



RESEARCH ARTICLE

HUMAN MIGRATION AND LAND USE CHANGE: A STUDY IN FAMAGUSTA REGION
OF NORTHERN CYPRUS

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ABSTRACT

The study highlights the present condition of an existing wetland district, as affected by migration. Its examined the now popularly known student environment within three (3) time steps, 1986, 1999 and 2013 respectively, placing these as the actor for the relative change in land-use. A multiple research method was applied, using data sourced via satellite imagery, structured questionnaire, and semi-structured interview. The outcome of the study revealed the location, extent of Urbanism and the distribution of different land-use categories in Karakol district located in Famagusta, North Cyprus. This study proposes that the implications of human migration on land use change need further investigation and better data in order to be more certain about trends.

INTRODUCTION

Time in memorial geographers has always recorded 70% of the earth's land mass to be occupied by water bodies, leaving 30% for human comfort. These comforts include the natural endogenous and exogenous resources among which is land, vegetation animals etc. Human activity started with the extinction of wild and domestic animals. The extinction of plant species soon accompanied the gradual global loss and more in-depth lumbering, clearing and burning of construction and aesthetic purposes increases the exhibiting changes observed in our urban and rural areas. There are hardly seen first tier/ first generation plants in most urban areas and thus giving urban designers the fight for the second or better put, artificial plants in surrounding neighbourhoods and exacting forceful greenery serving recreational purpose in the community. Thus, demanding some secondary budget in both government and housing/ estate developers' plan as human population increases naturally and artificially. Land-cover essentially implies the visible and physical character of the

earth's surface embodied in vegetation, soil, and water and built structures. While land-use characterizes the way, in which human and other habitants of the land functionally adapt, adopts and adjust land. It is in most cases economic adjustment imposed by man. Both term land- cover and land-use combines to form a composite term known as Land-use/cover change (LUCC) (Butenuth et al., 2007; Zubair, 2006). While some places exhibit more of direct factors, others have the indirect factors serving as a basic motive for change. Non-the-less, both direct and indirect factors could influence change in an area. Dominant direct driver of transformation as observed in numerous researches in time and space boils down on migration. Just as indecisive and minute as a farmer's choice to increase, reduce, continue, or stop farm practices may appear, it can likewise contribute as a questionable socioeconomic indirect factor that influences migration (Bregt et al., 2010). In whichever case of movement (rural or urban, urban or rural movement, immigration or emigration), negative or positive effects are observable as traits. For instance, a belief that outward movement of people from a community (rural or urban) automatically brings economic, cultural and biodiversity advantages in an area might not be very correct (Robson et al., 2011). Scanty researches on land use changes have been written about a place harbouring such a change at this time in the history of North Cyprus, a problem this study

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propose to solve by contributing to urban and sub-urban literatures as work done here will be a contributing material to migration policy and most importantly, land develops-ability decision now as well as in the near future. This research therefore considers migration as a socio-economic driver thoughtfully considered to be responsible for this change. With the objective of providing a documented literature of subsequent changes that has occurred ever since the resurgence of survival in Cyprus and the relative socio-economic responses. This study made use of spatial image classification (remote sensing tool and technique), ground truth observation, and questionnaire to put forward 'the role of migration on land-use in Karakol district Famagusta, North Cyprus between the time span of 1986 to 2013 at three (3) time steps.

Literature Review

Land use change in urban areas is mostly ignored or has little focus paid to it. Due to the definition of an urban city as an agricultural free zone, a character that distinguishes it from the sub-urban context, goals are therefore being set to capture and maintain this. Such development goals are considered to be necessary for creating an urban character. Thus, placing the urban area within the forces that decides its size and form as well as determining the outcomes. There are several agents responsible for the different pattern, forms and sizes of the proportion of the use of land. Land use/ land cover change (LUCC) has not been considered ordinarily a complex process, but one, which has actors, factors at different social and spatial level that decides what, when and where changes occur. Understanding the interrelationships between human and environment, we focus not only on process and on results at different organizational levels, which can continuously change the structure and composition of the landscape. These actors include farmers, natural conservation organizations, urban developers, policy makers etc. (Bregt *et al.*, 2010). Viewing these factors individually by considering few direct and indirect actors, an investigator have classified government and institutions as collateral actors that uses tools such as devaluation policy, liberalization, credit subsidies, infrastructural development, land tenure and distribution (exogenous forces) as contributing players in LUCC. In his research, the trajectory of land use is dependent on the interaction of all the exogenous forces and the socio-economic conditions of the land manager. His study on Ghana reflects the structural adjustment program needed for alleviating economic decline by using agricultural land (Braumoh, 2009). Regional, state, and national drivers are all regarded as fundamental forces behind migration serving an exogenous role in the migrant's location of origin over which there is little or no control. Those at the local level are moderating forces such as individuals, household or community incapable of independently determining movement, but act to explain why the exogenous force drive certain type or group of people to migrate. A survey movement toward the mega delta cities of the world, using Asian and African (11 countries), shows the limit of this spatial growth under four interaction conditions (i) local biophysical constraint due to human activities (ii) large scale environmental changes (iii) uncertainty around future economic growth (iv) effectiveness of urban planning institutions were explained (Seto, 2011). As infinite as the

