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LAND USE MEASURES TO SUSTAIN TRADITIONAL USES OF THE PRODUCTIVE LANDSCAPE IN DIBEEN KBA

SITUATION ANALYSIS AND MEASURES IDENTIFICATION

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Contents

Executive summary

The study area (extended Dibeen Key Biodiversity Area) surrounding Dibbeen Forest Reserve highlights: **1.** The value of biodiversity as an asset for land use (production and tourism), **2.** The need to monitor and manage the impacts of land use on biodiversity conservation, and **3.** Enhance the enforcement and create public awareness about biodiversity conservation and ecosystem services.

This document outlines the use of standardized criteria for implementing site-based sensitivity analysis. The method includes site evaluation based on the conservation value (i.e. species and habitat) and viability for conservation (i.e. threats) to serve the strategic objectives for land use planning. This method provides a standardized way to assign scores to the sites based on the status and trends of biodiversity, present threats on the biodiversity and habitats, and effectiveness of conservation efforts. The scoring system integrates a wide range of qualitative (level of degradation) and quantitative (species richness) data that may either be found in the literature and previous studies or gathered for the zoning and/land use planning. Appropriate indicator species and site variables can be assigned for the monitoring and sustainability of the procedure. The method also aims to identify landscapes were opportunities and incentives can be created *in situ* (on-farm), especially small-scale farmers to encourage investment in natural resource management practices. The project aims to introduce 'ecoagriculture': integrated conservation–agriculture landscapes in which biodiversity conservation is an explicit objective of agriculture and rural development, and the latter are explicitly considered in shaping conservation strategies.

An assessment of the biodiversity and land-use for the study area was conducted. The study area was divided into **9 zones** based on the landscape, land cover, and distinct ecological characters for each zone: **1.** Closed old-growth forests (7.5 % of the area), **2.** Open old-growth forests (12.8), **3.** Planted (man-made) forests (4.1), **4.** Non-forest Mediterranean areas (marginal undeveloped land, 14.7), **5.** Wadi systems, **6.** Zarqa River and King Talal Dam (0.6), **7.** Mix-use rural agricultural areas (47.3), **8.** Farmlands (4.7), and **9.** Urban areas (8.3).

The biodiversity of plants, mammals, birds and reptiles within the study area were assessed through literature reviews and field surveys (species presence/absence) to **1.** assign the ecological and conservation importance of species and identify key areas and species and identify key species and areas. **2.** Assess the effects of the different types of land use with the buffer zone. **3.** To provide conservation and management guideline for these species and areas.

Results from biodiversity assessment indicated the actual or potential presence of some 250 species of plants, 34 mammals (8 carnivora, 1 artiodactyla, 9 chiroptera, and 11 rodentia), 31 reptiles and amphibians (3 frogs, one tortoise, one terrapin, 13 lizards, and 13 snakes), and at least 75 birds. At least 8 of the recorded species have global conservation status, 23 species have regional or local conservation status, and at least 38 are considered habitat-restricted. Several of the recorded species (e.g. Aleppo pine, *Pinus halepensis*, Persian squirrel, *Sciurus anomales*, green Lizard, *Lacerta media*) are unique to the habitat in the study site. The dense growths of pine forests represent a unique habitat for the Persian squirrel and green lizard and should be protected.

Based on the developed criteria, the 9 zones can be ranked as follows from most important to least important: **1.** Closed old-growth forests, **2.** Zarqa River and King Talal Dam, **3.** Open old-

growth forests, **4.** Wadi systems, **5.** Non-forest Mediterranean areas (marginal undeveloped land), **6.** Mix-use rural agricultural areas, **7.** Farmlands, **8.** Planted (man-made) forests, **9.** Urban areas. A biodiversity map is provided to show the zones based on their importance for biodiversity and viability for protection.

The main factors that threaten the biodiversity of the area were identified as follows: Agricultural expansion causes habitat loss through forest-clearing and land conversion into farms, forest burning for charcoal production, wood-cutting, collection of wild edible/medicinal plants and overgrazing. Tourism and picnicking, including the movement and parking of vehicles in the study site. Over grazing and woodcutting within the study area should be regulated. These activities combined play a major role in the degradation of the habitats and loss of vegetation.

We recommend that all forests near Dibbeen be included in the buffer zone for the reserve as they present a continuation of the forest ecosystems of Dibben and offer refuge and increased area for the reserve to sustain viable populations of the key species such as the Persian squirrel. The closed old-growth forests between Al Mi'rad, Al Safa, and Al Safsafa receive exhibited the highest biodiversity score, representing the biodiversity 'hotspot' in the study area. We recommend that some measure of protection either by including the forest in the buffer zone or by declaring it as a special conservation area.

Habitat loss, hunting, and disturbance from intense tourism were prevalent throughout the study area and provided the main threats to the habitats. We recommend regulating and enforcing a zoning plan for the buffer zone to reduce the pressure of tourism in the reserve. Several planted forests of introduced pine occur in the area, we recommend that these be used for local tourism (picnicking) to relieve Dibbeen from some of the pressures caused by tourism.

The mix-use rural agricultural areas and the farmlands were identified as the main production landscapes in the area. Within these areas, agritourism and "eco-agricultural" practices (traditional agricultural practices, planting hedge grows of native plants, rock fencing, no chemicals and pollution, etc.…) should be adopted *in situ* (on-farm) for biodiversity conservation and integration in agricultural landscapes. Incentives (education, economic, institutional support) should be used to encourage farmers and land owners to adopt such practices.

Interventions and actions proposed for maintaining sustainable use of the productive landscape, for the conservation of biodiversity through land use measures, and for capacity building and awareness are discussed in Chapter 5 Actions for Sustainable Use of the Productive Landscape. Chapter 6 presents priority investments regarding land use to sustain the productive landscape and to achieve sustainable development goals.

Chapter 1 Present Situation and Trends

Land cover and ecological character of the study area

The landscape in the study area resembles an interwoven mosaic of farms, townships and villages, and forest fragments. To assess the ecological character for the study area, we considered each land cover separately based on its form and biodiversity composition and presence of key habitats.

The assessment of the biodiversity and land-use for the study area was conducted after dividing the study area into 9 zones and calculated their areas based on the landscape, land cover, and vegetation types: **1.** Closed old-growth forests (7.5 % of the area), **2.** Open old-growth forests (12.8), **3.** Planted (man-made) forests (4.1), **4.** Non-forest Mediterranean areas (marginal undeveloped land, 14.7), **5.** Wadi systems, **6.** Zarqa River and King Talal Dam (0.6), **7.** Mix-use rural agricultural areas (47.3), **8.** Farmlands (4.7), and **9.** Urban areas (8.3). These zones were expected to vary based on their ecological character due to the current situation of land cover and land uses.

Closed old-growth forests

This zone represents one of the best natural forests of closed-canopy, mixed old-growth Aleppo pine and evergreen oak ecosystems in Jordan. The area is located between Al Mi'rad (Jarash) and Al Safa (Ajloun) west of Dibbeen Forest Reserve. This type of forests is represented in Ajloun Forest Reserve (12 km^2 in total area) and partially in Dibbeen Nature Reserve (8 km^2 in total area), evergreen forests are represented by less than 3% of the total evergreen forests in the country as protected areas. Results from the biodiversity assessment indicated the actual or potential presence of around 250 species of plants, 32 species of mammals (8 carnivora, 1 artiodactyla, 8 chiroptera, and 10 rodentia) and 26 species of reptiles and amphibians (2 frogs, one tortoise, 12 lizards and 11 snakes). 37 of the recorded species have global, regional or national conservation status and 29 species are considered habitat-restricted and unique to the forest habitats that are prevalent in this zone. This zone is unique for the presence of old-growth Aleppo pine and oak trees that offer, food, refuge and nesting sites for many species.

Open old-growth forests

This zone is represented by natural forests of open-canopy evergreen oak ecosystems in Jordan. The area is located in Al 'Aluk and Bireen area east of Jarash. Results from the biodiversity assessment indicated the actual or potential presence of around 200 species of plants, 24 species of mammals (4 carnivora, 8 chiroptera, and 8 rodentia) and 24 species of reptiles and amphibians (2 frogs, 1 tortoise, 11 lizards and 9 snakes). 18 of the recorded species have global, regional or national conservation status and 23 species are considered habitat-restricted and unique to the

forest habitats that are prevalent in this zone. This zone is unique for the presence of scattered old-growth oak trees that offer, food, refuge and nesting sites for many species.

Non-forest Mediterranean habitats (also referred to as marginal undeveloped land)

The entire study area is under a biogeographic region known as the Mediterranean region, this zone refers to all areas that are not covered by forests, but contain some bushes and shrubs and thus considered non-forest Mediterranean habitats. Results from the biodiversity assessment indicated the actual or potential presence of 16 species of mammals (6 carnivora, 2 chiroptera, and 6 rodentia) and 16 species of reptiles (one tortoise, 7 lizards and 6 snakes). 6 of the recorded species have global, regional or national conservation status and 10 species are considered habitat-restricted and unique to the forest habitats that are prevalent in this zone.

Planted (Man-made) forests

There are several man-made forested areas that were planted by the Ministry of Agriculture within the eastern and southern portions of the study area. The trees in these areas are mostly non-native introduced black pine (*Pinus nigra*). Results from the biodiversity assessment indicated the actual or potential presence of at least 4 species of mammals (1 carnivora and 2 rodentia) and 4 species of reptiles (one tortoise and 3 lizards). one of the recorded species have global, regional or national conservation status and 2 species are considered habitat-restricted and unique to the forest habitats that are prevalent in this zone.

Wadi systems

Several wadis running in a north-south direction occur in the study area. Most run downstream into the Zarqa river basin. These wadis may have permanent water from springs or run temporarily from rain water. These wadis provide safe corridors for animal movement between forest patches across the study area. A waste-water treatment facility is located within Wadi Al Haddadeh (the major wadi system in the area) and dumps all the excess, treated waste-water into the wadi.

Zarqa River and King Talal Dam

At the southern boundary of the study area, runs the Zarqa River and the King Talal Dam. King Talal Dam is the largest man-made water body in the study area and is mainly fed by the Zarqa River and some tributaries of either temporary or permanent wadi systems descending from the eastern mountains into the Zarqa River basin. The water in the Zarqa River and King Talal Dam is highly polluted and thickly covered by blue-green algae, *Microcystis aeruginosa*. The Zarqa River is heavily polluted by pesticides and other chemicals, originating mainly from farms along the river, thick foam covering the water was observed throughout. Down west from the Dam, the water is much less polluted and disturbed by visitor as it is less accessible. The area was declared a special conservation area (Al Khayyouf) for its value for breeding birds and migratory species.

Mix-use rural agricultural areas (Orchids) and Farmlands (crop plantations)

These areas make up largest portion of the area and contains some form of agriculture, mostly olive and/or fruit farms. Originally, these farms were either forests that were cleared or part of the non-forest Mediterranean areas. The area is heavily degraded and altered by the agricultural activities, however, some species still survive using some microhabitats in the area (such as the stone walls, the hedges at the boundaries of the farms) or because of the supply of water from the irrigation of the farms.

Urban areas

Villages and townships occur throughout the study area and surround the reserve nearly from all sides. The densest is the urban built along the Jarash-Ajloun main road. Agriculture and livestock represent a major source of income for the local communities, though, some use tourism. House gardens and irrigation systems and open pools provide foraging habitats for bats.

Native biodiversity associations to traditional land uses and agriculture

The above report section discussed the ecological character and species diversity within the KBA. All listed species are still being observed in the KBA; hence, field observations shows that some species witnessed significant population decline consequent to anthropogenic interventions, population growth, and the associated growth in urban footprint and changes in land uses.

The following lists species dependent on traditional farming and negatively affected by non-friendly agriculture practices. This list was compiled by Mr. Sharif Jbour from the RIT team following consultation with senior experts in the field, and it was shared with all CEPF grantees who are undertaking studies similar and parallel to this study in Jordan, Lebanon, Tunisia and Morocco.

