

Appendix 6.1 – Additional Details on the Study Area

Overview

The Ruaha-Rungwa conservation landscape (~50,000 km²) comprises one National Park (NP; Ruaha), three Game Reserves (GRs; Rungwa, Kizigo and Muhesi), two Wildlife Management Areas (WMAs; MBOMIPA and Waga), one Game Controlled Area (GCA; Lunda-Mkwambi), and one Open Area (OA; Rungwa South). All are state-managed, with the exception of the WMAs, which are managed by nearby member communities. All are overseen by the Tanzania Wildlife Management Authority (TAWA), with the exception of the National Park, whose management falls under Tanzania National Parks (TANAPA). There are no fences present anywhere in the landscape.

Ruaha NP was extended in 2008 to include Usangu GR, and is the largest NP in East Africa at 20,226 km² (with the exception of the recently declared Nyerere NP). Only photographic tourism is permitted within its boundaries. Nevertheless, while most of Ruaha NP is well protected and receives relatively high levels of law-enforcement, a part is still converted to large-scale agriculture and has permanent human settlements. While legally part of the NP, these areas are not currently treated as such by management. In addition, the remainder of the NP experiences varying levels of anthropogenic pressures, including of bushmeat poaching and other illegal extraction of resources (logging, fishing, burning for honey gathering), particularly near the park's boundary.

The three GRs (**Rungwa**, **Kizigo** and **Muhesi**) are reserved for trophy hunting. Each GR is sub-divided into individual 'hunting blocks', only some of which were actively hunted at the time of study. All experience varying intensities of illegal activities (including: logging, bushmeat poaching, fishing, honey gathering, and mining). Although GRs receive similar levels of legal protection to the NP, on-the-ground law-enforcement varies greatly across their extent, with this being higher in actively hunted areas and during the hunting seasons, as hunting companies contribute to anti-poaching efforts.

Rungwa is the largest of the three GRs, at circa 9,100 km². It is divided in six blocks (five of which were hunted during the study period). Kizigo GR is the second largest, at circa 5,140 km², and is divided

in four block (three of which were hunted). Muhesi GR is the smallest (2,720 km²), and is divided into two hunting blocks, neither of which was hunted.

MBOMIPA (947 km²) and **Waga** (344 km²) **WMAs** are two community-led Wildlife Management Areas (WMAs), bordering Ruaha NP to the east, where both photographic tourism and trophy hunting are permitted, although neither were occurring at the time of study. Levels of protection vary within the area, and anthropogenic disturbances occur in the form of bushmeat poaching, extraction of other resources (logging, fishing, burning for honey gathering), and illegal grazing of livestock.

Lunda-Mkwambi GCA (1,700 km²) is reserved for trophy hunting. It comprises one hunting block in its northern part ('Lunda-Mkwambi North'), which was hunted at the time of the study. In **Rungwa South Open Area** (OA; 3,900 km²), to the north-west of RNP, both trophy hunting and limited legal resource extraction (logging, fishing) are permitted. It is divided into two hunting blocks ('Rungwa South OA' and 'Rungwa Mzombe OA'), with hunting occurring only in Rungwa South OA in the study period. Protection in both the GCA and OA is lower than in the GRs.

Finally, **unprotected village lands**, to the south & east of Ruaha NP, are characterised by varying levels of development, agriculture, pastoralism, and incidences of human-carnivore conflict.

Physiography & topography

The area primarily comprises an undulating plateau with occasional outcrops, low mountains in the south & west, as well as rolling hills, marsh lands ('mbugas'), open plains, and some moderately steep high hills in the eastern reaches of the landscape. A ridgeline runs from the south-west to the north-east of Ruaha NP, sloping down to the Great Ruaha River valley in the east and the Mzombe river valley in the west. Elevation in the ecosystem varies from 696m in the Ruaha River valley to 2,171m on mountain peaks in the south-west of Ruaha NP (ESA, 2009). The Great Ruaha, the Mzombe and the Kizigo rivers are the largest in the landscape, and key sources of surface water in the dry season.

Biomes & habitats

Ruaha-Rungwa sits at the intersection of three ecoregions: the southern *Acacia-Commiphora* bushland & thickets, where *Acacia* and thorny *Commiphora* trees dominate very productive grasslands, leading to high concentrations of large mammals, and the Central Zambezian and the Eastern miombo woodlands. The Central Zambezian miombo woodland, one of the largest ecozones on the continent, consists of a mostly flat plateau with poor soils, and of woodlands interspersed with grassy wetland ('mbugas', or 'dambos' in Southern Africa). Vegetation is dominated by *Brachystegia*, *Julbernardia* and *Isoberlina*. The Eastern miombo woodlands, dominated by similar vegetation, extend from south-eastern Tanzania into the easternmost areas of the study landscape (Olson et al., 2001).

Climate

All habitat types exhibit distinct season rainfall. However, while in the *Acacia-Commiphora* rainfall follows a bimodal pattern, with short rains from November to December and long rains in March to May, miombo woodlands experiences a single rain season, from November to March (Fick & Hijmans, 2017).

Biodiversity

As a result of being a meeting zone between the northern & southern hemisphere, the landscape is exceptionally rich in biodiversity, supporting more than 1,700 plant species, more than 570 of birds, and nearly 200 of mammal. The area boast almost all of Africa's large mammal species, including Tanzania's largest elephant population (Chase et al., 2016). Large ungulates include important populations of African buffalo (*Syncerus caffer*), giraffe (*Giraffa camelopardalis*), plains zebra (*Equus quagga*), waterbuck (*Kobus ellipsiprymnus*), Lichtenstein's Hartebeest (*Alcelaphus buselaphus lichtensteinii*), both greater (*Tragelaphus strepsiceros*) & lesser kudu (*Tragelaphus imberbis*), eland (*Taurotragus oryx*), and both typically southern-hemisphere species such as roan (*Hippotragus equinus*) & sable (*Hippotragus equinus*) and northern-hemisphere ones such as Grant's gazelle (*Nanger granti*). Small-medium sized ungulates include impala (*Aepyceros melampus*), bushbuck (*Tragelaphus sylvaticus*), common (*Sylvicapra grimmia*) & Natal red duiker (*Cephalophus natalensis*), Sharpe's

grysbok (*Raphicerus sharpei*), steenbok (*Raphicerus campestris*), Kirk's dik-dik (*Madoqua kirkii*), klipspringer (*Oreotragus oreotragus*), oribi (*Ourebia ourebi*), Southern (*Redunca arundinum*) & Bohor reedbuck (*Redunca redunca*). In addition to cheetah, all large carnivores typical of the eastern African savannah are present, including lion (*Panthera leo*), leopard (*Panthera pardus*), African wild dog (*Lycaon pictus*), and both spotted (*Crocuta crocuta*) and striped (*Hyaena hyaena*) hyaena, as well as a range of mesocarnivores (Foley et al., 2014; TAWIRI, 2019).

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