Marwell Wildlife

2018 Impact Report

African monarch butterfly *Danaus chrysippus*

photo © Tim Woodfine, Marwell Wildlife

Contents

Our Work

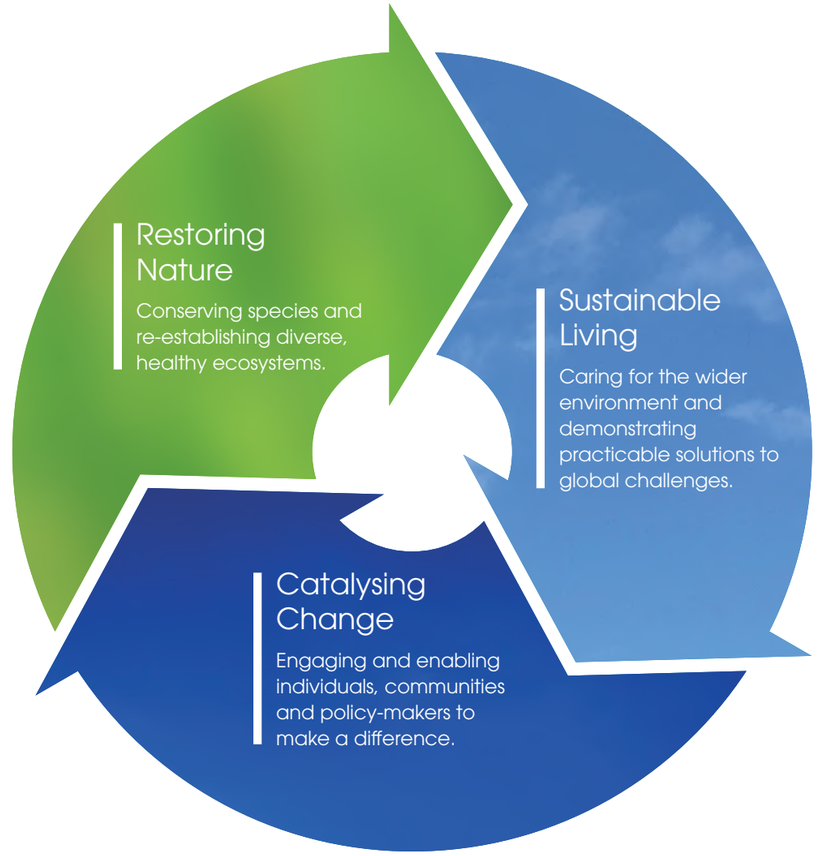
Welcome to our review of charitable activities and impacts for 2018. In the following sections we share highlights of our work to restore nature, promote sustainable living and help catalyse changes needed to improve the fortunes of people, wildlife and the wider environment.

We take an holistic and integrated approach to our mission of conserving biodiversity and other natural resources. This means drawing on the multi-disciplinary skills and experiences of our scientists, teachers and practical conservation managers. Our work is all about collaboration with like-minded organisations and communities wherever we work. Many of these alliances have been in place for years and positive outcomes are accruing because of long term commitments.

By 2018, a decade and a half of collaboration to revive the fortunes of Grevy's zebra in Kenya resulted in welcome evidence of an increase in the national population of this endangered species. Recalculation of our carbon footprint revealed a 73% reduction since our baseline year in 2008 despite growth in our organisation and infrastructure. We surpassed one million pupils visiting Marwell Zoo with their schools since our education programmes began 36 years ago.

There were also newer initiatives to celebrate, such as the beginning of a seminal project to monitor snow leopards across international borders; the opening of our new Energy for Life Tropical House to engage the public in the critical subject of climate change; and our contribution to the publication of the Asia-Pacific Regional Assessment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

Further details of these and many other initiatives are shared throughout this report.



Economic Impact

Our charitable delivery is possible because of resources generated by the operation of Marwell Zoo in Hampshire, creating a centre for enjoyment, learning, sustainability and scientific endeavour, and underwriting our conservation activities around the world. In 2018:

515,000 guests visited Marwell Zoo

246 full-time equivalent employees

£66.9 million Gross Value Added contributed to the regional and rural economy

1,100 jobs supported in the area

Over **1,500** local businesses supported by our supply chain

Where We Work

Internationally, we work with local stakeholders in places that are largely overlooked and under-represented, but that hold important wildlife populations in biologically and socio-economically uncertain environments. These are places with genuine need coupled with local aspiration for conservation, and the potential for scalable impact, including across international borders. It is also important that we get it right on our own patch, managing and using our own land sustainably, enhancing local biodiversity and contributing to species and habitat conservation across the wider landscape.

SOUTH OF ENGLAND

Semi-natural lowland ecosystems in the South of England.

TUNISIA

Southern Tunisian arid steppe and the Grand Erg Oriental.

ZIMBABWE

Matobo Hills, Zimbabwe.

KENYA

Semi-arid and arid rangelands of northern Kenya.

CENTRAL ASIA

Tian Shan mountain ecosystem bordering China, Kazakhstan and Kyrgyzstan.

Restoring Nature

Common spotted orchids *Dactylorhiza fuchsii*

photo © Tim Woodfine, Marvell Wildlife

Restoring Nature

Trans-Boundary Cooperation for Snow Leopards

20,000 km²
trans-boundary area set up to monitor snow leopards with camera traps.

An initiative to promote trans-boundary cooperation for snow leopard *Panthera uncia* conservation was advanced with a seminal workshop between China, Kazakhstan and Kyrgyzstan and preliminary fieldwork in the bordering Tian Shan mountain ecosystem.

Representatives from each country met earlier in the year for field-based training by the Marwell team and to agree joint aims and approaches, and address fundamental needs such as language translation, cultural awareness and information sharing. With a plan agreed, camera-trap surveys were set up across a 20,000km² area centred around the Pik Pobedy / Tomur Feng mountain, with snow leopards and other wildlife soon detected in all three countries. Work is now underway to identify individual snow leopards from their unique coat patterns and see if there is evidence of international animal travellers moving across borders.