human activity drives, the use and change in the land, there appear to be natural drivers that are expected to be the primary drivers of pull or push factors of migration. However, according to Chi and Marcouiller (2013), a yet to be commonly explored driver of migration is the place of natural amenity in deciding movement, either in the rural (forest, land availability, rivers, lakes, etc.) or in the urban context (game reserves, greenery, conserved vegetation area). He revealed in his study the potential trade-off possibilities between natural amenity and land develop-ability and concluded that the public lands are strongly associated with migration, land availability are likewise associated with migration, while forest and wetlands depends on the managerial recreation access provided with it.

The numerous drivers of land use change go a long way in either contributing positively such as restoring sustainable balance of payment, reducing inflation and creating more conditions for sustainable growth or on the other hand, it could also retain or worsen the existing increasing or decreasing migration, boosting spatial inequality, unstable economic reform and/or create increasing education opportunity magnet. The increase population as an external factor of inward movement in some cases could generate growth in once depopulating, devaluating, and distressed dying cities. The effect of this type reflects on the city population, labour market, housing market economies, fiscal health, and neighbourhoods. All of which are visible in urban, suburban and rural areas, but most evident in urban areas (James *et al.*, 1998). Although, as migrants maintain and strengthens their network sources at city, national or even international level and utilize this to influence entrepreneurship, a disproportional social character contribution to the rural area emerges, in which case negatively affects the housing market through land acquisition and price increase pushing the locally born to move out to local towns or even farther (Kalantaridis, 2010). However, it is assumed that when a nation sets to globalize, she works towards diversity, but not with the mind of having increasing low – income population which will affect the urban governance. Globalization has been identified as another driving force in urban development (land use change) which has proved positive to a degree, but this positive character has been unevenly distributed within and among cities (Balbo & Marconi, 2006). Robson and Berkes (2011), examine the generalised opinion of land-use change in relation to, out migration as not in all cases of advantage, leading to a positive outcome of the social, cultural, and economic as well as the biodiversity of the community. The authors stated clearly in a survey on Oaxaca and Mexico, where out movement of people reduced labour force, agricultural output, and species including increased food dependence on neighbouring communities. A very important thing to note is that to promote services, development, occupy model and plan itself, a plan is needed. This is a gap yet to be filled in regional studies as it focuses on a single or a few parts of development, thereby neglecting community parks, architectural designs and building permit, all which are fundamental to planning scheme. When the real world economic thinking is applied, market failure to allocate resources efficiently becomes the result (Baffour *et al.*, 2014). Critical is the issue of building permits, which requires pre-permit item (architectural design) from developers at the

statutory declaration of a planning or planned area; this was likewise emphasized by Carmona (1998), “Design Control”. In some cases, irrespective of protected areas, population encroachment/ sprawl might still be observed. Estes *et al* (2012) identified some reasons for human growth and land-cover changes around protected areas in relation to agricultural conversion. Where such conversion could be from natural habitat to agriculture. This study reveals that population increase do not only influence built space, but also could show an effect on personal consumption where movement from places of high population density and land scarcity to areas protected with natural habitats. To arrive at sustainable urbanization, Dewan (2009) supported the use of remote sensing and GIS to give an accurate analysis based on time series. He applied this method to socioeconomic data to derive the decrease in cultivated land, vegetation, and wetland area.

