# MRes Wildlife Conservation

# Research Project List; Academic Year 2022/23

## Preamble

The MRes Research Project List for the academic year 2022/23 is divided into three sections.

**1) Desk-based projects**

**2) Desk-based projects, but with the potential to build in a fieldwork component**

**3) Projects that are exclusively fieldwork-based**

It is our sincere hope that MRes Wildlife Conservation will run unhindered throughout the coming academic year, however, some degree of contingency planning is always necessary for overseas travel and field-based study. Due to ongoing uncertainty resulting from the Coronavirus pandemic and the conflict in Europe, travel and fieldwork restrictions may continue to be a feature of 2023, with implications for MRes research projects (undertaken from February to September). To build in flexibility to our planning, candidates selecting a first choice project from Section 3 should also select at least one other project from either Sections 1 or 2.

As a part of the interview process, programme leaders will assess candidate's interests, experience and strengths, with reference to available research projects, and there is an opportunity to discuss this more fully at interview.

## 1) Desk-based Projects

### *1a) Citizen science approaches to monitoring threatened wildlife species and their ecosystems in remote areas – a case study in Northern Kenya*

Up to date information is vital to understanding the extinction risks faced by species, including an understanding of the current environmental conditions they exist within. For many species, living in remote locations across the globe, inaccessibility means species distribution data is scarce and often out of date. To overcome these limitations, recent efforts have sought to assess the effectiveness of using local citizen scientists to collect these data.

The vast arid ecosystem of Northern Kenya is particularly sensitive to environmental change and is suffering from rapid land degradation due to increasing human pressures. Much of northern Kenya is relatively inaccessible, with sparse environmental information. The area is known to hold populations of endangered and vulnerable species including Grevy's zebra, elephants, giraffe, cheetah and lion. Knowledge gaps about these and other species may result in inefficient and ineffective conservation.

Community scout teams working with support from Marwell Wildlife have been using SMART tools to monitor key wildlife in Northern Kenya since 2017. With over 20 scouts, the community monitoring network includes 15 villages operating over an extent of approximately 10,000 $km^2$. Differences between scouts, in terms of literacy and training, and the ways in which they work (e.g. individually, in pairs or in teams) and organise their routes means that species data are imperfect. This project will seek to use the scout database of approximately 5,000 records to: (1) assess the effectiveness of citizen science; (2) develop initial species occupancy models were appropriate; (3) develop habitat-species models as a means of assessing vulnerability to future change.

It is envisioned that this project will develop skills in GIS and remote sensing, data analysis and manipulation, statistical modelling, occupancy analysis, and habitat suitability modelling.

Outputs from this project will contribute to conservation management and planning in northern Kenya and provide an assessment of the uses and limits of citizen science in this context. It is anticipated that this project could lead to a published paper.

**Desk-based in U.K.; Band A; Marwell Supervisor, Philip Riordan**

## 2) Desk-based projects with the potential for fieldwork

### *2a) Ecosystem functioning beyond protected areas in North African Sahelo-Saharan landscapes: scimitar-horned oryx in Tunisia*

For many wildlife species, protected areas (PAs) are often simply not large enough for them to reach sustainable population levels, with sufficient connectivity to ensure long-term resilience. Marwell Wildlife started a reintroduction programme for scimitar-horned oryx (Oryx dammah) SHO in Tunisia over 30-years ago, reinstating these previously extinct species into national parks. This has been highly successful but the protected areas have limited carrying capacity and are isolated from each other resulting in metapopulations that are not self-sustainable. Options to extend existing PAs or create new ones are not feasible and so we are working with the Tunisian government authorities to develop extended landscapes beyond PAs into which oryx can disperse. A case study area has been identified between two PAs in Tunisia and a feasibility assessment is in progress. As part of this assessment, there is a need to understand the current ecosystem status within the interstitial landscape and develop models of habitat suitability, dispersal and landscape permeability for SHO and other key species. The candidate will help to develop new mapping and prioritization approaches to SHO conservation that account for connectivity and coherence between natural and social conditions under climate change models.

This project will use existing data sets and remote sensing data, with the option to conduct fieldwork to collect new data. It will also provide to the candidate the rare opportunity to work in

close relationship with Tunisian biologists involved with Marwell's activities and so, to enhance the international work experience. The outputs from this project will contribute to the management of scimitar-horned oryx in Tunisia and enacting aridland conservation on the ground.

This project would suit a candidate with expertise and interests in Community ecology; ecosystem assessment; ecosystem connectivity; GIS; statistical modelling. It is anticipated that this project could lead to a published paper.