Marwell is party to the Global Snow Leopard & Ecosystem Protection Programme (GSLEP), which brings together non-governmental organisations with the 12 snow leopard range countries to secure the future of this iconic species. The Tian Shan mountains provide vital population linkages between the northern and southern portions of the species' three million km² range. There is also a fundamental need to ensure protection and trans-boundary cooperation for management of this unique ecosystem and glacial water towers along China's new Belt and Road initiative.

PARTNERS NABU Germany and Kyrgyzstan | Wildlife Institute, Beijing Forestry University, China | Almaty State Nature Reserve, Kazakhstan | Institute of Zoology, Ministry of Education and Science, Kazakhstan | National Academy of Science, Kyrgyzstan.

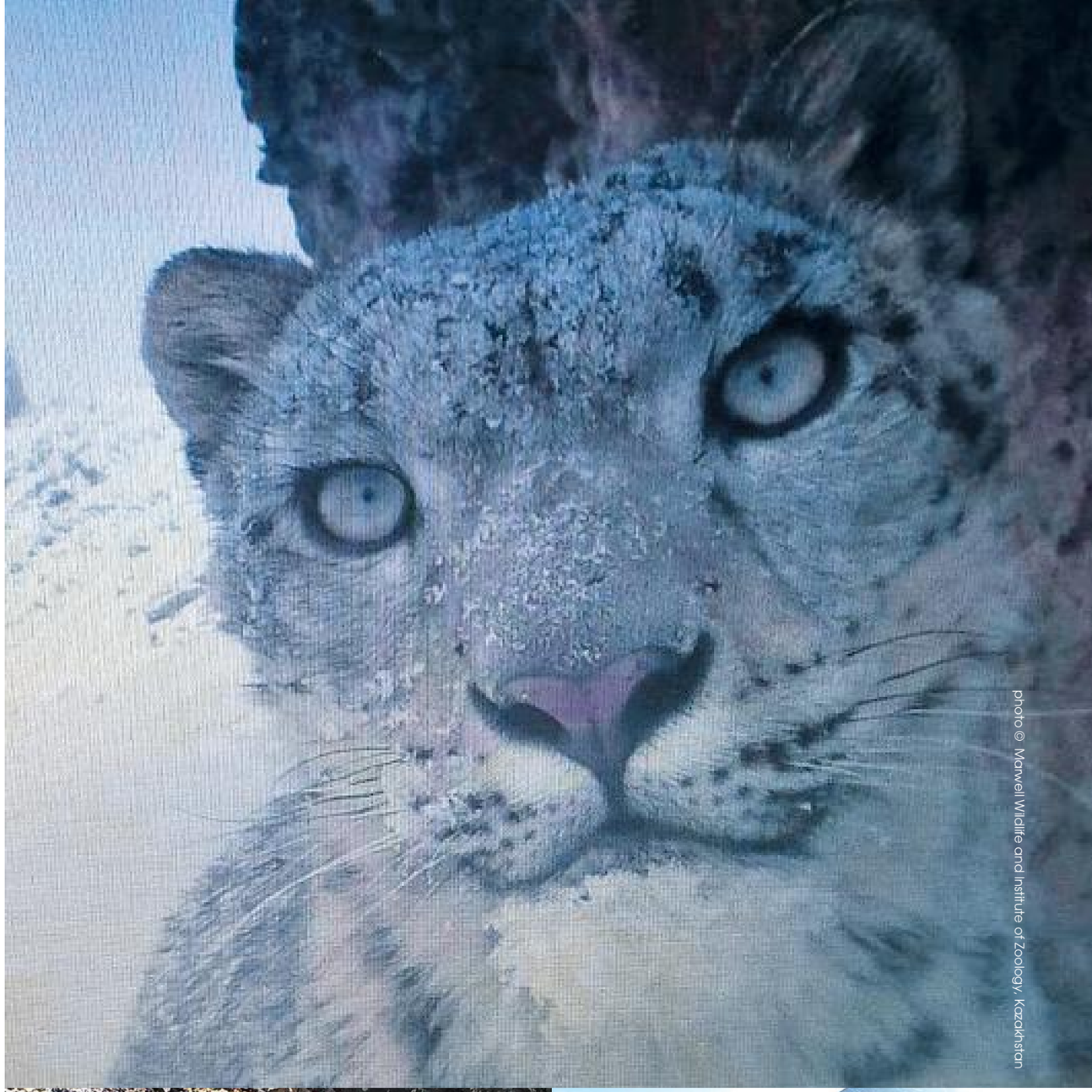
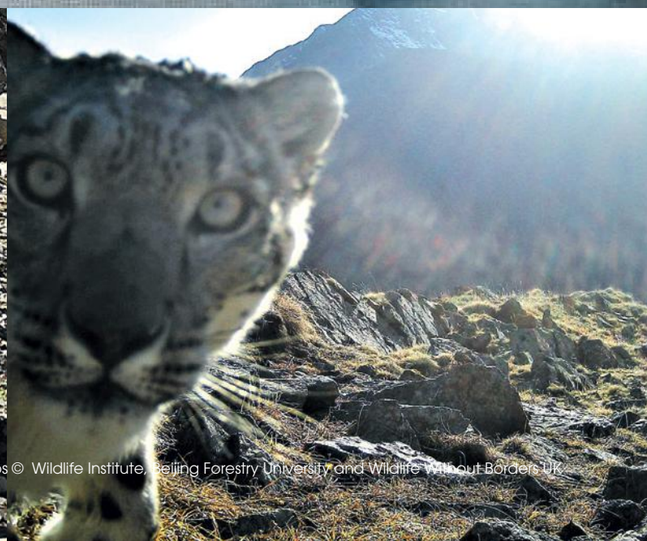


photo © Marwell Wildlife and Institute of Zoology, Kazakhstan



photos © Wildlife Institute, Beijing Forestry University and Wildlife Without Borders UK

> **ABOVE AND RIGHT**
Camera trap images of snow leopard *Panthera uncia* in the Tian Shan mountains.

Grevy's Zebra Numbers Increase

2,812
Grevy's zebra:
the national population estimate resulting from the 2018 Great Grevy's Rally.

