developments with efficient export-oriented transportation systems and high-level producer and government services; in countries with poor economies has been propelled by outward expansion of residential areas with inadequate services. Peri-urbanisation is used to describe the process within the phenomenon of urban sprawl that has spatial consequences of threatened sustainable use of space (Etxebarria and Astorkiza, 2012; Galli, et al, 2010; Trigal, 2010; Danese, Las Casas and Murgante, 2007; Mancebo, 2004). According to UNFPA (2007) report, the space taken up by urban localities is increasing faster than the urban population itself. The report indicates that between 2000 and 2030, the world's urban population is expected to increase by 72 percent while the built-up areas of cities could increase by 175 percent. Another study by Yale University, Texas Agriculture and Mechanical

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University and Boston University indicates that cities will be transforming a landmass nearly equivalent to 1.2 million square kilometres by 2030 worldwide (Seto, Güneralp and Hutyra, 2012 in Nyandwi, 2015). The same research highlights that in developing countries, cities of 100,000 people or more are expected to triple their built-up area.

Although peri-urban areas constitute foci of dynamic processes of city transformation, they are also conflict zones where urban and rural functions compete for space and resource exploitation. The move towards peri-urban areas is largely attributed to the relatively cheaper lands and less stringent development conditions as compared to those in the inner cities. Peri-urban areas provide livelihood opportunities whereby the settling population exploit adjacent resources such as forest products, minerals and water. Despite the fact that peri-urban areas constitute a conflicting zone for city transformation on the one hand, they also provide a breathing space for city expansion especially for the poor households. They therefore provide a challenge on how to balance planning for urban growth and resource conservation (Lupala, Mdemu and Butungo, 2014).

Peri-urbanization in China is responsible for the changing economic structure, encompassing a shift from an agricultural-based to a manufacturing-dominated economy; often manufacturing accounting for 60–70 percent of the Gross Regional Domestic Product (GRDP). It has been also responsible for the changing employment structure, shifting from agriculture to manufacturing, with agricultural employment usually declining in absolute terms accounting for only 20 percent or more of the local labour force; rapid population growth of between 5–8 percent annually, or even higher in key investment localities and changing spatial development patterns and rising land leasing costs; (Webster and Muller, 2002). Therefore, the question on how peri-urbanization is managed raises a critical concern over how national economic development and the quality of life for hundreds of millions of people who are migrating and settling in these areas will be promoted. Knowledge gap on the impact of change of peri-urban land uses replacing agricultural lands by other land uses and further its impact on nearby natural resources (forests and conservation areas) constitute one of the key parameters for examining these relationships. How rural people adapt to new ways of life following the changed status of peri-urban settlements is another factor that motivated the preparation of this paper.

Lambin, Geist and Lepers, (2003) argues that while land use changes are mainly influenced by change in demography, policies, economical and political or sometimes a combination of these factors; these changes may have profound negative impacts on forest ecosystems which provide services to support human life. In the Tanzanian context, peri-urbanization in large urban centres including Dar es Salaam, is contributing significantly in disappearance of nearby forests resulting into diminishment of ecosystem services (Burgess and Dickinson, 1993).

Urbanization-peri-urbanization nexus

Despite the fact that urbanization is a global phenomenon that is manifest across countries, it is more apparent in cities of the developing world. Viewed from the multiple perspectives of change in economic activities, spatial growth, and social and cultural attributes urbanization has an important role in the development of business agglomeration in cities (Lupala, 2002). According to UN-Habitat (2012a) urbanization will exert negative impacts especially in least developing but rapidly urbanizing countries due to inability to cope with the consequences of urbanization pressure. This pressure has been dramatically changing the city's urban spatial growth patterns resulting into low-rise horizontal development, fragmentation in the development and formation of slums or informal settlements. It has been reported by the World

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Bank (2005) and UN-Habitat (2006) that in developing countries the urban population will increase up to 4 billion by the year 2030 which is double of 2000 population. In the African context, about 45 per cent of the population will be urbanized by the year of 2025 (UN-Habitat, 2012). This population boom will result into intensive pressure on existing built environments, need for housing land be it in planned or unplanned areas and ultimately contribute towards uncontrolled spatial expansion of cities. Indeed, cities of the developing world have started facing numerous challenges such as inadequate supply of social and physical infrastructure, unplanned peri-urban growth, social inequality, environmental problems and competition of resources in the peri-urban areas where majority of the poor find refugee for settlement.

While peri-urban growth provides homes and livelihoods for the poor, urban sprawl is a burning debate with negative effects on cities built environment because it is accompanied with the high demand of services (Pont and Haupt, 2010) which ultimately increases the development cost. Hudalah, Winarso and Woltjer (2015) argue that: "although we acknowledge the growing contribution of peri-urban areas to regional economies, this is still at the expense of spatial cohesion, regional sustainability and quality of the physical environment. These undesirable consequences have been a reflection of fragmented institutional landscapes, particularly at the regional level". In other words, one can argue that while urbanization has been viewed as an irreversible process, it is directly linked to peri-urbanization because the migrating households find their space and livelihoods in urban fringe areas.

Conceptualizing Peri-urbanization

There is extensive literature debating on peri-urbanization as a concept and a process. As a concept Iaquinta and Drescher (2000) for example view peri-urban environments in their dynamic nature, wherein social forms and arrangements are created, modified and discarded. They are areas of *social compression* or *intensification* where the density of social forms, types and meanings increase and where conflicts and social evolution are manifest. Theoretically, Iaquinta and Drescher (2000) link it to the three key components of demographic referring to increasing population size and density; economic making reference to areas primarily with non-agricultural labour force; and social-psychological which include the consciousness of what it means to be *urban*. Other authors from geographic literature have coined it as limited fringe and extended fringe, rural non-farm, urban fringe, suburbs, suburban fringe zone, outlying adjacent zone, pseudo-suburbs, satellites and pseudo-satellites, inner and outer urban fringe areas and lately, peri-urban interface (Tacoli, 2003; Allen 2003.). As a process, Webster and Muller (2002) define peri-urbanization as a change that is highly dynamic one whereby the rural areas located on the outskirts of the established cities become more urban in character. The transformation occurs in physical, economic and social terms and often in peace-meal fashion. Therefore, peri-urban development usually involves rapid spatial change whereby small agricultural communities are forced to transform and adjust to an urban way of life in a very short time. Peri urbanization is stimulated by infusion of new investment, generally from outside, including foreign direct investment. High levels of migration are an important driver of social change. Citing Rakodi (1999), Webster and Muller (2002) further define peri-urban areas spatially as zones of transition between fully urbanized land in cities and in areas which are predominantly agricultural in terms of land use. They are characterized by mixed land uses and indeterminate inner and outer boundaries. In cities of the developing world, they are typically depicted by rapid environmental degradation and infrastructure backlogs. Arguing further in terms of spatial extent, Webster and Muller (2002) indicate that peri-urban zone begins just beyond the contiguous built-up urban area and sometimes extends as far as 150

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kilometres from the core city or as in the Chinese case, as far as 300 kilometres. However, the land that can be characterized as peri-urban shifts over time as cities, and the transition zone itself, expands outwards. This process results into constant changing mosaic of both traditional and modern land uses. The fact that so much land is involved, the effective land use guidance systems are virtually non-existent. In many cases a semi-equilibrium that is neither totally urban nor suburban will appear.

The United Nations Population Fund Agency [UNFPA] defines peri-urbanisation as the dynamic, diverse and disordered, increasingly space-intensive and largely in non-contiguous transitional zones between countryside and city (UNFPA, 2007). According to the International Human Dimensions Programme on Global Environmental Change IHDP (2005), peri-urbanisation may occur in the adjacent peri-urban areas, but on other occasions it may take place in distant places as these areas have been for sometimes neglected in most urban and environmental studies (IHDP, 2005). Such a development follows the traditional urban growth form that pre-supposes the appearance of peri-urban spaces in the vicinity of the town, having with it such strong organic and structural links that they sometimes end up being incorporated into (Macebo, 2008). Under that assumption, peri-urban areas have become the most contested grounds of informal urbanisation (Bourne et al., 2003).

The characteristics that depict peri urbanization process in most of the developing countries include: *changing economic structure* encompassing a shift from an agriculturally based to a manufacturing based economy, *changing employment structure* shifting from agriculture to manufacturing and *rapid population growth*. The latter phenomenon is often not captured in official data because the population of peri urban regions in many countries tend to be significantly under counted, such areas being defined as rural and in some instances, migrants to these zones do not officially register as local residents. Other features include: the *changing spatial development patterns* that are unplanned; limited services and rising land costs; there is a great deal of *land speculation* and community building to articulate local needs (Figure 1). An important question worth raising at this juncture is; what are the drivers of peri-urbanization?