**Desk-based in the U.K., with optional fieldwork component in Tunisia; Band A (optionally Band B); Marwell Supervisor, Tania Gilbert / Martin Wilkie / Philip Riordan**

***2b) Ecosystem functioning beyond protected areas in North African Sahelo-Saharan landscapes: addax in Tunisia***

For many wildlife species, protected areas (PAs) are often simply not large enough for them to reach sustainable population levels, with sufficient connectivity to ensure long-term resilience. Marwell Wildlife has been involved in the reintroduction and post-release monitoring of the critically endangered addax (Addax nasomaculatus) in Tunisia since 2007, helping to reinstating this previously locally extinct species into national parks. This has been highly successful, but the protected areas have limited carrying capacity and are isolated from each other resulting in metapopulations that are not self-sustainable. Options to extend existing PAs or create new ones are not feasible and so we are working with the Tunisian government authorities to develop extended landscapes beyond PAs into which addax can disperse within the Grand Erg Oriental. A case study area has been identified between two PAs in Tunisia and a feasibility assessment is in progress. As part of this assessment, there is a need to understand the current ecosystem status within the interstitial landscape and develop models of habitat suitability, dispersal and landscape permeability for addax and other key species. The candidate will help to develop new mapping and prioritization approaches to addax conservation that account for connectivity and coherence between natural and social conditions under climate change models.

This project will use existing data sets and remote sensing data, with the option to conduct fieldwork to collect new data. It will also provide to the candidate the rare opportunity to work in close relationship with Tunisian students involved with Marwell's activities and so, to enhance the international work experience. The likely conservation impacts are to provide some management option for enacting the aridland conservation on the ground.

This project would suit a candidate with expertise and interests in Community ecology; ecosystem assessment; ecosystem connectivity; GIS; statistical modelling. It is anticipated that this project could lead to a published paper.

**Desk-based in the U.K., with optional fieldwork component in Tunisia; Band A (optionally Band B); Marwell Supervisor, Tania Gilbert / Martin Wilkie / Philip Riordan**

***2c) Assessing Long-term Vegetation Change in Dghoumes National Park, Tunisia***

Dghoumes National Park supports several threatened species, including reintroduced populations of IUCN listed Extinct in the Wild Scimitar Horned Oryx (*Oryx dammah*) and Vulnerable Dorcas Gazelles (*Gazella dorcas*). This project will assess the impact of various factors on vegetation change both within and outside the park to evaluate the role of protected area management on biodiversity conservation. The project will employ various techniques including using NDVI imagery (freely available to download from https://earthexplorer.usgs.gov) to create a time-series of vegetation change in Dghoumes National Park from 1998 to present day. This will provide a long-term, objective and robust method for detecting temporal and spatial trends in vegetation cover within and outside of the park. Factors such as elevation and climatic variables (e.g. BIOCLIM data available from https://worldclim.org/bioclim) could be used to model drivers behind vegetation change and interpretation of results would benefit from ground-truthing in the field. This information can then be used to assess efficacy of park management, identify management priorities and model potential future changes under different management and climate scenarios. Outputs from the project will help inform the biodiversity management and post-release evaluation of reintroduced ungulate populations in Tunisia. It is anticipated that this project could lead to a published paper.

It is envisioned that this project will develop advanced skills in data management, manipulation and analysis, and statistical modelling, alongside competency in remote sensing technologies and GIS. The study will also provide an opportunity to work closely with Tunisian students involved with Marwell's activities further expanding the candidate's future network.

**Desk-based in the U.K., with optional fieldwork component in Tunisia; Band A (optionally Band B); Marwell Supervisor, Tania Gilbert / Martin Wilkie / Philip Riordan**