After over 20 years of working to conserve the endangered Grevy's zebra *Equus grevyi* in Kenya, we had very encouraging news about the species' status.

The 2018 'Great Grevy's Rally' (GGR) resulted in a population estimate of 2,812 (± 163) animals, compared to the 2,350 (± 93) recorded in 2016. Some of this increase is due to greater survey effort across our 25,000km^2 study area in the far north of Kenya where the species is very sparsely distributed. However, given that the intervening two years were characterised by drought and political unrest, the positive change in the fortunes of the Grevy's zebra appears real and compares favourably to other estimates produced in the last 15 years.

The 'Great Grevy's Rally' is a novel example of citizen science conceived by Kenya's Grevy's Zebra Technical Committee (GZTC) as a way of censusing the national population of this endangered species with greater confidence than previously possible. The 2018 GGR was possible thanks to 212 participants photographing Grevy's zebra across their range over the course of just two days. Sophisticated stripe recognition software was then used to identify individual animals from the thousands of images produced and calculate the population estimate. Teams used 4x4 vehicles to cover much of the Grevy's zebra range, but motorcycles and even light aircraft were needed to cover remote and inaccessible terrain, including the area surveyed by the Marwell team.

PARTNERS Kenya Wildlife Service | Grevy's Zebra Trust | Lewa Wildlife Conservancy | Milgis Trust | Northern Rangelands Trust | University of Princeton.

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ABOVE
Grevy's zebra *Equus grevyi* on the Lkotikal plains.

A stripe recognition alogorithm is used to identify individual Grevy's zebra by their unique patterns.

Searching for Grevy's zebra from the air.

Wildlife Monitoring in Northern Kenya

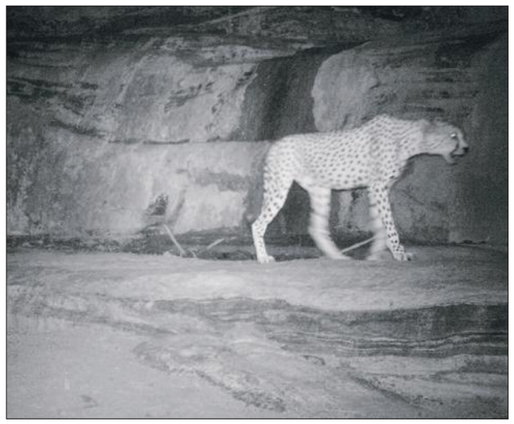
7,511 km
of patrol routes were covered by Community Wildlife Monitoring Scouts in 2018.

Our Community Wildlife Monitoring Scouts in the far north of Kenya conducted 1,568 patrols covering a combined distance of 7,511km.

Use of GPS enabled smart phones with a data collection app helped gather information about the status of wildlife, livestock and the wider environment. This surveillance capacity was enhanced with anecdotal reports from communities and camera-traps deployed at 10 locations contributing 5,414 images of wildlife across this dry landscape.

Twenty-four species of large mammals were detected during the year. Grevy's zebra locations corresponded with rainfall patterns and availability of grazing resources.

Notably, the number of elephant *Loxodonta africana* sightings appears to be increasing in parts of our study area; a possible outcome of long-term awareness raising and conservation efforts in the neighbouring Milgis ecosystem. The landscape also appears to be sustaining at least small populations of large predators with lion *Panthera leo*, leopard *Panthera pardus*, cheetah *Acinonyx jubatus*, spotted hyena *Crocuta crocuta*, striped hyena *Hyaena hyaena*, and even a pack of wild dogs *Lycaon pictus*, detected during the year. These data are improving our understanding of wildlife and interactions with people and livestock in this under-studied part of Kenya. Results are also important for informing local land management decisions and impacts on biodiversity.



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RIGHT
Night time camera trap images of elephant in Loltepes and cheetah in Anderi helping to improve knowledge of wildife in this under-studied part of northern Kenya.

PARTNERS Kenya Wildlife Service | Grevy's Zebra Trust | Lewa Wildlife Conservancy | Milgis Trust | Northern Rangelands Trust.

Aridland Biodiversity

We gleaned new insights into the biodiversity of Tunisia's arid protected areas and extended our long-term datasets by monitoring vegetation, collecting indirect evidence of mammal activity, and studying beetle assemblages and predators.

In Bou Hedma and Dghoumes National Parks beetle assemblages were dominated by omnivorous darkling beetles *Tenebrionidae*, associated with sandy soils and vegetation cover. Across the nine families of beetles found, there was encouraging evidence of species fulfilling a range of ecological functions from the recycling activities of dung beetles *Scarabaeidae* to the pollination services of flower chafers *Cetoniidae*. In the same protected areas, camera trap surveys and scat analyses were used to estimate the abundance of African golden wolves *Canis anthus* and improve understanding of their diets.

Beetles, fruit of wild shrubs, and herbs appear to be important for these opportunistic feeders, with rodents and birds variably occurring in their diet depending on location. There was little evidence of larger mammals in the diets of Tunisia's top predator, but they may scavenge carcasses or occasionally prey on weak or young antelope: important for helping to maintain healthy populations of herbivores.

Vegetation surveys and transects, documenting indirect evidence of mammal activity from tracks and dung, were undertaken in Dghoumes National Park and its surrounding environment for the eighth consecutive year. These long-term datasets are important for determining how these environments are changing and demonstrate the impact of protected areas for restoring arid steppe botanical communities and supporting associated wildlife.

PARTNERS Direction Générale des Forêts (Ministry of Agriculture), Tunisia | Bou Hedma and Dghoumes National Parks and associated CRDA | University of Tunis El Manar | University of Southampton.

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ABOVE
Vegetation surveys have been carried out in and around Dghoumes National Park for eight consecutive years.

The abundance and diet of African golden wolves *Canis anthus* was assessed via camera trap surveys and scat analysis.

Restoring **NATURE**

Monitoring and Managing Reintroduced Desert Fauna

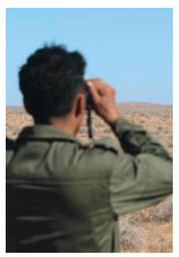
70
North African ostrich
now inhabit 3 protected areas in Tunisia, following a 127 year absence.

