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The impacts of land use change on partridge's population in the Marghazar valley of Swat District, Pakistan

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Abstract In landscape ecology, it has become increasingly essential to understand the consequences of past, current, and future human land use patterns for biodiversity and ecosystem function. The most significant factor affecting biodiversity loss is land-use and land-cover change (LULCC). We examine here the impact of long-term changes in LULCC from 2000–2020 on the biodiversity of Marghazar valley in Swat District. Information was also gathered on the perceptions of the surrounding communities based on the flow of ecosystem services (ES), historical changes, and the causes of those changes. Satellite imagery data were used to map LULCC, identify possible causes, and assess the impact of LULCC on the population of partridges. In the last 20 years, forest area has reduced by 23 km^2 (33%) and the seasonal water body has declined by 1.015 km^2 (2.15%). There was a 38.5 km^2 decrease in agricultural land. In contrast, the built-up area increased by 384%, resulting in a total growth of 26.3 km^2 and an expansion of 41.1 km^2 grassland. Deforestation, agricultural expansions, urbanization, economic considerations and changes in land tenure policy were identified to be the main drivers of LULCC. The primary impact of LULCC on partridges in the studied area are land degradation, population declines, habitat disruption, displacement of partridges by livestock and increasing human-wildlife conflicts. Despite ongoing human pressure, the Marghazar valley still provides extensive habitat for wildlife. Interventions may be needed to maintain biodiversity and ensure long-term ecological services in the area.

Keywords: land use land cover change, communities' perception, ecosystem services, urbanization, partridges, Pakistan

Összefoglalás A tájökológiában egyre fontosabbá vált a múltbeli, jelenlegi és jövőbeli emberi földhasználati minták biológiai sokféleségre és az ökoszisztéma működésére gyakorolt hatásainak megértése. A biológiai sokféleség csökkenését befolyásoló legjelentősebb tényező a földhasználat és a felszínborítottság változása (LULCC). Itt megvizsgáltuk a LULCC 2000–2020 közötti hosszú távú változásainak (LULCC) hatását a Marghazar-völgy biológiai sokféleségére (Swat District). Információkat gyűjtöttünk a környező közösségek észleléséről is az ökoszisztéma-szolgáltatások áramlása (ES), a történelmi változások és e változások okai alapján. A műholdas képadatokat a LULCC feltérképezésére, a lehetséges okok azonosítására és a (LULCC) fogolypopulációra gyakorolt hatásának felmérésére használtuk. Az elmúlt 20 évben (2000–2020) az erdőterület 23 km^2-rel (-33%), a szezonális víztest pedig 1,015 km^2-rel (2,15%) csökkent. A mezőgazdasági földterületek 38,5 km^2-rel csökkentek. Ezzel szemben az elmúlt 30 évben a beépített terület 384%-kal nőtt, ami összesen 26,3 km^2 növekedést és 41,1 km^2 gyepterület bővülését eredményezte. A LULCC fő mozgatórugói az erdőirtás, a mezőgazdasági terjeszkedés, az urbanizáció, a gazdasági megfontolások és a földbirtoklási politika változásai voltak. A LULCC elsődleges hatása a vizsgált terület fogoly állományára a talajromlás, a népességcsökkenés, az élőhelyek megzavarása, a foglyok állatállomány általi elmozdulása és az ember-vadon élő állatok konfliktusainak fokozódása. A folyamatos emberi nyomás ellenére a Swat régióban található Marghazar-völgy továbbra is kiterjedt élőhelyet biztosít a vadon élő állatok számára. Beavatkozásokra lehet szükség a biológiai sokféleség fenntartása és a terület hosszú távú ökológiai szolgáltatásainak biztosítása érdekében.

Kulcsszavak: földhasználat, felszínborítottság változása, a közösségek felfogása, ökoszisztéma-szolgáltatások, urbanizáció, fogoly, Pakisztán