***2d) Recovering North African ecosystems: assessment of fauna biodiversity in Tunisian protected areas***

Long-term landscape degradation has led to the need to recover ecosystems in North Africa, through establishing protected areas and reintroducing wildlife species previously driven to extinction. Reintroduction projects, including for the scimitar-horned oryx (*Oryx dammah*) have provided important drivers for wilder biodiversity conservation efforts. The success of these interventions should be evaluated in terms of their long-term impact on the wider environment and the functioning of restored ecosystems. The reintroduction of scimitar-horned oryx (SHO) in southern Tunisia took place between 1988 and 2007 and offers a particularly well-documented case-study. Ongoing monitoring data provide an opportunity to address fundamental ecological and behavioural questions in a real-world context. Data will be derived from an existing camera-trapping database, combined with habitat maps, remote sensing data and ground surveys. The key species within the mammalian and avian assemblage include SHO, Dorcas gazelles, African golden wolves, red foxes, African wildcats, hares, hedgehogs, wild boar, porcupines, striped hyena and North African ostrich. Camera trap data are collected from geographically independent protected areas, with similar features and reintroduction histories, allowing the candidate to explore the ecological and/or behavioural consequences of these changes. This project will also develop and provide important information for protected area management and planning in this climate-sensitive arid landscape. The likely conservation impacts are an improved understanding of the ecosystem balance for enacting ungulate reintroduction and conservation on the ground, linked to the 11 global Biodiversity Conservation Perspectives. It is anticipated that this project could lead to a published paper.

This project would suit a candidate with expertise and interests in Community ecology; niche theory; ecosystem assessment; GIS; statistical modelling.

**Desk-based in the U.K., with optional fieldwork component in Tunisia; Band A (optionally B); Marwell Supervisor, Tania Gilbert / Martin Wilkie / Rachel Gardner / Marie Petretto / Phillip Riordan**

***2e) Carbon sequestration in mixed lowland landscapes in U.K.***

In much of the world, landscapes are increasingly required to provide multiple benefits and ecosystem services, such as water security and flood prevention, food security and sustainable agriculture and ecosystem-based mitigation or adaptation solutions for climate change and biodiversity loss. In the south of the U.K., the land available is restricted by human activities and options such as rewilding are not viable. Taking the south of England as an example, this project will seek optimal solutions for carbon sequestration across a complex mixed-use lowland agricultural landscape, balancing the needs of both people and wildlife. Working with partners such as the local Wildlife Trusts this project will take existing data and produce spatial models that explore the trade-offs and synergies between different goals. Future scenarios will be developed that elucidate pathways under different policy directions, including emerging changes to agriculture following the U.K.'s departure from the European Union.

**Desk based in the U.K., with optional fieldwork component in the U.K.; Band A; Marwell Supervisor, Philip Riordan**

***2f) Developing Theory of Change models for conservation of goitered gazelle (Gazelle subgutturosa) in Kazakhstan***

Goitered gazelle (*Gazella subgutturosa*) populations have declined across their range in Central Asia and the Middle East. The biggest declines are thought to have occurred in the largest remaining population in Kazakhstan, which was previously estimated to number 20,000 animals.

Pressure from illegal hunting, habitat degradation, competition with livestock and commercial developments are all likely to have contributed to this decline. To be able to develop effective conservation plans for the species, it is essential to understand the relationships between stakeholders and their values and attitudes. Conservation planning increasingly uses logical models (e.g. Theory of Change) to identify the pathways and actions necessary to achieve positive outcomes. A recent project started by Marwell Wildlife and partners in Kazakhstan is seeking to understand the status of the goitered gazelle population, identify the causes of decline and provide mitigation measure for the protection of the species and their ecosystems. A vital part of this project is developing effective species planning that has the support of as wide a range of stakeholders as possible. To achieve this, the project here will use information collected during planning meetings and workshops and develop a logical model to highlight critical pathways towards agreed goals. This project will be largely desk-based, although there may be an opportunity to work with the team in Kazakhstan and optionally conduct follow-up meetings with stakeholders.

**Desk based in the U.K., with optional fieldwork component in Kazakhstan; Band A (optionally Band C); Marwell Supervisor, Philip Riordan**

### *2g) Linking logical (Theory of Change) and biophysical modelling to understand the challenges and opportunities for wildlife corridors between protected areas in the Sahelo-Saharan region of Tunisia*

For many wildlife species, protected areas (PAs) are often simply not large enough for them to reach sustainable population levels, with sufficient connectivity to ensure long-term resilience. Marwell Wildlife started a reintroduction programme for scimitar-horned oryx (*Oryx dammah*) SHO in Tunisia over 30 years ago, reinstating this previous extinct species into national parks. This has been highly successful and today the species has reached carrying capacity in most of the protected areas in which they occur. Options to extend existing PAs or create new ones are not feasible and so we are working with the Tunisian government authorities to develop extended landscapes beyond PAs into which oryx can disperse. A case study area has been identified between two PAs in Tunisia and a feasibility assessment is in progress.

In conjunction with ecosystem assessments of the interstitial areas, there is an urgent need to determine the necessary actions required by multiple and diverse stakeholders in the region. The plausible threats to SHO in this area include illegal hunting, commercial development, competition with livestock and habitat degradation. A vital part of this project is developing effective species planning that has the support of as wide a range of stakeholders as possible. To achieve this, the project here will use information collected during planning meetings and workshops and develop a logical model to highlight critical pathways towards the agreed goal of a sustainable population of oryx existing beyond PA boundaries.