We continued to monitor and study reintroduced populations of scimitar-horned oryx *Oryx dammah*, addax *Addax nasomaculatus* and North African ostrich *Struthio camelus camelus* across Tunisia's arid protected area network.

By 2018, there were around 220 scimitar-horned oryx occurring across five protected areas. All these animals are now wild born following the natural attrition of the founder population since the most recent release a decade ago, marking an important milestone in the re-establishment of this species. Results of our study on the genetics of reintroduced scimitar-horned oryx were shared with the Tunisian authorities as we develop ambitious plans to create a long term viable and self-sustaining population of a species that became extinct in the wild at the end of the 20th Century.

Addax numbers in Tunisia remained stable at around 100 animals across three protected areas. In 2018, we shipped tissue samples taken from these animals to the UK for genetic analyses. Initial results show little genetic variation amongst Tunisian addax, reflecting the sources of founders from US and European zoos. More detailed work is now underway to help formulate recommendations for a national meta-population management plan, which may include translocations of animals between sites and further augmentation from captive breeding programmes.

In 2018, the number of North African ostrich in Tunisia had grown to over 70 birds across three protected areas, with preparations underway for more releases. Studies were carried out to understand more about the behaviour of these giant flightless birds which we helped return to their natural habitat in Tunisia, after an absence of 127 years. Observations suggest that captive bred birds are particularly naïve, affecting their subsequent nesting, parenting, anti-predator and foraging behaviour. Given that ostriches born and raised under free-ranging conditions seem to perform much better, our preference is to minimise the intensive management phase of the reintroduction process.



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RIGHT
Monitoring scimitar-horned oryx *Oryx dammah* in Sidi Toui National Park.

Male addax *Addax nasomaculatus* in Djebil National Park.

PARTNERS Direction Générale des Forêts (Ministry of Agriculture), Tunisia | Dghoumes, Bou Hedma, Sidi Toui, Djebil, Senghar-Jabbes National Parks and Oued Dekouk, Orbata, Haddej, El Gonna Nature Reserve and associated CRDA | Royal Zoological Society of Scotland | University of Southampton | Sahara Conservation Fund | Al Ain Zoo | San Diego Zoo Global.

Habitat Restoration in the South of England

We undertook annual management and monitoring of woodland, grassland and heathland habitat across the Marwell Estate and at Eelmoor Marsh Site of Special Scientific Interest.

Long term plans to restore a block of semi-natural ancient woodland were advanced with the thinning and removal of just over a hectare of European larch *Larix decidua*, originally planted as a timber crop in Horsham Copse in the 1960s. Coppicing to diversify the understorey was carried out across a further 1.6 hectares, while 1,098 young trees of local provenance were planted to help re-establish nearly a hectare of woodland. This area of woodland disappeared from the old maps sometime between 1872 and 1897, so recreating it will help connect currently fragmented habitats.

We seeded 3.2 hectares of grassland with 19 species of wildflowers as part of a multi-year project to restore species-rich meadow and support pollinators. Just over 2,000 bales of hay were produced from 11.3 hectares of grassland, helping maintain this habitat while producing forage for zoo animals.

Year-round low intensity grazing by Przewalski's horses *Equus ferus przewalskii* and highland cattle *Bos taurus* was supplemented by mechanical habitat restoration techniques at Eelmoor Marsh. Turf scrapes to remove 0.7 hectares of rank purple moor grass *Molinia caerulea* exposed the underlying seed bank and returned this area to an earlier state of succession. Removing just over 4.7 hectares of encroaching scrub improved patches of wet and dry heath, while mowing of nearly 3.6 hectares of grass and heather dominated areas diversified vegetation structure to create favourable conditions for species, such as silver-studded blue butterflies *Plebejus argus* and woodlark *Lullula arborea*. Conditions were also improved for specialist wetland flora, such as the six species of insectivorous plants occurring at Eelmoor Marsh, by removing invasive vegetation along 180m of ditch and pool margins.

PARTNERS QinetiQ | Natural England.

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ABOVE
Highland cattle *Bos taurus* graze Eelmoor Marsh along with a bachelor group of Przewalski's horses *Equus ferus przewalskii.*

Mechanical methods are used to help restore degraded habitats.

Restoring **NATURE**

Recent Recoveries

400
species
of conservation concern can be found at Eelmoor Marsh.

Among the 27 species of butterfly recorded at Eelmoor Marsh in 2018, the dark green fritillary *Argynnis aglaja* appears to have become established having first been noted from a single sighting in 2016.

The species historically occurred across Farnborough Common, but was last recorded in 1943 before reappearing on nearby sites in recent years. Similarly, 2018 was a record year for the white admiral *Limenitis camilla* at Eelmoor Marsh. Although still found in low numbers, there has been a steady increase in sightings since the species was first noted on site in 2013 against a backdrop of the species declining in the wider environment.

A further seven examples of the rare marsh clubmoss *Lycopodiella inundata* were found at Eelmoor Marsh in 2018, suggesting that a combination of mechanical habitat restoration and grazing by Przewalski's horses and highland cattle are creating favourable open conditions across seasonally inundated peaty ground. Marsh clubmoss was rediscovered on site in 2015 when three plants were found nearly 60 years after it was last seen in this location.

Eelmoor Marsh is now a refuge for over 400 species of conservation concern, with many examples of fauna, flora and fungi reappearing on site or recovering from initially small numbers following habitat restoration during the last 23 years.

PARTNER QinetiQ.

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BELOW
The dark green fritillary *Argynnis aglaja* is now established at Eelmoor Marsh.

photo © Nicholas Montegriffo, Marwell Wildlife

Reintroducing Lizards with Tiny Technology

86
sand
lizards
were released
at Eelmoor
Marsh in 2018.

The second of three consecutive annual releases of sand lizards *Lacerta agilis* took place at Eelmoor Marsh Site of Special Scientific Interest over two days in mid-September.

