BIODIVERSTY ACTION PLAN

ILLASIT-TAVETA ROAD UPGRADE PROJECT

FINAL REPORT

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1. INTRODUCTION

GroundTruth was requested to develop a Biodiversity Action Plan (BAP) for the prosed upgrade of the Illasit-Taveta road, in south-central Kenya. BAPs are required for projects located in critical habitat and are recommended for high-risk projects in natural areas (IFC, 2012). A BAP describes i) the composite of actions and a rationale for how the project's mitigation strategy will achieve net gain (or no net loss), ii) the approach for how the mitigation hierarchy will be followed, and iii) the roles and responsibilities for internal staff and external partners (IFC, 2012). BAPs are designed to be living documents that should include agreed on timelines for regular review and update as new information arises and becomes available, the project progresses, and conservation context changes over time (IFC, 2012).

In order to provide suggestions on mitigation measures and management actions to not only prevent negative environmental impacts that may arise from the upgrade of the Illasit-Taveta road, but also to potentially enhance biodiversity, GroundTruth Water, Wetlands and Engineering (GroundTruth) were appointed by Sustainable Environmental Solutions (SES) to develop the BAP for the road upgrade project.

1.1 Project Description

The proposed project, hereafter referred to as the Illasit-Taveta road upgrade (or road upgrade), plans to upgrade the existing road between the towns of Taveta and Illasit (Laset) in southern Kenya (Figure 1-1). The existing road is a dirt road that has become degraded over time, and likely did not have proper stormwater systems in place to control runoff into the environment (Figure 1-2). The proposed road upgrade project is intended to improve the condition of the road, and should include plans and designs to adequately manage stormwater runoff into the environment.

The total length of the existing Illasit-Taveta road is approximately 65km. The southern section of the existing road bypasses the eastern side of Lake Chala (Figure 1-1), which is a caldera that formed after an eruption associated with Mt Kilimanjaro's most recent phase of volcanic activity some 250 000 years ago (Martin-Jones et al., 2020). Lake Chala and its immediate surrounds have been classified as an Alliance for Zero Extinction (AZE) site. AZE sites aim to prevent extinction by identifying and safeguarding key sites that are the last remaining refuge of at least one Endangered or Critically Endangered species (AZE, accessed May 2022). The designation of Lake Chala and surrounds as an AZE site potentially raises a fatal flaw for the project in terms of impacts to critical biodiversity species and processes, particularly as the existing road passes through the AZE for approximately 3.5km. In an effort to limit the risks to the Lake Chala AZE site and its biodiversity, the current plan for the proposed road upgrade includes a small realignment to bypass the eastern boundary of the AZE site (see Section 3.4.3, which provide a description of Lake Chala as an AZE site).

1.2 Aims and Objectives

The primary aim of this BAP is to achieve a 'no net loss' of biodiversity and a net gain for Critical Habitat by identifying a set of management actions that will maintain or enhance biodiversity patterns and processes in the area through which the Illasit-Taveta road passes, and which will need to be implemented as part of the proposed road upgrade project.

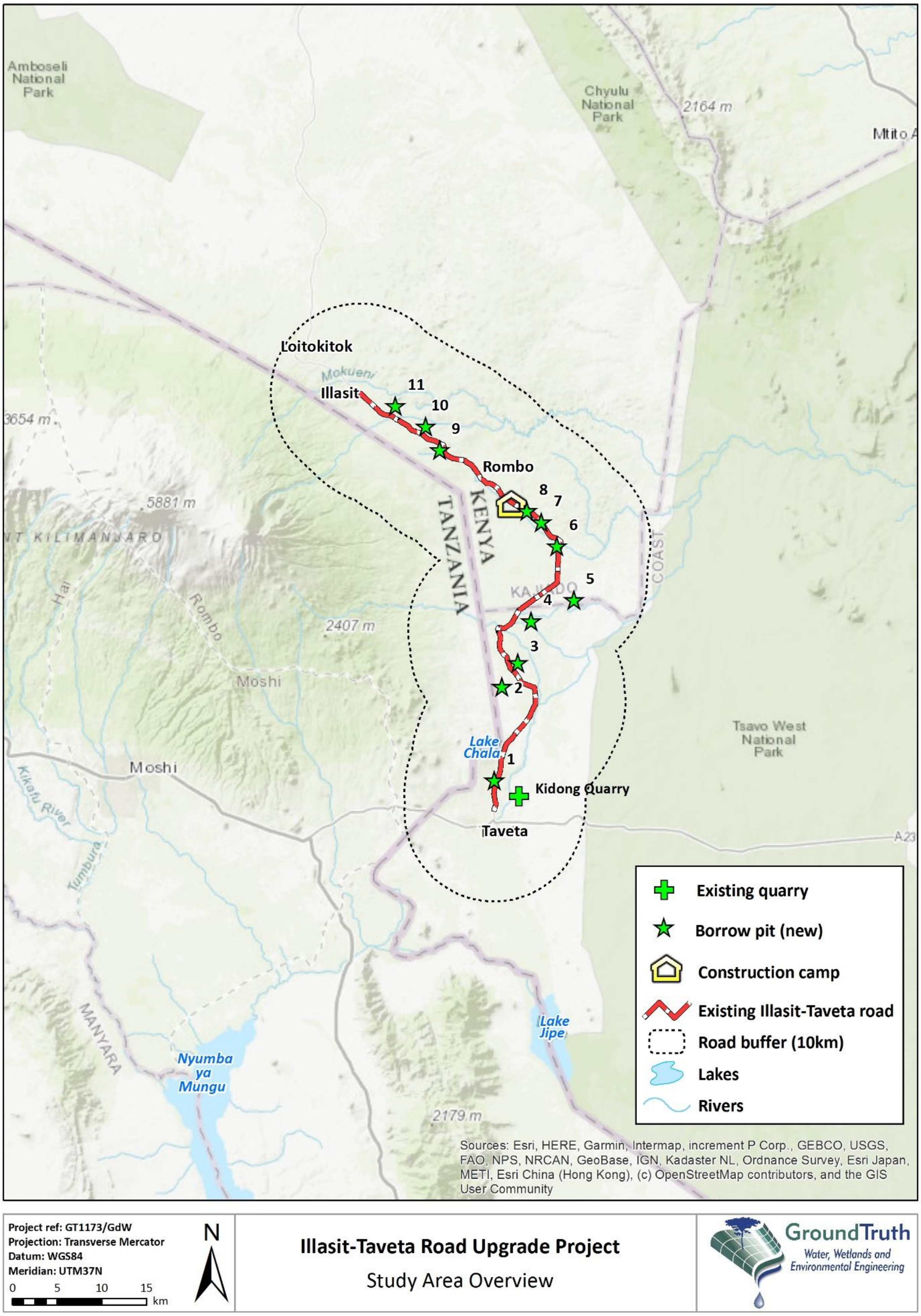

Figure 1-1 Overview of the study area for the proposed upgrade of the Illasit-Taveta Road

Figure 1-2 Poor stormwater management of the existing Illasit-Taveta Road resulting in severe erosion and gully formation withi the Rombo section of the road.

The following objectives are required to ensure that the project achieves the overall aim of the BAP:

- Appropriate mitigation measures need to be implemented, where necessary, to provide adequate compensation for biodiversity loss;
- The project must comply with national legislation/policy requirements;
- The project must comply with international environmental requirements and best practice, including principally, the International Finance Corporation (IFC) Performance Standard 6 (PS6) and Guidance Note 6 (GN6); and
- The project requires adequate staffing, resources, a clear timeline and a description of offsets to residual effects, or a separate offset implementation plan.

1.3 Scope of Work

The IFC Guidance Note 6 (IFC, 2019) provides the basis for developing a BAP. BAPs are generally required when projects are located within critical habitat/s and are recommended for high-risk projects in natural habitats.

The following standard tasks are required to develop a BAP as per the IFC Guidance Note 6:

- **Task 1:** Determine the legal and regulatory requirements
- **Task 2:** Desktop assessment of the project
- **Task 3:** Baseline survey of the biodiversity
- **Task 4:** Biodiversity impact assessment
- **Task 5:** Preparation of the BAP
    - **Task 5.1:** Establishment of priorities for conservation
    - **Task 5.2:** Identification of conservation actions

- **Task 6:** Implementation of the BAP
- **Task 7:** Monitoring, evaluation and improvement
- **Task 8:** Reporting, communication and verification of BAP performance

Normally, the Environmental and Social Impact Assessment (ESIA) of a project forms part of the BAP, specifically the ecological/biodiversity baseline study that helps to establish objectives and conservation priorities for the BAP. This presented a limitation for this study as an ESIA had not been formally undertaken, thus requiring desktop and field-based assessments to be undertaken within the time available to identify and define appropriate biodiversity objectives and priorities.

The following steps were followed to formalise the BAP process in the absence of pre-existing studies:

- **Step 1:** Review of available reports and databases covering biodiversity, applicable legislative and policy frameworks, and the road and stormwater designs to establish construction and operation drivers and pressures.
- **Step 2:** Desktop mapping of vegetation and ecosystems (and species information where available).
- **Step 3:** Conduct an in-field assessment to characterise natural vegetation and available habitats, as well as to identify biodiversity sensitivities.
- **Step 4:** Produce a baseline that adequately defines the biodiversity features within the road corridor, and highlight any key knowledge gaps that may need to be addressed.
- **Step 5:** Identify key biodiversity impacts from the project and provide adequate measures/ actions to mitigate impacts.
- **Step 6:** Develop a BAP through consultation with key stakeholders.

2. LEGAL AND REGULATORY FRAMEWORK

When developing a BAP, it is essential that the legal and regulatory requirements of the development or activity in question are understood. As such, the applicable legislation and policy frameworks relevant to the study site are presented below.

2.1 International Legislation and Policy

The government of Kenya have ratified the following laws and conventions that are relevant to this project:

- Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora (1973);
- United Nations (UN) Framework Convention on Climate Change;
- UN (Rio) Convention on Biological Diversity (CBD) (1992)[1];
- The RAMSAR Convention on Wetlands; and
- Convention on the Conservation of Migratory Species of Wild Animals.

2.2 National Legislation and Policy

In addition to being a signatory to various international laws and conventions, Kenya also has a number of national laws and policies that relate to the natural environment and are relevant to this study. Key legislation and policies are discussed in more detail below.

2.2.1 *The Constitution of Kenya 2010*

Article 42 of the constitution states that "*Every person has the right to a clean and healthy environment, which includes the right:*

(a) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and
(b) to have obligations relating to the environment fulfilled under Article 70."

Article 60(1) emphasises that land should be managed in an equitable, efficient, productive and sustainable manner according to various principles, one of which includes "*sound conservation and protection of ecologically sensitive areas*".

Article 69(1) defines the obligations of the State in respects of the environment, which includes:

(a) ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
(b) work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
(c) protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;

[1] The objectives of the CBD include biodiversity conservation, sustainable use of biological resources, and the fair and equitable use of biological and genetic resources. The CBD encourages individual countries to develop or adapt national strategies, plans or programmes to address the provisions of the Convention. Kenya become a signatory of the CBD on the 11th of June 1992.

(d) encourage public participation in the management, protection and conservation of the environment;
(e) protect genetic resources and biological diversity;
(f) establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
(g) eliminate processes and activities that are likely to endanger the environment; and
(h) utilise the environment and natural resources for the benefit of the people of Kenya.

Article 70 guarantees the right of every citizen to take court action in order to realise the environmental rights guaranteed under the constitution (i.e. the right to a clean and healthy environment as recognised and protected under Article 42).

2.2.2 *National Environmental Policy 2013*

The National Environmental Policy for Kenya provides broad guidelines with respect to the environment. This includes management of ecosystems and sustainable use of natural resources, which include forest ecosystems, freshwater and wetland ecosystems, land and soils, wildlife resources, livestock, etc. The policy also requires precautionary approaches to environmental challenges that may be encountered by developments to ensure better stewardship of the environment. It highlights that invasive alien species pose a serious threat to the environment, and that their introduction and spread can be facilitated by trade, transport/travel, and tourism developments. The policy also highlights the importance of maintaining environmental quality and health, which includes problems associated with air and water pollution. Environmental monitoring is therefore considered important to assess environmental conditions and trends, as well as to develop environmental action plans and enhance enforcement and compliance. The policy emphasises that functioning governance structures, legal and policy instruments, as well as institutional capacity for judicious implementation and enforcement are required to ensure effective environmental governance.

2.2.3 *Environmental Management Coordination Act (Act No. 8 of 1999)*

The Environmental Management Coordination Act (Act No. 8 of 1999), as amended in 2015, provides the legal and institutional frameworks for the protection and conservation of the environment, as well as sustainable use of natural resources.

The following institutions are established under the Act and have specific functions:

- **National Environment Council –** is responsible for policy formulation and directions for purposes of the Act, setting national goals and objectives, determining policies and priorities for the protection of the environment, etc.;
- **National Environment Management Authority (NEMA) –** NEMA is the principal authority charged with the implementation of all policies, as well as general supervision and coordination over all matters relating to the environment. In consultation with the lead agencies, NEMA is empowered to develop regulations, prescribe measures and standards and, issue guidelines for the management and conservation of natural resources and the environment;

- **National and District Environment Committees –** who are responsible for proper management of the environment within the provinces/districts, and performing any additional functions as prescribed by the Act;
- **Public Complaints Committee –** provides the administrative mechanism for addressing environmental harm/degradation;

The Act places an obligation (as well as penalties for breach or violation) on all persons to safeguard and enhance the environment so that the right to a clean and healthy environment is attained.

Broadly, the Act provides for environmental protection through:

- Environmental impact assessments;
- Environmental audit, monitoring and inspections;
- Water quality standards and affluent emissions; and
- Environmental restoration, conservation, and easements orders.

NEMA is also the Designated National Authority for certain Multilateral Environmental Agreements.

Section 43 of the Act provides for the protection of traditional interests. Specifically, this Act stipulates that the “Cabinet Secretary may, by notice in the *Gazette*, declare the traditional interests of local communities customarily resident within or around a lake basin, wetland, coastal zone or river basin or forest to be protected interests”.

Section 58 of EMCA addresses the need for an Environmental Impact Assessment Licence and stipulates that “any person, being a proponent of a project, shall before for an financing, commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the Second Schedule to this Act, submit a project report to the Authority, in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee”. Additionally, the Act states that the proponent “shall undertake a full environmental impact assessment study and submit an environmental impact assessment study report to the Authority prior to being issued with any licence by the Authority”.

2.2.4 *Wildlife Conservation and Management Act (Act No. 47 of 2013)*

The Wildlife Conservation and Management Act (Act No.47 of 2013) provides for the protection, conservation and management of wildlife in Kenya and applies to all wildlife resources on public, community and private land, and Kenya territorial waters. Part IV of the Act provides for various wildlife regulation mechanisms, specifically the establishment of County Wildlife Conservation and Compensation Committees who shall have various responsibilities, including to “participate at the county level in land use planning initiatives and in consultation with all relevant stakeholders with particular regard to critical wildlife habitats, corridors and dispersal areas for the better management and conservation of wildlife”. Part V of the Act outlines provisions for the establishment of wildlife endowment funds, the functions of which shall be to:

(a) develop wildlife conservation initiatives;
(b) manage and restore protected areas and conservancies;
(c) protect endangered species, habitats and ecosystems;
(d) support wildlife security operations;
(e) facilitate community based wildlife initiatives; and

(f) such other purposes as may be provided for by rules made under this Act.

Section 48 of the Act pertains to listed species and prohibits the carrying out of any activity "which is of a nature that may negatively impact on the survival of a listed species or which is specified in the notice or prohibit the carrying out of such activity without a permit issued by the service". Additionally, the Act outlines the requirements for developing the recovery plans for the conservation and management of all species listed under the Seventh Schedule.

2.2.5 *The Water Act (Act No. 43 of 2016)*

The Water Act (Act No. 43 of 2016) is intended to regulate the management and development of water resources, water and sewerage services. It defines a "water resource" as "*any lake, pond, swamp, marsh, stream, watercourse, estuary, aquifer, artesian basin or other body of flowing or standing water, whether above or below the ground, and includes sea water and transboundary waters within the territorial jurisdiction of Kenya*" whereby:

- "watercourse" means any natural channel or depression in which water flows regularly or intermittently, unless declared not to be a watercourse under this Act; and
- "stream" means the water contained in a watercourse, and includes a river:

The Water Act (Act No. 43 of 2016) also considers the following habitats to be part of the "water resource":

- "in-stream habitat" includes the physical structure of a water resource and the associated vegetation in relation to the bed of the watercourse; and
- "riparian habitat" means the dynamic complex of plant, animal and micro-organism communities and their non-living environment adjacent to and associated with a watercourse.

Although marshes are not explicitly defined in the Act, they would include areas that are frequently or continually inundated with water, characterised by emergent soft-stemmed vegetation adapted to saturated soil conditions (i.e. wetland), and include both freshwater and saltwater wetlands.

According to Section 143 (1) "*A person shall not, without authority conferred under this Act:*

(a) wilfully obstruct, interfere with, divert or obstruct water from any watercourse or any water resource, or negligently allow any such obstruction, interference, diversion or abstraction; or

(b) throw, convey, cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive matter or thing into or near to any water resource in such manner as to cause, or be likely to cause, pollution of the water resource."

2.3 Lender Requirements: International Finance Corporation (IFC) Standards

The project is required to meet the international standards of the World Bank Group, and specifically the IFC. The PS6, which is all about biodiversity, was thus used to maintain best practice for the purpose of the proposed Illasit-Taveta road upgrade. The IFC PS6 (IFC, 2012) and the associated GN6 (IFC, 2019) set out the requirements of this performance standard that have been guided by the CBD, and which integrate the Aichi Biodiversity Targets. PS6 essentially focuses on:

- the protection and conservation of biodiversity;

- maintenance of ecosystem services; and
- sustainable management of living natural resources.

The expected outcomes from any project is a "no-net-loss" or preferably a net gain of biodiversity through careful consultation with the mitigation hierarchy. This includes biodiversity offsets[2] where necessary to compensate for any residual biodiversity losses to maintain the "like-for-like or better" principle.

In accordance with IFC PS6 and GN6, habitats that support biodiversity are divided into three broad categories, namely modified, natural and critical habitats (see Box 2-1). A BAP is generally required for projects located in critical habitats (IFC, 2012a), and is recommended for projects that have the potential to significantly impact natural habitat (IFC, 2019). When a project occurs within a critical habitat/s that support exceptional biodiversity, then a "net gain" of biodiversity value will be required, which can be managed through the BAP process.

Box 2-1: IFC Habitat Categories

The IFC uses the following broad habitat categories to assess a project's influence on biodiversity:

- **Critical habitats:** areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.
- **Natural habitats** are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
- **Modified habitats** are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.

Habitats covers all terrestrial, freshwater or marine ecosystems.

[2] **Biodiversity offsets** are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development, and persisting after appropriate avoidance, minimisation and restoration measures have been taken into account.

3. BIODIVERSITY BASELINE

This biodiversity baseline was developed using available resources to perform both desktop and in-field assessments. Unfortunately, due to the global Covid 19 pandemic, the field-based component was limited to some extent. Nevertheless, the precautionary principle has been applied to ensure that any uncertainties are covered as part of implementation and monitoring of the proposed project.

3.1 Reference/Potential Natural Vegetation

Reference vegetation, or potential natural vegetation (PNV) as referred to by van Breugel *et al.* (2012), is the vegetation that is or would be present in the landscape under current conditions (including current climate and edaphic conditions), but without human interventions. It is used to describe the "pre-impact" conditions and characteristics of ecosystems, and are typically mapped at broad scales.

Kenya has a rich diversity of topographical, climatic, and soil conditions all of which influence the vegetation characteristics within the landscape (Zhou *et al.*, 2017). According to Edwards (1940), Kenya contains three major vegetation types (i.e. forest, grassland, and semi-arid grassland), each comprising several subtypes (e.g. mountain forest, *Acacia*-tall grass savannah, desert shrub-desert grass, etc.). These have since been revised by the van Breugel *et al.* (2015) as part of a collaborative initiative to map PNV throughout East Africa – the map distinguishes 48 different vegetation types, divided in four main vegetation groups: 16 forest types, 15 woodland and wooded grassland types, 5 bushland and thicket types and 12 other types.

There are two PNV types that broadly define the study area through which the Illasit-Taveta road passes, namely: 1) *Acacia-Commiphora* deciduous wooded grassland, and 2) Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket. They are described in more detail below. Generally, areas west of the Illasit-Taveta Road comprises *Acacia-Commiphora* deciduous wooded grassland and *Combretum* wooded grassland, while everything east of the road is Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket. Nested within these two vegetation types are perennial or non-perennial rivers, often lined with wooded riparian vegetation, and permanent or seasonal wetlands (or edaphic grasslands).

3.1.1 *Acacia-Commiphora deciduous wooded grassland*

Acacia-Commiphora deciduous wooded grassland occurs mainly within the north central parts of Tanzania (where it represents the most extensive woody vegetation type in the Serengeti National Park), but extents slightly into south central Kenya (Breugel *et al.*, 2015). These wooded grasslands differ from deciduous bushlands (e.g. Somalia-Masai Acacia-Commiphora deciduous bushland and thicket) by the insignificance of bushy plants other than *Acacia* and *Commiphora* species, and by the relative abundance of grasses (especially perennial grass species).

Characteristic/indicator species that occur within the deciduous wooded grasslands in Kenyan include *Acacia drepanolobium*, *Acacia gerrardii*, *Acacia hockii*, *Acacia mellifera*, *Acacia nilotica*, *Acacia oerfota*, *Acacia polyacantha*, *Acacia reficiens*, *Acacia senegal*, *Acacia seyal*, *Acacia sieberiana*, *Acacia tortilis*, *Acacia xanthophloea*, *Albizia amara*, *Balanites aegyptiaca*, *Commiphora schimperi*, *Cordia monoica*, *Croton dichogamus*, *Grewia fallax*, *Salvadora persica*, and *Terminalia brownii*.

From a conservation perspective, *Acacia-Commiphora* deciduous wooded grasslands are well protected with approximately 22% (of its 37 000km^2 mapped area) occurring within formally protected areas that fulfil the IUCN categories I to IV for protection and sustainable use, with an additional 7% falling within other nationally protected areas.

3.1.2 *Somalia-Masai Acacia-Commiphora deciduous bushland and thicket*

This extensive vegetation type stretches from its southern tip in central Tanzania through the eastern parts of Kenya, where it is dominant, into Ethiopia, where it becomes more expansive across the eastern half of Ethiopia. Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket is characterised by a predominantly woody plant community with a relatively low canopy made up of multiple-stemmed bushes or small bushy trees that are branched from near the base. Emergent trees with well-defined trunks (e.g. *Acacia tortilis*) do occur, and can be found extending well above the main canopy (up to a height of 10m), but they are virtually absent from the drier, northern areas where this vegetation occurs. In higher rainfall areas (especially on rocky hills), the emergent trees occur closer together and are somewhat larger (but only taller than 10m in exceptional situations), and form more of a woodland structure. Localised, impenetrable thickets also form part of this vegetation type.

The indicator species that categorise the main canopy, as well as key emergent species and smaller bushes and shrubs, succulents, and climbers include a relatively diverse list:

Acacia bussei, *Acacia mellifera*, *Acacia nilotica*, *Acacia reficiens*, *Acacia thomasii*, *Acacia tortilis*, *Adansonia digitata*, *Adenia globosa*, *Adenium obesum*, *Balanites aegyptiaca*, *Balanites glabra*, *Bauhinia tomentosa*, *Boscia coriacea*, *Boswellia neglecta*, *Bridelia taitensis*, *Cadaba farinosa*, *Cadaba heterotricha*, *Caesalpinia trothae*, *Calyptrotheca somalensis*, *Calyptrotheca taitense*, *Carphalea glaucescens*, *Cassia abbreviata*, *Caucanthus albidus*, *Cissus quadrangularis*, *Cissus rotundifolia*, *Combretum aculeatum*, *Commiphora africana*, *Commiphora campestris*, *Commiphora edulis*, *Commiphora erythraea*, *Commiphora schimperi*, *Cordia monoica*, *Cordia sinensis*, *Delonix elata*, *Dobera glabra*, *Dobera loranthifolia*, *Ecbolium amplexicaule*, *Ocimum spectabile*, *Euphorbia breviarticulata*, *Euphorbia invenusta*, *Euphorbia nyikae*, *Euphorbia quinquecostata*, *Euphorbia robecchii*, *Euphorbia scheffleri*, *Gerrardanthus lobatus*, *Givotia gosai*, *Grewia arborea*, *Grewia tembensis*, *Grewia tenax*, *Grewia villosa*, *Hymenodictyon parvifolium*, *Kedrostis gijef*, *Lannea alata*, *Lannea triphylla*, *Maerua denhardtiorum*, *Melia volkensii*, *Pergularia daemia*, *Platycelyphium voense*, *Premna hildebrandtii*, *Premna resinosa*, *Pyrenacantha malvifolia*, *Salvadora persica*, *Cynachum viminale*, *Sericocomopsis hildebrandtii*, *Sericocomopsis pallida*, *Sesamothamnus rivae*, *Sterculia rhynchocarpa*, *Sterculia stenocarpa*, *Terminalia orbicularis*, *Terminalia parvula*, *Terminalia spinosa*, *Thilachium thomasii*, and *Thunbergia guerkeana*.

Various grasses do occur in the understorey, such as the ephemeral species of *Aristida adscensionis*, *Aristida congesta*, *Brachiaria eruciformis* and *Brachiaria leersioides*, as well as the short-lived, perennial species of *Cenchrus ciliaris*, *Chloris roxburghiana* and *Schmidtia pappophoroides*.

3.1.3 *Wooded riparian*

Indicator trees in wooded riparian vegetation include: *Diospyros mespiliformis*, *Ficus sycomorus*, *Syzygium guineense*, and *Trichilia emetica*.

3.1.4 *Wetland vegetation*

Indicator wetland plants include: *Aristida adscensionis*, *Chloris gayana*, *Cynodon dactylon*, *Echinochloa haploclada*, *Panicum coloratum*, *Cenchrus mezianus*, *Tragus berteronianus*,

3.2 Land Cover Overview and Habitat Availability

Current land cover and land use activities play a significant role in influencing biodiversity patterns and processes. Up to 60% of the broader region supports extensive rangelands comprising mostly of bushland, thicket and wooded grassland. Another 19% includes vegetation with higher woody vegetation of which 8% includes montane forest on Mount Kilimanjaro. A relatively small area has been transformed by human settlement and agriculture. However, this situation drastically changes with proximity to the existing Illasit-Taveta road, highlighting the significant impact of land use change along the road (i.e. ribbon development) - Figure 3-1 and Figure 3-2 illustrate the significant changes in land cover composition from within the broader region to the 10km and 1km road buffers.

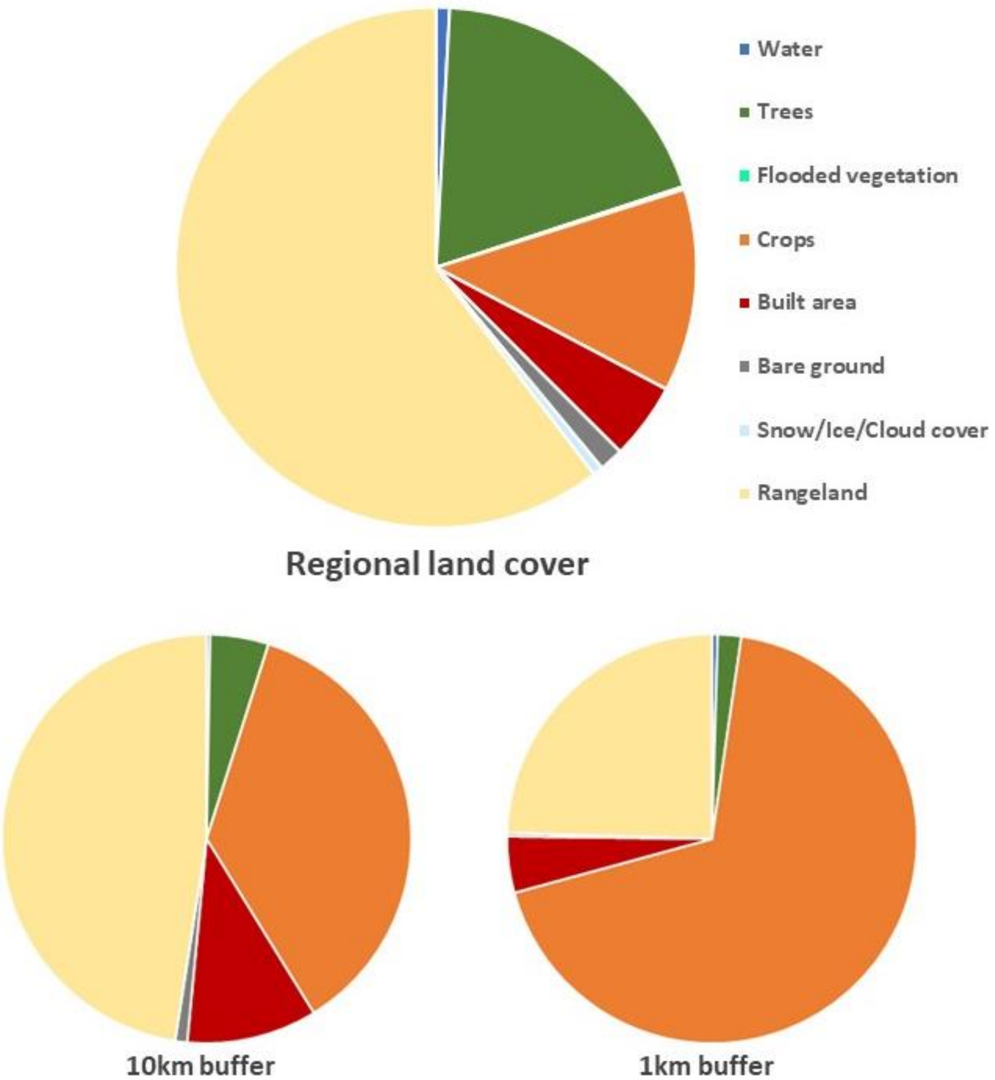

Figure 3-1 Relative proportion of land cover classes for the broader region (top) compared to the land cover adjacent to the existing Illasit-Taveta road based on a 10km (bottom left) and 1km (bottom right) buffer

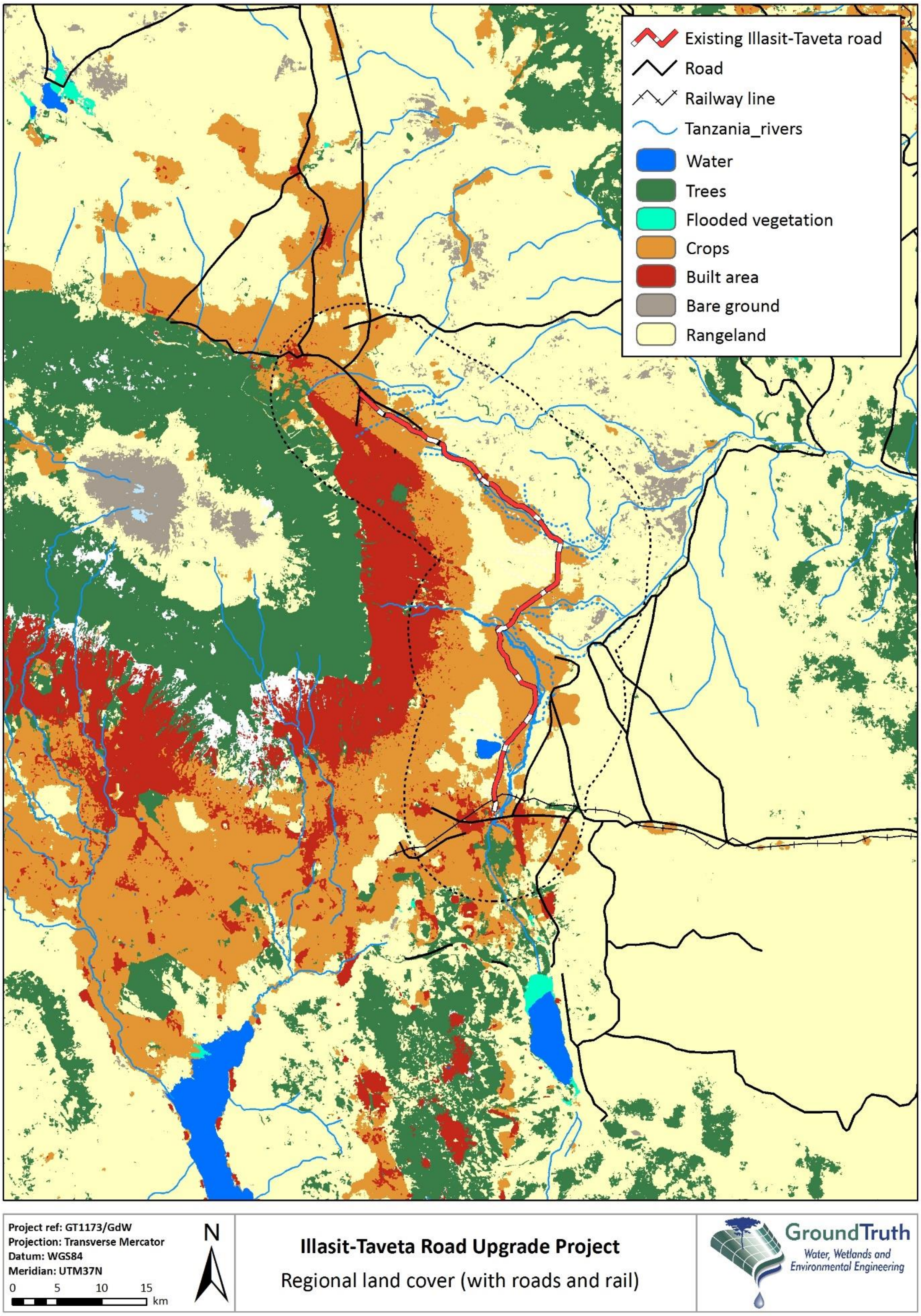

Figure 3-2 Land cover overview of the study area through which the existing Illasit-Taveta Road passes

3.3 Description of Flora along the Illasit-Taveta Road

In total, there are 225 families, 1538 genera and 6293 indigenous plant species that are known to occur in Kenya, with Fabaceae representing the most diverse family with 98 genera and 576 species (Zhou *et al.*, 2017). In addition, there are 62 families, 302 genera and 588 exotic species.

A small diversity of 60 indigenous plant species were recorded along the road corridor during March 2021, with another 57 being exotic or invasive species indicating the largely degraded state of vegetation along the road – this is congruent with the high levels of transformation (see Section 3.2). The indigenous component comprised predominantly of trees and shrubs with very few grasses and herbs observed due to dry climatic conditions and/or identified due to the lack of fertile plant material.

The main indigenous tree species encountered were:

Acacia nilotica, *Acacia robusta* subsp. *usambarensis*, *Acacia senegal*, *Acacia seyal* var. *seyal*, *Acacia xanthophloea*, *Acacia tortilis ssp spirocarpa*, *Albizia amara*, *Albizia gummifera*, *Balanites aegyptaica*, *Combretum molle*, *Croton megalocarpus*, *Croton macrostachyus*, *Faidherbia albida*, *Ficus sycomorus* subsp. *sycomorus*, *Lannea schweinfurthii* var. *stuhlmannii*, *Philenoptera eriocalyx*, and*Ziziphus mucronata* subsp. *mucronata.* **Appendix 1** presents a full list of plants recorded along the road.

3.3.1 *Vegetation communities*

Apart from the small area of natural vegetation at point 02 (see Figure 3-4), the existing road corridor passes through intensively farmed agricultural land. From the higher altitude around Illasit, where maize plantations are dominant, this gives way to fields of onions and tomatoes. The fields still contain some large *Acacia tortilis* trees (Figure 3-3), which provide shade for local inhabitants and livestock. The drainage lines and non-perennial rivers/streams still have a few indigenous trees but, in general, they are colonised by a mixture of invasive species that form the road verge in its entirety. The only permanent stream, the Lumi River, has a more definite fringe of natural vegetation, but no more than 30m on either side.

Figure 3-3 Free-standing *Acacia tortilis* trees on the edge of the existing Illasit-Taveta Road

The various plant communities that occur along the road are summarised as follows in terms of characteristic species:

- **Cultivated areas:** Mostly fields of onions, tomatoes and maize with some pigeon peas.
- **Inhabited areas:** Made up of largely ruderal, weedy and/or exotic species such as *Polyalthia longifolia* subsp. *pendula*, *Persea americana*, *Grevillea robusta*, *Carica papaya*, *Austrocylindropuntia subulata* subsp. *exaltata*, *Psidium guajava*, *Terminalia catappa*, *Terminalia mantaly*, *Ceiba pentandra*, *Cnidoscolus aconitifolius*, *Jatropha curcas*, *Manihot esculenta*, *Manihot glaziovii*, *Acrocarpus fraxinifolius*, *Delonix regia*, *Artocarpus heterophyllus*, *Ficus benjamina*, *Citrus sinensis*, *Azadirachta indica*, *Melia azedarach*, *Cascabela thevetia*, *Helianthus annuus*, *Tithonia diversifolia*, *Ipomoea carnea* subsp. *carnea*, *Tecoma stans var. stans*, *Duranta erecta*, *Agave americana*, *Agave sisalana*, *Saccharum officinarum* and *Cocos nucifera*
- **Degraded wooded grasslands:** *Acacia spp.*, *Albizia spp.*, *Balanites spp.* and *Croton spp.*
- **Bushland and thicket:** Comprising species that are typical of Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket but in a poor to moderate condition, occurring mainly within the Rombo section of the road (i.e. Section 3 of the Illasit-Taveta road – *c.f.* Section 4.1.2), where several species of Commiphora were recorded, namely *Commiphora africana*, *C. campestris*, *C. confusa*, *C. edulis*, *C. schimperi.* A relatively rare species of Acacia (i.e. *Acacia ancistroclada*) was also recorded in this section of the road.
- **Riparian thickets and gallery forest:** The main components being *Ficus sycomorus*, *Tabernaemontana ventricosa*, *Acacia xanthophloea* and the occasional *Mimusops riparia.*

3.3.2 *Species of Conservation Concern*

The only species of conservation concern (SCC) that was recorded during the field survey in March 2021 was *Mimusops riparia*, a riparian tree from the family Sapotaceae that is listed as Vulnerable under criteria B1+2b (Lovett and Clarke, 1998). It was found in gallery and riparian forest along the Lumi River. It is long overdue for re-assessment of its threat status; the current assessment took place in 1998. Given the range-restricted nature of this species, it is possible that the Lumi River is triggered as Critical Habitat. However, due to the lack of distribution data for this species, it is difficult to state with certainty whether its presence triggers Critical Habitat. Furthermore, the extent of occurrence (EOO) estimated using the 31 point localities that are available in the Global Biodiversity Information Facility (GBIF) is in the region of 150,000 to 200,000 km^2, which is well beyond the IUCN threshold set for restricted range – reported records from the Tana River would extent this range further norther into Kenya.

At point 05 (see Figure 3-4) there is a pond that appears to fill from the Lumi and is surrounded by natural forest. A guard belonging to the "Chala Water Programme" claimed that he was there to take visitor fees and objected to us walking around it. This should be flagged as having local support and conservation and avoided during the construction.

3.3.3 *Invasive Alien Plants (IAPs)*

Table 3-1 provides a list of exotic plants (invasive and naturalised) that have colonised the road verges and edges of cultivation along the existing Illasit-Taveta road, as well as within the watercourses (river/drainage channels) at the various road crossings. All of the invasive plants presented in Table 3-1 can be of significant cost to farming activity along the corridor and will be spread widely if seed is moved during the construction phase. IAPs have greatly compromised biodiversity in the area, causing significant degradation to vegetation that remains in the landscape.

Table 3-1 List of exotic plant species that were recorded along the Illasit-Taveta road

Family	Scientific name
Invasive plants	
Verbenaceae	*Lantana camara*
Asteraceae	*Xanthium strumarium*
Euphorbiaceae	*Ricinus communis*
Solanaceae	*Solanum campylacanthum*
Caesalpiniaceae (Leguminosae)	*Senna obtusifolia*
Asteraceae	*Tithonia diversifolia*
Euphorbiaceae	*Croton bonplandianus*
Caesalpiniaceae (Leguminosae)	*Chamaecrista absus*
Caesalpiniaceae (Leguminosae)	*Senna bicapsularis*
Apocynaceae	*Cascabela thevetia*
Caesalpiniaceae (Leguminosae)	*Acrocarpus fraxinifolius*
Papaveraceae	*Argemone mexicana*
Papaveraceae	*Argemone ochroleuca*
Asteraceae	*Parthenium hysterophorus*
Solanaceae	*Datura stramonium*
Solanaceae	*Datura metel*
Solanaceae	*Datura ferox*
Euphorbiaceae	*Croton bonplandianus*
Mimosaceae (Leguminosae)	*Prosopis juliflora*
Mimosaceae (Leguminosae)	*Leucaena leucocephala*
Cactaceae	*Austrocylindropuntia subulata* subsp. *exaltata*
Naturalised plants	
Caesalpiniaceae (Leguminosae)	*Senna spectabilis*
Caesalpiniaceae (Leguminosae)	*Senna siamea*
Moraceae	*Artocarpus heterophyllus*
Euphorbiaceae	*Ricinus communis*
Caesalpiniaceae (Leguminosae)	*Senna didymobotrya*
Caesalpiniaceae (Leguminosae)	*Senna obtusifolia*
Asteraceae	*Tithonia diversifolia*
Asteraceae	*Helianthus annuus*
Meliaceae	*Melia azedarach*
Solanaceae	*Datura stramonium*
Solanaceae	*Datura metel*
Bignoniaceae	*Tecoma stans* var. *stans*
Meliaceae	*Azadirachta indica*
Caesalpiniaceae (Leguminosae)	*Parkinsonia aculeata*
Combretaceae	*Terminalia catappa*
Myrtaceae	*Psidium guajava*
Verbenaceae	*Duranta erecta*
Asteraceae	*Ageratum conyzoides*
Agavaceae	*Agave sisalana Perrine*

Family	Scientific name
Convolvulaceae	*Ipomoea carnea* subsp. *carnea*
Arecaceae	*Cocos nucifera*
Caesalpiniaceae (Leguminosae)	*Senna spectabilis*
Caesalpiniaceae (Leguminosae)	*Senna siamea*
Moraceae	*Artocarpus heterophyllus*
Euphorbiaceae	*Ricinus communis*
Caesalpiniaceae (Leguminosae)	*Senna didymobotrya*
Caesalpiniaceae (Leguminosae)	*Senna obtusifolia*
Asteraceae	*Tithonia diversifolia*

3.4 Description of Fauna

3.4.1 *Mammals*

Kenya is home to a rich diversity of mammalian fauna, possessing approximately 390 species (Musila *et al.*, 2019). This includes 106 species of rodents, 104 species of bats, 63 species of even-toed ungulates, 36 species of insectivores and carnivores, 19 species of primates, five species of elephant shrews, four species of hyraxes and odd-toed ungulates, three species of afrosoricids, pangolins and hares and one species of aardvark, elephant, sirenian and hedgehog (Musila *et al.*, 2019).