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Introduction

Changes in biodiversity occur at all scales as a result of ongoing human alteration of the earth surface (Newbold *et al.* 2015). Around 32% of all known vertebrate species are experiencing decline in population or range contractions globally, with recorded species extinction rates many times greater than natural rates (Ceballos *et al.* 2017). Recent global meta-analyses have shown that some biodiversity metrics, such as species richness, have not decreased at smaller scales, such as biodiversity sampling scale (Vellend *et al.* 2017). However, these findings have been questioned, specifically whether the data is geographically and temporally biased (Gonzalez *et al.* 2016) or whether locations with and without land change were different (Cardinale *et al.* 2018). Land-use and land-cover change (LULCC) have been highlighted as a major driver of terrestrial biodiversity loss (Díaz *et al.* 2019). This raises a question of whether changes in land use can account for changes in local biodiversity measurements throughout time and space. Local biodiversity is also influenced by current LULCC around the world. Local biodiversity has been found to be consistently decreasing in areas with more intensively exploited land (Murphy & Romanuk 2014), in comparison to undisturbed primary vegetation, with 13.6% fewer species and 10.7% fewer individuals recorded (Newbold *et al.* 2015). The effects on biodiversity increases with the frequency of land use, ranging from no impact to a loss of more than 95% of mean species abundance (Taylor *et al.* 2014). For example, when more than 20% of a landscape is cleared, wildlife begins to disappear, and when less than 30% of the native vegetation remains, the loss of species accelerates rapidly (McAlpine *et al.* 2002). While the loss of habitat is the primary negative impact of clearing on biota, fragmentation and change of the remaining habitat has a significant negative secondary effect (Haddad *et al.* 2015). At landscape scale, which is defined as the extent to which spatiotemporal dynamics influence ecological processes (Pickett & Cadenasso 1995), regional biodiversity is affected by resource variability, such as food or nesting material, as well as ecological processes, such as migration or parasitism (Ullah *et al.* 2022). Until now, comparative studies have been attributed to a lack of data on local biodiversity change and landscape-wide LULCC (De Palma *et al.* 2018). As satellite imagery becomes more widely available, it is now possible to examine LULCC over a wider range of spatial and temporal scales (Pasquarella *et al.* 2016). Long-term satellite programs, such as NASA's Landsat, offer one of the most reliable sources of time series for monitoring land surface changes (Hermosilla *et al.* 2018).

The impact of local biodiversity change as measured by recurrent breeding bird surveys (BBS) has been extensively studied (Pardieck *et al.* 2018). Changes in bird diversity are often non-linear and reliant on the specific biodiversity measure used (Barnagaud *et al.*

2017). Bird diversity has changed differently across ecoregions and for birds with specific functional features (Jarzyna & Jetz 2017), like migratory or grassland-dependent species, which have dropped significantly in developed countries (Stanton *et al.* 2018).

Rittenhouse *et al.* (2010) reported that the composition of bird assemblages was altered in areas with more 'disturbed forests', as measured by remotely sensed time series. To our knowledge, no previous study has attempted into whether variations in LULCC throughout the landscape connect with and explain variations in local bird diversity. The goal of the study was to assess the changing land use patterns in Marghazar of Swat District from 2000 to 2020, as well as the likely reasons of these changes and their consequences on the wild partridge population. The study postulated that changes in land use patterns had resulted in a significant decline in partridge populations in the study region, and that land use changes in Marghazar might be caused by an increase in human population and associated activities.

Material and Methods

An overview of the study area

Marghazar, a mountainous region of Pakistan with numerous valleys, scrub and coniferous forests on the upper slopes, and alpine pastures on the ridges. It is located between 34–40 and 34–50 degrees North and 72–20 and 72–30 degrees East *(Figure 1)*. The annual rainfall ranges between 1,000 to 1,500 mm, providing enough water for infiltration and for a variety of plants. The valley rises gradually from 1,000 meters above sea level at Kokrai village to 3,000 meters at the summit of Mount Elem. The valley covers a total area of 367.7 km^2. The former King of Swat chose it for the Summer Palace, which is now known as Marghazar White's place, because of its natural beauty, and the valley attracts local and national tourists all year, especially in the summer. Marghazar is named after a combination of the words "Margha" and "Zar," as evidenced by its name. Margha is a local word that means "pertaining to birds," and Zar is a Persian word that means "garden" or "a spot where birds and flowers are nurtured." Despite the fact that the name was given some 50 years ago, it represents the fact that this valley was once a welcoming habitat for a variety of birds and plant species. Agricultural forming, livestock rearing, timbers and fuel wood are the primary sources of income for the majority of the population. On the basis of land-use and land-cover change (LULCC), three representative villages were chosen: Oghaz, Mount Elem and Jambil. The dominant tree species of the study area include *Pinus wallichiana, Pinus roxburghii Sarg. Cedrus deodara, Melia azedarachta, Ficus racemose, and Quercus baloot,* Shrubs include *Dodonea viscosa, Berberis lyceum, Desmodium elegans, Datura stramonium, Zizyphus oxyphylla,* and *Rubus fruticosus.* Herbs include *Poa annua, Heliotropium strigosum, Origanum vulgare, Solanum xanthocarpum* and *Hypricum perforatum*.

Among the area's main wildlife species are Brown Bear *(Ursus arctos isabellinus)*, Side-striped Jackal *(Lupulella adusta)*, Gray Wolf *(Canis lupus)*, European Rabbit *(Oryctolagus cuniculus),* Resus Macaque *(Macaca mulatta)*, Red Fox *(Vulpes vulpes)*, Indian Crested