MATERIALS AND METHODS

Field Study

North Cyprus is the third largest island situated in the north – eastern part of the Mediterranean Sea (34.5N latitudes and 32.5E longitude). It is 65 km away from Turkey, 95 km from Syria, 350km from Egypt and 750 km from Greece (Palmer 1990). Famagusta is an intact fortified town on the east coast of Cyprus with a long and fascinating history and deep significance as a heritage place, which fronts a bit of urgent threats. As indicated in (Fig 1), an investigation has demonstrated that Famagusta (indigenously called Gazimağusa) city located in North Cyprus can be considered to be composed of four main parts, inclusive of the Walled City. Asagi Maras region (district developed by Greek Cypriots); the Maras region — (the part of Maras closed to habitation since the 1974 war); and the newly developed quarters located toward the North-Western part of the walled city, thus giving Famagusta a unique urban settlement history (Önal *et al.*, 1999).

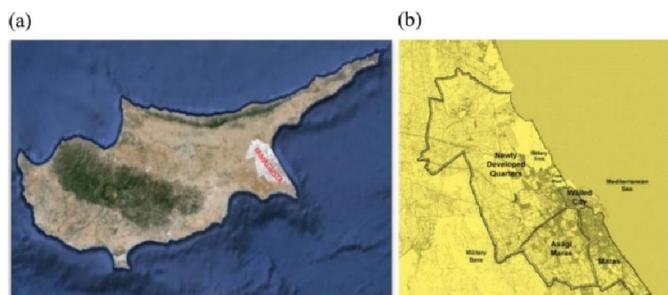


Fig. 1. (a) Map location of the study area, Famagusta city; (b) the four sub-regions of Famagusta city (Önal *et al.*, 1999)

Data collection and analysis

In order to provide the best and most comprehensive primary and secondary information for this study, both theoretical and logistical views such as satellite images for accurate coverage area, 85 structured and 5 semi-structured interview for user participatory research were used and directed towards achieving the pre-set aim and objectives. The use of satellite

imagery was essential to provide information on previous years and to be more cost effective in the course of this study.

Multi-Temporal Landsat TM/ETM+

Making use of remote sensing and GIS tools simultaneously to acquire, display, store, analyse and output data related to both urban and sub-urban environment, aerial photographs imageries with other satellite images has been presented to be the most cost effective method when working on land cover mapping throughout the world (Murai *et al.*, 2000). Landsat images from 1986, 1999, and 2013 were collected to disclose these environmental changes using multi- temporal satellite data, in order to draw out changes. The digital image-processing software ENVI 4.7 were used to process this, analysis, and integration of spatial data to reach the pre-set objectives of the study. ENVI software was used to generate the false colour composite, this was done by putting together near infrared, red, and green, which are bands 7, 4, and 2 together for the images. This form of combination is usually done in recognition of the vegetation, due to the sensitivity of plants to chlorophyll, thus reflecting very good to near infrared than the visible. As shown in (Fig 2), multi-temporal Landsat TM/ETM+ data acquired in early and mid to late summer dates in 1986, 1999, and 2013 have been used to classify all land cover in Famagusta. Moreover, most researchers have discovered, using both early summer (late May or early June) with mid to late summer (August or early September) to be the most useful image to obtain highest classification accuracy due to the climatic. Noticeable remarks are that in earlier images, fields planted to annual crops appear as bare soil and are perceived differently from forests, which have already fully shed their leaves. Therefore, when only a summer image is used, forests and some crops, especially grain crops become spectrally uniformly viewed. Meanwhile, the later summer image still plays a role to separate all grain crop fields from urban areas in as much possible amounts of impervious surfaces that are spectrally similar to bare soil (Ioannis *et al.*, 2011). Thus directly giving the visual location and extent of urban areas, spatial distribution of different land use category and providing the ability to supervise the changes in these features over time in Famagusta.

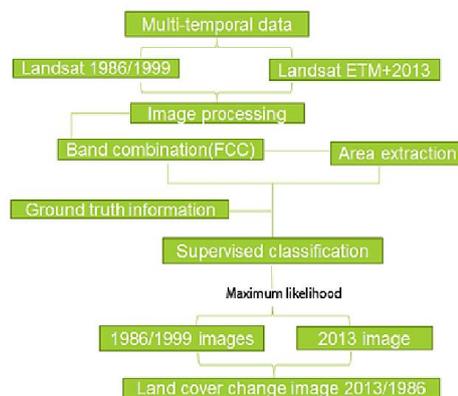


Fig. 2. (a) Multi-temporal Landsat TM/ETM+ (adopted from Ioannis *et al.*, 2011)