Although often viewed as a panacea for all conservation challenges, national parks are seldom sufficient to effectively protect and maintain a country's faunal diversity. In Kenya, sparse populations of wildlife in national reserves reflect their marginal wildlife importance, poor protection and heavy utilisation by livestock (Western et al., 2009). In fact, a significant proportion (more than 60%) of Kenya's large wild herbivores reside outside of protected areas throughout the year (Ojwang *et al.*, 2017). However, large game is well represented within the country's network of protected areas, with the presence of large populations of big game being one of the key factors driving the selection of areas in which to establish protected areas (Musila *et al.*, 2019). Conversely, protected areas were generally not established with the goal of conserving smaller mammals, and these thus often occur outside of protected areas, placing them at increased risk (Musila *et al.*, 2019). A further limitation to the success of Kenyan national parks in protecting and conserving mammal species is that only a fraction of the annual migratory range of large herbivores is included within them (Western et al., 2009). For example, most of Kenya's national parks possess only the dry season ranges of migratory species, such as wildebeest *Connochaetes taurinus*, resulting in animals having to migrate out of the park in the wet season, potentially placing them at increased risk (Western *et al.*, 2009).

Given that much of Kenya's wildlife exists outside of national parks and that many large herbivore species are likely to move through unprotected areas during their annual migrations, it is evident that development, even that outside of protected areas, has the potential to negatively impact on the country's mammalian diversity. This may occur through several mechanisms, such as habitat destruction and degradation and impeding of migratory routes. When assessing areas for potential development, it is thus crucial that the ability of the area to support mammals of conservation concern be understood. Furthermore, it is critical to understand whether the area falls within important habitat corridors and migratory routes.

Mammals of conservation concern

Of the 390 Kenyan mammal species, approximately 195 (or 50% of Kenyan diversity) are anticipated to occur within the broader study region. However, the actual number of species likely to occur within the vicinity of the road is anticipated to be far lower, with a review of actual records for the area suggesting that approximately 30 mammal species have been recorded in the area (GBIF, 2021). This may, however, be an underestimate as common species, such as Common Duiker *Sylvicapra grimmia*, which likely do occur in the area have not been recorded. Species recorded for the area largely include common antelope species, such as Impala *Aepyceros melampus*, Bushbuck *Tragelaphus scriptus*, and Common Wildebeest *Connochaetes taurinus*. The high number of species anticipated to occur within the broader study region is likely attributable to the presence of nearby national parks, such as Tsavo West National Park (east of the Illasit-Taveta Road) and Amboseli National Park (north west of Illasit).

Of the approximately 195 species anticipated to occur within the broader study region, 25 are Red Listed (Table 3-2). A closer review of these species' ranges revealed that seven of these species, namely Abbott's Duiker *Cephalophus spadix,* Mt. Kilimanjaro Guereza *Colobus caudatus*, East African Highland Shrew *Crocidura allex*, Eastern Tree Hyrax *Dendrohyrax validus*, Hippopotamus *Hippopotamus amphibius,* African Wild Dog *Lycaon pictus,* and Harrison's Large-Eared Giant Mastiff Bat *Otomops harrisoni*, have ranges that, whilst occurring in the broader study region, do not overlap with the proposed road alignment. These species are thus unlikely to be significantly impacted by the construction of the road. It is noted that the Red Listed species anticipated to occur within the vicinity of the road is skewed towards large mammals, with small rodents largely absent from the list. Kenya is one of Africa's most important countries for conservation of rodents and insectivores because of the large number of unique species found within the country (CBD, 2015). However, small mammals in the country are relatively poorly studied. As such, it is recognised that the list of species of conservation concern is not exhaustive and mammals not presented, particularly small rodents, may occur in the proximity of the proposed development.

Based on the further refinement of the list of Red Listed mammals anticipated to occur within the broader study region, 18 species have ranges that overlap with the proposed road alignment. Whether or not these species will occur in the vicinity of the road is largely dependent upon whether the area supports suitable habitat for them. In order to assess the likelihood of Red Listed mammals occurring within the vicinity of the road, a review of the habitat preferences for each species whose range overlaps with the proposed road alignment was undertaken and is summarised in Table 3-2.

The area within which the proposed road alignment falls reportedly has relatively low species richness and low species density (Ojwang *et al.*, 2017). Despite the low species densities, the area is reported to be a human-wildlife conflict hotspot, providing an indication that wildlife is undoubtedly present within the vicinity (Ojwang *et al.*, 2017).

Table 3-2 IUCN Red Listed mammals species anticipated to occur in the broader study region with brief descriptions of habitat preferences and their likelihood of occurrence within the area of influence of the Illasit-Taveta road (IUCN Red List, 2021)

Common name	Scientific name	Red List category	Habitat preference	Likelihood of Occurrence
Cheetah	*Acinonyx jubatus*	Vulnerable	Savanna, shrubland, grassland, desert	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of cheetah within the area is **possible** as some suitable habitat does exist.
African Clawless Otter	*Aonyx capensis*	Near Threatened	Seldom found far from freshwater	Given the presence of the Lumi River in the vicinity of the road upgrade, the presence of African Clawless Otters is **possible.** They are, however, likely to stay near the river given the relatively limited availability of other freshwater habitats in the area.
White Rhino	*Ceratotherium simum*	Near Threatened	Grassland in bushveld savanna	Given their dependency on grasslands, and the limited availability of these in the vicinity of the road upgrade, the presence of White Rhino is **possible** but **unlikely.** The high likelihood of poaching outside of protected areas further reduces the likelihood of finding the species in the vicinity of the road upgrade
Black Rhino	*Diceros bicornis*	Critically Endangered	Wide variety of habitats, from deserts to wetter wooded areas	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Black Rhino within the area is **possible** as some suitable habitat does exist. The high likelihood of poaching outside of protected areas reduces the likelihood of finding the species in the vicinity of the road upgrade.
African Straw-Coloured Fruit-Bat	*Eidolon helvum*	Near Threatened	Wide variety of habitats, from forest to urban areas	**Likely.** The high habitat tolerance of the species and its ability to survive in even urban setting suggests that it may well occur in the area.
Plains Zebra	*Equus quagga*	Near Threatened	Wide variety of habitats, with the exception of rain forests, deserts, dune forests and Cape Sclerophyllous vegetation	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Plains Zebra within the area is **possible** as some suitable habitat does exist.
Giraffe	*Giraffa camelopardalis*	Vulnerable	Most commonly savanna and	Although the habitat through which the road upgrade

Common name	Scientific name	Red List category	Habitat preference	Likelihood of Occurrence
			woodland	passes is largely degraded, the occurrence of Giraffe within the area is **possible** as some suitable habitat does exist.
Striped Hyaena	*Hyaena hyaena*	Near Threatened	Arid to semi-arid environments in open habitat or light thorn bush	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Striped Hyaena within the area is **possible** as some suitable habitat does exist.
Gerenuk	*Litocranius walleri*	Near Threatened	Bushland, thickets, semi-arid and arid thornbush, avoiding dense woodlands and very open grass-dominated habitats	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Gerenuk within the area is **possible** as some suitable habitat does exist.
African Savanna Elephant	*Loxodonta africana*	Endangered	Savanna, shrubland, grassland and desert	Given that the road upgrade passes through a known elephant migration corridor the occurrence of the species in the vicinity is **likely.**
Striped Leaf-Nosed Bat	*Macronycteris vittatus*	Near Threatened	Variety of savanna habitat types	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Striped Leaf-Nosed Bat within the area is **possible** as some suitable habitat does exist.
Lion	*Panthera leo*	Vulnerable	Wide variety of habitats, excluding tropical rainforest	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Lion within the area is **possible** as some suitable habitat does exist.
Leopard	*Panthera pardus*	Vulnerable	Wide variety of habitats, requiring contiguous habitat with low human impacts to reproduce successfully	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Leopard within the area is **possible** as some suitable habitat does exist.
Beisa Oryx	*Oryx beisa*	Endangered	Arid and semi-arid bushland and grassland	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Beisa Oryx within the area is **possible** as some suitable habitat does exist.
Mountain Reedbuck	*Redunca fulvorufula*	Endangered	Ridges and hillsides in broken rocky country and high-altitude grasslands	Limited suitable habitat exists for the species within the vicinity of the road upgrade, so although their occurrence within the area is **possible**, it is **unlikely.**
Temminck's Pangolin	*Smutsia temminckii*	Vulnerable	Savanna and woodland in low-lying regions with moderate to	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of Temminck's

Common name	Scientific name	Red List category	Habitat preference	Likelihood of Occurrence
			dense scrub. Also occurs in floodplain grassland, rocky slopes and sandveld up to 1,700 m asl. Occurs widely on well-managed livestock farms, but is absent from croplands and human settlements	Pangolin within the area is **possible** as some suitable habitat does exist. However, the presence of suitable habitat in much of the area reduces its likelihood of occurrence.
African Buffalo	*Syncerus caffer*	Near Threatened	Wide variety of habitats, including woodland, grassland and forest	Although the habitat through which the road upgrade passes is largely degraded, the occurrence of African Buffalo within the area is **possible** as some suitable habitat does exist.
Lesser Kudu	*Tragelaphus imberbis*	Near Threatened	associated with *Acacia-Commiphora* thornbush, generally avoiding open spaces and long grass	Due to the presence of *Acacia-Commiphora* thornbush within the vicinity of the road upgrade, the likelihood of occurrence for Lesser Kudu is **possible.**

The proposed development is a road upgrade rather than a road construction. As such, the land is already largely transformed. Furthermore, there is large amount of human settlement and intensive agriculture within the vicinity of the road. As such, it is unlikely that the area offers suitable habitat for most mammal species, and few are expected to reside in the area permanently. It must, however, be acknowledged that some species may utilise the area intermittently.

Corridors and migration

East African ecosystems are characterised by seasonal migrations of large herbivores, such as Elephants (*Loxodonta africana*) and Wildebeest (*Connochaetes taurinus*) (Schüßler *et al.*, 2018). These migrations are critical for distributing resources across vast landscapes, thus driving habitat heterogeneity (Schüßler *et al.*, 2018). However, anthropogenic activities, such as agricultural expansion, are blocking off many of these migratory routes, reducing population connectivity and leading to a corresponding decline in population numbers (Schüßler *et al.*, 2018). It is therefore crucial that migratory routes and habitat corridors present within a development footprint are considered and that strategies to maintain or restore landscape habitat connectivity are implemented.

A review of migratory routes located in the region suggests that the proposed road alignment could potentially impact the Kimana migration corridor identified by Schüßler *et al.* (2018). This corridor is, however, already highly threatened by expanding agriculture. Elephant migrations are known to occur within the region, predominantly between Amboseli, Chyulu Hills and Tsavo West National Parks (Schüßler *et al.*, 2018) – refer to Figure 3-6, which shows the position of these protected areas in relation to the proposed road upgrade. However, elephant have been reported to move from Tsavo West National Park in an (east to west) direction towards Kilimanjaro National Park (Figure 3-4) (Ojwang *et al.*, 2017). Due to dense inhabitation (settlement and intensive cultivation) on the eastern slopes of Mount Kilimanjaro and along the Kenyan-Tanzanian border, elephant and other mammals cannot reach Kilimanjaro National Park other than via the Tsavo West-Amboseli movement corridor to the north. Nevertheless, occasional movements of wildlife are still reported across the Illasit-Taveta road, so the proposed upgrade project still poses some risk to both elephant and other wildlife (see Box 3-1 below).

Schüßler *et al.* (2018) defined the location of important migration corridors and identified bottlenecks for population connectivity of migratory elephants (as an indicator species) in the Kenyan-Tanzanian borderlands. The eight migration corridors assessed by Schüßler *et al.* (2018) are all located north, north-west and west of Kilimanjaro National Park. There are two important corridors, namely Kimana and Lenkati/Lolterish, that allow connectivity between Amboseli and Kimana Wildlife Sanctuary and further across to Chyulu Hills and Tsavo West (Figure 3-6). Kimana Sanctuary is a key area for seasonal overlap and interbreeding of populations from Amboseli and Tsavo West (Western and Lindsay, 1984). However, the Kimana corridor, which crosses the C102 road north-north-west of Illasti town, decreased in width to only 400 m by 2017 (Schüßler *et al.,* 2018). The Mbirikani corridor that crosses the C102 ten kilometres north of the Kimana corridor is still viable but expected to decline with future land use changes (Kioko and Seno, 2011; Kikoti, 2016). Schüßler *et al.* (2018) recommended formal protection and further monitoring of these corridors, together with plans to guarantee exclusion of agriculture from important corridor areas.

Box 3-1: Stakeholder Engagement on Wildlife Corridors

In February 2021, Richard Bonham, the Director of Operations for the Big Life Foundation (BLF), an NGO based in Chyulu Hills, was contacted regarding the proposed upgrade of the Illasit-Taveta Road. Contact was then made with the BLF team based at the Rombo Patrol Base who were able to indicate the location of an important wildlife crossing point just north of their camp between points 01 and 02 (Figure 3-4). This part of the road has natural habitat on both sides of the road and is apparently used by Eland (*Tragelaphus oryx*), Plains Zebra (*Equus quagga*), Giraffe (*Giraffa camelopardalis*), Impala (*Aepyceros melampus*) and, occasionally, Elephant (Loxodonta *africana*). A small, tented camp called Olowuero Camp, located near the BLF Camp, was also visited, and staff from this camp confirmed that wildlife do cross the road at the point indicated by BLF.

Two failed attempts were made to locate KWS staff at Njukini Camp (Figure 3-4), however, the KWS Warden in Taveta, Mr Jirma Abdi Noor, who was very knowledgeable about wildlife movement across the Taveta County portion of the road, as well as information on Lake Chala and other freshwater springs in the area. He stated that he had a telephone call with Mr Nato Simiyu in 2020, who claimed he was working on the road upgrade project. Mr Jirma Abdi Noor said that he had repeated his assertion that the Njukini area still served as a crossing point for wildlife, but that the areas is becoming rapidly cut off by farming development and expanding human settlement – this is congruent with the findings made from the desktop mapping (see Section 4.1.3 and Appendix 2). In addition, the drainage lines at points 03 and 04 (Figure 3-4) appear to still offer some natural habitat for a wildlife crossing, *albeit* constricted and confined, as does the Lumi River bridge at point 05 (Figure 3-4). If a riparian border of 30m either side was enforced on the Lumi River it would allow movement to the international boundary with Tanzania and thereafter to the north or south. Mr Johnson Mwawasi, Managing Director of the Lumi River Resort, confirmed that the historically, wildlife would cross the road at these points, and used to use the Lumi River and various springs to drink water. However, the increasing human population along the Illasit-Taveta road restricts wildlife movement between the park and the road. Mr Mwawasi also confirmed that wildlife now tend to move between the park and Lake Jipe where there is no fence and the human population is still fairly sparse.

The former Assistant Director of KWS for Tsavo East and West, Mr Ken Ocheng, who is now at KWS Voi, was recently contacted. He confirmed the information on the two wildlife corridors described above, and agreed that a wildlife crossing design similar to that employed at Kimana on the Emali Oloitokitok road would be suitable to slow traffic and prevent collisions with animals.

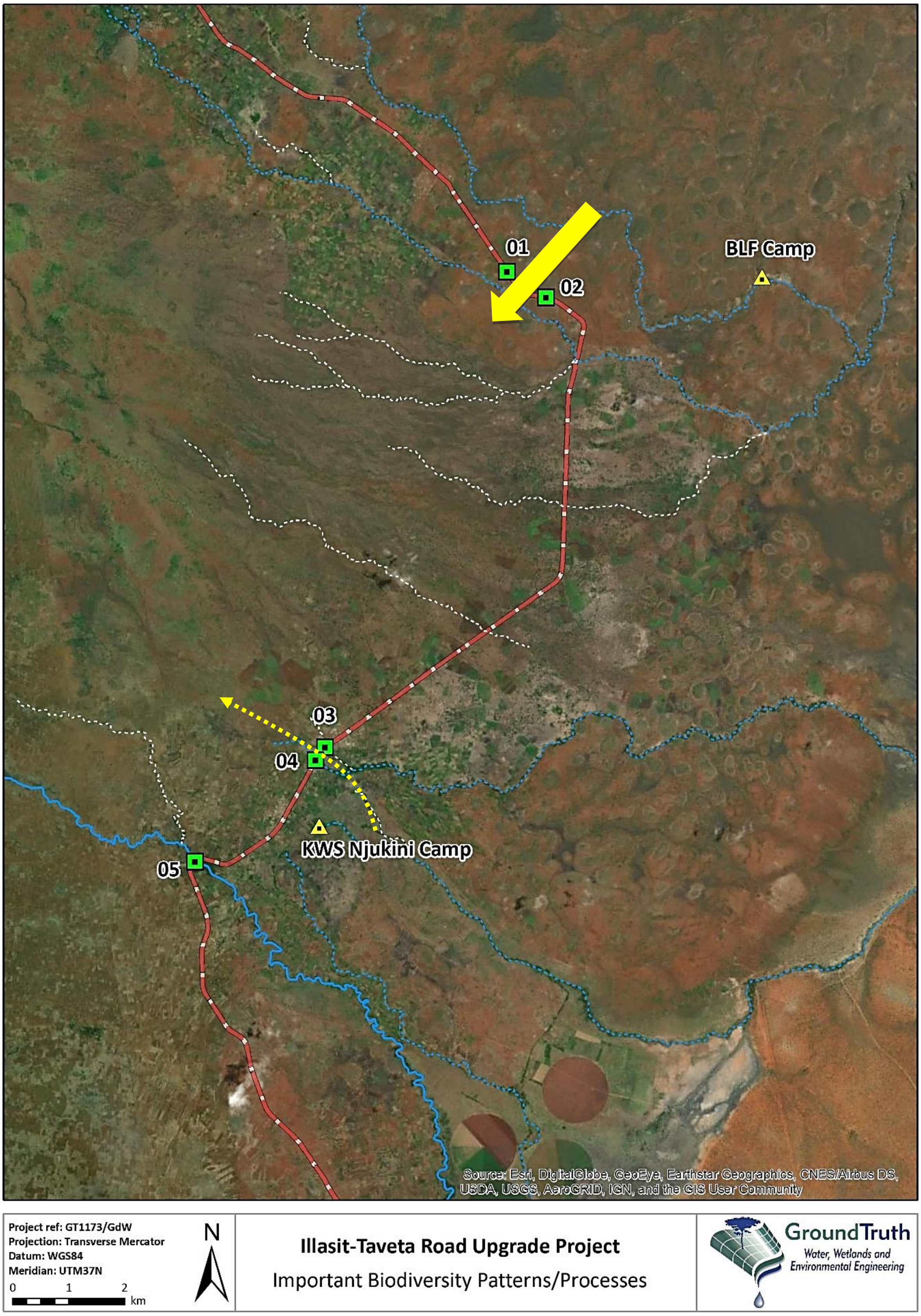

Figure 3-4 Location of two wildlife corridors (yellow arrows), the main Rombo Corridor between points 01 and 02 that is an active wildlife crossing, and the minor Njukini Corridor between points 03 and 04 that provides limited connectivity

Roads and wildlife

Road infrastructure has the potential to have numerous negative impacts on wildlife. Specifically, road infrastructure can lead to increased mortalities, isolate populations and reduce habitats and connectivity for wildlife populations (Lala *et al.*, 2021). In addition, roads alter animal activity, increase habitat disturbance and enhance invasion by alien species (Lala *et al.*, 2021) – the latter being clearly evident based on the vegetation field assessment (see Section 3.2.3).

Roadkill is one of the greatest anticipated impacts associated with road infrastructure, particularly in a country such as Kenya where much of the wildlife exists outside of national parks. Roadkill is not homogenous in distribution, with more mortalities witnessed in sections of road that are surrounded by thick vegetative cover rather than open areas (Lala *et al.*, 2021). Additionally, roadkill is not homogenous in terms of the type of species impacted. For example, nocturnal and crepuscular species are more likely to be killed by collisions with vehicles than diurnal species, possibly due to reduced driver visibility at night (Lala *et al.*, 2021). In Kenya, small mammals are often more impacted by roads than larger mammals, largely because road establishment doesn't take into consideration small mammal ecology and distribution, thus often fragmenting habitats and leading to the edge effect, whereby changes in the population or community occur at the boundary of a habitat.

In addition to occurring most commonly where thick vegetation is present, roadkill is often associated with contiguous protected habitat, proximity to rivers and shrub vegetation (Lala *et al.*, 2021). Furthermore, linear landscape features, such as riparian corridors and ditches, may channel wildlife alongside or across roadways (Lala *et al.*, 2021). When assessing an area for the potential development of a road it is therefore crucial that these features are identified in order to fully understand the impact that the road may have on mammal populations.

3.4.2 *Avifauna*

Kenya is ranked 13th in the world and 3rd in Africa for its bird diversity, which supports a total of 1,058 species excluding vagrant/accidental, uncertain and introduced records (BirdLife International, 2021). From this diversity there are 90 species that are currently Red Listed globally according to the IUCN, and there are 13 species that are endemic to the country (del Hoyo and Collar, 2014; del Hoyo and Collar, 2016). According the to IUCN Red List there are over 600 species that potentially occur in study area based on expected bird distributions, and this includes four Critically Endangered, ten Endangered, eight Vulnerable, 14 Near Threatened, and one Data Deficient species of bird. Given the availability, condition and fragmentation of habitats, it is expected that study area will only support a small fraction of the probable diversity. The Kenya Bird Atlas includes observations of up to 239 bird species (or 23% of Kenya's bird diversity, and approximately 40% of the probable diversity for the study area) that have been recorded from up to 11 pentads[3] that occur along the Illasit-Taveta Road.

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[3] A pentad is effectively a 5 by 5-minute grid (approximately 340ha) that is used by Kenya Bird Map to map the current distribution of all of Kenya's bird species and describe their status. Pentads used to assess occurrence of birds within the study area include: 0255_3735, 0250_3730, 0250_3735, 0255_3740, 0250_3745, 0250_3745, 0255_3745, 0300_3745, 0305_3745, 0310_3745, and 0320_3745. These pentads

Birds that have been more **commonly recorded** (from four or more pentads) include: Helmeted Guineafowl *Numida meleagris*, Von der Decken's Hornbill *Tockus deckeni*, White-bellied Go-away-bird *Crinifer leucogaster*, Black-faced Sandgrouse *Pterocles decorates*, Emerald-spotted Wood Dove *Turtur chalcospilos*, Namaqua Dove *Oena capensis*, Lilac-breasted Roller *Coracias caudatus*, Blue-naped Mousebird *Urocolius macrourus*, Cinnamon-breasted Bunting *Emberiza tahapisi*, Hildebrandt's Starling *Lamprotornis hildebrandti*, Superb Starling *Lamprotornis superbus*, and White-browed Sparrow-Weaver *Plocepasser mahali*.

Birds that have been **occasionally recorded** (from only one pentad) include (from a list of 143 species): African Hawk-eagle *Aquila spilogaster*, Common Ostrich *Struthio camelus*, Marabou Stork *Leptoptilos crumenifer*, Black Stork *Ciconia nigra*, Greater Painted-snipe *Rostratula benghalensis*, Eurasian Scops Owl *Otus scops*, African Grey Woodpecker *Dendropicos goertae*, Striped Kingfisher *Halcyon chelicuti*, Red-faced Cisticola *Cisticola erythrops*, Zitting Cisticola *Cisticola juncidis*, Pangani Longclaw *Macronyx aurantiigula*, Black-throated Wattle-eye *Platysteira peltata*, Baglafecht Weaver *Ploceus baglafecht*, and Bronzy Sunbird *Nectarinia kilimensis*.

The observations also include the following Red Listed species:

- Grey Crowned Crane *Balearica regulorum* (**Endangered**) –
- Southern Ground-hornbill *Bucorvus leadbeateri* (**Vulnerable**) – reported from single observation in the area east of Illasit, and is more commonly recorded in Tasvo West.
- Fischer's Lovebird *Agapornis fischeri* (**Near Threatened**) – the northern and western lowland areas surrounding Mount Kilimanjaro forms the eastern extent of its native distribution range, which stretches across northern Tanzania. It has been recorded east and north of Illasit and north of Loitokitok.

Endemic and/or range-restricted bird species are unlikely to inhabit the study area with the exception of possibly Brown and White Barbet *Lybius senex* – Chyulu Hills and the northern boundary of Tsavo West roughly define the southern extent of its occurrence.

3.4.3 *Herpetofauna*

Amphibians

Kenya is known to support approximately 111 species of amphibian (including seven species of caecilian). Of this diversity, up to 34 species (or 30% of the Kenyan diversity) of amphibian are expected to occur within the broader region. However, the actual diversity that is more likely to correspond with the study area is closer to 15 species based on the known distributions. These include mainly common and widespread species such as Common Reed frog *Hyperolius viridiflavus*, Senegal Kassina *Kassina senegalensis*, Garman's Toad *Sclerophrys garmani*, Guttural Toad *Sclerophrys gutturalis*, Northern Clawed Frog *Xenopus borealis*, Nile Rocket Frog *Ptychadena nilotica*, Anchieta's Rocket Frog *Ptychadena anchietae*.

None of the amphibians that are expected to occur in the study area are Red Listed. There are no critical habitats for amphibians that occur within the study area or which would be affected by the

contain a total of 30 full protocol cards (i.e. where observers have fully complied with the bird atlas protocols) and 55 adhoc observations.

road upgrade project. The forested habitats in Taita Hills, located 60km to the east, is the closest critical habitat for amphibians. The small fragment of forest in Kitobo located approximately 12km south-west of the study area has recently been discovered to be a unique hotspot for herpetofauna, including localised forest endemics.

Reptiles

Kenya is known to support up to 280 species of reptile. Of this diversity, up to 78 species (or 28% of the Kenyan diversity) of reptile are expected to occur within the broader region based on distributional data from the Kenya Reptile Atlas (Bwong *et al.*, 2014) and the IUCN Red List database. This expected diversity includes two tortoises, eight lizards, 11 skinks, two agamas, five geckos, six chameleons, 43 snakes, and one crocodile. however, the actual diversity is likely to be closer to 40 species based on the known distributions and habitat requirements of other species.

Reptiles that have been recorded from the study include Leopard Tortoise *Stigmochelys pardalis,* Nile Monitor *Varanus niloticus,* Red-headed Rock Agama *Agama lionotus*, Boulenger's Scrub Lizard *Nucras boulengeri,* Great Plated Lizard *Broadleysaurus major,* Sudan Mabuya *Trachylepis brevicollis,* Tree Skink *Trachylepis planifrons,* Striped Skink *Trachylepis striata,* Flathead Leaf-toed Gecko *Hemidactylus platycephalus*, Common African Flap-necked Chameleon *Chamaeleo dilepis*, Slender Chameleon *Chamaeleo gracilis*, Kilimanjaro Blade-horned Chameleon *Kinyongia tavetana*, Black Mamba *Dendroaspis polylepis*, Savanna vine snake *Thelotornis mossambicanus*, Short Racer *Platyceps brevis,* Spotted Bush Snake *Philothamnus semivariegatus,* Battersby's Green Snake *Philothamnus battersbyi,* Puff Adder *Bitis arietans,* and Nile Crocodile *Crocodylus niloticus*. These records, however, are largely focussed around Lake Chala, with very few records available for along the Illasit-Taveta road itself.

Only a single species of conservation concern occurs in the area, namely Kilimanjaro Blade-horned Chameleon *Kinyongia tavetana*, which is listed as Near Threatened (Tolley and Menegon, 2014). This species inhabits Afrotemperate forest, but is sometimes observed at forest edges and in the immediate surrounding transformed landscapes (Tilbury, 2010). Thus, it occur more frequently closer to Kilimanjaro, with occasional records extending eastwards up to around the Tanzania/Kenya border, including Lake Chala.

3.4.4 *Aquatic Fauna*

Compared to other countries in East Africa, Kenya supports a relatively modest diversity of freshwater biota. According to Darwall *et al.* (2005) this includes 211 species of fish (Class Actinopterygii), 96 molluscs (Phyllum Mollusca), 172 dragonflies/damselflies (Family Odonata), and 13 crabs (Order Decopoda).

Fish (Class Actinopterygii)

Up to 36 out of the 211 species (or 17% of the Kenyan diversity) of fish that are known to occur in Kenya potentially occur within the study area. A high proportion (>50%) of the expected fish diversity includes Red Listed species (Table 3-3), including highly localised species such as the Critically Endangered Lake Chala Tilapia *Oreochromis hunteri, which* is endemic to Lake Chala.

Three other species of cichlid also occur in Lake Chala including an undescribed *Oreochromis* species (sometimes erroneously referred to as *O. korogwe*), the widely distributed Redbreast Tilapia

Coptodon rendalli, and a haplochromine cichlid of the riverine *Astatotilapia bloyeti* complexis (Moser *et al.*, 2019). These have all been introduced to the lake, resulting in a significant decline in the *O. hunteri* population to the point that it is now rare in the lake, outnumbered by the three invasive species. The occurrence of the formerly abundant *O. hunteri* in such small numbers, its narrow habitat restriction and its limited morphological variability suggest recent population decline and loss of niche breadth in this Critically Endangered and highly endemic cichlid species (Mosser *et al.*, 2019).

Other than Lake Chala, the only other area that that would support fish populations is the Lumi River and its associated riverine habitats. Although it appears that the Lumi River does not flow continuously through the year, there are permanent pools that maintain suitable for a number of the fish species that are listed in Table 3-3 including several SCCs.

Table 3-3 IUCN Red Listed fish species anticipated to occur in the broader study region

Scientific name	Common name	Red List Category
Anguilla bengalensis	Indian Mottled Eel	Near Threatened
Anguilla bicolor	Shortfin Eel	
Anguilla marmorata	Marbled Eel	Near Threatened
Anguilla mossambica	African Longfin Eel	Near Threatened
Barbus sp. nov. 'Pangani'		Vulnerable
Chiloglanis deckenii		
Clarias gariepinus	African Catfish	
Clarotes laticeps		
Coptodon rendalli	Red-breasted Tilapia	
Ctenochromis aff. pectoralis		Vulnerable
Enteromius amboseli		Endangered
Enteromius jacksoni	Jackson's Barb	
Enteromius kerstenii	Redspot Barb	
Enteromius lineomaculatus	Line-spotted Barb	
Enteromius paludinosus	Straightfin Barb	
Enteromius quadralineatus		Endangered
Enteromius quadripunctatus	Fourspotted Barb	Data Deficient
Enteromius toppini	East Coast Barb	
Enteromius venustus	Red Pangani Barb	Data Deficient
Enteromius zanzibaricus	Zanzibar Barb	
Garra dembeensis	Dembea Stone Lapper	
Haplochromis (or Astatotilapia) bloyeti		Data Deficient
Labeo cylindricus	African Carp	
Labeo gregorii		
Labeo sp. nov. 'Mzima'		Vulnerable
Labeobarbus pagenstecheri		Data Deficient
Labeobarbus rhinoceros	Rhinofish	Data Deficient
Leiognathus equulus	Common Ponyfish	
Marcusenius sp. nov. 'Malindi'		Vulnerable
Microphis brachyurus	Opossum Pipefish	
Mormyrus tenuirostris	Athi Elephant-snout Fish	
Oreochromis esculentus		Critically Endangered

Scientific name	Common name	Red List Category
Oreochromis hunteri	Lake Chala Tilapia	Critically Endangered
Oreochromis jipe	Jipe Tilapia	Critically Endangered
Oreochromis korogwe		
Oreochromis variabilis	Victoria tilapia	Critically Endangered
Rhabdalestes tangensis		
Synodontis punctulatus		Data Deficient
Synodontis zanzibaricus	Eastcoast Squeaker	Data Deficient

Molluscs (Phyllum Mollusca)

Twelve out of the 96 species (or 13% of the Kenyan diversity) of freshwater mollusc that are known to occur in Kenya potentially occur within the broader study area. These include:

- **Gastropods (8 species) –** Bellamya capillata, Biomphalaria pfeifferi, Biomphalaria sudanica, *Bulinus globosus*, *Bulinus truncates*, *Burnupia caffra*, *Gabbiella verdcourti*, *Gyraulus costulatus*, *Lanistes ovum*, and *Melanoides tuberculata*; and
- **Bivalves (4 species) –** *Chambardia bourguignati*, *Chambardia wahlbergi*, *Corbicula africana*, *Sphaerium hartmanni*.

Several of the aforementioned gastropods have been recorded from the broader study area, and are also likely to inhabit suitable habitats (i.e. Lake Chala and the Lumi River) on-site, namely: *Biomphalaria pfeifferi*, *Bulinus globosus*, *Melanoides tuberculata* and *Gabbiella verdcourti*. *G. verdcourti* is currently listed as Endangered. Its type locality is the Salemba Stream near Taveta, and where is inhabits spring-fed stream with fallen branches and leaves.

Dragonflies/damselflies (Family Odonata)

The study area has the potential to support a reasonable diversity of dragonflies and damselflies, however, these would be localised concentrations where suitable habitat is available, namely Lake Chala and the Lumi River. Species that have been recorded at Lake Chala include: *Brachythemis leucosticta*, *Palpopleura lucia*, *Platycypha caligata*, *Trithemis annulata*, and *Trithemis kirbyi* (GBIF, 2021; iNaturalist, 2021).

Two species of conservation concern potentially occur within the broader study area, namely Giant Sprite *Pseudagrion bicoerulans* (Vulnerable) and *Allocnemis abbotti* (Near Threatened). It is unlikely that *P. bicoerulans* would inhabit areas around Lake Chala and the Lumi River given that it is only known to occur along mountain streams in forest, heather and afroalpine moorlands that are located elevations above 2 000m. It is possible that *A. abbotti* could occur along the Lumi River

Crabs (Order Decopoda).

Seven out of the 13 species (or 54% of the Kenyan diversity) of freshwater crab that are known to occur in Kenya potentially occur within the broader study area. These include widespread species such as *Caridina togoensis* and *Potamonautes obesus* and species with more restricted ranges such as *Potamonautes johnstoni*[4] and *Potamonautes suprasulcatus*. The expected diversity of freshwater crabs includes three SCCs, namely:

- ***Deckenia mitis* (Near Threatened) –** inhabits areas with stagnant surface water associated with wetlands, streams, and slow-flowing rivers. It is known to dig burrows into soft, silt-clay types of sediment, often down to the water table, and appears to avoid course-grained, sandy soils (Cumberlidge, 2008a).
- ***Potamonautes pilosus* (Vulnerable) –** currently only known to inhabit rivers draining the south-eastern slopes of Mount Kilimanjaro, and along the border between Kenya and Tanzania (Cumberlidge, 2008b).
- ***Potamonautes platycentron* (Endangered) –** Lake Chala is the type locality for this species, and there are very few records available (Cumberlidge, 2008c). *P. platycentron* is a lake-living crab, however, world freshwater crab experts believe that it could inhabit areas around the lake and that additional surveys will help to refine the area of occupancy (AOO) for the species (pers.comm., Professor Savel Daniels and Professor Neil Cumberlidge, 2021).

The survey undertaken by Prof. Daniels in January 2022 only found *P. platycentron* within Lake Chala supporting the evidence that it is endemic to the lake. *Deckenia mitis* was recorded from Lake Jipe and *P. johnstoni* was found to be widespread within the broader catchment. It is possible that *P. pilosus* occurs within the Lumi River given their habitat requirements and distributions.

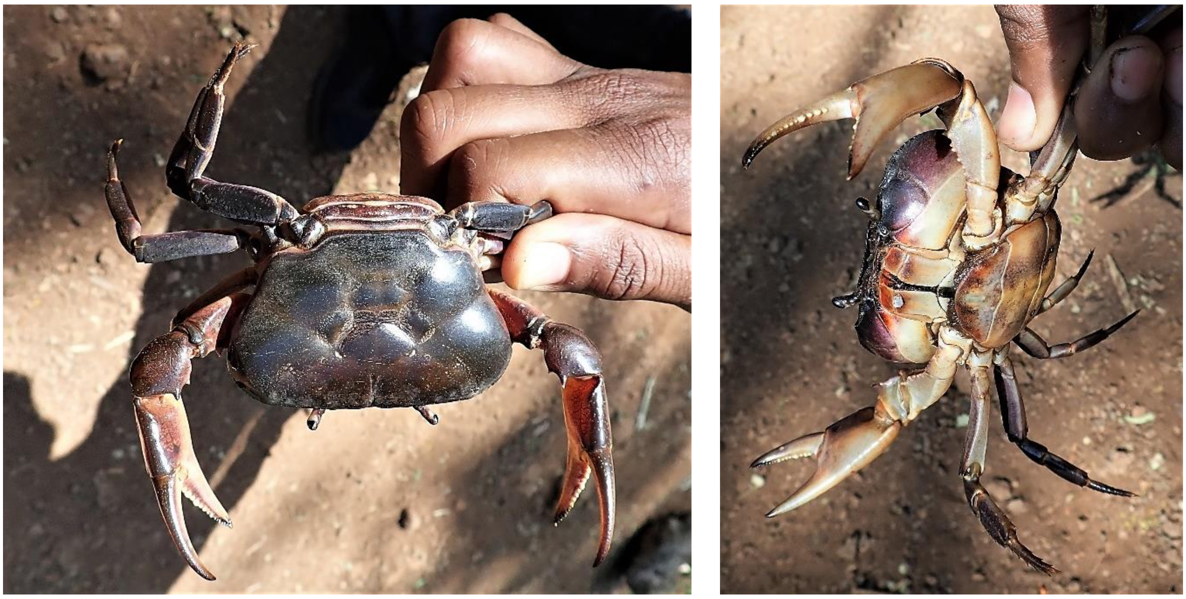


Figure 3-5 Mature female crab specimen observed from a spring near Taveta that has been provisionally identified by Professor Neil Cumberlidge as *Potamonautes cf. suprasulcatus*

3.5 Areas of Biodiversity Importance

3.5.1 *Protected Areas*

Kenya has 411 protected areas, covering just over 12% of the country's land area. Majority of the protected areas have been designated at a national level, and include 234 Forest Reserves, 30

[4] *Potamonautes johnstoni* is known to occur within Lake Chala.

National Reserves, 28 Community Nature Reserves, and 23 National Parks. A smaller portion are important at an international level, and include six UNESCO-MAP Biosphere Reserves, three World Heritage Sites, and six Ramsar Sites.

The existing Illasit-Taveta road does not pass through any protected areas, however, there are a number of protected areas that occur within the broader study area and in relatively close proximity. These include:

- **National Parks** such as Tsavo West (906,500ha), with its western boundary ranging from 3km to 25km to the east, Chyulu Hills (47,100ha) approximately 45km to the north-east, Amboseli (483,206ha) approximately 35km to the north-west, and Kilimanjaro (183,181ha) in Tanzania, with its eastern boundary ranging from 5km to 25km to the west.
- **Community Conservancies** such as Elerai (2,023ha), Tawi (2,347ha), Nailepu (1,578ha), Osupuku (1,214ha), Kimana Wildlife Sanctuary (2,428ha), and Motikanju (2,800ha) all of which are located approximately 20km north to north-west of the Illasit end of the road – these community conservancies are considered important for managing the corridor between Tsavo West, Chyulu and Amboseli, particularly for Elephant movement.
- **Kuku Group Ranch Private Reserve**, which is the only one of its kind that exists in Kenya, located approximately 15km north of the Illasit end of the road.
- **Loitokitok Forest Reserve** (765ha) is located immediately north-west from the Illasit end of the road. This area is currently being managed by the Loitokitok Community Forest Association in partnership with the Kenya Forest Service according the a Forest Management Agreement (FMA) and a Participatory Forest Management Plan (PFMP) to promote restoration of tree cover in the area.

The proposed road upgrade project is unlikely to negatively affect any of the protected areas, but could help promote tourism and sustainable development through improved access to these areas.

3.5.2 *Key Biodiversity Areas*

Globally, there are over 18,000 Key Biodiversity Areas (KBAs), which have been identified as "*sites contributing significantly to the global persistence of biodiversity*" (IUCN, 2016). Sites qualify as KBAs if they meet one or more of 11 criteria that are grouped into five categories, namely: threatened biodiversity, geographically restricted biodiversity, ecological integrity, biological processes, and irreplaceability. KBAs generally overlap (wholly or partly) with existing protected areas, however, their management requirement may differ (i.e. KBAs are managed in ways that ensure the persistence of the biodiversity elements for which it is important).

There are 121 KBAs that are nested within Kenya, covering an area of approximately 72,000km^2 (or 12.5% of the country). Only 11% of these are completed protected and 41% are partially protected.

KBAs that occur within the broader study area include:

- The aforementioned national parks (i.e. Tsavo West, Chyulu, Amboseli, and Kilimanjaro), which range between 5km and 50km in distance from the Illasit-Taveta road;
- Lake Chala, which is a transboundary KBA shared by Tanzania and Kenya, and discussed further in Section 3.4.3 below; and
- The North Pare Mountains, which are located to the south-west in Tanzania.