A total of 86 lizards were released as part of this species reintroduction initiative, which also aims to document the behaviour and fortunes of these rare reptiles as they adapt to life in their natural habitat. This included tracking 24 sub-adult sand lizards fitted with tiny radio transmitters to provide unique insight into the movements of otherwise elusive animals. So far, most tracking observations suggest that sand lizards remain within 30m of the release site.

However, our most adventurous animal moved nearly 100m within 3 weeks of release, before changing direction and travelling a further 70m in the following days. That's quite a distance for a small lizard over challenging terrain and provides helpful information about the dispersal capabilities of this species.

The project at Eelmoor Marsh follows the successful reintroduction of sand lizards at 26 previous locations across the south of England using animals bred at Marwell and contributes to the wider recovery of a species that had previously disappeared from much of its natural range in England and Wales.

PARTNERS QinetiQ | University of Southampton | Natural England | Amphibian & Reptile Conservation Trust.

> **RIGHT**
Sand lizard
Lacerta agilis,
one of Britain's
rarest reptiles.

photo © Jason Brown, Marwell Wildlife

Animal Welfare Assessment Grid

Building on our collaboration with the University of Surrey's School of Veterinary Medicine, we continued the development of a novel animal welfare assessment system for zoo animals.

The 'Animal Welfare Assessment Grid' (AWAG) produces a graphical representation of welfare standards based on scoring factors associated with physical and psychological health, environment, and veterinary and other management events. Having previously adapted the system for our primates, we completed and published outcomes of its application for large felids, and subsequently tested the use of AWAG for giraffes and scimitar-horned oryx.

The AWAG is proving to be a flexible tool for use across taxonomic groups and situations. Advancing the science and practice of animal care is a continual process, whether it is the husbandry of zoo animals, managing those in the process of reintroduction or wild to wild translocation or maintaining grazing livestock in nature reserves. We therefore see the AWAG system as an important development for supporting both ethical and biological aspects of conservation decision-making.

PARTNER University of Surrey, School of Veterinary Medicine.

> **RIGHT**
> The Animal Welfare Assessment Grid was used with large felids, including Amur leopard *Panthera pardus orientalis*.

photo © Jason Brown, Marwell Wildlife

Sustainable Living

Energy for Life
Tropical House
opened in 2018.

photo © Tim Woodiffe-Maxwell Wildlife

Sustainable Living

Progress on Carbon

photo © Tim Woodiwiss, Marwell Wildlife

73%
reduction
in Marwell's carbon footprint since 2008.

LEFT
Sequestration by Marwell's ancient woodlands will be considered in future calculations of our carbon footprint.

The recalculation of our carbon footprint revealed a 73% reduction over 10 years (from 1,705 tonnes CO_2e in 2008 to 463 tonnes CO_2e in 2018), following concerted action and despite growth of the organisation and our infrastructure.

Over this period, we started generating our own renewable energy through installation of solar photo-voltaic panels and a woodchip biomass boiler and decided to purchase electricity from guaranteed renewable sources. We achieved steady underlying progress because of efforts to monitor energy use and identify areas for incremental improvements. This includes changes in behaviour, regulating the times when electrical appliances or heating are needed, replacing equipment and appliances with the most energy efficient models, adopting energy efficient LED lighting, and adding insulation to older buildings.

Our 2018 carbon reduction figures coincided with the latest report and clear message from the Inter-Governmental Panel on Climate Change (IPCC) about the urgency of acting to limit the impacts of climate change. With the generation of low carbon energy from zoo animal bedding and dung being progressed and by considering the sequestration capacity of our woodlands and other conserved habitats, we have set ourselves the goal of surpassing carbon neutrality by Marwell's 50th anniversary in 2022.

Energy for Life

Photos © Josh Brown, Marwell Wildlife

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LEFT
The EFL Science Gallery allows guests to explore energy and climate change.

Inside the immersive EFL Tropical House.

Javan chevrotain *Tragulus javanicus*, one of a myriad of species inhabiting the EFL Tropical House.

Our new Energy for Life building was motivated by the need to reduce carbon emissions and address the threat of climate change.

It represents an important step in our ambitions to become a carbon positive organisation, apply novel use of low carbon energy technology and engage the public in this critical subject matter. Supported by Enterprise M3 LEP, this was embedded in the opening of a new tropical house, creating an immersive environment to interpret the flow of energy through life and explore the generation of renewable energy needed to power modern lifestyles.

The building has a lightweight envelope using the latest ETFE (ethylene tetrafluoroethylene) technology, creating an insulating canopy while allowing natural light to drive the lush internal habitat. The large, curved canopy directs rainwater into a 100,000-litre underground storage system for self-sufficient use in aquaria and plant watering. A biomass boiler generates heat from locally sourced Forestry Stewardship Council (FSC) certified woodchip, and a sophisticated building management system efficiently controls temperature and humidity.

The next phase of the project will result in energy produced from animal bedding and dung to heat the tropical house and a network of other buildings.

A myriad of plants and animals that comprise this immersive exhibit illustrate the flow of energy through life. The abundance of rapidly growing plants demonstrates the capture of energy from sunlight while fish, amphibians, reptiles, birds and mammals, provide examples of primary and secondary consumers. Large crocodile monitor lizards *Varanus salvadorii* represent the apex predators of our imagined ecosystem and the cycle is complete with invertebrates helping to tell the story of decomposition and recycling. The exhibit includes a colony of leaf cutter ants as a classic example of nature's environmental managers, growing fungi as a crop, composting waste, and creating nests with built in passive air-conditioning. Through interactive interpretation guests can choose to explore the flow of energy through life in more detail; how carbon cycles through living organisms and the wider environment; the relationship between carbon and climate change; the impacts of a warming world on wildlife and the environment; and solutions for energy efficiency and the generation of renewable power.

PARTNERS Enterprise M3 LEP | Terence O'Rourke Ltd | University of Southampton Clean Carbon Research Group | University of Surrey, School of Veterinary Medicine | Pirbright Institute | California Academy of Sciences | NASA Goddard Institute for Space Studies | Oregon State University | Stanford University.