Table 1. Statistical data increase of student population in (EMU) from 1986-2014

Year	Cypriot	Turkish	Foreign	Total
1986-1987	395	513	100	1008
1990-1991	4807	7512	717	13036
2013-2014	2888	7669	5532	16089

Source: EMU Registrar's office

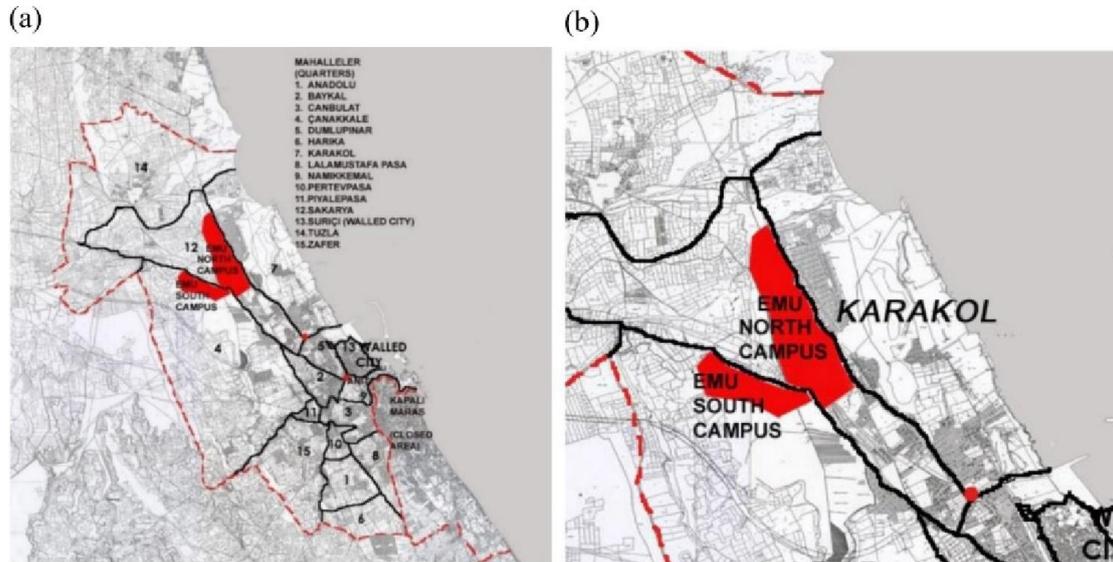


Fig. 3. (a) Map boundaries of the study area, Famagusta district boundaries; (b) Karakol district boundary

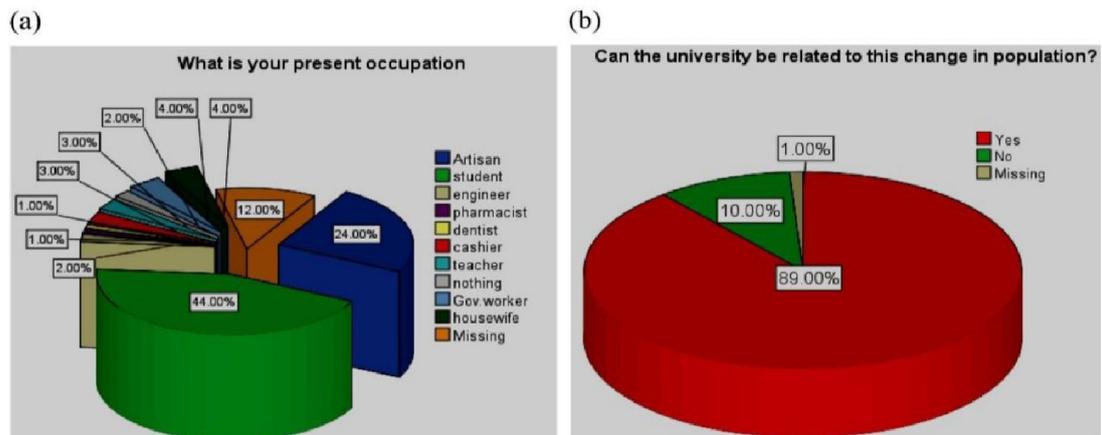


Fig. 4. (a) Occupation of occupants residing in the Karakol district; (b) respondent's opinion regarding the impact of EMU on increase or change in population