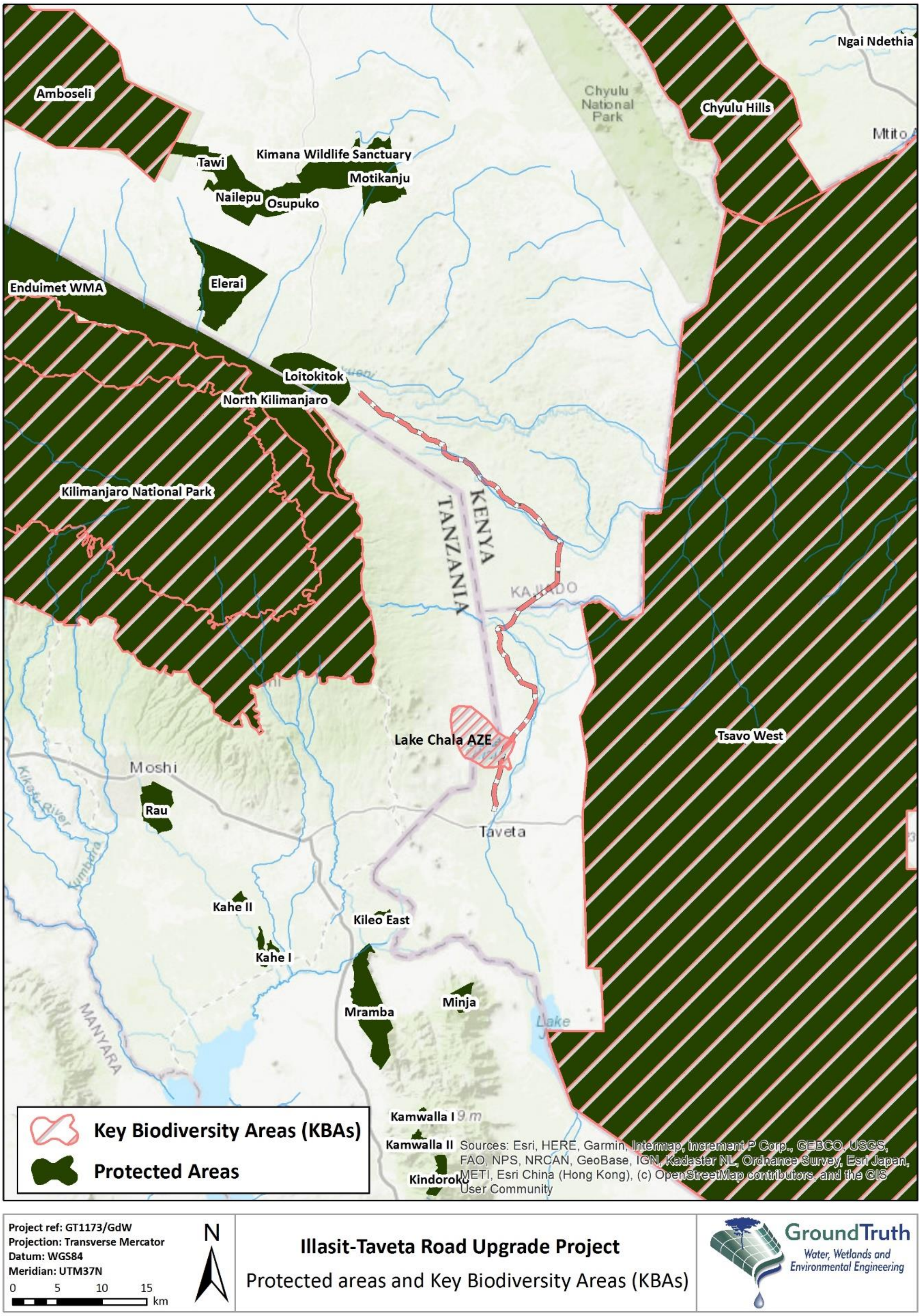


Figure 3-6 Distribution and extent of protected areas and Key Biodiversity Areas (KBAs) to occur in and around the Illasit-Taveta road

3.5.3 *Alliance for Zero Extinction (AZE) Sites*

The Alliance for Zero Extinction (AZE) works to identify and safeguard the most important sites for preventing global extinctions, and is largely driven by threatened species that are restricted to only a single site in the world. Globally, there are 853 AZE sites, of which six are located within Kenya. The protection of AZE sites is a recognized indicator for the CBD's Aichi Targets, particularly Aichi Targets 11 and 12, and governments are increasingly incorporating the conservation of AZE sites into their national policies, and international financial institutions use AZE sites to screen projects applying for lender support.

Lake Chala, which is located within the Pangani River Basin in the foothills of Mount Kilimanjaro (Hamerlynck *et al.*, 2008), is the type locality and only know habitat supporting the freshwater crab *Potamonautes platycentron* (Endandered), as well as the Critically Endangered cichlid *Oreochromis hunteri* (see Section 3.3.4). Consequently, the lake and its immediate surrounds have been classified as an AZE site by the AZE; the principal rationale for demarcation is based solely on *P. platycentron*. The existing Illasit-Taveta road runs directly past the eastern side of Lake Chala, and for approximately 3.5km through the AZE site (Figure 3-6). Existing records of *P. platycentron*, which have been validated by a freshwater crab expert, namely Professor Neil Cumberlidge, indicate that the crab is only known from Lake Chala, however, this is based on very limited sampling of freshwater crabs throughout East Africa. Nevertheless, this appears to be a classic island biogeography case, as the lake has very specific limnological parameters that may very well had led to speciation of *P. platycentron*. Another important factor is that Lake Chala is a crater lake (or caldera). As a result the lake can be considered disconnected from a topographical perspective

3.5.4 *UNESCO World Heritage Sites*

Kenya has seven UNESCO World Heritage sites, the closest being the Sacred Mijikenda Kaya Forests, approximately 220 km south-east of Taveta town, just inland from Mombasa. The closest World Heritage site is Kilimanjaro National Park, in Tanzania – Tanzania also has seven listed sites.

3.5.5 *Wetlands of international importance*

The RAMSAR Convention entered into force in Kenya on the 5th of October 1990. There are currently six sites designated as Wetlands of International Importance (or Ramsar Sites), covering an area of 265 449ha. Five sites are located north-west of Nairobi (e.g. Lake Elmenteita), while the sixth site is Tana River Delta is close to 300km west-north-west of the Illasit-Taveta road.

3.5.6 *Important Bird Areas (IBAs)*

Important Bird Areas (IBAs) are areas that are considered globally important for the conservation of bird populations. They have been identified by BirdLife International using a set of international criteria, which use specific IBA thresholds that have been set by regional and national governing organisations. Kenya has a total of 68 IBAs, several of which are situated in the broader landscape surrounding the Illasit-Taveta Road. These include the National Parks of Tsavo West, Chyulu, Amboseli, and Mount Kilimanjaro in Tanzania (see Section 3.4.1). There are also other smaller IBAs located west to south-west across the border in Tanzania (e.g. the North Pare Mountains complex and Nyumba ya Mungu Reservoir).

4. HABITAT ASSESSMENT

4.1 Overview of Road Sections

The Illasit-Taveta road can be split into five relatively homogenous sections based on present land cover (Figure 4-2), which were used to assess the overall availability of habitats to support biodiversity patterns and processes within the study area.

The area through which the road passes has been largely transformed by expanding settlements and cultivation, and has been heavily infested by IAPs. Only a few areas remain that will support biodiversity patterns and process with poor to (at best) moderate ecosystem services. The main exception is Lake Chala that has been relatively isolated from prevailing land use activities and ecological degraded due to its topographical setting.

Figure 4-1 Typical examples of land transformation from cultivation (top left and right) and degradation caused by erosion (bottom left) and infestations by invasive alien plants such as *Parthenium hysterophorus* (bottom right)

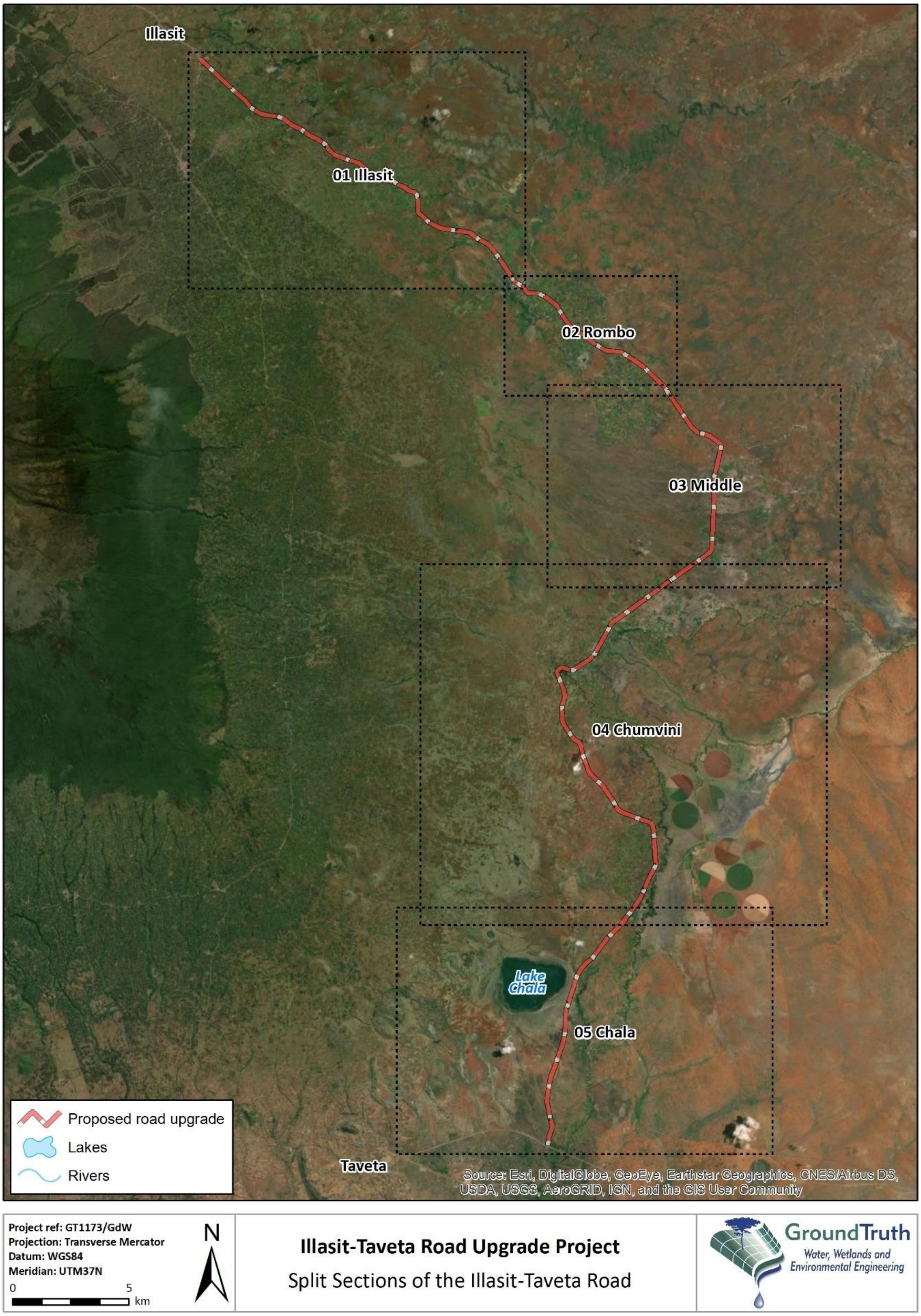
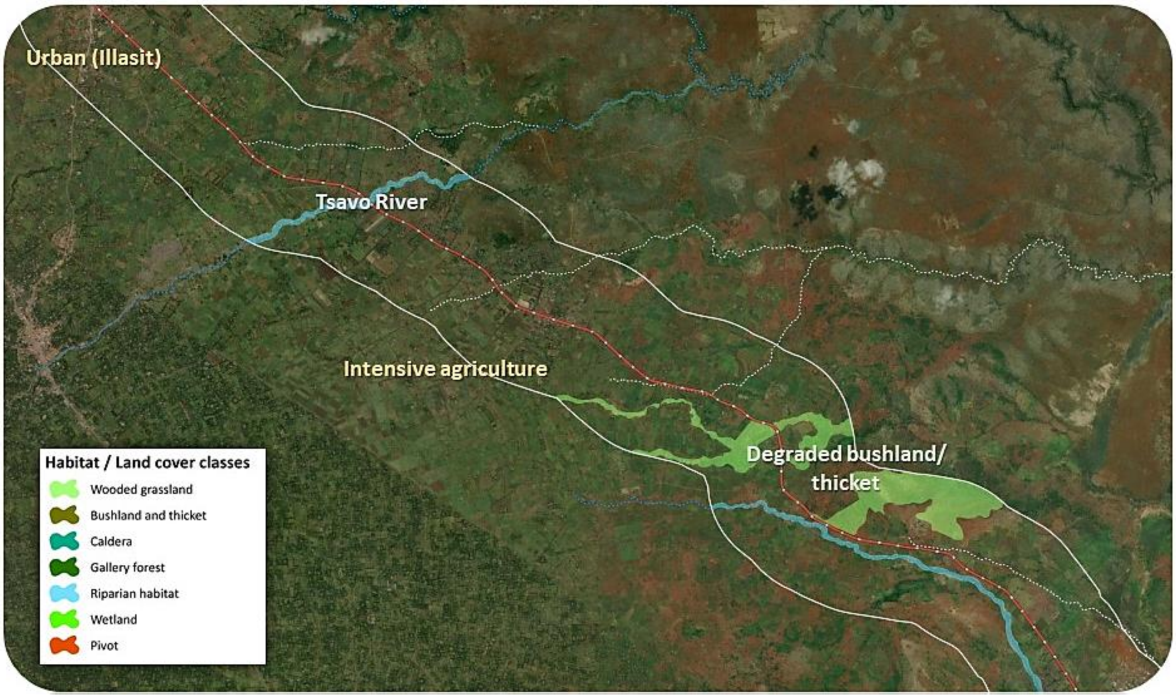


Figure 4-2 Overview of the existing Illasit-Taveta road and the designation of split road sections used to map and assess available habitats for supporting biodiversity

4.1.1 *Section 1 of the Illasit-Taveta Road (17.3km)*

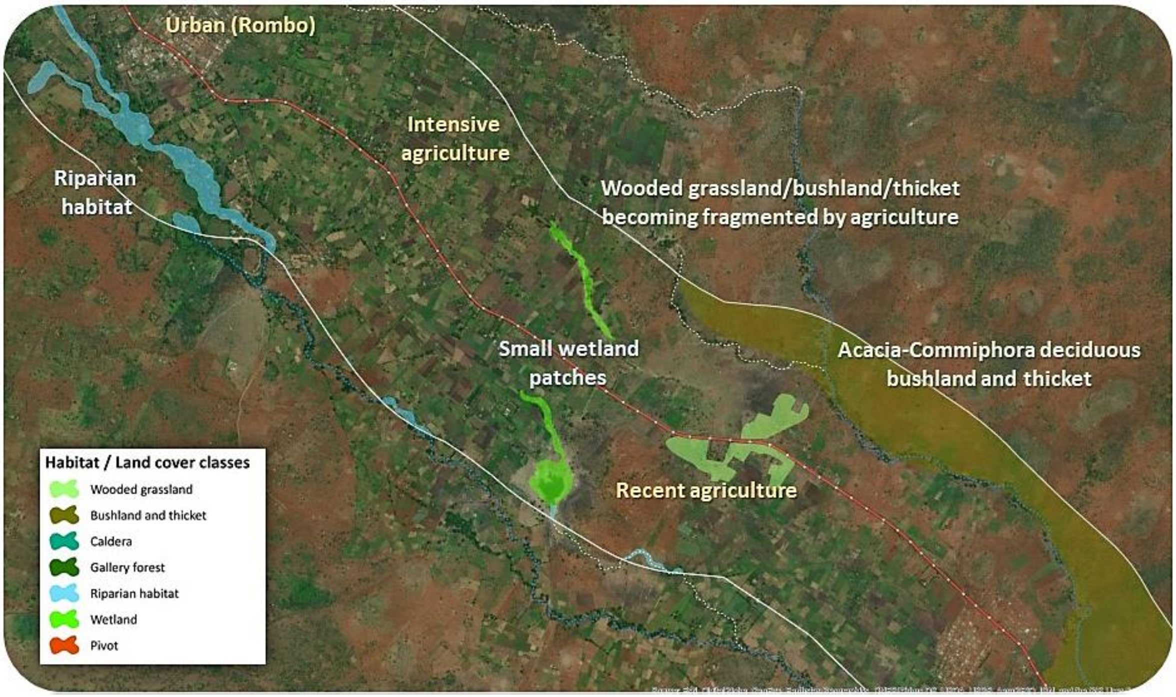


Section 1 of the Illasit-Taveta road extends from the town of Illastit for 17.3km to the small settlement of Rombo. This area has been extensively transformed by urban settlement and cultivation, and there are only a few remanent patches of riparian vegetation, such as along the Tsavo River (Figure 4-3) and the few smaller drainage lines (Figure 4-4), and terrestrial bushland/thicket.

Figure 4-3 The Tsavo River crossing viewed upstream (left) and downstream (right)

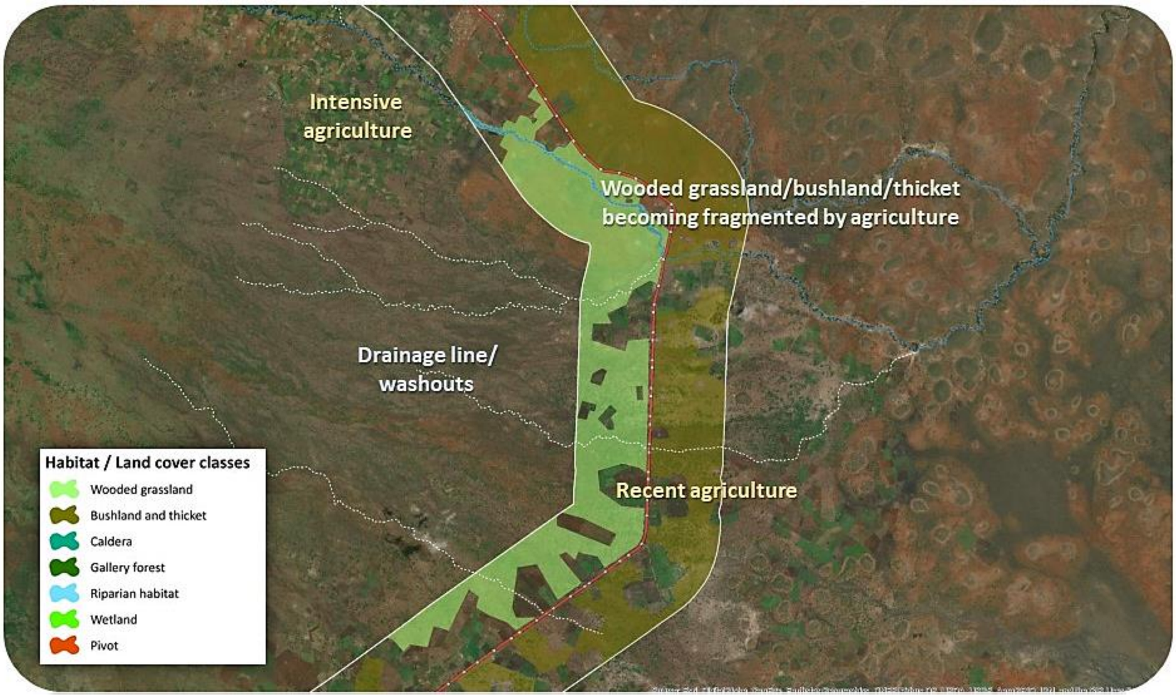

Figure 4-4 Drainage line viewed upstream (below left) and downstream (below right)

4.1.2 *Section 2 of the Illasit-Taveta Road (8.4km)*



Section 2 of the Illasit-Taveta road extends from the small settlement of Rombo for a distance of 8.4km through. A very small section (approximately 800m) of the road passes through or alongside degraded bushland, and there are two small wetland systems that are located more than 200m from the road that don't appear to be directly connected to the road hydrologically. Extensive natural habitat comprising *Acacia-Commiphora* deciduous bushland and thicket extends in a north-east direction away from the road, and forms part of extensive rangelands on the western side of Tsavo West National Park.

4.1.3 *Section 3 of the Illasit-Taveta Road (10.0km)*

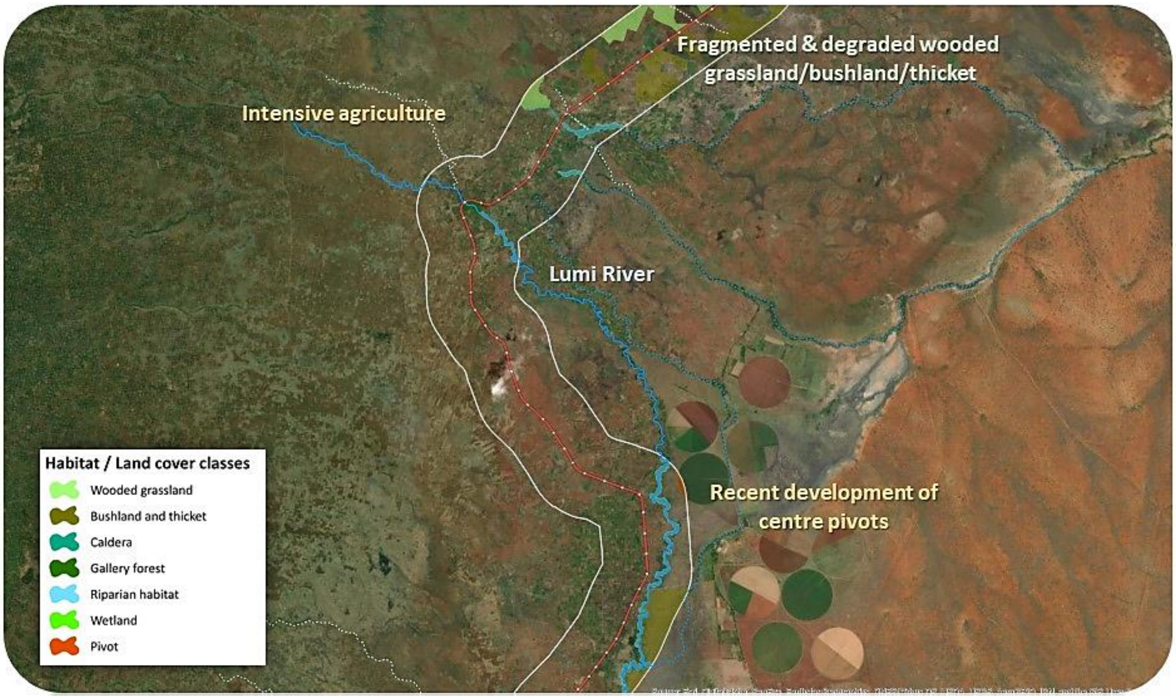


Section 3 of the Illasit-Taveta road, referred to as the Rombo corridorin Section 3.4.1, extends 10.0km through a relatively natural mosaic of bushland, thicket and wooded grassland, but that is becoming increasingly more fragmented by cultivation. Appendix 2 shows the rapid transformation of natural vegetation/habitat that has taken place within this section of the road over the last five to ten years due to development of cultivated lands. Apart from Lake Chala, this area is still expected to support a reasonable diversity of fauna and flora, especially as one moves further away from the edges of the road. This area is also likely to experience the more frequent presence and movement of fauna, ranging from various reptiles and small mammals to larger mammals, due to its ecological linkages to more extensive natural habitats to the east and west.

Figure 4-5 Illasit-Taveta road where it passes through relatively natural habitat comprising Acacia-*Commiphora* deciduous bushland and thicket (left) with some impacts experienced from livestock (right)

Figure 4-6 The crossing of the Ol Girra River viewed upstream (left) and downstream (right)

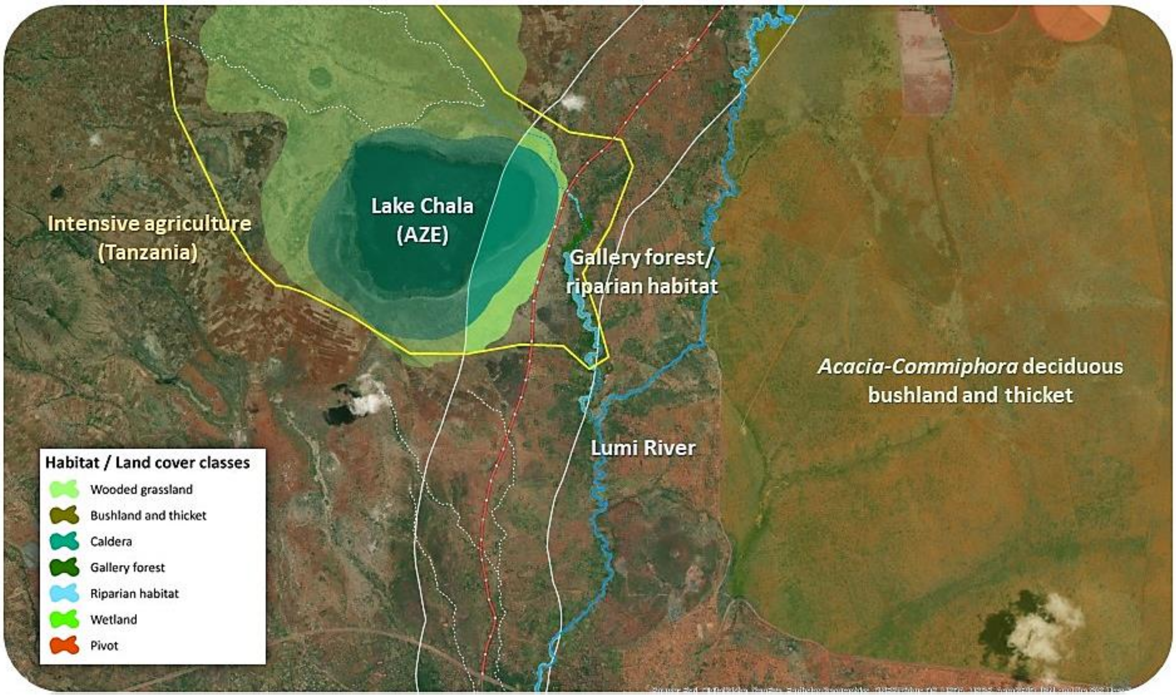
4.1.4 *Section 4 of the Illasit-Taveta Road (19.2km)*



This is the longest section of the Illasit-Taveta road that extends for 19.2km through densely cultivated areas, which includes an extensive farming operation with recently developed centre pivots that is located to the east of the southern portion of this section of the road. The Lumi River (Figure 4-7) is a significant biodiversity feature given its potential to support well-defined riparian forest and a reasonable diversity of freshwater biota including a number of probable Species of Conservation Concern (SCC). Downstream, the Lumi River runs roughly parallel to the existing Illasit-Taveta road, in places coming within 150m of the road.


Figure 4-7 The Lumi River slightly downstream of the road crossing with well-defined riparian forest and pools habitat providing refuge during low flow conditions

4.1.5 *Section 5 of the Illasit-Taveta Road (10.9km)*



This southern-most section of the road extends 10.9km through mainly farmlands, and is where the existing Illasit-Taveta road bypasses Lake Chala, a critical biodiversity feature should not experience any direct impacts from the road upgrade project, as well as any other land use activities. The Lumi River continues to run roughly parallel on the eastern side of the to the road. The road also crosses a tributary of the Lumi River, which runs around the northern side of Lake Chala. This tributary supports relatively good riparian forest approximately 500m downstream of the crossing.

4.2 Availability of Natural Habitats

The majority (approximately 64%) of the areas along the existing Illasit-Taveta road (up to 100 m) is completely transformed, and a further 28% is degraded. These areas offer little to no biodiversity value. The remaining areas occupy a much smaller portion (approximately 8%) of the overall length of road. These areas are largely within Section 3 where the Rombo corridor is located. The natural habitat that remains in this area is mostly *Acacia-Commiphora* deciduous bushland and thicket in moderate condition. This is also the only area where extensive rangelands to the east and north-east of the road (extending up to the western boundary of Tsavo West National Park) connects across the road to a contiguous patch of rangeland habitat covering approximately 7,500 ha to the west of the road. The rangelands that are adjacent to the road are becoming increasingly fragmented due to expanding settlement and agriculture in the region. There are also several non-perennial drainage systems that pass under the road.

The only areas in proximity to the road that are worth maintaining, or preferably enhancing, include:

- Lake Chala and the natural habitats around the rim of the crater;
- The Rombo corridor within Section 3 of the road that connects the areas comprising relatively natural wooded grassland, bushland, thicket vegetation west of the road with the more extensive areas to the east that link to the Tsavo West National Park that is 5-10km east of this section of the road;
- Riparian and gallery forests associated with the larger river systems, notably the Lumi River; and
- All watercourses as defined by the Water Act (Act No. 43 of 2016) of Kenya, however, these are mostly non-perennial and only flow during the rainfall season.

The aforementioned habitats are used to inform the Critical Habitat Assessment (see Section 5) taking into consideration landscape level biodiversity patterns and processes. It is important to consider that almost the entire eastern side of Mount Kilimanjaro, both within Tanzania and Kenya, has been transformed by human settlement and croplands (see Figure 3-2), resulting in very opportunities for movement within the broader landscape.

5. CRITICAL HABITAT ASSESSMENT

The IFC PS6 and GN6 defines critical habitat as "*areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes*".

Critical habitats are essentially areas that contain exceptional biodiversity and are considered the most significant/highest priority for biodiversity conservation. Determination of critical habitats takes into account the levels of threat (i.e. how vulnerable the habitat or species is to existing pressures) and how irreplaceable/rare or unique the habitat or species is. Critical habitat criteria are used to form the basis of any critical habitat assessment, namely:

- **Criterion 1:** Critically Endangered (CR) and/or Endangered (EN) species
- **Criterion 2:** Endemic or restricted-range species
- **Criterion 3:** Migratory or congregatory species
- **Criterion 4:** Highly threatened and/or unique ecosystems
- **Criterion 5:** Key evolutionary processes

In addition, projects that are located within internationally and/or nationally recognised areas of high biodiversity value may require a critical habitat assessment. These include:

- Areas that meet the criteria of the IUCN's Protected Area Categories Ia, Ib and II (**Criterion 6**); and
- Key Biodiversity Areas (KBAs), which encompass Important Bird Areas (IBAs) and Alliance for Zero Extinction (AZE) sites (**Criterion 7**).

Each biodiversity feature is assessed according to the aforementioned criteria. Numerical thresholds are evaluated for the first four criteria (i.e. Criteria 1 to 4), while best available scientific information and expert opinion are used to assess the last three criteria (i.e. Criteria 5 to 7). Table 5-1 below summarise the numerical thresholds used to assess the first four critical habitat criteria.

Table 5-1 Numerical thresholds used to assess crtical habitats in terms of criteria 1 to 4 of IFC PS6 and GN6

Criteria	Threshold
Criterion 1	a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species). b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in Criterion 1a. c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.
Criterion 2	a) Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.

Criteria	Threshold
Criterion 3	a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle. b) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.
Criterion 4	a) Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

5.1 Areas of Analysis

Appropriate areas were defined in order to assess critical habitats potentially affected by the proposed upgrade project for the Illasit-Taveta road. The area of influence (AOI) was defined as the immediate area that would have a direct impact on biodiversity, which includes the existing road and roadside and the proposed construction camps. A 10km buffer of the road was used to consider the biodiversity patterns and processes that are linked to road's AOI. Within this landscape setting, an ecologically appropriate area of analysis (EAAA) was defined for each biodiversity feature, which is largely dependent on the availability of suitable habitat that falls within the 10km buffer of the road.

5.2 Critical Habitat Screening

Initial screening was undertaken using the integrated Biodiversity Assessment Toolkit (iBAT) applied at a landscape level (including precautionary buffers up to 50km) to meet requirements of IFC PS6. The iBAT screening report includes a list of biodiversity features that potentially will be impacted by the proposed Illasit-Taveta road upgrade. These are summarised as follows:

- Critically Endangered and Endangered species – 14 plants, seven mammals, 17 birds, three reptiles, three amphibians, eight fish, and two insects;
- Endemic and restricted-range species – ten mammals, 11 birds, and seven amphibians;
- Up to 35 protected areas; and
- Up to KBAs.

Various data sources were consulted to verify and validate the species-level information (i.e. Criterion 1, 2 and 3) from the iBAT report including, but not limited to, the IUCN Red List database, the Global Biodiversity Information Facility(GBIF), iNaturalist, Kenya Atlases, scientific literature. The type of information that was obtained included extent of occurrence (EOO), area of occupancy (AOO), population estimates, conservation status (Red List category, endemic, range-restricted), range descriptions, habitat requirements, point localities, etc. in order to provide a justification regarding critical habitats that are more likely to be affected by the road upgrade. The species-specific information was also use to determine the likelihood of a particular species occurring within the area whether or not its distribution range falls within the AOI and 10km buffer.

Table 5-2 presents the full list of species from the iBAT report to establish the likelihood of each feature occurring within the projects AOI against CH Criteria 1, 2 and 3 whilst providing justifications for inclusion. It is important to note that this assessment is based largely on secondary data with limited primary data collected from systematic and comprehensive baseline surveys, and any critical gaps in information will be flagged by the CHA to be included in the project's BAP. The likelihood that each species occurs within the AOI is therefore provided based on the availability of suitable habitat to support the respective species.

Table 5-2 Critical Habitat screening and determination for IFC PS6 Criterion 1, 2 and 3 for the proposed Illatis-Taveta road upgrade project

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria						Justification	Likelihood [1]
									1a	1b	1c	2a	3a	3b		
Liliopsida	*Lagarosiphon hydrilloides*		17294	24	0	Unknown	EN + RR + E (KEN)	0.000%	N	N	N	N	N	N	AOI does not intercept range and 10km buffer is well beyond range. Known distribution restricted to Kenya, and may occur in Uganda. Only 24 records in GBIF, the nearest being Meru over 300km to the north. Inhabits still and slow moving water in perennial rivers/streams (including waterfalls). The IUCN distribution map does not match range description and GBIF localities. The area of the IUCN distribution map also greatly exceeds the EOO (i.e. 515,561km2 to 17,294km2).	Zero
Magnoliopsida	*Meineckia ovata*		8	8	0	10-49	CR + RR + E (KEN)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Known only from Ngangao forest in Taita Hills, 65km east of Taveta town, where it occurs in moist montane forest.	Zero
Magnoliopsida	*Psychotria crassipetala*		11286	48	0	Unknown	EN + RR	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Known only from Ngangao forest in Taita Hills, 65km east of Taveta town, and Chome Forest Reserve in Tanzania. Recent record from Lamu, extending the range to the north-east. Inhabits moist, evergreen forest.	Zero
Magnoliopsida	*Psychotria petitii*		309	12	0	Unknown	EN + RR + E (KEN)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Restricted to a few locations in Taita Hills, 65km east of Taveta town. Inhabits upland moist evergreen forest.	Zero
Magnoliopsida	*Impatiens teitensis*		4470	44	0	Unknown	EN + RR	0.000%	N	N	N	N	N	N	Includes two subspecies. Assessed under I.t subsp. teitensis	n/a
Magnoliopsida	*Impatiens volkensii subsp. volkensii*		29638.8	28	0	Unknown	EN + RR + E (TZ)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Only known from 7 localities in Tanzania, where it inhabits moist forest.	Zero
Magnoliopsida	*Impatiens teitensis subsp. teitensis*		41	16	0	Unknown	EN + RR + E (KEN)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Only known from 4 localities in Taita Hills, 65km east of Taveta town, where it grows along streams in swamp forest and montane forest.	Zero
Magnoliopsida	*Bullockia dyscritos*		23838.5	20	10	Unknown	EN + RR	0.042%	N	N	N	N	N	N	Small shrub that inhabits rocky areas from 750 to 1,330 masl. Also occurs on roadside banks and in grazed, eroded areas. Restricted to 5 localities in south-central Kenya and north-eastern Tanzania. AOI intercepts range. 12 occurrences recorded in GBIF, the closest being approximately 80km north-east of Illasit.	Very low
Magnoliopsida	*Crotalaria ukambensis*		33825	70	752	Unknown	EN + RR	2.223%	Y	N	N	N	N	N	Annual or perennial herb. Grows in deciduous bushland and grassland with scattered trees. Restricted distribution range in south-central Kenya and north-eastern Tanzania. AOI intercepts range. Over 50 occurrences recorded in GBIF indicating a more extensive range (>50,000km2). Closest record approximately 50km north-east of Rombo.	Low

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria						Justification	Likelihood [1]
									1a	1b	1c	2a	3a	3b		
Magnoliopsida	*Phyllanthus sacleuxii*		1831	24	0	Unknown	EN + RR + E (KEN)	0.000%	N	N	N	N	N	N	AOI does not intercept range and 10km buffer is well beyond range. Only known from a 6 localities in south-eastern Kenya, the closest being Taita Hills 65km east of the Taveta town. It inhabits rocky places in in evergreen forest.	Zero
Magnoliopsida	*Euphorbia petricola*		3560	20	0	Unknown	EN + RR + E (KEN)	0.000%	N	N	N	N	N	N	AOI does not intercept range and 10km buffer is well beyond range. Only known from a 5 localities within Kenya, the closest being approximately 90km east of the road at Rombo within Tsavo West NP. It inhabits crevices on rocy outcrops.	Zero
Magnoliopsida	*Chassalia discolor ssp. Taitensis*		163	60	0	Unknown	EN + RR + E (KEN)	0.000%	N	N	N	N	N	N	AOI does not intercept range and 10km buffer is well beyond range. Only known from 6 localities in Taita Hills, 65km east of Taveta town, where it grows in evergreen forest (including mist forest) between 1,450 and 1,950 masl.	Zero
Magnoliopsida	*Crotalaria arrecta*		777	<50	0	Unknown	EN + RR + E (KEN)	0.000%	N	N	N	N	N	N	AOI does not intercept range and 10km buffer is well beyond range. Only known from a few localities within Kenya, the closest being approximately 50km north-east of Illasit town within Chyulu Hills NP. Inhabits rocky areas (cliffs and mountain peaks) and tends to grow on volcanic ash.	Zero
Actinopterygii	*Oreochromis esculentus*	Singidia Tilapia	248372		1060	Unknown	CR	0.427%	N	N	N	N	N	N	Natural distribution includes the Lake Victoria and Lake Kanyaboli catchments. Been introduced to several dams and waters, including Lake Jipe of the Pangani River system. AOI occurs within Lumi River which drains into Lake Jipe approximately 40km south of Taveta town. Inhabits sheltered gulfs and bays of large lakes.	Very low
Actinopterygii	*Oreochromis variabilis*		265268		1060	Unknown	CR	0.400%	N	N	N	N	N	N	Endemic to the Lake Victoria drainage system where it can still be found in localised parts of the lake and in satellite lakes (mainly Burigi, Katwe and Kirumi). Also occurs in Nyumba ya Mungu Reservoir and several inland ponds where it is thought to have been introduced. AOI occurs within Lumi River which drains into Lake Jipe, which is connected to Nyumba ya Mungu Reservoir via the Ruvu River. Inhabits exposed and sandy shores of lakes where there is water movement, and also calm backwaters with water lilies - depth range is 0 to 40 m but prefers water less than 10 m deep.	Zero
Actinopterygii	*Oreochromis jipe*	Jipe Tilapia	6778	72	1060	Unknown	CR	15.639%	Y	N	N	N	N	N	Endemic to Lake Jipe, in the Pangani River catchment, and has since colonised Nyumba ya Mungu Reservoir via the Ruvu River. AOI occurs within Lumi River which drains into Lake Jipe approximately 40km south of Taveta town. Prefers riverine and inshore habitats of lakes.	Very high

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria						Justification	Likelihood [1]
									1a	1b	1c	2a	3a	3b		
Actinopterygii	*Oreochromis hunteri*	Lake Chala Tilapia	1060	5	1060	Unknown	CR	100.000%	Y	N	N	N	N	N	Endemic to Lake Chala where it generally is found at depths of 20 to 45m. 45 records in GBIF, some appear outside of the lake, but infact observations from within the lake.	Certain
Actinopterygii	*Rhabdalestes leleupi*		976	<100	0	Unknown	CR + RR + E (KEN)	0.000%	N	N	N	N	N	N	Endemic to Nyumba ya Mungu Reservoir and its outlet to the Pangani River, Tanzania. No occurrences recorded in GBIF. AOI does not intercept the range. Inhabits inshore and off-shore open waters of the lake and also permanent rivers.	Zero
Actinopterygii	*Haplochromis sp. nov. 'Amboseli'*		10236		0	Unknown	CR + RR + E (TZ)	0.000%	N	N	N	N	N	N	Endemic to the Amboseli swamps, 40km north-west of Illasit town. No occurrences recorded in GBIF. AOI does not intercept the range. Very little is known of its habitat and ecology.	Very low
Actinopterygii	*Enteromius quadralineatus*		5000		0	Unknown	EN + RR	0.000%	N	N	N	N	N	N	Endemic to the Malagarasi River in Tanzania and Barundi where it inhabits streams and rivers. 47 occurrences recorded in GBIF. IUCN distribution range includes the upper Pangani River system, which intercepts the AOI - this is not correct according to the range description and known occurrences.	Zero
Actinopterygii	*Enteromius amboseli*		4125	750	250	Unknown	EN + RR + E (KEN)	6.061%	Y	N	N	N	N	N	Only known to occur in swamps and streams in Amboseli NP and Mzima Springs in Tsavo West NP 36km east of Rombo. No occurrences recorded in GBIF. AOI within headwaters of Tsavo/Mokueni River system. Inhabits swamps and streams of Amboseli National Park and Mzima springs with preference for slow-moving waters with abundant vegetation.	Moderate
Amphibia	*Callulina dawida*	Taita Hills Warty Frog	249	4.3	0	Unknown	CR + RR + E (KEN)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Only occurs Taita Hills, 65km east of Taveta town. Inhabits moist montane forest.	Zero
Amphibia	*Callulina laphami*		16.5		0	Unknown	CR + RR + E (TZ)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Confined to Kindoroko and Minja Forest Reserves in the North Pare Mountains, Tanzania. Inhabits humid montane forest, where it is sometimes associated with streams and occasionally found on drier ridges.	Zero
Amphibia	*Boulengerula taitana*	Taita Hills Caecilian	1202	28	0	Unknown	EN + RR + E (TZ)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Restricted to three of the four forest patches at Taita Hills: Dawida, Mbololo and Kasigau. Fossorial, inhabiting montane forests and secondary habitats (i.e. plantation forests and cultivated land).	Zero