Although there might be several determinants, many authors seem to attribute this aspect to large scale investment especially in manufacturing, public policies that explicitly support dispersal of manufacturing away from the core and policies that advocate relocation of slum settlements, availability of relatively cheap labour especially in rural areas that evolves by peri-urbanization and increasing demand for residential land (housing) for the growing population (Webster and Muller,2002 and Appiah, *et.al.* 2014).

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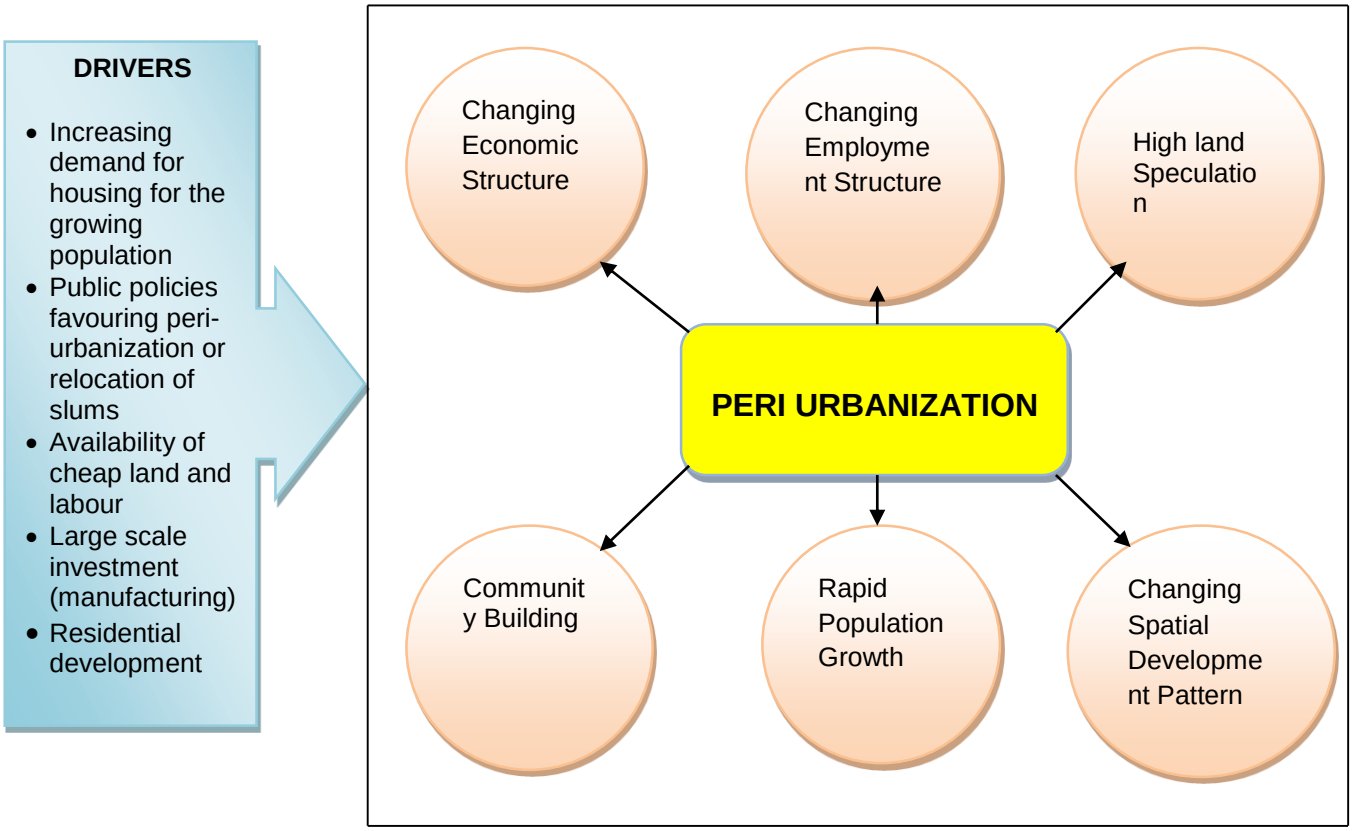

Figure 1: Peri-urbanization and its drivers

METHODS

Empirical data used in this paper comes from the research project titled: *"Impact of Urban Land Use and Climate Change on Coastal Forest Ecosystem Management (IULUCC)"* that was conducted between 2009 and 2013. The aerial photographs for 1975, 1980, 1995, 2010 and 2012 were used as inputs for developing land use and land use changes in the peri-urban areas adjacent to Pugu and Kazimzumbwi forest reserves. The land uses for each epoch of land cover were confirmed by representatives of four communities surrounding the forest reserves. Ten members from each of the four communities were selected and involved in the land use identification exercise. The age categories of the members were in the range between 20 and 60 years. Preliminary land use maps were produced for each period and ground-truthing was conducted for rectification of land use categories. The boundaries for various land use category were defined based on the land cover classes. The identified land uses included built up area, agriculture, residential and agricultural area, grazing, open land and infrastructure. Arc GIS was used as a tool to determine the area of each land use category for each epoch. Further, determined land use areas were used to quantify land use change over the specified periods. While the National Census Reports (1967-2012) and other secondary data were used to capture information on demographic trends, resource mapping was used to identify and quantify the types and trends of forest ecosystem services from 1975 to 2012. Identified ecosystem services focused provisioning services such as plant and animal species and water resources. These were further corroborated with Focus Group Discussions in the three settlements of study. Results

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from land use changes analysis for the periods 1975-1980, 1980-1995, 1995-2010 and 2010-2012 were compared with the results on changes in ecosystem services during the same periods in order to determine the link between peri-urbanization and changes in forest ecosystem services**.** Household interviews were conducted covering a total of 150 households (50 households from each of the settlements of Buyuni, Chanika and Masaki). Household interviews were also complemented with key informant interviews.

RESULTS

Spatial expansion of Dar es Salaam

Rapid land use changes have been taking place in peri urban areas of Dar es Salaam due to the influences of land demands triggered by population growth (Lupala, 2002a; Simon *et al*., 2006). The growth of Dar es Salaam has been largely structured by the four major arterial roads of Bagamoyo, Pugu, Morogoro and Kilwa. These roads which provide a link between Dar es Salaam and other parts of the country, have significantly contributed to the morphological structure of the city (Briggs and Mwamfupe, 2000). Until 1978, the spatial growth extent of Dar es Salaam was largely limited within a 14 kilometre radius. Rapid spatial expansion (especially in the peri-urban areas) started to explode in the 1990s and further expansion and consolidation in the 2000s (Figure 2). While the built up area in 1945 spanned to only 5 Kilometres from the city centre, by 2010 the growth of the city had reached about 35 Kilometres. Ribbon development can be noted along the arterial roads approaching the conurbations of Kisarawe, Kibaha and Bagamoyo located in the Coast Region. For peri urban areas that are located close to forest reserves residential land uses had over spilled into forest reserves. There were reports that some people from these settlements had started to harvest forest products illegally. As a result, peri-urbanization had culminated into diminishment of forest cover and ecosystem services.