- **Herpetofauna species dependent on traditional farming and negatively affected by non-friendly agricultural practices**
  - *Testudo graeca* Linnaeus, 1758 (**VU**)
  - *Mediodactylus kotschyi orientalis* Stepánek, 1937
  - *Chamaeleo chamaeleon recticrista* Boettger, 1880
  - *Stellagama stellio*
  - *Acanthodactylus tristrami* (Günther, 1864) More Iranoturanian
  - *Lacerta media* (Peters, 1964)
  - *Phoenicolacerta laevis* (Gray, 1838)
  - *Ablepharus rueppellii* festae Peracca, 1894
  - *Chalcides guentheri* Boulenger, 1887(**VU**)
  - *Chalcides ocellatus* (Forskål, 1775)
  - *Eumeces schneideri* (Daudin, 1802)
  - *Ophiomorus latastii* Günther, 1864
  - *Pseudopus apodus* (Pallas, 1775)
  - *Eirenis decemlineata* (Duméril, Bibron et Duméril, 1854)
  - *Eirenis lineomaculatus* Schmidt, 1939
  - *Eirenis rothi* Jan, 1863

- **Avifaunal species dependent on traditional farming and negatively affected by non-friendly agricultural practices**
    - Turtle Dove *Streptopelia turtur* (**VU**)
    - Eurasian Blue Tit *Cyanistes caeruleus*
    - Corn Bunting *Emberiza calandra*
    - Common Linnet *Linaria cannabina*

- **Avifaunal species <u>restricted to the Mediterranean</u> and dependent on traditional farming and negatively affected by non-friendly agricultural practices**
    - Black-eared Wheatear *Oenanthe hispanica*
    - Sardinian Warbler *Sylvia melanocephala*
    - Masked Shrike *Lanius nubicus*
    - Cretzschmar's Bunting *Emberiza caesia*

- **Species <u>endemic to the Levant</u>:**
    - Syrian Serin *Serinus syriacus* (**VU**): the species might potentially affect by changes in traditional land management schemes and agricultural intensification.

The total number of confirmed mammalian species from Dibeen Forest Reserve and its vicinity is 34 species (Table 8), with two species with global IUCN status. They are represented by eighteen families. Bats and rodents are the most common mammals with a total of 9 and 11 species respectively.

The following species of mammals can be considered as key species to the mammalian fauna of the study site. This is based on their limited range of distribution in Jordan within the confined woodland habitats and various forms of threats they are facing, mostly hunting and deforestation.

- The mountain gazelle *Gazella gazelle* which disappeared from the area due to loss of their habitat, hunting and disturbance.
- Roe deer *Capreolus capreolus* disappeared from the wild, hence, a reproduction programme was established about 20 years ago within the Gazelles Reserve by the Ministry of Agriculture.
- Wild Cat *Felis* Sylvestris is anticipated to be declining due to habitat loss and disturbance, in addition to its inbreeding with domestic cats.
- Forest dwelling bats (rainolufs sp.) which is also affected by habitat loss and the disturbance of their roasting sites (caves).
- The Persian squirrel *Sciurus anomalus* which is witnessing rapid population decline due to the degradation of their habitat, especially the deforestation of old pine trees, and the increased disturbance by picnicking.
- The Stone Martin *Martes foina* which is also witnessing population decline due to direct and accidental killing by farmers and hunters, and also disturbance to its habitat.
- The wild boar *Sus scrofa* as it has been reported by the locals to have significant population growth and becoming invasive and deleterious to the agriculture sector in the area. This is mainly due the decline in the populations of their natural predators in the wild, including the Wolf *Canis lupus*. the Stripped Hayna *Hyaena hyaena* and the Jackale *Canis aureus*.

Regarding flora, a total of 249 species from 53 families were identified. The recorded species included: 23 edible plants, 30 medicinal, 34 ornamental, 7 poisonous, 34 rare, 1 endangered, and 203 that were considered as common plants. The list included three rare and noteworthy species, *Iris bismarckiana*, *Anacamptis pyramidalis* and *Neotinia maculata*. The presence of *Iris bismarckiana* represented the second record in Jordan, *Neotinea maculata* orchid was reported for the first time from Jordan, whereas, *Anacamptis pyramidalis* was previously considered to be extinct.

Several species within the study site can be considered as indicative to ecosystem health. These indicator species are sensitive to environmental impacts and may indicate certain stages of forest degradation. The indicator species within Dibeen include:

- **Forest degradation indicators**: *Cistus creticus*, *Cistus salvifolius*, and *Sarcopoterium spinosum*. These were especially common in heavily grazed and sparsely oak forested areas.
- **Forest health indicators**: *Limodorum abortivum*, *Cephalanthera longifolia*, and *Neotinea maculate*.

Hence, it is important to note that the listing of the above-mentioned indicator species is not intended for robust assessment of the forest condition. It is only intended for prelimnary consideration of the forest condition upon which more robust methods, like the Forest Degradation Factor (FDI) assessment, can/shall be undertaken to identify the threshold value below which a forest can be termed as 'degraded'.

Also, other forage species and crop wild relatives can be used for the assessment of forest ecological condition and level of degradation, but more research is needed to identify these species.

Chapter 2 Landcover and Uses of the Productive Landscape

Change Trends in Land Cover and Land Use

Zurikat (2014) studied the change in landcover in Jerash governorate, which form significant proportion of the Dibeen KBA, over the period between the year 1952 and 2009 by analyzing aerial and sat images for the two mentioned years[1]. The study concluded the following:

I. **Landcover Categories**
   - Landcover in the study area constitute four main categories: agricultural land, forest, constructed land and marginal (unused) land.

II. **Character and trend of agricultural lands**
   - Agricultural lands spread over different levels, but they rise in areas where the level ranges between 500-1000 m and its slope ranges between 3-7% and 8-13% as it spreads on all directions, but it expands in the flat areas, especially horticulture areas. These lands contain olive trees, citrus fruits, almonds and vegetables, and field crops, the most important of which are wheat, barley, agricultural nurseries and plastic houses.
   - The agricultural land cover witnessed change and reached in the year of 2009 almost double the total area of agricultural land estimated for the same governorate from the year 1952. The reason for such a growth is perhaps the agricultural policy adopted by the government of Jordan in Jerash governorate during the twentieth century and the implementation of a number of agriculture development projects, the most important of which are:
     - The Zarqa River Basin Development Project / Supplementary Phase (1986-1997) aimed at protecting the soil from erosion, increasing the area designated for horticulture in areas with a slope of between 10-25% and the amount of rain in excess of 250 mm, and cultivating annual crops in areas where the slope is less than 10%.
     - Project to develop the lower basin of the Zarqa River (King Talal Dam) (1997-present).
     - Highland Development and Support Project (the Olive Project) that started in 1976 until 1985 This project was implemented to provide material and technical capabilities for reclamation of sloped lands that are used in an uneconomic way or untapped to grow them with fruit trees.
     - Diversification of Income Sources Project to Combat Poverty and Unemployment (2004) to support agriculture, especially protected agriculture. The agricultural lands have witnessed an urban sprawl in some areas, as the lands built on the expense of the agricultural lands expanded.

[1] The above findings from the mentioned study should be read with caution given some technical considerations raised by experts in the field on the quality of the used aerial and sat images which were reported to possibly overlap of confuse the delineation of forest with agricultural land and vice versa.

- About 17% of the original agricultural land was converted to residential (built) land, roads, forestation land or to abandoned or unused land. The following conclusions were made by the before mentioned study:
    - Transformed agricultural land into built land and roads (about 4.13 km2) is most apparent in the Jerash city, Souf, Sakib, Burma, Jibbeh, and Al-Mastaba areas. Possible reasons for this change include the increase in land prices upon construction of new roads, and the low economic return from agriculture.
    - Abandoned agricultural land left an area of about 5 km2 unexploited, especially lands which were cultivated with field crops and vegetables. Perhaps the reason for this is the continued increase in the rates of fragmentation of agricultural properties into small areas, which leads to their continued exit from production.

III. Character and trend of forest lands

- Forests are spread in areas with a level greater than 500 m and increase in cover and density in the areas with a level greater than 1000 m. Forests also increase in the regions whose slope is more than 14-20% and spread in the western and northwestern regions of the governorate.
- The forest Constituted about 8% (about 32 km^2) of the area of Jerash Governorate in 1952, and rose to 14% (about 66.75 km^2) in 2009, the rate of change reached about 76%. This change in the area of forest land constituted the transformation of agricultural and marginal land into forest through the national forestation programme, and also constituted exploitation of native natural forest and transforming it into other uses. More specifically, about 18 km^2 of the forest area maintained from the year 1952 through the year 2009 and the area of the land in which the forest cover has changed is about 14 km^2. The conversion of the 14 km^2 of forest land to other uses was as follow:
    - About 2.9 km2 has been transformed into private agricultural areas in the privately owned forests, where forest trees have been removed and replaced with olive and fruit trees cultivation. This type of change can be seen in the western governorate in the district of Burma, Souf (Al-Manara and Al-Dahra), Sakib (Al-Hawiyah, Al-Hussainiyat and Najdeh), and in Thaghret Asfour of Jerash.
    - About 4.4 km^2 of forest land has been converted into unexploited areas, as trees have been cut down and used for heating.
    - About 5.0 km^2 of forests have been converted into built lands, especially residential areas. This is evident in the Sakib, Souf, and north of Jerash, Al Mushairifah, and Kafarkhal areas.

IV. Character and trend of marginal lands

- The percentage of change in the marginal unexploited lands is about (-47.75%). It is noticeable that the area of the unexploited lands widens in areas whose levels range between 500-1000 m and lands whose slope ranges between 3-18% and on all directions.

- Most of the unexploited lands are located on a level from 500-1000 m and its slope is less than 20%, it receives a rain amount in excess of 400 mm of rain, and areas with an eastern slope, where it receives an amount of light and sunlight appropriate for agricultural crops, and most of these lands are suitable for agriculture, especially cultivation Fruit trees and rainfed crops.

V. Change in the built land

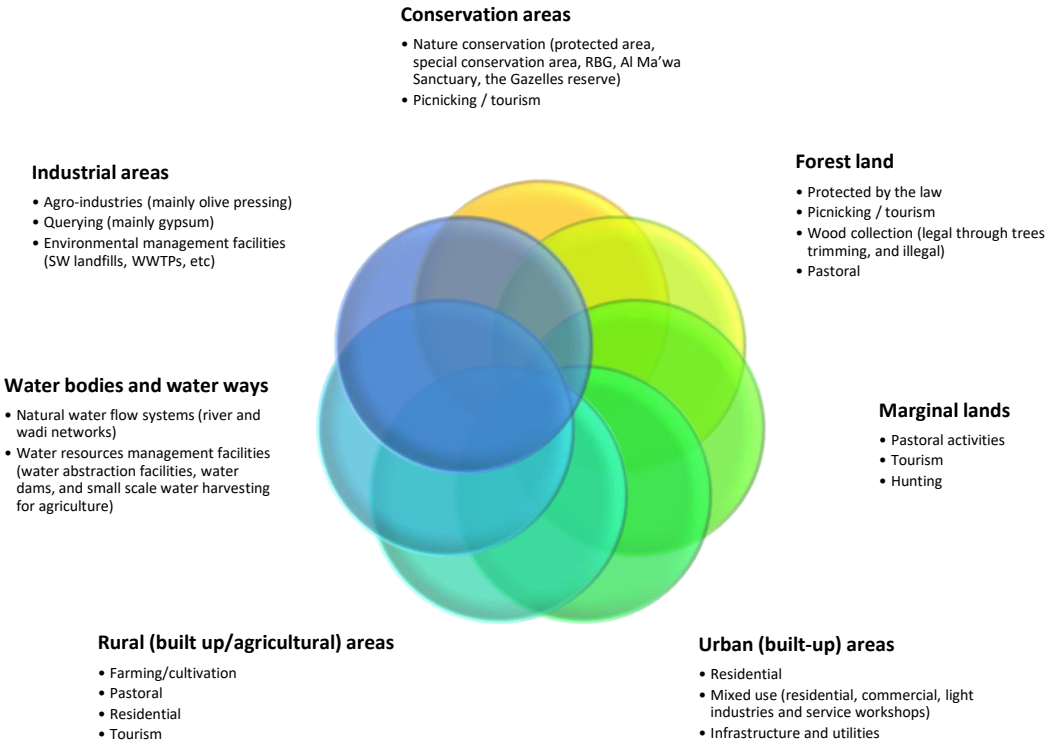
- The percentage of change in built land has reached about 608%. It is noticeable that the built land is spread in the flat and eastern areas of the governorate and the areas with low slope, but an expansion in the lands built at the expense of agricultural land and forests is observed.