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria 1a	1b	1c	2a	3a	3b	Justification	Likelihood [1]
Amphibia	*Scolecomorphus vittatus*	Banded Caecilian	46493	3569	0	Unknown	LC + RR	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Restricted to three of the four forest patches at Taita Hills: Dawida, Mbololo and Kasigau. Fossorial, inhabiting montane forests and secondary habitats (i.e. plantation forests and cultivated land).	Low
Amphibia	*Callulina kreffti*	Krefft's Warty Frog	101070	5608	0	Unknown	LC + RR	0.000%	N	N	N	N	N	N	Part of species complex that requires taxonomic resolution. Distribution does not intercept AOI and is well beyond 10km buffer. Restricted to 11 subpopulations - 2 in southeastern Kenya and 9 in northeastern Tanzania, the closest being the North Pare Mountains, 40km south of Taveta. Inhabits moist lowland and montane forests, but also frequents adjacent plantation forest, rural gardens and degraded forest.	Very low
Amphibia	*Amietia tenuoplicata*	Amani River Frog	160898	6573	0	Unknown	LC + RR	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Restricted to 12 subpopulations - 1 at Taita Hills (Kenya) 10 in Tanzania, and 1 in northern Malawi. Taita Hills is the closest subpopulation, 65km east of Taveta town. Inhabits forested streams.	Zero
Amphibia	*Strongylopus kilimanjaro*		595	595	0	Unknown	DD + RR + E (TZ)	0.000%	N	N	N	N	N	N	Only known from 3 collected specimens from Mount Kilimanjaro. Distribution does not intercept AOI or 10km buffer. Assumed to inhabit cold mountain streams at high altitudes.	Zero
Aves	*Gyps africanus*	White-backed Vulture	23400000		1559		CR	0.007%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map.Very few recorded occurrences by GBIF in EAAA.	Low
Aves	*Trigonoceps occipitalis*	White-headed Vulture	21100000		1559	2500-9999	CR	0.007%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Very few recorded occurrences by GBIF in EAAA, with higher numbers recorded within Tsavo West and Tsavo NPs.	Very low
Aves	*Necrosyrtes monachus*	Hooded Vulture	22500000		1559	197000	CR	0.007%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Very few recorded occurrences in GBIF - beyond EAAA, with higher numbers recorded within Tsavo West and Tsavo NPs.	Low
Aves	*Gyps rueppelli*	Rüppell's Vulture	14200000		1559	22000	CR	0.011%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Very few recorded occurrences in GBIF - beyond EAAA, with higher numbers recorded within Tsavo West and Tsavo NPs.	Very low
Aves	*Turdus helleri*	Taita Thrush	130	20	0	930	CR + RR + E	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Confined to three small forest patches in the Taita Hills, 65km east of Taveta town.	Zero

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria						Justification	Likelihood [1]
									1a	1b	1c	2a	3a	3b		
Aves	*Apalis fuscigularis*	Taita Apalis	16	4	0	210-430	CR + RR + E	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Restricted to a small number of forest fragments in Taita Hills, 65km east of Taveta town.	Zero
Aves	*Torgos tracheliotos*	Lappet-faced Vulture	34200000		1559	6500	EN	0.005%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Very few recorded occurrences by GBIF in EAAA, with higher numbers recorded within Amboseli, Tsavo West and Tsavo NPs.	Very low
Aves	*Sagittarius serpentarius*	Secretarybird	23200000		1559	6,700-67,000	EN	0.007%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Few recorded occurrences by GBIF in EAAA, with higher numbers recorded within Amboseli, Tsavo West and Tsavo NPs.	Low
Aves	*Ardeola idae*	Madagascar Pond-heron	1050000		1559	1,300-4,000	EN	0.148%	N	N	N	N	N	N	Breeds in Madagascar. Non-breeding range intercepts AOI. No records from Kenya Bird Map. Few recorded occurrences by GBIF, but well outside EAAA, nearest being Lake Jipe to south and Amboseli NP to the north.	Very low
Aves	*Aquila nipalensis*	Steppe Eagle	12600000		1559	50,000-75,000	EN	0.012%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Only one record by GBIF in EAAA (at Lake Chala in Tanzania), with most occurrences recorded from Amboseli, Tsavo West and Tsavo NPs.	Very low
Aves	*Neophron percnopterus*	Egyptian Vulture	50100000		1559	12,000-38,000	EN	0.003%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Only one record by GBIF in EAAA (near Taveta town), with few occurrences recorded from southern Kenya/northern Tanzania.	Very low
Aves	*Falco cherrug*	Saker Falcon	19100000		1559	12,200-29,800	EN	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Occurs mainly in northern Africa, breeds in central Europe. No records for Kenya from Kenya Bird Map and GBIF.	Zero
Aves	*Balearica regulorum*	Grey Crowned Crane	6070000		1559	17,700-22,300	EN	0.026%	N	N	N	N	N	N	Large distribution range. AOI intercepts range. Few records from Kenya Bird Map - reported fairly regularly in cultivated land, just north of road between Illasit and Rombo. Higher occurences recorded by GBIF outside the EAAA, especially from Amboseli NP.	High

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria						Justification	Likelihood ¹
									1a	1b	1c	2a	3a	3b		
Aves	*Polemaetus bellicosus*	Martial Eagle	26000000		1559	Unknown	EN	0.006%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Few records by GBIF in EAAA (at Lake Chala in Tanzania and western boundary of Tsavo West), with most occurrences recorded from Amboseli, Tsavo West and Tsavo NPs.	Low
Aves	*Terathopius ecaudatus*	Bateleur	23500000		1559	Unknown	EN	0.007%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. No records from Kenya Bird Map. Few records by GBIF in EAAA, with most occurrences recorded from Amboseli, Tsavo West and Tsavo NPs.	Low
Aves	*Zosterops silvanus*	Taita White-eye	2000		0	250-999	EN + RR + E	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Found only in remaining forest on Taita Hills and Mount Kasigau, 65km east of Taveta town.	Zero
Aves	*Acrocephalus griseldis*	Basra Reed-warbler	438000		436	1,500-7,000	EN	0.100%	N	N	N	N	N	N	Breeds in south-east Iraq. Non-breeding and passage range does not intercept AOI. Small area of passage range falls within 10km buffer east of the road. Inhabits mainly wetland habitats. No records from Kenya Bird Map and GBIF in EAAA. Only a few records from Amboseli and Tsavo West/Tsavo NPs.	Very low
Aves	*Poeoptera femoralis*	Abbott's Starling	42600		0	1,000-2,499	EN + RR	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Inhabits montane forests with closest records from Mount Kilimanjaro to the west and Taita Hills to the east.	Zero
Aves	*Turdus roehli*	Usambara Thrush	4700		0	Unknown	EN + RR + E (TZ)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Inhabits primary forest and is only found in north-east Tanzania in the North Pare and Usambara Mountains.	Zero
Aves	*Cinnyris usambaricus*	Usambara Double-collared Sunbird	30800		0	Unknown	EN + RR	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Inhabits montane habitats (forest, heath and grassland) and is restircted to Taita Hills (Kenya) and South Pare and Usambara Mountains (Tanzania).	Zero
Aves	*Nectarinia johnstoni*	Red-tufted Sunbird	849000	21552	0	Unknown	LC + RR	0.000%	N	N	N	N	N	N	Patchy distribution throughout East Africa. Inhabits high altitude shrubland and grassland, occasionally montane forest. Nearest population occurs on southern slopes of Mount Kilimanjaro. Distribution does not intercept AOI, but has a small overlap with 10km buffer, however, the IUCN Red List distribution should shift more to south-west (see Appendix 3).	Zero

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria 1a	1b	1c	2a	3a	3b	Justification	Likelihood [1]
Aves	*Ploceus castaneiceps*	Taveta Golden Weaver	45807		1559	Unknown	LC + RR	3.403%	N	N	N	Y	N	N	Restricted distribution range in southern Kenya/northern Tanzania. AOI intercepts range. Inhabits wetland habitats and occasionally adjacent shrublands, savanna, forests. Few occurences recorded by from Kenya Bird Map - reported fairly regularly just north of road between Illasit and Rombo, as well as in the large floodplain wetland south of Taveta town that drains into Lake Jipe. GBIF also has records from the Lumi River and Taveta town.	High
Aves	*Zosterops eurycricotus*	Kilimanjaro White-eye	13821		35	Unknown	LC + RR + E (TZ)	0.253%	N	N	N	N	N	N	Restricted distribution range in northern Tanzania. Distribution does not intercept AOI. Very small area of range falls within 10km buffer south-west of Illasti town. Inhabits subtropical/tropical moist montane forest. No occurences recorded by Kenya Bird Map. Few occurrences recorded in the EAAA with GBIF south of Loitokitok town.	Very low
Aves	*Zosterops mbuluensis*	Mbulu White-eye	50500	12834	1559	Unknown	LC + RR + E (TZ)	0.000%	N	N	N	N	N	N	Restricted distribution range in northern Tanzania and southern Kenyna (Chyulu Hills). Distribution does not intercept AOI and 10km buffer. Inhabits montane forest, but also shrublands and gardens. No occurences recorded by Kenya Bird Map.	Zero
Aves	*Mirafra pulpa*	Friedmann's Lark	218000		752		DD	0.345%	N	N	N	N	N	N	Small distribution range in northern Tanzania and southern Kenya. AOI intercepts range. Inhabits grassland, with preferrence for fairly dense grassland with bushes, possibly avoiding drier areas. No occurences recorded by Kenya Bird Map. Few occurrences recorded in GBIF but well beyond EAAA in Chyulu Hills, Tsavo West and Tsavo NPs.	Low
Insecta	*Parepistaurus lindneri*	Kilimanjaro Wigwag Grasshopper	3210		0	Unknown	EN + RR + E (TZ)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Restricted to northeastern Tanzania - found on western and southern slopes of Mount Kilimanjaro, at Ngurdoto Crater, Mount Meru and Monduli. Inhabits montane forest, but can also occur in plantation.	Zero
Insecta	*Aerotegmina taitensis*	Taita Balloon Bushcricket	95		0	Unknown	EN + RR + E (TZ)	0.000%	N	N	N	N	N	N	Distribution does not intercept AOI and is well beyond 10km buffer. Only known form Ngangao Forest and Mbololo Forest on Mount Vuria in Taita Hills, southern Kenya. Inhabits moist montane forest.	Zero
Malacostraca	*Potamonautes platycentron*		1060	5.2	5.2	Unknown	EN + RR	0.491%	Y	N	N	N	N	N	Endemic to Lake Chala where it inhabits the lake edges. IUCN distribution range covers the entire Lumi River catchment, however, it only occurs within the crater lake.	Certain
Mammalia	*Ceratotherium simum cottoni*	Northern White Rhino	320	320	0	2	CR + RR + E (KEN)	0.000%	N	N	N	N	N	N	This species is extinct in the wild and there are only two femals left in a highly secure sanctuary in central Kenya.	Zero
Mammalia	*Diceros bicornis*	Black Rhino		179136	752	3142	CR	0.420%	N	N	N	N	N	N	Three subspecies. Assessment based on D.b. michaeli.	n/a

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria 1a	1b	1c	2a	3a	3b	Justification	Likelihood [1]
Mammalia	*Diceros bicornis michaeli*	Eastern Black Rhino		25916	0	583	CR	0.000%	N	N	N	N	N	N	AOI intercepts range. Distribution range has been reduced to Kenya and parts of northern and central Tanzania, and Rwanda where it has been reintroduced. Extinct in Eritrea, Ethiopia, Somalia, South Sudan, Sudan, and Uganda. Less than 600 mature individuals, which all managed in highly secure parks and sanctuaries. Reintroduced individuals to Tsavo have since died, and remaining individuals are confined to an Intensive Protection Zone (IPZ).	Zero
Mammalia	*Cephalophus spadix*	Abbott's Duiker	156650	6679	37.3	1500	EN + RR + E (TZ)	0.558%	Y	N	N	N	N	N	Endemic to Tanzania,where it is found in a several montane and submontane forests in the north, east and south-west. It currently occurs in Mount Kilimanjaro, western Usambara, Rubeho, and Udzungwa mountains, Mt Rungwe, forests of the Southern Highlands (Livingstone, Irungu, Irenga, Ndukunduku, Madehani). Small area of range falls within 10km buffer, but this area is completely disconnected from the AOI due to land transformation/ inhabitation.	Low
Mammalia	*Lycaon pictus*	African Wild Dog	7529483	1303469	752	1409	EN	0.058%	N	N	N	N	N	N	The AOI and 10km buffer does not intercept the distribution range, with the range largely being confined to the nearby national parks (Tsavo east and west, South Kitui etc). Given the ability of Wild Dog to move accross large areas there is a change, albeit small, that they could traverse the AOI . However, limited habitat and prey is available, particularly the western side of the road, thus they will be discouraged to stay in the area. Furthermore, they would be forced out of the area due to human-livestock conflict. Nearest recorded occurrence by GBIF >25km to the east in Tsavo West NP.	Very low
Mammalia	*Loxodonta africana*	African Savanna Elephant	>10000000	1751703	752	Unknown	EN	0.043%	N	N	N	N	N	N	Extremely large distribution range. AOI intercepts range. Known to occur within the EAAA, though it is anticipated that the species does not frequent the AOI. GBIF indicates 8 observations in the EAAA between 2000 and 2017. Highest observations come from Amboseli NP, as well as Tsavo West and Tsavo NPs.	Low
Mammalia	*Oryx beisa subsp. callotis*	Fringe-eared Oryx	188270		752	3000-4000	EN	0.399%	N	N	N	N	N	N	Ranges from south of the Tana River in south-east Kenya and north-east Tanzania, spreading west and south to Mkomazi, Amboseli and sporadically appearing in Serengeti. AOI intercepts range. The species has been recorded within 10km buffer, but only 3 records.	Moderate

Taxonomic Group	Species Name	Common Name	EOO (KM^2)	AOO (KM^2	EAAA (KM^2	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria						Justification	Likelihood [1]
									1a	1b	1c	2a	3a	3b		
Mammalia	*Redunca fulvorufula*	Mountain Reedbuck	>10000000	1,067,791	376	Unknown	EN	0.035%	N	N	N	N	N	N	Extremely large distribution range,made up of three disjunct and widely separated populations in West, East and southern Africa. AOI intercept part of range. 10km buffer only marginally overlaps eastern edge of the East African population range. Here the EAAA is highly transformed, restricting movement towards AOI. There are no recorded occurrences in the GBIF within 177km of the AOI. Occurs on ridges and hillsides in broken rocky country and high altitude grasslands.	Very low
Mammalia	*Suncus aequatorius*	Taita Dwarf Shrew	884		0	Unknown	EN + RR + E (KEN)	0.000%	N	N	N	N	N	N	Occurs in disturbed remnant forest in highland regions of Taita Hills. Distribution does not intercept AOI and is well beyond 10km buffer. No suitable habitat.	Zero
Mammalia	*Crocidura allex*	East African Highland Shrew	73828	8047	32	Unknown	VU	0.398%	N	N	N	Y	N	N	The AOI overlaps with the edge of one of the species few disjunct populations (i.e. Kilamajaro). Montane species found in alpine grassland and swamp areas. Although rare, the species is common in the afro-alpine zone on Mount Kilimanjaro	Very low
Mammalia	*Crocidura usambarae*	Usambara Shrew	7721		0	Unknown	VU + RR + E (TZ)	0.000%	N	N	N	N	N	N	The AOI does not intercept distribution and range is well beyond 10km buffer. Common within the Chrome Forest Reserve, South Pare Mountains (Tanzania), where it inhabits montane forest at 2000 masl.	Zero
Mammalia	*Crocidura newmarki*	Newmark’s Shrew	859	859	0	Unknown	NT + RR + E (TZ)	0.000%	N	N	N	N	N	N	Endemic to eastern slopes of Mount Meru, Tanzania, where is inhabits submontane forest and ericoide shrublands between 1,800 and 3,600 masl. The AOI does not intercept distribution and range is well beyond 10km buffer.	Zero
Mammalia	*Myosorex zinki*	Kilimanjaro Mouse Shrew	1206	1206	3.2	Unknown	LC + RR + E (TZ)	0.265%	N	N	N	N	N	N	Locally abundant on Mt. Kilimanjaro where is inhabits a number of habitats (forest, heathland, moorland, up to edge of alpine desert) at elevations ranging from 2500 to 4000m asl. AOI does not intercept distribution, but very small part of range extends into the 10km buffer.	Very low
Mammalia	*Crocidura fischeri*	Fischer's Shrew	10408	3172	79	Unknown	DD + RR	0.759%	N	N	N	Y	N	N	Poorly known species of shrew. Only recorded from two sites - Nkuruman in southern Kenya (160 km north-west of Illasit town) and Himo in Tanzania (just south of Taveta town). AOI does not intercept distribution, but very small part of range extends into the 10km buffer. Its full geographic range can only be properly determined once the taxonomic issues surrounding Crocidura voi have been resolved.	Moderate

Taxonomic Group	Species Name	Common Name	EOO (KM²)	AOO (KM²	EAAA (KM²	Population Estimate	Status	Proportion of EOO/AOO within EAAA	Critical Habitat Criteria						Justification	Likelihood [1]
									1a	1b	1c	2a	3a	3b		
Mammalia	*Crocidura gracilipes*	Peters' Musk Shrew	Insufficient data to determine			Unknown	DD + RR + E (TZ)	0.000%	no	no	N	N	N	N	Only kNwn from the holotype, collected at the indistinct type locality of "Auf der Reise nach dem Kilimandscharo" which is usually taken as "Kilimanjaro, Tanzania". More recently, there have been records in Murchison Falls in Uganda, but these require confirmation.	Zero
Mammalia	*Gerbillus percivali*	Percival's Gerbil	165	18	0	Unknown	DD + RR + E (KEN)	0.000%	N	N	N	N	N	N	Little is known of the species. Only been recorded from southeastern Kenya at two localities the closet being at Maktau 40km east of the road. Appears to be associated with dry sandy plains with some thorn scrub.	Moderate
Mammalia	*Crocidura monax*	Kilimanjaro Shrew	13861	7199	0	Unknown	DD + RR + E (TZ)	0.000%	N	N	N	N	N	N	Occurs on Mount Kilimanjaro and the North Pare Mountains in northern Tanzania where it inhabits montane forest. AOI and EAAA does not overlap with the species range.	Zero
Reptilia	*Malacochersus tornieri*	Pancake Tortoise	385000	72000	752	Unknown	CR	0.195%	N	N	N	N	N	N	Occurs in 11 disjunct areas within Kenya, Tanzania and northern Zambia. EOO intercepts the AOI. The closest known subpopulation is 65km north-east from the road, and extends northwards from Tsavo West National Park. A second subpopulation occurs in Zambia approximately 75km south of the Taveta, and a third subpopulation occurs west of Mount Kilimanjaro approximately 100km from the road. Habitat specialist that inhabits rocky hills and outcrops within dry bushland and savanna. Does not migrate or move much, other than localised movements between areas of suitable habitat. No GBIF records within 100km of the road.	Very low
Reptilia	*Elapsoidea nigra*	Black Garter Snake	50760	3950	0	Unknown	LC + RR	0.000%	N	N	N	N	N	N	EOO does not intercept the AOI or 10km buffer. Occurs in 6 disjunct areas within southeastern Kenya and northeastern Tanzania. Closest subpopulation is 40km south of Taveta town in Tanzania. Inhabits moist evergreen forest, which is not present within the EAAA.	Very low
Reptilia	*Rhampholeon viridis*	Pare Pygmy Chameleon	1333	152	0	Unknown	EN + RR + E (TZ)	0.000%	N	N	N	N	N	N	EOO does not intercept the AOI or 10km buffer. Endemic to the North and South Pare Mountains, northern Tanzania, which extend from approximately 40km south of Taveta town in a southerly direction. Inhabits afrotemperate forest, sometimes found at forest edges. No suitable habitat provided within the EAAA.	Zero

[1] **Likelihood classes - Certain, Very high, High, Moderate, Low, Very low, Zero – that a species occurs within the AOI**

5.3 Critical Habitat Determination

The screening of biodiversity features was used to determine which features occur within the project's AOI. For most feature, very limited information is available to provide estimates of the locally affected populations in relation to the global population. Thus, EOO and AOO information was used as far as possible to determine whether the project's AOI would trigger the thresholds presented in Table 5-2.

5.3.1 *Critically Endangered and Endangered species*

Bullockia dyscritos

Bullockia dyscritos (also known as *Bullockia dyscriton*) is an Endangered plant from the Family Rubiaceae that was last assessed in November 2014 under criteria B2ab(iii).

It is a small, often compact shrub (0.5 to 3 m tall) that occurs in rocky habitat, but can be found growing on roadside banks and in grazed eroded areas (Ammano *et al.*, 2020). Restricted to five localities in south-central Kenya and north-eastern Tanzania (Figure 5-1). Its AOO and EOO is only 20km^2 and 23,838.5km^2 respectively, and its altitudinal range is between 750 and 1330 masl (Ammano *et al.*, 2020). The GBIF has 12 records of the species, which correspond with the localities presented by IUCN Ammano *et al.* (2020), the closest being approximately 80km north-east of Illasit, which was observed by Mr Quentin Luke in July 2005. *Bullockia dyscritos* was not recorded along the Illastit-Taveta road during the survey in March 2021, which was conducted by Mr Quentin Luke.

It is highly unlikely that the AOI supports more than 0.5% of the global population, despite there being extensive erosion – there is currently no information on its population size and trends.

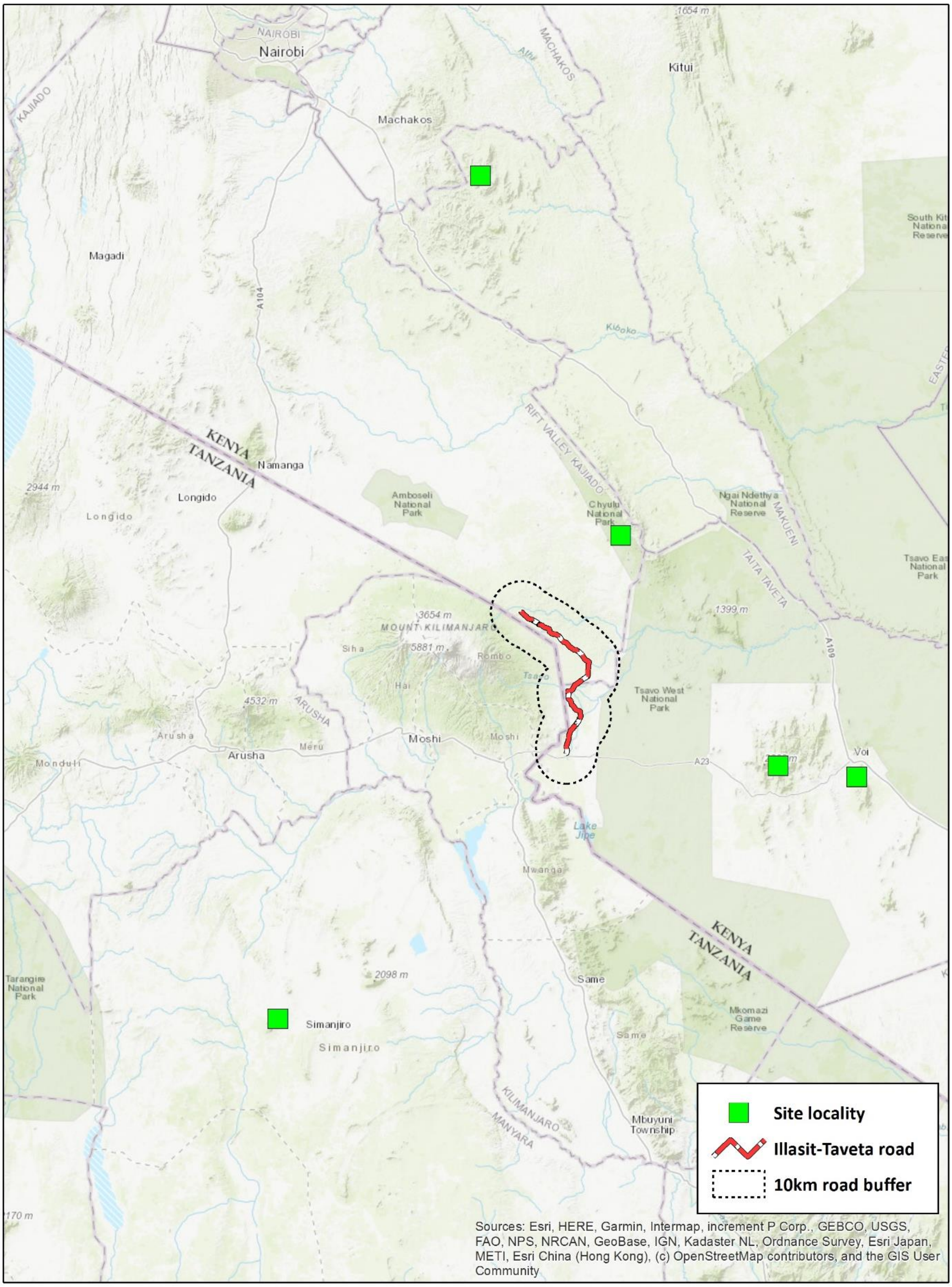


Figure 5-1 Point localities where *Bullockia dyscritos* has been recorded in relation to the proposed upgrade of the Illasit-Taveta Road, Kenya (after Ammano *et al.*, 2020)

Crotalaria ukambensis

Crotalaria ukambensis is an Endangered plant from the Family Fabaceae that was assessed in 2019 by the East African Plants Red List Authority under criteria B2ab(i,ii,iii,iv,v).

It is a procumbent or ascending much-branched annual or perennial up to 1 m-tall that occurs in deciduous bushland and grassland with scattered trees at altitudes ranging from 750 to 1,330 masl (IUCN SSC East African Plants Red List Authority, 2019). It is restricted to an EOO of 33,825.5km^2 in southern Kenya and northern Tanzania, and has an AOO of just 70km^2 (Figure 5-2). Most of the collections are very old, which is confirmed by the 31 records contained by the GBIF. The closest recorded site is approximately 45km west of Taveta town near Moshi (Tanzania). *Crotalaria ukambensis* was not recorded along the Illastit-Taveta road during the survey in March 2021. The only area along the Illasit-Taveta road where it may possibly occur is along Section 3 of the road (see Section 4.1.3).

It is highly unlikely that the AOI supports more than 0.5% of the global population – there is currently no information on its population size and trends.

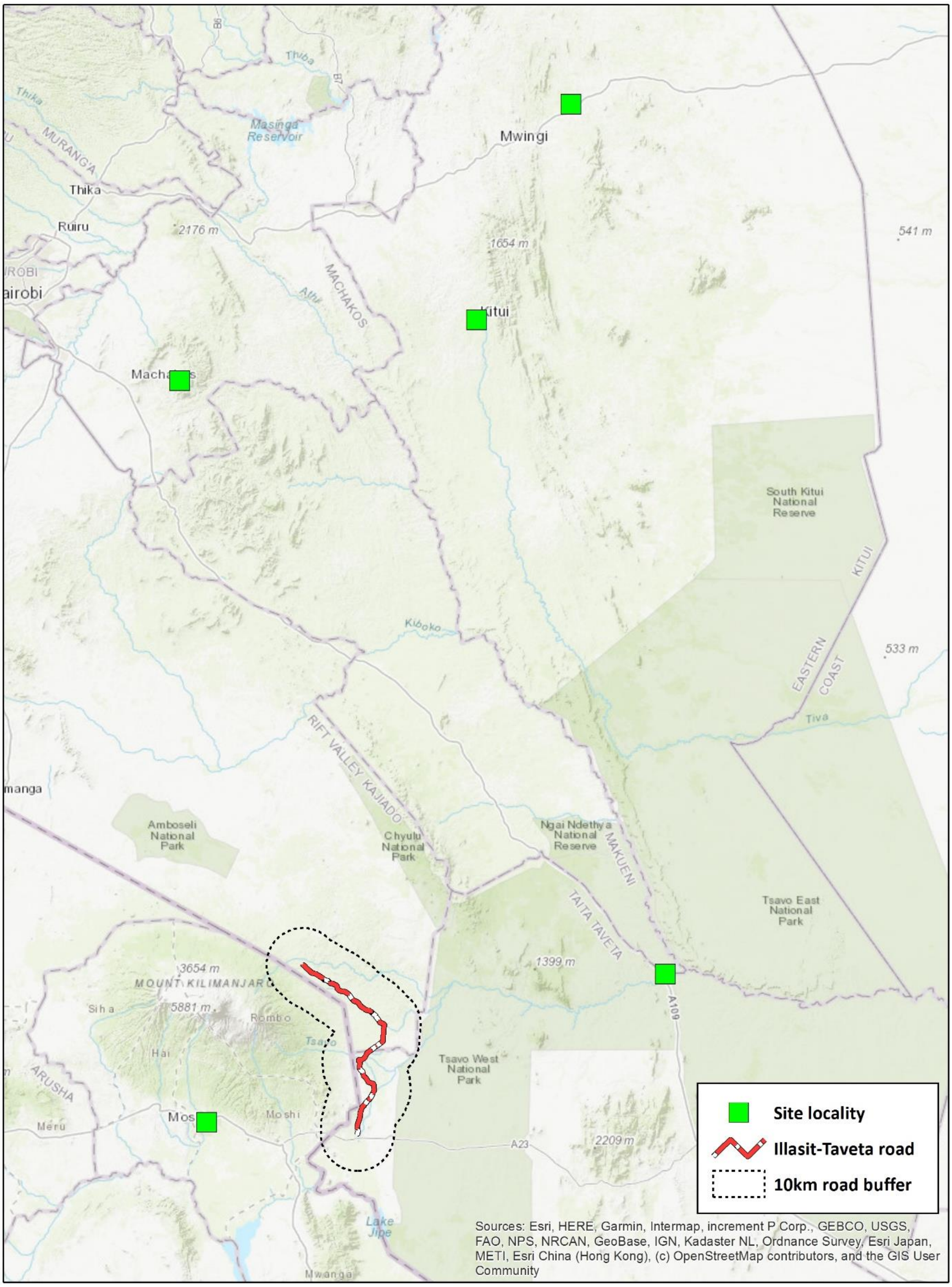


Figure 5-2 Point localities where *Crotalaria ukambensis* has been recorded in relation to the proposed upgrade of the Illasit-Taveta Road, Kenya (after IUCN SSC East African Plants Red List Authority, 2019)

Cephalophus spadix (Abbott's Duiker)

Cephalophus spadix is an Endangered mammal from the Family Bovidae that was assessed by Moyer *et al.* (2016) in January 2016 under criteria C2a(i).

Cephalophus spadix is endemic to Tanzania where it occurs in several montane and submontane forests (Figure 5-3), namely Mount Kilimanjaro, Mount Rungwe, western Usambara, Rubeho, Udzungwa mountains, and the Southern Highlands (Livingstone, Irungu, Irenga, Ndukunduku, Madehani) (Moyer *et al.*,2016). The Udzungwa Mountains and Mount Kilimanjaro might hold the only two viable populations (Rovero *et al.*, 2013).

It is found in interior and clearings of mature forest (Moyer *et al.*,2016). On Mount Kilimanjaro, it is commonest between 1,300 and 2,700 masl (Grimshaw *et al.*, 1995). It is also known from disturbed and secondary montane forest and bamboo forest from 300 to 2,500 masl, and even occasionally on plateau grassland (T. Davenport and S. Machaga unpubl.). Very little is known of its ecology and behaviour. It is an extremely secretive species, occurring at low densities and very rarely seen even where it is considered relatively common. Furthermore, it appears to be mainly nocturnal and crepuscular (F. Rovero unpubl.) and, as with most duiker species, probably prefers dense, understorey vegetation. Population is estimated to be fewer than 1,500 mature individuals and considered to be decreasing (Moyer *et al.*,2016).

Although a small portion of the AOI extends into forested areas on the north-eastern side of Mount Kilimanjaro, it is completely disconnected for the Illasit-Taveta road (Figure 5-3). Furthermore, given the dense human population around the entire eastern side of Mount Kilimanjaro, occurrences of *Cephalophus spadix* in the lower parts of the forest will be extremely low.

It is highly unlikely that the AOI supports more than 0.5% of the global population, and the proposed upgrade of the Illasit-Taveta road will not have any impact on the species given the lack of suitable forest habitat within the AOI and the level of landscape fragmentation.

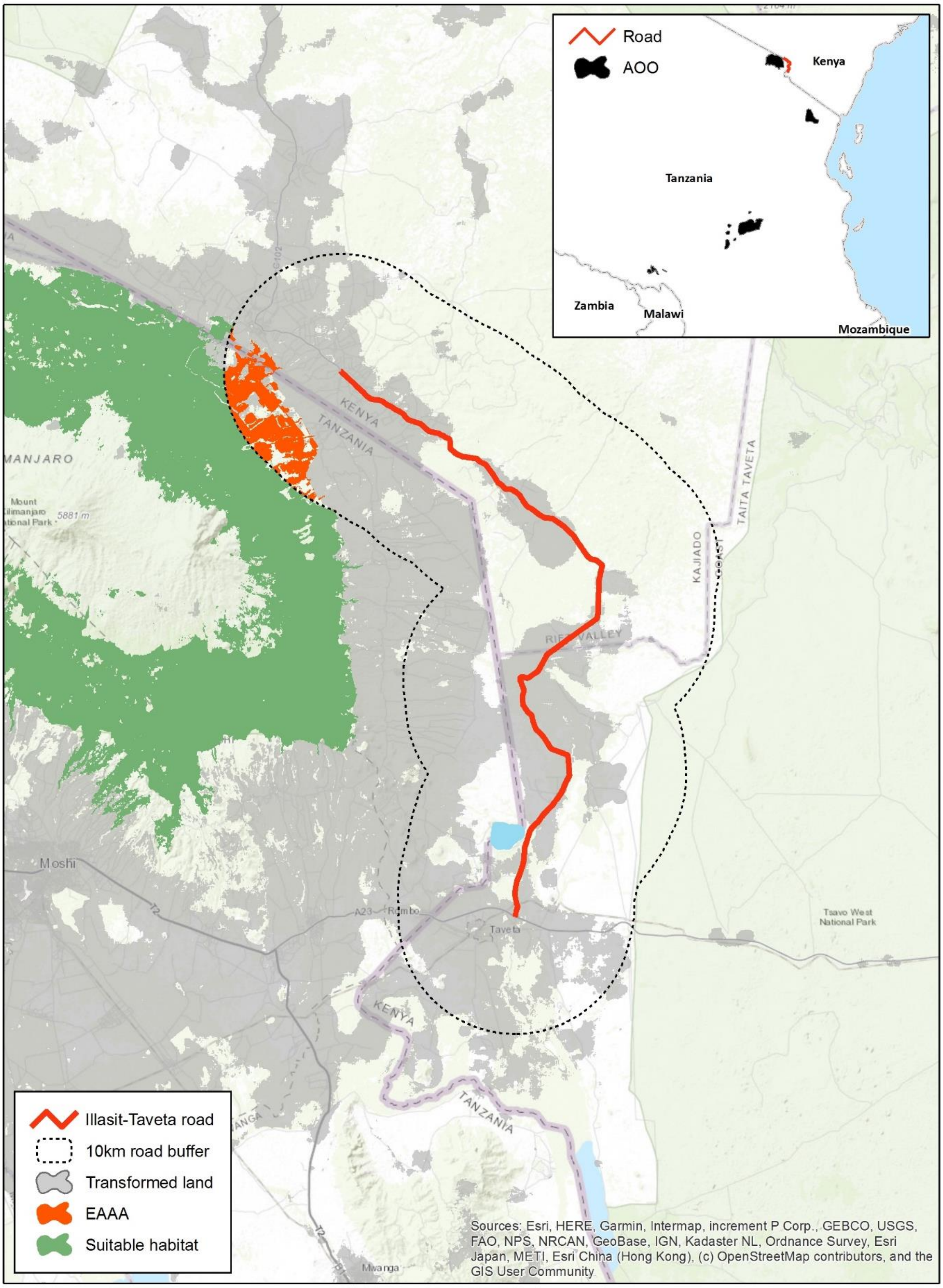


Figure 5-3 Abbott's Duiker (*Cephalophus spadix*) distribution from the Mount Kilimanjaro subpopulation in relation to the proposed upgrade of the Illasit-Taveta Road, Kenya

Oryx beisa subsp. *callotis* (Fringe-eared Oryx)

Oryx beisa ssp. callotis is a mammal from the Family Bovidae that was assessed as Vulnerable under criteria A2bd by the IUCN SSC Antelope Specialist Group (2018) in February 2018.

Genetic evidence has resulted in *Oryx beisa* being split into two sub-species, *Oryx beisa callotis* and *Oryx beisa beisa* (Masembe et al., 2006). *Oryx beisa beisa* is currently Endangered and occurs north of the range for *Oryx beisa callotis*.

Oryx beisa ssp. callotis has a fairly large range with an EOO of 188,000 km^2 that extends from south of the Tana River in south-eastern Kenya down to north- eastern Tanzania, spreading west and south to Mkomazi and Amboseli National Parks and sporadically appearing in the Serengeti (Wacher and Kingdon, 2013) (Figure 5-4). It inhabits arid grassland, Acacia-Commiphora bushland and open woodland where it feeds mainly on grasses, with some browse consumed during the dry season (Foley et al., 2014).

The global population is estimated to be around 4,000 to 6,000 individuals (approximately 3,000 to 4,000 mature individuals). In Kenya, the population drastically declined from 27,000 individuals in 1977 to 1980 to approximately 5,000 in the mid-1990s (East, 1999), and to 3,400 in 2011 to 2013 (Ogutu et al., 2016).

<u>Oryx beisa ssp. callotis</u> does not trigger any critical habitat thresholds as it is not listed as Critically Endangered or Endangered, and is not considered an endemic or restricted-range species.

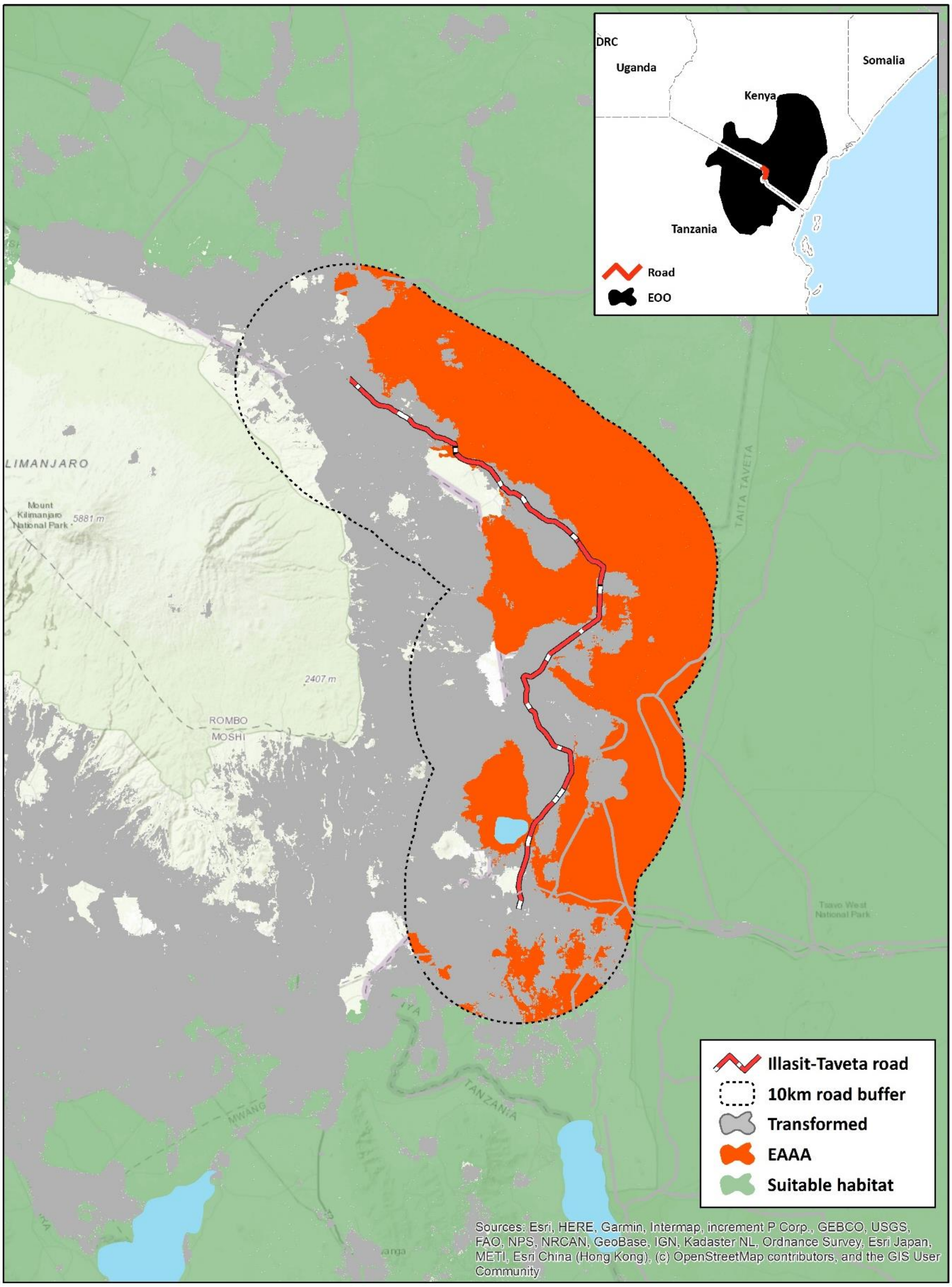


Figure 5-4 Fringe-eared Oryx (*Oryx beisa* subsp. *callotis*) distribution in relation to the proposed upgrade of the Illasit-Taveta Road, Kenya (Antelope Specialist Group, 2018)

Balearica regulorum (Grey Crowned Crane)

Balearica regulorum is an Endangered bird from the crane family (Family Gruidae) that was assessed by BirdLife International (2016a) in October 2016 under criteria A2acd+4acd.

Balearica regulorum occurs in eastern and southern Africa covering a large geographic range of 6,070,000 km^2 (Figure 5-5 The population (estimated at 26,500 to 33,500, which is roughly 17,700 to 22,300 mature individuals) in many areas such as in Kenya has experienced rapid decline (Beilfuss *et al.*, 2007), and Kenya is believed to have the largest remaining populations (10,000-12,500 individuals in 2014). It is not a migratory species, although it does may make variable local and seasonal movements depending on the abundance and distribution of food, nest-sites and rainfall (del Hoyo *et al.*, 1996). The timing of breeding varies in relation to the rains, with the breeding of East African populations peaking during dry periods.