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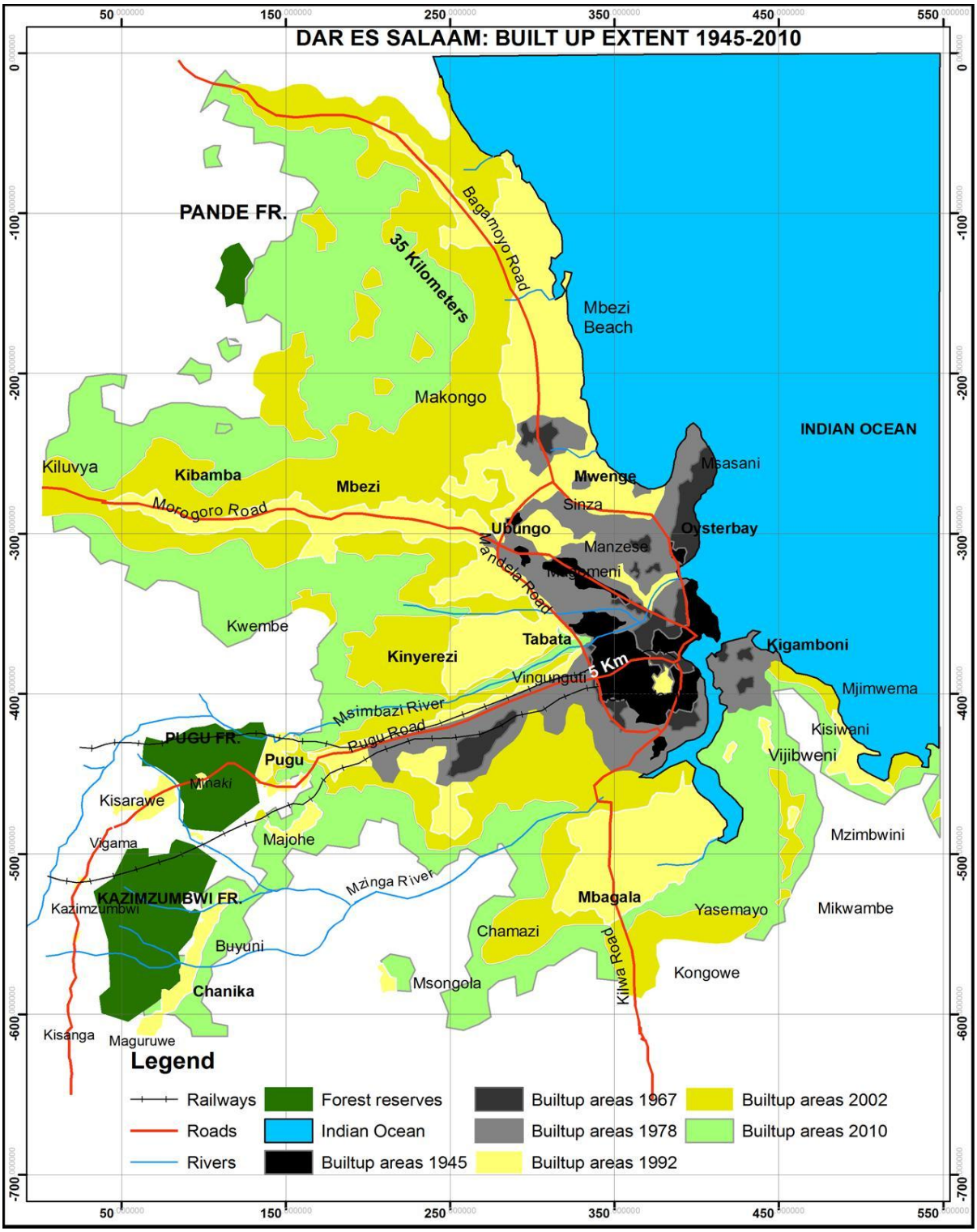

Figure 2: Spatial growth trends of Dar es Salaam (1945-2010)

Peri urbanization trends in Dar es Salaam

Statistics from two peri-urban settlements of Chanika and Pugu show that the two settlements were experiencing higher population growth since 1967. Population for Chanika settlement for example leapfrogged from 917 people in 1967 to 35,726 in 2012. This growth represents 39

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times increase compared to the initial population recorded in 1967. The same trend was noted in Pugu whose population increased from 1206 in 1967 to 22,322 in 2012 (Figure 3) (URT: 1967-2002). The implication of rapid population increase had a direct linked to rapid expansion of residential land uses in these settlements.

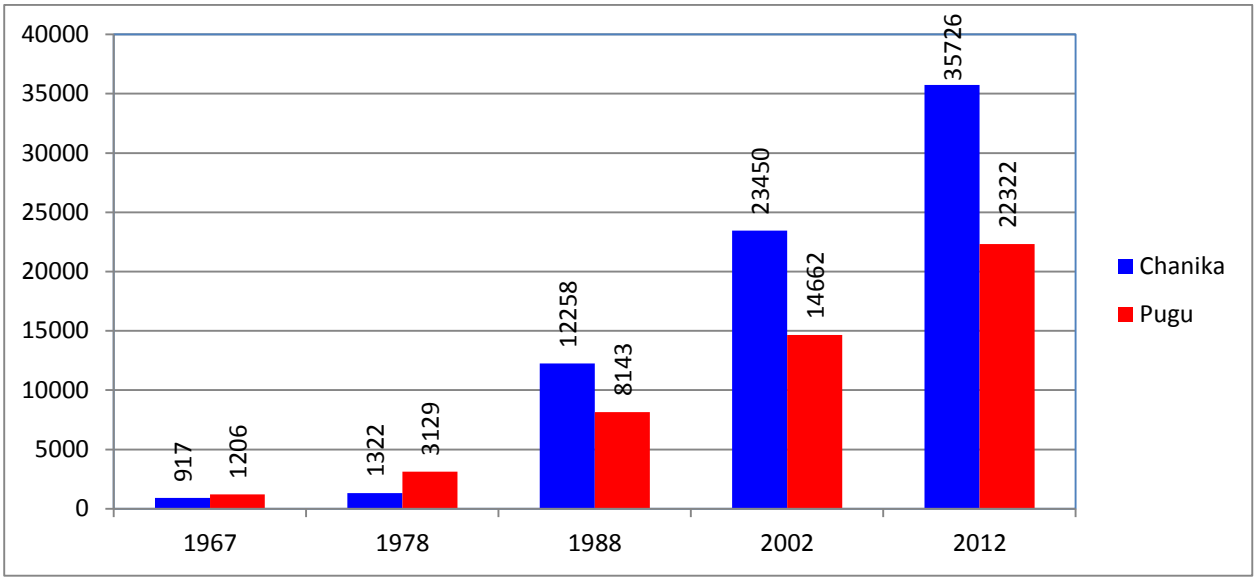

Figure 3: Peri urban population growth trends (1967-2012)

Changing spatial development pattern (Land use changes)

With regard to spatial expansion, analysis of land uses changes for the years of 1975, 1980, 1995, 2010 and 2012 indicate that there was a tremendous change particularly in the built-up area increasing from 608.78 hectares in 1975 to 4933.51 hectares in 2012 (Table 1 and Figures 4 and 5). This growth represents an increase from 2.4 to 19.1 percent of the total land area within the same period. Significant change was also notable on the category of residential/agricultural land that increased from 989.51 to 6,893.71 hectares within the same period. This represents a proportional increase from 3.8 to 26.7 percent.

Table 1: Land use changes (1970–2012)

Land Use	1975		1980		1995		2010		2012	
	Land use area (ha)	% cover	Land use area (ha)	% cover	Land use area (ha)	% cover	Land use area (ha)	% cover	Land use area (ha)	% cover
Built up area	608.78	2.4	689.78	2.67	1,573.85	6.09	3,970.01	15.37	4,933.51	19.10
Residential & Agricultural	989.51	3.8	1,582.16	6.13	2,327.15	9.01	6,042.28	23.40	6,893.71	26.70
Agriculture	2,499.27	9.7	5,219.19	20.21	6,418.24	24.85	5,214.52	20.19	3,696.54	14.31
Grazing /open land use	21,716.68	84.07	18,319.50	70.94	15,479.84	59.95	10,557.51	40.88	10,251.22	39.70
Infrastructural land use)	9.08	0.03	12.69	0.05	24.17	0.09	39.01	0.15	48.35	0.19
TOTAL	25823.32	100.0	25823.32	100.0	25823.32	100.0	25823.32	100.0	25823.32	100.0

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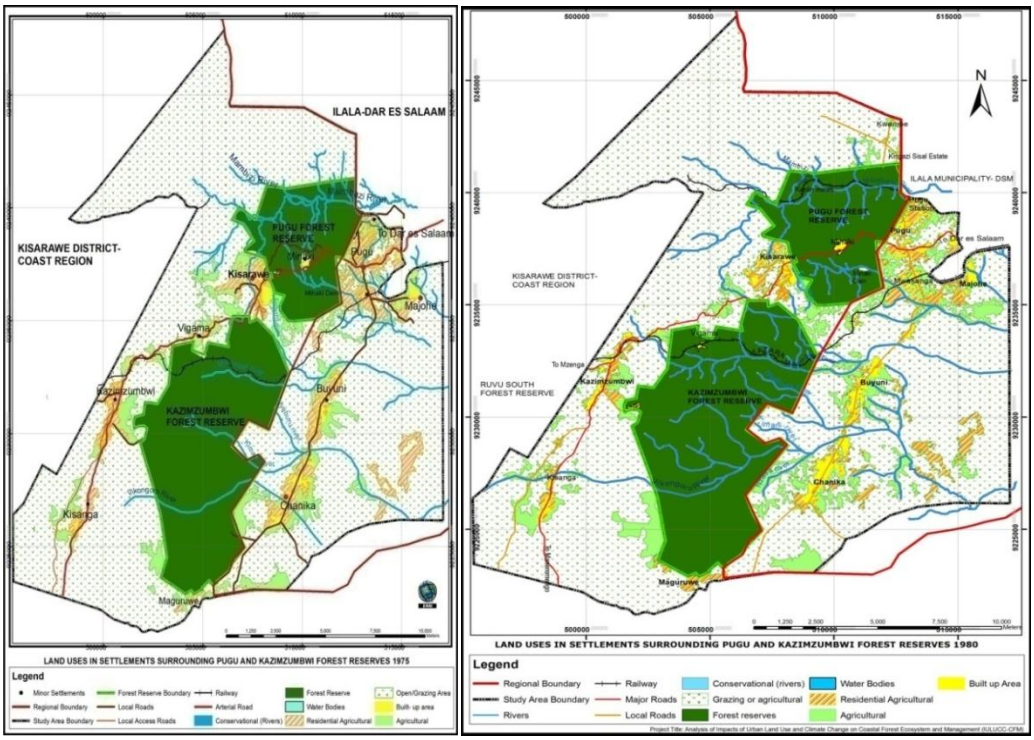