Uses of the Productive Landscape in Dibeen KBA

As part of this study we conducted rapid diagnosis of the KBA which also constituted interviewing local farmers and experts in the field. We also held a consultation workshop which amid to validate the study findings and to affirm the input from experts in the field.

The participants in the validation workshop confirmed their agreement of the study findings in General. They also confirmed their agreement with the description of the trends of change in the landcover within Jerash governorate as explained by Zurikat (2014), hence, they noted the need for further verification by using more technically sound aerial images to affirm calculated areas for each change in land cover and use.

The figure below summarizes the identified uses of the productive landscape in Dibeen KBA.



Regarding the change in use of the productive landscape, the following summarizes these changes and trends based on the outcomes from the literature review, field observations and the consultation process:

- **The agricultural sector**
  - Changes in agricultural practices (terraces, tillage, irrigation, fencing, chains, and windbreaks, ...)
  - Changes in agricultural patterns and cultivated varieties (agricultural cycle, cultivation of imported and / or hybrid species at the expense of local assets)
  - Entering new diseases and changes in the pattern and amount of use of agricultural chemicals compared to natural sources
  - Growth of private agricultural nurseries projects
  - Overgrazing and degradation of natural pastures and the impact of the livestock sector
  - Increased beekeeping projects
  - Increased forest burning and logging attacks
  - Use of treated wastewater for irrigation in areas near the Zarqa River
- **Urban growth / built-up areas**
  - The pattern of construction and the trend of vertical expansion in urban centers changed, which increases the population density in a way that is not matched by development on the infrastructure. Expanding construction in rural areas and increasing demand for infrastructure and services
  - Adding new areas to the organization and increasing the areas built at the expense of forests and agricultural lands without taking into account environmental requirements
  - Establishing many organizational and agricultural methods without observing the environmental requirements
- **Tourism**
  - Sustained growth in tourism development, especially ecotourism, tourist farms, restaurants, and tourist service facilities
  - Environmental impacts related to poor hiking organization (accumulation of waste / inconvenience / traffic crises) with weak economic returns on local communities

Factors affecting land use and uses of the natural layout produced in the study area

I. **Environmental, natural factors**
   a. Topographic properties and gradients
   b. Soil and climate characteristics as suitable for cultivation
   c. Change in water availability (surface and groundwater)
   d. Distribution of natural forests, afforestation areas and other environmental factors (establishment of reserves, increasing the area's attractiveness for hiking and tourism investment)

II. **Social and economic factors**

a. Socio-economic changes related to population growth, immigration, education and labor market trends
b. Traditional knowledge, local knowledge stock and the role of agricultural extension
c. Decrease in the relative market value of agricultural production (income from agriculture) compared to other alternatives

III. Government policies and projects

a. Land use instructions and controls
b. Government policies and projects concerned with agricultural and socio-economic development
c. The development of policies, laws and institutions concerned with environmental protection
d. Abundance and growth of infrastructure, especially roads and electricity, and improved services in the region (poor planning ?!)

IV. Technological development and the role of international institutions

a. (Agricultural mechanisms, agrochemicals, imported agricultural varieties / nurseries, training, etc.)

Impacts from Current Uses of the Productive Landscape on Biodiversity

Land Use Induced Threats to the Productive Landscape

The sections above discussed historic and current uses of the landscape and also land use practices. It can be concluded that rapid population growth driven by the high natural population growth and the immigrants challenge have formed major driver for speeding up changes in the landcover in the study area as it also driven deterioration in the ecological character of the landscape.

Poverty and unemployment have also been major driver for the ongoing change in the nature and scale of the uses of the productive landscape. In particular these two drivers are associated with unsustainable use of natural/biological resources. These drivers, and others, induced the following pressures and threats to biodiversity:

- Urban sprawl driven mainly by the growth of the local population and the increasing demeaned on vacation houses/villas/farms
- Land use planning and management systems which are less friendly to biodiversity. Under this title, the following are key challenges to the existence and productive of the productive landscape:
  - Fragmentation of land ownership;
  - Underdeveloped land use measure and instructions to effectively maintain private haraj/forest;
  - Weak and undervalued nature-based investments accompanied by very weak economic development in the area; and
  - Poor infrastructure (poorly planned, poorly constructed, poorly maintained, and absence of infrastructure development master plan to lead economic and social development in the area).

Forest Management and Conservation

The forests represent less than 1% of Jordan's the total area and are continuously under severe threats due to man-made changes and wood cutting. The remaining natural stands of Aleppo pine, evergreen and deciduous oak along with other historical trees (*Olea europa, Ceratonia siliqua, Pistacia palaestina*, *Amygdalus communis* and *Pyrus syriaca*) add extra value for the study site and require immediate protection. Other important tree species include *Arbutus andrachne* and *Crataegus aronia*.

Managing recreational tourism and nature conservation on the study site represents the main challenge for the management of the area. Additionally, the forests are under continuous pressure of unsustainable human activities such as illegal woodcutting and forest-clearing, overgrazing, poaching, disturbance and habitat fragmentation. These factors combined impose serious threats on the integrity of the forest and ecosystem function. The sustainable use of biodiversity in the area requires a conservation-oriented land use planning and an effective eco-tourism development plan. Due to the involvement of several parties and stakeholders, an integrated, participatory approach to site protection and tourism development may provide greater tourism benefits to the local community and Jordan.

The forests are the most important and most threatened habitat in the study area, below are five key **ecosystem services** that the forests/trees provide which justify the need to provide some sort of conservations measures for the forests, i.e. either by including them in the buffer zone or as a special conservation area:

I. Forest ecosystem provides shelter, food and ecological niches (nesting site) for all living components. Forests/trees provide nesting sites for many species such as the Persian squirrel (inside tree cavities) and many birds (such as tits and blue jays) that build their nests within cavities or on the branches. As an important component of the ecosystem, the removal of the trees through logging or deforestation will most definitely cause the loss of those species (squirrels and birds), and consequently, the loss of the predators that feed on them (e.g. Stone marten and birds of prey). This will have negative impacts of the whole biodiversity of the region and thus nature tourism.

II. Forests cover offer watershed protection, prevent soil erosion, floods and mitigate climate change. Forest trees are living machine that storage carbon, cooling temperature, trap dust, nutrient cycling, water and air purification.

III. The forest floor, or the O horizon, is one of the most distinctive features of a forest ecosystem. It mainly consists of shed vegetative parts, such as leaves, branches, bark, and stems, existing in various stages of decomposition above the soil surface. Although principally composed of non-living organic material, the forest floor also teems with a wide variety of fauna and flora. It is one of the richest components of the ecosystem from the standpoint of biodiversity. The forest floor serves as a bridge between the above ground living vegetation and the soil, and it is a crucial component in nutrient transfer through the biogeochemical cycle. Much of the energy and carbon fixed by forests is periodically added to the forest floor through litterfall, and a substantial portion of the nutrient requirements of forest ecosystems is supplied by decomposition of organic matter in the forest floor and soil surface. The sustained productivity of forests is closely linked with the decomposition of shed plant parts, particularly the nutrient-rich foliage. Organic debris improves soil structure as it is incorporated into the soil, and according to the forest tree species, the debris decomposition determine the soil PH.

IV. Forests/trees provide oxygen and air purification. This has a huge value for all living organisms including human beings. The loss of trees will result in high CO_2 concentrations, higher temperatures, less rain, droughts...etc. this leads to climate change on the local and global level. In this regard, trees have an economic benefit on the national and global levels.

V. Forests/trees are the main attraction for tourism in the area, foreign tourism for the biodiversity which is highly dependent on the forest, and local tourism for picnicking under the shade that the trees provide. Without the trees, the tourism value for the whole area will drop significantly, which has significant economic benefits for the local community, tourists buy lots of their needs from the local shops, they buy locally-grown fruits, and they may sleep in lodges. All of those services have significant socioeconomic benefits that we need to make clear and convince the locals, if we can show that the economic benefit of tourism which is sustained by the trees/shade outweighs the benefits from citing them and replacing them with an olive or grape farm, that would be best. We may need to come up with alternative uses for them (or members or their families) to win them to our side.

Agriculture

As discussed above, the study area witnessed rapid population growth associated with significant change in its landcover. Expansion in agricultural lands and forestation are among the most noticeable changes. Hence, changes to agricultural uses of the productive landscape have not been limited to expansion of agricultural areas, it has been combined with the following:

I. Increased demand on water resources, and increase in the abstraction of ground water sources. This have been serious issue to the water budget of the aquifer system, and consequently was reflected on the outflow characteristics for many natural water springs, and on the humidity of the soil. Such conditions are assumed to also affect the vegetation cover reliant on soil humidity, which became more sensitive to rainfall fluctuation.

II. Change in irrigation methods which are now more conservative and efficient, and also the use of treated waste water for irrigating farms near the Zarqa river.

III. Introduction of modern agricultural vehicles, equipment's and tools.

IV. Indiscriminate use and improper application of pesticides, especially by vegetable and fruit farmers.

V. With the expansion in agricultural areas, having most of the riparian habitat of the Zarqa river converted into agricultural fields for the cultivation of vegetables, having about half of the non-forest Mediterranean habitat converted into agricultural and urban uses, and cutting old native trees for agricultural expansion or for wood have been seriously negative to biodiversity. These changes have been associated with at least the following:

a. Less land is now available for native wild flora. It is now difficult to find many of the native flowering plants, especially the threatened and endemic species, as modern tillage techniques, current grazing management practices and the use of agro-chemicals have negatively affected the habitat for these species. Also, picnics are practicing indiscriminate collection of these plants, and many of them are taking out the entire plant with its roots to plant it at their homes.

b. Less land is available as habitat for mammals in general, but more specifically for large and medium-sized animals. The loss of their feeding and breeding habitat

and biological corridors as a result of changes in the landcover resulted in significant population decline of many of those species.

c. The before mentioned use of pesticides have been very deleterious to the environment, contaminating soil and water resources, and causing indiscriminate death of wildlife. Bio-accumulation of these poisons in the upper trophic level species is most likely. Hence, the government of Jordan is now paying more attention to this subject, and it is providing the farmers with some education on the safe use of agro-chemicals through the extension services provided by the Ministry of Agriculture. More work and focus on the impacts of such chemicals on biodiversity and consequently on the agriculture sector and farmers is definitely needed.

d. Introduction of new crop varieties is also noted, and these new varieties are replacing native productive species. These changes affect wild species reliant on native crop varieties and also introduces new pests and pathogens to the local ecosystem.

VI. Some of the noted impacts on mammals in Dibeen KBA include:

a. The mammals of Dibeen and its surroundings are threatened by habitat loss due to deforestation and fragmentation within the reserve and surrounding forests. This is evident in areas cultivated with olive and other crops of economic importance which located within the reserve and its boundaries. Fire and disturbance may have an effect on the current populations and should be closely monitored and studied in the future.

b. The scarcity of water during summer also has a negative impact on the populations of mammals in the area. Four squirrels were found drowned in water tanks situated on the roofs of scattered rest houses within the reserve. It seems that these animals fall inside the tanks while attempting to drink. Water is a limiting factor to the squirrel's distribution and several individuals were seen around the leaking water pipes (Amr et al. 2006).

c. Disturbance by intense human activities in the form of vacationing and picnicking has its negative impacts on the mammals of Dibeen. The squirrels in Dibeen Forest Reserve are extremely shy of people and vehicles that are continuously passing through the different parts of the reserve. The Persian squirrel is trapped and then sold as a pet animal in the streets of Amman, its population is declining due to trapping and expanding agriculture in its natural habitats (Amr et al. 2006).

d. Introduced species such house mice, rats, and feral cats all have negative effects on the local mammals. In addition to the increased competition with the local fauna on the limited resources, some species such as the wild cat is under pressure from hybridization with feral cats which affects the genetic diversity of the wild population.