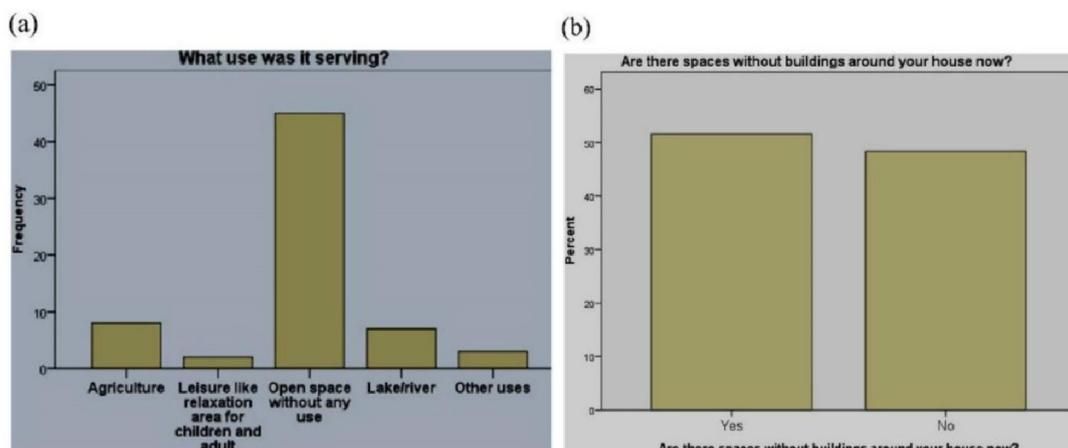


Fig. 5. (a) Respondents views on previous use of unconstructed area in Karakol district; (b) respondent's response on current availability of land or unconstructed spaces in Karakol area

Table 2. Land use/land cover distribution (1986, 1999, and 2013) of Famagusta

	1986	1986	1999	1999	2013	2013
Land-use/land-cover categories	Area (acres)	Area (%)	Area (acres)	Area (%)	Area (acres)	Area (%)
Built up area	8,293	1.095	3,338.96	3.75	92,023	11.1
Wetlands	165,807	20.46	160,501.95	19.36	150,221	18.12
Grasslands	66,323	8	84,976	10.25	109,018	13.15
Bareland	132,646	16	119,877.03	14.46	155,444	18.75
Water bodies	290,163	35	261,727.61	31.57	229,809	27.72
Light forest	165,807	20	171,113.65	20.64	142,263	17.16
Total	829,039	100	829,039	100	829,039	100