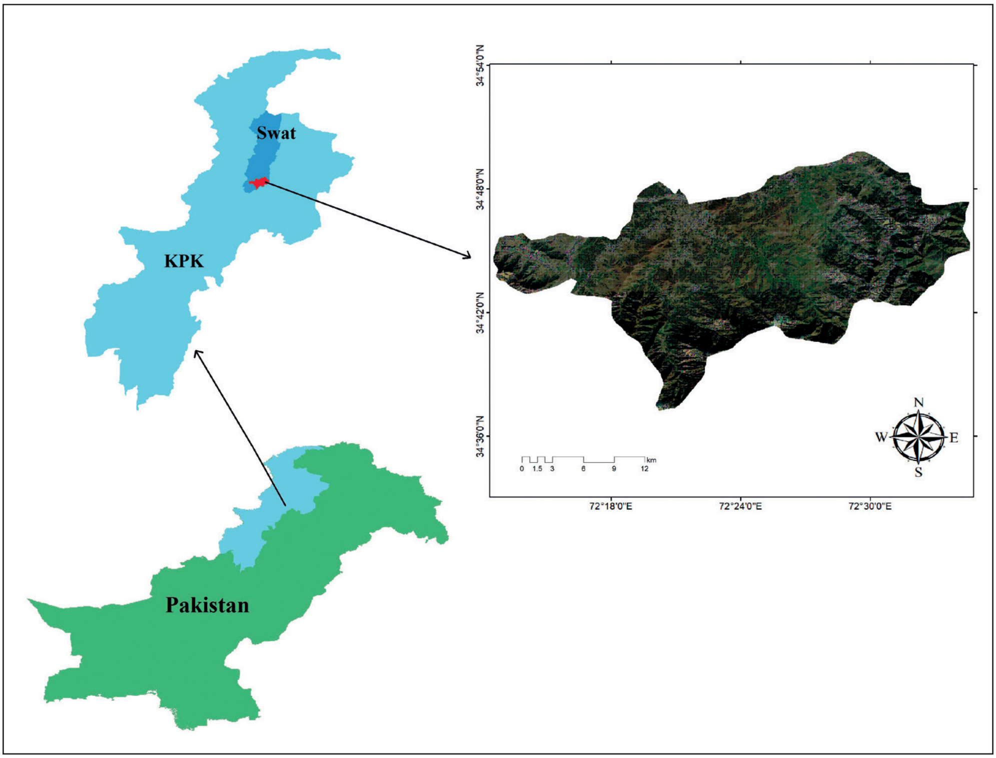

Figure 1. Map of Marghazar in Swat District, Pakistan
1. ábra Marghazar térképe, Swat körzet, Pakisztán

Porcupine *(Hystrix indica)*, Himalayan Goral *(Naemorhedus goral),* Chukar *(Alectoris chukar)*, Black Partridge *(Melanoperdix niger),* Grey Partridge *(Perdix perdix)*, Kalij Pheasant *(Lophura leucomelanos),* Koklass Pheasant *(Pucrasia macrolopha)*. A large population of small mammals, reptiles, and amphibians live in the ecosystem.

Study area selection

The study area was chosen based on the following characteristics. (1) The region has the highest coverage of temperate coniferous forest, which is threatened by deforestation. (2) Due to the present cease-fire in the district of Swat as a result of the present terrorism situation in the area, the fauna of the study area are rich.

Time periods selection

The data starts with the baseline of August 2000 when the infrastructure of Marghazar valley was less developed, when there were only local residents at the time and the outside peoples not coming that much. The next data point selected was 2010 with approximately one decade gap when there were Taliban militancy. They had complete hold of the whole valley and did a fast range of deforestation which affected the ecosystem of the area. The last data point is 2020, which is the latest available data. When the population is its peak and peoples from the outside valley came to reside here which has affected grossly the ecosystem of the valley as well. Several important institutional changes occurred during this period, and several development projects, were initiated in the region. The majority of these initiatives focused on economic growth, agriculture, and road infrastructure, all of which are often cited as a key drivers of land use change.

Tools and a participatory approach

To understand the people's perceptions on past biodiversity and the drivers of land use/cover dynamics for Marghazar region, we used a few participatory rural appraisal (PRA) methods such as focus groups, resource mapping, and transect walks, as well as a structured qualitative household survey using a semi-structured questionnaire of open-ended and closed questions. We divided the study area into three sites. We selected 40% of the 419 households in three sample sites for a household survey (N=170). *Table 1* shows a summary of the sample area for the household survey. The survey was performed in the local language at home in the morning and evening. Regardless of gender, the head of the household was interviewed (above 40 years). The survey questioned about people's attitudes toward land use changes and their impact on wild partridges, human population census numbers and ecosystem dependence, partridge population census details, and livestock population trends. Land use change data was collected using ARCGIS and EDRAS tools to acquire, view, and analyze satellite images. Identification of partridge species, present land use patterns, and land degradation were all done by direct observations. This included a 40-kilometer long line transect walk that ran diagonally through the study area. This was performed with the help of local game scouts. All species found at a distance of 1 km on either side of the line transect walk were identified and individual species counted. This happened during the month of September 2020. Using a digital camera, data was captured through photographs. It was useful in classifying land uses in the area as evidence of actual practice. Field visits were used to make ground validation in order to enhance change detection. This involved randomly selecting sites from the most recent land use base map and visiting each site to examine and verify if the land use type on the ground matched what was depicted on the map.