Figure 4: Land uses changes for settlements surrounding Pugu and Kazimzumbwi Forest Reserves (1975 and 1980)

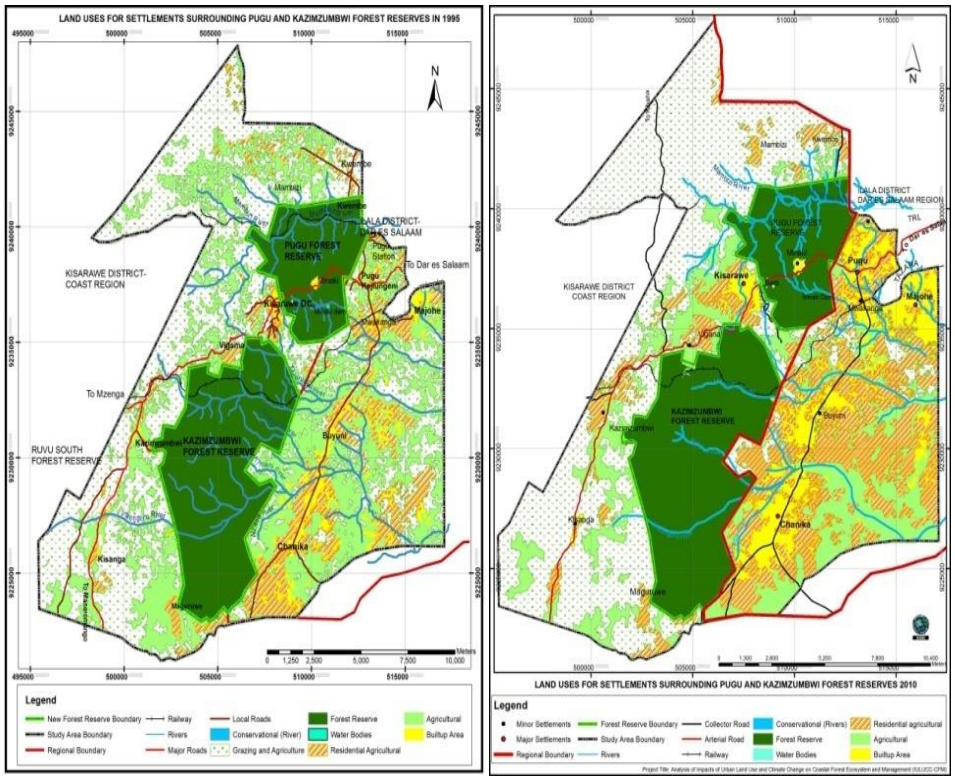

Figure 2: Spatial growth trends of Dar es Salaam (1945-2010

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Trends in forest cover changes

A similar analysis was made to determine the trend in changes on land cover changes for the two forest reserves of Pugu and Kazimzumbwi for the period spanning between 1980 and 2010. The major forest cover classes were closed forest, open forest, bushland, settlements and other land. Results from Pugu forest reserve show that closed forest cover diminished from 2106.6 hectares in 1980 to 1386.3 hectares in 2010. This represents a decrease by 34 percent in a period of 30 years. On the contrary, open forest increased from 110.4 to 490.2 hectares representing an increase of 380 percent. Similar trends prevailed for other cover types of settlements and other land uses and grassland (Figures 5 and 6).

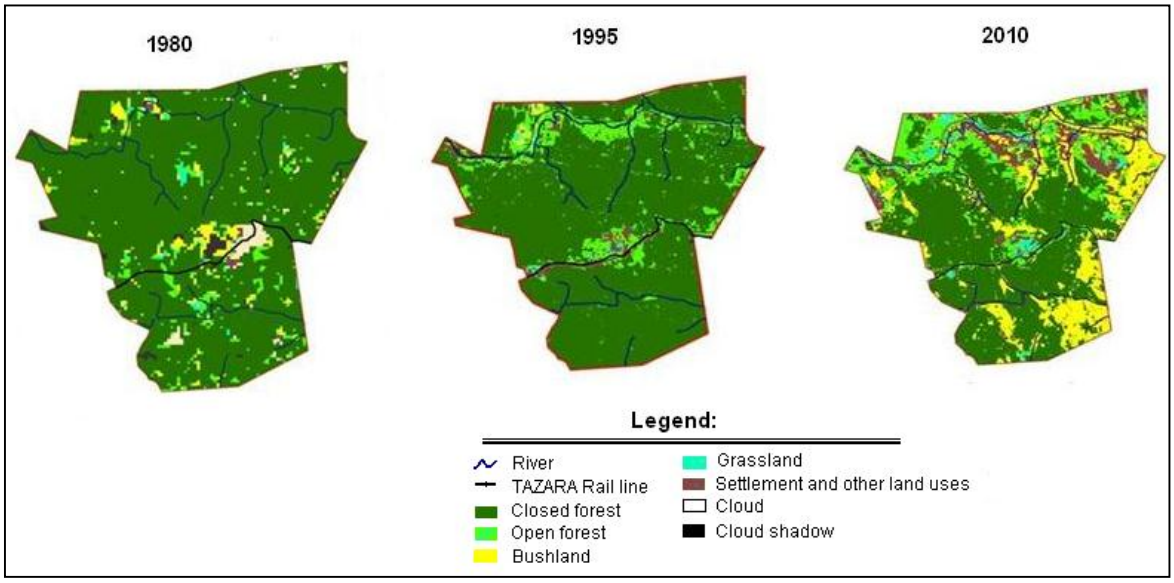

Figure 5: Land cover change in Pugu Forest Reserves (1980-2010)

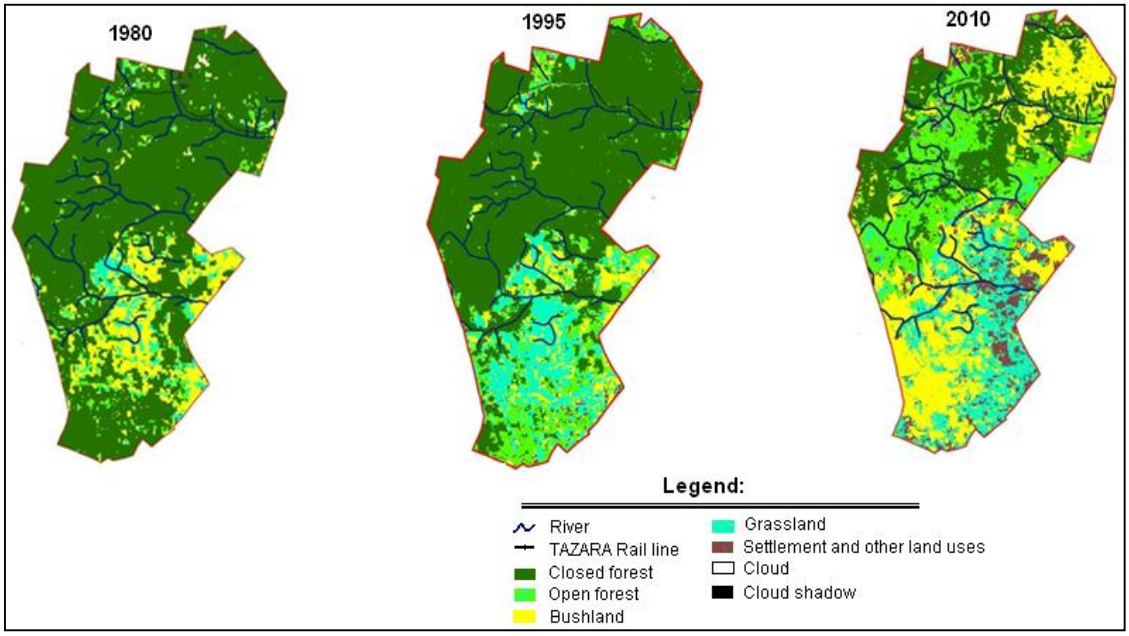

Figure 6: Land cover changes in Kazimzumbwi Forest Reserve (1980-2010)