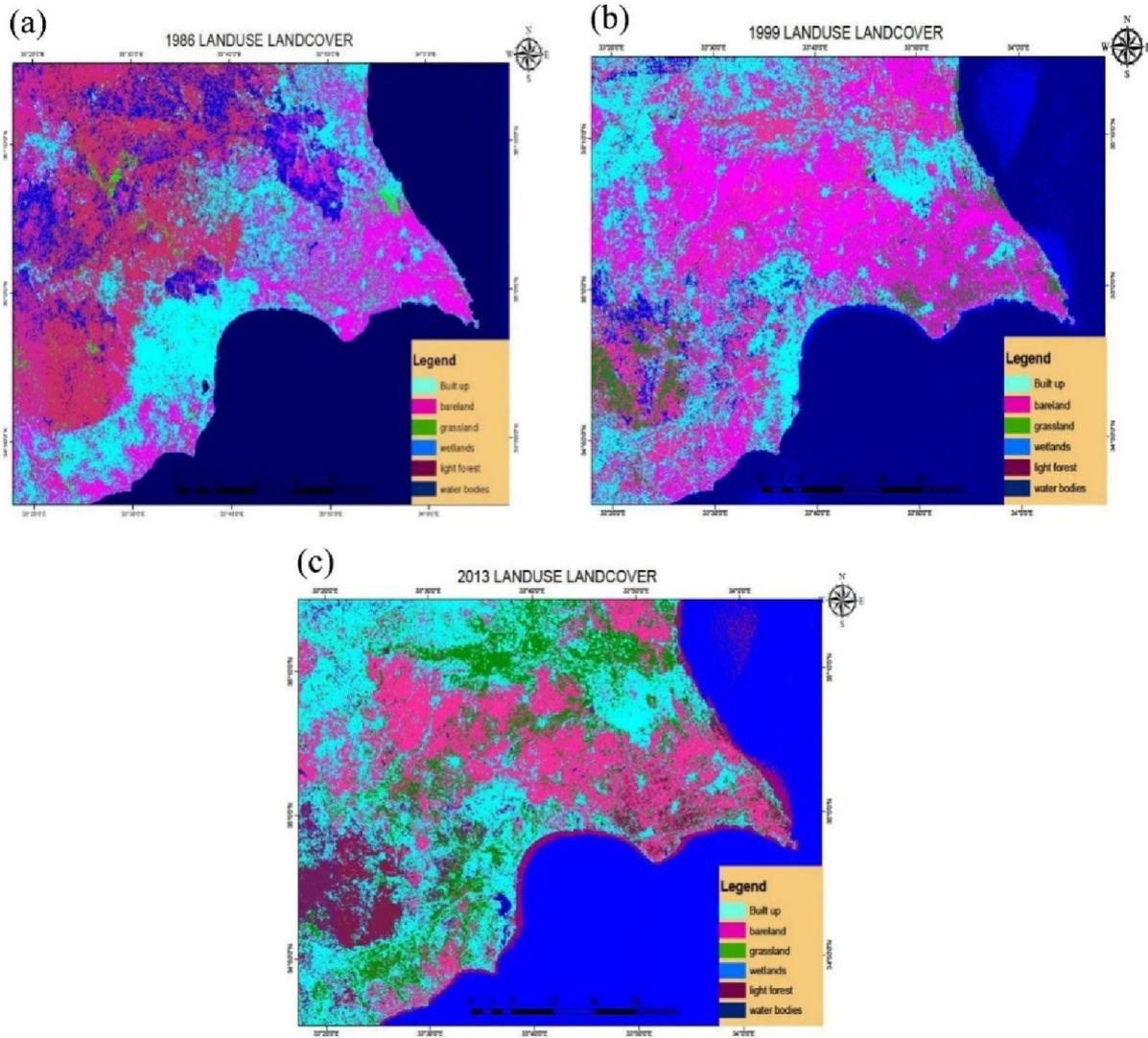


Fig. 6. Spatial distribution maps/images of Famagusta land use/land cover; 1986 (a), 1999 (b) and 2013 (c) (Landsat TM/ETM+)

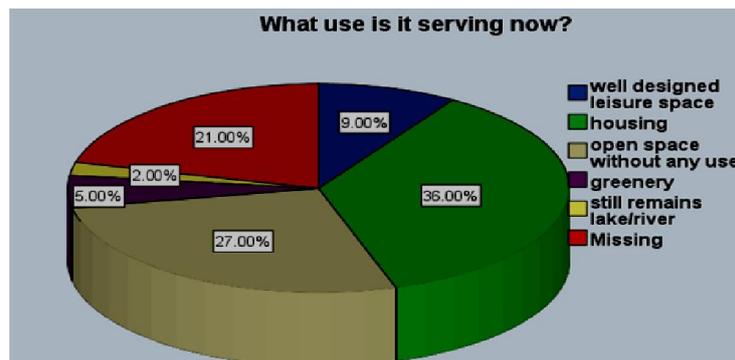


Fig. 7. Respondent’s opinion on the current uses of indiscriminately available lost spaces in Famagusta area

Questionnaire Survey

To get the optimum research result, opinions of residents in Karakol were accumulated with 85-structured questionnaire, administered at random interval of 10 buildings, and 5 semi-structured interviews. The structured data was assessed utilising Statistical Package for Social Sciences software (SPSS).

RESULTS AND DISCUSSION

When considering the historical background of the study areas, Famagusta has experienced different kinds of political, socio-economic, and cultural changes, which inevitably affected its development, growth, and consequent urban form. Before the war, the city was buoyant as an important trade and tourism centre with a population of approximately 41 000. Providing services to about 120 000 people, including its own inhabitants, as a sovereign nation-attributing commercial, administrative, educational, and recreational functions. The major source of income was from the harbour, commerce, and tourism. The post-war consequences were a separation of the Island into two regions (Turkish in the north, Greek in the south), which caused Famagusta the loss of a dominant position and populations. This transformed Famagusta to a rare example of war-torn cities, with almost an opposite change in urban direction and growth, without any population and thus any urban activity, the most dynamically developed quarter of the city became a ghost settlement. According to research conducted by the Town Planning Department in 1981, the population of Famagusta was increased to 20, 000, right after the war through migrations from Turkey in the following years, thus, causing an exchange of population between the two communities. As shown earlier, settlement all around the city were in some strategic ways (as shown in Fig 1), placing Turkish Cypriot refugees, mainly in Baykal, Canakkale, Dumlupinar, Namik Kemal, Sakarya, Tuzla, Canbulat and Lala Mustafa Pasa districts and refugees from Turkey were settled in Asagi Maras (Önal *et al.*, 1999). Following a very stagnant period, by the next era, the city at large had begun to adapt to the new channel of development of the Walled City, and the newly developing residential quarters (Karakol and Baykal districts). The city emerged in some growth and development tendencies with the establishment of a High Institute of Technology in 1979 and development of social housing projects by the central authorities (initiated in 1982). These proposals/ projects have since then played vital roles in shaping the city (Önal *et al.*, 1999). The increasing population, which is an external inward movement factor, in some cases could generate growth in once declining and distressed cities (James *et al.* 1998), a tendency that also increases the population of the youths in a location over others taking advantage of the institution as a magnet which modifies an existing nature. As schematically shown in (Fig 3), the newly developed residential district of Karakol was modified from an uninhabitable military base, Freeport, wetland and lake area to a major harbour of residential, social and commercial zone accommodating teenage, youths and adult population. At the time of research, over a thousand houses exist in Karakol district and still counting with the undergoing process of development around the university where housing projects and