VII. As a consequence of the above, and noting fragmentation of land ownership and the framers low return on agricultural investments, poor farmers dependent on small-sized farms and on local ecosystems for their livelihood are witnessing disturbance of their lifestyle. Many of those farmers abandoned farming and are either unemployed, working in other sectors, or working in farming as side-job.

Managing tourism/picnicking

Local tourism activity in Dibeen is significant, especially during the spring and summer months. Large numbers of local visitors come to Dibeen for picnicking, especially during weekends. Tourism activity has also expanded to other areas which used to be less affected by human activities. The following are the major existing and potential impacts of the unmanaged tourism activity in Dibeen:

I. Disturbance by intense human activities in the form of vacationing and picnicking has its negative impacts on the mammals of Dibeen. The squirrels in Dibeen Forest Reserve are extremely shy of people and vehicles that are continuously passing through the different parts of the reserve. The Persian squirrel is trapped and then sold as a pet animal in the streets of Amman, its population is declining due to trapping and expanding agriculture in its natural habitats.
II. Pollution by the garbage that's produced by the visitors around the picnic area. This impact has a significant effect on the natural habitat quality and beauty. The food remains may increase the number of scavengers such as foxes probably at the expense of other species. Littering and food remains in the picnic area and around it become an easy and reliable food source for some opportunistic animals, even squirrels.
III. Habitat degradation. The intensive human use for the area through picnicking especially in the spring and summer seasons has degraded the habitats and decreased its quality through the damage to the vegetation by vehicles, edible plants and wood collectors, this also causes decrease in soil quality as well.
IV. Road killing. The increased human activity in the reserve is also coupled with the increased probability of animals being killed when crossing these roads. Occasional killing of animals due to the attitude towards carnivores as people may kill the animals that they encounter or destroy their dens.

The negative effects of tourism on the biodiversity in Dibbeen and the key habitats within the study area can be minimized through a tourism plan with defined routes that may divert the picnicking activities into forests and areas with low biodiversity value such as the planted forests in the east and southeastern regions of the study area. These areas are closer to the main road that connects the major cities (Amman, Irbid, Jarash) from which most of the picnickers and/or tourisms converge. Agrotourism routes may also be established within the farmlands in the eastern side of the study site to bring some economic benefits to the local communities, while at the same time distract some of the activities away from the reserve.

Habitat loss and fragmentation

Private ownerships, illegal infringements, wood-cutting, forest burning, and forest-clearing in the study area all are major factors that have contributed greatly to the loss of habitats and the fragmentation of the forested areas. Consequently, the remaining woodlands are fragmented patches separated by roads, farms, and houses. Habitat loss and fragmentation is probably the most detrimental problem facing the forest because it affects all plants and animals in the ecosystem. It has negative impacts on the animals within the reserve though:

I. Loss of larger areas that can sustain viable populations of a species: Some carnivore species, such as the Stone Marten, are highly dependent on the quality of their habitat

for survival. Fragmentation and the consequent habitat loss will directly affect the population of some species by increasing competition for food and shelter within a small area.

II. Loss of wildlife corridors and movement ranges: larger animals require large areas to live in and be able to breed and form home ranges and territories. They also need to move for relatively long distances to find sufficient sources of food and water. Fragmentation and loss of natural habitats leave major obstructions in the movement of these animals and may force some to vacate the area entirely.

III. Edge effects: Fragmentation and the reduction of the natural habitat area also increases the proportion of forest edges and thus the probability of animals being exposed to nest predation, hunting, road killing, and other disturbances.

IV. Habitat degradation and loss of prey species: fragmentation of natural habitats also causes a general decline in the quality of a habitat and affects all trophic levels in the ecosystem, thus causing a decrease in the number of prey species like invertebrates, rodents, and reptiles, which causes the numbers of higher animals such as carnivores to decline.

Managing grazing

Overgrazing is a real threat to the integrity of the forests of the study area where herds (mainly of black goats) roam. Most of the grazing was seen near Burma. Overgrazing within the study area is the main cause of habitat degradation through the direct loss of vegetation and soil erosion. On heavily-grazed slopes, the loss of ground vegetation contributes to localized landslides and the toppling of pine trees. Overgrazing or uncontrolled grazing also has a negative impact on the biodiversity due to:

I. The direct loss of the vegetation covers that the animals feed on or use as cover and densites.

II. The disturbance caused by the livestock, dogs and the shepherds within the wilderness areas.

III. The direct killing of animals through hunting and/or destruction of burrows and dens that the shepherds encounter in the wild. Carnivore dens were seen destroyed and closed by placing stones over the entrance of the den or burning tires inside them.

Illegal and deforestation woodcutting

Wood cutting in the form of fire wood collection, charcoal production, and removal of trees to be replaced by agricultural fields. Arbutus and Oak trees are the main sources of wood, but pine trees are also removed for agricultural development. Wood cutting and removal of whole-trees for firewood and charcoal production is extensive in Dibeen and the surrounding areas. Oaks are generally preferred as a fuel source, pines and strawberry trees occasionally taken. This is a real concern given the fragility of this particular ecosystem. The long-term effects of sporadic deforestation would certainly be detrimental to the health of the forest.

This activity has direct and indirect impacts on the natural habitats and the biodiversity. Below is a list of the negative impacts that might result from the persistence of woodcutting:

I. Habitat loss due to the direct decrease in vegetated areas, this will also reduce the number of suitable habitats and refuge areas.

II. Habitat fragmentation due to woodcutting causes discontinuity and loss of safe corridors between forested areas. It also makes the smaller forested areas unsuitable to sustain viable populations of the larger species.

Unsustainable collection of wild plant species

Especially during the spring season, local people and visitors tends to collect wild edible plants for nutrition, wither for personal consumption or for sale in the market. These plants provide high nutrition value, preventive and/or curative value, and are basic ingredients for many authentic and traditional dishes.

Traditional wild plants collection methods are noted to be more sustainable and the tradition of sustainable harvest demonstrates strong bonds between the locals and their inhibited productive landscape in terms of ethical and sustainable harvest of biological resources. Hence, the new generations of the local communities and visitors of the area seems to be now short of the knowledge and appreciation about these methods and ethics.

Unsustainable harvest and collection of wild edible and medicinal species from the wild, next to overgrazing, are major drivers for the decline in the populations of edible, aromatic, medicinal and flowering species.

Chapter 3 Biodiversity Sensitivity Analysis and Mapping as a Tool for Biodiversity Responsible Land Use Planning

Overall Approach

As a result of different activities including local tourism, agriculture, and housing development, the forests have retracted significantly due to extensive deforestation for olive plantations. The negative implication of such human activity is very high, represented mostly by the loss and fragmentations of the forests.

The areas where the village occur are already heavily disturbed and maintain the main infrastructure services (road, water, and electricity) in the study area. This zone hosts the minimum biodiversity elements. This area is already disturbed from busy traffic and human settlements. The area has little value for biodiversity and can be assigned for human activities such as providing services for tourists that may range from lodges, to restaurants/rest areas, open produce markets with minimum amount of impacts on wildlife and biodiversity. However, urban expansion and development should be directed away from the forested areas into the currently disturbed farm areas.

Informed decision making for land use planning to maintain the productive landscape, to conserve biodiversity, and to achieve sustainable development require proper understanding of the ecological character of the subject areas, and the translation of the biodiversity value and sensitivity to a language which can be comprehended by the decision makers and the planning engineers. Biodiversity importance and sensitivity mapping is a common language between the biodiversity conservation community, local communities, decision makers and the planners.

Therefore, we developed science-based sensitivity analysis criteria and method which can be used to give numeric value for biodiversity value and sensitivity, and accordingly can be translated into heat map. The sensitivity analysis criteria and its application for Dibeen KBA are provided in Annex 1.

The method is quite simple, were biodiversity experts are required to undertake zoning of the study area using GIS tools and based on a combination of vegetation/habitat type, topographic features and uses of each zone. Landcover maps are accordingly of particular importance to undertake such zoning. Once the zones are defined and mapped, the ecologist will collate relevant data from secondary sources to apply the sensitivity analysis criteria, and will arrange it in data sets to facilitate valuation of each zone against each criterion. The sum of marks given to each zone for all applied criteria are then calculated to reflect the value and sensitivity of each. The higher the total score the more important and sensitive zone.

The scores can be then classified in score ranges, and each score range will be assigned specific color variant starting with red for the most important (highest score) to finally produce heat map or colored zones.

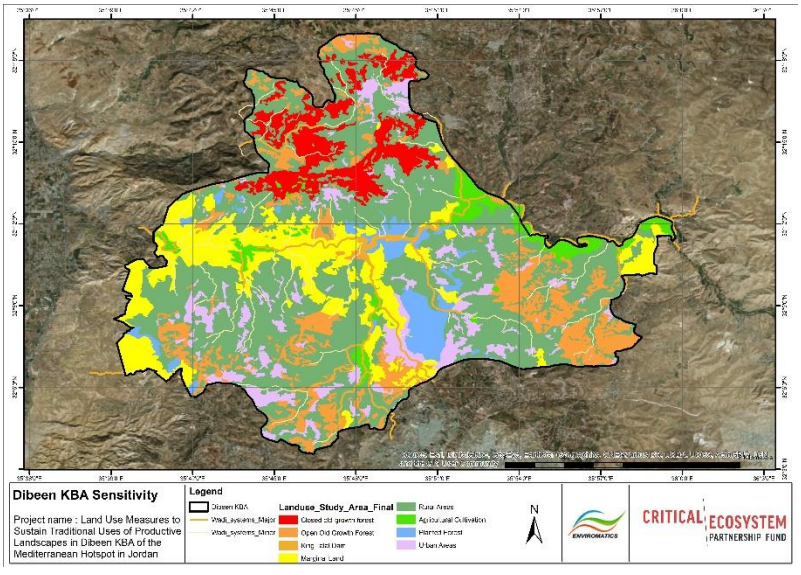
It is important to note that the more precise, accurate and up to date information we have, the more precise and accurate the sensitivity maps. Also, the application of this method and criteria can be applied at different planning levels: country-level, region-level, landscape-level, or even for spatial analysis. Hence, the application of it for spatial analysis will require further sub-zoning to reveal biodiversity value and sensitivity information needed to make land use decision.

Method Applied for Dibeen KBA

We applied a sensitivity analysis on the 9 zones of the study area using standardized criteria that were based on each area's species and habitats. The use of the criteria aimed to evaluate the biodiversity importance and conservation value of each zone. The evaluation criteria were divided into two categories: conservation values and threats and were based on quantitative (e.g. species richness) and qualitative (e.g. degree of heterogeneity) metrics and indicators that are widely used and accepted in conservation biology and landscape ecology. For each indicator, a parameter weighs the zones on the same scale to assign a score to each zone. The scores for each zone are then summed up from all indicators to provide a total score that reflects a zone's relative importance and viability. This approach aims to effectively quantify the biodiversity/conservation value and viability for each zone to create a spatially explicit map of ecoregions that are important for biodiversity.

The flora (vegetation types) and fauna (mammals, birds and reptiles) baseline surveys and field data on apparent threats to the biodiversity and habitats and current land uses, as well as expert knowledge, interviews with rangers and local communities, and data available from the literature were used to evaluate each zone. Due to the lack of data on the distribution of the distinctly large number of species of plants and birds, the species richness of each zone was not used, instead we relied on threatened and habitat-restricted species for those two groups.