Table 1. Description of sampling areas for household survey
1. táblázat A háztartások felméréséhez használt mintavételi területek leírása

Study area	**MARGHAZAR**			**Total**
Village name	Oghaz	Mount Elem	Jambil	–
Location	34.7420° N, 72.4552° E	34.6182° N, 72.3327° E	34.7222° N, 72.4450° E	
Total house hold	121	84	214	419
Sample size	49	34	87	170

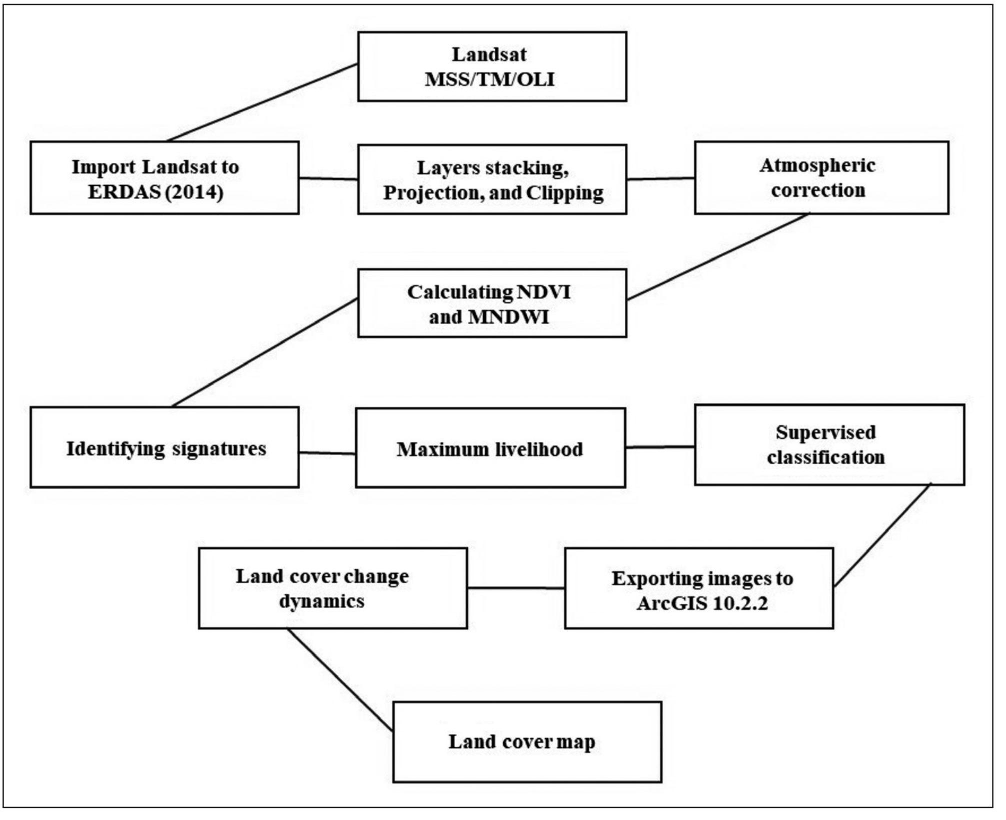

Figure 2. Paradigm of the overall methodology of LULCC
2. ábra A LULCC általános módszertanának paradigmája

Land use land cover change analysis

August was selected for obtaining satellite data for the study area due to least amount of cloud this month. The entire archive was observed and examined carefully to observe the images taken throughout in August month. Remotely sensed data for land cover assessment were obtained for three years 2000, 2010 and 2020. The data were obtained from Landsat Look Viewer comprises of Landsat MMS with spatial resolution of 60 m, having four bands and Landsat TM having spatial resolution of 30 m consist of 8 band. Spatial resolution of Landsat OLI is 30 m. The digital elevation model (DEM) was obtained from the Shuttle Radar Topography Mission (SRTM) from United State Geological Survey (USGS). *Figure 2* describes the overall processes that are included in the study.

Statistical analyses

All experimental results were examined by statistical package for social sciences IBM (SPSS) version 20 software database. Observations were considered statistically significant at ($p<0.05$).

Table 2. Change matrix of land cover (km²) in 2000 to 2020
2. táblázat A felszínborítottság (km²) változása 2000 és 2020 között

Total area of Marghazar region (367.7) km²			
Land cover type	2000	2010	2020
Barren area	102.99	95.68	103.80
Forest cover	68.23	54.19	45.26
Snow land	0.124	14.51	0
Agriculture	65.235	81.47	26.68
Water bodies	7.920	5.732	1.015
Buildup area	7.173	22.95	33.50
Grass land	115.97	93.21	157.16

Results

In 2000, Marghazar ecosystem had a total area of 367.7 km² *(Table 2)* out of which barren land had occupied 102.99 km², forest 68.23 km², snow cover 0.124 km², agricultural land 65.235 km², water bodies 7.920 km², buildup area 7.173 km² and grassland 115.97 km². By 2020 barren land had occupied 103.80 km², forest 45.26 km², snow cover 0 km², agricultural land 26.68 km², water bodies 1.015 km², buildup area 33.50 km² and grassland 157.16 km², respectively. The land use change maps *(Figure 3a,b,c)* show two strong trends: increasing fragmentation from 2000 to 2020 and change in land cover types especially decrease in forest cover (-33%), agriculture (-58.7%), snow (-100%), water bodies (-90.6%) and increase in built up area (384%), grass land (35.5%) and barren land (1.07%) *(Table 3)*.