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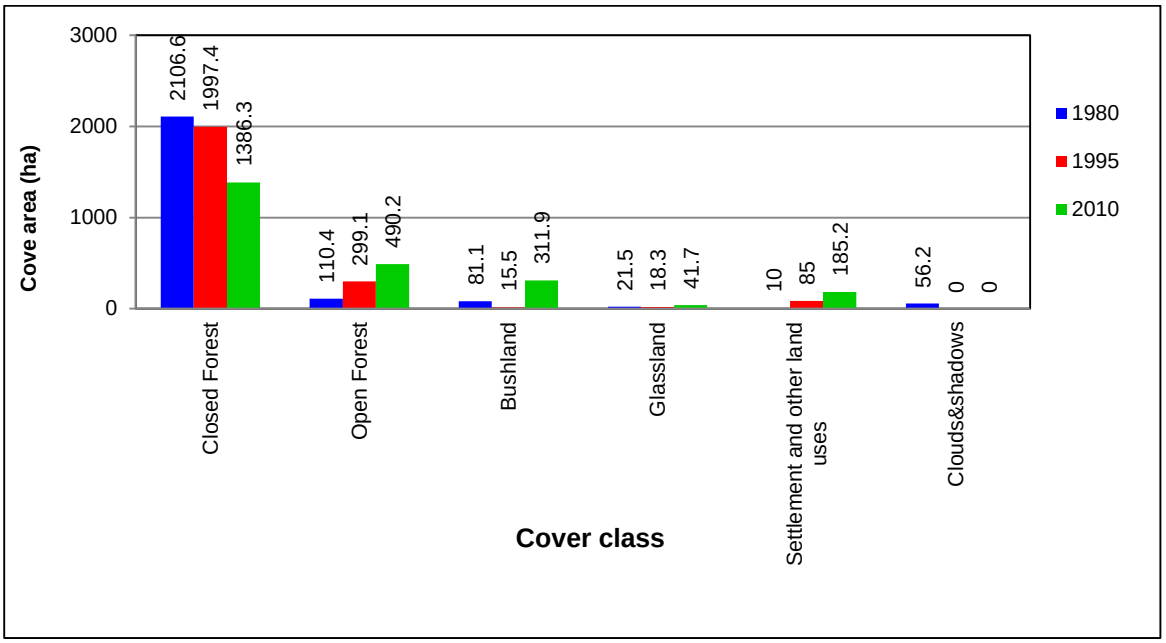

Figure 7: Trend in land cover changes for Pugu Forest Reserve (1980-2010)

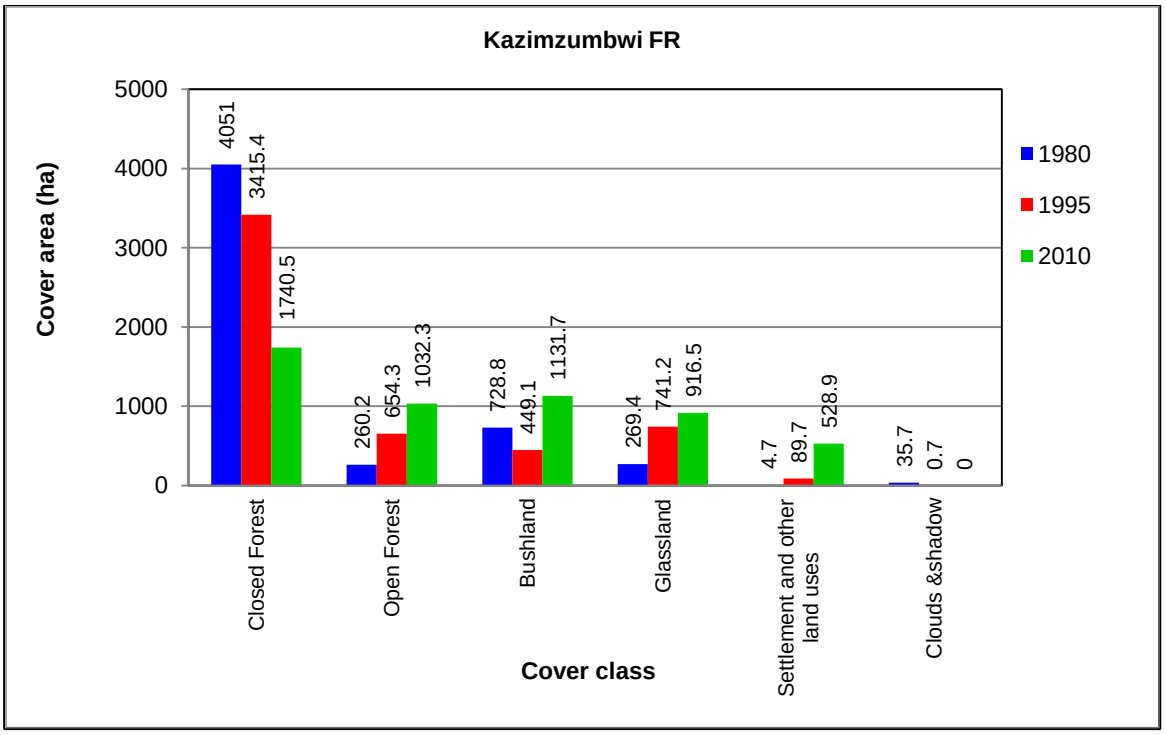

Figure 8: Land cover changes in Kazimzumbwi Forest Reserve (1980-2010)

A more serious forest cover changes was noted in Kazimzumbwi Forest Reserve. While closed forest cover decreased from 4051 hectares to 1740.5 hectares between 1980 and 2010 (representing a decrease by 57 percent), open forest increased from 260.2 to 1032.2 hectares within the same period respectively. Similarly, bush land increased from 269.4 to 1131.7

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hectares and settlements and other related cover from 4.7 to 528.9 hectares within the same periods respectively (Figures 7 and 8).

Drivers of forest cover changes

The key drivers of forest cover changes were analyzed from responses from household interview complemented with interview with key informants and officials from the Kisarawe district and Ilala Municipality. These were identified to include the rural urban migration and internal migration from within settlements. The increase in population resulted to intensification of human related activities, which included establishment of settlements, expansion of agricultural land and other non-farm activities particularly charcoal production. While about 57 percent of the sampled households originated from outside Dar es Salaam and Coast Region in particular; only 20 percent had their origin from the study area and 3 percent were natives from Chanika, Buyuni and Masaki (Figure 9).

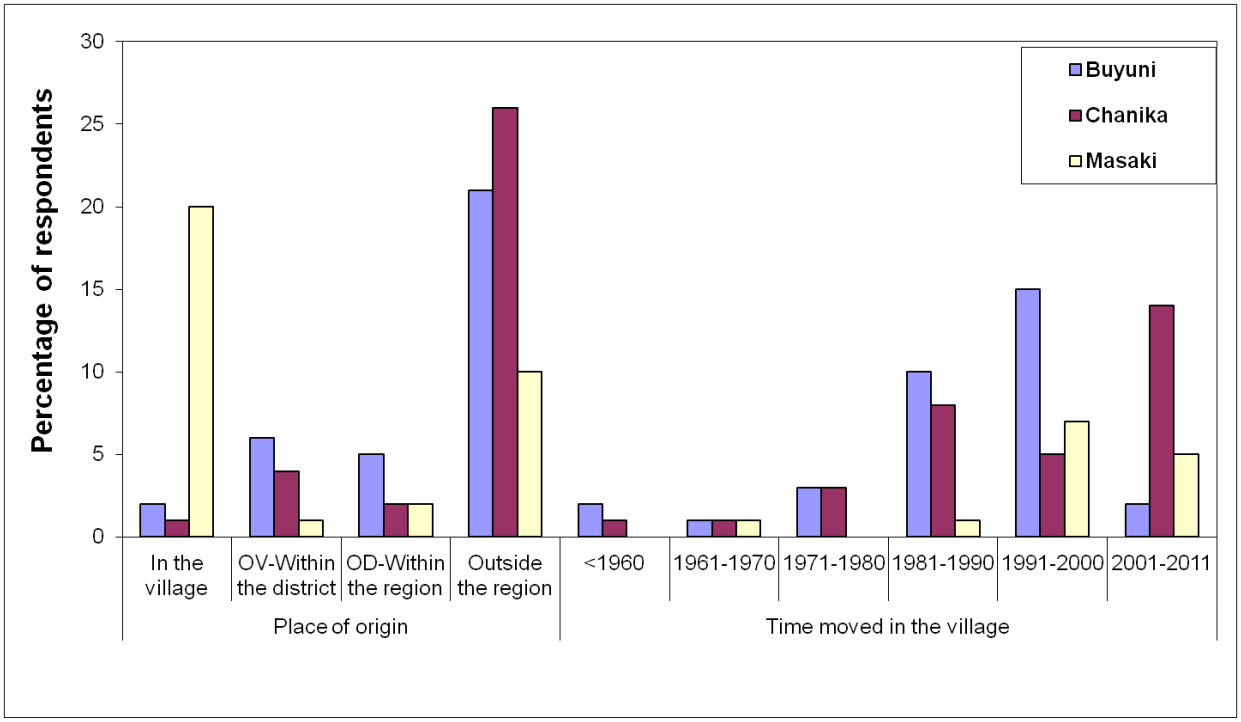

Figure 9: Immigration patterns in peri-urban areas of Buyuni, Chanika & Masaki Village

In the settlement of Chanika, people started to move in the area since early 1980s in search of agricultural land; and later in the 1982 they ventured in charcoal production. From 1985 most of the people started to establish permanent settlements in the village. By 2012, the village had 920 households and about 2339 inhabitants. The area continued receiving migrants from Dar es Salaam city who were searching for housing and agricultural land. It was reported that the villages near the forests reserves had experienced increased in-migration trends since the late 1990s. It was accordingly reported that while most of the people who came from Dar es Salaam up to the year 2000 were searching for agricultural land, in the next decade the migrating population was searching land for housing development.