Based on the developed criteria, the 9 zones can be ranked as follows from most important to least important: **1.** Closed old-growth forests, **2.** Zarqa River and King Talal Dam, **3.** Open old-growth forests, **4.** Wadi systems, **5.** Non-forest Mediterranean areas (marginal undeveloped land), 6. Mix-use rural agricultural areas, **7.** Farmlands, **8.** Planted (man-made) forests, **9.** Urban areas. A biodiversity map is provided to show the zones based on their importance for biodiversity and viability for protection. To identify important biodiversity areas (or the ecoregions of concern), we used the scores to produce a spatially explicit map of biodiversity and viability that shows the scale of biodiversity from important biodiversity areas or 'hotspots' in red to the least important biodiversity areas or 'cold spots' in blue.



The landcover and sensitivity analysis maps are provided in Annex 2.

Chapter 4 Responses to the Need to Sustain the Productive Landscape

Jordan have been taking serious response towards its obligations to conserve biodiversity and to maintain productive landscapes. Hence, these responses have been mostly focusing on the following:

1. Delineation of Key Biodiversity Areas (KBAs), including Important Bird Areas (IBA's), Important Pant Areas (IPA's), and Ramsar sites;
2. Designation of natural protected areas as Jordan already have national network of established and proposed protected areas covering all identified vegetation types, and refuges of valuable biodiversity;
3. Enforcement of environmental and social safeguard policies and tools, most importantly the environmental and social impact assessment regulations which govern environmental safeguarding across all existing and planned new investments;
4. Introduction of the Natural Heritage System to the national land use planning system. This response is pivotal to mainstreaming biodiversity conservation nation-wide and across all sector and development planning. This have been accompanied with the development of regional master plans and land use plans which pays particular attention to nature conservation needs, and piloting biodiversity responsible land use planning within the buffer zones of two protected areas;
5. Enforcement of hunting, grazing management and wood collection regulations;
6. Promoting and supporting investments in organic farming. This include supporting access to markets, certification scheme, extension services and awareness raising;
7. Implementing national and regional projects concerned with the protection of migratory species, like the Soaring Birds Project, the Egyptian Vulture project, etc.
8. Mainstreaming biodiversity conservation into the tourism sector (UNDP-BITS Project);
9. Awareness raising and training of the general public, the government and the private sector regarding nature conservation and sustainable development priorities, targets and approaches. One of the awareness and training actions relevant to agriculture is concerned with boosting organic farming and integrated pest's management;

Though good efforts have been put in place to address the needs to protect biodiversity and maintain productive landscapes, but still much more work is needed. The government and civil societies in Jordan do recognize these needs and there is currently a number of programmes and initiatives are being implemented, and others are in the pipeline. Though there are several stakeholders for the subject matter, the key stakeholders who implemented, currently implementing or planning to implement interventions relevant or linked to maintaining productive landscapes in Jordan include:

- **Governmental and Semi-governmental Organizations**
  - Jordan Ministry of Agriculture (MoAg)
  - Ministry of Local Administration (MoLA) and the local municipalities within Dibeen KBA
  - Ministry of Environment (MoEnv)
  - Ministry of Water and Irrigation (MoWI)
  - Ministry of Tourism and Antiquities
  - National Agricultural Research Center (NARC)

- **International Organizations and Development Agencies**
  - Food and Agriculture Organization of the United Nations (FAO)
  - United Nations Development Programme (UNDP)
  - European Commission
  - Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
  - United Nations Economic and Social Commission for Western Asia, ESCWA
  - UN Habitat
  - Netherlands Enterprise Agency (RVO)
- **Environmental and Agricultural NGOs**
  - The Royal Society for the Conservation of Nature (RSCN)
  - The Royal Botanical Garden (RBG)
  - Jordan Trail
  - Jordan River Foundation

It is also important to note that the Ministry of Environment and the Ministry of Agriculture are currently working together to (1) produce Jordan Green Growth Action Plan for the Agriculture Sector, and (2) to implement an ambitious forestation programme to increase the area of forest in Jordan. Other ongoing and pipeline investments in the area belongs to the following businesses:

- Economic development through:
  - Agricultural investments
  - Tourism investments especially in (1) vacation farms/villas, and (2) nature-based tourism
  - Wind farms for electricity generation
  - Possible growth in querying business
- Expansion in organic farming
- Climate change adaptation and rain water harvesting
- Infrastructure development and investments (solid waste transfer station, waste water networks and treatment plant, new roads, roads maintenance, etc.)

The review of the international community response to the need to maintain the productive landscapes and to ensure sustainable use of it reveals that most of the implemented programmes and projects were focusing on one or more of the following (quoted from GEF)[2]:

- Developing policy and regulatory frameworks that remove perverse subsidies and provide incentives for biodiversity-friendly land and resource use that remains productive but that does not degrade biodiversity.
- Spatial and land-use planning to ensure that land and resource use is appropriately situated to maximize production without undermining or degrading biodiversity.
- Improving and changing production practices to be more biodiversity friendly with a focus on sectors that have significant biodiversity impacts (agriculture, forestry, fisheries, tourism, extractives).
- Piloting an array of financial mechanisms (certification, payment for environmental services, access and benefit sharing agreements, etc.) to provide financial incentives to actors to change current practices that may be degrading biodiversity.

[2] https://www.thegef.org/topics/productive-landscapes-and-seascapes

Chapter 5 Actions for Sustainable Use of the Productive Landscape

An account of Identified Actions

Agriculture and tourism are noted as the dominant uses of the productive landscape in Dibeen KBA in specific, and in the East Mediterranean hotspot in general. The following proposed actions are aimed to promote and scale up sustainable use of the productive landscape in the study areas, and constitute four main sets of actions. The first is concerned with stimulating enabling environment for mainstreaming biodiversity responsible development and land use planning at national and regional levels. The second set is concerned with the agriculture uses of the landscape, and include actions to revive and scale up biodiversity responsible agricultural uses and practices, conservation of agro-biodiversity, and sustaining agro-biodiversity utilization. The third set is concerned with linking agricultural economy with the cultural economy through tourism development.

Biodiversity Responsible Development and Land Use Planning: Investing in the enabling environment

I. Develop and implement sustainable forest management plan thus to effectively manage respective conservation priorities, address current and expected threats, and to inform the design and implementation of the planned forestation programme in the area.

II. Develop and implement effective strategies of territorial development based on investments in all rural livelihood assets as well as products and services of specific natural and cultural identity.

   A. These strategies are required to note:

      (1) Biodiversity values and sensitivities (e.g. the need for micro-reserves and special conservation areas);

      (2) The social and economic values of the productive landscape for the local and national communities (people rights, economic development needs, etc.);

      (3) The need for incorporating traditional knowledge and best practices to maintain multiple sustainable use of the landscape and to incorporate variant interests of the different interest groups and stakeholders;

      (4) The need for sustainable utilization of agrobiodiversity and natural resources, and

      (5) The need for all uses to capitalize on the resiliency of production system and adaptation to harsh environments.

   B. Such investments should include:

      (1) Documentation of the national knowledge, skills and best practices held within the local communities in the productive landscape;

      (2) Development of effective, biodiversity responsible and rights-based land use measures which notes and pay particular attention to the natural/biological, social and economic values of the productive landscape, and translate those values into sustainable development investments. These measures are required to be mainstreamed in regional and local planning within/for the productive landscape, including the development and implementation of land use plans, sustainable economic development plans and guidelines, sustainable agriculture plans and guidelines;

(3) Implement capacity building for local and regional decision makers about the value of productive landscapes and the need to promote and maintain sustainable and environmentally responsible uses, and to control or prohibit unstainable uses;
(4) Awareness raising and behavioral change investments to support participatory conservation system and actions;
(5) Monitoring and evaluation; and
(6) Stimulating policy changes to address policies gaps and shortcoming related to governing and regulating the development and conservation of productive landscapes to achieve sustainable development goals.

Agriculture Actions and Investments

Traditional and Biodiversity Responsible Agriculture

I. Improve extension services regarding the value of the productive landscape and the need to support and scale up biodiversity responsible traditional and modern best practices (awareness raising, training and information centers/hubs). Such interventions should include demonstration of local best practices, best practices from the region and to encourage innovation and research to improve sustainable agricultural development. Linking providers of the extension services with nature conservation and biodiversity protection knowledge centers and organizations is also pivotal to promote and maintain dynamic conservation approaches through the entire productive landscape, and as such accommodate new findings and realities.
II. Build momentum and public interest in rewards for environmental services. This action may include information sharing, awareness raising, training and development of replicable and scalable pilot projects.
III. Develop ways of offering incentives to smallholder family farming communities and poor farmers who practice traditional agriculture and protect ecosystems of local and global significance. It should be also extended through the products or value chains that could benefit local native biodiversity. This can be arranged jointly with NGOs and civil society organizations able to develop and maintain programmes to utilize and conserve agricultural biodiversity, or to enhance the value chains which could benefit local native biodiversity. Examples of such investments include:
    A. bridging between farmers and agencies that pay for environmental services to enhance the economic value for the conservation of biodiversity through sustainable traditional agricultural practices, including permaculture, and other agroecological improvements (e.g. farm diversification, better use of local resources, etc.). Some of the good traditional and eco-agriculture practices to be employed on this regard include:
        i) Maintain in-situ crop and animal genetic diversity through selection and cultivation of Local land races, and controlling the cultivation of alien invasive crops
        ii) Biodiversity responsible tillage techniques
        iii) Maintaining natural water flow and stimulating irrigation efficiency
        iv) Integrated Pest Management (IPM) which allow for maintaining viable population of the natural predators to agricultural pests to ensure its control. Some of the practices like unsealed stone fences, avoiding use of agrochemicals

and replacing it with mechanical, cultural, physical and biological control, prohibiting direct killing of targeted IPM species (e.g. owls, carnivores, etc.) enhancing the habitat. IPM is one of the most important measures needed to promote and scale up organic farming.

v) Work with productive and women associations and CBOs to obtain certification (awareness, training, technical support and financing obtaining certification)

vi) Explore opportunities for marketing and enhancing sale of organic products from Dibeen KBA

vii) Revive the traditional use of stone fences/walls (Locally known as sanasel) to create agricultural terraces and to fence the farms which maintain small open pockets uncemented within the constructed fences. These buckets are of particular importance for reptiles and for owl's lifecycle, and enable benefiting from their natural role as natural predators of agricultural pests

viii) Application of agricultural/biological hedgerows through planting native natural productive tree species which can play the roles of wind brokers, biological connectors (corridors) to the surrounding landscape, and offer "products with cultural identity".

B. Facilitating the production of 'added value' products that come from biodiversity responsible and traditional farming systems that utilize and conserve unique agricultural biodiversity. Some of the possible investments in this field may include, but is not necessarily limited to:

i) micro and small-scale investments at the end of the dominant agricultural value chains, like for example jam production, production of olive and vegetables pickles, production of organic agri-products, etc.;

ii) supporting bee keeping and honey production investments which do have positive impact on the pollination of wild plants and agricultural plans

iii) improving local producers' access to specialized and niche markets favoring 'added value' agricultural products;

iv) specialized and public seasonal markets and exhibitions for 'added value' agricultural products to foster producer-customer direct sales which can generate hire return on agricultural investments.

Conservation of Agro-biodiversity and Sustaining Its Utilization

I. Development of traditional conservation systems, especially the old growth olive Orchards and groves, native grape and fruited varieties, and old growth native forest;

II. Supporting and enhancing the adoption and scale up of Permaculture;

III. Development and implementation of in-situ conservation measures in the farms and in the privately-owned forest thus to conserve and protect threatened and endemic species. This may include the establishment of micro-reserves within the farms, private forest and government lands to protect threatened species. Such measures will require compensation and/or incentive schemes to convince the owners to implement such measures and to ensure its durability;

IV. Establishment of ex-situ conservation pilot programmes like genebanks which are currently being implemented by NARC and the RBG, encouraging collection and characterization of local landraces and mainstreaming community gene banks where farmers save and exchange seeds of local land races freely;

V. Documenting and evaluating the traditional and current agricultural systems; and
VI. Evaluation and selection of the climate resilient, Local and economically viable genetic resources (land races) for community utilization.