Local communities' perspectives on the status of ES and LULCC

Figure 4 illustrates how communities have seen changes in ES flow during the last decade. Around 82% of the respondents believe that the forest ecosystem has decreased in the last 20 years. Fuel wood exploitation, illicit logging, charcoal production, shifting cultivation, agricultural area expansion, and population growth all contributed to the deteriorated forest ecosystem. In addition, the communities claim that there is almost no forest remained in the

Table 3. Summary of land cover statistics for 2000, 2010 and 2020
3. táblázat A 2000., 2010. és 2020. évi felszínborítottsági statisztikák összefoglalása

Land cover type	2000	2010	2020	P1 (2000–2010)	P2 (2010–2020)	Total% change
Barren area	28	26	28.3	-7.1	8.8	1.07
Forest cover	18.5	14.7	12.3	-20.5	-16.3	-33
Snow land	0.03	0.3	0	900	-100	-100
Agriculture	17.7	22.1	7.3	24.8	-66.9	-58.7
Water bodies	2.15	1.5	0.2	-30.2	-86.6	-90.6
Buildup area	1.9	6.2	9.2	226.3	48.3	384
Grass land	31.5	25.3	42.7	-19.6	68.7	35.5

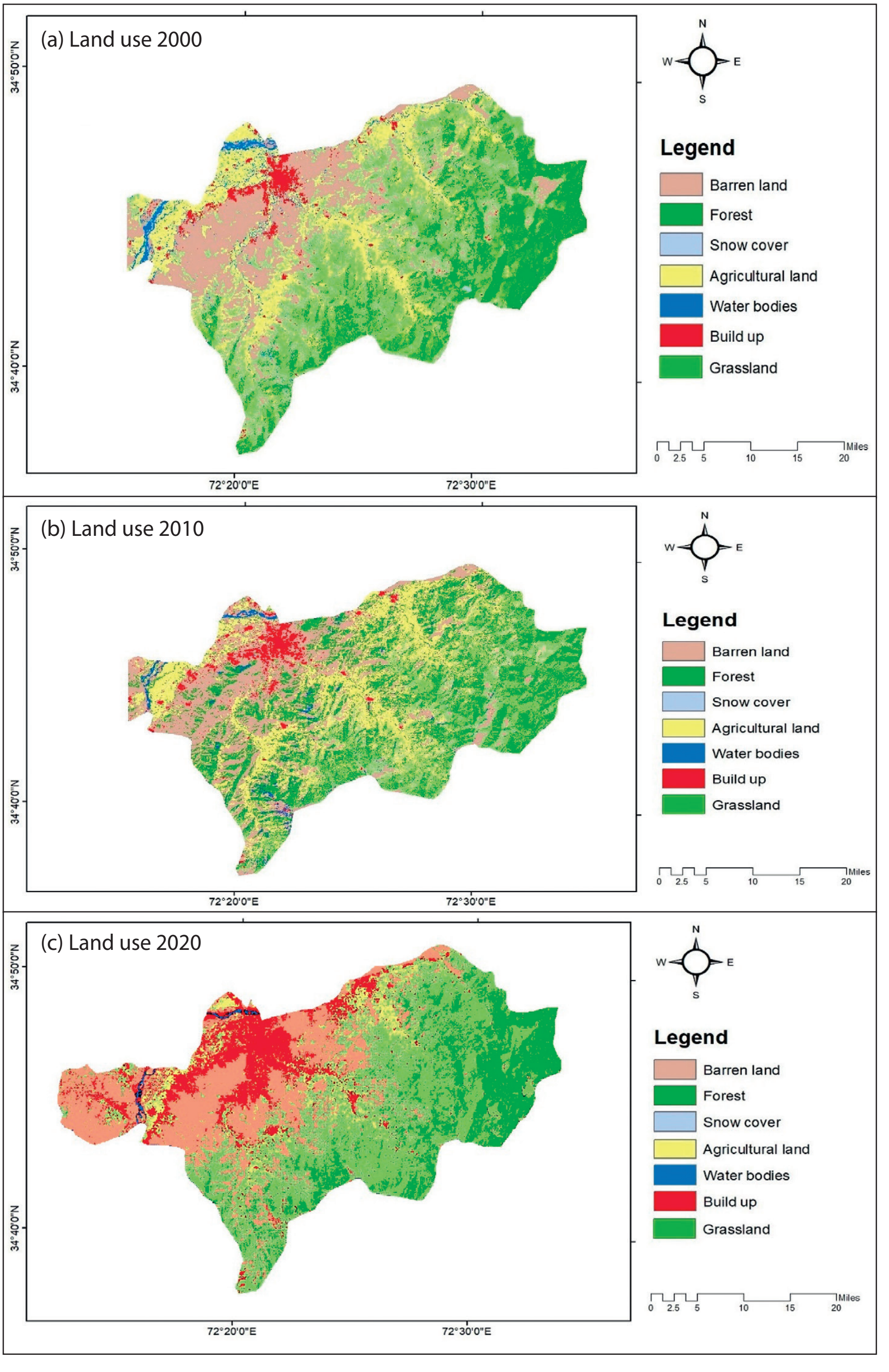

Figure 3. Land use and land cover maps of Marghazar valley (2000–2020)
3. ábra A Marghazar-völgy földhasználati és felszínborítottsági térképei (2000–2020)

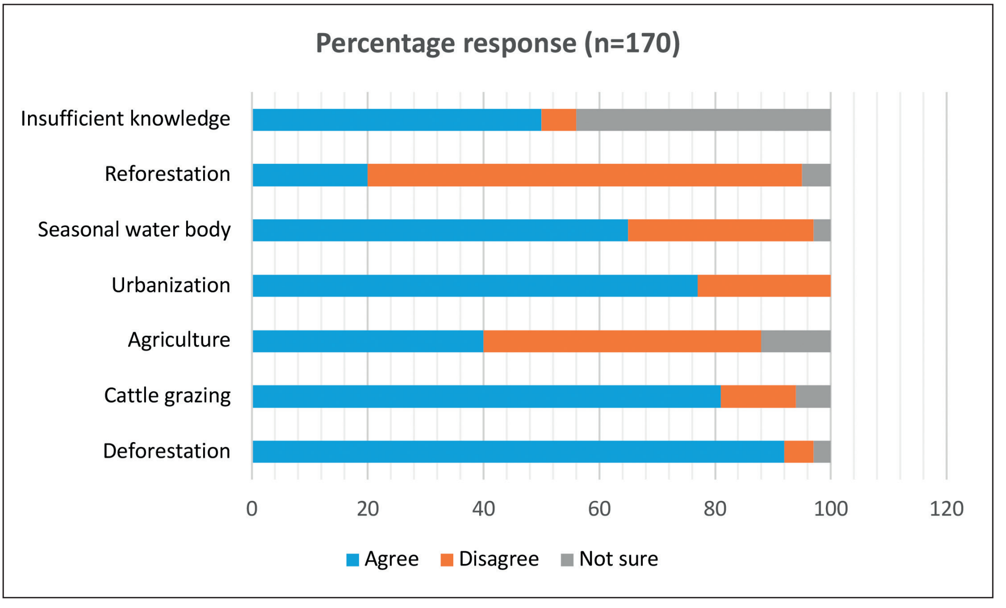

Figure 4. Local people's perspectives on the factors affecting land use/cover dynamics
4. ábra A helyi lakosság nézőpontja a földhasználat/felszínborítottsági dinamikáját befolyásoló tényezőkről

village area. Around 40% of the respondents said there had been an increase in the amount of land used for agriculture; while 48% of the respondents are disagree for such changes. Communities have stated that excessive use of chemical fertilizers has affected soil fertility and water quality. Approximately 77% of respondents indicated that the area used for urbanization has increased. Other factors for change include cattle grazing 81%, and a lack of concern about environmental problems, which accounts