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Other drivers were identified as the land market dynamics that was fuelled by the Chanika-Buyuni planning of residential plots as part of the 20,000 plots project in Dar es Salaam. The planning of this area increased the demand for land, housing, basic infrastructure and social services to the surrounding areas culminating into both planned and unplanned agglomerations. Extraction of forest products (charcoal, firewood harvesting, construction poles & logging for timber), dependence on firewood and charcoal as the main source of energy and livelihood and limited alternative livelihood strategies outside forest reserves were contributors to the steady decrease of forest cover of the two forest reserves.

The relationship between population increase and peoples' dependence on forest products was reported to exist albeit at varying levels in the three settlements. Firewood was reported to be the most dependable resource from forests followed by charcoal and building poles (Figure 10). Dependence on these forest products was one of the drivers of deforestation and diminishing forest cover in the nearby forest reserves.

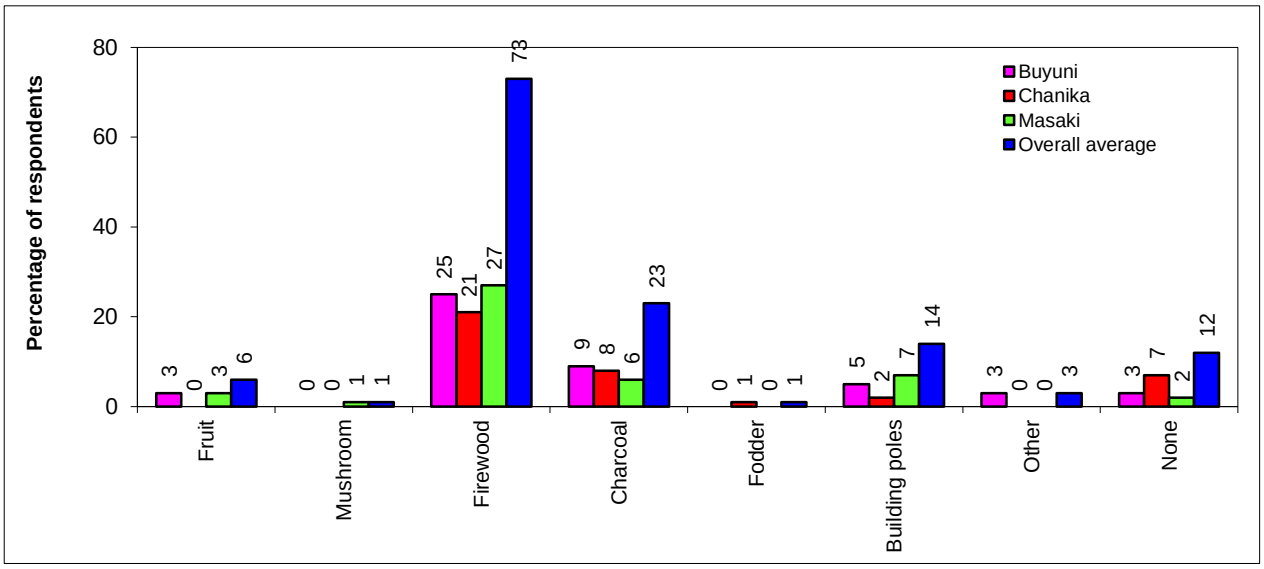

Figure 10: Dependence on forest products

The link between peri urbanization and diminishing forest cover

The diminishment of closed forest cover and the increase in non-forest cover types is closely linked to rapid peri-urbanization of the settlements surrounding these forest reserves with increased human activities. It was reported by Butungo (2013) that some people had invaded and established non-forest activities in the middle of Kazimzumbwi Forest Reserve. These included settlements, farming, cemetery and charcoal processing. These conflicting uses frequently culminated into conflicts between conservation initiatives from the government and encroachment of forest reserves by the surrounding communities. It was further reported by Butungo (2013) that court cases of illegal charcoal making activity were increasing. While in 2008 there were 96 court cases, this number increased to 156 cases in 2011 (Figure 11).

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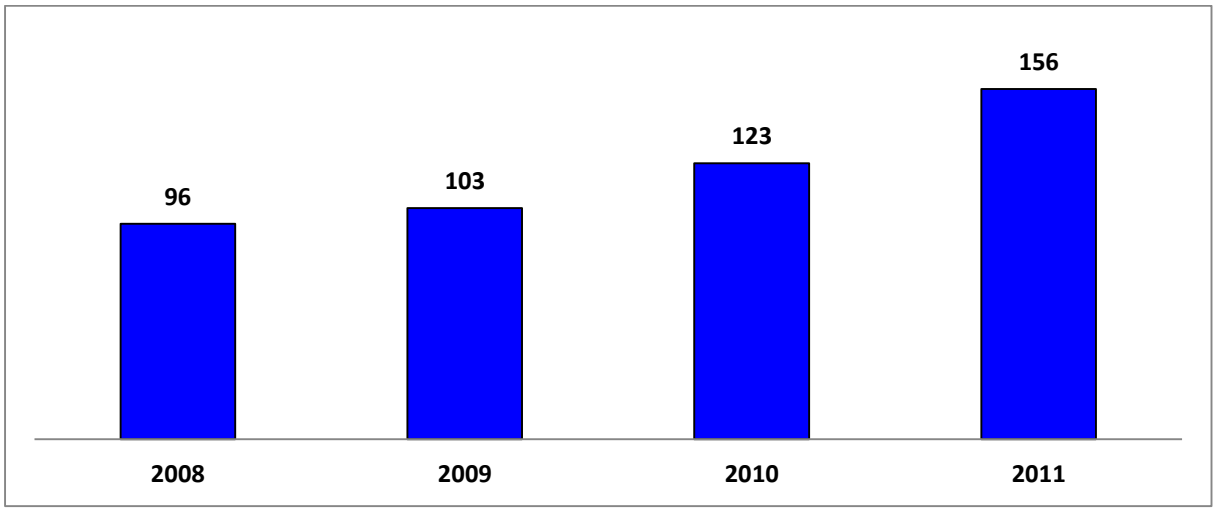

Figure 11: Number of court cases on illegal charcoal and firewood harvesting

As a result of intensified peri-urbanization and increased human activities, some settlements encroached the Pugu and Kazimzumbwi forest reserves despite the fact that no land use development or activities are allowed within the forest reserves. These included the Nzasa, Kimwani and Nyeburu settlements surrounding Kazimzumbwi Forest Reserve in Chanika. A study by Butungo (2013) further revealed that a total of reported 500 houses that were constructed within the forest reserves were demolished by the government in 2008. One company (Nyolu Construction Company) had planned, surveyed and allocated about 200 plots within Kazimzumbwi Forest Reserve. These plots were revoked and survey plans disapproved in 2010 (ibid.).

Changing Economic Structure

Across the three settlements, respondents experienced declining agricultural production. Responses from household interviews indicated that the majority of the people (77 percent) reported on the decrease in agriculture production. The decrease in agricultural production stimulated other forms of income generation activities such as charcoal making and expansion of agriculture land as a community response to the decline in agricultural production (Figure 12).