It inhabits wetlands (e.g. marshes, pans and dams with tall emergent vegetation), riverbanks, open riverine woodland, shallowly flooded plains, and temporary pools (del Hoyo *et al.*, 1996; Hockey *et al.*, 2005; Meine and Archibald, 1996; Urban *et al.*, 1986), as well as adjacent grasslands, open savannas, and croplands, pastures, fallow fields and irrigated areas (del Hoyo *et al.*, 1996, Meine and Archibald, 1996). It shows a preference for short to medium height open grasslands adjacent to wetlands for foraging (Meine and Archibald 1996), and breeds within or at the edges of wetlands (Meine and Archibald 1996) especially in marshes with water 1 m deep and with emergent vegetation 1 m above the water (Urban et al. 1986). It roosts in water along rivers or in marshes, or perches on nearby trees (Urban et al., 1986; Meine and Archibald, 1996).

The GBIF has over 45,000 occurrences for its entire range, with south-western Kenya and north-central Tanzania containing close to 30% of the reported records. Amboseli National Park has close to 1,000 occurrences reported represented significant portion of the region. It is also been reported along the Illasit-Taveta road, between the towns of Illasit and Rombo – here there have been 45 occurrences reported. This is supported by the reports from the Kenya Bird Atlas where the pentad immediately east of Illasit where there are 9 reported sightings from 29 full protocol cards (31%). Figure 5-5 shows areas within the AOI that contain wetlands as primary habitat for the species.

Although the species is reported fairly regularly within the area, especially in the croplands and small wetlands between the towns of Illasit and Rombo, it is highly unlikely that that the AOI supports more than 0.5% of the global population. Nevertheless, it will be important to make sure that stormwater runoff from the road is properly managed by well-designed stormwater infrastructure to control runoff so that it does not impact wetlands downstream where the species occurs regularly.

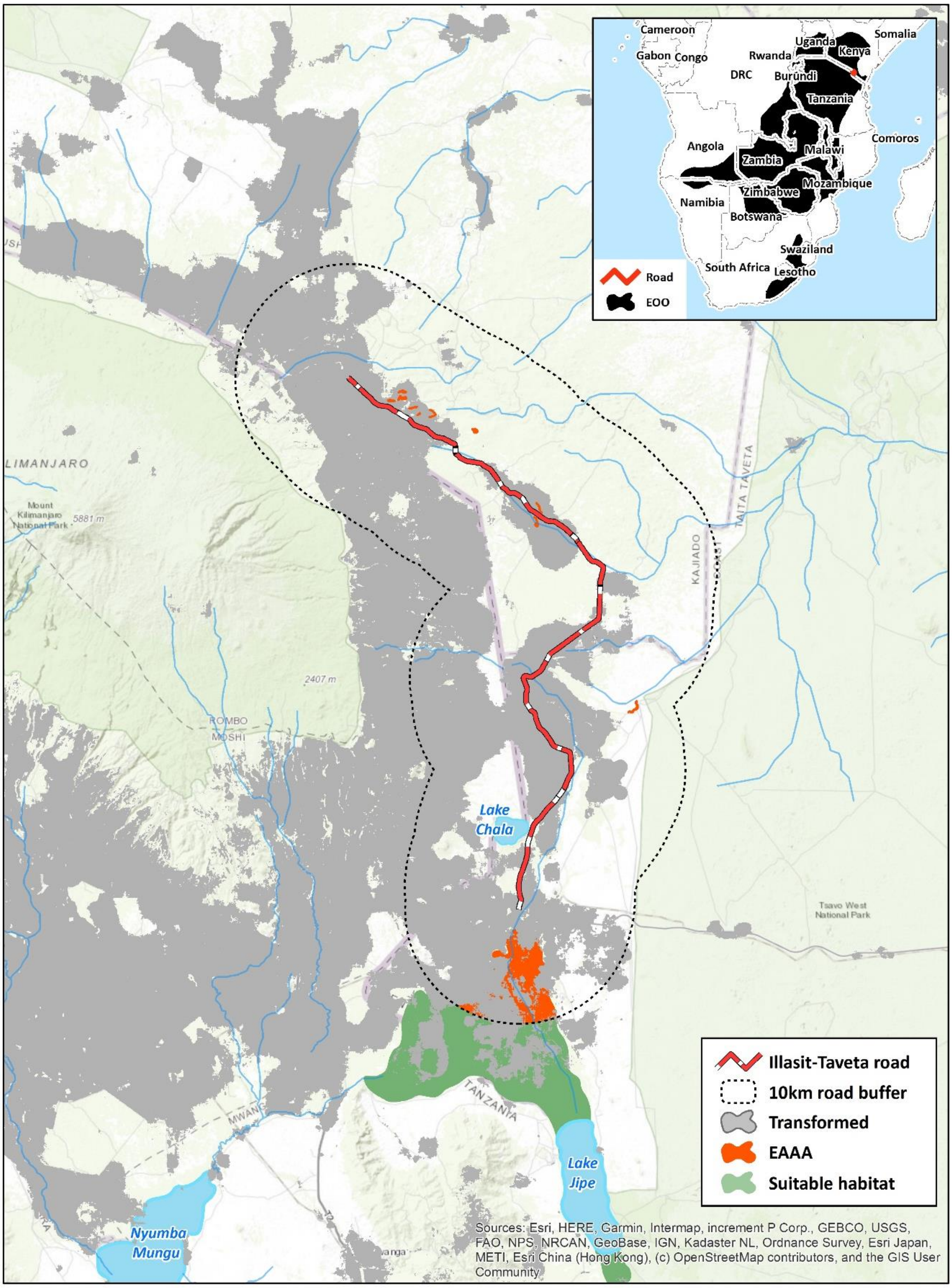


Figure 5-5 Distribution map of Grey Crowned Crane (*Balearica regulorum*) according the IUCN Red List database (BirdLife International, 2016a) in relation to the proposed road upgrade project between Illasit-Taveta

Enteromius amboseli (Amboseli Barb)

Enteromius amboseli is an Endangered fish from the Family Cyprinidae that was assessed by Schmidt (2020) in January 2020 under criteria B1ab(iii).

Enteromius amboseli is endemic to the middle Athi River catchment in southern Kenya (Schmidt *et al.*, 2018) and has a very restricted range – its EOO is 4,125 km^2 and its AOO is 1,128 km^2 (Figure 5-6 It is only known to occur in swamp and stream habitats with slow moving water and dense vegetation (Schmidt *et al.*, 2020). The few known localities include Amboseli National Park, the Kiambogo River (just east of Amboseli National Park), and the Mzima Springs (approximately 40 km east of the Illasit-Taveta road), which drains into the Tsavo River within Tsavo West National Park (Schmidt *et al.*, 2018; Schmidt *et al.*, 2020). The swamps and streams of Amboseli National Park and the Mzima Springs are under threat from surface water and groundwater abstractions and development of small and large scale agriculture. There no information is available regarding its population size and trend, and it is possible that the may also occur in northern Tanzania.

It is possible that *Enteromius amboseli* occurs within the AOI along the Tsavo River where suitable habitat exists, which is more likely further downstream closer to Tsavo West National Park. It is also possible that it occurs in other rivers in southern Kenya, such as the Lumi River, which does support suitable habitat. The EAAA mapped during critical habitat screening is approximately 250 km^2, and makes up 6% of the species' EOO.

***Enteromius amboseli* should be treated as a critical habitat triggering species given that it may occur within the Tsavo River, as well as potentially the Lumi River. However, there is only a moderate likelihood that it the species occurs within the Tsavo River, especially since the river does not flow for most of the year.**

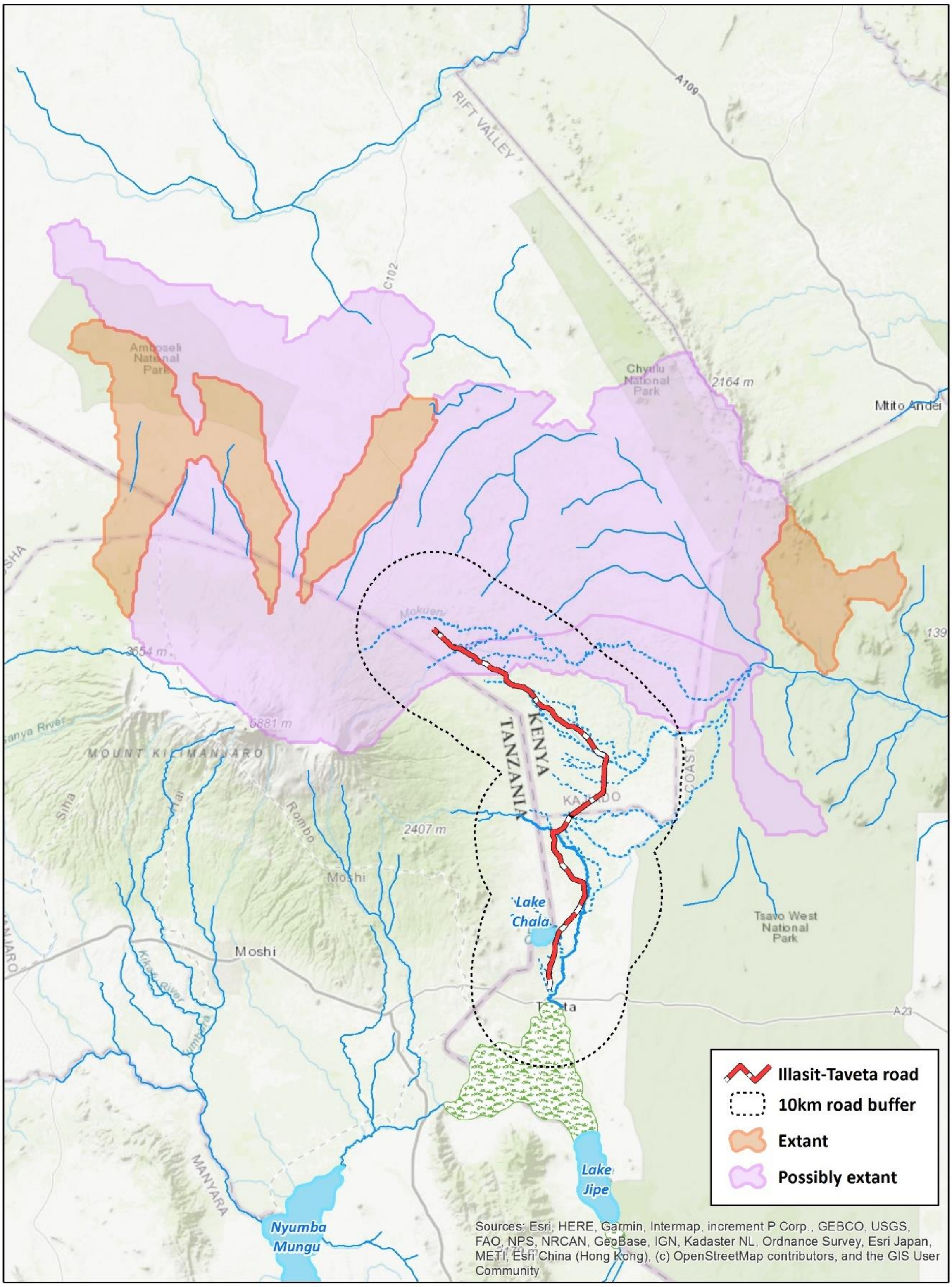


Figure 5-6 Distribution map of *Enteromius amboseli* according the IUCN Red List database (Schmidt et al., 2018) in relation to the proposed road upgrade project between Illasit-Taveta

Oreochromis esculentus (Singidia Tilapia)

Oreochromis esculentus is a Critically Endangered fish from the Family Cichlidae that was assessed by Twongo *et al.*(2006) in January 2006 under criteria A2bcde.

Oreochromis esculentus is endemic to the Lake Victoria basin (Figure 5-7), including various smaller lakes in Tanzania, Uganda (e.g. Kyoga Lake), and Kenya (Twongo *et al.*, 2006). Its common name refers to Lake Singida, but this population is the result of an introduction that happened in the 1950s (Genner *et al.*, 2018).

It has almost been eliminated from its natural distribution range due to predation (notably by Nile Perch), competitive exclusion and ecological displacement by introduced fishes (Twongo, 1995; Nagayi Kalule, 1999). The main population (in Lake Victoria) has declined by over 80% over the past 20 to 30 years (Twongo *et al.*, 2006). The remaining population is now limited to subpopulations residing in a few satellite lakes, which are themselves undergoing continued environmental degradation with heavy pressure from fishing. *Oreochromis esculentus* has been introduced to other catchments in Tanzania, including the Pangani River basin where it presents a threat to other native species such as *O. jipe* (Bayona et al., 2006). Originally (i.e. before competitive exclusion/predation by introduced species), it was confined to shallow waters (<20 m deep) and was most abundant in sheltered gulfs and bays in Lake Victoria (Witte and de Winter, 1995).

Close to 80% (251 of 321) of the occurrences in GBIF are from the Lake Victoria basin, while the remainder are from lakes in Tanzania located further south (e.g. Lakes Rukwa, Sangara, etc.). Additional localities are provided by Genner *et al.* (2018) confirming its occurrence throughout the Pangani River system up to Lake Jipe where it has displaced *O. jipe* as the dominant species (Hamerlynck *et al.*, 2008). It was also report by Hamerlynck *et al.* (2008) as comprising over 90% of the catches from Nyumba ya Mungu Reservoir.

***Oreochromis esculentus* should not be treated as a highly threatened species within the AOI as it is not a native species of the Pangani River basin.**

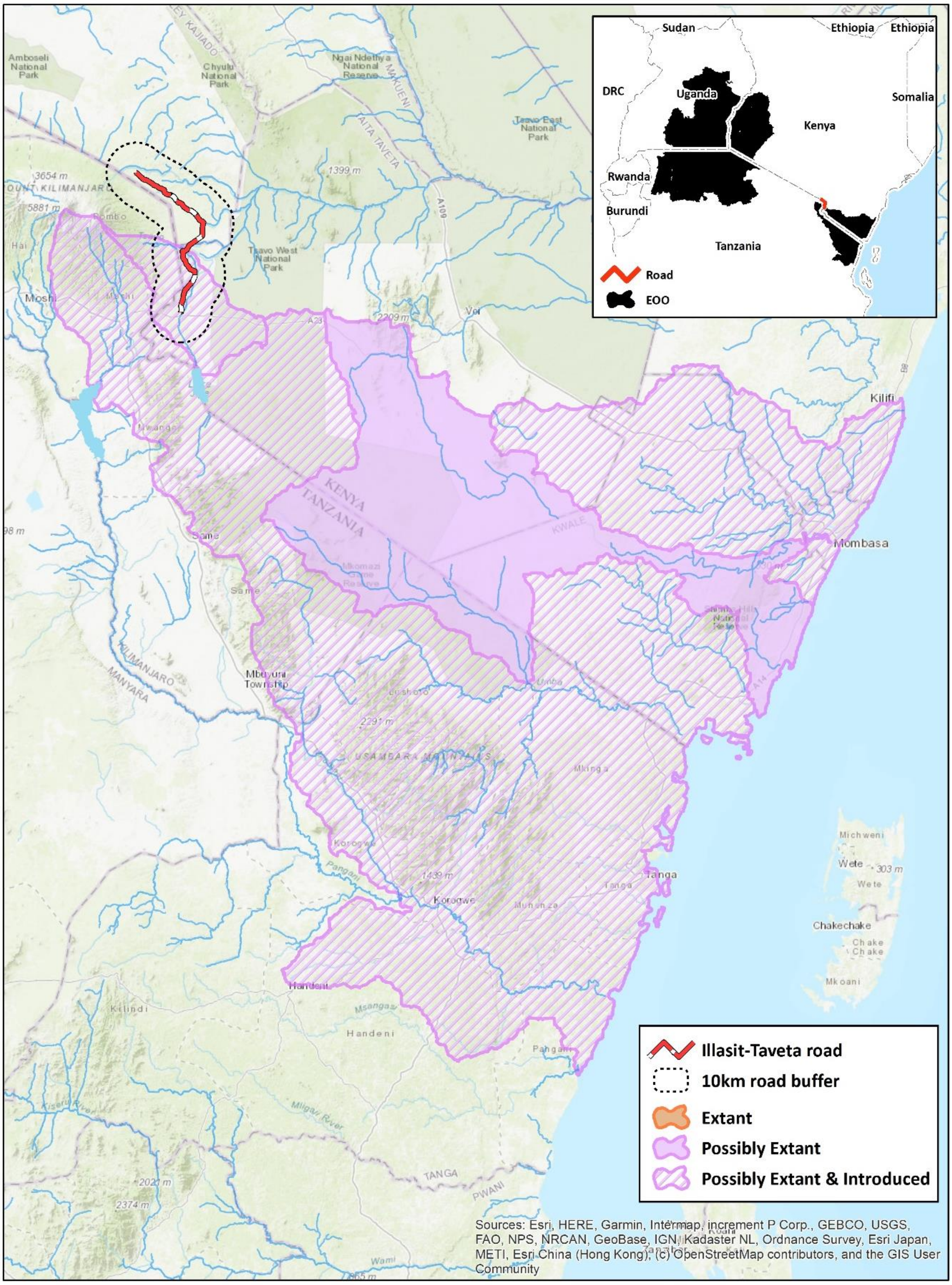


Figure 5-7 Distribution map of Singidia Tilapia (*Oreochromis esculentus*) according the IUCN Red List database (Twongo *et al.*, 2006) in relation to the proposed road upgrade project between Illasit-Taveta – its original/native EOO was the Lake Victoria basin as presented in ther insert

Oreochromis hunteri (Lake Chala Tilapia)

Oreochromis hunteri is a Critically Endangered fish from the Family Cichlidae that was assessed by Bayona *et al.* in 2006 under criteria B1ab(i,iii).

Oreochromis hunteri is known to be endemic to Lake Chala (Kenya and Tanzania) where it generally inhabits deep water (20 to 45 m). No information exists of the food preferences of adults, but young feed are known to feed on algae and debris on the bottom of the lake near the shore. Once considered abundant in the lake, population numbers have decreased significantly. The species is threatened by overfishing and use of gillnets (Hamerlynck *et al.*¸ 2008), siltation, seasonal drought and weed infestation (Bayona *et al.*, 2006), however, the greatest threat is more likely due to the introduction of other tilapia species to the lake, resulting in predation of juveniles and competition for resources. Moser *et al.* (2019) confirmed three non-native tilapia species in Lake Chala, namely an undescribed Oreochromis species that is sometimes incorrectly referred to as *O. korogwe*, Redbreast Tilapia *Coptodon rendalli*, and a haplochromine cichlid of the riverine *Astatotilapia bloyeti* complex. Prior to these introductions (i.e. from after 1951) the Lake Chala Tilapia was the only fish in the lake (Dadzie *et al.*¸ 1988) and the population would have been stable. However, the population numbers have significantly declined over the last few decades to the point that it is now considered fairly rare within the lake (Moser *et al.*, 2019).

Dr Benjamin Ngatunga, previously from the Tanzania Fisheries Research Institute (TAFIRI), has undertaken numerous fish surveys across the entire Pangani River basin, and confirmed collecting *O. hunteri* from Lake Chala (on the Tanzania side), but has never recorded it anywhere else in the system (Dr Benjamin Ngatunga pers.comm., 2022). This was corroborated by other ichthyologists and fisheries experts that have also surveyed the upper Pangani River system (Professor George F. Turner pers. comm., 2022; Dr Wanja Nyingi pers. comm., 2022).

Figure 5-8 illustrates the position of the existing Illasit-Taveta road in relation Lake Chala. Although the road is near the lake, it is completely disconnected from the lake by the topography associated with the crater. Consequently the road does not have any impact on the lake and its ecological functions and processes – all stormwater runoff, erosion and sedimentation is directed eastwards away from the lake. The road does however provide easy access to the rim of the crater, presenting some level of risk in terms of unsustainable use and overfishing, as well as further introductions of non-native species.

Given that <u>Oreochromis hunteri</u> only occurs in Lake Chala means that it triggers critical habitat according to Criterion 1a of the IFC PS6 as more than 0.5% of the global population occurs within the lake.

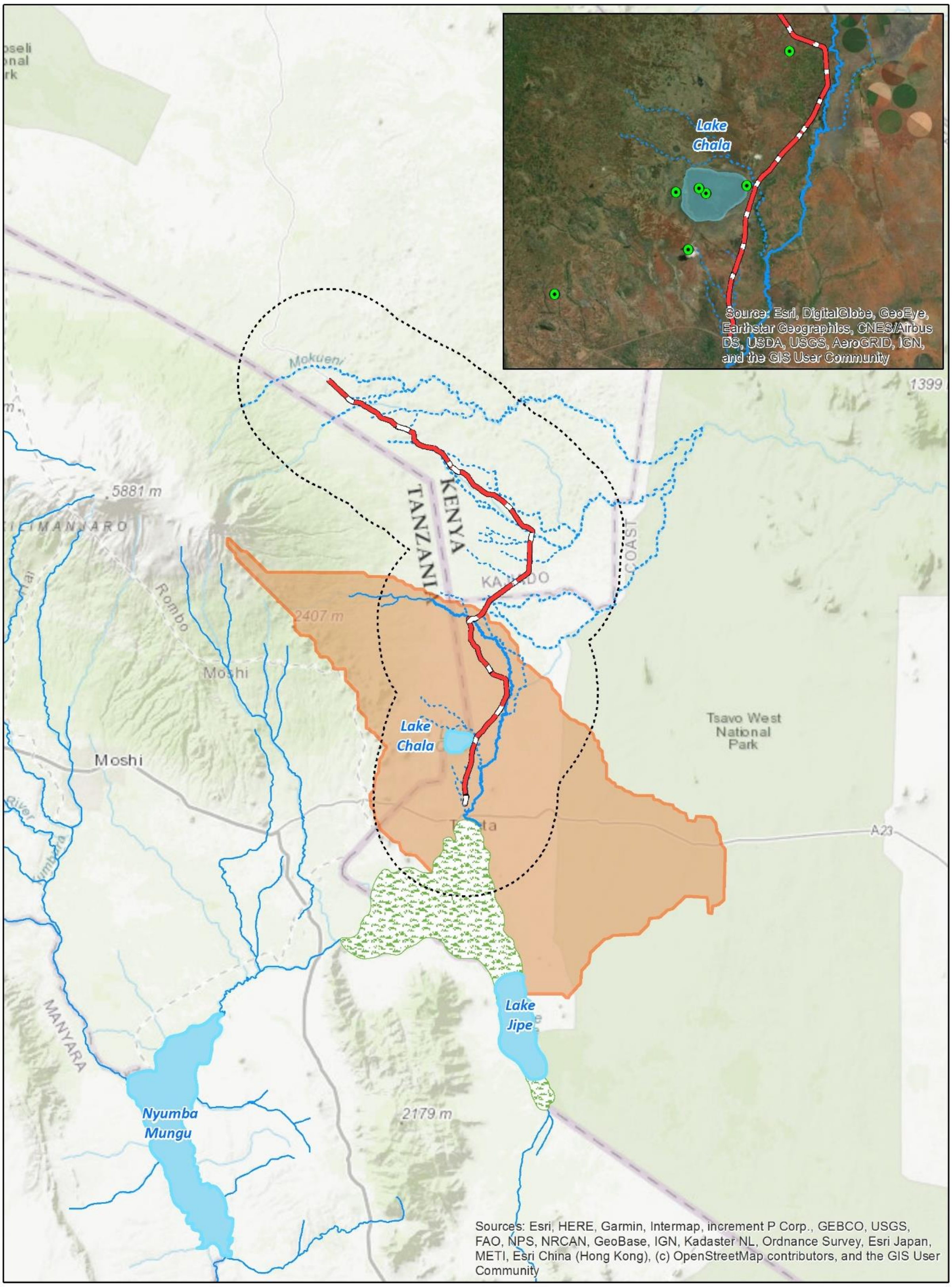


Figure 5-8 Distribution map of Lake Chala Tilapia (*Oreochromis hunteri*) according the IUCN Red List database (Bayona *et al.*, 2006) in relation to the proposed road upgrade project between Illasit-Taveta, with point localities from the GBIF (insert)

Oreochromis jipe (Jipe Tilapia)

Oreochromis jipe is a Critically Endangered fish from the Family Cichlidae that was assessed by Bayona and Hanssens in January 2006 under criteria B1ab(i,iii,v).

According to Bayona and Hanssens (2006) it is endemic to Lake Jipe, which is approximately 16 km² and located on the Ruvu River in the upper Pangani River basin, and has managed to colonise the Nyumba ya Mungu reservoir, a hydroelectric dam located on the Ruvu River approximately 45 km downstream that was built in the 1960s. The total estimated EOO as originally assessed Bayona and Hanssens (2006) was 72 km² (this area is actually the AOO and not EOO – the EOO for both lakes should be closer to 750 km²). More recent surveys undertaken by Genner *et al.* (2018) between 2011 and 2018 recorded *O. jipe* at other sites further down the system to Pangani Falls, which increases the EOO to approximately 43,000 km². Using the geographic range criteria only would not qualify *O. jipe* as Critically Endangered, Endangered or even Vulnerable.

Historically it was reported as the most abundant of three main species living within Lake Jipe, but it now no longer occurs in the numbers of the past and is not as widespread as it used to be, being restricted to the vegetated margins of the lake (Hamerlynck *et al.*, 2008).

O. jipe prefers riverine habitats or inshore areas for grazing and refuge (Bailey *et al.*, 1999) and it does not have a peak breeding season (Trewavas, 1983). Thus, it is likely to occur within the Lumi River system, which extends into the AOI. The catchment area of the Lumi River down to Lake Jipe is approximately 1,060 km², which is about 2.5% of the EOO expansion to 43,000 km² (Figure 5-9). Although, it is possible that the Red List category could change in future based on additional records from Genner *et al.* (2018), it will still need to be regarded as Critically Endangered until it can be reassessed.

<u>Oreochromis jipe</u> should be treated as a critical habitat triggering species given that it is likely to occur upstream of Lake Jipe within the Lumi River.

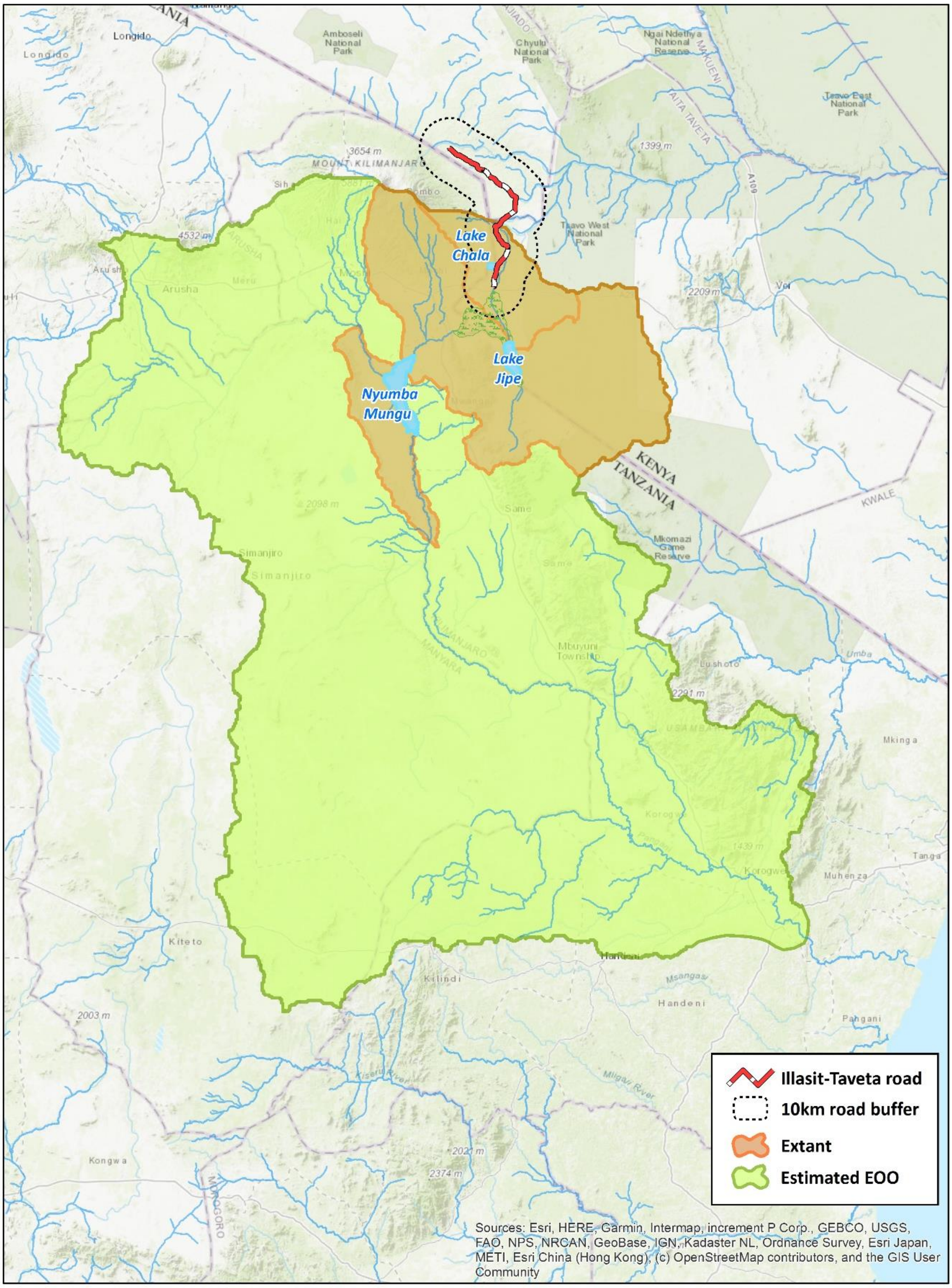


Figure 5-9 Distribution map of Jipe Tilapia (Oreochromis jipe) according the IUCN Red List database (Bayona and Hanssens, 2006) in relation to the proposed road upgrade project between Illasit-Taveta, with the potential EOO estimated

Malacochersus tornieri (Pancake Tortoise)

Malacochersus tornieri is a Critically Endangered reptile from the Family Testudinidae that was assessed by Mwaya *et al.* (2019) in October 2018 under criteria A4abcd.

Pancake Tortoise is a small, soft-shelled, dorso-ventrally flattened tortoise that is associated with scattered rocky hills, outcrops and kopjes in dry savannas of south-eastern and northern Kenya and northern, eastern and central Tanzania (Malonza, 2003). Their flattened and flexible shells enable them to push and wedge themselves in rock crevices (Loveridge and Williams, 1957). Their unique appearance and behaviour has also made popular in the international pet trade, placing them at risk from illegal collections in the wild (Malonza, 2003). They are listed in Appendix II of the Convention on International Trade in Endangered Species of wild fauna and flora (CITES).

Currently it occurs in 11 disjunct areas, with the closest subpopulation being 65km north-east from the town of Illasit, which extends northwards from Tsavo West National Park (Figure 5-10). A second subpopulation occurs in Zambia approximately 75km to the south of Taveta town, and a third subpopulation occurs west of Mount Kilimanjaro approximately 100km from the road. The species does not migrate or move much, other than small localised movements between areas of suitable habitat. The GBIF has over 500 occurrences recorded, which correspond well with the distribution map (Figure 5-10), but none of these records are within 100km of the road.

The only suitable habitat for Pancake Tortoise that occurs within the AOI, is at Lake Chala, however, the likelihood of them occurring here is exceptionally low. If there was a regular occurrence at Lake Chala, then it is likely that they would have been observed by numerous the researchers/visitors that frequently visit the lake – this is supported by the absence of iNaturalist observations.

It is highly unlikely that the AOI supports more than 0.5% of the global population – there is currently no information on its population size, but and trends indicate that the population is decreasing.

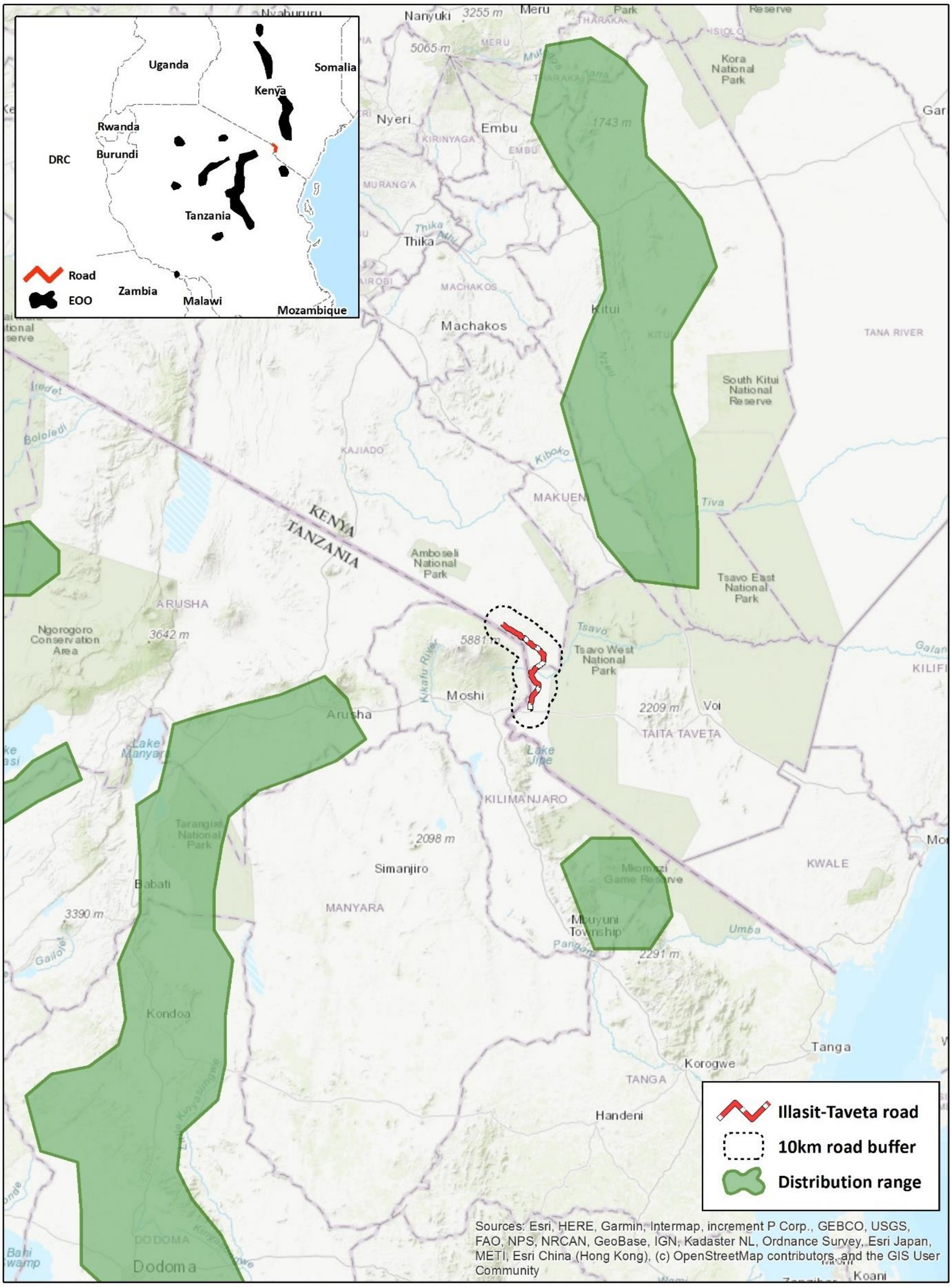


Figure 5-10 Pancake Tortoise (*Malacochersus tornieri*) distribution according the IUCN Red List database (Mwaya et al., 2019) in relation to the proposed road upgrade project between Illasit-Taveta

Potamonautes platycentron

Potamonautes platycentron is a freshwater crab from the Family Potamonautidae (Order Decapoda; Class Malacostraca) that was assessed as Endangered under criteria B1ab(iii)+2ab(iii) by Cumberlidge (2008) in January 2008.

According to Bott (1955), *Potamonautes platycentron* was originally treated as subspecies of the regionally widespread *Potamonautes johnstoni* (i.e. *Potamonautes johnstoni* spp. *platycentron*) but was later considered to be a distinct species (Reed and Cumberlidge, 2006).

It is lake-living species that only occurs in Lake Chala on the Kenya/Tanzania border. It therefore has a very limited geographic range with an AOO of less than 5.2 km² (Figure 5-11). It has potentially low population levels, and the population size is estimated at greater than 250 but fewer than 2,500 mature individuals. The species is threatened by increasing disturbance from growing human populations in the area surround Lake Chala.

Professor Savel Daniels conducted a fairly extensive survey during January/February 2022 within the Kenyan portion of the upper Pangani River basin, which included Lake Chala, the Lumi River, Lake Jipe, and various springs in the catchment (Figure 5-11). The objective of this survey was to actively search for *Potamonautes platycentron* in other parts of the catchment. *Potamonautes platycentron* was only recorded from within Lake Chala (at Site 1) and was not recorded from the other samples localities. This confirms the assessment that is provided by Cumberlidge (2008).

Given that Potamonautes platycentron only occurs in Lake Chala means that it triggers critical habitat according to Criterion 1a of the IFC PS6 as more than 0.5% of the global population occurs within the lake.

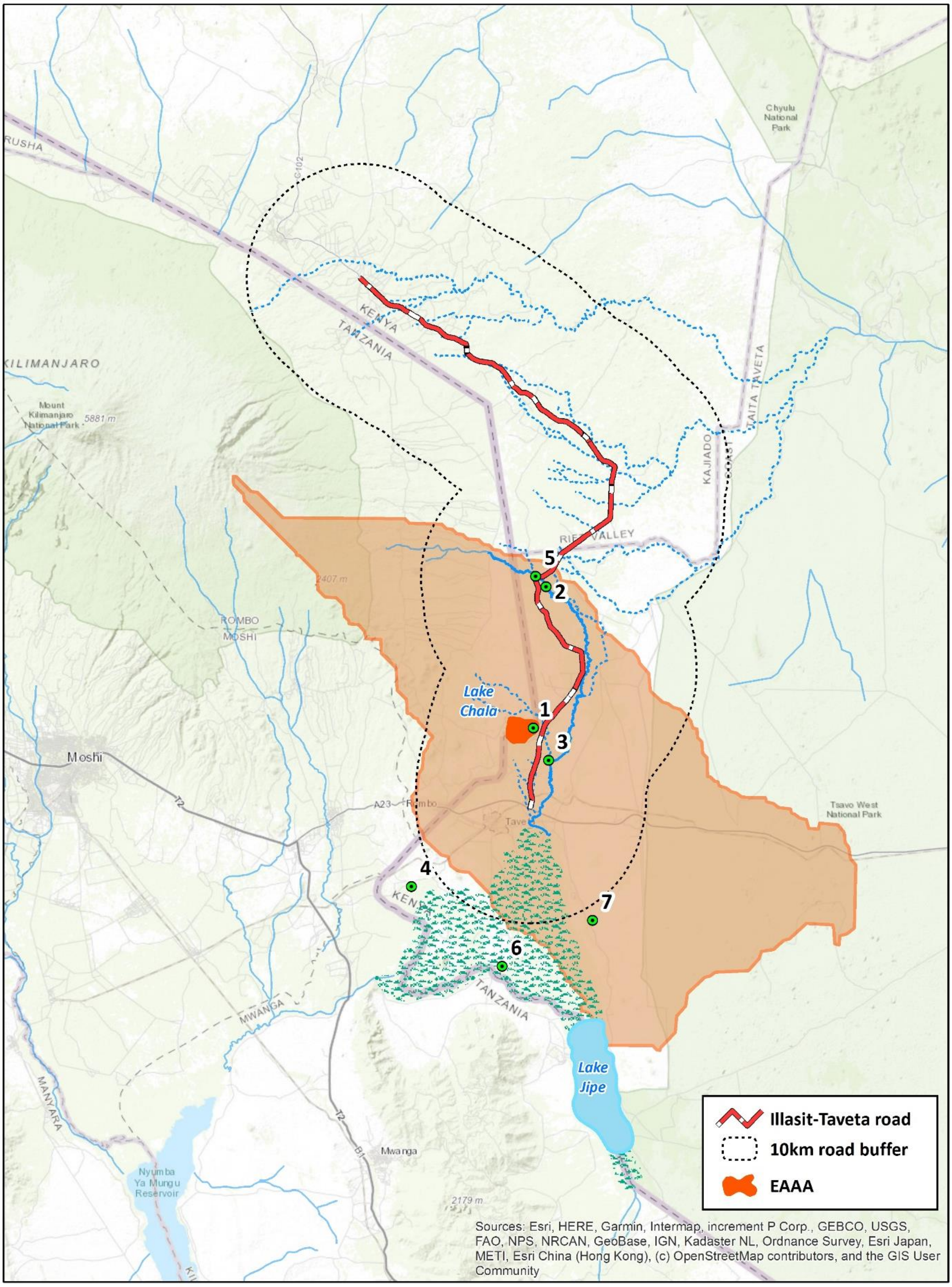


Figure 5-11 Distribtuion map of *Potamonautes platycentron* according to the IUCN Red List database (Cumberlidge, 2008) in relation to the proposed upgrade of the Illasit-Taveta Road, Kenya Kenya, with sample sites from the 2022 survey

5.3.2 *Endemic and Restricted-range species*

Crocidura fischeri (Fischer's Shrew)

Crocidura fischeri is a mammal from the Family Soricidae that was assessed by Gerrie and Kennerley (2016) in July 2016. It is listed as Data Deficient given the absence of recent information on its status, taxonomy, distribution and ecological requirements.

Crocidura fischeri is known only from two East African locations, the type locality of "Nguruman" in southern Kenya, and Himo in Tanzania approximately 30 km west of Taveta town (Figure 5-12. This species is uncommon, and little is known about it other than it is a dry savanna specialist that is not present in mountainous areas.

The EOO of the species is approximately 10,408 km^2, but given the highly fragmented nature of its known localities, its AOO is probably a more suitable measure of its range extent. The AOI includes a small (~0.8%) portion of the range of *Crocidura fischeri*, however, the available habitat here is not considered suitable and is highly fragmented by urban development in the Taveta-Holili area. Furthermore, until the taxonomic issues surrounding the relationship between *Crocidura fischeri* and *Crocidura voi* have been resolved it is difficult to determine the full extent of the species geographic range (Gerrie and Kennerley, 2016).

Given the limited information of the species' distribution range and habitat requirements, it is possible that it occurs outside of its current distribution within the southern Kenya and northern Tanzania range where dry savanna habitat exists in a natural state.

It is highly unlikely that the AOI supports more than 10% of the global population.