retail activities characterizes the socioeconomic culture of this district. Population increase does not influence built space only, but could also show an effect on personal consumption (Estes *et al.*, 2012). The growth of Karakol did not rely on land for agricultural purposes. However, in its own case, needed land for retailing to sustain the economic damage that occurred years back, a footprint that is yet to be entirely wiped out. An interview with some of the retail owners unveil that some of the users of this district do not reside within the district, but come from various neighbouring towns and villages that could be more than 15-20km (semi-structured interview) from their new workplace. From this claim, it is evidenced that the institution (now Eastern Mediterranean University) has been fulfilling its purpose of establishment of the original High Institute of Technology up-till-date. Moreover, an important observation is the multi-cultural diversity that has been created in this district, categorically, the authors can place this district as the most culturally diversified districts in Famagusta using the recent population statistic sourced from Eastern Mediterranean University (EMU) registrar's office (Table 1), with students from 83 international countries, many of which resides within Karakol district. As portrayed in (Fig 4a), the survey deduced that almost 45% of the building occupants in Karakol district where students and more than 20% are artisans whose residency (temporarily or permanently) is as a result of the service opportunity they are likely able to meet. The remaining, approximately 30% have similar reasons for the choice of location. From the list of vocational and professional qualification provided "student" 44%, "artisan 24% dominated the neighbourhood, while others "pharmacist (1%), dentist (1%), cashier (3%), teacher (3%), Government worker (4%), house wife (4%), and unemployed (2%), including engineer (2%), and 12% were missing. Accommodating more than 16000 students (a statistic almost doubled the overall population of Famagusta in 1986) has become the priority over the natural quality of the wetland district. Private developers are willing to sacrifice this natural harbour of the ecosystem (a very distinctive character in such a city) for human habitation. However, the reason behind this can be understood, even though, the vacant buildings in some places gives an evidence of the doubt to the expected intensions for the housing character with the need to build student apartments. The population evidently gives a visible correlation with the respondent's opinion of "Yes" 89%, "No" 10% and 1% missing (note: missing values are omitted responds to variable). The study results apparently show that about 90 % of the participants admitted to the fact that the university have a substantial effect on the population increase (Fig 4b). Following the implementation of the institution in this location, the intermediate district of Karakol with a total population of 7046 (municipality's statistics) has been a beneficiary of a considerable handful of the population that makes up the entire city. With the displayed transformation alongside modification of land area, in view of explaining the unconstructed area, a significant question based on Yes or No was administered to respondents in Karakol district. The study result found that that 63% of the respondents indicated that there are many un-built spaces around their buildings, although 27% admitted to no lost space (i.e. spaces without a particularly attributed function), while 10% of the respondents were without response or probably were indifferent about the