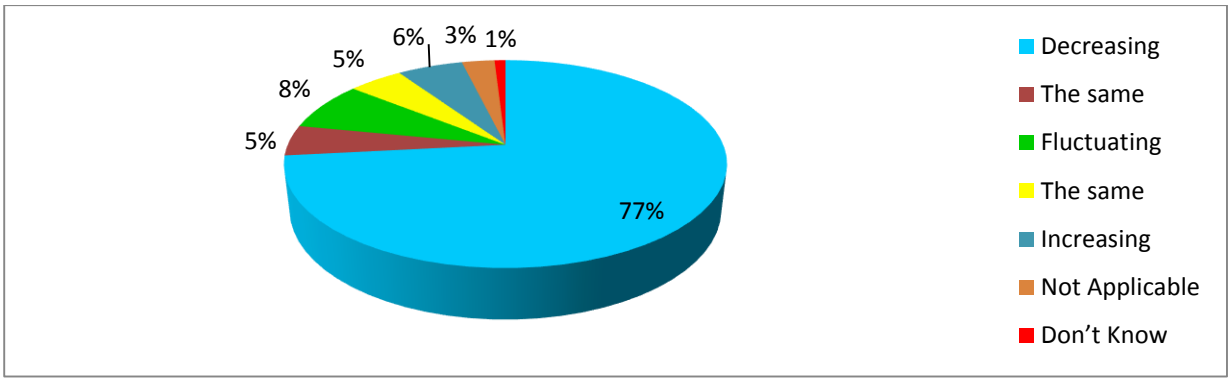

Figure 12: Respondents opinion on agricultural production

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Changing employment structure

A study the was extended to other settlements (of Pugu, Kazimzumbwi and Maguruwe) within the catchment of the forest reserves revealed that as peri-urban settlements continued to densify, land for agricultural activities were diminishing forcing people to shift to other economic activities. Results from interviews in the settlements of Pugu, Kazimzumbwi, Maguruwe and Buyuni indicated that casual labour and petty trading were increasingly becoming the dominant economic activities accounting for 40 and 30 percent in Maguruwe and Buyuni respectively. Other activities included; charcoal business, food vending and livestock keeping (Figure 13). Although changing or addition of livelihood activities by the communities was also related to coping strategies accruing from climate change effects, the rapid population influx in these settlements forced people to adapt to new ways of life amidst diminishing land sizes for agricultural activities. Majority of community members had engaged in these new livelihood activities to supplement their primary economic activities (Figure 13). It was also reported that some people changed the type of crops they used to produce. While in the past, they were growing groundnuts, maize and passion fruits; in recent years they have been producing cucumbers, watermelons green pepper, okra and cassava that fetch more price than the previous crops.

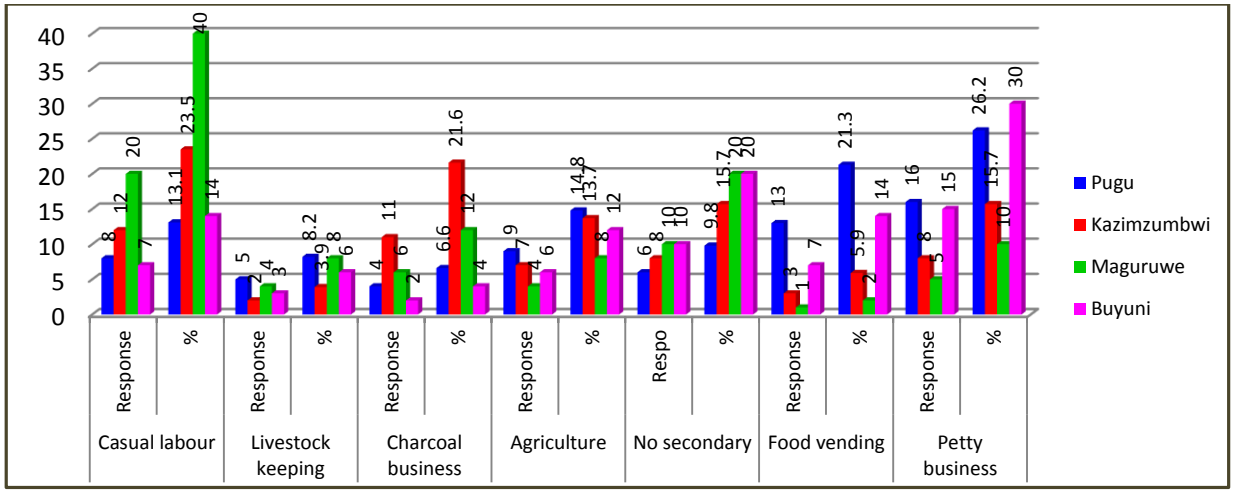

Figure 13: Secondary economic activities by community members (Source; Household interviews 2012)

Land speculation

As a consequence of rapid peri-urbanization many people have been acquiring land by buying even though actual development has been lagging behind. Household interviews show that 123 households representing 62 percent of all respondents got land through purchasing. The land purchase rates were higher in Chanika and Pugu settlements because these are immediate peri-urban settlements contiguous to the built-up areas of Dar es Salaam. The land purchase rates were recorded to be 74 and 76 percents respectively (Table 2). As Pugu and Chanika are increasingly becoming urban, informal land development was more apparent.

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Table 2: Land acquisition in Chanika, Pugu, Kisarawe and Kazimzumbwi

Land acquisition	Chanika		Pugu		Kisarawe		Kazimzumbwi		Total	
	No	%	No	%	No	%	No	%	No	%
Purchase	37	74	38	76	31	62	17	34	123	61.5
Inheritance	10	20	4	8	12	24	18	36	44	22.0
Free land occupation	1	2	3	6	3	6	15	30	22	11.0
Renting	2	4	5	10	4	8	0	-	11	5.5
Total	50	100	50	100	50	100	50	100	200	100

Source: Household interviews, September 2012

Effects of peri-urbanization on Pugu and Kazimzumbwi forest reserves

Although peri-urbanization has accommodated the increasing urban population and functions in the outskirts of Dar es Salaam City, the same process has culminated in severe effects in terms of forest cover, diminishing of forest ecosystem services, drying of water sources and decrease of animal species. These effects are discussed as follows:

Diminishing forest cover: As revealed in Figures 5 and 6, there has been a tremendous decrease of closed forest cover category in the two forest reserves. Results show that closed forest cover in Pugu forest reserve diminished by 34 percent in a period of 30 years. In Kazimzumbwi forest reserve, the trend was much more serious whereby closed forest diminished by 57 percent within the same period. The correlation between decrease in forest cover and peri urbanization is revealed by the increased in built up areas in the surrounding settlements which increased from 608.78 hectares (or 2.4 percent of the total area) to 4,933.51 hectares (representing 19.10 percent of the total area) between 1975 and 2012. Although depletion in forest cover may as well be attributed to other factors including climate change, the rapid cover decrease draws its strong link with increased human activities in peri-urban settlements and encroachment of forest reserves.

Decrease in animal species: A study that was done by Butungo (2013) under the "Impact of Urban Land Use and Climate Change on Coastal Forest Ecosystem Management (IULUCC)" project deploying resource mapping techniques and key informant interviews in the settlements of Chanika, Pugu, Kisarawe and Kazimzumbwi identified about 19 animal species which existed in Pugu and Kazimzumbwi Forests before 1970s. However these species have also shown an exponential decrease with time potentially because of forest cover depletion and increased human activities within and outside the forest reserves (Table 3). Butungo (2013) reports that out of 18 animal species that were identified under resource mapping exercise before 1970s, this number had decreased to 12 species between 1970-1980 and further to only four species in year 2012.

Table 3: Disappearance of animal species in Pugu and Kazimzumbwi Forest Reserves

SN	Animals specie	Before 1970s	1970-1980	1981-1995	1996-2010	2011-Todate
1.	Pantheraleo (Lions)					
2.	Panthera pardus -Leopards					
3.	Potamocherus larvatus (Wild pigs)					
4.	Loxodonta africana (Elephants)					
5.	Carcopithecus mitis (Hyenas)					

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6.	Savanah canrat (Thryonomys gregarionus and Swindevianus-Ndesi)					
7.	Colobus angolensis- Black monkeys					
8.	Bats					
9.	Colobus angolensis- White Colobus monkeys					
10.	Crocidura sp. (Shuru)					
11.	Hippopalumus amphibious (Hippopotamus)					
12.	Thomson ivk. (Minokela)					
13.	dendroaspispohyleps and bilis arietans Snakes					
14.	Civetctis civetticus (Fungo)					
15.	Tragelaphus scriptus (Mbala)					
16.	Capus sp. (Rabbits)					
17.	Madoqua kirkii (Digidigi)					
18.	Eagles (Tumbusi)					

	Available		Occasionally seen and sometimes with signs such as footprints, fur on trees or noises		No longer available

Source: Butungo, 2013.

Diminishing of forest ecosystem services: Collecting empirical evidence from resource mapping and interview from key persons in the same settlements, Butungo (2013) reported that the decreases of forest cover in the two forest reserves have also led to the decrease in plant species. While in the 1970s, there were a total of 26 plant species, this number has decreased to only seven (7) in 2012. Decrease in plant species has had impacts on other forest products such as honey from bee keeping and mushrooms. While in 2005/06 honey and wax production stood at 68 kilograms of honey and 5 kilograms of wax, there was neither honey nor wax that was being produced in the year 2011/2012 (Lupala, Mdemu and Butungo 2014). Mushrooms have also disappeared since early 1990s. The disappearance of mushrooms, honey and wax production is linked to clearance of Miombo tree species which usually support growth of mushrooms and suspension of bee hives. (ibid.).