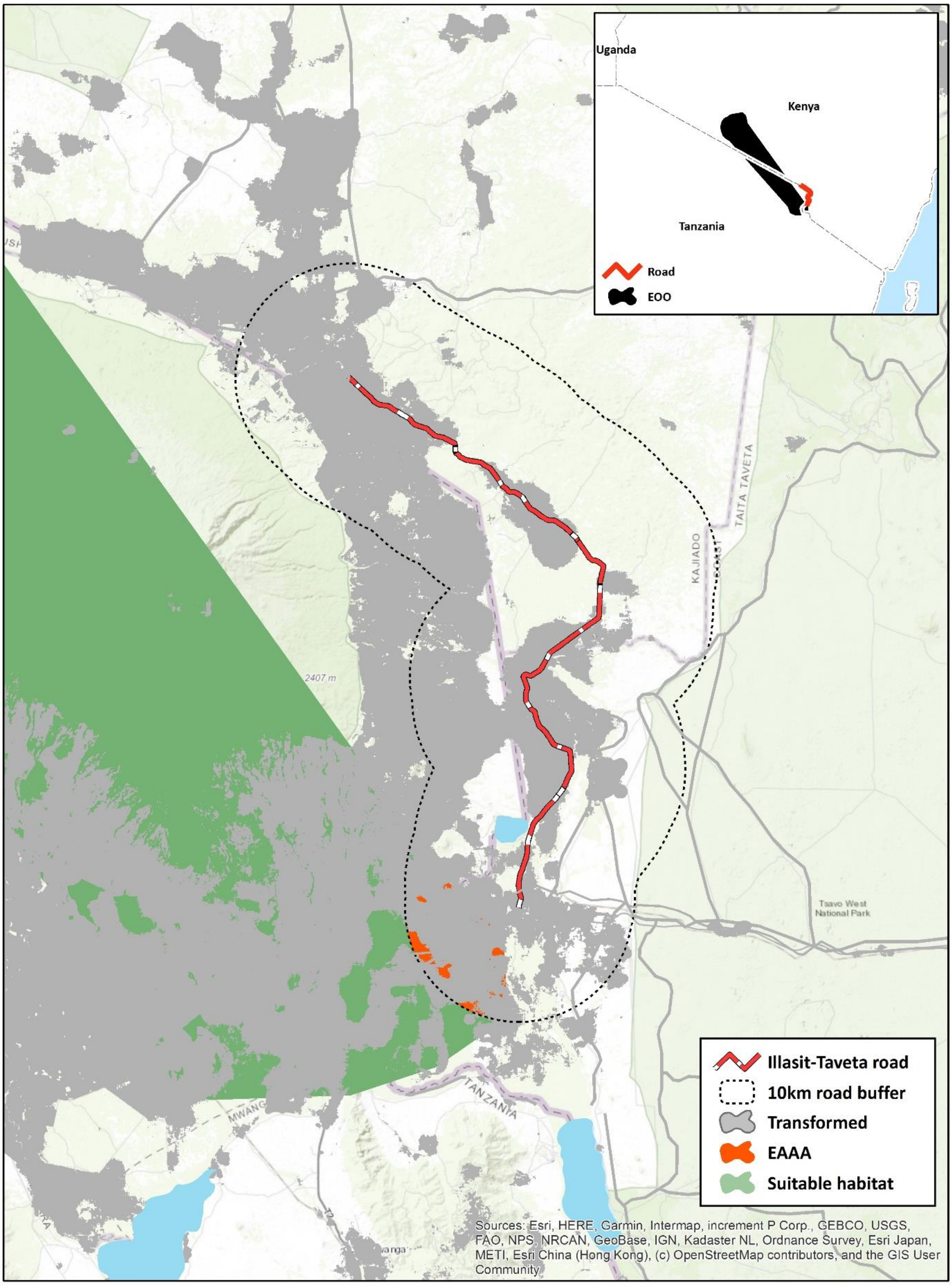


Figure 5-12 Fischer's Shrew (*Crocidura fischeri*) distribution in relation to the proposed upgrade of the Illasit-Taveta Road, Kenya Kenya (Gerrie and Kennerley, 2016)

Mirafra pulpa (Friedmann's Lark)

Mirafra pulpa is a bird from the weaver family (Family Alaudidae) that was assessed by BirdLife International (2021) in June 2020. It is listed as Data Deficient given that it is a very poorly known species that has only been observed erratically and may have a very small population (or simply evades detection by its movements).

It is known from three disjunct areas – south-western Ethiopia, central Kenya and south-central Kenya/north-central Tanzania. The geographic range for *Mirafra pulpa* is defined by an EOO of is 218,000 km^2 and an AOO of 42,000 km^2 (BirdLife International, 2021). The AOO of the southern subpopulation, where the Illasit-Taveta road is located, is 21,000 km^2 (Figure 5-13).

It appears to prefer fairly dense grassland with bushes, possibly avoiding drier areas, and feeds on grass seeds, small grasshoppers and beetles (Lack, 1977). Bradley (2020) suggested that the species may be associated with volcanic soils to some degree, which could explain its patchy distribution. It is also suspected that the population has declined due to its habitat being prone to overgrazing and conversion to cultivation (del Hoyo *et al.*, 2004).

Bradley (2020) analysed 51 dated records of occurrence, and all but eight records are from Kenya. The Kenyan records are principally from Tsavo East and Tsavo West National Parks, Buffalo Springs and Shaba National Reserves. The type specimen was collected in Ethiopia in 1912, but it has only been seen there once since then in 1998. There are also several records from Mkomazi Game Reserve in Tanzania from during 1994 to 1996 and a single record from south of Arusha in August 1998. The GBIF has 55 recorded occurrences, of which 29 (53%) correspond within the range for the southern subpopulation. These occurrences indicate that the range should probably be shifted a little to the east and expanded further north and east.

It is possible that the species could occur within the AOI, however, it is highly unlikely that the AOI supports more than 10% of the global population.

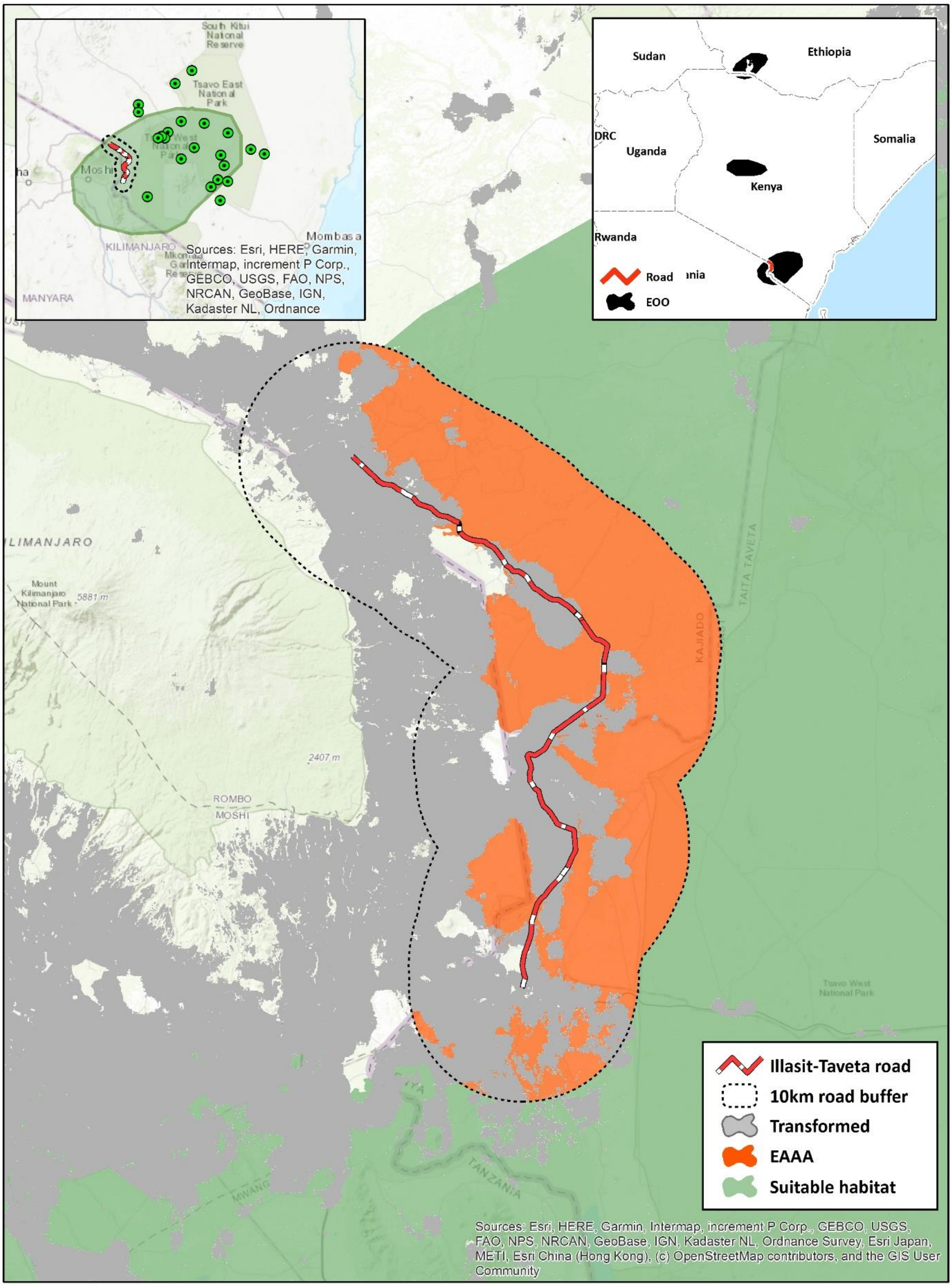


Figure 5-13 Distribution map of Friedmann's Lark (*Mirafra pulpa*) according the IUCN Red List database (BirdLife International, 2021) in relation to the proposed road upgrade project between Illasit-Taveta

Ploceus castaneiceps (Taveta Golden Weaver)

Ploceus castaneiceps is a bird from the Family Ploceidae that was assessed by BirdLife International (2016b) in October 2016. It is listed as Least Concern on the basis that the population appears stable, and the range size is greater than 20,000 km^2 (the threshold for Vulnerable).

Ploceus castaneiceps has a restricted range within southern Kenya and northern Tanzania – its EOO is 53,200 km^2 (BirdLife International, 2016b). It does not meet the thresholds as a Vulnerable species in terms of its range size. Although population size has not been quantified, it appears to be stable and does not approach the thresholds as a Vulnerable species in terms of population size and trends. As a result it is currently listed as Least Concern. Furthermore, Fry and Keith (2004) reported the species to be common within suitable habitats within its range.

The species was first collected in 1888 by HCV Hunter along the Useri River, near Taveta town (Shelley 1905). In Kenya, it is found in the Amboseli and Taveta areas, and Lake Jipe. In Tanzania, it occurs along the Pangani River, around Mount Meru and Mount Kilimanjaro (Weaver Watch, 2022).

It inhabits areas with woodland and dry bushveld, moving into swampy and flooded areas to breed in colonies. Nests are typically suspended over water on reeds, bulrushes (Typha) or overhanging trees. The breeding season is from October to May in Kenya, and September to January and April to May in Tanzania.

137 out of 1449 (~9%) of the occurrences that are recorded by the GBIF fall within the AOI – approximately 50% of the occurrences are from the Arusha area on the south-western side of Mount Kilimanjaro. The Kenya Bird Atlas project has 54 reported sightings of *Ploceus castaneiceps* from 12 different pentads (each covering 9km by 9km area) based on full protocol submissions – there are 11 adhoc sightings from five pentads covering the same area as the full protocols. Out of 152 full protocol submissions for eight of the 12 pentads, *Ploceus castaneiceps* was reported 37 times (i.e. 37%). Amboseli NP and surrounds has a total of 119 cards covered by five pentads, but only 17 sightings (i.e. 15%), while in the pentad located immediately east of Illasit town, it has been sighted 17 times out of 29 cards submitted (i.e. 59%). There are 15 additional sighting reported from Lake Jipe. Figure 5-14 shows the location of suitable wetland areas where *Ploceus castaneiceps* is known to occur within the AOI.

It is highly unlikely that the AOI supports more than 10% of the global population, however, it will be important to make sure that stormwater runoff from the road is properly managed by well-designed stormwater infrastructure to control runoff so that it does not impact wetlands downstream where the species occurs regularly.

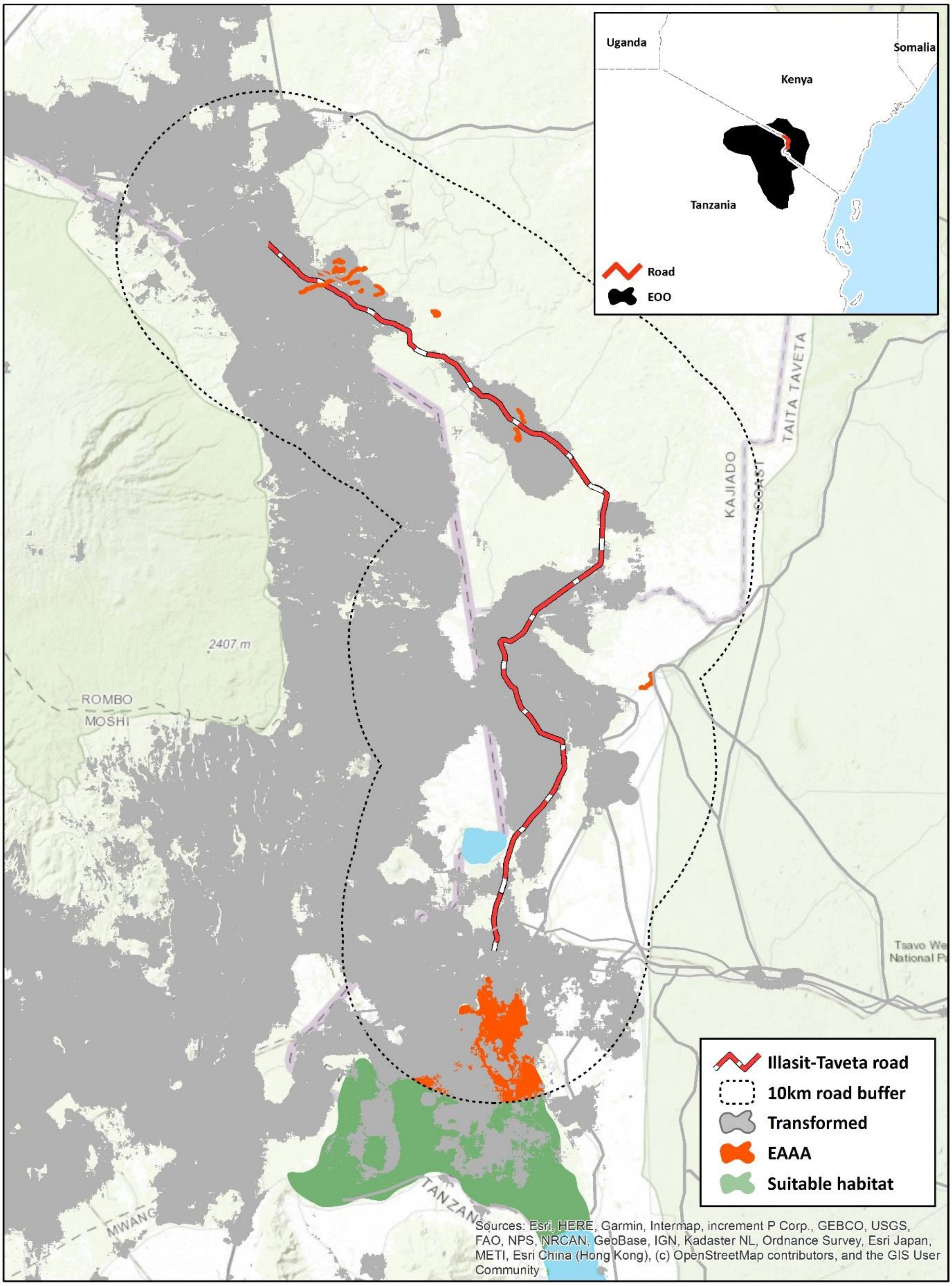


Figure 5-14 Distribution map of Taveta Golden Weaver (*Ploceus castaneiceps*) according the IUCN Red List database (BirdLife International, 2016b) in relation to the proposed road upgrade project between Illasit-Taveta

Scolecomorphus vittatus (Banded Caecilian)

Scolecomorphus vittatus is an amphibian from the Family Scolecomorphidae that was assessed by the Amphibian Specialist Group (2016) in October 2015. It is listed as Least Concern given that it is widely distributed, uses several habitat types, and is able to adapt to some degree of habitat modification.

It is endemic to Tanzania, and has an EOO of 46,493 km^2 and an AOO of 3,569 km^2 (Figure 5-15). The population comprises several subpopulations that are spread across the Eastern Arc Mountains from the North Pare Mountains, approximately 40km south of Taveta town, down to the Uluguru mountains over 750 km further to the south. It is locally abundant within its subpopulations, and the species has been observed across its range since 2000 and was last seen in April 2012 according to the 53 occurrence records in the GBIF. Although its distribution appears to be severely fragmented, there has been little to no surveying in the areas between (Amphibian Specialist Group, 2016).

It is a soil-dwelling species that inhabits a range of habitats including, subtropical or tropical moist lowland forests, subtropical or tropical moist montane forests, plantations, small farms and rural gardens, and heavily degraded former forests (Amphibian Specialist Group, 2016).

Its distribution does not extend into southern Kenya, but given its broad range of habitats it is possible that it could occur within the AOI, particularly in the areas south of Illasit town that border onto the forested areas of Mount Kilimanjaro.

It is highly unlikely that the AOI supports more than 10% of the global population.

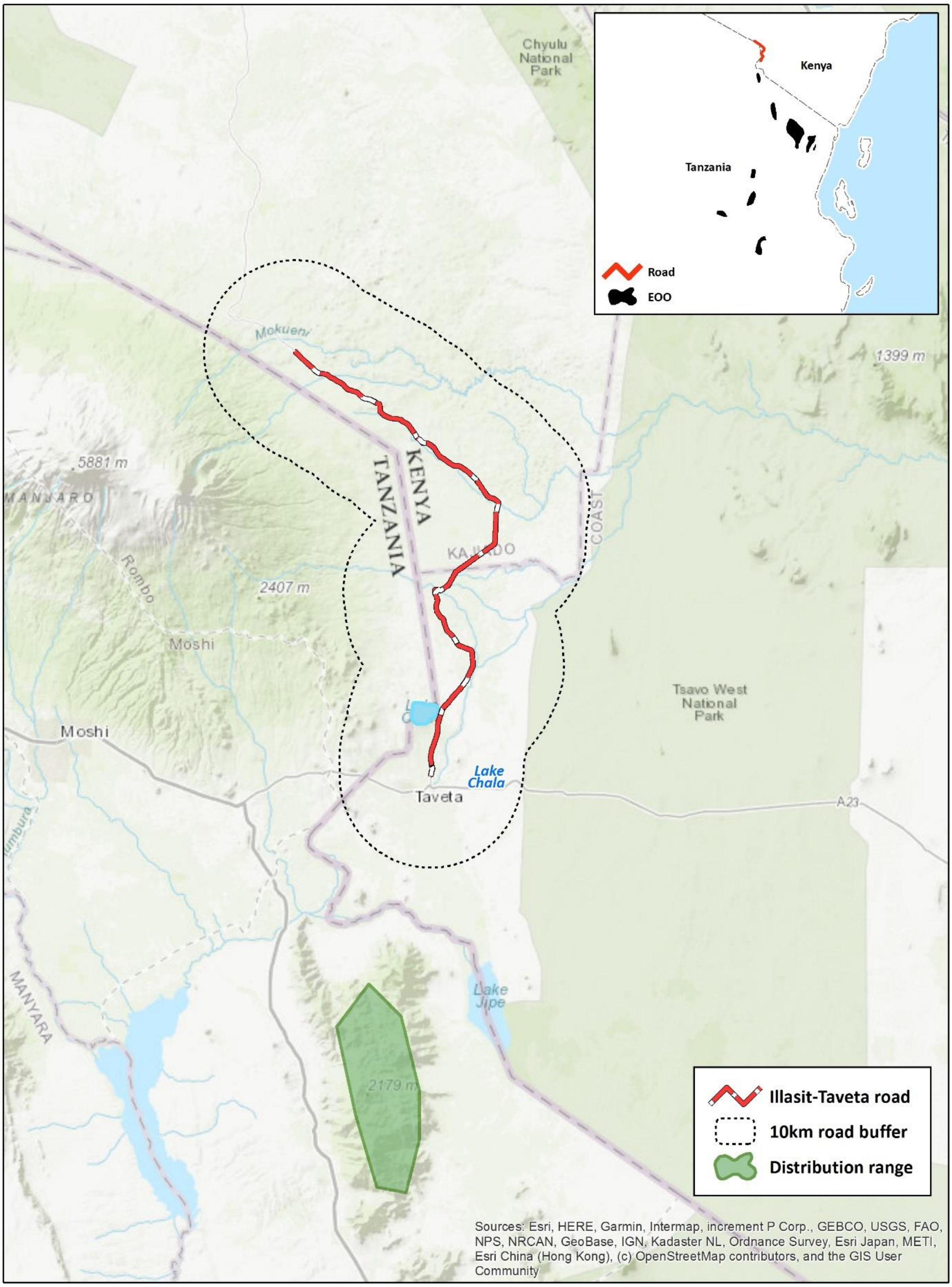


Figure 5-15 Banded Caecilian (*Scolecomorphus vittatus*) distribution in relation to the proposed upgrade of the Illasit-Taveta Road, Kenya (Amphibian Specialist Group, 2016)

5.3.2.1 *Threatened or unique ecosystems*

Currently there are no threatened or unique ecosystems listed by the IUCN Red List of Ecosystems for Kenya and Tanzania. Although dated, Olson and Dinerstein (1998) characterise 200 broad ecoregions, which have been identified on a global scale as having exceptional levels of species richness or endemism or where there are unique ecological or evolutionary processes; these ecoregions also target representative examples of global biomes covering various biogeographic regions. The AOI occurs within the East African Acacia Savannas that extend across large parts of Ethiopia, Sudan, Kenya, Uganda and Tanzania, and which corresponds fairly well with the Somalia-Masai Acacia-Commiphora deciduous bushlands and thickets (see Section 3.1.2), as originally described by White (1983), then revised by van Breugel *et al.* (2012). The East African Acacia Savannas ecoregion is considered notable for the large mammal assemblages that have established because of the highly productive grazing and browsing potential of the ecosystems. As a result, it has evolved to support large-scale migrations of herbivores, such as wildebeest and zebra, populations of which have been declining due to habitat alteration and hunting/poaching. Olson and Dinerstein (1998) considered the East African Acacia Savannas to be Vulnerable.

Burgess *et al.* (2004) divided the East African Acacia Savannas into Northern Acacia-Commiphora Deciduous Bushlands and Thickets and Southern Acacia-Commiphora Deciduous Bushlands and Thickets due to the change from drier to moister habitats – these ecoregions basically transition along the Kenya-Tanzanian border. The Northern Acacia-Commiphora Deciduous Bushlands and Thickets, which best describes the dominant ecoregion that is potentially affected by the AOI, forms part of the Somali-Masai regional centre of endemism. Martin and Burgess (2022) provide an overview of the importance of the ecoregion:

- Mammal diversity is high, but there are relatively few endemics – all are rodents.
- Several species of arid-adapted ungulates occur in the region (e.g. Grevy's Zebra, Beisa Oryx, Gerenuk, and Lesser Kudu).
- Elephant numbers in Tsavo National Park declined from nearly 35,000 to about 14,000 due to a period of drought followed by heavy poaching – the elephant population in 2012 consisted of 12,182 individuals.
- Of an estimated 65,000 black rhinos present in East Africa in the 1960s, only about 630 now remain in Kenya.
- African Wild Dog numbers have declined greatly and are extirpated from many regions where they once inhabited.
- Other large carnivores such as Lion and Cheetah occur in the region and there are important populations of Reticulated and Masai Giraffe.
- One threatened reptile, the Pancake Tortoise, occurs in the region, but has been overexploited for the pet trade.
- Large areas of habitat still remain and are found in a number of well-functioning national parks and reserves.
- The habitats and species in the ecoregion are increasingly threatened by unsustainable water use, frequent grassland burning, tree cutting, and farmland expansion.

- Illegal hunting for skins, ivory, and rhino horn have also severely reduced populations of large animals, particularly elephants and rhinoceros.
- The priority conservation actions for the next decade will be to: 1) enforce markets of ivory and decrease the demand to reduce black market ivory prices and prevent illegal killing of wildlife; 2) implement low-cost, locally implemented water management techniques including soil moisture retention practices; and 3) expand alternative livelihoods including wildlife tourism.

Kenya's development blueprints on ensuring environmental sustainability (i.e. the 2010 Constitution, Vision 2030, and Sustainable Development Goals (SDG)) recognize the importance of sustainable resource use, reducing biodiversity loss, and maintenance of ecosystems processes. In the Vision 2030, under the conservation strategic thrust, the flagship project on securing wildlife dispersal areas and migratory corridors features prominently as one of the economic and social pillars. In support of this vision, Ojwang *et al.* (2017) undertook a study to map important wildlife dispersal areas and migratory corridors that are outside of protected areas. This work focussed on the southern Kenya rangeland ecosystems of which two fall within the broader landscape of the AOI, namely the Amboseli-West Kilimanjaro (AWK) and the Tsavo Conservation Area (TCA) Ecosystems (Figure 5-16). Eight keystone species were selected (i.e. elephants, wildebeest, Burchell's (Common or Plains) Zebra, Grevy's Zebra, giraffe, buffalo, topi and oryx) and used to map important dispersal areas/corridors.

A total of 58 migratory routes and corridors were identified in the southern Kenya rangeland ecosystems, eight in the AWK area and ten in the TCA. One of the AWK routes approaches the AOI in the vicinity of Rombo, on the northern side of the Illasit-Taveta road, but settlement and croplands in this area would inhibit movement to the road itself – see Section 3.2 which highlights the land cover transformation within the AOI, and Section 4.1.1 and 4.1.2 which describe the habitat availability in the Rombo area. Another route occurs to the south of Taveta town, which accounts for movement pattern between Tsavo West National Park and Lake Jipe, however, this route is blocked by settlements, small-scale farming areas and fences.

The AOI covers approximately 6.3% of the AWK and 0.6% of the TCA, however, the effective habitat areas that contribute to functioning of the AWK and TCA ecosystems are degraded by the land cover transformation and habitat fragmentation. Furthermore, the AWK routes are mainly to provide linkages from Chyulu Hills to Amboseli and around the northern and western side of Mount Kilimanjaro to other national parks in Tanzania, while the TCA routes account for important movement corridors that are located east of Tsavo West National Park, and down to Mkomazi National Park in Tanzania. Thus, whilst wildlife may utilise corridors that intercept the AOI, it is not anticipated that this will occur frequently.

Although the AWK and TCA Ecosystems are deemed to be high priority areas for biodiversity conservation by national conservation planning organisations under Criterion 4b, the core areas supporting these ecosystems are positioned well away from the AOI.

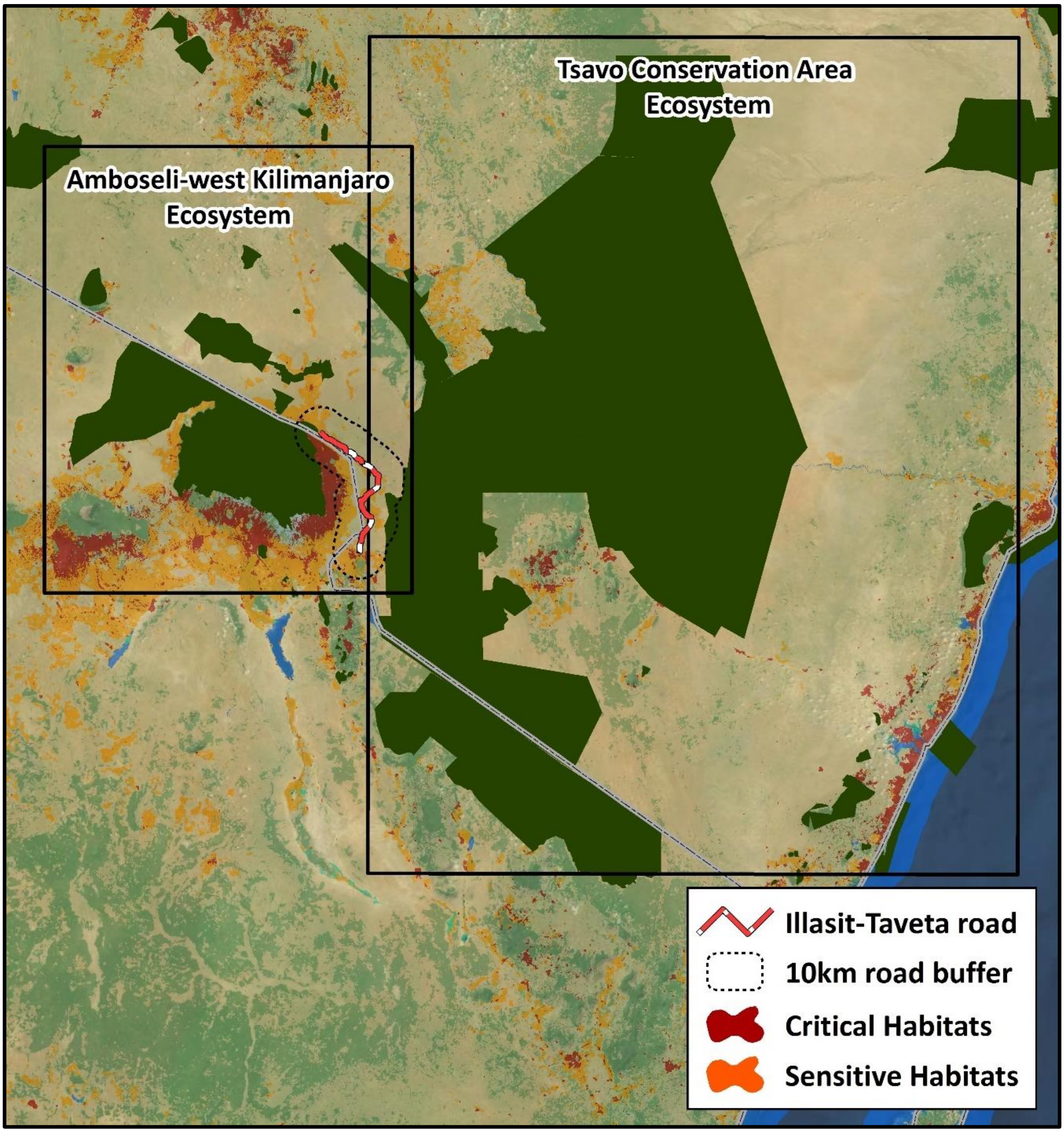


Figure 5-16 Broad regions supporting the southern Kenya rangelands of the Amboseli-West Kilimanjaro and Tsavo-Mkomazi Ecosystems in relation to the existing Illasit-Taveta road and protected area networks

5.3.3 *International or national areas of biodiversity importance*

Section 3.5 provides an overview of numerous international and national areas that are potentially important for supporting biodiversity patterns and processes. These areas include National Parks (NP), National Reserves (NR), Forest Reserves (FR) and Forest Plantations (FP), Community Conservancies (CC), Wildlife Sanctuaries (WS) and Wildlife Management Areas (WMA), Key Biodiversity Areas (KBAs), Important Bird Areas (IBAs), Alliance for Zero Extinction (AZE) sites, World Heritage Sites (WHS) as listed in Table 5-3.

Table 5-3 List of international and national areas of biodiversity importance that occur within the broader landscape of the Illasit-Taveta road

Number	Name	IUCN Category	Area (km^2)	NP	NR	FR/FP	CC	WS/WMA	KBA	IBA	AZE	WHS	Proximity (km
1	Amboseli	II	392.0	yes					yes	yes			32.9
2	Chyulu Hills	II	471.0	yes					yes	yes			40.2
3	Tsavo West	II	9065.0	yes					yes	yes			3.8-10
4	Kilimanjaro National Park	II	753.5	yes					yes	yes		yes	12.9 to 27.4
5	Kilimanjaro National Park	II	1831.8	yes					yes	yes			5.8 to 22.1
6	Kileo East	III	1.8			yes							15.9
7	Mramba	IV	33.6			yes				yes			20.3
8	Minja	IV	5.2			yes							19.5
9	Kamwalla I	IV	1.2			yes							33.8
10	Kamwalla II	IV	2.9			yes							36.3
11	Kiverenge	IV	23.3			yes							45.7
12	Mkomazi National Park	IV	3445.7	yes					yes	yes			53.8
13	Imbirikani	Not Reported	4.6				yes						47.6
14	Tawi	Not Reported	23.5				yes						28.3
15	Nailepu	Not Reported	15.8				yes						22.4
16	Osupuko	Not Reported	12.1				yes						21.7
17	Kimana Wildlife Sanctuary	Not Reported	24.3				yes						22.8
18	Motikanju	Not Reported	28.0				yes						19.8
19	Elerai	Not Reported	20.2				yes						16.8
20	Loitokitok	Not Reported	27.8			yes							1.2
21	Tsavo Road and Railways	Not Reported	5.3		yes				yes				63.7
22	Lumo (north)	Not Reported	431.0					yes					44.0
22	Lumo (south)	Not Reported	431.0					yes					51.3
23	Taita Hills	Not Reported	113.4					yes					55.8
24	Enduimet WMA/ Longido Game Controlled Area	Not Reported	751.0					yes		yes			26.0
25	North Kilimanjaro	Not Reported	81.2			yes							5.0
26	Rau	Not Reported	15.4			yes		yes		yes			35.8
27	Kahe II	Not Reported	3.1			yes		yes		yes			29.5
28	Kahe I	Not Reported	6.0			yes		yes		yes			28.6
29	Kindoroko	Not Reported	8.9			yes		yes		yes			38.5

Number	Name	IUCN Category	Area (km^2)	NP	NR	FR/FP	CC	WS/WMA	KBA	IBA	AZE	WHS	Proximity (km
30	Ngai Ndethia	VI	212.0		yes								65.3
31	Taita Hills Forests	n/a							Yes	yes	yes		55.4
32	Lake Chala	n/a							Yes		yes		0.0
33	Nyumba ya Mungu	n/a							Yes	Yes			31.3

There are no RAMSAR Sites within the landscape. Sixteen out of the 33 areas are located within Tanzania and are disconnected from the Illasit-Taveta road from an administrative perspective, while others are others are disconnected either by land transformation or by other protected areas. Areas that are most sensitive in terms of biodiversity are the KBAs and AZEs, notably Lake Chala AZE and Taita Hills Forests. Areas that have the greatest potential to be affected by the proposed Illasit-Taveta road upgrade project are those that are closest to the road, and which are partially connected by natural habitats that are intersected by the road. These are discussed in the following sections.

Kilimanjaro National Park and World Heritage Site

Mount Kilimanjaro National Park is located west of the Illasit-Taveta road within Tanzania at a distance ranging from 5.8 km at its nearest point to 22.1 km at its furthest point. The Mount Kilimanjaro World Heritage Site (WHS) portion largely occupies the higher elevation parts of the Kilimanjaro National Park (above the tree line at 2,700 m). It was inscribed on the World Heritage List under Natural Criterion vii in 1987 as follows:

Mount Kilimanjaro is one of the largest volcanoes in the world. It has three main volcanic peaks, Kibo, Mawenzi, and Shira. With its snow-capped peak and glaciers, it is the highest mountain in Africa. The mountain has five main vegetation zones from the lowest to the highest point: lower slopes, montane forest, heath and moorland, alpine desert and summit. The whole mountain, including the montane forest belt, is very rich in species, in particular mammals, many of them endangered species. For this combination of features, but mostly its height, its physical form and snow cap, and its isolation above the surrounding plains, Mount Kilimanjaro is considered an outstanding example of a superlative natural phenomenon.

Kilimanjaro National Park was established in 1973, initially comprised the whole of the mountain above the tree line and six forest corridors stretching down through the montane forest belt. The World Heritage Committee recommended extending the national park to include more areas of montane forest. Following a 2005 extension, the National Park includes all of the natural forest which was in the Kilimanjaro Forest Reserve, and as such fulfils the criteria of integrity. Kilimanjaro National Park is protected under national legislation as a National Park and a management plan is in place.

Compared to other tropical mountains it is not as diverse, nor are there high levels of endemism, however, it still supports a range of forest types including the subalpine cloud forest comprising the giant heather *Erica trimera* and several endemic species such as the Giant Groundsel, *Dendrosenecio kilimanjari*. There are numerous range restricted species such as the Mt. Kilimanjaro Guereza *Colobus caudatus* (VU), Abbott's Duiker *Cephalophus spadixt* (EN) Abbott's Starling *Poeoptera femoralisis* and the Kilimanjaro Blade-horned Chameleon *Kinyongia tavetanaalso*. It is also an IBA/KBA in support of important and sensitive biodiversity.

The main threat is climate change – the mountain's glaciers are melting fast and are expected to disappear within a couple of decades; there will likely be a shift in altitudinal zonation of vegetation types. Tourism pressure, wildfires and illegal hunting are also threating the integrity of the area. The mountain is becoming increasingly isolated due to intensive settlement and cultivation on the lower slope and wider landscape which has significantly reduce connectivity with nearby areas especially to the west (Arusha National Park) and north-west (Amboseli National Park, Kenya) and historical migration routes of keystone species, such as elephants, are being lost.

The Project will not impact the site's Outstanding Universal Value (OUV). The road is 5.8 to 22.1 km from the National Park and 12.9 to 27.4 km from the WHS, so there will be no direct impacts either to the Park or the WHS which occupies the area above the tree line. There will not be any indirect effects as the land between the road and the Tanzanian border is already converted and similarly on the Tanzanian side, there are high levels of conversion in the surrounding area and lower slopes.

Loitokitok Forest Reserve

The Loitokitok Forest Reserve is located immediately north-west from the Illasit end of the road. It was designated as Forest Reserve at a national level in 1977, and covers an area of 27.8 km^2 although the reported area is 7.7km^2. The area is currently being managed by the Loitokitok Community Forest Association in partnership with the Kenya Forest Service according to a Forest Management Agreement (FMA) and a Participatory Forest Management Plan (PFMP) to promote restoration of tree cover in the area. It is almost entirely transformed by agriculture and expanding settlement around the town of Illasit.

The Vulnerable Mt Kilimanjaro Guereza (Colobus caudatus) has been recorded in the Reserve and as such, the Reserve may possess critical habitat for the species. However, the road upgrade project will not have any negative impacts on the Loitokitok Forest Reserve.

Tsavo West National Park

Tsavo West National Park covers an area of 9,065 km^2 and is separated from the even larger Tsavo East National Park by the A109 Nairobi-Mombasa road and railway line. Together with adjoining ranches and protected areas, they comprise the TCA. Tsavo West National Park boasts varied habitats (comprising open grasslands, scrublands, and Acacia woodlands, riverine vegetation and rocky ridges), diverse and abundant wildlife, a rhino sanctuary, and the Mzima Springs, which produces vast quantities of clean, freshwater. The Mzima Springs is also one of the few sites that support the Endangered Amboseli Barb (*Enteromius amboseli*). The park is operated by Kenya Wildlife Service. Other key features include Tsavo West National Park has a variety of wildlife, such as the Eastern Black Rhino (Critically Endangered), African Savanna Elephant (Endangered), Masai Giraffe (Endangered), Hippopotamus (Vulnerable), Leopard (Vulnerable), Lion (Vulnerable), Lesser Kudu (Near Threatened), as well as numerous other smaller animals.

A small portion of the eastern edge of the AOI extends into the western parts of the park and, as such, Critical Habitat is triggered. This area of overlap is approximately 0.9% of the park's area, although, it is highly unlikely that the proposed road upgrade will have negative impacts on the biodiversity residing within this section of the park.

Lake Chala KBA/AZE

Lake Chala is a small (4.2km^2), deep (90m) crater lake located on the south-eastern foothills of Mount Kilimanjaro (Figure 5-17). It occurs at an elevation of 877m above sea level, and the Kenya and Tanzania border passes directly through the middle of the lake in a roughly north to south direction. Given its topographical setting, the lake is hydrologically disconnected from the surrounding landscape, and water supply to the lake is exclusively subterranean from deep aquifers, although the lake does receive some direct input from rainfall. As a consequence, the water in the lake is very clear, and habitats comprise largely of rock and lava sand substrates. The lake itself is surrounded by steep slopes covered with densely, forested vegetation, which also supports unique flora (Figure 5-18).

Lake Chala is a designated AZE site, and thus is treated as a critical habitat according to IFC PS6 and GN6. This is due to the fact that the lake supports the entire global population of the freshwater crab *Potomonautes platycentron* (Endangered). The lake also supports the Critically Endangered Lake Chala Tilapia (*Oreochromis hunteri*), which is a trigger species for Lake Chala being a KBA, but not the AZE for some reason.

However, the actual AZE boundary extends well beyond the physical boundary of the caldera, and the rationale for delineating the boundary is not entirely clear. World freshwater crab experts, namely Professor Neil Cumberlidge (based at the Northern Michigan University) and Professor Savel Daniels (based at the Stellenbosch University, South Africa) were engaged in March/April 2021 to try understand the rationale for delineating the AZE boundary to account for the AOO of *P. platycentron*. Prof. Daniels did emphasise the paucity of data regarding the species due to very limited sampling in East Africa. It appears that rivers immediately around the lake were incorporated into the delineation process as a precaution given the uncertainty regarding the distribution of *P. platycentron*, whether it occurs in these adjacent rivers that form part of the Lumi River system (see Section 4.1.5).

A focused field survey was carried out in January 2022 by Prof. Daniels to determine the actual occurrence of *P. platycentron* within the landscape – see *Potomonautes platycentron* in Section 5.3.1. Given that this survey confirmed that the species only occurs in Lake Chala supports the criteria used for the AZE designation – the same rationale also applies to *O. hunteri* (see *Oreochromis hunteri* in Section 5.3.1). However, the boundary that was used to define the KBA originally, and which was later applied for the AZE, is not based on adequate scientific evidence, especially when considering the topographical nature of the crater lake.

A separate process is currently underway to present sound scientific evidence to the AZE Secretariat to motivate for the boundary of the KBA/AZE to be redefined. Failure to do so would require a significant realignment to be made to the existing Illasit-Taveta road to allow for the upgrades to take place, which will have a serious impact on communities affected by a realignment process. The evidence presented to the AZE Secretariat is provided in Appendix 4, specifically Section 3.1 (current delineation), Section 3.2 (hydrological interactions) and Section 3.3 (revised delineation).