This project will be largely desk-based, although there may be an opportunity to work with the team in Tunisia and optionally conduct follow-up meetings with stakeholders. This project would suit a candidate with expertise and interests in GIS; social/political sciences; ecosystem accounting and preferably with skills in French and/or Arabic.

**Desk based in the U.K. with optional fieldwork component in Tunisia; Band A (optionally Band B); Marwell Supervisor, Philip Riordan**

### *2h) Assessing change to ecosystem services resulting from conservation management in Kenya*

The human pressure exerted on fragile grasslands can often be detrimental to ecosystem function, to wildlife populations and for the human wellbeing of the communities living within these landscapes in Kenya. Conservation management is a fundamental part of the cultural and economic security of these areas, and protected area management aims to ensure longevity and availability of resources for humans and wildlife. Based north of Mt. Kenya, on the border of Meru County, the landscape is a complex of rich savannah grassland, with forest and riparian habitats and other transitional habitats under varying land uses with grazing as a major factor. These and other human pressures, such as climate change, are adding to the ongoing challenges to the conservation of local biodiversity faced by land managers on the ground. In northern Kenya, community conservancies have been established to find a balance between often conflicting requirements of people and wildlife. Quantifying the change to the value of ecosystem services as a result of a site-based management intervention is integral to

determining the ecological impact to wildlife and people. An assessment can also help anticipate the change going forward under shifting human pressures. The study uses the TESSA toolkit (developed at Cambridge University by Dr Kelvin Peh and colleagues) to assess the changes to ecosystem services and quantify the biological impacts. The work will support the large-scale and ongoing management of a diverse and ecologically-valuable protected area, and help inform long-term management, using a novel analytical approach. The candidate should be adaptable and solution-conscious, able to work in sometimes challenging environments. The study forms part of a broader piece of research which will model the ecological response of global grasslands to human pressure.

**Desk-based in the U.K., with optional fieldwork component in Kenya; Band A (optionally Band C); Marwell Supervisor, Martin Wilkie**

***2j) Apply a novel method of population network analysis using sharing of viral infections as a proxy for contact between individuals***

Host genetics gives population structure at a macro scale, but finer detail is needed to infer contact between individuals of a species in a timeframe meaningful for disease transmission. Disease causing organisms themselves are often rare or difficult to detect but studying other viruses in healthy individuals has great potential to inform population-level risks. Working with University of Surrey School of Veterinary Medicine, the virome of a subsample of individuals will be analysed to detect candidate viruses that occur in the population at high prevalence and are frequently shared. Proof of principle has been demonstrated with adenoviruses in bat populations (Li et al. 2010). Crucially we do not need pathogenic viruses for these investigations, but instead viruses that are ubiquitous and whose evolution can be reliably studied. Virus specific PCRs will then be developed and used for targeted testing of samples from the population. Detected viruses will be sequenced, and the relationship of the viruses inferred using Bayesian phylogeny. The resulting analysis will inform the level and frequency of interaction between individuals in the population.

This work will have implications beyond the species and ecosystem studied, developing techniques applicable to other species and populations. Also, the samples collected could be part of wider objective: non-invasive monitoring of wildlife population health, combined with

analysis of the microbiome, stress indicators, antimicrobial resistance, and toxins all from the same samples.

This project will target either wild populations, where non-invasive samples such as faeces are already available or can be easily collected, or captive populations where there is inconsistent contact between individuals and faeces, or saliva can be easily sampled.

***2k) Quantifying Impacts of supplementary feeding on endangered Grevy's zebra in Kenya; Can camera trap data enable assessment of individual health and population dynamics?***

Climate change, resulting in increasing droughts and human pressures exerted on fragile habitats can often be detrimental to ecosystem function, to wildlife populations and also for the human wellbeing of the communities living within these landscapes. Conservation interventions seek to mitigate these effects but require scientific evaluation to understand their impacts. Grevy's Zebra are the most endangered of all zebra species, and the focus of ongoing collaborative monitoring and research efforts across their range. Grevy's herd dynamics, including reproductive behaviour, are highly associated with water sources, and thus population numbers can be badly affected during drought. The Grevy's zebra Technical Committee in Kenya provides supplementary hay during times of prolonged drought to try to mitigate impacts on Grevy's. The aim of this intervention is to support Grevy's health and survival, particularly females engaged in parental care of foals, and thus mitigate detrimental drought-effects on recruitment in these important populations. Questions persist about the success and impact of these interventions on population dynamics and individual health, and this forms the basis of this project. Crucially, this project will, for the very first time, seek to assess body condition of Grevy's zebra, during drought interventions, and to generate and trial a novel method for interpreting impacts of conservation interventions in terms of both population dynamics and individual health. A pre-existing and established network of camera traps, including at supplementary hay provision sites, combined with stripe identification technology provides a large photographic dataset for this research project, with scope to contribute to ongoing monitoring of Grevy's numbers.