Accelerating the Clean Economy in the South of England

Motivated by the most recent report from the Inter-Governmental Panel on Climate Change (IPCC) we teamed up with the Department for Business, Energy and Industrial Strategy (BEIS), the University of Southampton Clean Carbon Research Group, Future South, and Enterprise M3 LEP to host a high-profile cross-sector event called 'Accelerating the Clean Economy in the South'.

The event was held under the wider auspices of the inaugural 'Green Great Britain' week, designed to promote clean growth at the heart of the Government's Modern Industrial Strategy, and raise awareness of how business and the public can contribute to tackling climate change.

Our event brought together over 80 delegates from business, academic institutions, civil society organisations and local government from across the region to discuss clean growth opportunities, financing and collaboration. Key speakers included Lord Henley, Parliamentary Under-Secretary of State for BEIS, Professor Sir Christopher Snowden, President and Vice-Chancellor of the University of Southampton; and Dave Axam Chair of 'Enterprise M3 LEP' Local Enterprise Partnership and Managing Director of technology firm Ai2EV. Connections made that day are beginning to emerge in the form of funding propositions, research and development contracts and other collaborations which we hope will lead to transformative change.

PARTNERS University of Southampton Clean Carbon Research Group | Future South | Department for Business, Energy and Industrial Strategy | Enterprise M3 LEP.

ABOVE
Over 80 delegates with an interest in growing the clean economy met at Marwell.

Lord Henley, Parliamentary Under-Secretary of State at the Department of Business, Energy and Industrial Strategy, speaking.

Energy Efficiency with Artificial Intelligence

ABOVE
Thermal image of nyala antelope *Tragelaphus angasii*.

Achieving efficient heating of zoo antelope accommodation, in collaboration with IBM, was recognised by the UK Government as an example of excellence in innovation marking the anniversary of the Industrial Strategy white paper.

The project itself created a system for heating indoor accommodation when our nyala antelope *Tragelaphus angasii* needed it for their comfort, but otherwise leaving it off to save energy. This meant creating a thermal imaging smart sensor that samples the animals' sleeping area every second and sends this image via the internet to IBM's Watson artificial intelligence platform in the cloud, to detect whether or not there is an animal present. If there is, and the temperature is too low, the heating automatically turns on. Thousands of thermal images trained a neural network algorithm to learn what the animals look like, so it could reliably make this decision.

We estimate that controlling heating according to need and scaling this up across multiple houses could result in energy and cost savings of around 30%. However, there are many other potential situations where detecting the presence or absence of animals or people (and whether there are "a few" or "lots" of them) could trigger an action such as heating or lighting, but with greater energy efficiency.

PARTNER IBM.

Environmental Standards

We received recognition for our environmental and ethical performance in three important ways.

Following a four-day audit, we received certification of our Environmental Management System (EMS) against the new ISO14001: 2015 standard. Our EMS has provided the basis for managing our environmental aspects and achieving continual improvements since 2009. We achieved the 'Gold' standard at the 2018 Winchester Green Impact Awards recognising progress we've made against a wide range of sustainability criteria, including reduction in carbon emissions. We also attained The Soil Association's 'Food for Life' Silver standard for serving freshly prepared food using locally and sustainably sourced ingredients with high standards of animal welfare in Café Graze.

Catalysing Change

A child attending the Kids Love Nature Kindergarten at Marwell exploring our woodlands.

photo © Kids Love Nature

Catalysing Change

Natural Curiosity

1 million pupils have visited Marwell with their schools since our education programmes began 36 years ago.

> **RIGHT**
A member of the Wild Explorers Club hones her fieldwork skills.

Nature Nursery

A variety of enriching nature-based experiences were provided for pre-school children attending the Kids Love Nature Kindergarten at Marwell, throughout the course of the year.

The children explored our woodlands and fields by day and used camera-traps to discover night-time wildlife such as badgers, deer and foxes. They also enjoyed opportunities to learn about animals during 'mini-zoologist' sessions and spending time with vets, plants and animal management teams in the zoo, all led by our dedicated Nature Interpreter. With its free-flowing environment, the Kids Love Nature Kindergarten opened at Marwell in 2016, achieving an 'Outstanding' OFSTED rating within its first year.

School Zoo Visits

In July, we celebrated our millionth pupil to visit Marwell Zoo since our education programmes began 36 years ago.

A total of 42,885 children came with their schools during the year and we ran 861 workshops for groups throughout all key stages of the national curriculum. Adaptation, classification, rainforests, conservation, and sessions about animals linked to various aspects of the primary science curriculum proved to be popular subject matter choices for teachers.

Wild Explorers Club

The Wild Explorers Club met monthly in 2018. There were plenty of opportunities for our junior members to develop their field skills, including: species identification and dormouse surveys in our woodlands, a pollinator survey, navigating by compass, and animal tracking with radio transmitters and receivers.

Supported by an enthusiastic group of volunteers, the Wild Explorers Club follows some well-founded principles of environmental education to create positive associations and explore nature scientifically and creatively. Younger children (ages 4-8) participate with their families to reinforce positive values through shared experiences, while we encourage older children (ages 9-12) to develop a sense of independence, socialise and collaborate, and learn skills to help wildlife.

photo © Jason Brown, Marwell Wildlife

photo © Jason Brown, Marwell Wildlife

photo © Dambari Wildlife Trust

Natural Curiosity

Matobo Biodiversity Monitoring Project

A total of 275 secondary pupils (age 15–18) participated in the Matobo Biodiversity Monitoring Project, during the 6th year of this initiative run by the Dambari Wildlife Trust in Zimbabwe.

The project engages pupils attending rural schools within a 10km radius of the Matobo National Park with the aim of building inter-generational capacity for local communities to monitor and conserve natural resources. This year's participants learnt about the biology, ecological importance and identification of invertebrates, amphibians, reptiles, birds and mammals, along with the practical application of survey methods and equipment. Eighty pupils and 10 teachers then joined the now annual field trip and networking visit to Matobo National Park to share their experiences and celebrate the natural world.