The proposed road upgrade will not have a direct impact on the critical habitats supporting both P. platycentron and O. hunteri occurring within Lake Chala, and indirect impacts from stormwater generated from changing the road surface from gravel/dirt to asphalt will not have a negative impact on the groundwater flows supporting the lake. The only possible impact that could be anticipated is from improved access for people using the lake for subsistence fishing or people visiting the lake as a tourist attraction.

Figure 5-17 Aerial view of Lake Chala taken from the south on 10 December 2010, with the existing Illasit-Taveta road running through the bottom right corner (Hansbaer, 2010)

Figure 5-18 Oblique view of Lake Chala taken from the south in March 2021 (Luke, 2021)

5.3.4 *Critical Habitats*

The critical habitat features identified during the CHA screening and determination process were mapped based on present availability. These include:

- The Tsavo River as potentially supporting the Endangered Amboseli Barb (*Enteromius amboseli*) downstream closer to Tsavo West National Park where suitable riverine habitat is available – see Section 5.3.1;
- The Lumi River as potentially supporting the Critically Endangered Jipe Tilapia (*Oreochromis jipe*);
- Lake Chala as supporting the only known populations of Critically Endangered Chala Tilapia (*Oreochromis hunteri*) and the Endangered crab, *Potamonautes platycentron*; and
- A small section of Tsavo West National Park that marginally extends into the AOI.

Figure 5-19 presents the locations and extents of the critical habitats that will need to be carefully managed through the implementation of the BAP (Section 7).

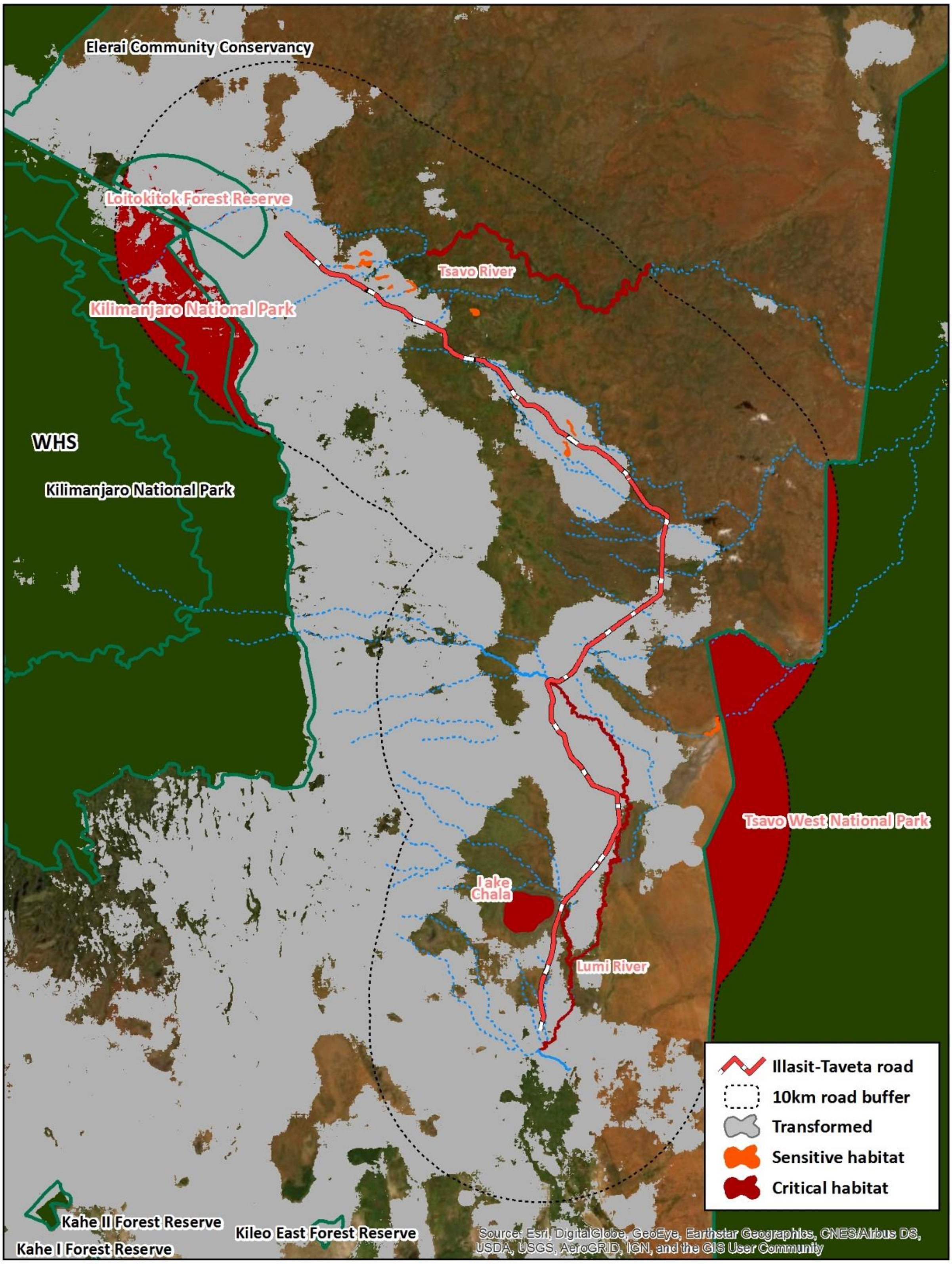


Figure 5-19 Critical habitats occuring along the existing Illasit-Taveta road within 10 km of the road that support key biodiversity features

6. IMPACT ASSESSMENT

It is anticipated that the proposed Illasit-Taveta road upgrade could have a number of impacts on the local ecosystems, both terrestrial and aquatic, as well as the species present within the study area, including known and probable critical habitats as determined in Section 5.3.

6.1 Overview of Biodiversity Impacts

Despite the high levels of transformation that has already taken place along the existing Illasist-Taveta road, the proposed upgrade project will impact biodiversity to some degree, which could extend into the surrounding landscape where highly sensitive and threatened biodiversity features exist. Overall, the project will not result in significant loss and/or fragmentation of natural habitat given that it is an existing road, and the land directly adjacent to the road is either transformed by croplands and human settlement or it is highly degraded by ruderal plants and IAPs.

The following impacts have been identified based on the activities proposed for the Illasist-Taveta road upgrade project (including associated construction camps):

- Permanent loss/destruction of habitat to accommodate a wider (approximately 40m-wide) road reserve:
  - 125 ha of transformed land corresponding 64% of the proposed road upgrade;
  - 55 ha of degraded habitat with poor to very poor vegetation cover;
  - an additional loss of up to 44 ha of degraded terrestrial savannah from the development of eight out of the 11 planned borrow pits, namely Borrow Pits 1, 2, 3, 4, 8, 9, 10 and 11, as well as the main construction camp (see Figure 1-1);
  - 15 ha of terrestrial savannah in a more moderate condition, largely within the Middle Section (i.e. Road Section 3; see Section 4.1.3) corresponding up to ten kilometres of the road that passes through *Acacia-Commiphora* deciduous bushland and thicket that is fragmented by several areas of croplands;
  - an additional loss of 10.5 ha *Acacia-Commiphora* deciduous bushland and thicket from the development of three out of the 11 planned borrow pits, namely Borrow Pits 5, 6 and 7 (see Figure 1-1); and
  - small (0.5 ha) loss of riparian forest habitat to upgrade the road crossing the headwaters of the Lumi River, which is currently assessed as Critical Habitat pending outcomes of further infield surveys (*c.f.* Section 7.1.2).
- Erosion and sedimentation of watercourses (i.e. rivers and wetlands) and drainage lines resulting from stormwater runoff from the road, leading to further channel incision, bed scouring, bank collapse – this is expected to be a positive impact for aquatic ecosystems given the current situation of the road, but provided that the stormwater runoff from the upgraded road is properly managed.
- Introduction of foreign materials (e.g. construction material) into watercourses, as well as water quality issues associated with the development of the road (e.g. fuel/oil spills, application of herbicides for IAP control, etc.) that will affect downstream environments.

- Wildlife mortality from animal-vehicle collisions (AVCs), as well as from illegal hunting/poaching by construction personnel.
- Disturbance and displacement of fauna, particularly within the area of the Rombo corridor where savanna rangeland east and west of the road connects across the road.
- Establishment and spread of IAPs along the entire length of road.
- Indirect disturbance to critical habitat areas associated with Lake Chala and potentially the Lumi and Tsavo Rivers from increased access for people (local residents and tourists) into the area.

6.2 Rating and Evaluation of Impacts on Biodiversity

Given the nature of the development, namely the upgrade of an existing road, it is anticipated that impacts will be associated with two phases of the project: 1) during the construction phase of the road and 2) during the operation phase of the road. These impacts can be grouped into the following categories:

- *Direct ecosystem destruction and modification impacts*: the direct physical destruction and/or modification of communities and habitat during the construction and operational phases of the project. This includes habitat loss, biota fatalities, population reductions, barriers to movement, etc.
- *Indirect ecosystem disturbance impacts:* the indirect impacts to the biota and communities as a result of activities occurring within close proximity. This may include alteration of moisture conditions, increase erosion and sedimentation, increased alien plant invasion, noise pollution, etc.
- *Cumulative impacts to biodiversity patterns and processes:* the accumulation of effects from multiple roads and highways within the broader landscape, which collectively increase habitat fragmentation resulting in loss of habitat integrity through creation of barriers to species movement patterns and ecological processes.

The Impact Assessment aimed to identify both the direct and indirect impacts likely to be associated with each of the two phases of the project, assess the significance of these impacts and propose mitigation measures to address them. The impacts associated with each phase of the project are summarized in Table 6-1 below.

Table 6-1 Impacts associated with the construction and operation of the Illasit-Taveta road upgrade

Phase	Activity	Impact	Impact type
Construction	Construction of contractors' camp near Rombo	Loss of habitat and flora and fauna due to clearing **4 ha of degraded vegetation**	Direct
		Increased poaching pressure due to influx of workers	Direct
		Generation of waste (domestic, construction etc.)	Direct
		Increased demand for natural resources (wood, water, etc.)	Direct
	Vegetation clearing along road route to accommodate a wider road reserve	Loss of habitat and flora and fauna due to clearing **15 ha of savanna vegetation in moderate condition**, plus **55 ha of degraded vegetation**	Direct
		Loss of fauna due to habitat loss, mortalities and disturbance (noise, dust, etc.)	Direct
		Erosion and sedimentation of nearby watercourses due to clearing of vegetation	Indirect
		Alien plant invasion due to creation of new open and disturbed spaces	Indirect
		Dust creation	Indirect
		Altered hydrology due to increased runoff	Indirect
	Development of borrow pits/quarries	Habitat loss and fragmentation due to clearing **40 ha of savanna vegetation in moderate condition**, plus **10 ha of degraded vegetation**	Direct
		Loss of fauna due to habitat loss, mortalities and disturbance (noise, dust etc)	Direct

Phase	Activity	Impact	Impact type
		Habitat loss	Direct
		Erosion and sedimentation due to vegetation removal and topsoil removal	Indirect
		Dust creation	Indirect
		Noise pollution during blasting and operation	Indirect
		Air pollution due to dust from blasting and exhaust fumes from vehicles	Indirect
	Road development (resurfacing etc.)	Noise pollution due to vehicle operations	Direct
		Faunal disturbance due to vehicle activity (noise, vibrations, light pollution at night)	Direct
		Altered hydrology due to implementation of stormwater management plans	Direct
		Air pollution due to exhaust fumes	Indirect
		Soil erosion due to increased runoff as a result of creation of impervious surfaces	Indirect
		Increased traffic for transporting staff which results in increase faunal fatalities due to impacts with vehicles.	Direct
Operation	Utilization of road by vehicles	Air pollution due to exhaust fumes	Indirect
		Mortality of fauna due to collisions	Direct

Phase	Activity	Impact	Impact type
		Habitat fragmentation/barrier effect due to the presence of a busy road preventing or deterring animals from crossing from one side to the other	Cumulative
		Loss of fauna due to disturbance (light, sound, vibration ec)	Indirect
		Altered hydrology due to implementation of stormwater management plan	Direct
		Increased poaching pressure due to increase human traffic through the area	Direct
		Increased pollution due to contaminated runoff, littering by people passing through etc.	Direct
	Road maintenance	Generation of waste during maintenance	Direct

Once having identified the impacts likely to be associated with each phase of the road upgrade, it is then necessary to identify the significance of each of the impacts identified. To determine the significance of the impacts associated with the road upgrade, the methodology outlined in Series 5 (Impact Significance) of the Department of Environmental Affairs Integrated Environmental Management Information Series (2002) was adopted. This methodology proposes various criteria be assessed for each impact found to be associated with a development. Such criteria include:

- **Extent** of impact: The area effected by an impact
- **Duration of impact:** The length or lifetime of the impact
- **Frequency:** How often the impact is anticipated to occur
- **Intensity/severity:** The magnitude of the impact
- **Status of impact:** Either positive (benefit), negative (cost) or neutral
- **Probability/likelihood of occurrence:** The likelihood that the impact will occur
- **Reversibility:** Whether the impact is reversible or permanent
- **Mitigation potential:** The potential that exists for mitigation measures to be implemented
- **Cumulative impacts:** Where impacts in isolation may not have significant impacts, it must be considered whether, when added to new or existing impacts from other activities, the cumulative impacts may have significant consequences.

Each of these criteria can be characterized as having either a low, moderate, or high significance for each if the identified impacts. The characterization applied to each for this study is presented in Table 6-2 below. It must be noted that any impacts to Critical Habitats are considered to have a "High" significance.

Table 6-2 Criteria characterisation levels

Criteria	Low	Moderate	High
Extent	Local Restricted to site	Beyond site boundary, within local area/within the AOI	Widespread Regional/national/international
Duration	Short-term (only during project activity)	Medium-term (up to 24 months after project completion)	Permanent Long-term (more than 15 years)
Frequency	Once, or rarely	Occasionally	Consistently or permanently
Intensity/severity	Disturbance of degraded areas, minor changes in species assemblage	Disturbance of areas that have potential conservation value or are of use as resources. Changes in species assemblage	Disturbance of pristine areas that have important conservation value. Destruction of rare or endangered species
Likelihood of occurrence	Little to no chance of the impact occurring	50/50 chance that the impact may occur	Greater than 50% chance of the impact occurring
Reversibility	Reversible	Partly reversible	Not reversible

Criteria	Low	Moderate	High
Mitigation potential	Little or no mechanism to mitigate negative impacts	Potential to mitigate negative impacts. However, the implementation of mitigation measures may still not prevent some negative effects	High potential to mitigate negative impacts to the level of insignificant effects.

Each of the key impacts identified were reviewed and their significance assessed based on the various assessment criteria. Impacts were assessed to establish their significance in both the absence and presence of mitigation measures. The evaluations for each key impact, as well as proposed mitigation measures are presented in the tables below and should be read in conjunction with the BAP in Section 7.

Table 6-3 Impact significance and proposed mitigation measures associated with vegetation clearing (as a direct impact) to upgrade the Illasit-Taveta road

Impact	Loss of flora and fauna due to vegetation clearing	
Impact Description	Mortalities of fauna and flora during clearing process as well as movement of mobile species away from the area due to disturbance by machinery. This impact will be associated with the construction of contractor camps, borrow pits and clearing of vegetation along the road route.	
Impact scenario	***No mitigation***	***Good mitigation***
Extent	Low	Low
Duration	Low	Low
Frequency	Low	Low
Intensity/severity	Moderate	Low
Status of impact	Negative	Neutral
Likelihood	High	Moderate
Reversibility	Low	Low
Mitigation potential	Moderate	Moderate
Cumulative impacts	Moderate	Moderate
Significance	**Moderate**	**Low**
Mitigation measures	• Restrict vegetation clearing to only the project footprints associated with the contractor camp, borrow pits and road reserve. • Conduct and search and rescue operation prior to vegetation clearing in order to relocate to safer areas any species of	

Impact	Loss of flora and fauna due to vegetation clearing
	conservation importance. • Once the contractors' camp has been dismantled, ensure revegetation of the area using suitable indigenous species. This should be done under the guidance of an appropriate specialist. • Develop and implement rehabilitation plans for all borrow pits. • Undertake alien vegetation clearing within the area operated as a contractors' camp to enhance natural biodiversity. • Implement suitable measures, such as wildlife crossings, to allow wildlife to move freely away from disturbance during clearing – see BAP details. . • Any alien plants cleared should be destroyed to prevent reinfestation. • Removed vegetation should be stockpiled in bare areas to prevent damage to remaining vegetation.

Table 6-4 Impact significance and proposed mitigation measures associated with increased poaching pressure (as an indirect impact)

Impact	Increased poaching pressure	
Impact Description	Due to the presence of contract personnel in the area there is a risk that poaching of wildlife may occur to provide game meat, or as a sport. This may result in a decline in wildlife numbers, and/or cause wildlife to move away from the area. This impact is likely to be associated with both phases of the project due to the presence of contract personnel, as well as improved access to the area once the road upgrade has been completed.	
Impact scenario	***No mitigation***	***Good mitigation***
Extent	Moderate	Low
Duration	High	Low
Frequency	Moderate	Low
Intensity/severity	Moderate to high	Low
Status of impact	Negative	Neutral
Likelihood	Moderate	Low
Reversibility	Low	Low
Mitigation potential	Moderate	Moderate
Cumulative impacts	Moderate	Moderate
Significance	**Moderate**	**Low**
Mitigation measures	• The contractor should create consequence for employees caught	

Impact	Increased poaching pressure
	engaging in hunting in the area, such as suspension of employment, disciplinary hearings etc. • Awareness should created amongst employees, through meetings, pamphlets etc., about poaching, the importance of wildlife and the consequences in engaging in poaching activities • Employee security personnel to check for poaching equipment and assess the surrounding area for snares

Table 6-5 Impact significance and proposed mitigation measures associated with generation of waste resulting directly and indirectly from the Illasit-Taveta road upgrade

Impact	Generation of waste	
Impact Description	Due to the presence of contract personnel in the area and increased traffic through the area once the road is completed, it is anticipated that generation of waste in the area will be increased. This will include generation of solid waste (litter, plastic pollution etc.), chemicals from fuel spillages, sewage from the contractors' camp and water pollution of nearby water sources due to contaminated runoff and possibly utilization these sources by personnel for domestic purposes.	
Impact scenario	***No mitigation***	***Good mitigation***
Extent	Moderate	Low
Duration	High	Low
Frequency	Moderate	Low
Intensity/severity	Moderate to high	Low
Status of impact	Negative	Neutral
Likelihood	Moderate	Low
Reversibility	Low	Low
Mitigation potential	Moderate	Moderate
Cumulative impacts	Moderate	Moderate
Significance	**Moderate to high**	**Low**
Mitigation measures	• Prepare a waste management plan • Install septic tanks for the contractors' camp and monitor these to prevent blockages and/or overflow • Provide bins throughout the camp for disposal of litter • Collect waste regularly and dispose of this appropriately (in a approved landfill) • Separate and recycle waste where possible • Store chemicals and fuels in contained areas. These should be	

Impact	Generation of waste
	paved • Create awareness amongst contractors to prevent littering • Undertake litter clean-ups along the road • Provide appropriate washroom facilities so as to avoid the need to utilize aquatic environments

Table 6-6 Impact significance and proposed mitigation measures associated with increased demand for natural resources (as an indirect impact)

Impact	Increased demand for natural resources	
Impact Description	Due to the presence of contract personnel in the area there will likely be an increased demand for natural resources, likely firewood and water. The latter is particularly important when considering potential use of springs to supply water during construction. This is only anticipated to be associated with the construction phase of the project.	
Impact scenario	***No mitigation***	***Good mitigation***
Extent	Moderate	Low
Duration	Low	Low
Frequency	Moderate	Low
Intensity/severity	Moderate to high	Low
Status of impact	Negative	Neutral
Likelihood	Moderate	Low
Reversibility	Low	Low
Mitigation potential	Moderate	Moderate
Cumulative impacts	Moderate	Moderate
Significance	**Moderate**	**Low**
Mitigation measures	• Contractors should be made aware of the fact that they should not harvest natural resources from the surrounding environment. If it is deemed necessary for them to do so, they should restrict this to the harvesting of alien or invasive species. • Contractors must be provided with ample supplies of clean water in order to avoid the need to utilize aquatic environments	

Table 6-7 Impact significance and proposed mitigation measures associated with increased demand for habitat loss and fragmentation – directly and cumulatively impacting biodiversity patterns and processes (including some Critical Habitat)

Impact	Habitat loss and fragmentation	
Impact Description	The clearing of vegetation along the route is anticipated to result in the loss of habitat for a number of faunal. This includes <1 ha of potential Critical Habitat along the Lumi River. In addition, the construction of the road is anticipated to further fragment some natural habitat within the Rombo section of the road. It must be noted that a road is already in place. However, the road upgrade is likely to results in the widening of the road, change in surface type to a more impermeable surface and increase traffic volumes.	
Impact scenario	***No mitigation***	***Good mitigation***
Extent	Low	Low
Duration	High	High
Frequency	Moderate	Low
Intensity/severity	High	Low
Status of impact	Negative	Neutral
Likelihood	High	Low
Reversibility	Moderate	Low
Mitigation potential	Moderate	Moderate
Cumulative impacts	Moderate	Moderate
Significance	**High**	**Low**
Mitigation measures	• Restrict vegetation clearing to the project footprint • Avoid clearing areas of biodiversity value (i.e. high densities of indigenous vegetation) and especially Critical Habitat along the Lumi River – see BAP details in Section 7.1.2 • Offset impacts from loss of any Critical Habitat – see BAP details in Section 7.1.2 • Indigenous vegetation should be planted along the edge of the road following completion of the upgrade to replace lost habitat • Wildlife crossings should be installed at key points along the route, such as along the Rombo section of the road – see BAP details in Section 7.1.1	

Table 6-8 Impact significance and proposed mitigation measures associated with loss of fauna due to habitat loss, mortalities and disturbance (noise pollution) as a direct and indirect impact from the proposed road upgrade

Impact	Loss of fauna due to habitat loss, mortalities and disturbance	
Impact Description	It is anticipated that the construction of the road will result in the loss of fauna in the area as they will decline as a result of habitat loss (addressed above), mortalities during vegetation clearing, or due to movement away from the areas as a result of disturbance (dust pollution, noise pollution, light pollution)	
Impact scenario	***No mitigation***	***Good mitigation***
Extent	Moderate	Low
Duration	High	Low
Frequency	Moderate	Low
Intensity/severity	Low	Low
Status of impact	Negative	Neutral
Likelihood	High	Low
Reversibility	Low	Low
Mitigation potential	Moderate	Moderate
Cumulative impacts	Moderate	Moderate
Significance	**Moderate**	**Low**
Mitigation measures	• Restrict vegetation clearing to the project footprint. • Conduct a search and rescue operation within natural habitats prior to vegetation clearing in order to relocate to safer areas any species of conservation importance. • Implement suitable measures, such as wildlife crossings, to allow wildlife to move freely away from disturbance during clearing – see BAP details. • During construction, contractors should avoid nighttime construction in an effort to limit both light and noise pollution. • Implement dust suppression measures, such as spraying roads with water regularly. • Compact roads to prevent dust generation.	

Table 6-9 Impact significance and proposed mitigation measures associated from erosion and sedimentation as a direct and indirect impact from the proposed road upgrade

Impact	Stormwater runoff, erosion and sedimentation
Impact Description	The removal of vegetation along the route, as well as various earthworks, are likely to result in erosion, which in turn will likely lead to the sedimentation of nearby watercourses. This is anticipated to be most associated with the construction phase of the project, although if not dealt with properly can go on for a long period of time. This will

Impact	Stormwater runoff, erosion and sedimentation	
	be exacerbated by the increased runoff generated from the hardened and impervious surface of the road once upgraded.	
Impact scenario	***No mitigation***	***Good mitigation***
Extent	Moderate	Low
Duration	High	Low
Frequency	High	Low
Intensity/severity	Moderate to high	Low
Status of impact	Negative	Neutral
Likelihood	Moderate	Low
Reversibility	Low	Low
Mitigation potential	Moderate	Moderate
Cumulative impacts	Moderate	Moderate
Significance	**Moderate**	**Low**
Mitigation measures	• Install drainage systems (e.g. mitre drains) to control runoff from the road into the environment and prevent localized erosion. • Following completion of the road upgrade, areas denuded of vegetation should be revegetated. • Existing erosion gullies within and connected to the road reserve need to be rehabilitated and revegetated. • Regularly clear culverts of sediment to prevent this washing into aquatic systems.	

Table 6-10 Impact significance and proposed mitigation measures associated with alien plant infestation as an indirect impact from the proposed road upgrade

Impact	Alien plant infestation	
Impact Description	The removal of vegetation along the route creates open niches and disturbance which are often quickly colonized by alien plants. This, in turn, has negative consequences for native biodiversity.	
Impact scenario	***No mitigation***	***Good mitigation***
Extent	Low	Low
Duration	High	Low
Frequency	High	Low

Impact	Alien plant infestation	
Intensity/severity	Moderate	Low
Status of impact	Negative	Neutral
Likelihood	High	Low
Reversibility	Low	Low
Mitigation potential	Moderate	Moderate
Cumulative impacts	Moderate	Moderate
Significance	**Moderate**	**Low**
Mitigation measures	• Monitor the area for the presence of alien species along the road route, and in and around borrow pits and construction camps. • Where alien species are detected, these should be cleared using appropriate clearing methods according to an approved aline plant control plan. • Areas denuded of vegetation should be revegetated with indigenous vegetation.	

7. BAP ACTIONS

A BAP is required for all projects located in critical habitat, and is recommended for projects that have the potential to significantly impact natural habitat (IFC, 2012; IFC, 2019).

7.1 Biodiversity Priorities and Objectives to Address Significant Impacts

The primary purpose of developing this BAP for the Illasit-Taveta road upgrade project is to ensure that specific biodiversity objectives and management actions are put in place to protect and conserve species and habitats that are of importance. Generally, a BAP is not required for modified habitats, unless these are determined to be critical habitat, and the BAP should aim to achieve "no net loss" of natural habitats and a "net gain" in critical habitats in accordance with IFC PS6 (IFC, 2012; IFC, 2019).

Actions have been developed for priority biodiversity features that have been identified in this study, to ensure that biodiversity impacts are adequately addressed according to the mitigation hierarchy, i.e. to avoid, reduce (or minimise), remedy (or rehabilitate/restore), and/or offset. This will allow for the careful management of risk during the construction and operation phases of the proposed road upgrade, thereby ensuring the best possible outcome for the project, while maintaining the wellbeing of biodiversity and local communities.

7.1.1 *Action Plan for Priority Terrestrial Biodiversity Features*

The proposed road upgrade will have an impact on terrestrial habitats (and associated fauna and flora) within the Rombo Corridor (i.e. Road Section 3). Although this section of road does not affect any Critical Habitat, it does allow for some irregular movement of larger mammals (including Savanna Elephant), which are more concentrated within game farms to the east, as well as Tsavo West National Park.

Objective T1: Reduce wildlife mortality and disturbance

Action T1-1: Inform construction teams regarding the importance of the Rombo Corridor					
• **Target:** All construction teams and personnel need to be made well aware of the importance of the Rombo Corridor for supporting wildlife movement; driver awareness of all fauna that are prone to mortality from vehicle collision to be promoted; personnel (and stakeholders) to be encouraged to collect photographs of fauna using smartphone Apps (e.g. GeoODK) to build knowledge of animal hotspots. • **Indicators:** number contractor/personnel trained through toolbox talks, number of office posters printed and erected; smartphone app loaded; central database developed to collate and analyse data capture by personnel using the designated smartphone App.					
Mitigation hierarchy	**Avoid**	**Reduce**	**Remedy**	**Offset**	**Additional action**

- **Start:** from commencement of construction phase.
- **End:** at the end of construction phase for construction teams/personnel; ongoing for stakeholders for first two years of operation.
- **Frequency:** Ongoing and continuous during construction phase; and during staff inductions.
- **Responsibility:** Health and Safety Executive (HSE) Manager, with support from external ecological consultants and/or NGOs.
- **Details:** Obtain any spatial data that can be used to inform the mapping of wildlife movement/concentrations along the road and across the Rombo Corridor.

Action T1-2: Avoid illegal hunting and poaching of animals

- **Target:** All construction teams and personnel need to be informed that any illegal hunting/poaching will not be accepted and any cases will be treated seriously with disciplinary action taken.
- **Indicators:** Number contractor/personnel informed through toolbox talks; number of illegal hunting/poaching cases lodged.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** from commencement of construction phase.
- **End:** at completion of construction phase.
- **Frequency:** Ongoing and continuous during construction phase; and during staff inductions.
- **Responsibility:** Health and Safety Executive (HSE) Manager.
- **Details:** Serious cases of illegal hunting/poaching (i.e. of protected species or SCCs) will need to be reported to the police and conservation authorities.

Action T1-3: Avoid and reduce wildlife mortality from AVCs

- **Target:** To prevent accidental collision of vehicles with wildlife, particularly within the Rombo Corridor.
- **Indicators:** Potential hotspots for wildlife collisions identified using the detail habitat maps (Action T1-1); road designs include crossings similar to one at Kimana on the Emali-Oloitokitok road for the two wildlife corridors (Figure 3-4); two smartphone app developed to geolocate photographs and upload to a central database to record number and type of wildlife injured or killed; monitoring of road kills by construction personnel and stakeholder using smartphone app; safe driving training and awareness campaigns for preventing AVCs; instalment of warning signs; introduction of speed calming measures; enforcement of speed limits.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** from commencement of construction phase.
- **End:** ongoing into the operation phase.
- **Frequency:** Ongoing and continuous during construction and operation phases.
- **Responsibility:** Health and Safety Executive (HSE) Manager; road traffic authorities.
- **Details:** Speed reduction measures need to be introduced through the Rombo Corridor, either through acceptable speed limits (determined by road traffic authorities and wildlife NGOs) and/or speed control measures (e.g. speed bumps) based on known wildlife crossing hotspots

and informed over time using monitoring data. Warning signboards need to be installed at crossing hotspots to caution motorists of animals crossing the road.

Safe driving and awareness campaigns should be held, both for construction teams/personnel and communities regularly using the road, to educate drivers what they can do to reduce their chances of having an AVC, what they should do if they encounter wildlife on the road, etc. using exiting training resources such as the Wildlife Collision Prevention Program (available from https://www.wildlifecollisions.ca/).

Objective T2: Management and control of invasive alien plants (IAPs)

Action T2-1: Develop and implement a plan to control the establishment and spread of IAPs

- **Target:** Assess the extent of the problem regarding IAPs to determine the types of species needing to be controlled, as well as IAP distributions and hotspots.
- **Indicator:** baseline IAP survey conducted along the length of road; maps of IAP extents and hotspots; IAP Control Plan developed; initial clearing of IAPs; revegetation of indigenous vegetation in heavily infested areas; follow-up clearing of IAPs; monitoring surveys conducted.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** Upon completion of the construction phase.
- **End:** Five years, thereafter, entering into an ongoing maintenance programme.
- **Frequency:** Baseline and IAP Plan (once off); initial clearing of IAPs (once off to remove most IAP cover); follow-up clearing of IAPs (every six months to manage regrowth.
- **Responsibility:** Road Construction Manager, Environmental Manager, Ecological consultant with IAP experience; IAP contractor.
- **Details:** Control of IAPs should take place along the entire road reserve, as well as within construction camps, but should extend outside of the road reserve (by a minimum of 30m) where it passes through the Rombo Corridor. Effective management of IAPs is imperative in order to prevent further spread and establishment in the broader environment, and will requires an integrated approach using a combination of mechanical and chemical control methods that are recommended and approved for target IAP species. Regular follow ups over a five year period will be critical to properly address the extent and severity of the IAP problem. In addition, revegetation using desired indigenous plants (preferably grasses) will be essential in order to establish cover to supress regrowth and re-establishment of IAPs.

7.1.2 *Action Plan for Aquatic Biodiversity Features*

The proposed road upgrade will also impact various aquatic habitats and their associated fauna and flora. These habitats include a few non-perennial rivers systems (e.g. Tsavo and Ol Girra Rivers) and one more perennial river system (i.e. Lumi River). The Lumi River is an important biodiversity feature and Critical Habitat given that it provides suitable habitat for a few SCCs, including the Vulnerable tree *Mimusops riparia*, fish (notably the Critically Endangered *Oreochromis jipe*, which triggers the Lumi River as Critical Habitat – see Figure 5-19), and the Endangered Mollusc *Gabbiella verdcourti* (no distribution data mapped for the species but known to inhabit spring-fed pools in the Taita-Taveta District in south-eastern Kenya, so it is range-restricted and may occur within sections of the Lumi River). Furthermore, all river systems are considered important given the provision of ecosystem services they offer. Although, drainage system are not necessarily classified as riverine habitat (or watercourse as defined by the National Water Act (Act No. 43 of 2016), they are important in terms of conveying surface runoff into river system positioned downstream. They therefore act as conduits for impacts (largely stormwater runoff and water pollution) that could even extend into Critical Habitats located further downstream (e.g. Tsavo River mainstem). Appropriate management actions are therefore provided to largely safeguard ecological processes, but also to avoid impacts to important riverine biodiversity (including Critical Habitat trigger species).

Objective A1: Minimise stormwater impacts and erosion within drainage systems

Action A1-1: Review stormwater runoff designs

- **Target:** Independent review of road designs and stormwater management plans by an environmental engineer.
- **Indicators:** Independent review conducted with recommendations for stormwater management.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** during the design/planning phase.
- **End:** At least two months before construction starts.
- **Frequency:** Once off.
- **Responsibility:** Road Construction Manager; External/independent environmental engineer with stormwater management experience.
- **Details:** Stormwater runoff from the road surfaces poses a serious risk to the receiving environment downstream, particularly riverine systems, due the effects caused by scouring, erosion and sedimentation. An independent review by a suitably qualified environmental engineer with road/stormwater experience, would add great value to ensure that stormwater is adequately manage as it leaves the road.

Action A1-2: Soil conservation and erosion control

- **Target:** Develop and implement a detailed rehabilitation plan to address the severe erosion and gullies/dongas that have formed along the existing road.
- **Indicators:** Surveys conducted by environmental engineer/s to assess the extent and severity of erosion; interventions identified to stabilise soils, gullies and dongas; rehabilitation plan developed; implementation of interventions; monitoring of interventions.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** During the design/planning phase.
- **End:** Within one year of the operation phase starting.
- **Frequency:** ongoing during the design and construction phases.
- **Responsibility:** Road Construction Manager; External/independent environmental engineer with stormwater management experience.
- **Details:** Soil conservation and erosion control interventions will be required to ensure that downstream aquatic environments do not become more severely impacted from sedimentation.

Objective A2: Protect and maintain aquatic habitats and associated biodiversity

Action A2-1: Assess the ecological health and integrity of river systems

- **Target:** Conduct biomonitoring within the Lumi River and the various non-perennial rivers (e.g. Tsavo River) upstream and downstream of the road crossings to determine present ecological state (PES).
- **Indicators:** River health baseline; *in-situ* water chemistry sampling; water clarity/turbidity sampling; instream and riparian habitat integrity assessments; benthic diatoms sampling; aquatic macroinvertebrates sampling; monitoring sites established; biomonitoring surveys during construction.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** Six months before construction starts.
- **End:** Two years after construction is completed.
- **Frequency:** Biannually.
- **Responsibility:** Environmental Manager; external/independent riverine ecologist.
- **Details:** River ecosystems should be assessed using a tools that have been developed purposefully for aquatic biomonitoring of rivers using a range of indicators (i.e. riparian and instream habitat, benthic diatoms, aquatic macroinvertebrates, and *in-situ* water quality and water clarity/turbidity. Each biomonitoring surveys will provides detailed information of various factors affecting the aquatic environments, the road construction process, as well as integrating understanding of impacts derived from terrestrial landscapes and upstream catchment areas.

Action A2-2: Conduct surveys of the Lumi River to establish its biodiversity value and verify Critical Habitats

- **Target:** Undertake surveys along the Lumi River, targeting key indicator groups (i.e. fish, molluscs and dragonflies/damselflies) to determine the occurrence of SCCs, especially Jipe Tilapia (*Oreochromis jipe*).
- **Indicators:** Surveys of aquatic biota conducted prior to construction; eDNA samples collected and analysed; inventory of aquatic biota and SCCs that inhabit the Lumi River; results and possible implications communicated to the project team; appropriate steps taken to further minimise impacts; monitoring of SCCs.

Mitigation	Avoid	Reduce	Remedy	Offset	Additional

hierarchy					action

- **Start:** Six months before construction starts.
- **End:** Monitoring continuing up to two years into operation phase.
- **Frequency:** Surveys during April and November with annual monitoring thereafter.
- **Responsibility:** External ecological consultant and/or aquatic specialists/experts.
- **Details:** The focused surveys of the Lumi River are required to provide more confident knowledge regarding the importance and sensitivity of the river in terms of supporting SCCs. Ongoing monitoring of SCCs will then provide data to assess the impacts of the project, as well as to help make management decisions regarding additional mitigation measures.

Action A2-3: Avoid losses of riparian forest and riverine habitats

- **Target:** Ground-truth the extent of riparian forest and riverine habitats in the vicinity of road crossings and mark out no-go areas for during construction, and include appropriate buffers.
- **Indicators:** Desktop mapping of riparian forest / gallery forest; river crossings inspected and no-go areas clearly marked; surveys of aquatic biota conducted prior to construction to verify Critical Habitat along the Lumi River; eDNA samples collected and analysed; inventory of aquatic biota and SCCs that inhabit the Lumi River; results and possible implications communicated to the project team; appropriate steps taken to further minimise impacts; monitoring of SCCs; construction teams/personnel informed of the importance of working away from no-go areas; non-compliances to be monitored and reported; non-compliances corrected with immediately effect.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** Six months before construction starts.
- **End:** Monitoring continuing up to two years into operation phase.
- **Frequency:** Monthly when construction is taking place at river crossings.
- **Responsibility:** Environmental Manager and/or HSE Manager and an ECO.
- **Details:** Clear boundary markers (e.g. painted stakes and/or hazard tape) needs to be put in place before construction takes place at respective river crossing, and sites need to be regularly inspected. Photographic evidence needs to be obtained to record any non-compliances, which then need to be filed with corrective actions put in place to rectify damages caused to riparian forest with immediate effect. Robust offset needs to be developed with a management plan to implement.

Objective A3: Avoid water quality impacts to aquatic habitats

Action A3-1: Avoid losses of riparian forest

- **Target:** No foreign materials from the construction process (e.g. sand, cement, etc.) or contaminants (e.g. fuel/oil from construction vehicles) should be discarded into any watercourse or drainage system to avoid water quality impacts to downstream aquatic habitats.
- **Indicators:** Construction teams/personnel informed of the importance of avoiding water quality impacts and preventing any environmental contamination; no-go areas enforced by an

ECO; non-compliances regularly monitored and reported; spill remediation protocol developed to respond to spills/non-compliances to rectify spills with immediate effect.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** Two months prior to construction.
- **End:** Ongoing throughout the construction phase.
- **Frequency:** Monthly when construction is taking place at river crossings.
- **Responsibility:** Environmental Manager and/or HSE Manager and an ECO.
- **Details:** Emergency preparedness protocols need to be developed to rapidly and effectively deal with accidental spills or deliberate infringements. Clear boundary markers (e.g. painted stakes and/or hazard tape) need to be put in place before construction takes place at respective river crossing, and sites need to be regularly inspected. Photographic evidence needs to be obtained to record any non-compliances, which then need to be filed with corrective actions put in place to rectify damages caused to riparian forest with immediate effect.

7.1.3 *Action Plan for Critical Biodiversity Features*

Lake Chala will not be directly impacted upon by the proposed Illasit-Taveta road, but may experience indirect impacts from more people accessing the lake via improved road transport and access. Kenyan and Tanzanian conservation authorities should initiate a transboundary stewardship process to investigate ways of improving the protection of Lake Chala, including ways for promoting sustainable ecotourism and agriculture with local communities surrounding the lake. The greatest threat to the lake will depend on future projects requiring water abstraction – both directly from the lake and/or indirectly from the (deep) groundwater systems that supply water to the lake. In addition, and based on the outcomes from further surveys of aquatic biodiversity within the Lumi River (i.e. presence of Jipe Tilapia in the Lumi River confirmed), develop and implement an offset strategy to compensate for any (direct and indirect) loss or degradation of Critical Habitat and associated species.

Objective CH1: Conservation Stewardship and Protection of Critical Habitats

Action CH1-1: Promote awareness of the Lake Chala AZE

- **Target:** Awareness signboards of the KBA/AZE at main vehicle access points to Lake Chala.
- **Indicators:** Lake Chala KBA/AZE signboard/s designed and erected; no further transformation of habitat within and around the rim of the crater.

Mitigation hierarchy	Avoid	Reduce	Remedy	Offset	Additional action

- **Start:** Signboard/s designed within one month of construction starting.
- **End:** Signboard/s erected within two months of being designed.
- **Frequency:** Once off.
- **Responsibility:** Construction company and graphic designers with support from an ecological consultant and/or NGO; key stakeholders (Kenya Wildlife Services, Big Life Foundation, etc.).

Action CH1-2: Compensate losses of Critical Habitat along Lumi River					
• **Target:** Riverine stewardship programme for the Lumi River to offset the loss of any Critical Habitat pending outcomes of A2-2. • **Indicators:** Presence of SCC within Lumi River confirmed; Critical Habitat mapping revised; plan to offset impacts on Critical Habitat/s developed and implemented (see recommended offset strategy in Section 8); detailed monitoring and evaluation plan for Critical Habitats developed to define suitable indicators and targets.					
Mitigation hierarchy	**Avoid**	**Reduce**	**Remedy**	**Offset**	**Additional action**
• **Start:** Six months before construction starts. • **End:** Before construction starts, particularly in relation to the Lumi River crossing. • **Frequency:** Once off. • **Responsibility:** Environmental Manager; external/independent riverine ecologist with offset experience.					

8. OFFSET STRATEGY

Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant negative residual impacts on biodiversity that arise from a project development (BBOP, 2012; ICMM IUCN, 2012; McKenny and Kiesecker, 2010; World Bank Group, 2016). The goal of biodiversity offsets is to achieve "no-net-loss", and preferably a "net gain" of biodiversity in terms of species composition, habitat structure, ecosystem function and human use and cultural values associated with biodiversity. Ultimately, a biodiversity offset is a commitment by the developer to compensate for residual impacts on biodiversity after appropriate avoidance, minimisation and on-site rehabilitation measures have been taken into account according to the mitigation hierarchy (DEADP, 2007). Figure 8-1 provides and illustration of the mitigation hierarchy, typically managed through the project ESIA process, and how offsets are eventually defined to account for residual impacts to achieve a no-net-loss/net-gain.