**Desk-based in the U.K., with optional fieldwork component in Kenya; Supervisor: Dr Heidi Mitchell**

**2l) Landscape determinants of distribution and abundance if Goitered gazelle in eastern Kazakhstan**

Goitered gazelle (*Gazella subgutturosa*) populations have declined across their range in Central Asia and the Middle East. The biggest declines are thought to have occurred in the largest remaining population in Kazakhstan, which was previously estimated to number 20,000 animals. Pressure from illegal hunting, habitat degradation, competition with livestock and commercial developments are all likely to have contributed to this decline.

Effective conservation plans for the species, require an understanding of the landscape determinants of species occurrence and their densities. A recent project started by Marwell Wildlife and partners in Kazakhstan has gathered data about the goitered gazelle populations across the east of the country. Data have been collected from ground-based field surveys and aerial counts, inside protected areas (e.g. Altyn-Emel and Charyn National Parks) and across the wider landscape outside protection. This project will develop distribution and habitat models using GIS and other tools to determine what landscape features influence goitered gazelle occurrence and numbers. Remote-sensed data and background mapping will be used to construct models. This project will be largely desk-based, although there may be an opportunity to work with the team in Kazakhstan and optionally conduct further fieldwork.

**Desk based in the U.K., with optional fieldwork component in Kazakhstan; Band A (optionally Band C); Marwell Supervisor, Philip Riordan**

## 3) Exclusively fieldwork based projects

### *3a) Examining ecosystem resilience by determining the functional response of below-ground invertebrates to a grazing pressure gradient*

Among complex grassland systems in the U.K., conservation grazing is adopted as a solution to maintaining and enhancing local biodiversity. In protected area management, grazing can be employed at varying densities, having differing impacts on wildlife communities and the subsequent recovery of the ecosystem. The role that invertebrates play in maintaining ecosystem functioning in response to grazing pressure is important because of the diverse functions they have for ecosystem productivity. In unimproved grasslands increased abundance and diversity of insect communities supports the concept that these systems are resilient to environmental change, but grazing may become detrimental if not managed at the right level. This study explores the functional diversity of below-ground invertebrates in response to human pressure. The candidate should be adaptable, solution-conscious, and if field -based elements permit field-prepared and able to work in sometimes challenging environments. The study forms part of a broader piece of research which will model the ecological response of global grasslands to human pressures.

**Field-based in the U.K.; Band A; Marwell Supervisor, Martin Wilkie**

### *3b) Grevy's zebra social behaviour as a determinant of energetic intake*

The endangered Grevy's zebra (*Equus grevyi*) formerly ranged across the arid regions of northern Kenya, southern Ethiopia, and South Sudan. Hunting, competition with livestock and dramatic ecosystem degradation due to human activities and climate change resulted in substantial declines in the Grey’s zebra population over the 20th century. With a total global population approaching 3,000 individuals, the Grevy’s zebra is now fragmented across what remains of its former range. As a social species, the composition of herds in these fragmented populations will have an impact on survival, either through breeding or foraging. Behavioural

changes in response to population changes and consequential network dynamics might therefore be anticipated. The research will explore the impact of social behaviours on individual foraging in Grevy's zebra herds. Developing social interaction matrices, these will be applied to individual rates of intake and foraging success relative to availability and distribution of resources. The results of this research will provide insights into anticipated changes as populations become more fragmented and prioritise actions in areas of concern.

**Fieldwork-based in Kenya; Band C; Marwell Supervisor, Heidi Mitchell**

## Research Bands

**Indicative student research-costs are provided as 3 bands, A, B & C, and provide guidance based on the experience of the programme team. Please note, actual costs will vary, depending on choices made by the student, for example, a number of Band A desk-based projects have the potential to be free. There will be an opportunity to discuss student research-costs at interview.**

**A = £1,900.00**

**B = £3,100.00**

**C = £4,400.00**