Outreach in the Far North of Kenya

Concerned by a generational gap developing between parents who grew up with more abundant wildlife and their children who see so little of it today, we continued outreach activities with 86 children attending remote, rural schools in Kurungu, Anderi and Keleswa.

For the first time, pre-schools were included in the process of raising awareness about wildlife and the importance of caring for the environment, with 65 children in Anderi and Loltepes participating. There were also parallel engagement opportunities for a group of 30 Lchekuti in Anderi. These are young children tasked with looking after their families' livestock and who, typically, have never been to school but who have an intimate knowledge of the environment and the wildlife they encounter during their daily herding activities.

< **LEFT**
Child using interactive technology to find out about animal species in the EFL Tropical House.

Members of the Matobo Biodiversity Monitoring Project compete in an inter-school quiz during a field-trip and networking visit to Matobo National Park.

A-level students particpating in a wildlife conservation workshop.

Higher Education

Our scientists supervised and facilitated 12 undergraduate and 17 postgraduate research projects to completion during the year, and taught over 400 university students, contributing to academic qualifications in the UK and internationally.

MRes Wildlife Conservation

We marked the fifth anniversary of our Master of Research degree (MRes) in Wildlife Conservation, run in collaboration with the University of Southampton, with the graduation of nine students.

This impressive cohort were awarded five Merits and four Distinctions between them, reflecting the quality of research undertaken. To date, 38 students have completed the course with ten (26%) going on to study for a PhD, nineteen (50%) employed in wildlife conservation or a related field and a further five (13%) employed in other sectors. We accept a small number of students each year, embedded in our Conservation Biology team, exposed to real-world challenges, and undertaking projects contributing to our programmes of work in the UK, Kenya, Zimbabwe, Tunisia and China.

Veterinary Medicine

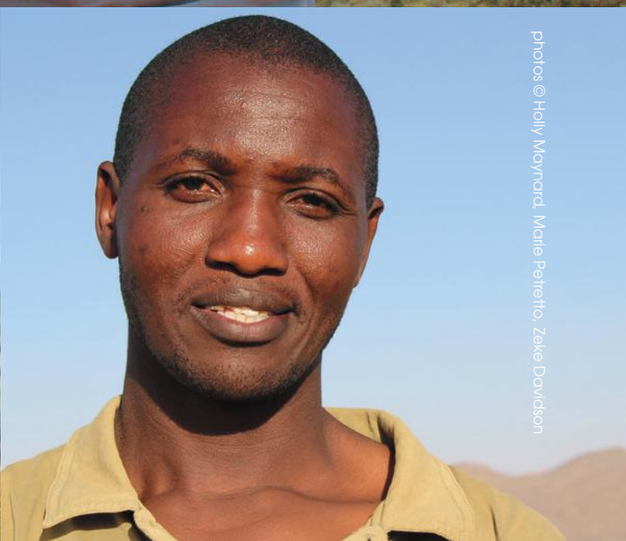
We delivered a series of specialist lectures and workshops on biodiversity and ecosystem health, conservation biology, and zoo and wildlife medicine for 107 students from the University of Surrey's School of Veterinary Medicine.

Attending the UK's newest vet school with a global outlook, students are encouraged to explore the diversity of opportunities available to veterinary professionals and how they may contribute solutions for domestic animal, wildlife and human health. Teaching provision is part of our wider collaboration with the University of Surrey, with final year electives commencing at Marwell in 2019 and a growing portfolio of joint research projects.

Trainee Teachers

In partnership with the University of Southampton, we created and delivered three new teacher training Focus Days.

A total of 56 secondary student teachers attended sessions designed to encourage experiential learning outside the classroom, showcase the value of biodiversity and importance of conservation, and inspire confidence in teachers of students with special educational needs. Meanwhile, 254 primary student teachers from the University of Winchester joined us to find out more about our conservation work in the UK and internationally, and to gain insights into educational opportunities of school visits and how to plan them; an initiative now in its eighth consecutive year.



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> **RIGHT**
Kezia Bellamy, one of 38 students to graduate the MRes Wildlife Conservation in the last 5 years.

In Tunisia, (clockwise) Amira Saidi, Chawki Najjar, Faouz Kiliani and Khalil Meliane graduated with Masters degrees in Evolutionary Ecology.

In Kenya, George Anyona completed his Masters degree in Conservation Biology.

Participation and Capacity Building

8,326
voluntary hours
were contributed by individuals and businesses to support our mission in 2018.

Marwell Volunteers

130 dedicated volunteers contributed a collective 6,370 hours of their time in support of our mission in 2018.

This greatly enhanced our ability to engage schools and the visiting public, run the Wild Explorers Club and deliver a range of other critical functions to make Marwell Zoo a place of enjoyment and learning.

Business Generosity

Thirty-five groups from businesses across the region collectively contributed the skills of 326 employees and 1,956 hours of their time to support a variety of activities.

This included woodland management, tree planting, restoration of chalk grassland through wildflower seeding, and processing of browse for winter feeding of zoo animals with specialist diets.

ABOVE
Voluntary groups from local businesses helping to plant trees.

Catalysing **CHANGE**

60
protected area personnel, NGO staff and community conservation scouts were trained in wildlife monitoring techniques in 2018.

International Training and Capacity Building

We provided training in wildlife survey and monitoring techniques for 60 people in six countries throughout the course of the year.

Eight participants from Kyrgyzstan (six from NABU and two from the National Academy of Science); four from Kazakhstan (three from the Institute of Zoology and one from Almaty State Nature Reserve); and five from the Wildlife Institute in China, engaged in field training delivered by our team to facilitate trans-boundary monitoring of snow leopards.

In Zimbabwe, 16 Rangers (seven from the Stanley Livingstone Anti-poaching Unit and nine from the Matobo National Park) completed the standardised Sandwith Rhino Monitoring Course delivered by the Dambari Wildlife Trust. Four of the Rangers from Matobo National Park, who undertook an advanced version of the course, successfully met the competency standards to become trainers themselves.