Converting Agriculture Impacts into Business Opportunities

I. Manage the environmental impacts associated with olive oil production, especially management of the industrial waste water from the olive pressers (including Zibar) through the production of treated water for irrigation, recovery of energy and environmentally responsible management of pollutants on water and biodiversity;
II. Improve resources efficiency in the agriculture sector through improving irrigation efficiency, investing in renewable energy to enhance revenue from agriculture, and stimulate investments in agricultural waste (composting, waste to energy, etc.); and
III. Improve the environmental management of the use of treated waste water in agriculture. Currently, many farmers are using treated waste water disposed by the WWTPs into Zarqa river. Monitoring of treated waste water use in irrigating edible plants is currently in place, but is noted to be in need for further enhancement and employment of modern monitoring technologies to ensure the quality of the final products, to avoid soil contamination, and to protect biodiversity.

Integrating Agricultural with Cultural Economies: Tourism Investments

I. Increase the investments in the "cultural economy" (ecotourism, cultural identity products, local gastronomy and other products pertaining to richness of local cultures and resources). An investment priority under this strategic direction is supporting the development and scale up of micro and small-scale investments in agri-tourism and nature-based tourism (agri-tourism trails, seasonal traditional agriculture festivals, etc.) which can provide excellent outlet for marketing of agricultural products produced by traditional and other biodiversity responsible farming which can bring good value to sold products compared to selling in regular and central markets. This investment option is important because:
    A. It can also provide opportunities for the development of other nature-based tourism investments and products like organic or authentic restaurants, home-based tourism services, living traditional agriculture experiences (agricultural lodges, villas, etc.), and as such boos revival of traditional agricultural and create jobs for locals.
    B. Such investments are likely to induced visitors and buyers to pay for conservation measures that offset the loss of biodiversity in agricultural landscapes to increase farmers' income and livelihood security.
    C. can generate financial and other incentives for environmental service providers to maintain biodiversity-rich agricultural landscapes; and
    D. It can be easily linked to tourism development (quantity and quality) by linking the heritage values of the productive landscape, with the productive and natural values of the same. For instance, local and foreign tourists visiting the archaeological and heritage sites are logically interested in enhancing their visit experience to these sites by living the traditional way of living in these areas, observing traditional uses, and enjoying traditional authentic meals and local products.

Chapter 6 Recommendations

Recommended land use measures

Strategic Direction for Biodiversity Responcible Land Use Planning and Management

As explained in above sections, Dibeen KBA is part of a larger productive landscape with long history of use by humans. The uses are diverse and include residential, agricultural, tourism, industrial, and nature conservation uses. Each one of the main mentioned uses also constitute sub-categories, like for example tourism which include nature-based tourism, cultural tourism and agri-tourism.

The KBA was analyzed for biological importance and sensitivity. The produced maps show absence of well-planned land use which can maintain sustainable uses of the productive landscape, conserve biodiversity and also to contribute to sustainable development in this important area.

The recommended strategic direction for land use in this area is biodiversity-responsible land use which can sustain environmentally responsible and traditional uses of the productive landscape. This strategic direction constitutes three main priority investments:

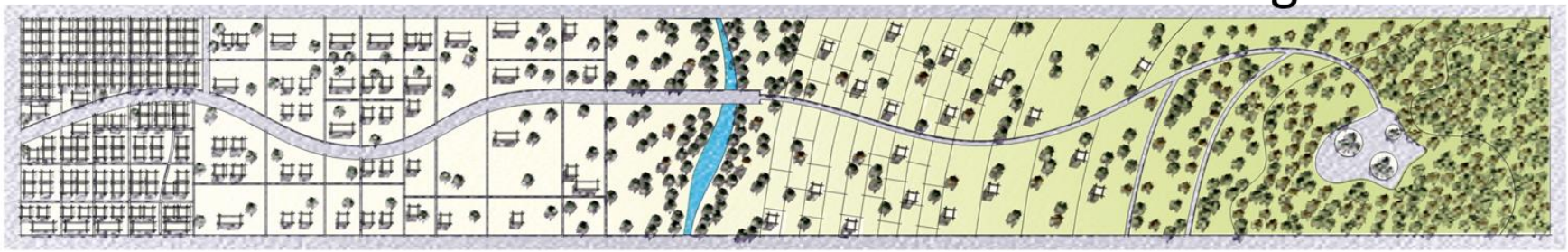
I. adopt the natural heritage system developed by the RSCN;
II. implement the land use plan prepared through the UNDP BITS Project by Consolidated Consultants Group and Enviromatics for the buffer zone of Dibeen Protected Area;
III. develop and adopt transect model across the KBA which addresses nature conservation needs, promote urban and peri-urban agriculture, and creates buffers and transitional zones capable of absorbing urbanization impacts and controlling it before it reaches the identified highly sensitive biodiversity areas (see example in page 29); and
IV. promote, support and enhance urban and peri-urban agriculture.

For the later, greening the urban centers, enhancing urban agriculture, and promoting eco-agriculture in peri-urban areas are deterministic to maintaining the character of the productive landscape of Dibeen KBA. It is also pivotal for poverty alleviation and local economic development, enhance the attractiveness and connectivity of the productive landscape for economic green growth, and of course for other values. Hence, achieving such targets require investments to create the recognition and interest among planners and politicians at the national and local levels following consent approach.

This also require substantial investment by the government and municipalities to upgrade and green the infrastructure within the area in general, but most importantly within the major towns and villages, and to define clear direction for urban growth noting biodiversity value and sensitivity, overall to effectively manage urban expansion and to control encroachment of productive lands and important biodiversity areas.

Specific recommendations for each biodiversity sensitive area, and for the rural and urban areas, are presented below.

Transect Model For Land Use and Sectoral Planning in Dibeen



Residential			Natural Water FLow	Agriculture		Natural Heritage System	
High Density	Moderate Density	Low Density	Natural Water Flow System	Traditional Agriculture	Eco-agriculture	Transition Area	Core Area (Forest)
This area is located in the heart of the organized areas and represents the main gatherings or villages. It includes services, utilities, and high-density residential areas.	This area is located within the organizational boundaries and it contains medium density residential areas.	This category aims to reduce urban sprawl and preserve agricultural land located around the organized areas.	Consists of lands that include natural water sources or form a major part involved in the natural water flow system in the form of valleys, wells and springs.	It includes agricultural land outside the buffer zone.	Includes farmland within the buffer zone.	It consists of public and private lands that provide additional protection for lands at risk that need additional development, such as slopes greater than 30%.	It includes the original natural forest land consisting of an old-growth forest area and forests connected to the Dibbin Protected Area.

Source: Consolidated Consultants Group - Land Use Plan for the Buffer Zone of Dibeen Protected Area

Measures for the Natural old-growth forests

This zone exhibits the highest biodiversity within the study area and provides sufficient area size and shelters for the largest species that require large home ranges such as wolves and hyaenas. The presence of those species adds additional value for this zone making it a biodiversity 'hotspot' in the area and makes it very important for the protection of these locally threatened species.

We highly recommend that some sort of protection be provided for these forests by either including it in the buffer zone for Dibbeen and to be monitored and protected from logging and hunting or by declaring it as a special conservation area. All illegal infringements on these forests via housing development or agriculture should be retracted back with rehabilitation programs be implemented to restore the forest habitats. Strict laws of enforcement should be implemented to prohibit and prevent any further infringements. Agricultural and/or anthropogenic activities will inevitably increase the disturbance and pollution (noise and air) effect on the biodiversity of this zone.

Seed collection of native species and re-introduction is recommended, in particular in degraded government-owned forest, and also for / through the reforestation programme planned to be implemented by the Ministry of Agriculture and the Ministry of Environment.

The presence of the Persian squirrel (*Sciurus anomalus*) the stone marten (*Martes foina*), and green lacerta (*Lacerta media*) add additional value for this zone and the protection of these flagship species which have limited distribution to parts of Ajloun and Dibbeen forests. We recommend that these forests be included in the buffer zone for Dibbeen and to be monitored and protected from logging and hunting. Agricultural and/or development activities within close proximity to the reserve will cause complete loss of the habitats through deforestation. Anthropogenic activities will inevitably increase the disturbance and pollution (noise and air) effect on the biodiversity of the reserve. Deforestation also causes habitat fragmentation and increases the percentage of edge habitats in the forest, and thus increasing nest predation on many birds by invasive species such as crows.

Several natural and man-made caves are found in the area, the largest of which is Wardah cave which is found under the road near the western edge of the study area. a few other smaller caves were seen west of Najdeh. All these caves provide crucial roosting and hibernating sites for at least nine species of bats in the area. Many animals (e.g. snakes) also take refuge within the caves during the day time. Most of the caves however suffer from littering, digging, burning, and mining. Wardah cave used to harbour large colonies of bats, however, much of it at this point has been destroyed by mining in the area. This cave is about 6 km from the western edge of Dibbeen and may be far from the buffer zone.

Measures for Non-forest Mediterranean areas

Much of this zone must have had natural forests at some point and became degraded through the intense pressure of logging and deforestation for agriculture, urban development, and grazing over the years. This zone is important for birds that require larger areas to roam for foraging on the ground (e.g. chucker) or aerial hunting for snakes and small mammals and reptiles (e.g. short-toed eagle and shrikes). Much of the area has steep slopes and could be used for rotational grazing and/or agriculture through the use of terraces and open rock fences that may provide dens and

refuge for reptiles and small mammals. However, any large-scale agricultural practices that include intensive use of pesticides in the area will pose a threat on the local wildlife, mainly the populations of resident and migratory birds as well as bats.

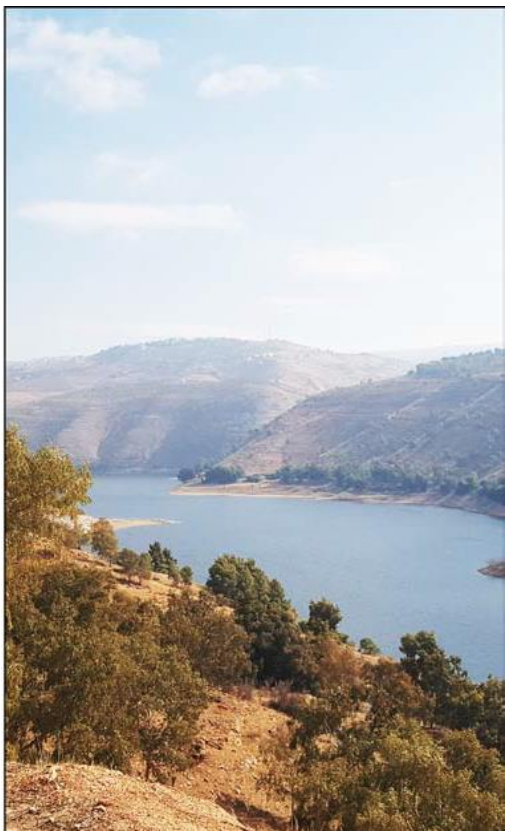
It is also highly recommended to develop and implement efficient, science-based and community engaging sustainable grazing management programme. Such a programme is required to establish informed decision making in particular with regard to the carrying capacity of the rangeland, and to assure regulation of sustainable grazing within the carrying capacity threshold, and to constitute restoration of native habitat and species.

Measures for Planted (man-made) forests

Given the negative effects that tourism has on the reserve including: disturbance, trash, and vehicle traffic (these effects are apparent in the picnic area of Dibeen Forest Reserve), these forested areas around Dibeen provide a viable alternative and a valuable public resource for recreation. This may help in relieving the pressure on the reserve and at the same time provide the visitors with the shady picnic area that they desire. This area is already disturbed and has little value for biodiversity and can be assigned for human activities such as picnicking, with minimum amount of impacts on wildlife and biodiversity. These forests are fully accessible by roads and occur near townships and farms where visitors can buy supplies and local fruit produce, some areas also provide scenic views overlooking the King Talal Dam. Public awareness of the value of the unique forest ecosystems of Dibbeen and the need to preserve them will help in the long-term maintenance of the reserve area.

Measures for Wadi systems

The wadis often support aquatic vegetation where amphibians and aquatic insects thrive. Most of the wadis also provide safe corridors for animal movement between forested areas. These wadi systems should be protected by law as they provide unique habitats for the study area.