for 10% of the changes. Prior to the 1970s, the majority of the people in the study area said there were significant numbers of wild sheep, bears, jackals, wolves, rabbits, monkeys, and foxes in the area. These animals are now extremely rare in the area; the decline in species abundance appears to have started in the early 1980s, when livestock keepers arrived. Such changes in the study area have resulted in a significant decrease in biodiversity. Deforestation, urbanization, and increased soil erosion leading to sedimentation, erratic rainfall, and the drying out of rain water storage ponds are all major concerns. Around 20% of those surveyed said that reforestation had helped to mitigate some of the negative effects. During the dry season, a large number of respondents (65%) perceived a substantial decrease in seasonal water bodies.

Population change

According to the 2010 census, Marghazar region of Swat District has an annual human population growth rate of 17%. In 2020, this translates to 4,927 people and a population density of 24 people/km^2. The entire human population in the area is expected to reach 6,245 person by 2030. Because of the increasing population growth in the area, there is a greater

Table 4. Local communities depend on ecosystem services (ES) for their livelihoods
4. táblázat A helyi közösségek megélhetése az ökoszisztéma szolgáltatásoktól (ES) függ

Ecosystem	Oghaz	Mount Elem	Jambil
Goods and services provisioning	Timber	Timber	Fuel wood
	Fuel wood	Fuel wood	Vegetables
	Fruits	Drinking water	Fruits
	Vegetables	Water for irrigation	Ornamental plants
	Cereals	Wild edible fruits	Water for irrigation
	Drinking water	Vegetables	Drinking water
	Water for bathing	Grazing	Grazing
	Grazing		
	Medicinal plants		

demand for land for farming, habitation, and infrastructure development, which has resulted in the destruction of large areas of wetland, forestland, woodland, mountain, and grassland that serve as partridge's habitats.