Our 19 community wildlife monitoring scouts in northern Kenya were beneficiaries of training in the use of GPS-enabled smart phones to record sightings and evidence of wildlife, livestock and other aspects of the environment. Four eco-guards responsible for the management of Dghoumes National Park in Tunisia, received training in the use of camera-traps for wildlife monitoring, while four final year veterinary students benefitted from practical and theoretical training in wildlife and conservation medicine by participating in fieldwork operations.

ABOVE
Community monitoring wildlife scouts with Kenyan team members Lizbeth Mate, Enrita Lesoloiya, and Clarine Kigoli.

Multiplying Impact

Much of our work is focussed on resolving geographically discreet conservation and environmental challenges. However, we also draw on our experiences and engage in local, national, regional and global forums and collaborations to influence wider policy and practice.

Biodiversity and Ecosystem Services

Time was contributed to support the publication of the Asia-Pacific Regional Assessment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

As an independent intergovernmental body established in 2012, IPBES provides policymakers with objective scientific assessments about the state of the planet's biodiversity, ecosystems and the benefits they provide to people, together with tools and methods to protect and sustainably use these vital natural assets. Formal adoption of the Regional Assessment by governments in 2018 was an important step allowing the results to be incorporated into policy and achieving better integration of government actions in support of biodiversity and ecosystems.

Status of the World's Antelopes

We continued hosting the Programme Office of the IUCN Species Survival Commission Antelope Specialist Group, the world's leading body of scientific and practical expertise on the status and conservation of all antelope species, for the fourth consecutive year.

The process of updating Red List Assessments for all 150 species was completed in 2018, providing contemporary information on the status of antelope in support of local and global conservation decisions.

Action for Grevy's Zebra

With representation on Kenya's Grevy's Zebra Technical Committee (GZTC), we helped compile a new 10-year Recovery and Action Plan for the species, which was launched in 2018.

While the two previous strategies were defined by 'status review' (2008) and 'stabilisation' (2012), this new plan sees the focus shifting to population growth.

> **RIGHT**
> Philip Riordan and the IPBES Asia-Pacific team celebrating the formal adoption of the Regional Assessment by governments. This important step allows the results of the assessment to be incorporated into policy and decision making, developing better integration of government actions in support of biodiversity and ecosystems.

Multiplying Impact

photo © John Newby Sahara Conservation Fund

< LEFT
In 2018, offspring of scimitar-horned oryx previously sent from Marwell to Abu Dhabi for conservation breeding, were released into the78,000 km² Ouadi Rimé-Ouadi Achim protected area in Chad. Led by the Environment Agency Abu Dhabi and the Government of Chad, this ambitious multi-year reintroduction programme is implemented by the Sahara Conservation Fund and supporting partners.

The Global Snow Leopard and Ecosystem Protection Programme (GSLEP)

Our role within GSLEP provides unique opportunities to highlight the successes and challenges for snow leopard conservation with governments across the species' range.

In 2018, with colleagues in Beijing Forestry University's Wildlife Institute and together with the Chinese National Grasslands and Forestry Administration, we organised the first international meeting for snow leopard held in China for 10 years. Through the continued work of our team in China and engagement with both government and the emerging NGO community, we have seen a dramatic increase in the levels of interest for snow leopard conservation. Over 300 Chinese delegates attended the 2018 conference, compared to fewer than 10 in 2008. Snow leopards are a truly international species, as emphasised through our transboundary project, but through our team's persistence, China is now establishing itself as the principal custodian of this emblematic species.

Saharan Wildlife

We continued to support the operations and governance of the Sahara Conservation Fund (SCF), contributing to a new strategic plan developed throughout the course of the year.

SCF exists to conserve the wildlife of the Sahara and bordering Sahelian grasslands and, with interests closely aligned to our own, is a key strategic partner extending our impact in North Africa.

Sustainability Forums

Chairing the Winchester Sustainable Business Network and coordinating the Solent branch of the Institute of Environmental Management and Assessment, we arranged local networking events for 180 environmental professionals from local businesses, government and non-governmental organisations.

We shared our experiences of the circular economy and using life cycle thinking in sustainable purchasing decisions.
We hosted a conference for 71 delegates on sustainable zoo animal nutrition addressing sourcing of diets, including palm oil in animal feed, animal welfare in the supply chain and third-party certification of suppliers; and a workshop for 40 participants from the zoo and aquarium sector examining the environmental impacts of plastics, how to reduce single-use plastics and boost recycling.

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PARTNERS

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PHOTOGRAPHIC CONTRIBUTORS

Jason Brown, Marwell Wildlife
Dambari Wildlife Trust
Zeke Davidson, Marwell Wildlife
Paul Drane
IPBES 6 Plenary
Eric Isselee, Shutterstock
Enrita Lesoloiya, Marwell Wildlife
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photo © Paul Drane

Looking to the Future

Our new Charitable Impact Plan sets out our aspirations between 2019 and 2022, by which time Marwell will be 50 years old.

In the last 50 years, the human population grew from 3.7 billion to 7.8 billion people. In the next 50 years, there may be 10 billion people sharing our planet and experiencing ever more rapid changes in the fabric and function of society. We are therefore facing unprecedented demand on biodiversity and other natural resources. What society now chooses to do about loss of biodiversity, climate change and other environmental challenges, will have imminent consequences for wildlife and the quality of human life across the planet.

Our new plan is motivated by these needs and encouraged by positive outcomes of our work to date which often bucks wider trends. We are now charting some bold new courses to expand populations and ranges of threatened species for which we have special responsibilities; become a carbon positive organisation; and help realign relationships with nature by promoting environmental literacy, building further capacity for conservation, and using our experiences to influence wider policy and practice.

Because healthy ecosystems are so vital to our future, this will become a key theme for our work. We will also be doing more to measure and optimise the positive social impacts of our work, recognising that conservation solutions lie with the individual and community custodians of nature.

Restored habitat in Dghoumes National Park, Tunisia.

^
ABOVE
Regenerated vegetation.

>
RIGHT
Blister beetle *Family: Meloidae.*

photo © Tim Woodfine, Marwell Wildlife

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marwell.org.uk/conservation

to access our publications
marwell.org.uk/publications

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