Measures for Zarqa river and KT Dam

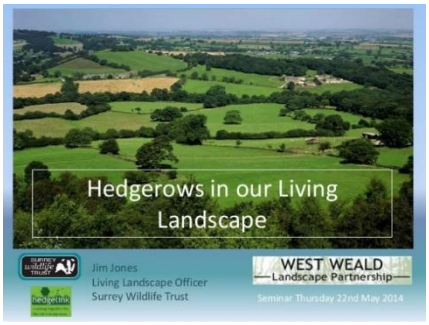
The basin runs in westward wadi systems with many tributaries from the northern side (within the study area) draining into the basin. In the middle of the basin is King Talal Dam. The aquatic habitats in the wadi and water vegetation offers suitable habitats for several amphibians and reptiles, of particular interest is the Striped-necked Terrapin, *Mauremys rivulata*, which inhabits polluted and unpolluted natural and man-made water bodies in the Mediterranean and Irano-turanian regions in north western. Other species include a dense population of the dice snake, *Natrix tessellata*, tree frog, *Hyla savignyi*, Lavantine frog, *Rana bedriagae*. The reed vegetation also offers suitable habitats for many birds and mammals.

Measures for Mix-use rural agricultural areas (Orchids) and Farmlands (crop plantations)

These zones make up the largest areas within the study area and provide the main production landscapes with economic benefits to the livelihood of local people and land owners. Farmlands can be used to promote eco-agriculture and agrotourism, these activities may provide an economic benefit to the locals while at the same time decrease the negative effects of tourism and picnicking on the reserve. Eco-agricultural practices including: traditional agricultural practices, planting hedge grows of native plants, rock fencing, no chemicals and pollution, etc…) should be adopted *in situ* (on-farm) for biodiversity conservation and integration in agricultural landscapes. Incentives (education, economic, institutional support) should be used to encourage farmers and land owners to adopt such practices.

Recommended best agricultural practices

Biodiversity-Friendly farming



I. **Hedgerows-a great asset to a farm:** The maintenance of hedge grows and windbreaks is the strategy most often correlated with the conservation of wild biodiversity within agricultural landscapes. Hedge grows can be used to enhance the biodiversity value of agricultural landscape by providing habitats, shelters, and ecological networks (corridors) that connect natural habitat areas in the landscape. landscape connectivity between large patches of forest can be effectively maintained through retention of tree cover on the farm, such as live fences, windbreaks, and hedges in grazing lands and agricultural fields.

II. **Biological pest controls** (natural predators and parasites): IPM approaches are often preferable to chemical pesticides. For example, instead of pesticides, it is sometimes possible to use a natural predator such as Barn owls keeping mice populations in-check.

III. **Biodiversity responsible farm infrastructure and practices.** This include traditional stone fencing and terracing structures, efficient irrigation systems, eco-friendly animal barns, agriculture waste management system, eco-friendly tillage methods and equipment's, cultivation of local native varieties, agricultural diversification, rationale use of fertilizers, establishment of micro-reserves within the farm to conserve endangered species, etc.

Developing incentives and economic mechanisms for *in situ* biodiversity conservation in agricultural landscapes

Economic and social incentives can motivate collective action of local communities towards sustainable, biodiversity-friendly farming. Piloting the implementation of such incentives would be of great value to test its effectiveness within Jordanian context, and accordingly to modify it for scale up and replication, and for demonstrating the efficiency of such actions for sustaining the productive landscape and to achieve sustainable development. Incentives may include:

I. Environmental education and ecoagriculture extension services:

Some forms of land and resource degradation may be easily observed (e.g. deforestation), while others take long periods of time for their effects to be observed (e.g. loss of beneficial species or loss of soil fertility due to chemical). Farmers and land owners may be poorly informed about the damage they caused to the ecosystem, especially for farmers and land owners new to the area and unfamiliar with its essential biotic components. Investment in training and familiarizing farmers of the ecosystem and the services it provides may be used to reverse and/or rehabilitate the degraded resources by improving the farm design, harvest methods, and communication with other farmers and environmental agencies.

Investment Action: training programs for farmers and land owners on ecosystems services and sustainable methods that can be used to for biodiversity conservation in agricultural landscapes.

II. Economic incentives

The livelihood of farmers is based on economic importance of resources critical for farmers to maintain and improve the natural resources. Farmers are likely to accommodate biodiversity-friendly farming if the degradation of resources would lower the economic value. They would also be interested in the implementation of ecoagriculture improvements to their farms and agricultural practices if it is sponsored and would help them to improve the rate of return on their investments.

Investment actions: maintain competitive agricultural prices, subsidies, and improve technology to increase productivity and improve fragile land. eco-certification of agricultural products and financial investors' oversight of agricultural investments can be mobilized to shift financial incentives towards ecoagriculture.

III. Institutional support

Farmers and land owners could benefit from group actions (environmental agencies, NGOs) that would invest or organize land use to attain environmental aims.

Investment actions: support local societies, loosen control on local organizations, support conflict resolutions.

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Annex 1: Applied biodiversity value and sensitivity analysis criteria for Dibeen KBA

Biodiversity Value and Sensitivity Analysis														
Value	**Indicator**	**Parameter**	**Max Score**	**Parameter Scale**	**Scoring**	**Close old-growth forests**	**Open old-growth forests**	**Planted forests**	**Non-forest Mediterranean**	**Wadi systems**	**Zarqa River and KT Dam**	**Rural Areas**	**Farmlands**	**Urban areas**
Biological Importance/Conservation	**Species richness**	how many species overall does an area contain	5	<10	1	5	5	3	5	5	5	5	5	3
				10 to 30	2									
				31 to 50	3									
				Above 50	5									
	Biome-restricted species	Number of species in an area that are restricted to the biogeographic region	5	1	1	5	5	2	5	5	5	5	5	2
				2 to 4	2									
				5 to 10	3									
				Above 10	5									
	Species of high global conservation concern	Number of threatened species	5	none	1	4	3	3	4	3	4	3	3	1
				1	2									
				2--3	3									
				4--5	4									
				> 5	5									
	Species of regional/national	Number of rare, Restricted Range species (endemic) and/or threatened species	5	None	1	5	4	2	5	4	5	3	4	2
				1--3	2									
				4--5	3									

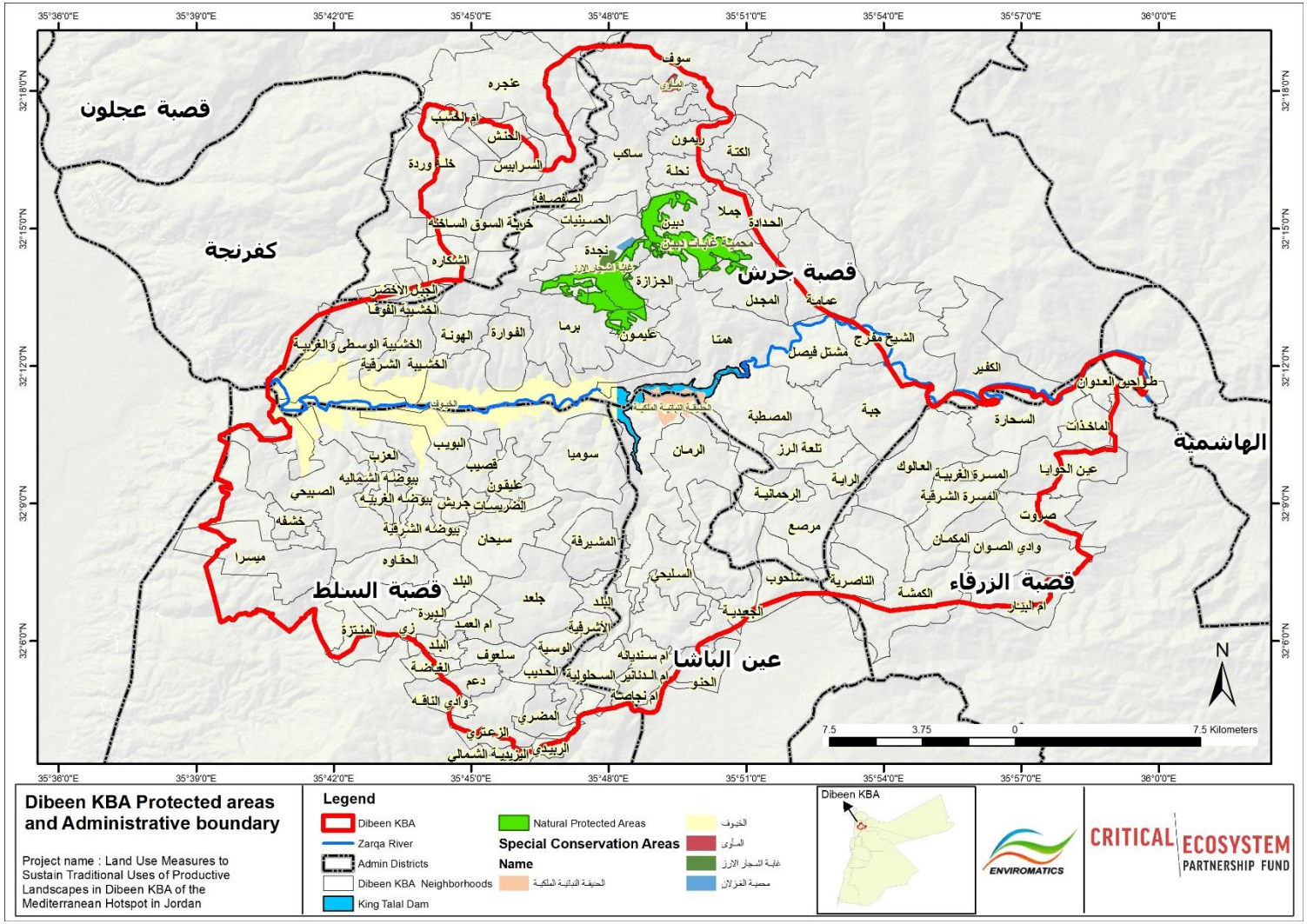
Biodiversity Value and Sensitivity Analysis														
Value	**Indicator**	**Parameter**	**Max Score**	**Parameter Scale**	**Scoring**	**Close old-growth forests**	**Open old-growth forests**	**Planted forests**	**Non-forest Mediterranean**	**Wadi systems**	**Zarqa River and KT Dam**	**Rural Areas**	**Farmlands**	**Urban areas**
	conservation concern			6--8	4									
				> 8	5									
	Irreplacability: Habitat importance for key species	Habitat of good/healthy and functional condition for breeding of key species	3	Low	1	3	3	1	2	2	1	1	1	1
				Moderate	2									
				High	3									
		Area size: can the area sustain viable populations, home range for the key species	3	None	0	3	3	0	0	0	3	0	0	0
				Yes	3									
		Degree of habitat heterogeneity (Number of habitat types within the zone/area)	3	Low	1	3	2	1	2	2	2	1	1	1
				Moderate	2									
				High	3									
	landscape characters: Importance of the area/habitat for ecosystem	If the loss of respective habitat in subject area will trigger fragmentation of the ecosystem/habitat, or will	3	Not expected	1	3	2	2	1	2	1	1	1	1
				Likely	2									