Use of ES as a source of livelihood

Communities in the three study areas, namely Oghaz, Mount Elem and Jambil, showed varying levels of dependence depending on ecosystem proximity. It was found that all of the dependent communities seem to make the best use of the ecosystems available to them. Our qualitative data revealed that local residents depend on a variety of ES from the study area to support their livelihoods *(Table 4)*. Nearly all of the respondents in Oghaz village cited that they consume vegetables (60%) and wild edible fruits/vegetables (50%) from the forest ecosystem. Around 100% of respondents use water for drinking, 90% for bathing, and 100% of the villagers collects wood for fuel and 2% use medicinal plants. Despite deforestation and destruction of forest areas, forests continue to provide the village with fuel wood. About 80% of the respondents in Mount Elem consumed fuel wood from forests. Deforestation in the valley is dominant. Similarly, the local agro-ecosystem looms vegetable production (50%) as well as wild and edible fruits (30%). Water is used by about 60% of respondents for drinking and 30% for irrigation.

In Jambil village, only 15% of those surveyed said they used forest fuel wood. The agro-ecosystem in the region appears to be very productive. Around 70% of the households cultivate vegetables, 10% ornamental plants, and 50% cultivate fruits. Fresh water is mostly used for drinking (90%) and for irrigation purposes (10%).

Effects of Land Use Change on partridge population in Marghazar

According to 91% of respondents, LULCC in the study area had a significant effect on partridges population (χ^2 =123.70, DF=1, P<0.0001). The main effects are a significant

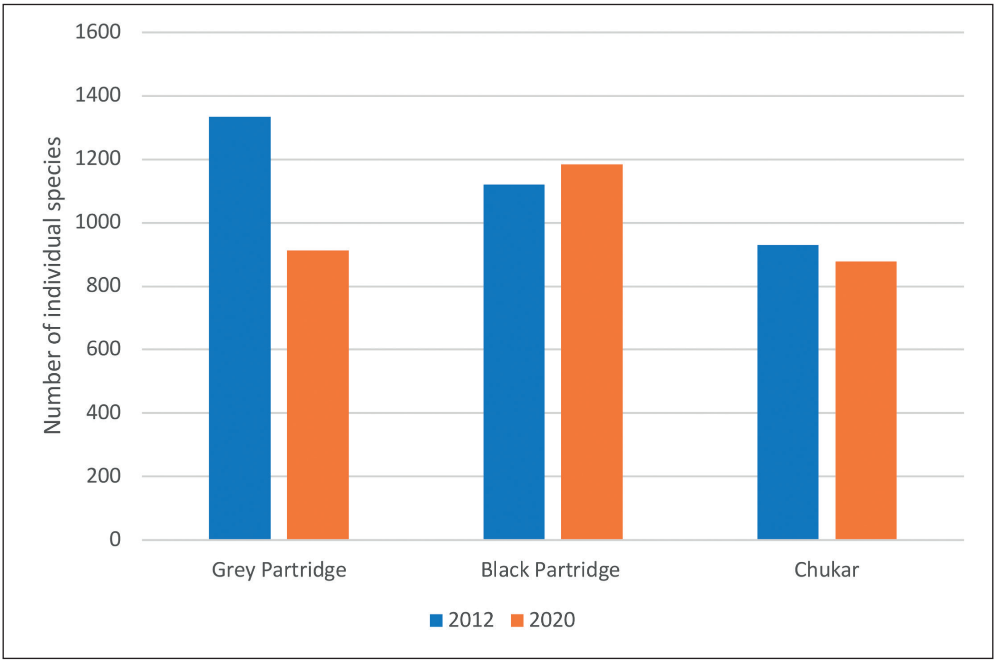

Figure 5. Partridge's population estimates for 2012 and 2020 in the study area
5. ábra A foglyok 2012-re és 2020-ra vonatkozó populációs becslései a vizsgált területen

decrease in the number of partridges and other wildlife habitats, a significant increase in human and wildlife conflicts (χ^2 =165.38, DF=1, P<0.0001), habitat degradation, displacement of partridges, land degradation and appearance of invasive plant species.

Trends in decrease of partridge population in Marghazar

Bird counts conducted in the study area by different agencies on three species of wild partridges have shown a decline in their numbers. According to the 2012 bird counts, the most numerous partridge was the Grey Partridge, which had a population total of approximately 1,334 individuals, followed by Black Partridge (1120) and Chukar (930). In 2020, Black Partridge was the most numerous with a population estimate of 1,185 individual followed by Grey Partridge (912) and Chukar (878) *(Figure 5)*. A comparison of 2012 and 2020 count for the same species in the same region showed a decrease in numbers for Grey Partridge and Chukar and an increase for Black Partridge.