Drying of rivers water sources: Pugu and Kazimzumbwi are the sources of water for Kimani, Msimbazi, Vikongoro, Nzasa, Mambizi, Mzumbwi and Nyeburu rivers. The two forest reserves also constitute catchments for the Minaki dam, Zingiziwa pond, Mvuti pond and Gogo swamps that support various livelihood activities in respective areas (Table 4). Increased peri urbanization and human activities have equally impacted on the forest reserves to continue functioning as water sources for these water bodies.

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Table 4: Water availability trends and use around Pugu and Kazimzumbwi Forest Reserves

Water sources	Use	Before 1970s	1970-1980	1981-1995	1996-2010	2011-Todate
Kimani River (Pugu Forest Reserves)	Commercial fishing, irrigation agriculture honey making and water supply source for Kisarawe town					
Msimbazi River (Pugu Forest Reserves)	Fishing, agriculture (Sisal, starchy food)					
Vikongoro River (Kazimzumbwi Forest Reserves)	Fishing, water for domestic activities					
Nzasa River (Kazimzumbwi Forest Reserves)	Water for domestic use					
Mambizi River (Pugu Forest Reserves)	Honey harvesting, agriculture					
Mzumbwi River (Kazimzumbwi Forest Reserves)	Fishing, agriculture					
Nyeburu River (Kazimzumbwi Forest Reserves)	Agriculture, water for domestic activities					
Minaki Dam (Pugu Forest Reserves)	Water supply source for Minaki secondary school and Kisarawe town					
Zingiziwa Pond	Breeding place for Hippopotamus, fishing, agriculture					
Mvuti Pond (Kazimzumbwi Forest Reserves)	Was formerly used for fishing before 1990s, agriculture					
Gogo Swamps (Kazimzumbwi Forest Reserves)	Water for domestic use					

	Hold water annually		Hold water only during rain seasons		Contain water only when it rains

Source: Butungo, 2013

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DISCUSSION

Although one cannot draw a clear line linking peri-urbanization and forest depletion in the foregoing discussion, evidences shows that the former seems to be playing a significant contribution towards the latter. Increased human activities, as a result of peri-urbanization seem to be impacting on forest cover and associated ecosystem services. This is clearly revealed by the proportional relationship on the rapid increase in built up area that seems to correlate with the rapid decrease in forest cover from the two forest reserves (Figure 14).

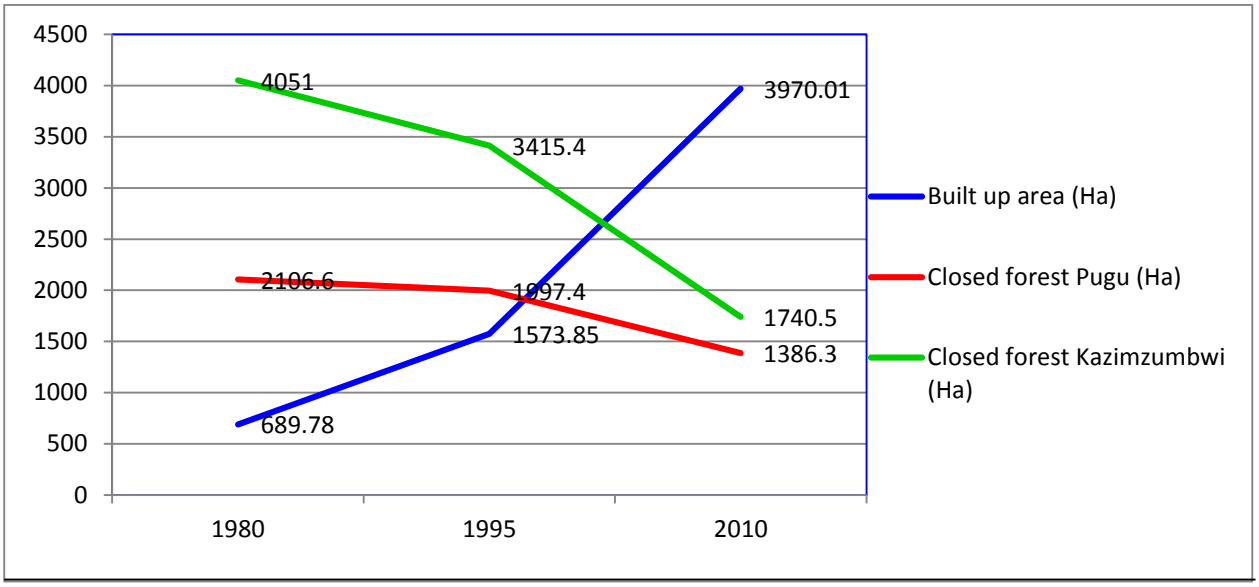

Figure 14: Inverse relation between built up area and forest cover

Similar observations have been noted by Appiah *et al (2014)* in their article; *"Determinants of Peri-urbanization and Land Use Change Patterns in Peri-Urban Ghana"* in the Bosomtwe district. They observed that peri-urbanization was contributing to land use and land cover changes that was manifest in the form of land use conversions and land use modifications. As the core urban areas were becoming congested, the spill-over effect of urban population's relocation was affecting the predominantly rural Bosomtwe district. Although not much has been reported in terms of effects on natural resources, the authors report that increasing rate of peri-urbanization has culminated into increased demand for residential, recreational (Hotels and Guest houses) and commercial land uses at the expense of agro-forest land uses (Appiah *et al*., 2014).

Recapitulating the key variables characterizing peri-urbanization, Webster and Muller (2002) points out to the changing economic and employment structure, shifting from agriculture to manufacturing, rapid population growth, changing spatial development patterns and land speculation. Although evidence from cases in this paper does not show any change in terms of shift from agriculture to manufacturing, there is a strong evidence with respect to rapid increase in population, rapid change in terms of spatial development depicted by the increase in built up areas with time and land speculation also depicted by the dominance of purchase of land in these rapidly urbanizing settlements. Unlike in middle income countries where manufacturing replaced agriculture, changes in occupational structure including diversification of livelihood activities characterized dynamics of peri-urbanization in this context. While the associated effects in the context of Ghana was land use changes at the expense of agro-forest issues, in

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this context peri-urbanization has largely correlated with the depletion of nearby forest reserves of Pugu and Kazimzumbwi. This has been manifest in the rapid decrease in forest cover and animal species, diminishing of ecosystem services including the drying of water sources. Increasing demand for housing for the growing population and availability of relatively cheap land for housing development seems to be the key drivers of peri urbanization.

From policy perspective, section 4.3.1 of the Tanzania Human Settlements Development Policy (2000) provides for the need to limit the spatial expansion of towns and cities. It categorically provides for the need to control physical growth of urban areas so as to reduce urban sprawl, to facilitate economy in the use of land, provision of infrastructure services, to protect the urban environment and to ensure functional and efficient urban systems (URT, 2000). Although this policy provision is largely focusing on urban growth, it essentially puts emphasis on limiting uncontrolled city expansion that ultimately impact on the surrounding services and natural resources.

CONCLUSION AND RECOMMENDATION

This paper has empirically shown that rapid peri-urbanization has been taking place with considerable effects to the nearby forest reserves of Pugu and Kazimzumbwi. It has attempted to illustrate the proxy link between rapid changes of land uses in the peri-urban areas of Dar es Salaam and the depletion in forest cover of the two forest reserves. The key drivers of peri-urbanization have been identified to include; rural urban migration and internal population migration from within settlements, land market dynamics (relatively cheap land) that have been fuelled by the planning of residential plots in nearby settlements, land speculation and increased need for non-farm activities particularly charcoal production as source of livelihood to people living nearby these forest reserves. Considerable effects have been noted that have a direct link with peri- urbanization processes. Apart from diminishing forest cover, others included the decline in number and types of animal and plant species and drying of water sources. On the basis of these observations, it is recommended that the government in collaboration with key stakeholders should engage in developing guidelines for managing peri-urbanization processes and limiting uncontrolled urban expansion in the urban fringes of rapidly urbanizing cities. Practical intervention strategies for both physical planning and alternative livelihood strategies for peri-urban communities ought to be developed with a primary objective of conserving the nearby forest reserves. It is further recommended that awareness creation on the need to preserve forests as major resources for ecosystem services and participatory approaches to forest management should be inculcated for sustainable development and co-existence of urbanized settlements and forest reserves.

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