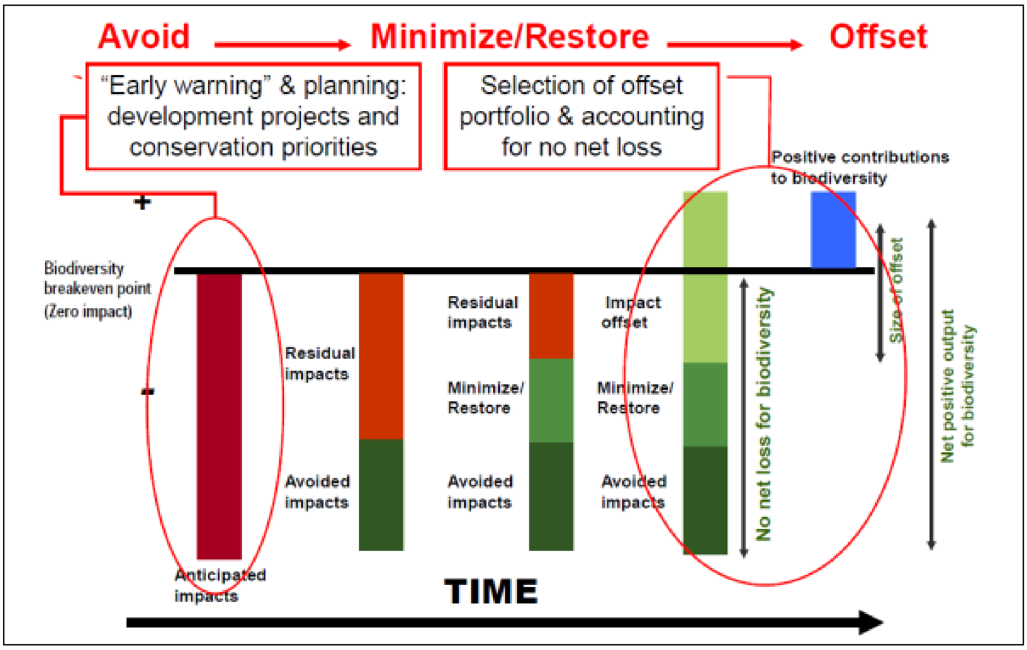


Figure 8-1 A strategic approach for mitigating potential impacts across a site (after Kiesecker *et al.*, 2009)

The proposed Illasit-Taveta road upgrade is expected to have a relatively small residual impact, provided mitigation measures provided in Section 6 are properly implemented. This is mostly due to the project being aligned with the existing road, and the significant land transformation along the road. The increased width that is planned for the existing road reserve is by another 30 m. The affected habitat areas calculated within the wider road reserve are presented in Section 4.2. In summary, this includes 99.0 ha of degraded/modified habitat and 25.5 ha of natural habitat. The latter includes a small area (0.5 ha) of gallery forest and riverine habitat on the upper Lumi River in the Chumvini area. The Lumi River is currently assessed and mapped as Critical Habitat given the potential for Jipe Tilapia (*Oreochromis jipe*) occurring downstream.

The design of a biodiversity offset should preferably aim to be equivalent in relation to the biodiversity feature/s impacted, which is often referred to as the "like-for-like" principle. BBOP

(2009) emphasise ten other principles to guide offset development and implementation (Table 8-1). Principles 1, 2, 4, 8 and the "like-for-like" principle being more fundamental according to Pope *et al.* (2021).

Table 8-1 Biodiversity Offsets Principles (BBOP 2009, p 16)

Principle	Definition
No net loss (Principle 1)	A biodiversity offset should be designed and implemented to achieve *in situ*, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.
Additional conservation outcomes (Principle 2)	A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.
Adherence to the mitigation hierarchy (Principle 3)	A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimisation and on-site rehabilitation measures have been taken according to the mitigation hierarchy.
Limits to what can be offset (Principle 4)	There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.
Landscape context (Principle 5)	A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.
Stakeholder participation (Principle 6)	In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring.
Equity (Principle 7)	A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognised rights of indigenous peoples and local communities.
Long-term outcomes (Principle 8)	The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in perpetuity.
Transparency (Principle 9)	The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.
Science and traditional knowledge (Principle 10)	The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

8.1 Offset Calculation

Typically, biodiversity offsets require a detailed steps to be followed to determine the most suitable offset while addressing the principles in Table 8-1. As a minimum, and in order to meet the requirements of IFC PS6, it is recommended that a biodiversity offset be considered to achieve "no net loss" to compensate (at a 1:1 ratio) for the loss of 25.0 ha of natural habitat that will result from the Illasit-Taveta road upgrade project. In addition, and to account for a "net gain" from the loss of 0.5 ha of critical habitat to upgrade the road crossing the Lumi River, a 1:10 ratio is applied, adding another 5 ha. The total area effectively needing to be offset comes to 30.0 ha.

Given the scale of the offset that is calculated, a standalone biodiversity offset developed specifically for the Illasit-Taveta road upgrade would not be financially feasible, making it more difficult to achieve the desired offset principles. As an alternative, it is suggested the upfront capital covering the full value of the offset be invested using financial mechanisms to fund and support existing and already establish programmes. The management actions and objectives set out in such programmes, however, would need to deliver on-the-ground conservation outcomes, preferably in the context of the local landscape.

8.2 Opportunities for Biodiversity Offsets in the Landscape

Taking the above offset concept into consideration, the following options are provided as potential, locally available offset receiving areas (ordered from most feasible to least feasible):

8.2.1 *Conservation of wildlife corridors in the Amboseli Ecosystem*

Wildlife corridors outside of protected areas are essential to enable movement of large mammal populations between core conservation areas. This is especially the case in the Amboseli Ecosystem, where rapid human population growth and expanding agricultural developments over the last few decades have severely constricted wildlife corridors that connect Tsavo West, Amboseli and Kilimanjaro National Parks. Currently, there are only a few areas that provide the last remaining natural habitat for important species such as elephant to move through, some of which are restricted bottlenecks (see Section 3.4.1).

The Big Life Foundation (BLF) is a very active NGO that has been involved in continuous holistic conservation in the Greater Amboseli Ecosystem for 30 years. The organisation focuses on four key areas 1) wildlife protection, 2) human-wildlife conflict, 3) habitat protection and 4) community programmes. Currently, BLF is responsible for protecting close to 650 ha of rangeland in the Greater Amboseli Ecosystem. Since its inception, BLF has expanded operations to employ more than 500 local Maasai, with more than 40 permanent outposts and tent-based field units, 14 patrol vehicles, 2 tracker dogs, and 2 planes for aerial surveillance. Although, their focus is primarily on antipoaching and protection of charismatic species (i.e. rhino and elephant), they continue to work with communities to protect strategic wildlife corridors and dispersal areas, so that the ecosystem remains functional and continues to support both humans and wildlife.

Important points for consideration:

- NGOs like BLF have good track-records and transparent in terms of operational programmes and financing. Being well-resourced, they are also more likely to successfully achieve conservation goals and target that are in place, making it possible to achieve a net gain of biodiversity.

- BLF provide opportunities to use upfront capital from the biodiversity offset to support existing and/or initiate programmes aimed at conserving and managing wildlife corridors where they are most needed, thereby addressing the "like-for-like" principle to some extent with respect to the Rombo corridor (see Section 3.4.1).
- One of the BLF ranger outposts is located within the Rombo corridor, which makes it possible for them to offer support through ongoing monitoring of the wildlife movements in the vicinity of the Illasit-Taveta road.

8.2.2 *Restoration of the Loitokitok Forest Reserve*

The Loitokitok Forest Reserve is an important area for forest conservation and is located near the town of Illasit, and falls within the project AOI (Fig ??). It is also an important water catchment area for the region and supports food production and livestock farming for local communities. Any enhancement and expansion of forest habitat will not only have positive outcomes for biodiversity (including threatened species such as Abbott's Duiker *Cephalophus spadix* and Mt. Kilimanjaro Guereza *Colobus caudatus*), but also people living in the area that depend on the supply of ecosystem goods and services (notably clean water).

Kenya Forest Service recently signed a Forest Management Agreement (FMA) for the Loitokitok Forest Reserve in accordance with the Forest Conservation and Management Act (Act no 34 of 2016). The World Wildlife Fund (WWF) in support of this is currently in the process of implementing a sub-national Restoration Opportunity Assessment Methodology (ROAM) for the Loitokitok-Amboseli area through the Forest Landscape Restoration (FLR) in Africa Programme (WWF, 2022). WWF-Germany is providing technical, financial and organizational support to WWF-Kenya to assist Kenya in meeting its obligations under the Bonn Challenge/AFR100 which aim to restore 5.1 million ha of deforested and degraded lands by 2030. Although the programme is funded by the International Climate Initiative (IKI) of the German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU), there will, without a doubt, be opportunities to provide further financial support by using the upfront capital from the biodiversity offset to help sustain any forest restoration activities in future.

Important points for consideration:

- Forest restoration does necessarily address the "like-for-like" principle, but does present an opportunity for trading up by enhancing and conserving critical habitat linked to the lower slopes of Mount Kilimanjaro.
- There are numerous river systems flowing through Loitokitok Forest Reserve that could be incorporated specifically into the area selected to utilise the upfront capital from the biodiversity offset, thus providing a more suitable mechanism to offset riverine/riparian losses, particularly in relation to the Lumi River.
- The forest restoration concept would also be more sustainable in the long-term, especially given that it is already associated with a nationally protected area.

8.2.3 *Formal Protection of Lake Chala*

Lake Chala, despite being an AZE site and KBA, does not have any form of protection at the national level. As presented in Section 7.1.3, conservation authorities (preferably both Kenya and Tanzania) should initiate a process to establish national-level protection of Lake Chala and to develop a management plan for the area. The management plan should include ways for promoting sustainable ecotourism given the presence of existing facilities, together with programmes to manage fisheries within the lake, particularly measures to safeguard endemic populations of highly threatened species (i.e. the Critically Endangered *Oreochromis hunterii* (Lake Chala Tilapia) and Endangered *Potamonautes platycentron*).

Important points for consideration:

- This does not necessarily address the "like-for-like" principle, but is a possible option for trading up given the AZE/KBA status of Lake Chala and availability of critical habitat.
- There are existing ecotourism operations that utilise the lake with some accommodation/facilities on the crater rim. These venues would be a key stakeholder in ensuring the long-term conservation and protection of the lake, with conservation levees used to help maintain and manage the resource.
- Upfront capital would offer financial support to establish and setup the protected area, but this would only cover short- to medium-term development and implementation processes. Furthermore, the process would need to be managed by a suitably qualified organisation that is able to work closely with the conservation authorities.

8.2.4 *Community adopt-a-river programme for the Lumi River*

The Lumi River is the only perennial river system that intersects the Illasit-Taveta road that supports SCC, including potentially the Critically Endangered *Oreochromis jipe* (Jipe Tilapia). Flows in the rivers system are supported by several springs that appear to be supplied by shallow groundwater systems that are sustained by rainfall falling over the eastern slopes of Mount Kilimanjaro.

Long-term management of the Lumi River could be established using a river stewardship programme that is supported by local communities living along the river, down to the A23 road crossing. A riverine management plan would need to be developed and relevant communities engaged to determine key role players and actors that will influence wise use and sustain management of the river ecosystem. Local citizens and schools can be engaged to build awareness regarding the importance of conserving the river system, and trained using citizen science tools to monitor the health and functioning of the system.

Important points for consideration:

- Addresses the "like-for-like" principle, but only for impacts and loss of riparian forest and riverine habitat.
- Largely dependent on willingness and enthusiasm of local communities.
- Medium- to long-term feasibility is less certain given that the upfront capital would not sustain the programme in perpetuity, so would require viable management systems to continue the programme in future.

8.3 Offset Cost Estimation

Land values obtained during the Lot 32 Resettlement Action Plan (RAP) for the Illasit-Taveta road upgrade (Lartech Africa and SE Solutions, 2022) were used as the basis to determine cost to secure land for the offset. Land values ranged from 300,000 to 700,000 (averaging 623,077) Kenyan Shillings per acre according to a sample size of 13 properties. Using the upper limit, values were changed into hectare equivalents (i.e. KES 1,730,000 per ha) and converted into US Dollars using the 2022 average exchange rate (i.e. 0.0087 USD to one KES).

The calculated upfront capital amount for the biodiversity offset amounts to approximately USD 450,000. Once the final amount is agreed upon and the most feasible offset option is selected, then the upfront capital should be transferred to an interest-bearing account of the relevant organisation responsible for implementing the selected conservation programme. It is important to note that annual progress reports and financial audit reports will need to be produced by the managing organisation to show how the upfront capital has been used to improve/enhance biodiversity in the landscape.

9. MONITORING AND EVALUATION PLAN

A Biodiversity Monitoring and Evaluation Programme (BMEP) is a fundamental aspect of demonstrating compliance with IFC PS6 (IFC, 2019). The BMEP will be designed to assess whether any unexpected impacts on biodiversity are occurring, thus allowing for an adaptive feedback approach to be implemented. Additionally, the BMEP will allow for confirmation that the responsible parties are implementing the BAP as required and that the desired conservation outcomes are being achieved. GN51 and GN52 of PS6 provide the criteria for a suitable BMEP, which should include the following (IFC, 2019):

I. **Baseline:** the status of the biodiversity values prior to the project's impacts;
II. **Process:** monitoring of the implementation of mitigation measures and management controls;
III. **Outcomes:** monitoring of the status of biodiversity values during the life of the project, compared to the baseline.

The development of a BMEP requires the selection of a suitable set of indicators for the biodiversity values requiring mitigation and management (IFC, 2019). These should be selected based on their ability to inform decisions about mitigation and management and their ability to measure effects with adequate statistical power.

Thresholds should be set against which to compare monitoring results. Should monitoring results fail to comply with these thresholds, the management plans should be adapted to address any deficiencies in performance (IFC, 2019). It is critical that the results of monitoring are reviewed regularly to allow for this adaptive feedback process to be effectively implemented. Where monitoring reveals poor performance, the reasons for this failure, such as poorly trained staff or insufficient funds, should be identified and rectified (IFC, 2019). Additionally, should monitoring results indicate that project impacts to biodiversity were either underestimated, or benefits from management actions overestimated, the impact assessment and relevant management plans should be updated (IFC, 2019).

The BMEP will require the monitoring of the nature, extent, quality and spatial configuration of habitats and species of conservation significance within the project footprint, as well as within the broader study area. All monitoring will require collection of routine monitoring information to enable any evaluations to be made regarding implementation effectiveness for various activities associated with the road upgrade. Monitoring approaches applied should ideally be rapid and cost-effective and will likely include methods such as remote sensing.

The first step in the development of the BMEP will be the selection of indicators. Local experts will need to be engaged to develop these indicators, but it is anticipated that indicators will include the following:

- Extent of key terrestrial habitats
- Condition of key terrestrial habitats
- Water quality of key aquatic ecosystems
- Degree of erosion/sedimentation of key aquatic ecosystems
- Number of animals trapped in excavations

- Extent of IAP infestations
- Number of faunal specimens (or evidence of fauna, e.g. spoor or scat) observed along the entire length of the road
- Number of reports of illegal hunting, including snares
- Number of road kills along the entire length of the road

For all indicators proposed, baseline data will need to be collected prior to the development commencing. Some of this data, such as extent of habits, has been collected as part of the BAP process.

Monitoring methodologies, including suggested frequency and responsible personnel, associated with the aforementioned indicators are as follows:

- Daily to weekly monitoring (including capturing of photographic evidence) of all construction areas for any disturbances caused to terrestrial habitats, aquatic habitats, and fauna and flora;
- Quarterly assessments of available aerial imagery to assess the extent of habitats;
- Bi-annual (dry season and wet season) vegetation assessments to assess the condition of terrestrial habitat;
- Ongoing monitoring by construction personnel and stakeholders to collect photographic evidence of fauna along the entire length of road, and particularly the Rombo Corridor section;
- Regular (minimum bi-weekly) inspections by construction personnel of any excavations for animals that may have become trapped;
- Monthly audit reports to be provided by an ECO to provide feedback of progress, infringements/non-compliances, wildlife observations, illegal hunting/poaching, road kills, rehabilitation processes, etc.;
- Quarterly monitoring of IAPs to report progress and adapt methods pertaining to the IAP control programme, with records maintained of all IAP operations (including areas cleared, number of labour units, amount of herbicide used, etc.);
- Monthly water quality sampling of river crossing (including in-situ water chemistry – temperature, pH, dissolved oxygen, conductivity – and water clarity and/or turbidity);
- Monthly assessments of river crossings to assess the degree of erosion/ sedimentation;
- Bi-annual biomonitoring to collect benthic diatom samples, assess habitat integrity, and perform macroinvertebrate surveys using appropriate indices and methods; and
- Monitor areas being rehabilitated using fixed-point-photographs, with a close-out site inspection provided by botanist/ecologist with rehabilitation experience.

Thresholds for the identified indicators will be defined based on the outcome of baseline assessments and the results of monitoring compared against these thresholds. Where failures are observed, adaptive management will be implemented.

A robust and appropriately designed, long-term biodiversity monitoring and evaluation program aimed at assessing the status of the Critical Habitat will need to be developed for the Lumi River following outcomes of the additional surveys, as well as appropriate management actions and indicators that are associated with the biodiversity offset.

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11. APPENDICES

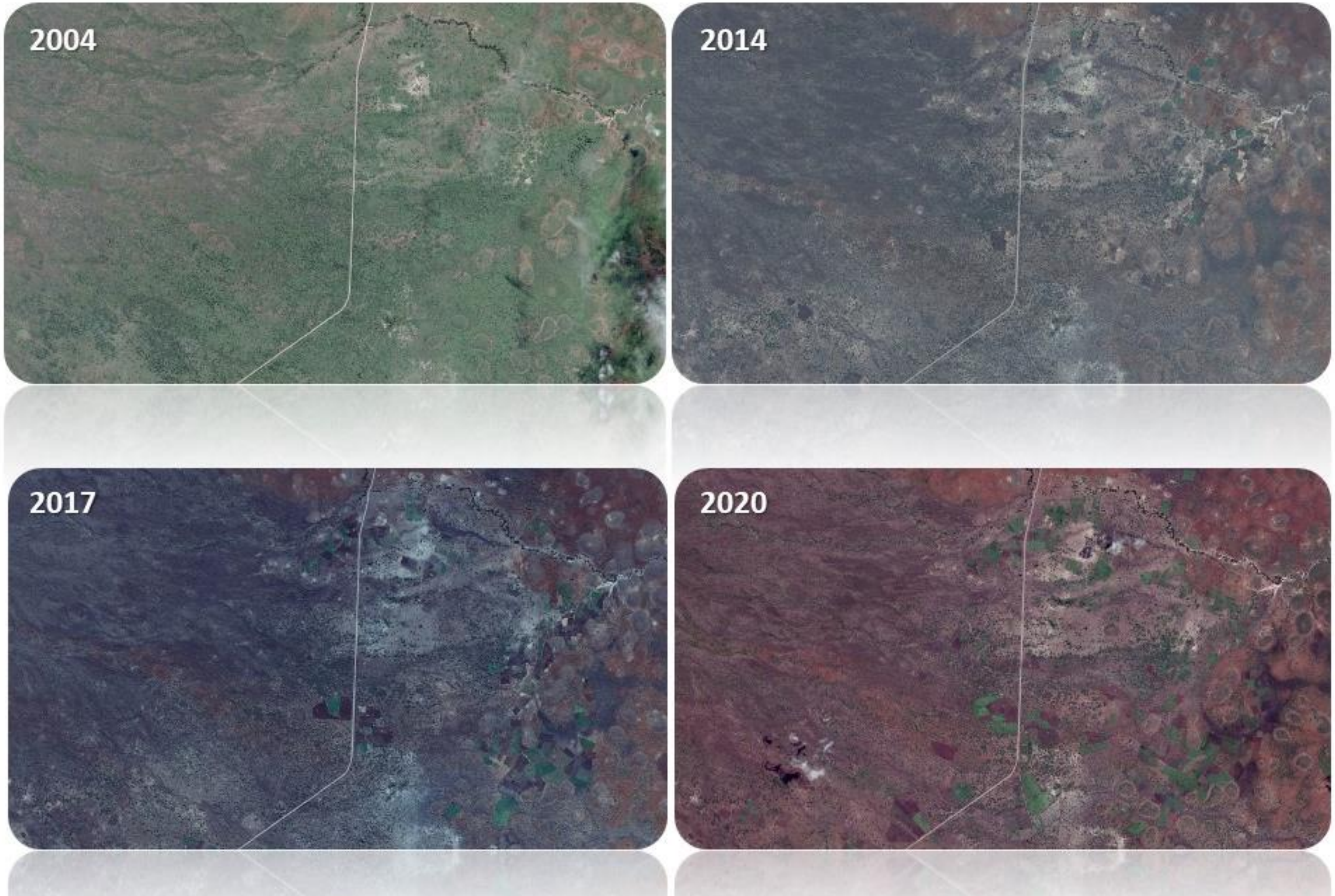
Appendix 1: List of plants recorded along the Illasit-Taveta road in March 2021

Family	Scientific name	
Mimosaceae (Leguminosae)	Acacia ancistroclada	
Mimosaceae (Leguminosae)	Acacia nilotica	
Mimosaceae (Leguminosae)	Acacia polyacantha ssp. campylacantha	
Mimosaceae (Leguminosae)	Acacia robusta ssp. usambarensis	
Mimosaceae (Leguminosae)	Acacia senegal	
Mimosaceae (Leguminosae)	Acacia seyal var. seyal	
Mimosaceae (Leguminosae)	Acacia tortilis ssp. spirocarpa	
Mimosaceae (Leguminosae)	Acacia xanthophloea	
Euphorbiaceae	Acalypha fruticosa	
Caesalpiniaceae (Leguminosae)	Acrocarpus fraxinifolius	Exotic (invasive)
Pteridaceae	Adiantum capillus-veneris	
Agavaceae	Agave americana	Exotic (cultivated)
Agavaceae	Agave sisalana	Exotic (naturalised)
Agavaceae	Agave sp.	Exotic (cultivated)
Asteraceae	Ageratum conyzoides	Exotic (naturalised)
Mimosaceae (Leguminosae)	Albizia amara	
Mimosaceae (Leguminosae)	Albizia gummifera var. gummifera	
Mimosaceae (Leguminosae)	Albizia petersiana	
Alliaceae	Allium cepa	Exotic (cultivated)
Sapindaceae	Allophylus rubifolius var. dasystachys	
Asphodelaceae	Aloe secundiflora var. secundiflora	
Papaveraceae	Argemone mexicana	Exotic (invasive)
Papaveraceae	Argemone ochroleuca	Exotic (invasive)
Moraceae	Artocarpus heterophyllus	Exotic (naturalised/cultivated)
Araucariaceae	Auracaria columnaris	Exotic (cultivated)
Cactaceae	Austrocylindropuntia subulata ssp. exaltata	Exotic (invasive)
Meliaceae	Azadirachta indica	Exotic (naturalised)
Zygophyllaceae	Balanites aegyptiaca var. aegyptiaca	
Zygophyllaceae	Balanites glabra	
Rhamnaceae	Berchemia discolor	
Phyllanthaceae	Bridelia micrantha	
Papilionaceae (Leguminosae)	Cajanus cajan	Exotic (cultivated)
Apocynaceae	Calotropis procera	
Capparaceae	Capparis tomentosa	
Caricaceae	Carica papaya	Exotic (cultivated)
Apocynaceae	Cascabela thevetia	Exotic (invasive/cultivated)
Malvaceae	Ceiba pentandra	
Poaceae	Cenchrus purpureus	Exotic (cultivated)
Caesalpiniaceae (Leguminosae)	Chamaecrista absus	Exotic (invasive)
Thelypteridaceae	Christella dentata	
Vitaceae	Cissus sp.	
Rutaceae	Citrus sinensis	Exotic (cultivated)

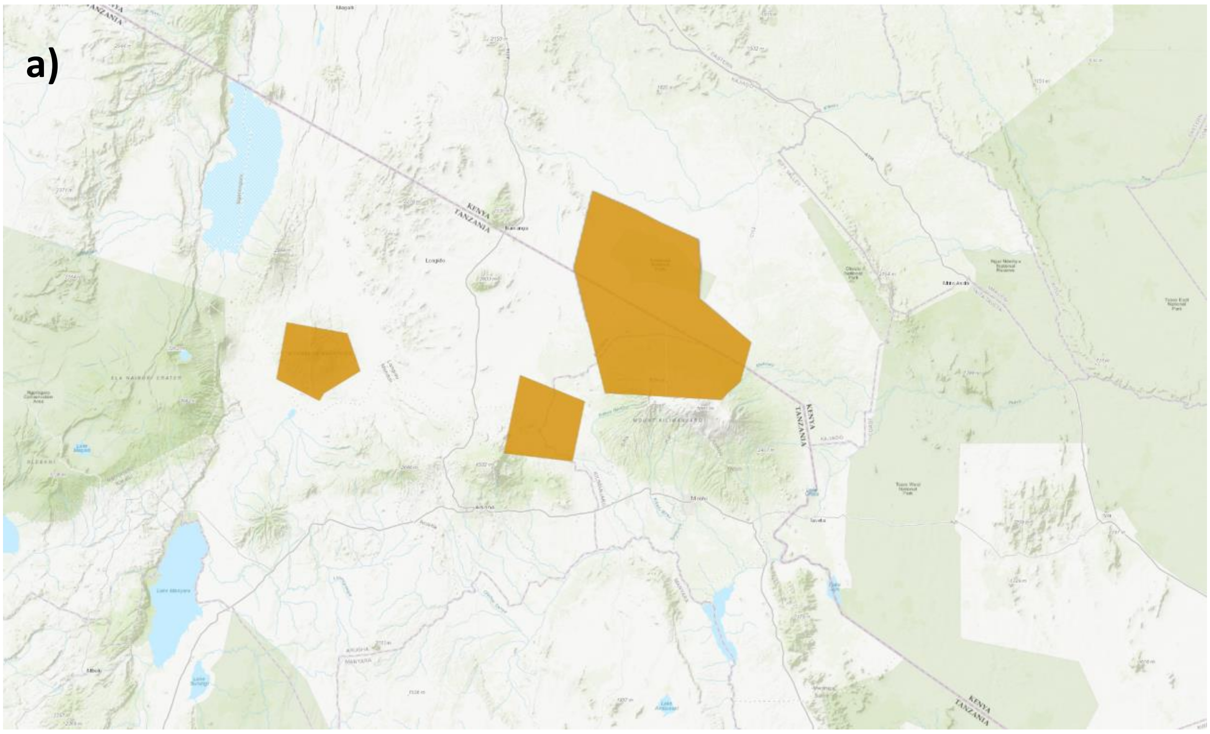
Family	Scientific name	
Euphorbiaceae	Cnidoscolus aconitifolius	Exotic (cultivated)
Arecaceae	Cocos nucifera	Exotic (naturalised)
Combretaceae	Combretum molle	
Combretaceae	Combretum mossambicense	
Bursaraceae	Commiphora habessinica ssp. habessinica	
Euphorbiaceae	Croton bonplandianus	Exotic (invasive)
Euphorbiaceae	Croton macrostachyus	
Euphorbiaceae	Croton megalocarpus	
Vitaceae	Cyphostemma thomasii	
Solanaceae	Datura ferox	Exotic (invasive)
Solanaceae	Datura metel	Exotic (naturalised/invasive)
Solanaceae	Datura stramonium	Exotic (naturalised/invasive)
Caesalpiniaceae (Leguminosae)	Delonix regia	Exotic (cultivated)
Putranjivaceae	Drypetes natalensis var. leiogyna	
Verbenaceae	Duranta erecta	Exotic (naturalised/cultivated)
Papilionaceae (Leguminosae)	Erythrina abyssinica ssp. abyssinica	
Euphorbiaceae	Euphorbia tirucalli	
Mimosaceae (Leguminosae)	Faidherbia albida	
Moraceae	Ficus benjamina	Exotic (cultivated)
Moraceae	Ficus natalensis	
Moraceae	Ficus sycomorus ssp. sycomorus	
Moraceae	Ficus wakefieldii	
Colchicaceae	Gloriosa superba var. superba	
Proteaceae	Grevillea robusta	Exotic (cultivated)
Rutaceae	Harrisonia abyssinica	
Asteraceae	Helianthus annuus	Exotic (naturalised/cultivated)
Convolvulaceae	Ipomoea carnea ssp. carnea	Exotic (naturalised/cultivated)
Bignoniaceae	Jacaranda mimosifolia	Exotic (naturalised/cultivated)
Euphorbiaceae	Jatropha curcas	Exotic (cultivated)
Anacardiaceae	Lannea rivae	
Anacardiaceae	Lannea schweinfurthii var. stuhlmannii	
Verbenaceae	Lantana camara	Exotic (invasive)
Araceae	Lemnaceae sp.	
Lamiaceae	Leonotis nepetifolia var. nepetifolia	
Mimosaceae (Leguminosae)	Leucaena leucocephala	Exotic (invasive)
Euphorbiaceae	Manihot esculenta	Exotic (cultivated)
Euphorbiaceae	Manihot glaziovii	
Bignoniaceae	Markhamia lutea	Exotic (cultivated)
Meliaceae	Melia azedarach	Exotic (naturalised)
Moraceae	Milicia excelsa	Near Threatened
Sapotaceae	Mimusops riparia	Vulnerable
Cucurbitaceae	Momordica spinosa	
Moringaceae	Moringa oleifera	Exotic (naturalised)
Moraceae	Morus sp.	Exotic (cultivated)
Musaceae	Musa sp.	Exotic (cultivated)
Caesalpiniaceae (Leguminosae)	Parkinsonia aculeata	Exotic (naturalised)

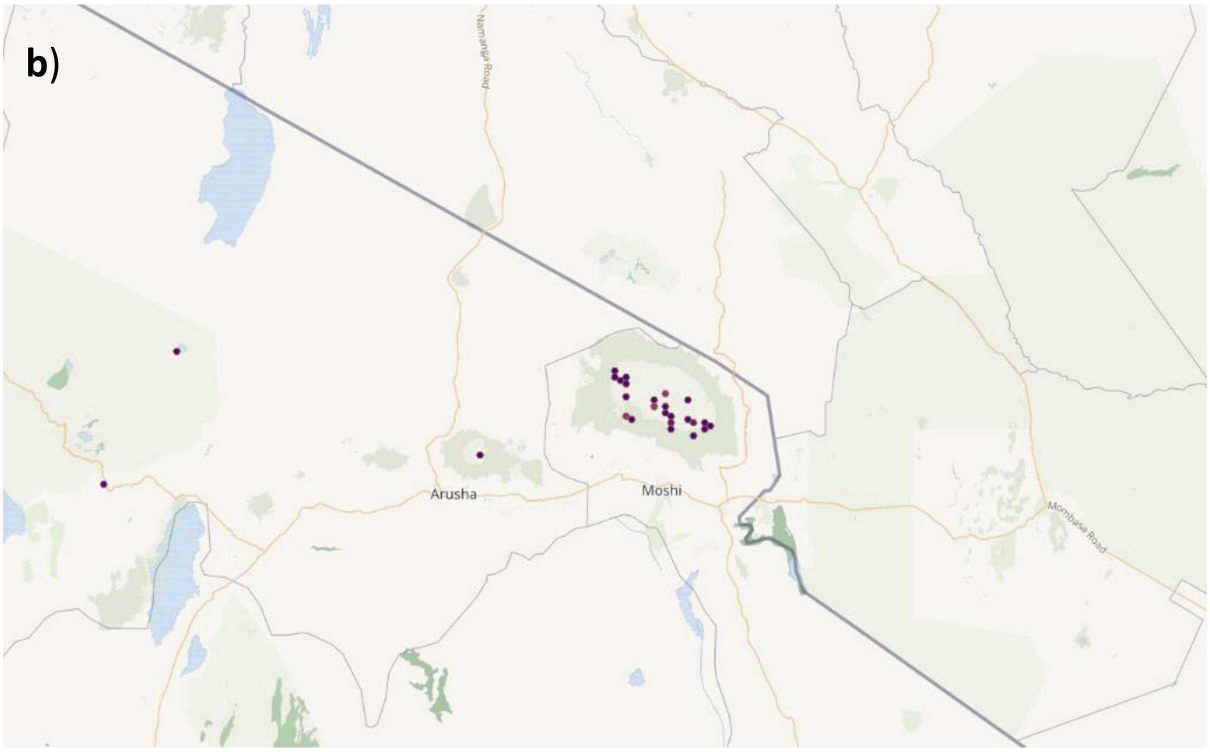
Family	Scientific name	
Asteraceae	Parthenium hysterophorus	Exotic (invasive)
Rubiaceae	Pavetta sp.	
Lauraceae	Persea americana	Exotic (cultivated)
Papilionaceae (Leguminosae)	Philenoptera eriocalyx	
Annonaceae	Polyalthia longifolia ssp. pendula	Exotic (cultivated)
Mimosaceae (Leguminosae)	Prosopis juliflora	Exotic (invasive)
Acanthaceae	Pseuderanthemum hildebrandtii	
Myrtaceae	Psidium guajava	Exotic (naturalised)
Rubiaceae	Psychotria capensis ssp. riparia	
Apocynaceae	Rauvolfia caffra	
Euphorbiaceae	Ricinus communis	Exotic (naturalised/invasive)
Acanthaceae	Ruellia prostrata	
Apocynaceae	Saba comorensis	
Poaceae	Saccharum officinarum	Exotic (cultivated)
Salicaceae	Salix subserrata	
Dracaenaceae	Sansevieria dawei	
Anacardiaceae	Schinus molle	Exotic (cultivated)
Caesalpiniaceae (Leguminosae)	Senna bicapsularis	Exotic (invasive)
Caesalpiniaceae (Leguminosae)	Senna didymobotrya	Exotic (naturalised)
Caesalpiniaceae (Leguminosae)	Senna obtusifolia	Exotic (naturalised/invasive)
Caesalpiniaceae (Leguminosae)	Senna siamea	Exotic (naturalised/cultivated)
Caesalpiniaceae (Leguminosae)	Senna singueana	
Caesalpiniaceae (Leguminosae)	Senna spectabilis	Exotic (naturalised/cultivated)
Poaceae	Setaria homonyma	
Solanaceae	Solanum campylacanthum	Exotic (invasive)
Solanaceae	Solanum lycopersicum	Exotic (cultivated)
Bignoniaceae	Spathodea campanulata ssp. campanulata	Exotic (cultivated)
Euphorbiaceae	Synadenium molle	
Myrtaceae	Syzygium guineense	
Apocynaceae	Tabernaemontana ventricosa	
Bignoniaceae	Tecoma stans var. stans	Exotic (naturalised)
Combretaceae	Terminalia catappa	Exotic (naturalised/cultivated)
Combretaceae	Terminalia mantaly	Exotic (cultivated)
Combretaceae	Terminalia prunioides	
Malvaceae	Thespesia garckeana var. garckeana	
Asteraceae	Tithonia diversifolia	Exotic (naturalised/invasive)
Meliaceae	Trichilia emetica	
Rubiaceae	Vangueria infausta	
Rubiaceae	Vangueria madagascariensis	
Asteraceae	Xanthium strumarium	Exotic (invasive)
Poaceae	Zea mays	Exotic (cultivated)
Cucurbitaceae	Zehneria oligosperma	
Rhamnaceae	Ziziphus mucronata ssp. mucronata	

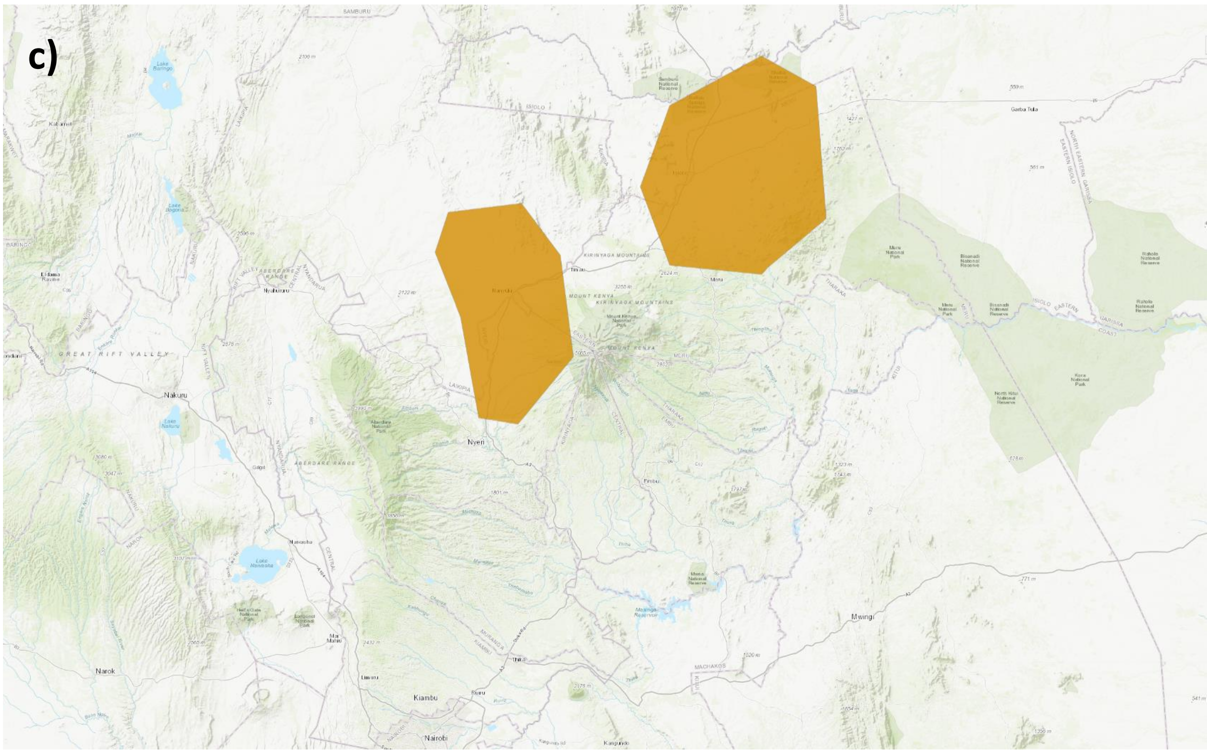
Appendix 2: Times series of aerial photographs obtained from Google Earth for the years 2004, 2014, 2017 and 2020 illustrating the rapid transformation of natural habitat for cultivation

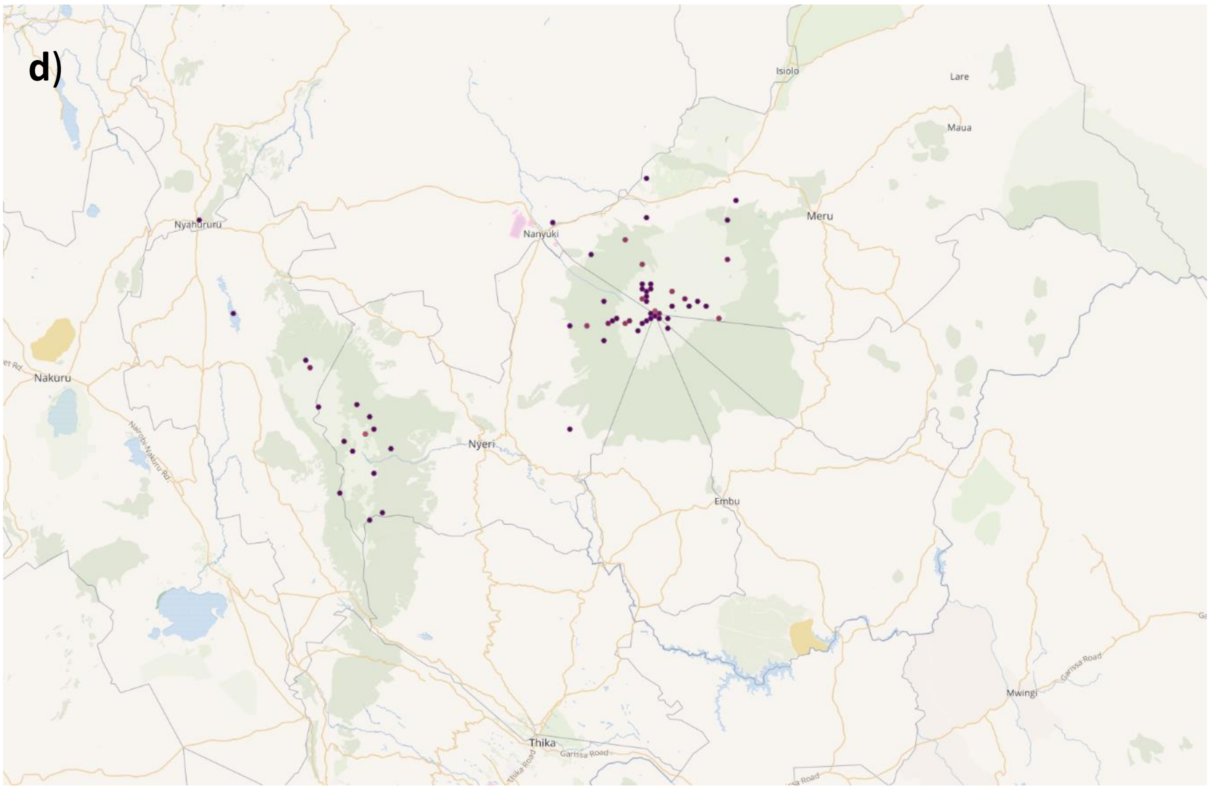


Appendix 3: Red Tufted Sunbird distribution two subpopulations, a) Kilimanjaro/Arusha and c) Nairobi, with occurrence data from the GBIF (b and d respectively) indicating an error in the IUCN ranges






c)
GREAT RIFT VALLEY
MOUNT KENYA
Nakuru
Nyeri
Narok
Kiambu
Nairobi
Mwingi


d)
Isiolo
Lare
Maua
Meru
Nyahururu
Nanyuki
Nakuru
Nyeri
Embu
Thika
Mwingi
Garissa Road

Appendix 4: Lake Chala Alliance for Zero Extinction (AZE) Assessment: Draft Report (GroundTruth, 2022) – see attached report