vicinity. The result of the increased population in the district cannot be far-fetched, as opportunities to cease; the leftover of land (from military zone and free port) has submerged the previous wetland property of the land parcel. In some cases, irrespective of protected areas, population encroachment/sprawl might still be observable (Estes *et al.* 2012). This causes a reduction in preservation policy enforceable by the management bodies in this part of the Island. Interviewed respondent's opinion about the previous use of space, shows "agriculture" N=8, "open space without use" N=45, "leisure for children" N=2 and "lake" N=7 (Fig 5a). This demonstrated that not only will the area not be protected, but also cannot continue serving the agricultural function it used to be known for, even in its least percentage (interviewed respondent's opinion). Quite a complex issue to understand here is the large chunk of people ('missing' N=35) who neglected this aspect of the research in their response, the question therefore is, could this reaction be related to land use negligence? Today, only strict regulations retain some part of the urbanizing area in Famagusta as a whole and widely visible change is taking place generally. A wide sprawl of buildings in Karakol spread like flaming fire, and bearing lost spaces that only opens opportunity for same land use character. As shown in (Fig 5b), personal observation and respondent's opinion point out the indiscriminately scattered spaces left to accommodate divers land use character needed in a district. Now we can see that changes of such are measurable, to check and control unwanted direction of develop-ability and uses, either on a suburban or urban scale. As it can be seen in (Fig 6), the use of remotely sensed Satellite imageries and respondents view reveal the present use to which the wetland has lost its distinct character to a recent character of "housing" 36%, "open space without use" 27%, "well designed leisure space" 9%, "greenery" 5%, "lake" 2% (Fig 7), including percentage at which change has occurred in Famagusta at large. The statistical land use / lands cover distributions for each studied year as derived from the maps are presented in the (Table 2). The number of figures presented in (Table 2) represents the static area of each land use and land cover category for each study year. Built-up in 1986 barely could cover 829.39 acres of the total land area, which was the least class with just a bit above 1% of the total percentage, but within 3 decades time interval, the population has skyrocketed to 11.1% in 2013. This is in no way unrelated to the fact that the city (Famagusta) has increased in population and therefore, directly derive its need from land with an approximately 10% increase difference from 2013. A factor of which shows the relationship with the similar decrease in wetland area which was as high as over 20% in 1986, but has by more than 2%, reduced to 18.12% and in acreage, moved from 165.807 acres to 150.221 acres, a major concern in this study. The increasing bare surfaces and grassland has been reported described by respondents (semi structured interview) as a factor of negligence by individual housing developers who converts a portion of land to housing, creating an open space that can't be maintained, and therefore are left as lost spaces this has made grassland to increase from 66.323 acres in 1986 to 109.018 in 2013 which is a 5.15% increased interval from its initial 8% as at 1986. A more pathetic observation of the land use characteristics of Karakol district is the fact that, water bodies which had the largest occupancy of land with 35% in 1986 has been affected and

reduced to 27% at 229.809 acres in 2013, although housing facility could not solely account for this change, non-the less human activity is likely traceable in the change. This character is supported by the chart below in relation to the opinions from residents of the Karakol district of Famagusta on. While the light forest characteristic available there has also been reduced to approximately 17% in 2013, thus climatic disturbance is expected to increase with such loss of forest, which serves as wind breakage in an ecosystem.

Table Conclusion

Discussing the issue of land-use change could be on global or local level. Both scales have theories and models applicable for substantial guidance. While the study at local level uses explicit theories that can be utilised in the real world situations, the global theories seem more broad and generalized for world problems. Population dynamics associated with migration have always been mentioned as a major driver of land-use change, among others. Karakol district has been observed to have gradually lost a distinct nature when one reviews the overall study, although contrary to the authors initial opinion, buildings in this district do not remain vacant for a longer duration of 1-2 years, but this does not account for the numerous view of the motive behind day-in-day-out emerging structures which was questioned, upon the researchers observation since the last 8 months. This unawareness therefore points out a reason why policy makers need to be informed of the consequence of natural loss. Thus, the result of this study intended to help policy makers monitor the changes in the features highlighted over time and in the development of housing facilities, which are direct results of increasing internal movement and international migration. This study considered the general land use change in no order, but places migration (population growth) as the focal point of the review as observable changes is becoming visible even to the naked eye. Therefore, there is need to create a documented awareness that will function as an update in the consideration of land developability, as well as a map that will provide the opportunities to know the direction of further encroachment. This study inference also sets before other investigators in this field and related fields the need for considering topics such as land-use change between major ring-roads, changes around urban centres and within suburbs and communities in order to identify growth using the multi-nuclei structure, and lastly, land use change at the geography of districts linked with economic indicators for a correlation and regression on economic driving forces behind land-use/land cover change (LUCC) in North Cyprus. For a number of reasons, this study has major limitations, which can entirely be overcome when and if data that is more comprehensive becomes available. Even though, using the limited available data has so far been able to find out some important aspects of the way that migration is related to land use change in the Famagusta region. However, this study proposes that the implications of human migration on land use change need further investigation and better data in order to be more certain about trends.

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