Discussion

The LULCC has been highlighted as one of the most significant change agents on the planet (Chettri & Sharma 2016). As a result of this LULCC, the flow of ES is disrupted (Janssen & Anderies 2007). Widespread deforestation and unplanned LULCC threatens natural ecosystems (Sidle *et al.* 2007), reduces multi functionality (Kandziora *et al.* 2014), and restricts the habitat of globally threatened species (Kandziora *et al.* 2014). In recent years, the Swat District has shown a considerable LULCC (Ullah *et al.* 2021), which our study has confirmed. Many previous studies have reported similar significant changes (Qasim *et al.* 2011). As a result, it represents a constant change in the size of the land. Changes in ES availability, however, bring challenges to communities who depend on it for their livelihood (Chaudhary *et al.* 2016). Despite the huge reduction in forested area, communities in Oghaz village still rely on forests for fuel wood. Landscapes are always changing due to natural and anthropogenic factors, hence these affects are dynamic (Turner & Gardner 2015). Previous studies have reported that LULCC across a landscape can have a long-term impact on local biodiversity due to 'biotic lag' effects (Ewers *et al.* 2013). However, most research (Ullah *et al.* 2021) focused on smaller geographical regions and changes in forest cover, rather than focusing on the main effects of landscape-wide LULCC on local biodiversity across spatiotemporal ranges. Increased agricultural production affects 40% of land area, posing a serious threat to biodiversity (Foley *et al.* 2011). According to a Chinese study, increased food production and arable land have a negative impact on biodiversity (Hou *et al*. 2015). Intensive agricultural techniques and herbicide use are having an increasingly negative impact on the natural capacities of lands to sustain biodiversity and ecosystem function. The decrease in land used for wildlife habitats indicates that wildlife conservation is not an important source of livelihood for the local inhabit of the area. As a result, convincing the local population to maintain wildlife habitats because of its long-term benefits is impossible. Local residents benefit directly from the study area through timber, fuel wood, grazing, and horticulture crops. As a result, it is not surprising that they have recently cleared their land for human settlements, irrigation and infrastructure development, all at the expense of conservation efforts. Livestock overcrowding has led to overgrazing in the study area, especially in areas appropriate for feeding and breeding. The effects of overgrazing, as seen during the visit, include landslides, soil erosion and the emergence of invasive plant species. Overgrazing can disrupt the structure and composition of the vegetation, which can affect biodiversity and predator-prey interactions (Blaum *et al.* 2007).

Land use/cover changes affect the development of biodiversity in the study area, and so the transition of forest and woodland into pasture and arable land exposes wild animals to illegal hunting, eventually leading to an increase in human-wildlife conflicts. Our findings have major implications for conservation and management in developing countries' more human-dominated forest landscapes (Newbold *et al.* 2020, Sol *et al.* 2020). In the recent decade, changing land use patterns in Marghazar have led to the loss of key habitats and decline in partridge's population. The land that used to be good for partridge habitat is now personal land. The regions that have been transformed into human settlements are no longer accessible to partridges. Urbanization has been particularly noticeable in places where partridge favorability has declined, suggesting that it may have had a significant negative impact on partridges population. This is supported by a study conducted on Arizona native birds (Green & Baker 2003). Replacement of natural forests with monocultures of tree species has been a major source of biodiversity loss in various parts of the world (Ullah *et al.* 2021). Our studies clearly indicate that recent landscape changes in this region have altered the distribution of favorable habitats for partridges. It is noteworthy, for example that the proportion of areas that are suitable for natural vegetation in 2012, has dropped in areas where the species' habitat has degraded. In contrast, partridge favorability increased as the area under these vegetation types increased, especially in scrubland. Newbold *et al.* (2020) and Sol *et al*. (2020) also found similar findings in global reviews of field studies. The biodiversity of the study area and other portions of the valley will continue to decline as a result of this changes. Despite the fact that anthropogenic deterioration is producing significant habitat fragmentation in the valley, the majority of biodiversity, including flora and fauna goes unquantified. Linking land use/cover and biodiversity loss is crucial for determining how much we have lost and how much we will lose if the current trend continues. Political producers and regulators should adopt an approach to providing "buffer zones" around key biodiversity sites, while promoting community and cultural activities to enhance the biodiversity of the region and improve local livelihoods (Munishi *et al.* 2011).

Conclusions

There is clear evidence that Marghazar valley land use/cover has changed drastically over time. The majority of the region was transformed into agricultural, urbanization, and grazing area as a result of anthropogenic activities. The biodiversity of the area is being degraded by the local community. The majority of the population is impoverished, illiterate, and unconcerned about biodiversity conservation. Conservation efforts for wildlife habitats and communities will aid in the maintenance of a variety of ecosystem services that will benefit human well-being.

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