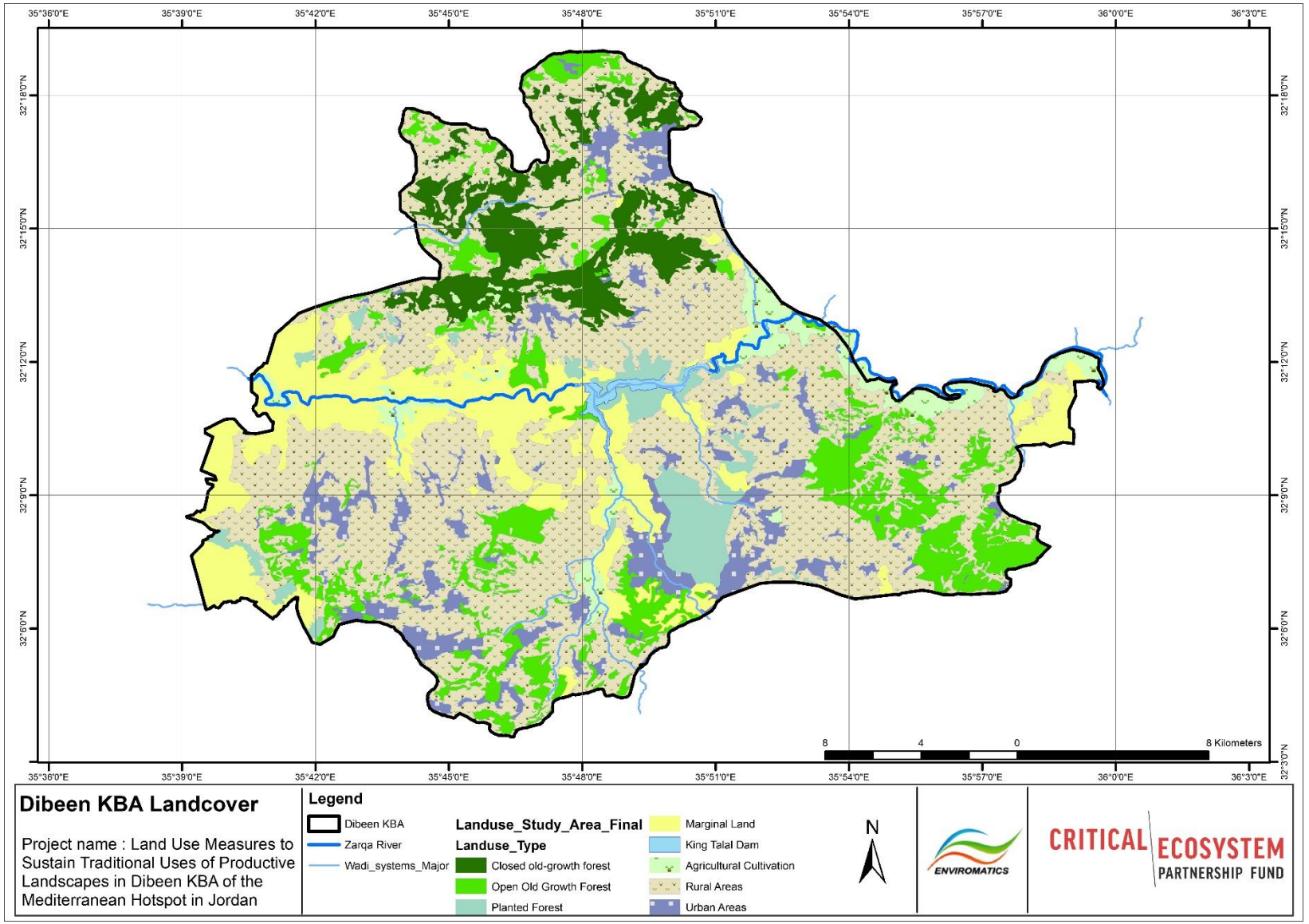
Biodiversity Value and Sensitivity Analysis														
Value	**Indicator**	**Parameter**	**Max Score**	**Parameter Scale**	**Scoring**	**Close old-growth forests**	**Open old-growth forests**	**Planted forests**	**Non-forest Mediterranean**	**Wadi systems**	**Zarqa River and KT Dam**	**Rural Areas**	**Farmlands**	**Urban areas**
	integrity and functionality (important physical elements)	trigger further degradation within the ecosystem		Very likely	3									
		Being part of biological corridor for key species	3	No	1	3	2	2	2	3	3	1	2	1
				moderate importance	2									
				high importance	3									
		Percent forest cover (or level of fragmentation) based on the number (or %) of trees per dunum of land	5	1% to 10%	1	5	2	4	2	1	1	1	1	1
				11% to 20%	2									
				21% to 30%	3									
				30% to 50%	4									
				Above 50%	5									
		Hydrology: springs, ponds, catchment	3	Absence	1	3	1	1	3	3	3	1	3	3
				Presence	3									
	Sub-total Marks for Conservation Value					**42**	**32**	**21**	**31**	**30**	**33**	**22**	**26**	**16**
Viabili	**Degradation Level**	Magnitude of degradation within the area: general use, habitat loss, overgrazing,	5	Very high	1	4	3	2	2	3	3	2	1	1
				High	2									
				Moderate	3									

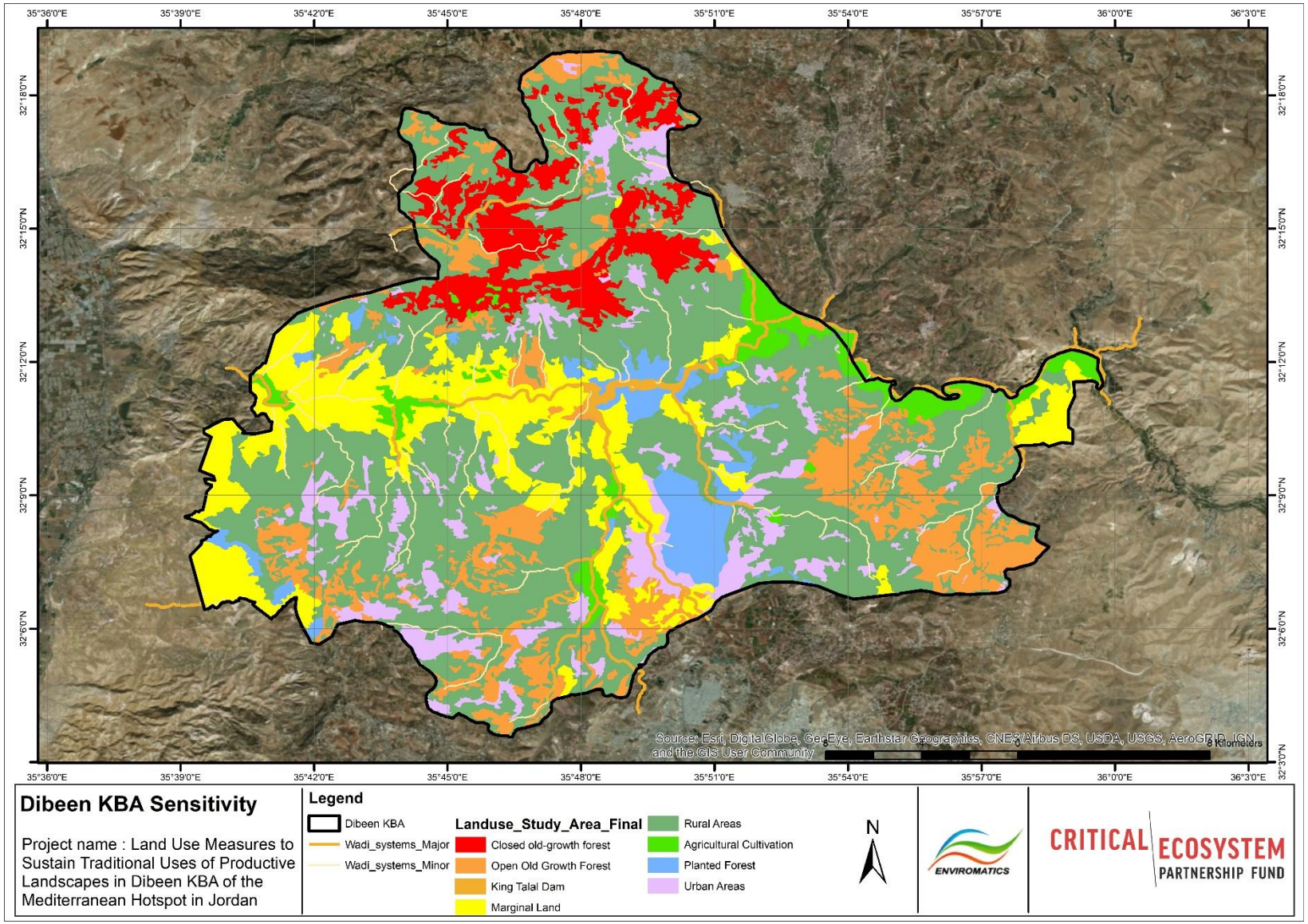
Biodiversity Value and Sensitivity Analysis														
Value	**Indicator**	**Parameter**	**Max Score**	**Parameter Scale**	**Scoring**	**Close old-growth forests**	**Open old-growth forests**	**Planted forests**	**Non-forest Mediterranean**	**Wadi systems**	**Zarqa River and KT Dam**	**Rural Areas**	**Farmlands**	**Urban areas**
		Human-caused disturbance (wood-cutting, hunting, garbage),		Low	4									
				None	5									
	Pressure and level of threat from current land uses	Level of urbanization: scaling and/or percentages of housing & urban areas, Commercial & industrial areas, …	5	Very high	1	4	3	4	3	4	4	3	2	1
				High	2									
				Moderate	3									
				Low	4									
				None	5									
		Level of public use (tourism): picnicking, hiking, ….	4	High/intensive	1	4	2	2	2	2	2	2	2	2
				Medium	2									
				Low	4									
		Agricultural and aquaculture: Extensive, mechanical and chemical use, sporadic, livestock, aquaculture, annual crops, trees, ….	5	Very high	1	3	3	2	2	2	2	2	1	1
				High	2									
				Moderate	3									
				Low	4									
				None	5									
			3	High/intensive	1	3	2	2	2	2	2	2	1	1

Biodiversity Value and Sensitivity Analysis														
Value	Indicator	Parameter	Max Score	Parameter Scale	Scoring	Close old-growth forests	Open old-growth forests	Planted forests	Non-forest Mediterranean	Wadi systems	Zarqa River and KT Dam	Rural Areas	Farmlands	Urban areas
		Infrastructure and services: Roads, water, electricity,		Medium	2									
				Low	3									
Sub-total Marks for Viability for Conservation						**18**	**13**	**12**	**11**	**13**	**13**	**11**	**7**	**6**
Total score	**65**					**60**	**45**	**33**	**42**	**43**	**46**	**33**	**33**	**22**
Percentage of Score (out of 100%)						**92%**	**69%**	**51%**	**65%**	**66%**	**71%**	**51%**	**51%**	**34%**

Annex 2: Administrative boundaries, landcover, and biodiversity value and sensitivity maps for Dibeen KBA




35°36'0"E
35°39'0"E
35°42'0"E
35°45'0"E
35°48'0"E
35°51'0"E
35°54'0"E
35°57'0"E
36°0'0"E
36°3'0"E
32°18'0"N
32°15'0"N
32°12'0"N
32°9'0"N
32°6'0"N
32°3'0"N
8
4
0
8 Kilometers
Dibeen KBA Landcover
Project name : Land Use Measures to Sustain Traditional Uses of Productive Landscapes in Dibeen KBA of the Mediterranean Hotspot in Jordan
Legend
Dibeen KBA
Zarqa River
Wadi_systems_Major
Landuse_Study_Area_Final
Landuse_Type
Closed old-growth forest
Open Old Growth Forest
Planted Forest
Marginal Land
King Talal Dam
Agricultural Cultivation
Rural Areas
Urban Areas
N
ENVIROMATICS
CRITICAL ECOSYSTEM PARTNERSHIP FUND


35°36'0"E
35°39'0"E
35°42'0"E
35°45'0"E
35°48'0"E
35°51'0"E
35°54'0"E
35°57'0"E
36°0'0"E
36°3'0"E
32°18'0"N
32°15'0"N
32°12'0"N
32°9'0"N
32°6'0"N
32°3'0"N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
0
3
6 Kilometers
Dibeen KBA Sensitivity
Project name : Land Use Measures to Sustain Traditional Uses of Productive Landscapes in Dibeen KBA of the Mediterranean Hotspot in Jordan
Legend
Dibeen KBA
Wadi_systems_Major
Wadi_systems_Minor
Landuse_Study_Area_Final
Closed old-growth forest
Open Old Growth Forest
King Talal Dam
Marginal Land
Rural Areas
Agricultural Cultivation
Planted Forest
Urban Areas
N
ENVIROMATICS
CRITICAL ECOSYSTEM PARTNERSHIP FUND